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«Would you say that the price you pay for electricity is fair?» Consumers' satisfaction and utility reforms in the EU15

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ABSTRACT

The research question addressed by this paper is a simple one: are European consumers happy with the price they pay for electricity supply services after two decades of reforms? We focus on self-assessed consumers' satisfaction as reported in three waves of the Eurobarometer surveys, 2000–2002–2004, conditioning on a set of indicators of public ownership and liberalisation across the EU-15. After controlling for individual and country characteristics, we find that consumers are happier with the prices they pay when in their country there are both public ownership and liberalisation. We discuss this finding.

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1. Introduction

Over two decades, privatisation, vertical disintegration and liberalisation have extensively reshaped the structure of network industries (Newbery 2000; Pollitt, 2007) in the European Union (EU) (see e.g. Martin et al., 2005, for a survey). While empirical literature has usually focused on changes in efficiency of the utilities, rather surprisingly the research on the impact of reforms on consumers' welfare is less developed (with some notable exceptions, such as the research by Catherine Waddams and her co-authors, see e.g. Ugaz and Waddams Price, 2003; Brazier et al. 2006, Giulietti et al. 2005). Moreover, most of the empirical literature on this subject deals with individual countries, because of the lack of comparable cross-country evidence.

In this paper we explore comparable data on perceptions by European consumers, i.e. subjective data on happiness with the price of electricity across the EU-15. In related papers we also extend the analysis to other network industries (telephone services and gas supply) and to other issues (accessibility and quality), see Fiorio et al. (2007).

There are two reasons to consider data on social attitudes in the context of the debate on utility reform. First, because attitudes are

important per se. Policy-makers and regulators are well aware that utility reforms are in the forefront of public debate in the EU, and may raise vocal opposition or support. Second, subjective data can be a complement to objective evidence in order to evaluate the welfare impact of reforms.

In this paper we use self-declared individual attitudes to answer a simple research question: Are consumers happier in countries where the electricity industry has been privatised and opened to market? We use three waves of Eurobarometer Surveys, 2000–2002–2004, for the EU-15 countries, and ECTR (Indicators of regulation in energy, transport and communications) data provided by the OECD to describe the extent of reform by country and by year. We then test the association of privatisation and liberalisation on attitudes of users of electricity.¹ Our approach, while based on publicly accessible databases and standard econometric methods, is novel in the regulatory economics literature. It addresses an important policy reform issue in the EU and of some relevance for other regions (e.g. the US and Latin America) where some have advocated electricity reforms building on the liberalisation experience in Europe, and notably in the UK.

¹ In general terms, reforms might be related to prices and lack of consumer satisfaction. As there is no way to solve this problem given the available data, one should view our work as an analysis of correlations rather than of causal effects of utility reforms on consumers' satisfaction.

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Our empirical findings suggest that *first*, individual consumers attitudes on electricity prices are, as expected, strongly correlated with average prices in each country; *second*, that the implementation of the overall reform package (privatisation and liberalisation) does not increase the probability to be satisfied after having controlled for individual and country specific factors. In fact, privatisation is correlated with the probability to be dissatisfied with prices, while – as expected – liberalisation is correlated with higher satisfaction. Thus the two reforms work in opposite directions in shaping social attitudes. We offer our interpretation of these perhaps counter-intuitive results, and discuss – with due caution – possible policy implications.

The rest of the paper is organised as follows: after a discussion of our research motivation (Section 2), a presentation of Eurobarometer and Regref data (Section 3), and a descriptive statistics (Section 4), we estimate a set of conditional models of consumer satisfaction (Section 5). In the concluding section we discuss our findings and their policy implications.

2. Research motivation

Following privatisation and liberalisation in the UK in the 1990s (Florio, 2004), and the EU directives in the last ten years, a new energy reform paradigm has emerged, or 'a measure of consensus over some generic measures for achieving a well functioning market-oriented industry' (Jamasb and Pollitt, 2007, p. 2). For the first time in the history of the electricity industry in Europe a unique cross-country policy reform pattern has been advocated and is more or less being applied. Similar reforms have been implemented in some developing countries, closely monitored by the international institutions such as the World Bank (Lampietti et al., 2007) or the European Bank for Reconstruction and Development (e.g. for a discussion of the current situation of the South East Europe electricity market, see Pollitt, 2007).

The new paradigm is usually simplified as suggesting three parallel changes: privatisation (sale of existing publicly owned firms and licensing of private entrants), unbundling (associated with incentive regulation of the networks, third-party-access, establishing and independent regulator), and market opening (i.e. allowing entry and competition in generation and retail). It seems reasonable to look at the new paradigm as a set of policy reforms based on increased confidence in market forces and private ownership, against the decline in confidence in planning and public ownership, for a number of reasons that we do not discuss in this paper, see Millward (2005) for a historical perspective on the earlier industry organisation. Moreover, the ambition by the European Commission (EC) to create an 'internal' (in fact a trans-boundary) market for services of general interest, may contribute to the explanation of the policy reversal.

The case for implementing the comprehensive reform paradigm rests until now more on a set of hypothesis and on conceptual models reasoning and fragmented evidence than on systematic cross-country empirical research based on standard econometric approaches. Florio and Florio (2009) survey recent literature on this topic (there is also an earlier, and usually inconclusive literature on the direct comparison of the performance of public and private ownership, less related to our theme, see e.g. Roland, 2008). In our perspective of empirical analysis, country variations in reforms adoption are potentially interesting. In fact, while according to some views privatisation can be seen as a pre-commitment to non-interference and may be associated with the reduction of government involvement in the sector, the degrees of freedom in the reform design (and governments' credibility) are higher than sometimes is suggested. For example, against the two polar cases of public monopoly and full privatisation, unbundling and market opening, in some countries there may be privatisation combined with vertical integration and limited market entry, while in others we can observe full liberalisation combined with decentralised public ownership (Pollitt, 2008). We show below some of these combinations for the EU-15.

After two decades of experience with the implementation of the electricity reform paradigm in Europe, it seems appropriate to move from speculation on its merits to testing its impact on empirical grounds. While there is some evidence of successful reform at the country level within the EU, e.g. for the UK (Newbery and Pollitt, 1997; Domah and Pollitt, 2001) and for the Scandinavian countries (von der Fehr et al., 2005), other authors, using cross country data, are unable to find clear econometric evidence of the positive effects of reforms (e.g. Steiner, 2001; Hattori and Tsutsui, 2004 for the early phases of the reform process, the criticism by Pollitt (2007) on these papers, and new evidence by Florio and Florio (2009).

Particularly, it is interesting to check the differential impact of privatisation against other reforms, because admittedly their association is far from granted (see Jamasb and Pollitt, 2005), even with the mentioned proviso of the credibility of government's pre-commitment through ownership divestiture to avoid excessive interference in the management of the industry. While the EU directives are mute on this point, OECD and World Bank economists tend to link together ownership and market opening (see Conway and Nicoletti, 2006, or Lampietti et al., 2007).

As the jury on the optimal combination of reforms is still out, the last word on their outcome rests ultimately on empirical analysis. It is apparent that, while there is a common direction of reform, substantial variations exist over time and across states. Our empirical analysis exploits this variability.

As for any public policy, the evaluation of welfare changes is the cornerstone of predicting long term success. In developed economies, where issues of access and quality of the services are a relatively minor concern, and where (average) prices were more cost-reflective even under public monopoly, the key signal that influences the consumers' evaluation of public utilities reforms is price. It is interesting to distinguish here between actual price as recorded in available statistical data, and perceived price fairness, as recorded by surveys among consumers.

Ideally one would like to consider micro-evidence of changes in appropriate welfare measures. The informative burden to look into individual agents is often considerable, because one would need to know at least individual preferences about different uses of electricity, price structures for type of users, and their income. This information at the EU level is not available in comparable form across Member States. For example, we have comparable national data on the price per kWh by domestic users of electricity broken down by ranges of yearly consumption, but we do not have comparable matching data on the income of those users, or even the number of individuals by each household.

One strategy to discover some individual-level information is to adopt a different empirical shortcut: as a complement to relying on revealed preference through the estimation of individual compensated demand functions (or their proxies) we can turn to stated preferences, i.e. subjective well-being measures. In other words, we analyse consumers' answers to direct questions about their own satisfaction about price paid of electricity supply.

While this may look as a dramatic change of perspective in economic welfare analysis, it is in fact much less strong that it may appear when compared with actual practice of cost-benefit testing in project or policy evaluation. In fact, applied CBA, usually regarded as objective welfare evaluation and often officially endorsed by government agencies, routinely uses contingent evaluation methods e.g. in regulatory impact analysis (see Boardman et al., 2005 for a survey of applied literature). Such methods revolve around eliciting, through surveys on users, direct information on willingness-to-pay or willingness-to-accept policy changes.

To an applied welfare economist, using revealed or stated preferences is a matter of convenience and of data availability more than a fundamental methodological divide. Any approach has possible bias. Consumers may misperceive prices, and statistical offices may

misrepresent through national average prices a much more complex structure.²

This discussion of empirical approaches to the evaluation of the welfare impact of policy reforms has a close resemblance with the wider debate on the merits of the 'economics of happiness' (Graham, 2006; Layard, 2005). The typical focus of this recent research avenue is the study of the relationship between subjective well being as self assessed by individuals, and objective macroeconomic welfare indicators, such as national income, inflation or unemployment (Frey and Stutzer, 2002). We propose to use a similar approach in a microeconomic context. Services of general interest are sufficiently important to influence perceptions of well being. While such perceptions can be wrong, they are of course based on the information set available to the respondent, plus an idiosyncratic bias. Thus, when a respondent says, in one country and in one year, that he evaluates the price of electricity as 'fair', we can assume that he is telling us something about his subjective well being. It seems reasonable to assume that if an individual is happy with the price he pays, then he is in a better (perceived) welfare position than somebody who feels to be compelled to pay too much for what he gets. Moreover, and most important, we can test this, using average national prices as a control variable. Thus, if we find that, after controlling for possible individual bias, there is the expected relation between perceptions and actual (average) prices, we can be more confident about the interpretation of the results of data on social attitudes. The parallelism with happiness economics is here that while the latter research typically relates overall subjective well being to macroeconomic variables, here we focus on satisfaction on a specific, albeit important consumption item. If there are variations across time and across countries in the frequency of those who assess the price of electricity as fair, we can exploit this variability to indirectly test the impact of the reform on (perceived) welfare of respondents.

3. The data

Eurobarometer public opinion surveys (henceforth, EB)³ have been conducted on behalf of the Directorate-General for Education and Culture of the European Commission each spring and autumn since autumn 1973. An identical set of questions is asked to representative samples of the population aged fifteen years or over in each Member State. In each household, the respondent is drawn at random. Questions are asked during a face-to-face interview at respondent's home and in the appropriate national language. The regular sample in standard Eurobarometer surveys is 1000 people per country except Luxembourg (600), the United Kingdom (1000 in Great Britain and 300 in Northern Ireland) and Germany (since EB34, 1000 in East Germany and 1000 in West Germany). Each survey comes with a set of weights obtained, using marginal and intercellular weighting, carried out on the basis of the population description provided by Eurostat in the Regional Statistics Yearbooks. We use these weights throughout the whole analysis to follow.⁴

In years 2000 (Eurobarometer, 2002), 2002 (Eurobarometer, 2004) and 2004 (Eurobarometer, 2006) the Eurobarometer surveys included some questions concerning several aspects of various services of general interest (SGI), including telephone, electricity supply, gas supply, water supply, postal, transport and rail services. In this paper we focus on consumers' satisfaction with electricity prices for two main reasons. First, electricity is an important sector which, in recent years and with

Table 1

Some descriptive statistics for electricity prices satisfaction.
Source: Our calculations on EB datasets.

Country	Average (s.e.) of consumer satisfaction with electricity prices		
	Year 2000	Year 2002	Year 2004
Belgium	0.442 (0.016)	0.637 (0.015)	0.765 (0.014)
Denmark	0.714 (0.014)	0.678 (0.015)	0.849 (0.011)
Germany	0.602 (0.012)	0.584 (0.012)	0.692 (0.013)
Greece	0.538 (0.016)	0.379 (0.015)	0.320 (0.015)
Italy	0.465 (0.016)	0.367 (0.016)	0.480 (0.018)
Spain	0.483 (0.016)	0.512 (0.016)	0.661 (0.016)
France	0.559 (0.016)	0.558 (0.016)	0.654 (0.016)
Ireland	0.793 (0.013)	0.623 (0.016)	0.703 (0.015)
Luxembourg	0.823 (0.016)	0.789 (0.017)	0.784 (0.020)
Netherlands	0.747 (0.014)	0.724 (0.015)	0.833 (0.013)
Portugal	0.380 (0.016)	0.445 (0.016)	0.544 (0.016)
UK	0.757 (0.012)	0.776 (0.012)	0.888 (0.009)
Finland	0.639 (0.016)	0.602 (0.016)	0.385 (0.016)
Sweden	0.653 (0.015)	0.607 (0.016)	0.500 (0.016)
Austria	0.591 (0.016)	0.646 (0.016)	0.764 (0.015)
EU-15	0.608 (0.004)	0.592 (0.004)	0.656 (0.004)

Note: The statistics refer to the consumers' satisfaction with electricity price, where 0 means dissatisfied and 1 means satisfied.

variability across the EU-15, has undergone a large number of extensive reforms mostly aimed at reducing the public sector share in the industry, and increasing liberalisation of the industry. Second, by looking at prices rather than quality or accessibility, for instance, we concentrate on a clearly identifiable economic variable, which is easily understood by customers thus presumably reducing measurement error, and a variable that is supposed to be mostly affected by recent reforms.

Respondents are asked to state whether they find that the price paid for electricity services is excessive, unfair or fair. However, as the difference between excessive and unfair may not be very clear-cut, we classified respondents into "satisfied" and "not satisfied". In particular, the dichotomous (0/1) consumer price satisfaction variable is recorded as equal to 1 if the respondent states that the price he pays for electricity services is fair, and is recorded equal to 0 otherwise.⁵

As shown in Table 1, which reports the unconditional mean of the dichotomous satisfaction variable and its standard error in each country and in the whole EU-15, it is possible to spot groups of countries where satisfaction is relatively high with respect to others. Some Southern European countries, namely Italy, Greece and Portugal tend to score the worst for electricity price satisfaction, others, such as the UK, the Netherlands and Denmark score the best. There is also some trend of an increasing satisfaction along the six-year period considered. The trend is clearly positive for countries such as Belgium, Spain, Portugal and Austria, while in Greece, Finland and Sweden is

² For an analysis of reforms and actual average prices see Florio and Florio (2009) and the survey of the related literature therein.

³ EB surveys always come with an issue number. In our notation to follow, we denote EB34 the issue 34 of the Eurobarometer surveys and similarly for other issues.

⁴ A detailed analysis on the Eurobarometer data can be found on the official Eurobarometer web site: http://europa.eu.int/comm/public_opinion/.

⁵ For an analysis of electricity price satisfaction using ordinal discrete choice instead of dichotomous models, see Florio, Florio, Salini and Ferrari (2007).

negative, and across the whole EU-15 there are signs that the average satisfaction with consumers price is improving.

There are a set of possible reasons why satisfaction is so different across EU-15 member countries. It might be that some countries show a lower level of satisfaction than others because people tend to complain more than in others, or because some groups of the population (e.g. unemployed) are sampled more often than others, or it might be that some country-specific characteristics affect average national satisfaction. For instance, it might be that satisfaction with price and quality is correlated with general economic conditions of the countries, so that if workers have trouble finding jobs and income growth is sluggish, they might also rate a lower satisfaction with services than in a period of economic expansion. Moreover, and most important, electricity market conditions matter and as across the EU liberalisation, privatisation and vertical disintegration of the electricity industry differ, this might be reflected in the average level of consumers' satisfaction about the prices they pay.

One rankings of countries by the extent of regulatory reforms can be constructed using the indicators of regulation in energy, transport and communications (ETCR), an increasingly popular database produced at the OECD (Conway and Nicoletti, 2006).⁶ This database records a set of variables including “public ownership” (PO), which measures the public ownership in the electricity sector and is coded from 0 (private ownership) to 6 (public ownership), “vertical integration” (VI), which is an indicator of vertical separation and is coded from 0 (ownership separation) to 6 (integration), and “entry regulation” (ER), which measures legal conditions of entry in a market and is coded from 0 (free entry) to 6 (franchised to one firm). The sector indicator (SEC) comes as a simple average of PO, VI and ER indices. In ECTR these four variables are presented as continuous variables in the [0,6] range, however they come from the aggregation of ordinal variables whose cardinalisation might be controversial. For instance, while there is a clear ordering between private, mostly private, mixed, mostly public and public ownership, one may want to check whether results strongly depend on the particular cardinalisation adopted.⁷ Moreover, the ER and VI indicators are obtained as simple averages of variables describing very diverse dimensions of entry regulation and vertical integration which might have limited effect on consumers perceived satisfaction and might also introduce a multicollinearity problem in the estimation process to follow. Hence, we focus on three core variables provided in the ECTR dataset (for more details on available data, see Table A1):

1. The industry score (SEC);
2. The public ownership score (PO);
3. The minimum consumption threshold for allowing consumers to choose the electricity provider (ER3).

The SEC score is meant to give an overall assessment of the reform as a whole. Focussing on the main dimensions of the reform package, we used the PO variable to measure the extent of privatisation reforms and the ER3 variable to measure the extent of liberalisation policies that allowed consumers to choose among different providers with the likely largest effect on their perceived satisfaction. All these variables are coded in the [0,6] range. As mentioned before, one may question the cardinalisation provided by the OECD in the ECTR dataset. Hence, we also defined two dichotomous variables:

4. The public ownership dummy (POd), which is equal to one if the ownership structure of the largest companies in the generation,

transmission, distribution and supply segments of the electricity industry is public and zero otherwise

5. The no consumers' choice variable (ER3d) which is equal to one if there exists a threshold that consumers must exceed in order to be able to choose their electricity supplier and equal to zero otherwise.

Table 2 presents a stem-and-leaf plot since the end of 1990s, where the roots are given by the PO indicator, the following branches are VI and ER indicators and leaves present a clear trend towards a more private, more disintegrated and more liberalised market. A glimpse to this table points out that the United Kingdom is always at the bottom (i.e. the most reformed), while some of the less satisfied countries (for instance, Greece) are on the upper part of the table even in 2003.

For the period considered (1999–2004) the variables SEC, PO and ER3 provide evidence of the fact that the trend has been clearly downward but also that there exists a considerable heterogeneity across countries and across time. For instance, countries such as France or Ireland have not reduced the public ownership in the largest producing firm, while the Netherlands have transformed it from public to private within a couple of years. For the same period also average prices present some variability, being the highest in Portugal and in Denmark, where there is mixed public/private ownership in the electricity industry, and lowest in Finland, where mixed ownership goes along with maximum freedom of entry in the market (see Table A2 in the Appendix A for more details).

Although ECTR provides a long yearly time series for the period 1975–2007, we only consider years 1999–2004 as the EB data are available for years 2000, 2002 and 2004.

4. The empirical model

Although informative, the results descriptive data in the previous section are unconditional to other individual and country-specific characteristics and do not allow one to see whether there is any pattern in satisfaction across groups of consumers and across countries. In this section we try to shed some light on this issue, by analysing consumers' satisfaction, controlling for a set of information about each respondent and the country he lives in.

As we do not know the exact level of individual satisfaction, S_i^* , for each service, we assume that satisfaction is generated by a latent variable model:

$$S_i^* = \beta_0 + \mathbf{x}'_i \boldsymbol{\beta} + e_i \quad (1)$$

where $i = 1, \dots, N$ for a sample of N individuals, $\mathbf{x}'_i \boldsymbol{\beta} = \beta_1 x_{i1} + \dots + \beta_k x_{ik}$ includes individual characteristics (i.e. sex, occupation, etc.) accounting for individual observed heterogeneity, time-varying country macroeconomic variables (i.e. GDP level and population density, etc.) accounting for time-varying heterogeneity, a time fixed-effects to capture any linear time trend and some time-invariant country-fixed effects to capture any country-specific effects. Finally, e_i is a continuously distributed variable independent of \mathbf{x}_i , and accounts for unobserved heterogeneity. As S_i^* is latent, for each individual i , one can only observe

$$S_i = 1 \left[S_i^* > 0 \right]$$

where $1[]$ is equal to 1 if the argument is true and equal to zero otherwise. Assuming that e_i is distributed as a standard normal we obtain the probit model:

$$\begin{aligned} \Pr(S = 1 | \mathbf{x}) &= \Pr(S^* > 0 | \mathbf{x}) = \Pr(e > \boldsymbol{\beta}_0 - \mathbf{x}\boldsymbol{\beta} | \mathbf{x}) = 1 - \Phi(\boldsymbol{\beta}_0 - \mathbf{x}\boldsymbol{\beta}) \\ &= \Phi(\mathbf{x}\boldsymbol{\beta} - \boldsymbol{\beta}_0) \equiv p(\mathbf{x}) \end{aligned}$$

⁶ A former version of ECTR was known as REGREF and used by various authors, including Alesina et al. (2005), Azmat et al. (2007).

⁷ For details on the aggregation methodology followed by Conway and Nicoletti (2006), see Table A1.

Table 2
A steam-and-leaf representation of the ECTR dataset since 1998.
Source: Our elaborations on ECTR. Data source: Conway and Nicoletti (2006).

PO	VI	ER	1998	1999	2000	2001	2002	2003
Public	Integrated	No TPA	France Greece Italy Netherlands	France				
	Accounting separation	No TPA Regulated TPA	Ireland	Greece Italy	Greece France	France Greece	France	France
	Separate companies	Regulated TPA		Netherlands		Ireland	Greece Ireland	Greece Ireland
Mostly public	Integrated	No TPA	Austria Denmark					
	Accounting separation	No TPA Regulated TPA	Portugal					
Mixed	Separate companies	Regulated TPA	Finland					
	Integrated	No TPA Negotiated TPA Regulated TPA			Austria Denmark	Denmark		
	Accounting separation	No TPA Negotiated TPA Regulated TPA	Germany	Austria Denmark Portugal Germany	Germany Austria Italy	Germany		
	Separate companies	Negotiated TPA Regulated TPA	Sweden	Finland Sweden	Finland Portugal Sweden	Austria Denmark Finland Italy Portugal Sweden	Germany Austria Denmark Finland Italy Portugal Sweden	Germany Austria Denmark Finland Italy Portugal Sweden
Mostly private	Integrated	No TPA	Belgium	Belgium				
	Accounting separation	Regulated TPA			Belgium			
Private	Separate companies	No TPA Regulated TPA	Spain	Spain	Spain	Belgium Spain	Belgium Spain	Belgium Spain
	Accounting separation	Regulated TPA Regulated TPA	UK	UK	Netherlands UK	Netherlands UK	Netherlands UK	Luxembourg Netherlands UK

Note: TPA stands for “third party access”.

where ϕ is the standard normal cumulative density function. The partial effect of $x_{j,j=2,\dots,k}$, on $p(\mathbf{x})$ depends on \mathbf{x} through the standard normal density function, $\phi(\mathbf{x}\beta)$, as $\partial p(\mathbf{x})/\partial x_j = \phi(\mathbf{x}\beta)\beta_j$.

As we have three repeated cross sections of the EB dataset (for years 2000, 2002 and 2004), over 15 EU countries, we pool them obtaining the following model:

$$S_{it}^* = \sum_{s=2002,2004} \gamma_s d_{s,it} + \sum_{j=1}^{15} \alpha_j d_{j,it} + \mathbf{x}'_{it}\beta + e_{it} \quad (2)$$

where the year dummy γ_s is equal one if $s = t$ and zero otherwise and the country dummy α_j is equal 1 if individual i lives in country j and zero otherwise. The intercept is omitted as all country dummies are included. Model (2) is estimated as a random effect model as errors are assumed independent over both i and t , with heteroskedasticity correction.

As controls, \mathbf{x} , we used a set of individual characteristics (including sex, age, marital status, age when finished education, occupation, political views, and respondent's cooperation during the interview as assessed by the interviewer),⁸ of country fixed-effects, year dummies, some country-level macroeconomic variables (population density, GDP per capita, Gini index for disposable income, consumer price index, and the price paid for electricity by the average consumer). All information

⁸ Information about economic variables such as respondent's contribution to household income and household income, although certainly relevant, could not be included as not consistently present in all the datasets considered. Some variables, such as age, age when stopped education, and occupation can however be regarded as proxies of individual income.

about individual characteristics come in the Eurobarometer databases EB53 (for year 2000), EB58 (for year 2002) and EB61.2 (for year 2004), while macroeconomic variables are obtained by Eurostat or by the International Energy Agency. As the primary focus of our paper is to assess whether consumers think that they pay a fair price for electricity and whether this perception is at all correlated with recent reforms, we also include country-level variables taken from the ECTR database, namely the sector index (SEC), the public ownership (PO), the minimum consumption threshold scores for choosing provider (ER3). For avoiding possible collinearity among regulatory variables we only include the variable ER3 as a proxy for liberalisation, as it is the most likely to be linked to individual satisfaction among all ECTR variables measuring entry regulation and market opening. We also checked whether the peculiar cardinalisation of ECTR variables (see Section 3), is driving results or whether they are robust even to a different definition of reform variables. In particular, we defined a dichotomous dummy variables for public ownership (POd) and one for the existence of minimum consumption thresholds for choosing a provider (ER3d), which are equal to one if, respectively, the industry ownership is public, and consumers are not able to choose their electricity supplier, and they are equal to zero otherwise.

5. Results

In this paper we are mainly interested to assess whether self-assessed consumers' satisfaction is correlated with privatisation and liberalisation of electricity supply. In particular, by exploiting the variability across time and across the EU-15 countries, we test whether reforms moving towards privatisation and more liberalisation are

Table 3
Electricity price fairness: probit estimation, marginal effects.

	(A)	(B)	(C)	(D)
<i>Macroeconomic variables and time dummies^a</i>				
Electricity av. price (US\$/kW h in PPP)				-1.011**
Consumer price index				0.027***
Population density		0.005*	0.007***	0.004
GDP per capita		0	0	0.002
Gini		-0.007	-0.011***	-0.001
GDP growth rate		-0.005		
Employment growth rate		0.007*		
Country dummies	Yes	Yes	Yes	Yes
Year: 2002	-0.005	-0.014	-0.001	-0.002
Year: 2004	0.092***	0.028***	0.021***	0.017***
<i>Individual characteristics^b</i>				
Female	-0.017**	-0.007**	-0.005**	-0.003*
30 < Age ≤ 45	-0.022*	-0.008*	-0.006*	-0.004
45 < Age ≤ 60	-0.012	-0.005	-0.003	-0.002
60 < Age ≤ 75	0.007	0.002	0.002	0.002
Age < 75	0.058**	0.020**	0.014**	0.011***
Age when stop. educ.: 16–19	0.023**	0.008**	0.006**	0.004**
Age when stop. educ.: 20+	0.045***	0.016***	0.011***	0.009***
Single	0.01	0.004	0.002	0.002
Managers	0.055***	0.020***	0.013***	0.010***
Other white collars	0.016	0.006	0.004	0.003
Manual worker	0.006	0.002	0.002	0.001
House person	0.039**	0.014**	0.010**	0.007**
Unemployed	-0.038**	-0.015*	-0.010*	-0.009*
Retired	0.030*	0.012*	0.008*	0.006*
Students	0.097***	0.034***	0.023***	0.017***
Political views: centre	0.021*	0.008*	0.005*	0.004**
Political views: right	-0.002	-0.001	-0.001	0
Political views: DK/NA	-0.009	-0.004	-0.003	-0.002
Resp. cooper.: average/bad	-0.056***	-0.022***	-0.015***	-0.013***
Obs.	43,333	42,366	43,333	38,673
Log likelihood	-2.70E+	-2.63E+	-2.70E+	-2.40E+
	04	04	04	04
Chi-squared	4520.627	4669.873	4538.013	4339.883

^a Omitted category is Year: 2000.

^b Omitted categories are: male, 14 < Age ≤ 30, age when stopped education: age < 15/NA, married or in couple, self-employed, political views: left, and respondent's co-operation: excellent/fair.

* $p < 0.10$.

** $p < 0.05$.

*** $p < 0.01$.

positively associated with the satisfaction of consumers. Given the way the ECTR scores are defined, a negative sign of coefficients regarding one of the regulatory variables should be interpreted as evidence that in countries with more liberalised/privatised electricity supply there is a higher probability of satisfaction than in others, *ceteris paribus*. A positive sign, instead, would be evidence for the contrary.

A crucial role is played by the price paid by the average consumer. In fact, if the average price is not included among controls and it is correlated with the reform variables, the estimation of the statistical association between consumers' satisfaction and reform variables would be biased. In particular, maintaining that higher average price lowers consumer satisfaction, if reforms (a lower values of ECTR variables, e.g. more privatisation) are negatively correlated with prices, the omitted variable will cause the reform coefficients to be biased upward, if reforms are positively correlated with prices, the omitted variable bias will be negative. If, on the contrary, the price variable is included, the interpretation of a statistically significant reform variable coefficients is that the likelihood of satisfaction of the individual consumer with average individual characteristics, controlling for average macroeconomic variables, is correlated with the reform even after controlling for the average price paid.

Table 3 presents the estimated marginal effects of individual satisfaction as in model (2) conditioning only on individual characteristics of the respondent, besides introducing country and

time dummies. It shows that females are slightly less satisfied than males, elderly people are 1% more likely to be satisfied than youngsters after controlling also for average prices. More educated people tend to be more satisfied than people who stopped studying before the age of 15, while there is no significant difference in terms of marital status, managers and students tend to be consistently more satisfied than self-employed people, with unemployed being the least satisfied. Respondents with moderate political views tend to complain less about electricity prices than people at both the extremes of the political spectrum, and controlling for respondents co-operation it emerges that less co-operative people tend to declare themselves as less satisfied, with a probability between 5% and 1%. The time trend shows that satisfaction is significantly larger in 2004 with respect to 2000.

In column (B) we controlled for some macroeconomic characteristics at the country level,⁹ such as population density, per capita GDP, Gini index, employment and per capita GDP growth rates and none of them seems highly significant, most likely due to multicorrelation problems. After dropping variables with the highest variance inflating factors (namely, GDP and employment growth rate), column C shows that population density is correlated with more satisfaction, and Gini inequality index, on the contrary, with less satisfaction, consistently with our *a priori* expectations. However, when also consumer price index and the average electricity price is included in the analysis, all macroeconomic variables lose statistical significance (column D). In this latter case it emerges that satisfaction is negatively correlated with electricity consumer prices but it is positively correlated with the consumer price index, and indicator of a relative price effect.

Looking at this pattern we are interested to discern whether recent policies of privatisation, market liberalisation and industry disintegration had any significant effect on consumers' satisfaction. Using the ECTR indicators, we started from introducing the score index for the whole sector (SEC) for assessing the correlation between consumers' satisfaction and an indicator of the whole reform package. Then we unpacked the reform replacing the SEC index with two key indicators of reforms, namely the public ownership score (PO) and the minimum threshold that consumer must exceed for choosing their electricity provider (ER3). Finally, we test whether result are dependent on the particular cardinalisation adopted in the ECTR database and tested whether results are robust to a dichotomisation of the public ownership variable (POd) and of the consumer's choice of providers (ER3d). First we estimate these three models without the average electricity price and we report estimation results in the first three columns of Table 4, in columns A, B and C, respectively.

In Table 4, columns D, E and F, we report the estimation of models of satisfaction including as reform variables the industry score (SEC), the privatisation and consumer choice scores (PO and ER3) and the privatisation and consumer choice dummies (POd and ER3d), respectively. Table 4 shows that, probably quite surprisingly to some readers, satisfaction increases the higher is the SEC index, regardless of having included the average electricity price among controls. Hence, the interpretation is that, controlling for individual characteristics, country and time fixed effects and some macroeconomic variables, consumers' satisfaction is likely to be higher in countries whose SEC score is higher, i.e. in countries where the reform process is less advanced. More in detail, if the reforms score (SEC) increases by one unit from its average of 2.2 in the sample considered, the probability of satisfaction is predicted to increased by nearly 4%, with no control for average prices (column A) and nearly 7% after controlling for prices (column D). In other words, the reform package as a whole (low SEC score) is negatively correlated with average likelihood of satisfaction among consumers. This result is robust to the introduction of average electricity prices as controls. The change in the point-wise coefficient of the SEC score suggests that, since, as

⁹ The data source of this variable is the Eurostat website: <http://ec.europa.eu/eurostat>.

Table 4
Electricity price fairness: probit marginal effects with ECTR variables. ECTR variables are contemporaneous to the year of interview.

	(A)	(B)	(C)	(D)	(E)	(F)
<i>ECTR aggregate indicators</i>						
SEC: industry score (0–6)	0.037***			0.070***		
PO: public ownership		0.145***			0.162***	
ER3: minimum threshold for consumers		−0.010**			−0.014***	
POd: public ownership			0.204***			0.208***
ER3d: no consumer choice			−0.037**			−0.054***
<i>Macroeconomic variables and time dummies^a</i>						
Electricity av. price (US\$/kW h in PPP)				−2.379***	−1.157**	−0.910*
Consumer price index	0.016**	0.018***	0.024***	0.033***	0.029***	0.037***
Year: 2002	0.018	0.008	−0.001	0.042***	0.007	−0.01
Year: 2004	0.119***	0.105***	0.094***	0.168***	0.117***	0.098***
Population density	0.008***	0	0.003	0.006***	−0.004*	−0.002
GDP per capita	−0.004***	−0.002	0.001	−0.003***	0.001	0.003**
Gini	−0.013***	−0.016***	−0.011***	0.001	−0.005	0.002
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
<i>Individual characteristics^b</i>						
Female	−0.016**	−0.016**	−0.016**	−0.015*	−0.015*	−0.015*
30 < Age ≤ 45	−0.021*	−0.021*	−0.021*	−0.019*	−0.019*	−0.019*
45 < Age ≤ 60	−0.012	−0.012	−0.012	−0.011	−0.011	−0.011
60 < Age ≤ 75	0.005	0.005	0.006	0.007	0.008	0.008
Age < 75	0.055**	0.054**	0.055**	0.055**	0.055**	0.055**
Age when stop. educ.: 16–19	0.021**	0.021**	0.020**	0.020**	0.020**	0.020**
Age when stop. educ.: 20+	0.042***	0.043***	0.043***	0.045***	0.045***	0.045***
Single	0.009	0.009	0.009	0.008	0.009	0.009
Managers	0.052***	0.051***	0.052***	0.052***	0.050***	0.052***
Other white collars	0.017	0.016	0.017	0.014	0.012	0.014
Manual worker	0.007	0.006	0.007	0.007	0.004	0.005
House person	0.038**	0.037**	0.038**	0.036**	0.035**	0.036**
Unemployed	−0.036**	−0.037**	−0.036**	−0.037*	−0.039**	−0.038**
Retired	0.030*	0.029*	0.030*	0.030*	0.028	0.029*
Students	0.093***	0.092***	0.093***	0.094***	0.091***	0.092***
Political views: centre	0.019**	0.019**	0.019**	0.019**	0.019**	0.019**
Political views: right	−0.002	−0.002	−0.002	−0.002	−0.002	−0.002
Political views: DK/NA	−0.008	−0.009	−0.008	−0.008	−0.008	−0.008
Resp. cooper.: average/bad	−0.053***	−0.053***	−0.053***	−0.055***	−0.056***	−0.056***
Obs.	43,333	43,333	43,333	38,673	38,673	38,673
Log likelihood	−2.69E+04	−2.69E+04	−2.69E+04	−2.39E+04	−2.40E+04	−2.39E+04
Chi-squared	4575.927	4540.029	4616.5	4339.948	4280.008	4381.43

^a Omitted category is Year: 2000.

^b Omitted categories are: male, 14 < Age ≤ 30, age when stopped education: age < 15/NA, married or in couple, self-employed, political views: left, and respondent's co-operation: excellent/fair.

* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

expected, average electricity price is negatively correlated with satisfaction, the omission of the price variable induces the coefficient to be biased downwards, i.e. prices are negatively correlated with the SEC score.

As we would like to understand whether all components of the reform package are similarly correlated with consumer's satisfaction, we unpacked the SEC score into its main components: public ownership of the main provider and consumer's choice of providers. Using the ECTR score, with and without average prices, estimation results are presented in Table 4, columns B and D, respectively. It emerges that consumers are significantly more likely to be satisfied with electricity prices if they live in countries with more public ownership in the electricity industry, and again the omission of average electricity price among controls will bias downward the coefficient PO coefficient. On the contrary, the variable we used to provide a proxy of liberalisation, i.e. the consumer's choice of provider, enters the regression with a negative sign suggesting that consumers are more likely to be satisfied the freer they are to choose their electricity provider. Comparing results with and without controlling for average electricity prices it emerges that the omitted variable bias is relevant mainly for the public ownership variable, and again suggesting that prices are lower the higher is public share in the electricity industry.

Finally, columns C and F report the estimation of consumer satisfaction models using dummy variables instead if scores for industry reforms, without and with the inclusion of prices, respectively showing that results do not depend on the particular cardinalisation adopted in the ECTR dataset.

6. Robustness checks

Results presented in Table 4 have been tested for robustness in two main ways. First, we estimated the same models reported in Table 4 replacing all regulatory variables with their values lagged one period. Results are reported in Table 5, whose structure is similar to that of Table 4.¹⁰ They clearly show that results are largely confirmed, especially as for the public ownership variables. While the consumer choice score (ER3) is no more statistically significant after controlling for prices, it remains largely statistically significant if no cardinalisation is used and a dummy variable is used instead.

Second, we checked whether results are driven by the inclusion of some particular country. Hence we estimated two models of those

¹⁰ All models include controls for individual characteristics of respondents, macroeconomic variables, time dummies, country fixed effects and average electricity price exactly as in Table 4, but coefficients are not reported for reasons of space.

Table 5
Electricity price fairness: probit marginal effects with ECTR variables. ECTR variables are lagged one period with respect to the year of interview.

	(A)	(B)	(C)	(D)	(E)	(F)
<i>ECTR aggregate indicators</i>						
SEC: industry score (0–6)	0.030***			0.060***		
PO: public ownership		0.093***			0.081***	
ER3: minimum threshold for consumers		−0.006**			0.001	
POd: public ownership			0.105***			0.108***
ER3d: no cons. choice			−0.087***			−0.104***
Electricity av. price (US\$/kW h in PPP)				−1.208**	−1.382***	−1.209**
Other macroec. var.s and time dummies (1)	Yes	Yes	Yes	Yes	Yes	Yes
Individual charact. (2)	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	43333	43333	43333	38673	38673	38673
Log likelihood	−2.69E+04	−2.69E+04	−2.69E+04	−2.39E+04	−2.39E+04	−2.39E+04
Chi-squared	4560.096	4608.262	4635.085	4320.814	4373.075	4461.229

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

All regressions include controls for individual characteristics of respondents, macroeconomic variables, time dummies, country fixed effects and average electricity price (in US\$/kW h in PPP). Coefficients for these variables are omitted for reasons of space. For additional information on the variables included refer to Table 4.

estimated previously, and in particular those controlling for average electricity prices and using the public ownership and consumers' choice variables, both as scores and as dummy variables with ECTR variables contemporaneous to the date of the interview (exactly the same models as in Table 4, columns E and F) and removed one country at a time. Results are presented in Table 6 and show that while results are nearly always confirmed (with the only exception of Greece and Austria) when the score variables are used, the sign of significant coefficients is always

confirmed. Removing the cardinalisation, and using the dummy variables POd and ER3d, results of Table 4 are strongly confirmed with at least 95% confidence levels across all subsamples.

7. Conclusions

This paper has presented a new empirical analysis of consumers' satisfaction for electricity service in the EU 15 member states. While

Table 6
Robustness checks of results on public ownership (PO) and liberalisation (LI) coefficients, excluding one country at a time. ECTR variables are contemporaneous to the year of interview.

	Excluding UK		Excluding BE		Excluding DK		Excluding DE	
PO: (a)	0.183***		0.162***		0.162***		0.166***	
ER3: (a)	−0.022***		−0.014***		−0.014***		−0.019***	
POd: (a)		0.186***		0.208***		0.209***		0.195***
ER3: (a)		−0.085***		−0.054***		−0.055***		−0.043**
Obs.	34,967	34,967	37,706	37,706	35,773	35,773	33,776	33,776
Log likelihood	−2.29E+04	−2.29E+04	−2.33E+04	−2.33E+04	−2.22E+04	−2.22E+04	−2.06E+04	−2.06E+04
Chi-squared	3154.368	3251.285	4261.574	4362.863	3620.198	3723.866	4069.326	4158.226
	Excluding GR		Excluding IT		Excluding ES		Excluding FR	
PO: (a)	−0.042		0.134***		0.137***		0.167***	
ER3: (a)	−0.021***		−0.008*		−0.011***		−0.011**	
POd: (a)		0.073**		0.194***		0.207***		0.201***
ER3d: (a)		−0.050***		−0.035**		−0.069***		−0.049**
Obs.	35,713	35,713	36,083	36,083	35,898	35,898	35,887	35,887
Log likelihood	−2.21E+04	−2.21E+04	−2.19E+04	−2.19E+04	−2.20E+04	−2.20E+04	−2.19E+04	−2.19E+04
Chi-squared	4185.726	4269.813	4280.788	4368.279	4228.743	4314.874	4142.331	4242.727
	Excluding IE		Excluding LU		Excluding NL		Excluding PT	
PO: (a)	0.160***		0.178***		0.205***		0.158***	
ER3: (a)	−0.013***		−0.015***		−0.019***		−0.013***	
POd: (a)		0.211***		0.213***		0.221***		0.209***
ER3d: (a)		−0.050***		−0.054***		−0.073***		−0.048**
Obs.	36,037	36,037	37,144	37,144	36,018	36,018	35,814	35,814
Log likelihood	−2.23E+04	−2.23E+04	−2.30E+04	−2.30E+04	−2.24E+04	−2.24E+04	−2.21E+04	−2.21E+04
Chi-squared	3854.975	3954.753	4004.621	4031.722	3494.61	3642.476	4240.516	4337.951
	Excluding FI		Excluding SE		Excluding AU			
PO: (a)	0.162***		0.162***			0.097**		
ER3: (a)	−0.012***		−0.014***			0.006		
POd: (a)		0.211***		0.208***				0.199***
ER3d: (a)		−0.042**		−0.054***				−0.039**
Obs.	35,879	35,879	38,673	38,673	36,054	36,054	36,054	36,054
Log likelihood	−2.22E+04	−2.22E+04	−2.40E+04	−2.40E+04	−2.39E+04	−2.23E+04	−2.23E+04	−2.23E+04
Chi-squared	4271.631	4367.28	4280.008	4381.43	4059.602	4125.08		

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

All regressions include controls for individual characteristics of respondents, macroeconomic variables, time dummies, country fixed effects and average electricity price (in US\$/kW h in PPP). Coefficients for these variables are omitted for reasons of space. For additional information on the variables included refer to Table 4.

(a) PO: stands for "PO: public ownership"; ER3: stands for "ER3: minimum threshold for consumers"; POd stands for "POd: public ownership"; ER3d: stands for "ER3d: no consumer choice".

some individual characteristics in the samples, and some macroeconomic controls contribute to explain the degree of satisfaction in Eurobarometer surveys 2002 to 2004, in these concluding remarks we focus on the impact of regulatory variables.

The electricity reforms in Europe over the last years have often assumed that efficiency and welfare would be enhanced by two key institutional changes: privatisation and liberalisation. The two reforms are usually considered as related. This does not seem to be a necessary condition for industry change, however, because in principle there may be liberalisation without (full or partial) privatisation of the incumbent; and because there may be privatisation without (full or partial) liberalisation. In fact across the EU member states and over time we can observe several patterns. For example, around 2000–2003, Finland, Sweden, Austria, Denmark, Italy and Spain all have mixed ownership with unbundling and third party access (TPA), while France, Ireland and Greece still have a mostly government-owned incumbent. Belgium used to have a mostly private vertically integrated industry since the 1970s, and only recently there was unbundling and TPA. Germany used to have mixed ownership of the electricity industry since the 1970s and never changed this feature, while slowly moved from no TPA to regulated TPA in recent years. The UK was the front-runner of the comprehensive reform paradigm, but some Scandinavian countries have taken a different path. Thus, in this paper we have asked a simple question: are consumers happier with electricity supply in countries where the reforms have been implemented? Can we disentangle the effect on attitudes of privatisation from liberalisation?

To answer the question, a traditional approach in applied welfare economics is to consider changes in consumers' surplus or in other appropriate welfare measures. While we think that this objective measurement is still the core test for the reforms, it is also interesting to look – with a due warning of caution – to perceptions. After all, if in countries where the reforms have been implemented prices go down and consistently consumers' satisfaction go up, compared with countries lagging behind, there is a double check of the success of the reform.

We find that consumers' satisfaction about prices is higher in countries where public ownership of electricity industry is large. Liberalisation seems, however, to be associated with a more positive perception of electricity prices in the series of time and in the countries we consider. The combined effect of the two reforms together (as represented by the OECD aggregate reform index) is to slightly decrease consumer satisfaction. Thus, one may be tempted to conclude that the consumer perceives to be more protected when there are both government ownership and some competition.

How can we interpret these results and do they have policy implications? One may suspect that survey respondents are biased in their perceptions, and tend to see public ownership as more protective of their interests. This interpretation implies that when a consumer is asked the question “In general, would you say that the price you pay for electricity supply service is fair or unfair?” (we cite from the English version of the Eurobarometro questionnaire) he knows whether in his country the industry is under public ownership or not. Then, one may suspect that the answer is driven by this information and by a sentiment of protection given by public ownership. An alternative and more straightforward interpretation is that in responding to the question, whatever the knowledge of the respondent on ownership, he just focuses on his perception of price fairness. The same applies to any liberalisation variables, as we are not testing attitudes on those variables, but simply answers to a direct question on prices. Unfortunately we cannot test also what is the information of respondents on our variables of interests, and whether they have a bias pro-public ownership and pro-liberalisation (but we control for political views). However, what we could do was to test whether price satisfaction and average actual prices, that we use as controls, are correlated. As we find that individual perceived price fairness is strongly negatively correlated to actual average price paid (Florio and Florio, 2009), as expected, we

can be reasonably confident that this quite large sample of respondents is mostly driven by their perceptions of the price they pay, and not by other confounding factors, that we have tried to control as far as possible with the data we have.

Turning then to the policy implications question, we need to be cautious. We cannot conclude that our findings suggest that the combination of public ownership and liberalisation is better than, for example, the combination of privatisation and liberalisation. There is, however, a clear message arising from our findings. Our bottom line is that policy makers should consider that there is some evidence of higher satisfaction with electricity prices when market opening is associated with public ownership of some segments of the industry, and until now the impact of liberalisation on price perceptions is limited. Only additional research based on more traditional hard evidence on household prices, demand elasticity, income distribution, etc, will tell us where we are on balance with the large-scale electricity reform experiment in the European Union. In the meanwhile, policy-makers should take notice of what consumers say.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.eneco.2010.05.006.

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