MARCO MAGNANI

Department of Economics and Management, University of Padova, Italy and Italian Regulatory Authority for Energy, Network and the Environment (ARERA)

FABIO M. MANENTI

Department of Economics and Management, University of Padova, Italy

PAOLA VALBONESI

Department of Economics and Management, University of Padova, Italy and Higher School of Economics, National Research University, (HSE-NRU), Moscow

MEASURING SWITCHING COSTS IN THE ITALIAN RESIDENTIAL ELECTRICITY MARKET

March 2022

Marco Fanno Working Papers – 258

Department of Economics and Management "Marco Fanno"
University of Padova
Via del Santo 33, 35123 Padova

Measuring Switching Costs in the Italian Residential Electricity Market*

Marco Magnani† Fabio M. Manenti‡ Paola Valbonesi§

March 10, 2022

Abstract

Liberalised retail electricity markets in European countries are still characterised by low consumer engagement, especially where regulated prices are still in place. Using an original dataset of Italian prices and the number of residential consumers, we study the presence and magnitude of switching costs – i.e., costs incurred by consumers when changing supplier and a source of inertia – in the free market. We find that switching from the incumbent to any other competitor in the free market involves high costs – almost as high as yearly energy expenditure – while leaving competitors is less expensive. We also carry out two counterfactual analyses. In the first, we show that consumers would have incurred lower average switching costs over the years had the market been less concentrated; in the second, we simulate how switching costs could evolve once the market is fully liberalised and regulated prices are phased out.

KEYWORDS: Electricity Retail Markets; liberalisation in Electricity Markets; Switching Cost; Consumer Behaviour; Firm reputation.
JEL CODES: D12; L94; L98

*Previous versions of the paper were presented at the XI N.E.R.I. Workshop, at the EARIE 2021 Annual Conference and at the 15^{th} Annual Competition and Regulation Summer School and Conference (CRESSE). We are grateful to Roberto Bonfatti, Riccardo Camboni, Fulvio Fontini, Richard Green, Elisabetta Iossa, Leonardo Madio, Federico Navarra, Antonio Nicolò, Michele Polo, Michelangelo Rossi and Oz Shy for their useful comments. The usual disclaimer applies.

†Corresponding author, Department of Economics and Management, University of Padova, Italy and Italian Regulatory Authority for Energy, Network and the Environment (ARERA). E-mail: marco.magnani@unipd.it.

‡Department of Economics and Management, University of Padova, Italy. E-mail: fabio.manenti@unipd.it.

§Department of Economics and Management, University of Padova, Italy and Higher School of Economics, National Research University, (HSE-NRU), Moscow. E-mail: paola.valbonesi@unipd.it.

1 Introduction

Full liberalisation of retail electricity markets has been long advocated by the European Union as a tool to achieve greater integration in and between national markets; more recently, it has also been deemed a way for consumers to benefit from the process of energy transition.[1] The unbundling of vertically integrated electricity utilities at the national level has facilitated entry by firms competing at the generation, wholesale and/or retail levels. The main aim of introducing competition in different segments of the electricity chain is to achieve more competitive pricing in the short run and create incentives to provide consumers with new value-added services in the medium/long run. However, the resulting liberalised retail electricity markets in European countries are almost everywhere characterised by strong friction and often coexist with a still significantly regulated market. One of the main reasons for these frictions is the presence of switching costs, i.e., time-based and cognitive-based costs on consumers changing provider (Burnham et al., 2003); where consumers face such costs, they may prefer to stay with their current supplier even though cheaper alternatives are available on the market, thus nullifying the advantages of liberalisation.

This paper investigates the existence and magnitude of switching costs in the residential electricity market in Italy, where it is forbidden for energy providers to charge monetary fees when a consumer exits the contract.[2] By adapting the theoretical method proposed in Shy (2002) and Krafft and Salies (2008), we aim to evaluate consumer switching costs in the free market using an original dataset of electricity prices and the number of residential consumers provided by the Italian Regulatory Authority for Energy, Networks and the Environment (ARERA, hereafter).

The Italian retail electricity market is a suitable setting to conduct such an investigation. Following the general aims promoted by the European Union in several directives,[3] it has undergone a gradual liberalisation, starting with business consumers in early 2000 and moving to residential consumers in 2007.[4] In Italy, as well as in other European countries, the liberalisation process has created a hybrid market where

[1] European Commission. (2015). *Delivering a New Deal for Energy Consumers.* COM 339; and European Commission. (2015). *Best practices on Renewable Energy Self-consumption.* SWD 141.

[2] ARERA Resolution no. 302/2016/R/COM.

[3] See: Directive 96/92/EC of the European Parliament and of the Council of 19 December 1996 concerning common rules for the internal market in electricity; Directive 2003/54/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in electricity; Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity; Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity, amending Directive 2012/27/EU.

[4] Italian Legislative Decree no. 79 of 16 March 1999, (aka the *Bersani Decree*).

a regulated and a free market coexist; micro businesses[5] and residential consumers can, in fact, maintain their contract with the incumbent supplier under a regulated price (called *servizio di maggior tutela*, i.e., enhanced protection service, hereafter SMT),[6] or they can look for an alternative and switch to the free market. SMT is the *de facto* default contract of customers who have not switched to a firm in the free market. SMT price and contractual conditions are set by ARERA. The co-existence of regulated prices with free market contracts is a common policy framework in European and in North American countries alike (ACER-CEER, 2020). In the next few years, the SMT will be completely phased out and consumers will have to choose their electricity service contract on the fully liberalised market. Following Directive (EU) 2019/944, regulated prices will end by January 2023 for micro businesses,[7] and by January 2024 for households.[8]

Electricity being a homogeneous good, consumption decisions should be driven by Bertrand-like economic arguments, with consumers choosing the cheapest price from those available in the market. In Italy, the data show that this is not the case: despite the absence of exit fees and the presence in the free market of much cheaper contracts, as illustrated in Figure 1a,[9] many consumers have never switched. As of March 2021, 43% of residential consumers continue to be served by the regulated incumbent and the rate by which consumers are migrating to the free market, considering the entire consumer base, is around 3-5% on a yearly basis (ARERA, 2021a). Similar trends in consumer behaviour are recorded in the electricity markets of other European countries (CEER, 2019; Martimort et al., 2020).

Additionally, even consumers who have switched to the liberalised electricity market do not actively take part in market dynamics. According to ARERA, in 2019, only 1% of residential consumers in the free market, on a monthly basis, made a further switch (ARERA, 2021a). These numbers are quite surprising if one takes a look at prices

[5]At the European level, micro businesses are defined as enterprises which employ fewer than 10 persons and whose annual turnover and/or annual balance sheet total does not exceed €2 million. In Italy, however, only micro business with a committed power below 15 kW can maintain the old regulated electricity provider.

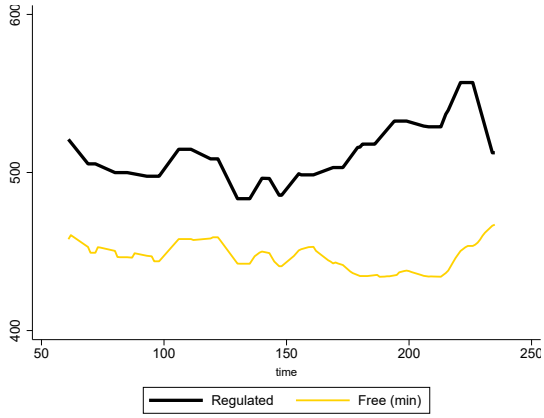
[6]Unlike in the free market, where any firm can sell any contract without geographical restrictions, in each local market regulated contracts are offered by a single firm. The market comprises a national incumbent, serving most Italian cities, and a few local incumbents, each supplying at most a few, typically neighbouring, cities.

[7]Italian Legislative Decree no. 162, December 30 2019 (the so-called *Decreto Milleproroghe 2019*)

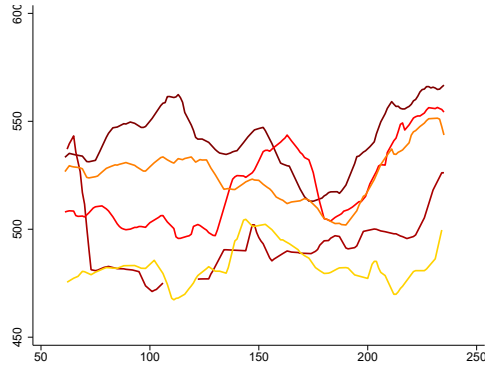
[8]Law no. 233, December 29, 2021

[9]Data are provided by ARERA through the former public comparison website *TrovaOfferte*, on which retailers' offers were updated on a weekly basis. Price data in Figures 1a and 1b show the estimated annual expenditure by a household consuming 2700 kWh in the period January 2015–May 2018. To eliminate short-term distortions, 8-week moving averages have been computed. As for the free market, the graph shows the estimated annual expenditure considering, for each week, the cheapest offer available on the market.

Figure 1: Free market and regulated prices (*source*: TrovaOfferte).



(a) Free vs *regulated market*



(b) Price dispersion on the free market

on the free market. Figure 1b shows, in the period January 2015 – May 2018, the evolution of prices for a sample of five retailers; what immediately catches the attention is the presence of a significant and persistent price dispersion, with firms charging very different prices for the same contract. One would expect this price dispersion to translate into high switching rates since it is always possible for a consumer to find better offers on the market. Switching data, however, tell us that this is not the case.

Our empirical findings reveal that in the free market switching costs are extremely important and persistent and they affect particularly the customers of the national incumbent;[10] conversely, they appear to be less significant for the customers of the other retailers. This is likely due to the different characteristics of the consumers of the national incumbent versus other firms. In fact, a significant portion of the subscribers of the incumbent in the free market are former customers of the same firm in the regulated market. As highlighted in ARERA (2021b), the national incumbent has exploited its position as SMT operator to "shuttle" its customers towards the free market. Consequently, unlike the customers of new entrants, those of the incumbent may not have made a rational switch to the free market. They are not really engaged with market dynamics and therefore are less likely to switch, i.e., they face large switching costs.

Our methodology is used to carry out two counterfactuals. In the first, we measure the switching costs if the market structure had had a more balanced structure. In Italy, as in many other European countries, the process of liberalising electricity markets has resulted in the entry of a large number of small operators with little brand recognition and lower perceived reliability. The liberalisation process has therefore led to the creation of a market characterised by one or a few dominant firms (the subsidiary of the

[10]In Italy, the national incumbent serves regulated consumers in more than 90% of municipalities (Dragotto et al., 2021).

national incumbent in the free market) and a fringe of medium, small and very small operators. Hence, we assume the presence of a tight duopoly, with the incumbent firm competing with a rival firm with a similar market share. Our exercise reveals that a more balanced market structure could have led to an overall reduction in switching costs. In the second counterfactual, we measure switching costs when the market is fully liberalised and the SMT ceases to exist, as planned for 2024. Interestingly, we find that full liberalisation will reduce customers switching costs.

The remaining sections are organized as follows: Section 2 discusses the literature this paper contributes to. Section 3 presents the theoretical setting. Section 4 describes the data used in our empirical analysis. Section 5 presents and discusses the resulting measures of switching costs, while in Section 6 we carry out the counterfactual analyses. Finally, Section 7 draws conclusions and indicates directions for future research.

2 Literature review

This paper mainly contributes to two main strands of the literature. The first investigates the competitiveness of retail electricity markets, with a focus on how this competitiveness relates to consumer switching behaviour. Hortaçsu et al. (2017) study the determinants of consumer choice for electricity contracts in Texas. Giulietti et al. (2014) develop a sequential search cost model and estimate predictions looking at the British domestic electricity market following its opening up to competition in 1999. Their results show that estimated search costs match observed consumer switching behaviour well. Airoldi and Polo (2017) present a sequential search cost model which they apply to Italian electricity prices in the first quarter of 2017: they found that consumers could make gains by switching to the best offer in the free market. We add to this literature by studying friction on the consumer side, in a setting where a regulated and liberalised market coexist.

In the same strand of literature, recent studies on switching costs in energy markets have also been carried out using survey data. In a large Internet survey of the Japanese electricity market, conducted six months before and after the full retail liberalisation in the country, Shin and Managi (2017) investigate consumer satisfaction concerning the reform process and the determinants of consumer switching behaviour. Using a logistic regression and non-parametric testing approach, they found that large consumers are more likely to switch, but households with all-electricity systems are 90% less likely to switch compared to households that used both electricity and gas. Exploiting a Danish online survey comprising self-administered questionnaires in 2011, Yang (2014) investigates barriers/incentives to switching (i.e., consumer loyalty; the

perceived benefit of switching; the perceived consequences of switching; and the perceived complexity of switching) in the retail electricity market. He finds that greater consumer loyalty and lower economic benefits contribute to higher inertia preventing consumers from switching; moreover, the "non-switching" group consumed more than the uncertain group, and the "switching" group consumed less. Barriers to switching have been also investigated by Fontana et al. (2019) based on a large Italian survey: they found that consumer awareness is positively affected by level of education, frequent use of the Internet, number of household components, age and area of residence. Moreover, difficulties in price comparisons seem to to be positively impacted by the number of household members and the frequency of Internet use. Focusing on the residential Italian electricity market, Dragotto et al. (2021) show that regions recording stronger firm incumbency are subject to larger consumer inertia in leaving the regulated market, and this effect is reinforced by the number of active free market retailers; on the other hand, switching by consumers already in the free market is positively affected by firm incumbency. Giulietti et al. (2005) – from a dataset of about 700 interviews of British consumers – investigate the determinants of search and switching costs in the UK energy markets. They found that consumers who view supplier reputation as very important are significantly less likely to switch: note, this result is in line with the differences we find in consumer switching costs between the incumbent and rival firms.

The second strand of literature refers to the empirical estimation of the approach to switching costs developed by Shy (2002). In his paper, Shy empirically applies his approach to the mobile phone market in Israel and to the Finnish demand deposit banking industry. Using the same theoretical framework, Carlsson and Löfgren (2006) estimate switching costs for the airline industry – a market where repeat purchases are common. Both Leibbrandt (2010) and Egarius and Weill (2016) investigate the role of switching costs in the banking industry: the former analyzing the banks' decision to make payment networks compatible and the latter comparing cooperative banks with commercial banks. Salies (2005) measures the value of switching costs in the Great Britain deregulated retail electricity market.[11] More recently, Björkman (2021) analysed switching costs in the Swedish electricity market and found that, for some firms, these costs amount to almost 100% of energy bills. We contribute to this literature with novel results for switching costs gleaned from an original dataset for the retail electricity market in Italy – a setting where consumer inertia is widespread and where the transition to a fully liberalised market is ongoing.

[11] As far as we know, this is the only paper that uses the approach in Shy (2002) to measure switching costs in the early reformed electricity market in the United Kingdom.

3 The theory of switching costs

We calculate switching costs in the free market adapting the method of Shy (2002), as proposed in Krafft and Salies (2008). The main difference with the original model is that, in our setting, firms in the free market compete to attract consumers switching from the regulated market as well. However, we do not specifically model the switching process from the regulated to the free market and, as clarified below, assume that only a given share of customers of the regulated firm switches to the free market; these customers are assumed to move to the firm in the free market charging the lowest price.

Firms compete in prices. At the equilibrium, prices must satisfy the so-called *Undercut-proof property*; according to this equilibrium concept, each firm charges the highest possible price such that rival firms do not find an undercutting strategy profitable, i.e., charging a price that, by subsidizing switching costs, induces all consumers to switch. As in Shy (2002) and Krafft and Salies (2008), we assume that each firm considers whether to undercut one and only one competing firm at a time; this means that with n active firms there are n pairs of competing firms. The main difference with Krafft and Salies (2008) is that in our setting we must take into account that the firm charging the lowest price attracts consumers who move away from the regulated market.

Suppose that firm 1 is the firm charging the lowest price, and firm i is any of the other $n-1$ firms: $p_1 < \min\{p_2, \ldots, p_n\}$. Let us indicate with N_1 the number of firm 1 customers in the free market, with N_i, $i = 2, \ldots, n$, those of firm i, and with N_R the number of customers in the regulated segment of the market. We assume that a share $\alpha \in [0, 1]$ of the consumers of the regulated firm are actually considering moving to the free market. We define these customers as "active customers" on the regulated market. According to our assumption, at the equilibrium they switch to firm 1 and this implies that, unlike in Krafft and Salies (2008), we have two different types of pairs of firms in the undercutting relationship: pairs include firm 1, namely the firm that in equilibrium attracts consumers from the regulated market, and pairs that do not involve firm 1.

For this second type of firm, the calculation of switching costs is exactly the same as in Krafft and Salies (2008). Consider the competition between firm i and firm j, with $i \neq j = 2, \ldots, n$. Indicating with S_{ij} the cost of switching to firm j incurred by the consumers of firm i and with S_{ji} the cost of switching from firm j to firm i, the solution to the model based on the so called Undercut-proof Property (see Shy, 2002) yields to the following formulas for switching costs:

$$S_{ij} = p_i - p_j \frac{N_j}{N_i + N_j}, \quad \text{and} \quad S_{ji} = p_j - p_i \frac{N_i}{N_i + N_j}. \tag{1}$$

Consider now the competition between firm 1 and any firm $i = 2, \ldots, n$. The switching costs incurred by consumers switching between these two firms are determined on the basis of the Undercut-proof Properties characterising the competition between them. Specifically, at the Undercut-proof equilibrium *i*) firm 1 charges the highest possible price such that for firm i it is not worth following an undercutting strategy, i.e., charging a price lower than $p_1 - S_{i1}$ to attract all the consumers of firm 1, and *ii*) firm i charges the highest possible price such that for firm 1 it is not worth following an undercutting strategy, i.e., charging a price lower than $p_i - S_{1i}$. Formally, these two conditions mean that equilibrium prices must be such that $p_1(N_1 + \alpha N_R) \geq (p_i - S_{i1})(N_1 + N_2 + \alpha N_R)$ and $p_i N_i \geq (p_1 - S_{1i})(N_1 + N_2 + \alpha N_R)$. As firms charge the highest possible price, at the equilibrium these conditions hold to equality, hence the following switching costs:

$$S_{i1} = p_i - p_1 \frac{N_1 + \alpha N_R}{N_1 + N_i + \alpha N_R}, \quad \text{and} \quad S_{1i} = p_1 - p_i \frac{N_i}{N_1 + N_i + \alpha N_R}. \tag{2}$$

4 The data

In order to measure switching costs using expressions (1) and (2) we need information on prices and the number of consumers. Subsections 4.1 and 4.2 present the data we rely on to conduct our empirical exercise.

4.1 Prices

We retrieved information on prices from TrovaOfferte, a price comparison website run by ARERA from April 2009 to September 2018. Although firms were not required to upload their offers on TrovaOfferte, the vast majority of the firms did so and, as confirmed by ARERA, eventually firms accounting for more than 90% of the market were active on the website – including the national incumbent, local incumbents and other new entrants in the free market.[12] To facilitate the comparison, for each offer the website showed the estimated yearly spending according to a consumption level indicated by the user — offers were then ranked from the lowest to the highest. Firms posted their offers on a weekly basis and, on average, each firm posted five offers.[13]

[12] See the press release by ARERA (in Italian) *Energia: mercati di massa dinamici, ma concorrenza ancora non matura* available at https://www.arera.it/it/com_stampa/15/150212cs.htm

[13] It should be noted that retailers have only partial control over the overall offer. Annual spending has two components: the first, often called the *raw material component*, is fully appropriated by the firm selling electricity; and the second, comprising system, transmission, distribution, metering charges, and taxes, is transferred to firms operating along the grid—distribution and transmission system operators—and the Government. The retailer can only set the price of the first component,

While offers were on a weekly basis, the data on the number of consumers of each operator is only annual. In order to match the data on offers with those for the number of consumers we had to build an indicator that was representative of each firm's offers throughout the year. For this purpose, we computed the yearly average of the cheapest weekly offer of each provider. This corresponds to the *price* variable used in our computations of switching costs.

Our observations cover the period 2015-2018. Table 1 shows the values of the *price* variable for firms for which we have information on the number of consumers; offers are ordered in terms of the market share of firms, from the largest to the smallest.[14] Overall, the firms in our dataset serve over 90% of all consumers and are therefore extremely representative of the free electricity market in Italy; each firm included in our dataset has a market share above 1%. Further, in the last row of Table 1 the price (as an average over the year) of the regulated offer is also shown.[15]

Table 1. Yearly spending in €*

2015		**2016**		**2017**		**2018**	
Firm	**Spending**	**Firm**	**Spending**	**Firm**	**Spending**	**Firm**	**Spending**
1	477.9	1	480.0	1	473.8	1	509.2
2	474.3	2	486.1	2	489.4	2	499.0
3	476.9	3	474.5	3	467.2	3	512.6
4	480.9	4	487.1	4	487.1	4	505.6
5	479.7	5	454.5	5	476.6	5	542.6
6	508.0	6	504.2	6	448.9	6	472.8
7	476.5	7	469.7	7	449.7	7	460.8
		8	452.7	8	448.2	8	490.6
		9	481.9	9	473.1	9	481.3
		10	477.0	10	449.1	10	479.9
				11	473.1	11	501.8
Mean	482.0	476.8		467.0		496.0	
Reg	504.4	Reg	495.3	Reg	521.2	Reg	537.3

* Firms ordered in terms of market shares from the largest to the smallest.

whereas the second component is fully regulated and is the same for all firms.

[14]Our dataset includes the following providers: Acea, Dolomiti Energia (only from 2016), Edison, Enel Energia, Engie Italia (only from 2016), Eni Gas e Luce, E.On Energia, Green Network, Illumia (only from 2017), Iren Mercato, Sorgenia (only from 2016).

[15]To allow consumers to compare the commercial offers available on the free market with the regulated price, ARERA published the regulated price on TrovaOfferte. This information was updated every three months.

The data shown in Table 1 confirm that *i*) the free market is more competitive than the regulated market and *ii*) the free market is characterised by persistent price dispersion. In relation to this second point, it should be noted that the difference between the lowest and the highest offers available exceeded 80€ in 2018, a value close to 15% of the average estimated expenditure of a representative household.

In light of this evidence, and given the homogeneity of the services offered, one would expect to observe sizable switching rates; such a high price dispersion, in fact, means that individuals can always find significant savings opportunities by changing electricity provider. But in the period under consideration switching rates within the free market were relatively low. We believe that the combination of high price dispersion and low switching rates is a clear indicator of the presence of significant switching costs.

4.2 Number of consumers

The number of consumers was retrieved from the ARERA database (*Registro Centrale Ufficiale*), which tracks each Points of Delivery (hereafter, PODs) in the Italian territory. A POD is an alphanumeric code uniquely identifying the physical point where the energy provider delivers electricity to consumers. Each POD can be identified by the electricity meter — a tool measuring the amount of electric energy consumed by an end user.

The information pertaining to the number of users for each firm is confidential and cannot be published even anonymously. For this reason, in Table 2, we limit ourselves to showing the summary statistics of our sample of firms. The sample is highly representative of the free market: for example, for 2018, it records close to 10 million residential consumers out of a population of around 11 million consumers, hence 90% of the free market (ARERA, 2021a). Overall, in line with ARERA data (ARERA, 2021b), our sample shows that the market is highly concentrated, focused on one large provider, but also extremely splintered, with many small and even tiny outliers with a handful of consumers.

More specifically, the market comprises two large firms covering around 80% of the market, with a sizable presence across the country — the national incumbent in the electricity sector (close to 70% of market share) and the national incumbent in gas services, mid-sized firms (covering around 12-15% of the market),[16] and smaller firms that might have either a scattered or a concentrated presence in the country. It is important to stress that although firms can often be concentrated in specific areas of

[16]Typically, these firms have a sizable presence in one or two regions or are local incumbents in bigger municipalities (e.g., Milan, Rome, Reggio Emilia).

Table 2. Summary statistics for the number of consumers.

	2015	2016	2017	2018
Total number	7,031,059	7,877,477	8,773,629	9,859,967
Mean	1,004,437	721,272	787,748	896,361
Standard deviation	1,775,430	1,638,024	1,710,917	1,993,034
Minimum	69,244	62,990	51,781	69,447
Maximum	4,956,307	5,576,256	6,205,457	6,825,367
Number of firms	7	10	11	11
Active customers - αN_R	2,926,240	2,782,717	2,976,283	2,712,243

the country, the market is at the national level; firms' offers are valid nationwide and even small firms compete directly with larger firms despite the fact that their customers are located in fewer regions of the country.

In the last line of Table 2 we show the number of so-called active customers, i.e. users who switched from the regulated to the free market. As discussed in Section 3, this is relevant information for the calculation of switching costs – see expression (2). To figure out, approximately, how many active consumers there are each year, we resort to the surveys conducted by ARERA with which the regulator asked each customer of the regulated firm if, in the presence of a better offer, he/she would be willing to switch to a firm on the free market. According to these surveys, 10%-30% of consumers of the regulated firm declared their intention to switch to the free market in the few months following the interview. In line with these surveys, we calibrate parameter α to the intermediate value of 0.2.;[17] from the data relating to the number of customers with a regulated contract provided by ARERA, we obtain the figures in the table.

5 Empirical Results

Table 3 shows our measure of switching costs in 2018, based on expressions (1) and (2);[18] years 2015 to 2017 are shown in the Appendix. These figures indicate the cost (measured in €) a subscriber of each firm in the sample incurs when switching to each target firm. Firms are ordered according to market shares, from the largest to the smallest. Reading by rows, firm i's switching cost must be interpreted as the cost of switching from firm i to the target firm (firms in the row of the table). In 2018, Firm 7 is the firm posting the lowest price which, according to our assumption about consumers switching from the regulated to the free market, attracts all active customers.

[17] Values around $\alpha = 0.2$ do not have a significant impact on our measures of switching costs.

[18] The values shown in Table 3 and in all the subsequent tables are expressed in €.

Consider, for example, firm 1: our estimation suggests that customers of this firm face a cost of €435 when switching to firm 2, €475 to firm 3, €494 to firm 4, and so on. In the table, a bold number indicates switching cost higher than 85% of the current yearly bill.

Table 3. Switching costs from firm i to target firms (2018).

Firm	Target firm										
i	1	2	3	4	5	6	7	8	9	10	11
1	-	**435**	**475**	**478**	**494**	**498**	373	**499**	**502**	**503**	**504**
2	65	-	350	361	**422**	**439**	173	**443**	**461**	**467**	**471**
3	37	158	-	271	357	390	118	396	**431**	**442**	**450**
4	27	143	238	-	340	375	107	381	418	429	438
5	47	114	177	191	-	322	111	329	380	398	411
6	-24	37	93	107	183	-	38	242	295	314	327
7	102	315	387	393	**426**	**434**	-	**436**	**445**	**447**	**449**
8	-8	48	99	113	184	240	53	-	300	319	332
9	-21	21	56	68	122	183	36	185	-	262	274
10	-23	14	43	54	100	163	32	165	219	-	252
11	-2	31	53	65	102	166	52	166	219	240	-

Bold numbers: switching costs $\geq$ 85% of the yearly bill.

Overall, consumers of firm 1 – the national incumbent in the electricity market – seem to be the most affected by switching costs; except in one case, if they switch, they incur a cost larger than 85% of their yearly bill regardless of which company they switch to. Except for firm 2 – the national incumbent in the gas market – and firm 7 – the low price firm benefiting from consumers migrating from the regulated market – which some cases also have large switching costs, consumers of the other firms appear to bear a much lower switching cost. In particular, customers of the smaller firms incur small or negative switching costs, that is either they suffer very little harm from switching, or they even benefit.[19]

These results reveal the existence of a clear fragmentation of consumers in the free market: on the one hand, customers of firm 1, the national incumbent in the electricity market plus, to a lesser extent, customers of firm 2, the national incumbent in the gas

[19]Our findings only partially confirm the findings of Björkman (2021) in the Swedish market, where switching costs range, on average, from 70%-95% of yearly electricity spending for virtually all firms. The difference is probably due to the different structure of the electricity market in Italy and Sweden. Unlike Italy, in Sweden the market is far less concentrated and without a predominant role of the incumbent operator which, in Italy, has a strong position both in the regulated sector and in the free market.

market and, on the other hand, all the others, i.e., customers of small firms. Customers of the incumbents face high switching costs; they are rather inert with a very low tendency to switch. This is particularly true in relation to firm 1, the national incumbent; this provider, in fact, is also active as a regulated firm at the national level[20] and over the years has operated in order to allow the smooth transition of its consumer base from the regulated to the free market—although companies operating in the two markets are separate entities. This occurs because the same brand is used for both companies to trigger brand recognition by consumers, easing the switching process. Further, as assessed by the Italian Competition Authority in 2019, the exchange of information between regulated and free-market branches is common, including the personal data of consumers under regulated contracts. These consumers are typically less engaged with market dynamics,[21] having waited years before entering the free market. Thereafter, they are characterised by higher search and cognitive costs and after changing providers are locked-in by the incumbent with further switching becoming too expensive. It is therefore not surprising that these consumers are essentially inert, and very unwilling to change operator, because of the high switching costs. Very similar arguments apply to customers of firm 2, the national incumbent in the gas market. Most of these customers switch to this provider because it also supplies them with gas; firm 2 has a very recognizable brand and, like firm 1, has adopted strategies aimed at facilitating the switch to its electricity services by its consumers in the gas market. As above, these customers tend to be rather inert and probably unwilling to switch again.

Conversely, the switching costs faced by consumers of smaller operators are much lower, or actually negative. These values have a clear explanation too. They reveal that consumers of small firms tend to be more actively involved in switching. They are much more engaged in market dynamics than the previous type of consumers as their choice was not primed by the incumbent, but was more deliberate and favoured a company with which they had no experience. These individuals are very familiar with offers and switching is painless or actually beneficial. The magnitude of switching costs, as detailed in Section 1, depends on psychological, time- and effort-based components (Burnham et al., 2003); consumers who search for alternatives efficiently and are less intimidated by the switching process — with lower switching costs — are able to find cheaper offers. At the same time, the firm posting the lowest price, i.e., firm 7, though smaller, has higher switching costs than similar firms, as it attracts consumers from

[20] As the regulated provider, this firm serves around 90% of Italian municipalities (Dragotto et al., 2021).

[21] Among the reasons, ARERA (2019) highlights the poor understanding of market functioning, distrust of free market providers and status quo bias, i.e., belief that the default option is the best despite better alternatives.

regulated contracts that are on average more inert.

Following Shy (2002), these results can also be interpreted in terms of the value of lost time incurred by consumers who want to switch to another provider. Larger firms — typically, incumbents — attract consumers who value their time and hence tend to be more inert, incurring higher switching costs; while consumers who value their time less join smaller firms and need fewer incentives to switch provider. This interpretation is in line with the hypothesis that when consumers switch to the free market with the regulated firm — the incumbent — they might have been pressured to do so by the firm itself and therefore chose without following a traditional decision-making path.[22]

A similar discussion applies to years 2015, 2016 and 2017 for which measures of switching costs can be found in the Appendix.

6 Counterfactual analysis

6.1 Switching costs in a more balanced market

Our findings reveal the existence of consumer fragmentation in the free market: on the one hand, the customers of the national incumbents facing very large switching costs and, on the other, subscribers to the other firms.

These results raise an interesting question related to the effects of the liberalisation of the electricity market. In Italy, as in many other European countries, the liberalisation process has resulted in the entry of a large number of operators who have struggled to acquire significant market share. A possible alternative for the policymaker could have been to promote a smaller number of competitors, but able to take over larger market shares. One wonders what would happen to switching costs if market shares were more balanced? In order to answer this question, we recomputed switching costs in a simulated duopoly comprising the largest firm and a hypothetical competitor such that:

- its consumer base is given by the sum of the number of consumers of all firms (except the largest) in a given year;
- its price is given by the average price of all firms (except the largest) in a given year.

Table 4 shows switching costs in this hypothetical duopoly; in 2015 the lowest price is from firm 1 while from 2016 to 2018 the lowest price is given by the average price of

[22] This would also explain why switching rates in the free market appear to be positively affected by concentration rates (see, Dragotto et al., 2021).

the competitive fringe. When the incumbent competes with a larger firm, its switching cost becomes smaller while that of the latter increases. Apparently, as the incumbent's competitor grows, switching costs are shared more evenly by the two firms.

Table 4. Measures of switching costs between 2015 and 2018 (hypothetical duopoly)

Firm	2015	2016	2017	2018
1	235	253	254	283
2	245	225	216	218

What is the overall effect on consumers of a duopoly rather than a large incumbent and a fringe of small competitors? To answer we would need a measure of the costs incurred at industry level; unfortunately, we do not have detailed information regarding the number of switches from one firm to another and therefore we cannot derive a precise measure of the costs incurred globally in a given year. However, it is reasonable to assume that switching rates are related to the market share of each firm; based on this, we compute average switching costs by weighting each firm's switching costs with its market share. More specifically, we calculate for each firm i the average switching costs – the sum of the costs of switching from firm i to all other firms weighted by the (relative) market share of the target firm – and then calculate the weighted average of these values, where weights correspond to the market share of each firm i.

Formally, given the switching costs from firm i to firm j computed using the observed market data (aka the "Full sample"), the average industry switching cost $\mathcal{S}$ is given by:

$$\mathcal{S} = \sum_{i=1}^{n} \frac{N_i}{N} \sum_{j=1, j\neq i}^{n} \frac{N_j}{N - N_i} S_{ij}. \tag{3}$$

In the case of the hypothetical duopoly the average switching cost in a given year is simply the weighted average based on the market share of each company.

Table 5 shows average industry switching costs, both for the case of the full sample and the hypothetical duopoly. From the results, two interesting considerations emerge. The first observation is that in average terms the switching costs are higher in the Full sample than in the case of the hypothetical duopoly, suggesting that the presence of large incumbents and a fringe of small, competitive firms is inefficient, at least in terms of switching costs. The second observation is that the difference in aggregate switching costs grows over time, suggesting an overall deterioration in the competitive conditions of the market.[23]

[23]Note that in both cases, industry switching costs seem to decrease over time.

Table 5. Average industry switching costs

	2015	2016	2017	2018
Full sample	298	331	331	349
Simulated duopoly	238	245	243	263

Although limited in scope, this exercise would seem to suggest that had the incumbent faced a more solid and entrenched rival – rather than scattered and fragmented competition –, average switching costs would have been less severe. As previously mentioned, one of the reasons for the strong inertia of consumers in electricity markets is the reputation of firms (Giulietti et al., 2005); small firms, either new to the market or historically present only at the local level, are largely without reputation and might therefore be perceived as unreliable by consumers, who tend not to choose them as energy suppliers even where they provide cheaper contracts.

We are aware of the limitations of this exercise and we certainly do not advocate a mere decrease in the number of firms;[24] however, our analysis seems to show that in designing the liberalisation process, policymakers should have taken into account the role of the market structure in guaranteeing switching and the related benefits of the free market.

6.1.1 Switching costs in a fully liberalised market

Our setting can also be fruitfully used to analyze another interesting counterfactual, i.e. to evaluate how switching costs might evolve once the electricity market in Italy is fully liberalised.

As mentioned in Section 1, as of March 2021, 43% of households were still supplied under regulated contracts. However, following Directive (EU) 2019/944, all consumers (with the exception of energy poor and vulnerable households) must enter the free market by 2024. Regulated prices had already been phased out for most of the business sector in 2021.[25] Business customers who were yet to switch to the free market by July 2021 were assigned to free market providers by an auction mechanism. Four providers won the auction to serve about 200,000 business consumers previously assigned to regulated contracts. ARERA is working on a similar mechanism to phase out regulated prices for the remaining business customers in 2023 and for households in 2024.

[24] It is known, for example, that in less competitive markets not only prices can be higher bu firms may have also smaller incentives to innovate.

[25] Including small-and-medium enterprises and micro-businesses with a committed power above 15 kW.

Table 6. Switching costs with full liberalisation - first 4 firms attracting regulated consumers.

	Target firm										
	1	2	3	4	5	6	7	8	9	10	11
1	-	357	432	438	475	483	501	485	493	509	497
2	22	-	239	422	346	379	390	385	419	430	437
3	17	84	-	357	248	298	314	304	355	373	385
4	9	71	130	-	229	281	297	287	339	357	369
5	39	75	101	112	-	224	242	225	279	300	312
6	-31	1	23	34	76	-	158	140	193	214	225
7	-44	-13	6	17	54	119	-	118	170	191	201
8	-14	16	34	45	81	146	164	-	197	217	228
9	-25	-1	7	17	34	102	118	97	-	161	168
10	-27	-5	0	9	20	88	105	82	125	-	147
11	-5	15	17	26	30	99	114	91	130	146	-

Table 7. Switching costs with full liberalisation - all firms attracting regulated consumers.

	Target firm										
	1	2	3	4	5	6	7	8	9	10	11
1	-	357	459	438	494	498	499	499	502	503	504
2	22	-	301	254	422	439	173	443	461	467	471
3	37	158	-	271	357	390	118	396	431	442	450
4	27	143	238	-	340	375	107	381	418	429	438
5	47	114	177	191	-	322	111	329	380	398	411
6	-24	37	93	107	183	-	38	242	295	314	327
7	102	315	387	393	426	434	-	436	445	447	449
8	-8	48	99	113	184	240	53	-	300	319	332
9	-21	21	56	68	122	183	36	185	-	262	274
10	-23	14	43	54	100	163	32	165	219	-	252
11	-2	31	53	65	102	166	52	166	219	240	-

A crucial decision that will have to be made is how to allocate consumers who, at the time of liberalisation, have not yet changed operator. Using data from 2018 as a starting base, we compare two alternatives: in the first, we assume that, as for the business sector, the largest four firms operating in the free market will be assigned the household customers still with a regulated contract. In the second, we assume that regulated customers are assigned to each firm in our sample according to their market share. In both cases, we assume that consumers from the regulated market are assigned

to the firm in the free market based on its market share.

Inevitably, the assumption alters our switching cost formula and, consequently, the measures of switching costs. Using the now well-known Shy formula, the costs of switching from firm i to firm j, where firm j also obtains a share of regulated customers based on its market share γ_j, are the following:

$$S_{ij} = p_i - p_j \frac{N_j + \gamma_j N_R}{N_i + N_j + \gamma_j N_R}. \tag{4}$$

Table 6 shows the estimated switching costs in the first scenario, and Table 7 shows the switching costs in the second. Using the same methodology as above, we compute our measure of average switching costs in Table 8.

From our exercise it emerges that full liberalisation may have a positive effect on switching costs, which in both scenarios are significantly reduced compared to the pre-liberalisation situation. The message is clear: eliminating the regulated market can stimulate consumer mobility. More specifically, Table 8 seems to suggest that it is preferable as far as possible to extend the allocation of consumers with a regulated contract; average switching costs, in fact, are equal to €316 when the customers in the regulated market are assigned to the four largest firms in the free market, and are equal to €311 when these customers are assigned to all the firms in our sample.

Again, we are aware of the limitations of this exercise. Computations are based on market shares and prices in 2018 and take them as given. Not only have these changed since then but, and more importantly, at the time of liberalisation, companies will inevitably react by changing their pricing strategies; market shares will change as well and, as a result, so will switching costs. It will be interesting to check our predictions using real data, once the regulated market is effectively phased out.

Table 8. Average switching costs with full liberalisation

	2018
Full sample	349
Full liberalisation (4 firms)	316
Full liberalisation (all firms)	311

7 Conclusion and policy implications

Our results show that in the free retail energy market the costs of switching can be substantial, a fact that may explain why in Italy, and similarly in many other European countries, the development of effective competition is particularly slow. We have also

found evidence of a clear segmentation between the subscribers of incumbent firms and those of new entrants: while the latter seem to be less affected by switching costs, the former appear to bear large switching costs.

In light of this market segmentation, we conducted an initial counterfactual in which, instead of a concentrated market characterised by the presence of a national incumbent and a fringe of small new entrants, we calculated how switching costs might have been if the market had been more balanced. This counterfactual shows that switching costs at the market level could have been lower. Due to the extreme flexibility of the methodology used for the calculation of switching costs, based on Shy (2002), we were also able to conduct a second counterfactual to simulate the impact of full market liberalisation, as planned for 2024. Interestingly, we find that full liberalisation will have the effect of reducing customers switching costs.

Our findings might help regulators to face the challenges posed by the full liberalisation of the residential energy market. In particular, our analysis highlights the impact on switching costs of the market structure following liberalisation; our counterfactual reveals, in fact, that if the market had developed in a more balanced way, with fewer but more solid and reliable rival firms, consumers would have benefited in terms of lower switching costs. There are various ways in which a regulator can influence the market structure, favouring the entry of the best equipped, most reliable and financially stable operators, for example, by requiring them to fulfill more stringent capital requirements in order to enter the market or by introducing a transparent qualification system for providers entering the retail electricity market. As an alternative the regulator could require retailers to enter into long-term contracts with distributors and/or transmission operators; indeed, these contracts should be provided only by firms with adequate financial and operational means. These regulatory policies clearly have a cost in terms of the lower degree of competition that develops in the market, but they have the benefit of stimulating the entry and the development of more solid energy firms, capable of operating in the market and able to provide better services to consumers, ultimately favouring switching behaviour. Finally, considering auctions that will be adopted by 2024 to assign consumers who haven't yet switched to the free market,[26] we suggest to include qualification rules to screen firms allowed to enter such competition. These qualification rules need to select providers bidding for consumers to be solid enough to increase consumers trust and to support their switching in the energy market.

[26]In 2021, by auction, ARERA assigned to free market providers small-and-medium enterprises and micro-businesses with a committed power of over 15 kW; a similar mechanism will be applied in 2023 to the remaining micro-businesses and in 2024 to residential consumers.

Funding details

This study received the support of the Italian Regulatory Authority for Energy, Networks and the Environment under the Research Grant "Misure atte ad elevare la capacità, la consapevolezza e la partecipazione attiva del cliente finale nei mercati dell'energia elettrica e del gas naturale" and of the University of Padova under the Grant "Dotazione Ordinaria Ricerca - DOR".

Disclosure statement

No potential conflict of interest is reported by the authors.

Data availability statement

The data supporting the findings of this study were provided by the Italian Regulatory Authority for Energy, Networks and the Environment (ARERA). Restrictions apply to the availability of these data, used under license for this study.

References

ACER-CEER (2020). *Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2019*.

Airoldi, A. and Polo, M. (2017). Opening the retail electricity markets: Puzzles, drawbacks and policy options. Technical report, IEFE, Center for Research on Energy and Environmental Economics and Policy.

ARERA (2019). *Indagine sulla liberalizzazione del mercato dell'energia elettrica e del gas*. Available at https://www.arera.it/allegati/eventi/190220_indagine.pdf.

ARERA (2021a). *Dati statistici*. Available at https://www.arera.it/it/dati/elenco_dati.htm.

ARERA (2021b). *Monitoraggio Retail. Rapporto per l'anno 2019*. Report n. 71/2021/I/COM.

Björkman, E. (2021). Estimating switching costs in electricity retailing: Empirical evidence from Sweden. Dissertation. Available at http://urn.kb.se/resolve?urn=urn:nbn:se:umu:diva-184719.

Burnham, T. A., Frels, J. K., and Mahajan, V. (2003). Consumer switching costs: a typology, antecedents, and consequences. *Journal of the Academy of marketing Science*, 31(2):109–126.

Carlsson, F. and Löfgren, Å. (2006). Airline choice, switching costs and frequent flyer programmes. *Applied Economics*, 38(13):1469–1475.

CEER (2019). *Monitoring Report on the Performance of European Retail Markets in 2018*.

Dragotto, M., Magnani, M., and Valbonesi, P. (2021). Consumer inertia and firm incumbency in liberalised retail electricity markets: An empirical investigation. University of Padua, Marco Fanno WP n. 77-2021.

Egarius, D. and Weill, L. (2016). Switching costs and market power in the banking industry: The case of cooperative banks. *Journal of International Financial Markets, Institutions and Money*, 42:155–165.

Fontana, M., Iori, M., and Nava, C. R. (2019). Switching behavior in the italian electricity retail market: Logistic and mixed effect bayesian estimations of consumer choice. *Energy Policy*, 129:339–351.

Giulietti, M., Price, C. W., and Waterson, M. (2005). Consumer choice and competition policy: A study of UK energy markets. *The Economic Journal*, 115(506):949–968.

Giulietti, M., Waterson, M., and Wildenbeest, M. (2014). Estimation of search frictions in the British electricity market. *The Journal of Industrial Economics*, 62(4):555–590.

Hortaçsu, A., Madanizadeh, S. A., and Puller, S. L. (2017). Power to choose? an analysis of consumer inertia in the residential electricity market. *American Economic Journal: Economic Policy*, 9(4):192–226.

Krafft, J. and Salies, E. (2008). The diffusion of ADSL and costs of switching Internet providers in the broadband industry: Evidence from the French case. *Research Policy*, 37(4):706–719.

Leibbrandt, G. (2010). Establishing compatibility between europe's payment systems. *International Journal of Industrial Organization*, 28(1):69–73.

Martimort, D., Pouyet, J., and Staropoli, C. (2020). Use and abuse of regulated prices in electricity markets: How to regulate regulated prices? *Journal of Economics and Management Strategy*, 29(3):605–634.

Salies, E. (2005). A measure of switching costs in the GB electricity retail market. *mimeo*.

Shin, K. J. and Managi, S. (2017). Liberalization of a retail electricity market: Consumer satisfaction and household switching behavior in Japan. *Energy Policy*, 110:675–685.

Shy, O. (2002). A quick-and-easy method for estimating switching costs. *International Journal of Industrial Organization*, 20(1):71–87.

Yang, Y. (2014). Understanding household switching behavior in the retail electricity market. *Energy Policy*, 69:406–414.

Appendix A

Table A1. Switching costs from firm i to target firms (2015).

	Target firm						
	1	2	3	4	5	6	7
1	-	267	**435**	**454**	**467**	**467**	**471**
2	209	-	**421**	**445**	**461**	**461**	**466**
3	40	46	-	311	389	388	**418**
4	27	36	169	-	338	335	381
5	12	18	90	142	-	232	296
6	40	46	115	165	262	-	319
7	5	10	58	96	181	232	-

Bold numbers: switching costs $\geq$ 85% of the yearly bill.

Firm 2 charges the lowest price.

Table A2. Switching costs from firm i to target firms (2016).

	Target firm									
	1	2	3	4	5	6	7	8	9	10
1	-	402	**445**	**455**	**471**	**472**	**473**	326	**474**	**475**
2	83	-	346	380	**441**	**445**	**451**	156	**459**	**459**
3	30	132	-	280	381	387	398	83	**414**	**415**
4	31	107	202	-	359	366	380	77	401	403
5	-16	16	78	105	-	229	253	19	283	286
6	32	57	112	134	253	-	278	66	308	312
7	-3	20	73	93	210	208	-	30	265	269
8	135	321	**389**	**407**	**435**	**437**	**439**	-	**442**	**442**
9	7	24	67	82	189	183	212	39	-	246
10	2	18	61	76	183	176	205	34	234	-

Bold numbers: switching costs $\geq$ 85% of the yearly bill.

Firm 8 charges lowest price.

Table A3. Switching costs from firm i to target firm (2017).

	Target firm										
	1	2	3	4	5	6	7	8	9	10	11
1	-	**401**	**443**	**449**	**460**	**464**	**466**	326	**468**	**469**	**470**
2	87	-	355	377	**420**	**437**	**450**	159	**459**	**461**	**468**
3	25	119	-	260	326	357	381	76	**399**	**406**	**418**
4	37	110	219	-	314	349	378	82	399	408	**422**
5	17	59	148	166	-	281	315	54	341	354	374
6	-14	17	97	111	180	-	260	21	288	302	324
7	-16	3	72	81	145	190	-	16	253	270	293
8	131	319	**389**	**401**	**421**	**428**	**433**	-	**437**	**438**	**440**
9	5	15	73	77	133	177	210	36	-	256	279
10	-19	-11	46	48	103	147	179	11	288	-	248
11	3	6	55	53	100	143	172	32	194	215	-

Bold numbers: switching costs $\geq 85\%$ of the yearly bill.

Firm 8 charges the lowest price.