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1. Introduction

In the course of the European Commission's objective of liberalizing and integrating all electricity and gas markets of the European Union, the Portuguese electricity market went through a radical transformation. Formerly, the state owned incumbent Energias de Portugal (EDP), produced, distributed and supplied all Portuguese households with electricity and gas. Today, producers, suppliers and consumers engage in a free market. The formerly regulated tariffs which are still available for the majority of consumers are currently being abolished. The objective of this paper is to examine and discuss the effects of the Portuguese electricity and gas market liberalization in terms of efficiency improvements for household consumers in Portugal. To be effective, liberalized markets should be designed in a way that encourages efficient competition: where customers exercise choice, where new competitors enter the market and existing ones compete, where the customer experience is positive and where the costs of competition do not outweigh the benefits (Lewis, Bogacka, 2014, 2). While the level of competitiveness and the number of new entrants in the Portuguese market are examined in brief, the analysis of the customers' behaviour and exercise of choice is the core objective of this paper. An active market participation of consumers is considered as a strong indicator for the functioning of a market. Understanding what customers value and which criteria are relevant for their decision making are therefore of great relevance for policy makers and businesses. Analysing the market development within the transitional period of abolishing the regulated tariffs is particularly interesting as this is likely to trigger to additional market turbulences.

This paper is structured in two sections. The first part lays the theoretical framework for the second part and is divided into 3 chapters. The first chapter analyses the process and results of the liberalisation of the European Union's energy markets. After looking at the regulative perspective, the second chapter analyzes the consumer behaviour in utility switching. The third chapter focuses on the Portuguese market for household energy supply in terms of competition and price developments. The second section econometrically analyzes the customer switching behaviour of Portuguese electricity customers based on a quantitative study with 405 respondents. At first, a logistic regression model is used in order to predict the switching behaviour of Portuguese electricity consumers. Thereafter, a multiple linear regression model is applied to analyze the switching intention of the same respondents.

The results of the model suggest that effective retention or poaching strategies require precise segmentation in order to successfully target customers as they do not have homogenous preferences. Yet, market knowledge and the perceived transparency of the offer stimulate the switching behaviour for the vast majority of customers. The results also suggest that consumers trade off saving opportunities with reliability, while the vast majority of all Portuguese are price sensitive. Moreover, differences exist among the choice criteria of the real switchers and intenders which suggests that inertia plays an important role for a large proportion of customers.

2. The market liberalisation in the European Union

In 1994, the European Commission (EC) published the White Paper "An Energy Policy for the European Union" (1994) in which it announced its proposed energy policy framework for the Member States of the European Union (EU). The risks related to the upcoming effects of climate change and the increasing dependence on foreign primary energy supplies from instable political environments needed to be diminished. As the report further states, the future energy outlook required greater solidarity within the Union in terms of energy choices. These challenges presupposed a reconsideration and restructuring of the roles and interests of the member states in terms of their cooperation and market structure.

The energy supply and distribution in Europe's member states was formerly dominated by state-owned monopolies, which were protected from competition and followed mainly national interests (Sioshansi, 2006). The EC considered this market structure as unsuitable to tackle the forthcoming challenges. The solution to these aims and threats was supposed to be achieved by measures of […*deregulation and limiting public intervention to what is strictly necessary in order to ensure public interests and welfare, sustainable development, consumer protection and economic and social cohesion*] (European Commission, 1994). By creating a union wide legal framework, composed by directives of the EC, all energy markets within the EU would need to follow equal stipulations and thereby become reformable.

The core objective behind this measure was creating an integrated energy market for the EU which would eventually, through the forces of market-mechanisms, increase the efficiency of the markets. By abolishing national restrictions and allowing competition - in terms of energy generation and retailing - on a national and EU-wide level, the EC laid the basis for the

creation of a single EU energy market. An integrated, single energy market was considered capable of (European Commission, 2008):

- Increasing the EU's influence on the global energy market
- Enhancing the energy solidarity among the member states
- Implementing EU-wide sustainability and efficiency programs

Besides these strategic and political objectives, the liberalization process was assumed to increase the market efficiency and have positive welfare effects on the EU. According to the Austrian School of Economics, independent economic actors, referred to as entrepreneurs competing in free markets are more likely to create efficient market equilibriums than central planners, such as monopolistic utilities. The entrepreneur is incentivized to continuously seek for market imperfections and improving these as imperfections are the source of profit opportunities. Competition is considered as an activity or process (Hayek, 1968), through which information is released and from which market participants learn and develop. A central conclusion is that this information was not available before competition released it and therefore, it would not be available to the central planner. In short, competitive markets have an information advantage towards monopolies. As long as economically meaningful information is extractable, profit opportunities exist. Discovering, processing and utilising this information is the central role of the entrepreneur in driving the market towards the efficient equilibrium. The entrepreneur is considered to be especially suitable for this as a result of his creative, innovative, dynamic and risk taking characteristics (Defeuilley, 2009). The alertness and sound business conception of entrepreneurs allows and drives them to innovate their product or service, as increased productive capacity is again rewarded with profit opportunities (Kirzner, 1997b). As economic agents enter a market as long as profit opportunities exist, the market price is reduced until it reaches the marginal costs. The more homogenous a product is, the greater the competition affects the price as other possibilities of differentiation are limited.

Inspired also by the real life example of the British market liberalization (Dorsman et. al 2011), the EC foresaw significant improvements in terms of greater competitiveness of the economy, better customer experience, such as a greater choice of suppliers and improvements in terms of price-quality ratios. The liberalized market was expected to have positive effects

on the security of supply and environmental protection as it would attract large investments and generate new innovations.

2.1. Results of the market liberalization

Research on the effects of the liberalization process in the EU identifies that still several objectives have not been realized. The European Commissioner for Competition Policy, Neelie Kroes (2007), came to the conclusion that Europe's energy markets were far from the set objectives, 10 years after gradually liberalizing the markets. The "deeply concerning results" were related to the high levels of concentration of the incumbents, low levels of cross-border trade, the existence of entry-barriers for new entrants resulting from a lack of transparency concerning the operations in the wholesale sector and the vertical foreclosure maintaining the market dominance of the former state monopolies.

The evidently slow progress in the market liberalization has several reasons. Domanico (2007) argues that they have a political and economic nature. The security of supply and the economic importance justify governmental interventions and the will to maintain significant national control over the domestic energy markets which inhibits the EU market integration.

Dorsman et al. (2011) point out the problems of technical barriers related to the characteristics of energy, as it relies on a physical network which negatively impacts the liquidity of the market. Moreover the strong interdependence and coordination among regions needed in order to make trade possible, is often geographically unfeasible and tends to fragment rather than integrate the market. Domanico furthermore emphasizes that the EC has not managed to adequately approach the lack of investments into international interconnection infrastructure through its directives.

Littlechild (2009) argues that the theoretical conclusions drawn from market liberalisation, as described by the Austrian school, do in most cases not apply to the liberalisation of electricity retail markets. Consumers are not always capable of making rational decisions and the decision base is rarely only cost driven. Moreover, technological innovation is unlikely to occur as the experience shows.

Pollitt (2009) analyzed the development of the energy markets from the perspective of the EU-27 member states. While some states have performed better than others, the overall

market had improved in terms of cross border trade, improvements in labour productivity and some price falls, moreover a degree of price convergence were observed. However, from 2003 onwards prices rose and diverged again.

The EC (2012) comes to similar conclusions in a more recent review. The slow adjustment of the member states national legislation and nationally inspired policies are limiting the process of creating a competitive market at national levels and the development of the integrated European market. Yet, many European consumers are now facing greater variety of choice from increased competition and improved price comparison tools. The EC also registered increased cross-border trade and wholesale electricity prices increasing significantly less than the costs of primary fossil energy sources.

Advances in market coupling have increased the security of supply and allowed prices to converge. The full implementation of existing legislation will be completed in 2014. Big progresses have already been achieved since February 2014 in terms of creating an internal energy market for the north-western European Electricity market (European Commission, 2014). 14 EU-member states, accounting for 75 percent of the EU energy consumption, have created a day-ahead market for coupling wholesale electricity markets. By using implicit auctions, the day-ahead transmission capacity – being the amount of capacity available at cross border interconnections – is used integrate the different spot markets (Nord Pool Spot, 2014). Overcapacities of one region, where prices are lower flow into deficit areas, where prices are higher and thereby create price convergence.

3. Customer Utility Switching

From an EU-wide perspective, one can conclude that the liberalization process has led to measureable improvements in the market; however, when comparing the electricity market with other formerly state controlled markets, such as the telecommunication market (Wieringa and Verhoef, 2007) the progress of market improvements appears to be slow. Since the regulative perspective has been analyzed so far, it is useful to look at the demand side of the market. In the following a detailed overview of the consumer mobility, the theory of customer utility switching, the consumer behaviour in energy markets and the product features of household energy is provided.

3.1. Consumer mobility in the European Union

As mentioned before, the most conventional economic theory argues that markets which are considered as free benefit consumers as decreased prices and product innovations improve the consumer's surplus. A prerequisite for this theory are rational decisions of consumers. Consequently, a consumer would choose a different energy supplier whenever a better offer - according to his preferences - is available in the market[1]. However, research indicates that the consumers' mobility in electricity and gas markets is very low within the EU (ECME Consortium, 2010) as it is in the world average (VaasaETT, 2012). In 2013, in average 7 percent of all consumers switched their supplier and 4 percent switched their tariff with their existing supplier. It is important to notice that a continuous increase is observable on an EU-wide scale, yet not to a satisfying extent. One of the three core objectives of the EC is creating a consumer-oriented market. As noted by Jerzy Buzek (2013), former president of the European Parliament, energy consumers are at the very core of the internal EU energy market. As such, they must *"play a more active role in stimulating market competition, moving from passive service recipients to active informed consumers and prosumers"*. Prosumers are understood as more proactive market participants who express their demand and are often engaged in the product or service development. The demand side has the duty of disciplining the market by signalling its demand for improvements in order to guarantee the functioning of the market. The vital role of the consumer is increasingly recognised in competition policy most dominantly in markets which have recently been opened for competition (see Giulietti et al., 2005 referring to Prendergast, 2002; Waterson, 2003).

In the following the reasons for the low levels of participation will be analyzed from the theoretical standpoint of customer utility switching as well as the market indicators for the general attractiveness of switching.

Before examining the switching behaviour in more detail, it is useful to provide a precise definition and an overview over the most commonly accepted theories of customer switching. The comprehensive definition for customer utility switching and switching activity, adopted by the Council of European Energy Regulators (CEER) is the following: "*A switch is*

[1] Chapter 3.2 describes this principle in further detail

essentially seen as the free (by choice) movement of a customer (defined in terms of an overall relationship or the supply points and quantity of electricity or gas associated with the relationship) from one supplier to another. Switching activity is defined as the number of switches in a given period of time." (VaasaETT, 2012, p. 10). The opposite of switching the provider is termed as retaining the customer as a result of loyalty. This terminology will be used in this sense throughout the entire paper.

3.2. Theory on Customer Switching

The theoretical approaches towards questions of customer switching (or churn) are usually examined by the fields marketing and economics. Economists tend to approach churn from the switching cost perspective, which can emerge from several different sources.

3.2.1. Switching Cost Theory

Generally speaking, switching costs arise from the customer's desire for compatibility between a new purchase and his previous investment (Klemperer, 1995). Any deviation from this compatibility incurs either physical or opportunity costs. Avoiding these costs requires the consumer to remain loyal. Klemperer relates to these switching costs as investments, which could have a physical, informational, psychological, or artificially-created nature.

The relevant costs/investments for switching the energy provider could arise from:

- Transaction costs of switching (physical). E.g. the searching and enforcement costs, which increase with the complexity of the market.
- Costs of learning how to use new brands (informational). E.g. when the billing is changed from one bill to two separate bills for transmission and supply.
- Uncertainty related to unknown brands (informational). E.g. searching costs related to the reliability, economic condition, customer-experience, etc. with a new supplier.
- Economic brand loyalty (artificially-created). E.g. bonus programs for bundling several services (electricity, gas, maintenance, TV, Internet, etc.) from one supplier.

- Need for compatibility (physical) E.g. equipment or installation costs can occur when switching from an "All-In-One supplier" (electricity, gas TV, Internet) to one or several new suppliers
- Non-economic brand loyalty (psychological). E.g. a consumer being initially indifferent towards several products of the same purpose, often prioritises one of those products after a trial and will therefore continue to prioritise it in future. This is referred to as reducing cognitive dissonance (Brehm, 1956).

Switching costs only occur once a product has been obtained. However, thereafter all of these above mentioned conditions have the ability to turn ex ante homogenous products or services into ex post heterogeneous ones (Klemperer, 1995) with a new preference order. Nevertheless, a consumer can obviously also perceive benefits from switching as an improved price-quality ratio, improved service level, or joy from trying something new. In this sense, any repeat purchasing situation, the decision maker is confronted with a trade-off between potential benefits and costs of switching. Economists most commonly explain the purchasing decisions of individuals using the rational choice theory which suggests that an agent will always choose the alternative providing the greatest utility, usually being the most cost effective decision. The correct decision requires full information about the existing alternatives.

3.2.2. Marketing approach

The field of marketing also analyzes the concept and sources of customer switching from a switching cost perspective. However, the role of inertia has greater relevance in marketing and is therefore considered separately and not as part of the switching costs as in economics. It is well documented in marketing literature and correctly referred to as "inertia in brand choice" (see Dubé et al., 2010). Inertia essentially has the same effect as loyalty; however the customer's decision making of a purchase differs in both cases. In case of loyalty conviction prevails, whereas inertia triggers purchases out of convenience.

Other scholars distinguish inertia from loyalty by the level of consciousness involved in a purchase (Huang and Yu, 1999). Inertia can also be regarded as the persistence of consumers towards products they once purchased in the past. However, these definitions do not seem to clearly differentiate the marketing approach from the economic definition, being the

customer's desire for compatibility between a new purchase and his previous investment. In order to fully understand the differentiation between inertia and switching costs, the decision process must be analyzed. As argued before, economists most commonly explain the purchasing decisions of individuals using the rational choice theory which presumes that consumers choose the solution which maximises their individual utility taking their total wealth into consideration.

Research in behavioural science suggests that consumers often don't follow this rational switching behaviour. They tend to favour the status quo that is, staying with the brand they already have or are currently consuming. Hence, Lee and Neil (2012) define inertia as the attitudinal propensity of being *passive* or *inactive* and therefore maintaining the status quo. Depending on the level of consumer inertia, retention can be achieved even when better offers, in terms of cost efficiency, exist in the market. The same may hold true for a dissatisfying experience with the current provider. This means that a consumer which is confronted with a switching decision, where the costs and benefits of the outcome and the probabilities assigned to these events are known so that the expected utility associated with the outcome were greater than 0 ($E(u^{s}_{it})>0$), inert customers could still tend to stay with the current provider offering no utility improvement.

This leads to the conclusion that some consumers are either unable or unwilling to continuously compare existing offers and re-evaluate their consumption decision (Ek, Söderholm, 2008), which contradicts the utility maximising principle of the rational choice theory. As Solomon et al. (2002) argue, an inert consumer simply has insufficient motivation to consider alternatives. This is why the distinction between inertia and loyalty is emphasized in marketing literature. While loyal customers find a rational reason not to switch, inertia affected consumers act irrationally and rather unconsciously. The remaining question is what features really affect the level of inertia and how present it is in the market of household energy?

Kahneman and Tversky (1979) contributed to a new understanding of consumer behaviour in terms of the evaluation of costs and benefits of an uncertain outcome. They labelled their finding loss aversion which expresses that people typically value losses greater than gains. Inertia is often related to the endowment effect, which claims that consumers value goods they once owned higher than others, even if they just had received it shortly before and no

emotional binding is necessarily attached to the product. Staying with the current supplier, although price savings are available in the market, could in this sense also be a related to the endowment effect. Another approach argues that users have more experience and knowledge about their current supplier and therefore associate greater confidence with them (Ek, Söderholm, 2008). It is important to note that this does not imply that the customer experiences satisfaction or feelings of commitment with the current supplier. Most consumers are considered risk averse, therefore the perception of risk with the alternative supplier devalues the option and puts the current supplier in a favourable position.

Switching costs are also considered in the field of Marketing, however the approach differs slightly from the perspective of economists. Rather than looking at switching behaviour from the "Cost Perspective", marketers often look at the value perspective of retaining a customer. Wieringa and Verhoef (2007) understand switching behaviour as a result of two broadly defined groups of antecedents: the economic and the social. The economic perspective focuses on the economic value of the relationship. Several studies indicate that satisfied customers are more loyal and customer loyalty increases a company's profitability (Hallowell, 1996). The overall satisfaction therefore expresses this economic value which is usually composed by several determinants, the most significant being the perceived price levels and price value ratio (Wieringa and Verhoef, 2007). Therefore, the challenge of the economic approach lies in quantifying the value of overall satisfaction.

Social determinants distinguish themselves by considering more social and affective influences. Several scholars have pointed out the relevance of trust and commitment in retaining old or attracting new customers (Garbarino and Johnson, 1999, Morgan and Hunt, 1994). Trust in relationships with brands or an entire organization is considered as the confidence in the quality and reliability of the services offered to the customer. Commitment results from the identification with the organization as well as the psychological attachment to it. If all determinants (social and economic) could be quantified, companies could more accurately predict how high expenses for the retention of customers, such as advertising, loyalty programs etcetera should be and distribute them more precisely.

3.2.3. Conclusions

Wieringa and Verhoef (2007) point out the importance of both economic and social switching determinants for liberalizing markets. Electricity and gas customers throughout the EU have been unaccustomed to new suppliers which most likely increases the role of the social components trust and commitment. Customers have become familiar with the services and charges and they have learned what they can expect. Therefore, consumers lack the judgment experience of the economic determinants such as perceived price levels and price value ratio. It is not particularly surprising that less knowledge of consumers about the competing suppliers has a direct negative effect on switching rates (Capraro et al., 2003).

It is important to mention that the above discussed switching costs and inertia are general findings of the fields of Marketing and Economics. When analyzing the reasons for low customer involvement in the electricity market, it is important to identify which *switching costs* are relevant within the electricity industry, as these may heavily differ from other industries. However, it is also important to emphasize the relevance of these findings, e.g. for policy makers, when objecting (as in the EU) to increase consumer mobility, competition and price reductions.

Besides switching costs, the origin of *inertia* must be closely examined. Since consumers tend to repurchase products from the same brand, although there are functionally identical alternative products available, the first entrant gains a significant benefit towards his followers. With this, the first entrant receives a degree of market power over its customers and following competitors, which allows them to charge a price premium (Klemperer, 1995) and reduces the consumer welfare.

In this sense, it is valuable to also look at the *current market share of providers* since they influence the future and current profitability of companies and potentially also the feasibility of competition. This insight is essentially true in liberalizing markets which were formerly controlled by state-owned monopolies which supplied all of the markets customers, such as within the electricity and gas markets.

In order to fully understand the origin and relevance of switching costs and inertia, analyzing the *product features* of household energy products is essential, as these are unique in many senses. Moreover, the next chapter reviews the most relevant theoretical findings of consumer behaviour in customer utility switching.

3.3. Product Features of Electricity and Gas

This chapter aims to explain the reluctance of electricity and gas consumers to switch providers as a result of the unique product characteristics. Following the classification of Watson et al. (2002), electricity and gas are most closely related to convenience goods. Convenience goods are products which are purchased very frequently and they are typically cheap enough to consume without reflecting too much about the investment. The consumer knows what to expect from such products and does not want to spend a lot of time in the decision process. Nevertheless, electricity and gas are unique in many terms. Unlike most other products, there is no substitute for electricity. For gas this must essentially not always hold true, although the variety of alternatives to heating and cooking with gas is also very limited. Few substitution possibilities decrease the price elasticity of demand and reduce the ability and willingness to switch as consumers become less price sensitive.

In fact, the elasticity of demand for electricity and gas is very low as shown in various studies. Fan and Hyndman (2011) reviewed the existing literature for the price elasticity of demand in liberalized electricity markets and estimated it for South Australia. Although they identified large inconsistencies within the results of different papers, the most frequent results for the short-term price elasticity was among -0.2 to -0.4 and in the long run -0.5 to -0.7. They could not identify significant differences among the commercial, residential and industrial sectors.

Another differentiating feature of energy its intangibility. Tarn (2005) analyzes the effects of intangibility in service markets and argues that the intangible nature increases the customers' perceived risks and uncertainty of services. This conclusion is based on the belief that consumers find intangible services difficult to evaluate. Since they have difficulties assessing the quality, the feeling of uncertainty obviously also increases. Intangibility also increases the perceptual defence and perceptual equilibrium, which indicates that consumers choose or interpret information in a way that it is consistent with former beliefs and therefore reduces the intention to switch a brand.

As both products are homogenous goods, few differentiation possibilities exists. Consumers expect to be supplied continuously, unlimitedly and reliably, however once this criteria is fulfilled, the only playground for providers to compete on is based on price, service and reputation.

3.4. Theory on the Purchasing Process in Utility Switching

Additional useful knowledge about the low responsiveness of household energy customers can be identified when analyzing the characteristics of consumer behaviour. Kotler and Keller (2009) argue that a purchase, or as in the case of long term contractual commitments a customer switch, begins with a stimulant that creates a need recognition. A need can have a psychological or functional nature, whereas energy as a product is classified as the latter.

For finite products, a need recognition typically arises naturally when the good or service is depleted, nevertheless it can also arise through promotional activities.

Need recognition: As mentioned above, gas and electricity are intangible products and infinite in their supply. Consumers will never run out of the supplied energy, therefore the awareness and recognition of a need decreases. In this sense, need recognition most likely arises from other sources, such as the electricity bill. Although the expenses are not notably considered while using the good, the total annual expenditures could incentivize the need of cheaper alternatives. Electricity, gas and other fuel expenses account for more than five percent of the household budgets within EU-27 average (Eurostat, 2009 and own calculations). Watson et al. (2002) point out that utility companies are attempting to decrease this stimulant by encouraging paying via direct debit schemes. Stimulants could also arise from a weak service performance or notable price increases of the current supplier or from the energy regulators initiatives of public consultation and awareness programs. Nevertheless, the need recognition for household energy is low.

Information Search: Once a need is recognized, consumers become active in the information search. The level of risk associated with the purchase of the product influences whether high or low involvement is dedicated to the information search. The higher the risk is perceived, the greater the involvement. The associated risk essentially depends on the total costs, the urgency and the experience level. Routine purchases, such as electricity and gas mostly don't require any involvement. However, switching the provider requires high involvement, as the expenses for household energy play an important role in the consumers' budget and consumers in general have low experience levels with switching the energy provider. Moreover, intangible products are in general associated with higher risks and feelings of uncertainty than tangible products (see Tarn, 2005). Due to the intangible nature of energy

products, consumers also find the information search complex, since they have no feeling for how much they use (Parmar et al. 2000). Also, the reliability of supply and service is of great relevance for consumers, which increases the associated risk of making a bad switch. The high level of associated risk will require high involvement in the information search. This is perceived as costly (in terms of switching costs) to the consumer. Low saving expectations in combination with the high involvement required to switch the provider contributes to the explanation of why consumers are sluggish in utility switching.

Evaluation of alternatives and purchase decision: Once the information search is completed, the consumer considers a set of potential alternatives which are referred to as the evoked set. As mentioned above, energy as a product is consumed out of a functional need. Yet, when evaluating alternatives in the purchase decision, consumers are likely to also feel an emotional need, such as safety, reliability, etcetera of the provider. Wieringa and Verhoef (2007) demonstrate the relevance of trust and quality perceptions in electricity consumers switching intention[2]. Well established brands experience an advantage as they are more likely to be part of the evoked set and the familiarity reduces the associated risk of the decision maker.

After considering the costs and benefits a purchase decision follows. As stated in chapter 3.1.2, economists following the rational decision theory assume consumers to switch when their $E(u^{s}_{i,t}) > 0$. However, as research on customer utility switching shows (chapter 3.5), household energy consumers do not always act as rational as the theory assumes.

In summary, the analysis of the elements of the purchase process and the product features of electricity and gas, it becomes apparent that the low levels of customer switching are not necessarily attributed to inappropriately or poorly designed market conditions. Incumbents are likely to have an advantage towards new entrants as they are well established as first movers. Consumers have built expectations, and got used to their services. This becomes evident when considering that many years after the beginnings of full competition and liberalisation in the electricity and gas market there is no country in which the incumbent does not serve the majority of clients (VaasaETT, 2012). Considering the low levels of need recognition, the challenges of the information search, the loss aversion and consumers'

[2] Chapter 3.5 provides a more detailed overview of Wieringa and Verhoef (2007) findings about switching determinants in the liberalizing Dutch electricity market.

inertia, it seems comprehensible that switching rates have been low and rather unlikely that consumers will frequently switch their energy provider unless substantial benefits can be derived from it or switching costs decrease significantly. Switching costs decrease from increased marketing activities of alternative suppliers, awareness programs from the national regulators, the customers learning effect as shown in the following chapter etcetera.

3.5. Research on Consumer Utility Switching in Energy Markets

Parmar et al. (2000) analysed different sources for the reluctance of UK consumers to switch their gas supplier. Their findings provide support for an *investment model*, which evaluates the probability to perform a switch based on the present value of the investment. Costs arise immediately and are classified in a similar sense as the above described switching costs. The benefits from switching result from the value of future savings. Risk aversion is also considered in the investment model as a measure of future expectations of the market development. If the consumer believes that the price differences between the current supplier and the competitors are only of short duration, they will have a higher risk aversion.

Their results show that the likelihood of switching increases with prior switching experience from another utility. This finding was further supported by an assessment of consumer markets conducted by the European Commission (2013). Switching is perceived as considerably easier for those who have once switched, throughout all 14 tested consumer markets. Further positive influences are the household size and the “gas-bill size”. Education, age, income and employment do not reveal any clear effects on switching behaviours while risk aversion negatively correlates with switching. Moreover, the paper indicates that several participants experienced difficulties in obtaining an equivalent service at a lower price from a different supplier.

Watson et al. (2002) refer to a qualitative research undertaken by a German consulting firm in which they question the mere benefit of lower prices for the consumers and investigate the factors which incentivize switching intentions. The survey was conducted prior to the liberalization in Germany and its respondents revealed that price reductions were the key factor in switching decisions, however for many consumers it was not a sufficient incentive. Energy efficiency, green energy, switching bonuses and hostility towards the former

incumbent are switching drivers which were additionally identified. On the other hand, avoiding nuclear power, the value of patience, as prices were expected to decrease in time, and concerns over the integrity of supply were identified as reasons not to perform a switch. Moreover, the German consumers expected that switching costs would exceed the benefits. The authors come to the conclusion that many of the expectations have not been sufficiently achieved. Switching rates remained low also because new entrants find it difficult to make convincing price based offers and inertia remains of great importance.

Wieringa and Verhoef (2007) conduct an *exploratory study* of the switching behaviour in the liberalizing Dutch energy market. Based on a survey questioning the Dutch electricity users about their perceptions of the price and quality, trust, word of mouth intentions and switching costs in an economic and psychological sense, they aim to define the determinants of switching behaviour. Three significant variables were extracted using the principal component analysis, which explain over 60 percent of the variation data. These being relationship quality (which refers to trust and word of mouth, quality and price perceptions), perceived switching costs and attractiveness of switching. The switching behaviour is examined by estimating a *Logistic Regression Model*, with the three Principal Components as explanatory variables and switching intention as dependent variable.

23.5 percent of all Dutch respondents indicated the intention to switch as they preferred another electricity supplier towards their current one. The strongest driver for the intention to switch was the relationship quality. The second most explanatory variable in the model were switching costs which had approximately half as much of an impact as quality relationship. The least influential parameter was the attractiveness of switching, which examined the perceived differences of the suppliers in terms of quality and price, and in this sense the perceived gains of switching.

The analyzed data also provides information about the number of additional contracts, such as cable TV, obtained from the electricity supplier. The results indicate a negative relationship between number of contracts and the intention to switch. This insight provides evidence for higher levels of loyalty where switching costs are greater. Unfortunately the study doesn't reveal whether this loyalty comes from economic or psychological brand loyalty or the need for compatibility as classified by Klemperer (1995). Further results suggest that heavy users are less likely to switch, which contradicts the findings of Parmar et al. (2000), however the

significance is very low and only holds true assuming no heterogeneity among the respondents.

In a deeper analysis, the assumption of heterogeneity is taken into account using the *Latent Class Analysis*. The authors emphasize the improvements of this approach as categorizing customers into segments with similar switching intentions results in a more optimal model and provides a more differentiated view on the customer. They derive four customer segments and analyze them separately which reveals significantly different results for three of the four explanatory variables.

All segments experience higher switching intentions when switching costs decrease, however the majority (77% of the respondents) are not heavily affected. Of the remaining two segments, only one (Segment 3 - 9% of the respondents) reacts very sensitively. A very similar pattern is identified for the perceived attractiveness of switching. While the majority (91% of the respondents) are insensitive towards this variable, the customers of Segment 3 are again highly sensitive to this variable. The influence of the usage rate becomes inconsistent when comparing the segments, as the majority (77% of the respondents) are not significantly affected by this variable. The most sensitive responding customers of Segment 3 have higher switching intentions as consumption increases. For one segment the opposite is the case. Two variables, quality relationship and the number of contracts, remain consistent.

After comparing the different insights with the switching rates, the authors draw the following conclusions. All customers value good quality relationship and nearly all (94% of all respondents) are fairly loyal, with switching intentions of approximately 20 percent. The majority of these customers are quite insensitive towards all other explanatory variables. These customers do not heavily respond to the ease or attractiveness of switching, their consumption level or the number of contracts they obtain from one supplier. Only a small customer share, represented by segment 3, show high sensitivity levels, however this doesn't notably affect the switching intention.

With this, the authors point out the relevance of inertia in liberalizing markets. Most Dutch electricity customers appear uninterested in the potential benefits or costs of switching but preferably desire a trustful and reliable service at a reasonable price quality ratio. This observation matched the de facto low levels of switching in the liberalising Dutch electricity market. In this sense a switching intention mostly does not correspond to an actual switch.

Only one segment (6% of the respondents) appears to be very disloyal but no explanatory variable stands out to explain this.

Ek and Söderholm (2008) create an own theoretical framework to identify the switching intention of customers in Sweden. They model the purchasing process in a similar way as described in chapter 3.4. The authors consider three different sources as potential stimulants for need recognition. The "Push Effect" is related to a dissatisfying performance of the current supplier as a result of e.g. price increases, a negative personal experience etcetera. "Pull Effects" stem from attractive competitors' offers, which catch the attention of a consumer. The "Status quo Effect" considers a number of well documented phenomena of the fields of psychology and economics which are related to consumers' reluctance to switch. Besides the already mentioned aspects of inertia and loss aversion, the authors also consider extremeness aversion, omission losses and the endowment effect. Extremeness aversion describes the dislike of extreme outcomes which many consumers experience and therefore prefer not to face the risk of switching (Simonson, Tversky, 1992). Omission losses refer to the concept of omission biases, which define peoples' preference of making passive rather than active decision. In terms of switching behaviour individuals would rather not perform a switch than experience greater regrets of making a bad choice. The endowment effect describes the hypothesis that people value what they own higher. They're willing to pay more to retain an object they already own than they would be willing to pay to purchase it of someone else.

The survey reveals that Swedish electricity consumers experience significant transaction costs such as having difficulties of understanding the offers of alternative suppliers and their own contracts. They find it time consuming to compare alternative offers and difficult to understand their conditions, while only few experience that switching can save money. The results also indicate the existence of the status quo effect, as the level of confidence given to the current supplier deviated largely from the alternatives.

Findings on the actual switching behaviour show that households with higher incomes and higher electricity costs are more likely to switch. This also holds true for consumers believing that the high prices reflect a lack of competition. It seems likely that the level of market knowledge has a great influence on the switching intention. This is further supported by the finding that experienced difficulties in understanding the electricity bill as well as the benefits of switching, reduces the likelihood to switch. The Swedish consumers also show greater trust

towards their current supplier than the existing alternatives. This does not only emphasize the relevance of trust in the switching decision but it could also be interpreted as an indicator for the "home bias" explaining inertia. Consumers are likely to know more about their current supplier, therefore they implicitly associate greater confidence with it and therefore do not believe that there are better alternatives available.

Gender, internet use degree to which the debate about the liberalisation was followed in the media had no significant influence on the switching intention. In comparison to other studies, this survey examined the role of social descriptive norms, in the sense of doing what other people tend to do. The results support the hypothesis that the switching likelihood increases when others also have done so further indicating that the associated risk with switching is of great relevance.

Wilson and Price (2010) analyzed the switching decisions of UK electricity consumers focusing on their ability of making the "right decision" when switching their provider. The optimal choice certainly depends on the individual's preference and is therefore challenging to model. Yet, when analyzing consumers decisions solely towards their ability to find the most cost saving opportunity, the authors found that only approximately one fifth of all consumers found the optimal supplier and that in average only 30 to 50 percent of the potential gains were derived from switching. Not finding the optimal supplier and giving up available gains can be related to high search costs and do not contradict the principle of rational decisions. However, 15 to 30 percent of all consumers appear to choose entirely irrational as they had given up surpluses after choosing an alternative supplier.

Moreover, consumers learning ability was identified as very weak, since first switchers made similarly good decisions as their experienced counterparts. While no clear reason for the poor choices could be identified, the authors found that a minority of the choices were made by preferring a dual supply (electricity and gas) from one supplier. Further rather weak support for making poor choices could be related to misleading selling activities. The main conclusion however was that the poor choices were related to decision error or inattention.

Annala et al. (2013) studied the rationality in decision making of Finish residential electricity customers between 2007 and 2010. By comparing the saving opportunities (up to 200 Euros per year) and actual rate of switching the authors identified a great deal of consumer passivity and explained this by the limited ability of making rational choices.

The energy Think-Tank VaasaETT (2012) annually conducts a switching analysis of the global energy retail markets which offers further interesting findings. Extensive evidence was found for existence of transfer pricing. According to VaasaETT prices in electricity and gas markets can be broken down into 3 areas. Taxes (VAT and energy taxes), distribution and retailing. Transfer pricing describes the process of shifting costs from retailing to the distribution. This occurs as a lack of unbundling of the incumbent (most dominantly in European markets). Although the incumbent's operative areas of distribution and retailing are by now legally separated, the ownership remains connected. By shifting costs of retailing to the transmission, the fixed costs component increases while the variable share of the total costs decrease. The same principal holds true for the share of taxes on total costs. Markets with a high share of fixed costs provide competitors and new entrants a smaller playground to compete. Underbidding the price of the incumbent becomes more difficult as cost improvements in the retailing area have a smaller effect on the total costs. Consequently, the saving potential for customers is decreases as does the probability of switching.

Another interesting finding is that countries with higher levels of state ownership of the incumbent had lower switching levels which are likely to be a consequence of the states lack of regulative incentives. It would be interesting to compare the levels of state ownership and the share of transmission costs on total costs across countries, however this exceeds the objective of this paper.

VaasaETT provides further proof that the potential savings are among the most influential drivers for consumer utility switching. Comparing the relationship between savings and switching on a European wide scale shows that the saving potential (being the spread between the cheapest and most expensive retailer) and customer switching are significantly correlated. However, this correlation is weak. The authors come to the conclusion that the Marketing quality in the different countries differ significantly and explains much of the variation. Customers in countries with strong Marketing activities respond more elastically to savings. The same holds true for Door-to-Door sales activities, which have proven to be the most efficient sales channel.

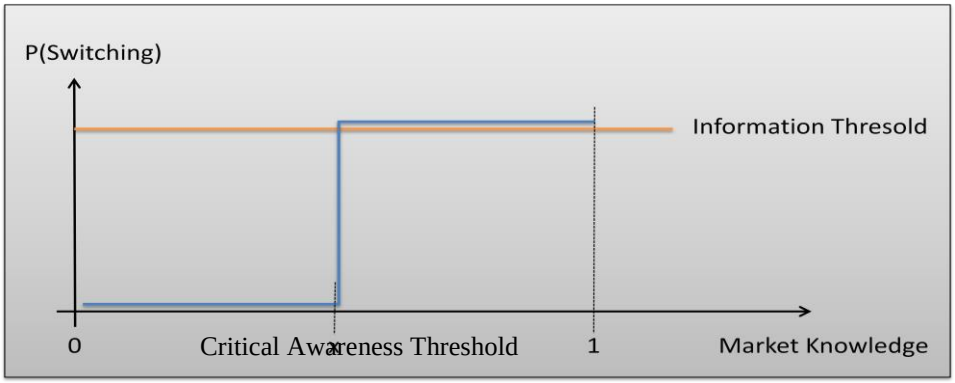
An even stronger correlation was found between switching rates and the annualised price volatility. The volatility is calculated as the sum of the annual price deviations of the default contract. Rapid fluctuations in the retail price stimulate the switching behaviour by creating

awareness or dissatisfaction. This finding is coherent with electricity and gas consumers' preference for fixed price contracts. Many customers are willing to pay a premium for fixed price tariffs which again underline the importance of risk aversion. Similarly, the absolute price level per kWh is not a strong determinant of switching. It is the relative change in the disposable income that is relevant for end users rather than the current price.

A rather obvious entry barrier for new competitors and a further incentive to stick with the incumbent stems from regulated tariffs. Prices set below total costs lead to cross subsidisation among consumer groups. The low profit margins resulting from this pricing policy negatively affect further investments and competition as the uncertainty of running a profitable business increases which also raises the cost of capital for further investments (European Commission, 2014). Regulated prices above costs may also discourage switching as competitive tariffs cluster around the regulated tariff and price differences become less obvious. Moreover the regulating agency and its price setting methodology could become subject to frequent adoptions as the price is relevant to the public and in this sense a popular political topic.

Hostility towards the current energy supplier has a strong influence on the switching behaviour (VaasaETT, 2012, Watson et al. 2002). However, according to the market research of the energy Think-Tank VaasaETT, a relatively high level of dissatisfaction is required for a customer to perform a switch. The same holds true for market knowledge, however as VaasaETT (2012) argues, market knowledge only has to reach a certain threshold which provides sufficient knowledge and confidence to perform a switch. Less knowledge than the "critical awareness threshold" will prevent from switching while knowledge exceeding this threshold will not further impact the probability of switching. Price Comparison tools play an important role in facilitating information in a simplified way and thereby reducing the searching costs of customers.

FIGURE 1 – RELATIONSHIP BETWEEN MARKET KNOWLEDGE AND THE PROBABILITY OF SWITCHING



3.6. Conclusions

As economists emphasize many switching costs play a vital role in customer utility switching. Above all, the transaction costs have proven to be an important feature in customer switching decisions, as the above analysed studies have shown. Consumers experience difficulties in understanding the market, in terms of their own electricity bill and the competitors' offers which increases their switching costs. Less knowledge about the market clearly decreases the likelihood of switching and results in poorer switching decisions. Besides the difficulties of screening the market, many consumers find it very time consuming, to a point where the benefits are perceived as lower than the costs of making the optimal choice. However, some consumers fail to make rational decisions all together, which cannot be attributed to the existence of transaction costs but is reasoned by decision errors or limited attention.

Market knowledge has the opposite effect. Closely related to this finding is that higher income households, higher educational levels and higher bill sizes also increase the probability of switching, most likely because these households are more knowledgeable of the market.

Economic brand loyalty was identified as a rather weak switching cost. However, the number of additional contracts a user obtains from his electricity supplier generates savings in time or money for the user and reduces the likelihood of switching. There was no direct evidence found for costs of learning, as no new installations must be undertaken, yet bundling services could be interpreted in such way as the billing of all services occurs in one and increase the convenience.

The level of risk aversion negatively affects the switching rate of consumers. Uncertainty concerns the assumptions about the future market development, the cost saving opportunities and the reliability of alternative suppliers and has a strong impact on the switching behaviour of consumers.

Most research identifies strong levels of inertia. Proof for this stems from the fact that the switching intention of people usually exceeds the actual switching rate. If a consumer indicates his willingness to switch, one must assume that the evaluation of the different offers has been undertaken in a conscious way and a more suitable alternative provider was found. If the conscious choice does not lead to any action, the consumer is inert. Inertia may also lead to the decision not to make the effort of evaluating the alternatives. Swedish consumers

clearly indicated greater trust towards their supplier than the alternatives. Considering the low switching rate (Ek and Söderholm, 2008) it is likely to believe, that this conclusion is not a result of a rational evaluation but from the knowledge surplus consumers have of the existing supplier. This knowledge surplus creates greater confidence and values the status quo higher.

Hostility can lead to switching however it needs to reach a high level before consumers actively search for alternatives. The dissatisfaction of consumers in the electricity and gas industry is generally high. In a study conducted by the EC Consumer Markets Scoreboard (2013), electricity market ranked on the 28th place of 31 service markets. The dissatisfaction most commonly leads to a switch when prices fluctuate.

TABLE 1 - DETERMINANTS OF SWITCHING BEHAVIOUR IN THE HOUSEHOLD ENERGY MARKET

Potential Determinants of Consumer Utility Switching	
Switching	Loyalty
• Market Knowledge • Reliability • Easiness of Switching • Hostility • Saving Potential • Marketing Activity • Household Size • Bill Size • Income Levels • Education	• Transaction Costs • Economic Brand Loyalty • Little Market Knowledge • Uncertainty • Risk Aversion • High Ratio of Fixed Costs (Transmission and Taxes) to Variable Costs (Retailing) • High Levels of State Ownership Price Regulations

4. The Portuguese Energy Market

The following chapter is structured in 2 parts. At first an overview over the market liberalization process in Portugal will be presented emphasizing how it has affected the market conditions with respect to the above defined objectives of the European Commission. Thereafter the current market situation will be discussed in the light of market indicators such as the market concentration, switching rates and the industry perceptions.

4.1. The Liberalisation Process in Portugal

Although the Portuguese electricity and gas market was first opened towards liberalisation in 1981, the legal unbundling of the electricity transmission network only started in the middle of the nineties. EDP, the former vertically integrated monopoly was gradually privatized in 1997. Until 2011, eight re-privatisation stages followed, when the Portuguese government eventually approved the direct sale of its remaining 21.35 percent share held by the public asset management company Parpública to the China Three Gorges Corporation (EDP, 2013). The full legal opening of the market to all consumers commenced in 2006 following the EC Directive 2003/54/EC (Ferreira et al., 2007). The first step towards introducing Portugal to the envisioned integrated EU-wide energy market was taken by creating the Iberian Electricity market MIBEL which launched in 2007 (OMIP, 2014). The electric generation sector was fully opened towards competition in 1991.

4.1.1. Unbundling

The legal unbundling of generation, transmission and retailing began in 1997. The transmission system is operated by REN (Redes Energéticas Nacionais) under a concession granted by the Portuguese government. In a Fact Sheet on Unbundling, the Council of European Energy Regulators (CEER, 2007) highlights, that the legal unbundling was followed by decreasing total investments into the transmission network in Portugal (ERSE, 2014). However, the full ownership unbundling which occurred in 2000, eventually led to higher levels of investment into the transmission network, an improved network quality and also lower prices.

4.1.2. National Regulator and Regulated Prices

The regulatory authority in Portugal is ERSE, which regulates the prices of the national transmission company Rede Eléctrica Nacional (REN). Formerly ERSE set the tariffs for final low voltage consumers, however regulated end user tariffs are, since January 1st 2013 no longer available. Existing customers with regulated tariffs were granted a three year transition period to select a new supplier in the free market before the regulated tariffs finally extinct (ERSE, 2014). Consumers with higher consumption levels (greater than 10.35 kVA for electricity and greater than 500 m^3 of gas) saw their regulated tariff end in mid 2012 with a granted transitional period until the end of 2014. During this transitional period, eligible consumers may either switch to a contract offered within the liberalised market or continue to be supplied by the last-resort provider EDP with a tariff set by the energy regulator ERSE. This tariff is gradually adapted to current market conditions and will definitely extinct at the end of the transitional period (ERSE, 2014).

These measures conclude the final steps of the liberalisation process and are especially interesting in terms of customer switching. In total approximately 4.7 million electricity customers and 1.1 million gas customers are affected by the regulative changes. 950,000 electricity customers and 146,000 gas customers will need to make a decision towards their household energy supply latest by the end of this year (ICIS, 2014). However, not deciding an alternative supplier or a new contract with EDP is obviously also possible. In this case the supply will continue to come from the former monopolist EDP. The Portuguese customers of regulated tariffs were notified by this regulative change by a post mail from EDP, moreover the information is available on the homepage of ERSE and EDP. The notification also includes information about a list of alternative suppliers and further information that can be found on the website of ERSE.

The extinction of regulated tariffs is especially interesting to observe as the existence of such regulations, as argued above, negatively impacts switching. Regulated tariffs are considered as an entry barrier for new entrants when prices are set below marginal costs. This also leads to cross-subsidisation among consumer groups and devalues future investments. In the opposite case, where prices are set above marginal costs, the regulated price can create a cluster inhibiting price competition. The termination of the regulated – and for the majority of Portuguese consumers – current contract must be considered as a sufficient need recognition.

Rational consumers should become aware of the market availabilities and make a conscious choice balancing costs and benefits. Considering this development, it is especially interesting to monitor the switching rate and switching behaviour in Portugal within this period of time.

4.2. Household Energy Consumption Levels in Portugal

The information of the following chapter is based on ABB's Energy Efficiency Report for Portugal (2012). The total energy consumption experienced a vast increase from 1990 to 2000, thereafter it increased moderately at an average of 0.3 percent from 2000 to 2007. In the following 3 years, as a result of the financial crisis, the energy demand decreased by close to six percent. In total the country's energy consumption per capita is 35 percent below the EU average. The electricity supply has greater relevance, with the consumption level being 20 percent below the EU average. While the electricity demand doubled from 1990 to 2010, the relevance of gas is comparably low, accounting for 19 percent of the total demand. The sharp increase in electricity demand mainly results from a sharp increase in the household and service sectors. The industry's share on total electricity demand decreased from 51 percent to 33 percent from 1990 to 2010 although the industrial demand increased steadily within this period of time.

Wiesmann et al. (2011) conduct an econometric study of the Portuguese residential electricity market in which they identify differences in consumption habits. They find proof for geographical differences, where northern more eastern homes consume less than the southern and west-coast counterpart. Further insights reveal that the electricity consumption in urban households is higher per capita than rural ones. The same holds true for single family households, greater floor space (expressing the per capita space for living in a dwelling) and higher incomes, although the income elasticity of demand was identified as low.

While the purchasing power of Portuguese consumers had also developed along side with the average development of the EU-member states, it dropped by five percent in the recent past two years (Eurostats, 2014). At the same time, the electricity prices show a volatile development.

4.3. Household Energy Price Development in Portugal

The household energy price, which was relevant for the vast majority of Portuguese households, was subject to regulation undertaken by the energy regulator ERSE. While these tariffs are phasing out gradually as mentioned above, they are still very present within the Portuguese market. As for 2010, 92 percent of all households were still served by the supplier of last resort with a regulated tariff (ERGEG 2010). The regulated tariff price for end users heavily influences the attractiveness of competing offers and often becomes a competitive barrier (cf. European Commission, 2014). Therefore it is useful to examine the price composition and price setting regulations.

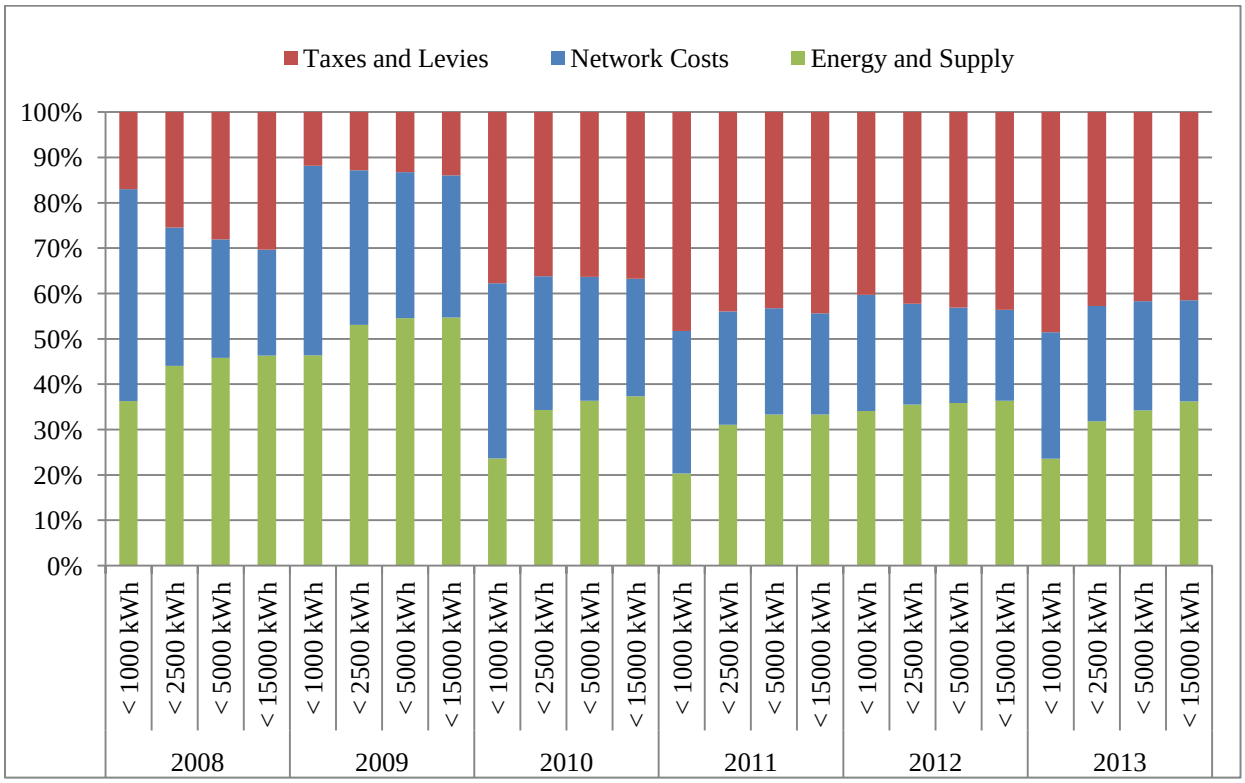
4.3.1. Electricity Price Development in Portugal

The regulated electricity tariff is annually adapted in December of each year for the following 12 months (January to December) based on the price forecasts of the Portuguese energy regulator ERSE. The price is determined considering the marginal cost recovery and the allowed revenues for each regulated activity (Apolinário et al. 2006). The forecast is based on the regulated companies' physical and accounting data of the previous year and their cost estimations for the following year. Taking this information into account, ERSE drafts a proposal which must be approved by the Tariff Council. However, Portugal's energy consumption is heavily dependent on oil, which accounted for 50 percent of the total energy consumption in 2010 (ABB 2010). Oil as most fossil fuel commodities is exposed to heavy price fluctuations which makes predictions more difficult. As ERGERG's (2010) report points out, the regulated price estimates can greatly deviate from the actual market development and create market disruptions as it happened in 2008. The forecasted price was set at 50 EUR/MWh which did not consider the continuous sharp increase in oil prices, which exceeded 140 Dollars per Barrel in July 2008. While the regulated prices could not be adapted, market prices increased to 70 €/MWh, which basically put the competitors out of business. As the regulators set the market price at 70 €/MWh for the following year, the effects of the financial crisis had decreased oil prices and consequently the deregulated electricity prices to 44 €/MWh.

Independently of the expected costs, which need to be recovered by the regulated tariff, the regulated supplier is granted a nominal rate of return over the net assets of 8 percent before

taxes. The same regulation applies for the distribution of electricity. For the transmission, the rate of return is set at 7 percent, nominal and before taxes. The final price for consumers depends on the consumption level. Figure 2 shows the development for the residential electricity price by consumption levels as defined by Eurostat. Prices are categorized into *Energy and Supply*, *Network Costs* and *Taxes and Levies*. The national prices represent the weighted average considering the market shares of the suppliers, according to Eurostat Database 2014. For the normally scaled display see Appendix Figure 12.

FIGURE 2: ELECTRICITY PRICES BY COMPONENTS AND CONSUMPTION LEVELS SCALED TO 100%



Source: Eurostat

From 2008 to 2013, prices for the components of electricity have experienced major changes. For the lowest consumption level (< 1000 kWh), the energy and supply price greatly decreased (-33%) as did the network costs (-39%). At the same time, these improvements were overshadowed by the rapid increase of taxes and levies which nearly tripled within this time period, therefore no total price improvements are observable. Taxes and Levies increased greatly for all other consumer groups, just as the network costs did. While energy and supply prices remained relatively constant for the consumption levels between 1000 kWh and 5000

kWh, the highest consumption level experienced a 14 percent increase in energy and supply costs. Summing up all components, a sharp price increases (35% - 45%) for all consumption levels above 1000 kWh becomes evident, while the total costs for the lowest consumption level remained stable. (see Table 2 for detailed figures).

The increase in taxes and levies is distinctly higher than within the EU-28 weighted average where this figure increased by 36.5 percent from 2008 to 2012 (European Commission 2014), while Portuguese experienced the second highest increase in the EU with more than 100 percent increase in every consumption segment. This is also reflected in absolute terms, as taxes and levies on electricity consumption in Portugal by now contributes to more than 40 percent of the total electricity costs, clearly exceeding the European Union weighted average of 30 percent. Only Germany and Denmark now have a greater share of taxes and levies contributing to the total costs. A further breakdown of taxes and levies into the *value added tax (VAT)* and *taxes related to energy policy* reveals that the main price driver stems from increases in the VAT (VaasaETT, 2013). In 2011, the VAT rate applicable for electricity and gas had increased from 6% to 23% (Eurelectric, 2012).

Energy and supply costs hardly changed within the European Union's weighted average; however network costs clearly increased. A very similar picture is observable for the Portuguese market. VaasaETT and Energie Control Austria Ltd. annually monitor the price development for 15 EU member states. For 2012, the average residential electricity price for Portugal was calculated to be 21.58 Euros, 8.7 percent higher than the selected average. Considering the electricity price within the EU from the perspective of purchasing powers however reveals a very different picture. The low purchasing power of Portuguese households elevates Portugal to the most expensive country among the 15 analysed countries. Simultaneously, Portuguese households spend the greatest share of their disposable income on electricity. Taking the low levels of elasticity into account, this relationship is predictable. Moreover, the VaasaETT report finds that when adjusting the price increases for inflation, Portugal experienced the highest residential electricity price rise among all countries.

TABLE 2: ELECTRICITY PRICE BY CONSUMPTION LEVELS AND COMPONENTS

Price Developments for Portuguese Domestic Consumers (€ / kWh)								
X < 1000 kWh	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**%-Change p.a.**	**%-Change abs.**
Network Costs	0,1597	0,1362	0,1299	0,1183	0,0857	0,0979	-7,83%	-39%
Taxes and Levies	0,0581	0,0385	0,1269	0,1816	0,1346	0,1703	19,63%	193%
Energy and Supply	0,1238	0,1511	0,0795	0,0764	0,1138	0,0827	-6,50%	-33%
							Delta Price p.a.	**Delta Price abs.**
							0,45%	2,72%
1000 kWh < X < 2500 kWh	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**%-Change p.a.**	**%-Change abs.**
Network Costs	0,0531	0,0616	0,0551	0,0528	0,0506	0,0596	1,94%	12%
Taxes and Levies	0,0444	0,0232	0,0675	0,0930	0,0964	0,1003	14,55%	126%
Energy and Supply	0,0767	0,0960	0,0640	0,0656	0,0810	0,0747	-0,44%	-3%
							Delta Price p.a.	**Delta Price abs.**
							5,09%	34,67%
2500 kWh < X < 5000 kWh	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**%-Change p.a.**	**%-Change abs.**
Network Costs	0,0398	0,0514	0,0455	0,0442	0,0434	0,0514	4,36%	29%
Taxes and Levies	0,0428	0,0211	0,0605	0,0813	0,0889	0,0888	12,93%	107%
Energy and Supply	0,0699	0,0870	0,0605	0,0626	0,0740	0,0729	0,70%	4%
							Delta Price p.a.	**Delta Price abs.**
							5,74%	39,74%
5000 kWh < X < 15000 kWh	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**%-Change p.a.**	**%-Change abs.**
Network Costs	0,0319	0,0449	0,0392	0,0382	0,0381	0,0444	5,67%	39%
Taxes and Levies	0,0415	0,0200	0,0557	0,0760	0,0829	0,0826	12,16%	99%
Energy and Supply	0,0633	0,0784	0,0566	0,0570	0,0691	0,0720	2,17%	14%
							Delta Price p.a.	**Delta Price abs.**
X = Consumption							6,46%	45,57%

Data source: EuroStat

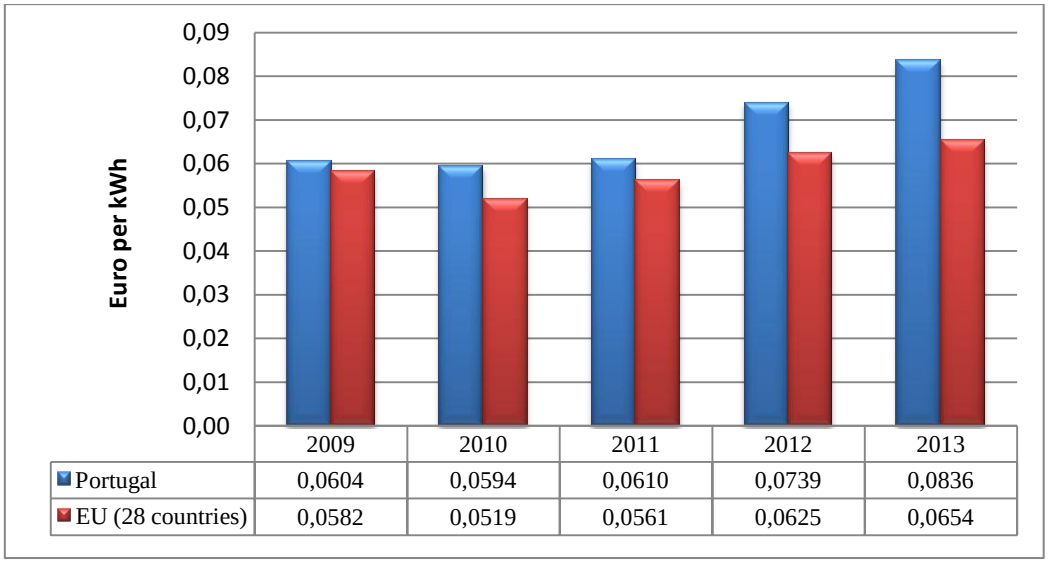
4.3.2. Gas Price Development in Portugal

The Portuguese gas market was fully opened towards competition in 2010. As Portugal has no domestic gas supplies, it is entirely dependent on imports, 90 percent of which come from Nigeria and Algeria (European Commission, 2011). The final gas price for domestic users in Portugal has increased at an average annual rate of 6.7 percent from 2009 until 2013, nearly three times as strong as the EU-28 average of 2.3 percent. VaasaETT (2013) reports the Portuguese price increase to be the second highest among the analyzed countries in Europe. Considering the energy costs as share of the total costs, shows that only Denmark has a lower ratio of energy costs to total costs than Portugal. The energy costs are the only competitive

price component. A low share of energy costs as part of the total costs decreases the price differentiation abilities for competitors.

As a result of this rapid rise in prices, Portuguese households paid 28 percent more than the average household in the EU. Adjusting the price differences for purchasing power again reveals even greater imbalances. Portugal's purchasing power was 24 percent lower than the EU-28 average in 2012 (Eurostat, 2014). Considering the Purchasing Power Standard (PPS) elevated Portugal to the second most expensive country for domestic users in Europe in 2012 (VaasaETT, 2013). This rapid increase is, similarly as in case of the electricity prices, attributed to tax and levy raises, which more than tripled within this time period.

FIGURE 3: GAS PRICES FOR DOMESTIC CONSUMERS IN PORTUGAL AND THE EU-28 COUNTRIES IN THE FIRST HALF OF EACH YEAR



	2009	2010	2011	2012	2013
Portugal	0,0604	0,0594	0,0610	0,0739	0,0836
EU (28 countries)	0,0582	0,0519	0,0561	0,0625	0,0654

Source: Eurostat Energy

4.3.3. Conclusion

The effects of the liberalisation process and its increased competition seem to have been positive in terms of price improvements for electricity prices within the competitive price components. However, this benefit has been overshadowed by vast increases in taxes, levies and network costs in general terms. The low share of energy costs both for gas and electricity prices, makes price competition less feasible. The lower the share of the price component is, the less effect cost savings have on the total costs. For those customers who emphasize the value of costs in their switching decision, the incentive to switch decreases with lower energy

costs. Retailers are also less incentivized to bring down costs, as price improvements become less visible for consumers who base their switching decision on total costs. On the other hand, inefficiencies in operations or high profit margins of retailers become less visible to consumers. Portugal's low share of energy costs certainly impedes efficient competition as the attractiveness of switching decreases. This becomes evident when comparing annual cost saving opportunities in cross country comparisons. Although Portugal ranges among the countries with the highest household energy costs in Europe, saving opportunities[3] are among the lowest (VaasaETT 2013). From a price based perspective, Portuguese households have a great incentive to become active in their choice of the most suitable supplier as their average income levels are low and household energy costs are very high. The large spending on electricity and gas as a share of the disposable household income should drive the Portuguese switching behaviour. At the same time, the market offers only low saving opportunities which reduce the attractiveness of switching suppliers.

4.4. Industry perception

Portuguese households are generally dissatisfied with the domestic electricity and gas service market. A consumer market research conducted by the European Commission (2012) assessed Portugal's service markets to be within the EU-27 average. Within this ranking, the electricity service market is considered as the worst performing of all sectors in Portugal. The gas market performs better, but is also ranked as below average.

4.5. Concentration Ratio

One particular specification of the Portuguese retail energy market is its high degree of concentration. Although six suppliers are currently competing in the electricity market, EDP Comercial dominated the market with a share of 82,4%, followed by Endesa (9,7%) and Galp Energia (5,4%) in terms of supplied number of customers (Jornal da Energia, 2013). Regarding annual consumption, EDP Comercial only supplied 42.6% of the market indicating that large (mostly industrial) consumers have a different supplier then EDP. Endesa's and Iberdrola's share is significantly higher accounting for 23% and 21% respectively. Strong

[3] Saving opportunities are expressed as the difference between annual costs of the standard contract of the default supplier and the cheapest contract available on the market, including discounts.

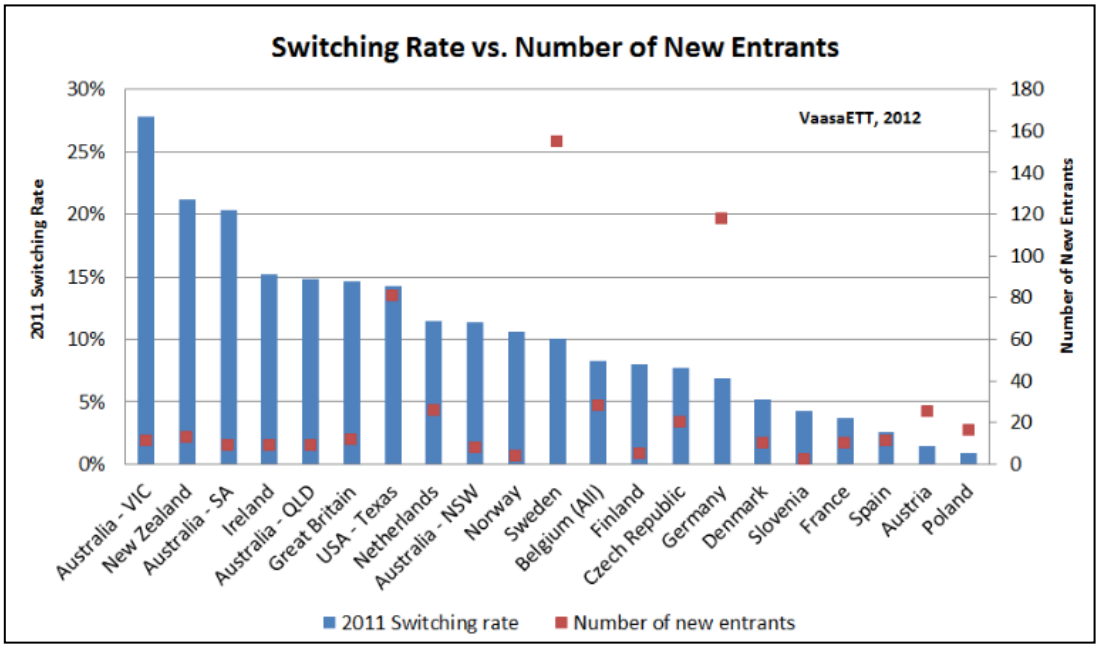
market shares express a company's ability to exercise market power, which is essentially defined as charging prices above the marginal costs, by reducing the supplied quantity or setting higher prices without losing market shares. The market power increases when a small number of participants interact in a market with low elasticity of demand and the availability of substitutes is low (Pollitt, Jamasb 2005). As argued before, substitutes are basically nonexistent and elasticity of demand is very low in electricity and gas retailing. The concentration ratio is therefore considered as a useful measurement of industry or market competitiveness.

In 2013, the cumulative market share of the 3 largest electricity providers (CR_3) in Portugal exceeded 97 percent and the Herfindahl-Hirschmann Index (HHI) score was above 6900 points. The Herfindahl-Hirschmann Index score is given by the sum of the squared market shares of all market participants (Russo et al., 2010). Its absolute figure is commonly used by the EC in order to measure competition levels within a market. The relative change of the index, as a result of a merge, is used by the EC merger control in order to prevent the realization of exceedingly dominant players. If the HHI indications are beneath the following thresholds, usually no measurement is undertaken in cases of horizontal mergers (Verouden, 2004):

- HHI < 1000
- 1000 < HHI < 2000 and delta < 250
- HHI > 2000 and delta < 150

Furthermore market shares above 25% usually lead to investigations concerning the compatibility of a merge. Although the concentration ratio and HHI index values are still high in many other liberalized countries of the EU, EDP Comercial's market dominance in Portugal gave sufficient concern to the EC to prohibit the proposed merger between EDP Comercial and GDP in 2004 (European Commission 2012). The EC regards extensive market power as one of the major issues towards competition (European Comission, 2004a). However, VaasaETT (2012) argues that no evidence can be found that the number of market participants or new entrants has a direct effect on switching rates (Figure 4). What matters is the quality of the alternative offer which is often measured in the cost savings. Green and Newberry (1992) nevertheless provide evidence for the close relationship between prices and the number of participants within the English and Welsh liberalized markets.

FIGURE 4 - SWITCHING RATE AND NUMBER OF NEW ENTRANTS



Source: VaasaETT (2012)

Nevertheless, the dominant market position of EDP Comercial is likely to create a market entry barrier for the new competitors. As a result of low market shares, the new entrants may not reach the benefits from sufficient economies of scale which are necessary in order to provide attractive prices or superior services. Small new entrants usually do not have the marketing capacity as the well known and established incumbent, which is essential to build the trust level with new customers. The considerable competitors of EDP Comercial are therefore no new industry entrants, but well established firms which operate in the Spanish energy market. Small new entrants find it very difficult to establish a meaningful customer base as shown in the following chapter.

In the following, Portugal's current degree of liberalization will be examined, in terms of the previously described objectives of the European Commission towards creating an efficient energy market for the European Union.

4.6. Switching Rates

From a regulatory standpoint, Portugal's government has fulfilled the structural requirements of the European Commission in providing a transparent and free energy retailing market. The competition clearly entered the market, proven by 10 electricity retailers and 18 natural gas

retailers (European Commission, 2011) which were active on the liberalised market. The termination of regulated tariffs and the comparably high price levels for both gas and electricity in combination with the low income levels of Portuguese households should positively affect the switching rate in Portugal. Moreover, the dissatisfaction with the current household energy market, as expressed in the industry perception, is expected to most dominantly affect the former monopolist EDP Comercial as it could lead to a source of hostility which, as shown before, increases the switching probability.

On the other hand, the competition is very limited in its ability to compete on a price focused strategy as only a small share of the total costs are attributed to the energy costs. Competing in other spheres seems very difficult as the market dominance of the former incumbent puts it in a favourable position. Both effects negatively affect the switching behaviour of Portuguese electricity and gas consumers.

While the switching rate in Portugal has been very low until 2010 for households (2.3 percent in 2010 and 1.1 percent in 2011), the market for large and industrial consumers has been more active with 27.4 percent in 2010 (European Commission, 2011). In 2012, Portuguese household energy market experienced the second highest switching rate in the European Union with 13.2 percent. This also represented the greatest annual increase in 2012 within the EU-28 member states (ACER, 2012).

5. An Econometric Analysis of the Portuguese Switching Behaviour

In the following chapters a nationwide Portuguese survey examining the consumer behaviour is analyzed. The objective is to provide distinctive insights and drawing valuable conclusions from the Portuguese customers' switching behaviour. Chapter 5.1 and 5.2 provide a descriptive analysis of selected variables, which were identified as relevant in the existing literature (chapter 3.2 – 3.6). Thereafter, a theoretical introduction into the logistic regression model and the results of the applied model, predicting the *switching behaviour*, is presented. After analysing the switching behaviour of the respondents, chapter 5.4 describes the results of a multiple linear regression examining the *switching intention* of the respondents. Finally, the conclusions derived from both models' results are presented in chapter 5.5.

5.1. Data Description

The nationwide Portuguese survey containing 55 questions was conducted in 2013 and received 405 valid responses. 17 of the questions analyze the respondents overall satisfaction, knowledge and perception of the market and his or her current supplier. These questions provide distinctive insights and allow drawing valuable conclusions about the consumer behaviour. These variables are therefore used as explanatory variables in two different regression models predicting the switching behaviour of the respondents. The other questions give insights about the current supplier which allows conclusions about the market share distribution and consequently the switching rate within the sample, as explained in further detail in the following chapters.

Moreover, the collected data provides insights into the socio economic characteristics such as the education, the profession and social class of the respondent which can, as demonstrated in chapter 3.5, lead to further relevant insights into the consumers' behaviour. Also, the approximate household's income, number of people living inside the household, the age distribution of the members and the number of unemployed people is measured. The geographic distribution was collected in accordance with the defined Nielsen areas in Portugal. The sampled data is representative in terms of the geographical-, income level-, gender- and age- distribution.

5.2. Data Analysis

In the following an overview of the most relevant variables of the data set are presented. The objective at this stage is to provide useful descriptive rather than predictive insights in order to understand which variables are of relevance for the predictive modelling and how the individual variables are related to each other. The descriptive analysis is based on the insights gained from other scholars' research as presented in chapter 3.5. Not all of the variables highlighted in the following are of significant relevance in explaining and predicting customer switching, however it is useful to screen all variables as country specific differences may exist. Chapter 5.3.4 and 5.3.7 analyze the results of the regression models and hence demonstrate which of these explanatory variables are of relevance for the Portuguese market.

5.2.1. Market Shares

The switching rate of 9.4 percent within the sample represents the reality well. The market share is clearly dominated by EDP with over 90 percent. While EDP customers are slightly overrepresented, Endesa customers, normally accounting for close to ten percent market share, are underrepresented with only 3 percent of the respondents. Galp Energia as well as the least occurring group "other suppliers" are well represented as they show only slight deviations from the real market shares with 4 and 2.5 percent.

5.2.2. Market Knowledge

The survey questioned the market knowledge of the participants by asking them to name which alternative suppliers they knew in the Portuguese market. Approximately half of all respondents were not able to name one alternative energy supplier in Portugal, less than every sixth person knew two and only one in twenty respondents knew three. The most famous alternative suppliers were Galp Energia and Endesa. The variable was relabelled as *the number of competitors known* and labelled *MK1*.

As described in chapter 3.5, several studies have found a relationship between market knowledge and the likelihood of switching, whereas greater knowledge increases the probability of customer switching (Capraro et al., 2003, VaasaETT, 2012, Ek and Söderholm, 2008). This question analysing market knowledge in this survey may not clarify the full degree of each participant's market knowledge, but it does serve as a useful indicator for the switching behaviour of the Portuguese. The knowledge appears to be generally low as the mean number of alternatives known is 0.75 with a standard deviation (SD) of 0.89 (see Figure 5).

Market knowledge was also questioned by judging the statement: *I have good knowledge about the offers of the other providers* on a 7 point Likert scale (1=strongly disagree to 7=strongly agree) and labelled as *MK2*. The respondents seem to feel generally unknowledgeable about the market offers. The mean response of 2.74 and a SD of 1.6 clearly indicate this (see Figure 6).

The number of competitors known (*MK1)* is significantly and positively correlated (0.278) with the personal judgement about the knowledge of the market offers *(MK2)* at a p-Value of

0.01 which indicates that more knowledgeable respondents also feel more confident about their market knowledge. Market knowledge is of great relevance, as suggested by existing literature. The number of competitors known significantly correlates with most other explanatory variables as well, most importantly education, social class, internet use, age and gender. In the sample, higher education levels are related to higher social classes, higher internet use and the age which all contribute to the number of competitors known.

FIGURE 5 – PERSONAL JUDGEMENT OF MARKET KNOWLEDGE

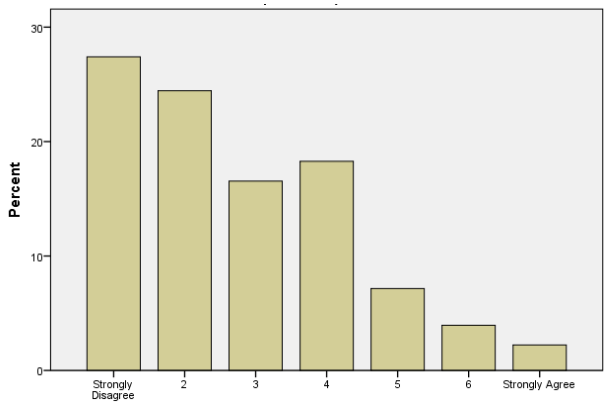
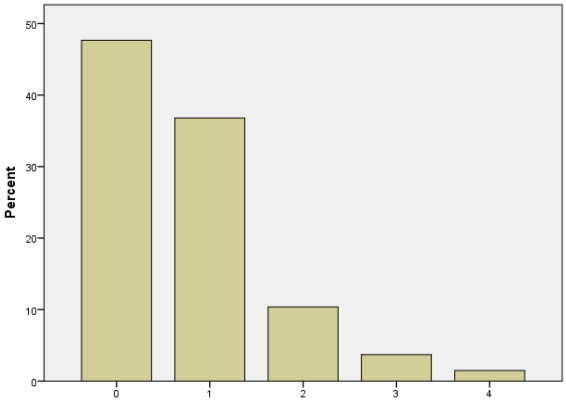


FIGURE 6 – NUMBER OF COMPETITORS KNOWN



5.2.3. Internet Usage

The internet usage of the participants was measured indirectly by asking them where they commonly use the internet. Multiple answers could be selected to whether there is access “at home”, “at work”, “at school” or “others”. Respondents that replied to 2 or more categories were grouped as user with a “high” usage of the internet; one or less categories selected were grouped as having “average” and “low” use of the internet. Although the location(s) must not reveal whether somebody uses the internet regularly or not, some conclusions still seem reasonable. A respondent using the internet at home, at work and in other places is likely to be a more regular user and hence more internet affine than someone who indicates not having any of these accessibilities.

Nearly one quarter of all respondents indicated that they had a low or no accessibility to the internet. The groups of medium and good access are of equal size. Since many switchers use the internet as an information source to find the most suitable supplier and online price comparison tools play an important role in the selection process as in the switching initiative, it is reasonable to assume that more internet affine people – ceteris paribus are also more

likely to switch their supplier. The results indicate that this conclusion holds true as the lowest rates of switchers are found among the low accessibility group (5%), the second highest among the average accessibility group (11%) and the highest share among the last group (13%). However, these results are not statistically significant at a p-Value of 0.1 which is used as the minimum threshold level for significance throughout the paper. This may also be related to the formulation of the question which doesn't precisely measure the level of internet usage or the level of affinity. However, other studies analyzing the relationship between internet use and switching rates could not either identify any significant relationship (Ek and Söderholm, 2008). It seems as if the access to, and understanding of the internet is no relevant barrier to switching for electricity consumers. The strongest influencers of this variable are the social class, followed by education levels and age.

5.2.4. Gender

The gender in the sample is distributed relatively evenly with a slight female overrepresentation of 57.8 percent as the true female share lies at 51.2 percent. Unlike other studies (Ek and Söderholm, 2008) the gender does affect the switching behaviour among the respondents in the sample. 16 percent of all men have switched whereas only 7 percent of all women have done so. Men also have a greater intention to switch their provider in the near future. Women have been identified to be more risk averse in economic decision as shown in several studies (e.g. Jianakoplos and Bernasek, 2008) which could contribute to the low switching levels as the associated risks of switching the electricity provider are often high. However, a closer analysis reveals that men have more knowledge about alternative offers in the market which certainly affects the switching rate within the sample. The greater knowledge of competitors is most likely related to the higher educational levels achieved by the male representatives, which again could be related to a significantly greater representation of men among the young respondents. This relation does however not hold true for the variables social classes and internet use. The variable is labelled *Gender*.

5.2.5. Reliability

Respondents were asked whether the *Price*, *Reliability* or *Other Factors* would make them switch their provider, while multiple responses were allowed. The price was relevant for more than 90 percent and the reliability for more than 30 percent of the customers. Several studies

(e.g. Wieringa and Verhoef 2007, Parmar et al. 2000) have already identified the relevance of the reliability in households' energy supply for certain customer segments. While no significant correlation could be identified between switching and the price factor, reliability shows a strong correlation. *Reliability* and *Price* are also negatively correlated to each other, meaning that those customers who value reliability care less about the price and vice versa. The variable is labelled *Reliability*.

5.2.6. Household Size, Income and Expected Savings

Ek and Söderholm (2008) identified the household income to positively affect churn. The relationship between income and education levels and market knowledge respectively appears to be a likely causality for this observation as higher income households benefit less from bill savings than their counterparts. Furthermore, they identified the bill size to have a positive contribution to switching as did other scholars Parmar et al. (2000). Additionally, the bill size per household member has been observed to positively affect the switching behaviour.

In the underlying survey, the household income was measured in 6 categories ranging from less than 500 Euros to more than 2500 Euros in which the respondents are evenly distributed (see Table 10 for exact illustration). The household size was regrouped into 4 categories from single households to more or equal to four members. The two variables are as expected significantly correlated at a 0.01 level.

The variable "*households' approximate net income*" indicates that higher income households are more likely to switch in the near future. Higher incomes also positively correlate with the variable "alternative suppliers known" and male representation which suits the conclusions drawn in the previous chapters 5.3.7 and 5.3.9.

Closely related to the income are the *expected savings* for the following year. Stronger conclusions could be drawn from the latter variable. The respondents expected savings were regrouped into 4 categories representing the variable "*savings*", which contributes, other than the income variable, to the predictive capability of the models. The variables are labelled *HH_Size HH_Income* and *Expected Savings*.

5.2.7. Geographical Distribution

The relationship between the geographical location and the switching behaviour can be analysed in various forms. One might assume that people living in urban areas are more likely to switch the provider, for reasons of higher advertising penetration, or less likely, as the average income levels are higher and therefore customers are less price sensitive. The relation between switching behaviours and the city size was yet highly insignificant in the data set. The same hold true for the switching intention.

While the city size provides no further insights, the distribution into Nielsen areas significantly correlates with the switching rate at a 0.05 level. This classification was introduced by the consulting firm AC Nielsen and aims to classify areas towards common consumer behaviour, economic structure and cultural identity. For the Portuguese classification see Figure 14. Higher switching rates were achieved around the higher populated Nielsen areas (I, II and III) in central (Lisbon and suburbs) and north western Portugal (Porto, Coimbra, Braga, Aveiro, Viano do Castelo) whereas lower rates are observed in the north-eastern and southern parts of the country.

A further segmentation into the more densely populated areas in the central and north western area of Portugal and the less densely remaining areas revealed even stronger results within the predictive models. This result was also suggested by Wiesmann et al. (2011) econometric analysis of the consumption levels in Portugal. Therefore the variable "*geographical distribution*" was introduced measuring the geographical influence on the likelihood of switching. The variable is labelled *Geograph_Distribution*.

5.2.8. Commitment

Commitment results from the identification with the organization as well as the psychological attachment to it. Several scholars have pointed out the relevance commitment in retaining old or attracting new customers (Garbarino and Johnson, 1999, Morgan and Hunt, 1994). Wieringa and Verhoef (2000) analyzed the commitment of a customer by his or her word of mouth intentions. The more a person would recommend his supplier to others, the greater his level of commitment was judged.

In the underlying survey commitment was measured in two ways. Once analysing the statement: *I clearly prefer this provider compared to the others that I know (COM1)* and secondly by the judgement: *I recommend this provider to my family, colleagues and friends (COM2).* Both variables show a high degree of indecisiveness (means at 3.74 and 3.5). *COM1* has an even distribution and *(COM2)* a positively skewed distribution for.

5.3. Logistic Regressions

The logistic regression or logit regression is a non-linear, and mostly multiple regression analysis. The core difference towards most other multiple regressions is that the logistic regression is appropriately used for explaining or predicting non-metric dependent variables, following Hair et al. (2006) classification of metric and non-metric variables as described in chapter 5.3.5 and 5.3.6.

5.3.1. The Binary Logit Regression

The most common form, as used for the following analysis, is the binary logit regression. It is modeled as a linear combination of two or more independent variables predicting or explaining one single dependent dichotomous variable. It is especially designed for events which can only result in two states, such as receiving an illness or not, passing or failing an exam or having switched the provider or remained loyal as in the underlying case. While the dependent and observed variable customer switching is naturally restricted to two states, that is remaining loyal or switching, the values attributed to this event are either 0 or 1. The objective however is not to observe who has switched or not but to predict whether this event will occur or not. This is expressed by the likelihood P(y) of the complementary events y occurring as:

$$P(y = 0) + P(y = 1) = 1 \; and \; P(y = 0) = 1 - P(y = 1) \qquad (1)$$

The binary logit model is used to derive the probabilities P(y = 0) and P(y = 1) respectively from the observations and these observations are expressed by the explanatory variables. In order to perform this, the logit model assumes that a latent variable z_i exists (Backhaus et al., 2011) which is modeled as a linear relationship between the explanatory variables (X_1, X_2, …, X_n) and unknown parameters α and β_i:

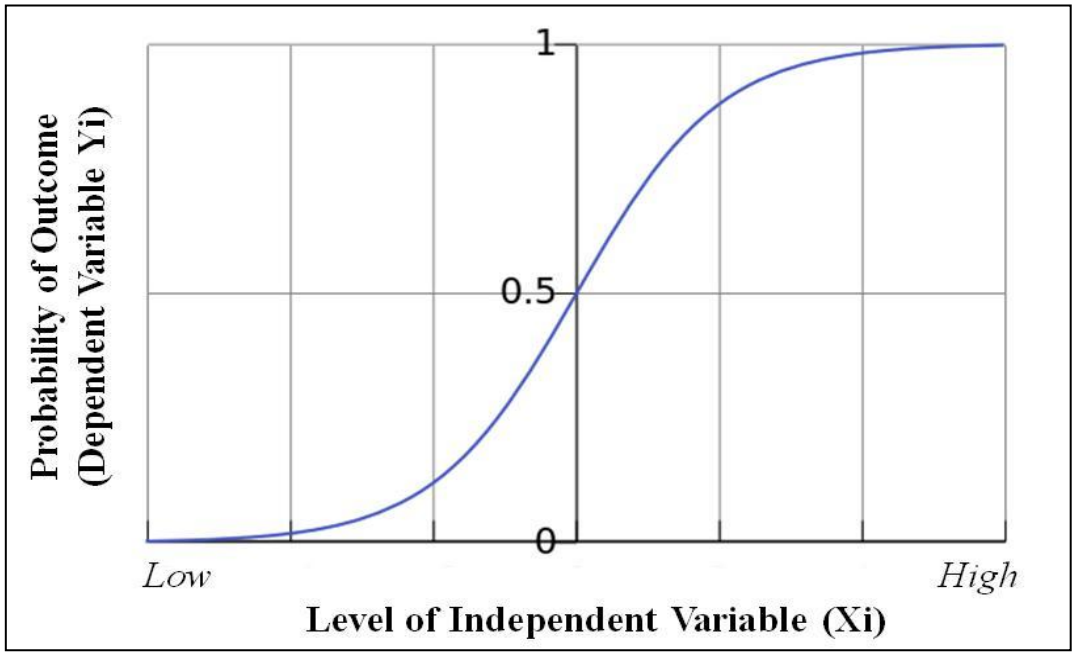
$$z_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n \quad (2)$$

and also considers the binary form of y:

$$y_i = \begin{cases} 1, & z_i > 0 \\ 0, & z_i \leq 0 \end{cases} \quad (3)$$

The variable z_i connects the binary condition of the dependent variable Y and the observed explanatory variables X_i. Its linear combination of the parameters and explanatory variables can be regarded as an index expressing the aggregated influence of the variables X_i on the outcome of the event (Kleinbaum, 2006). As α and β_i are unknown parameters, they need to be estimated based on the underlying data in order to fit the model. Most commonly the parameters are estimated using the Maximum Likelihood method (Hair et al., 2006) as described in the following chapter. The β_i weight the explanatory variables towards their explanatory power and can take upon values of positive or negative infinity. The sum over all $\beta_i X_i$ defines the slope of the logistic regression equation (Wuensch, 2014). The α describes the z-value if all explanatory variables were 0. A positive α shifts the function of z (Figure 7) to the left whereas a negative α does the opposite. The algebraic sign of the β_i indicates its contribution to the P(Y=1). Negative signs decrease the probability while positive signs increase it. Greater β_i increase the steepness of the function. The greater the explanatory variables X_i, the more likely the event outcome will be 1 if β_i is positive and vice versa.

FIGURE 7 - S-SHAPED CURVE OF THE LOGIT REGRESSION



5.3.2. Odds Ratios and Probabilities of the Event Outcome

Once the parameters are determined, the odds ratios and probabilities of each outcome can be derived from the model. The predicted odds of switching the energy supplier are given by:

$$OR = e^{\beta i X i} \tag{4}$$

The derived result of the odds ratio express how much more likely a consumer with the attribute X_i (e.g. gender = male) is to switch the provider than the counterparty. In order to derive the likelihood of the event y occurring as a measure of z_i, a probability function is required which translates the variable z_i into probabilities and limits the predicted value to the range of 0 and 1 (Hair et al., 2006). The probability of the binary logit regression is therefore based on the following function:

$$P(y = 1) = \mathrm{f}(z_i) = \frac{1}{1+e^{-z_i}} \tag{5}$$

The function f(z) translates changes among the independent variables to increased or decreased probabilities of the dependent outcome. If the value is greater than 0.5, the observation is assigned to 1, as in the underlying case being a switcher, if it is lower than 0.5 the observation is assigned to 0, being loyal. The cut-off point at 0.5 marks the point where the probability of belonging to event 0 or 1 equals zero. However, the cut-off point can be adjusted accordingly.

The better the parameters can be fitted to the observations of logistic curve, the more accurate the predictions of the model become. Plotting the variables of the function z_i (2) into the equation (5) highlights this relationship:

$$P(y_i) = \frac{1}{1+e^{-\alpha \sum \beta_i X_i}} \tag{6}$$

As the graph of a logit function (Figure 7) follows the shape as an S-curve and is fitted within the an outcome range between 0 and 1, it is highly suitable to describe the probability of an events outcome (such as switching) resulting from changes among the explanatory variables (Karp, 2009).

5.3.3. Estimating the Models Parameters

As mentioned above, the estimation of the logit model's parameters is most commonly undertaken using the maximum likelihood method. The objective of this estimation is to define the estimates of the logit regression in an iterative process so that the probability of predicting the outcomes of the events y_i is maximized. Since the outcomes are binary, the following relation can be established:

$$P(y_i) = \begin{cases} \frac{1}{(1+e^{-z_i})}, & y_i > 0 \\ 1 - \frac{1}{(1+e^{-z_i})}, & y_i \leq 0 \end{cases} \quad (7)$$

For the underlying case this means that the parameters (α, β_i) are defined such that the probability of a correct prediction to whether a person has switched or not is maximized. In this process, the highest cumulative probability of all individual participants is searched. The maximization problem must therefore consider the probability of independent events, which leads to the following Likelihood-function (Hosmer and Lemeshow, 2000):

$$\max_{y_i} = \prod_{i=1}^{n} \left(\frac{1}{1+e^{-z_i}}\right)^{y_i} \left(1 - \frac{1}{1+e^{-z_i}}\right)^{1-y_i} \rightarrow max \quad (8)$$

The likelihood function is most commonly maximized using the iterative process of the Newton-Raphson-algorithm (Backhaus et al., 2011). Moreover the likelihood value is used when calculating the overall model fit (Hair et al., 2006).

5.3.4. Research on the Binary Logistic Regression

The model's ability to translate the examined factors into probabilities of the final outcome differentiates the logit regression from more regular regressions such as the OLS regression and has contributed to its increasing popularity as a statistical technique (Karp, 2009 and Kleinbaum, 2010). Moreover this model is also superior in statistical terms compared to alternative models of event outcomes, especially in terms of the predictive power of churn models (Neslin et al., 2006). As argued by Hair et al. (2006), the model is often preferred by researchers due to its straightforward statistical tests, wide range of diagnostics and similarity with the multiple regressions.

The logit regression is often argued to be suitable to explain customer switching. Considering the S-shape of the function's graph shows an upper and lower threshold after which the slope of the graph changes notably. Hence, it requires a relatively large z in order to observe a slope increase in f(z). This characteristic is referred to as the saturation effect, where changes in the extremes of the latent variable result in very low deviations in the probability of an outcome change. However, once this threshold is overcome, the graph increases steadily with z until reaching the upper threshold, after which the slope declines slowly again.

Translating this concept into the observed variables of the underlying data set means that e.g. an increase in the market knowledge of a participant from 1, being the lowest level, to 2 will result in a lower probability change of switching than an increase from 3 to 4 (on a 7 item Lickert scale), although the knowledge increase is $\Delta 1$ in both cases. This reflects the reality well as consumers with low levels of market knowledge are likely to be insecure about switching and know little about potential saving possibilities, etcetera. Most consumers require a minimum knowledge base which is considered as a switching threshold. Only when this threshold is reached or overcome, the inhibiting effects of low market knowledge towards switching are compensated and the likelihood of switching suddenly increases greatly. Likewise, once the upper threshold of market knowledge is overcome, indicating that the consumer has sufficient knowledge to make a reasonable decision, a further knowledge increase doesn't greatly affect the switching probability. The consumer is likely to already know about most market offers, the low risks of switching etcetera. Besides market knowledge, saving opportunities and risk aversion, this non-linear relationship is likely to hold true for other influencers of customer switching (see chapter 3.5) such as marketing activities of competitors, household sizes, consumption levels, hostility towards the incumbent and price fluctuations. The lower extreme of the z-function could be interpreted as inert behaviour, which has been documented widely within the customer utility switching literature. Therefore applying the concept of a logarithmic relationship between the independent variables and the likelihood of switching is suitable.

5.3.5. The Dependent Variable

The dependent variable in the underlying sample is the switching behaviour of Portuguese electricity customers. The respondents were asked to indicate their current energy supplier. As formerly all households were supplied by the incumbent EDP Comercial, any deviation from

this supplier indicates a switch. Out of the 405 respondents 38 indicated having a different supplier than EDP Comercial which accounts for 9.4 percent and represents the current switching rate of well (for the exact distribution of the market shares see Data Analysis chapter 5.2).

Non-metric data, as of the dependent variable switching, can be measured either by nominal or ordinal scales and is described by differences in kind or type towards the presence or absence of a feature. The data is discrete as it can only take upon one of these particular features, excluding all others. The dependent variable is expressed by a nominal scale and therefore has no further quantitative meaning. As in this case where the switching behaviour is measured, the level of loyalty or how often a customer has switched the supplier cannot be ranked or classified other than belonging to the group of switchers or loyal. However, since the objective of this analysis is to identify and model which attributes of consumers contribute to switching or remaining loyal, the number of switches is less important. Moreover, since the actual rate of switching only gained momentum in the same year the study was conducted, it is rather unlikely that the participants have switched several times.

The initial variable indicating the individual's energy provider was recoded into a binary form of loyal customers who remained with the incumbent and switchers who have chosen any of the alternative suppliers. The new values attributed to the variable are 0 being a switcher and 1 being loyal.

5.3.6. The Explanatory Variables

The independent variables can be of metric or non-metric nature for logistic regressions (Hair et al. 2006), whereas non-metric variables are transformed into Dummy or binary variables. The logit regression is therefore often used when the predictor variables are mixed and not nicely distributed as the logit regression makes no assumptions about the distribution of the explanatory variables (Wuensch, 2014).

The variables included in the model are *Reliability, Market Knowledge (MK1), Geographical Distribution, Gender, Expected Savings, Price Sensitivity, Transparency*. All variables included in the regression have a significant effect on customer switching with p-values lower than 0.1. The significance tests the established null hypothesis (H_0) that there is no difference in the logarithm of the odds of switching for the dependent variable. For all p-levels smaller

than 0.1, the H_0 can be rejected suggesting that there is a relationship between the dependent variable and the switching intention in the population. Table 3 shows the regression output from which the regression equation results as the following:

TABLE 3 - LOGISTIC REGRESSION RESULTS

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Reliability	1,293	,568	5,176	1	,023	3,643
	Geograph_Distribution	,845	,431	3,839	1	,050	2,327
	Gender	,687	,382	3,225	1	,073	1,987
	Price_Sensitivity	-,334	,148	5,104	1	,024	,716
	Expected_Savings	-,335	,200	2,801	1	,094	,715
	Transparency	-,432	,125	12,004	1	,001	,649
	Market_Knowledge (MK1)	-,829	,264	9,890	1	,002	,436
	Constant	4,426	1,420	9,721	1	,002	83,633

a. Variable(s) entered on step 1: Reliability, Geograph_Distribution, Gender, Price_Sensitivity, Expected_Savings, Transparency, Market Knowledge (MK1).

Reliability (coded *0 = not a reason to switch* and *1 = reason to switch*) is the strongest indicator for whether a customer has decided to switch or not. The odds ratio *Exp (B)* predicted by the model indicates that people who value reliability are 3.64 times more likely to remain loyal. This result confirms the relevance of reliability for a customer which was identified by many other researchers such as Parmar et al. (2000) and Wieringa and Verhoef (2007) who came to the conclusion that the reliability was more important than potential savings. Several scholars have pointed out the relevance reliability in retaining customers in other fields of marketing (Garbarino and Johnson, 1999, Morgan and Hunt, 1994) however it seems to play an especially important role in household energy. As mentioned in the data analysis (chapter 5.2) only approximately 30 percent of all customers consider the reliability as a reason to switch the provider. Out of these, only 4 percent have in fact already switched, less than half of the average switching rate. As argued by Wieringa and Verhoef (2007), social determinants for switching are especially important in former monopolistically structured markets. The most plausible reason for this is that customers lack the judgment experience of economic determinants such as perceived price levels and price value ratio, as they are unaccustomed to alternative offers. Several further reasons explaining the relevance

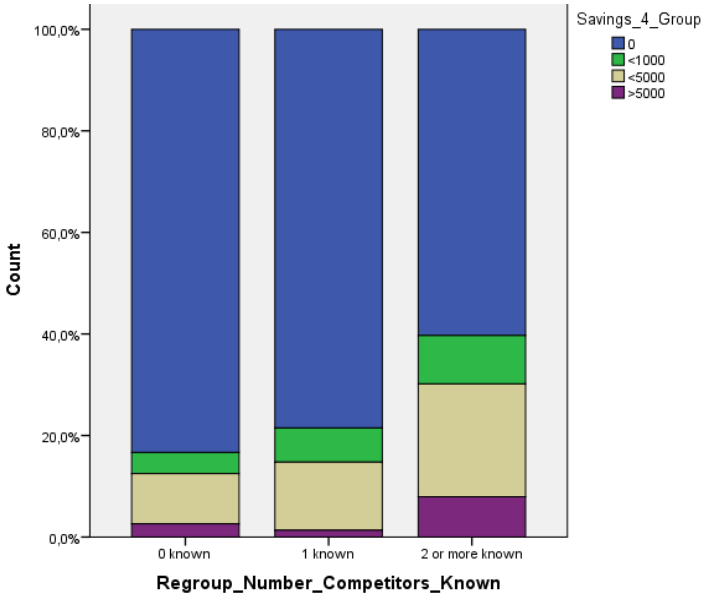
of reliability can be derived from the theoretical part of this paper such the intangibility of electricity (chapter 3.3), the purchasing process (chapter 3.4), and the supply integrity (3.5).

The geographical location of the respondent is the second strongest predictor among the sample. It is relevant within the model for switching decisions, as the inhabitants of the more densely populated areas in the north-west and central Portugal show more than twice as high odds of switching compared to the rest of the country. No significant correlation could be found among other geographical methods of distributing the sample as into city sizes or Nielsen areas.

The gender of the respondent has a similarly strong effect. Among the collected data set, male switchers make up 16 percent, compared to 7 percent among women. Similarly, the odds of switching are more than double as high for men as for women. Although other researchers do not find any gender-specific differences in the switching behaviour, the reasons for the higher switching rates in the data set (as described in chapter 5.2.4) are comprehensible. Unfortunately the Portuguese regulator does not publish information about the gender of the switchers, so that the result of the sample can be compared to the total population.

The *price sensitivity* was measured by asking the respondents to evaluate the following statement on a 7 point Lickert scale: *The price factor is fundamental for my decision whether to maintain or switch my provider*. The negative sign of the parameter indicates that higher price sensitivity is related to a higher probability of switching the provider. Its odds ratio of 0.716 tells that a one point increase in the consumers price sensitivity increases the probability of switching by the multiplicative factor of 0.716. This corresponds to a decrease of nearly 30 percent.

FIGURE 8 - NUMBER OF COMPETITORS KNOWN DEFINED BY EXPECTED SAVINGS

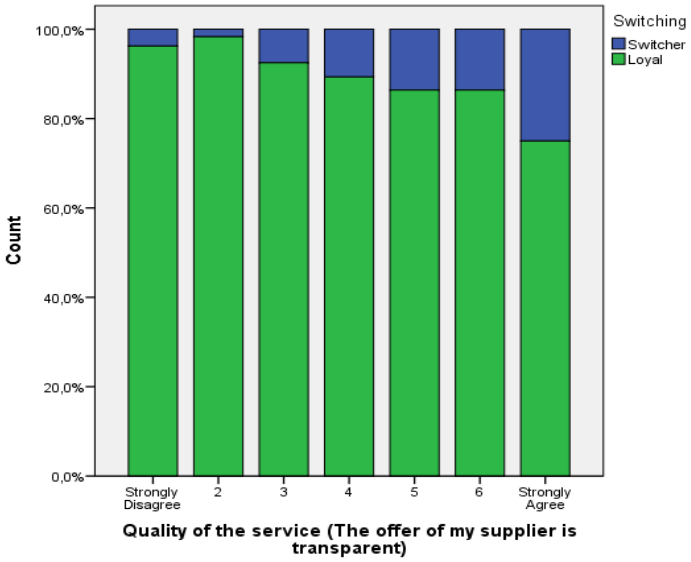


The variable *Expected Savings* measures the households expected annual savings for 2014. Unsurprisingly in a country which is in the state of an ongoing recession, 78 percent of the respondents do not expect to save money at all, while 6 percent expect to save less than

1000 Euros, 13 percent less than 5000 Euros and only 3 percent more than 5000 Euros. The variables influence is very similar to the price sensitivity. People with greater saving expectations have a higher likelihood of switching. This might appear counterintuitive at first sight considering that people with lower saving expectations should be more price sensitive and hence be more likely to switch. This however assumes that the all respondents are knowledgeable about saving opportunities from switching. An alternative explanation is that people with greater saving expectations are able to make more rational economic decisions. Relating the saving expectations with market knowledge indeed reveals a correlation significant at a p-value of 0.01 which supports the latter statement. Figure 8 shows that those respondents who know more alternative suppliers have a higher saving expectation.

Transparency, which was assessed by quantifying the statement: *The offer of my supplier is transparent*, is significant and included in the model. Customers who perceive their offer as transparent are also more likely to have switched their provider. Customers who have undergone a switching process seem to perceive their offer as more transparent than those who haven't. Figure 9 demonstrates this relation. This relationship also fits the switching cost theory as those customers who do not feel to fully understand their offer experience higher switching costs and are therefore less likely to switch. The variable transparency is not related with market knowledge (MK1) but it positively correlates with the own knowledge judgement of alternative offers at a p-Value < 0.01. This indicates that some consumers find it generally difficult to understand the offers of energy providers. A similar finding was observed by Wilson and Price (2010) for the UK market.

FIGURE 9 - TRANSPARENCY DEFINED BY SWITCHING (SCALED TO 100%)



Market knowledge *(MK1)* is the weakest predictor variable and described by the number of competitors known by the respondent. Its negative sign demonstrates that increasing knowledge also increases the likelihood of switching. The odds ratio score of 0.838 indicates that an additional competitor known decreases the probability of being loyal by the

multiplicative factor of 0.838. This seemingly logical negative relationship between increasing market knowledge and decreasing degrees of loyalty of a consumer has been found in many other studies e.g. Capraro et al., (2003).

5.3.1. Results of the Logit Regression

Out of the 405 respondents, 399 were included into the analysis. 37 respondents were identified as switchers corresponding to 9.3 percent (= 37 / 399). Therefore the classification accuracy, which serves as a benchmark for the logit model, equals 90.7 percent (Appendux Table 12).

Assessing the goodness of fit:

The Omnibus Tests of Model Coefficients shows that the logit model is significant. The goodness of fit can be measured by the two pseudo r^2 measures of Cox and Snell or Nagelkerke, which both show indicate a sufficient fit of the model (Table 13). However, a better measure is provided by the Hosmer and Lemeshow Test. The test suggests creating groups of equal size, according to their values derived from the logit model, and comparing the observed with the expected frequencies analog to the Pearson chi-Square Statistic (Baltes-Götz, 2012). It tests if there is a statistically significant difference in the way the model predicts the expected frequencies towards the observed frequencies. Values above 0.6 are considered as useful for the logistic regression.

The logit regression model is used to predict the explanatory variable "switching" based on estimated coefficients for the independent variables. These are summarized in the final regression equation as the following:

REGRESSION EQUATION

$$z_i = 4.426 + 1{,}293*\text{Reliability} + 0.845*\text{ Geograph. Distribution} + 0.687*\text{Gender} - 0.334*\text{Price\_Sensitivity} - 0.335*\text{Exp Savings} - 0.432*\text{ Transparency} - 0.829*\text{MK1} - 0.339$$

With this, the final model correctly predicts 21.6 percent of the switchers and 100 percent of the loyal customers as represented in Table 4.With this, the overall percentage results in 92.7 percent compared to 90.7 percent (Table 12).

TABLE 4 - RESULT OF THE LOGISTIC REGRESSION MODEL

Classification Table[a]

Observed			Predicted		
			Switching		Percentage Correct
			Switcher	Loyal	
Step 1	Switching	Switcher	8	29	21,6
		Loyal	0	362	100,0
	Overall Percentage				92,7

a. The cut value is ,500

5.4. Linear Regression

The linear regression models a relationship between the dependent variable and the explanatory variable(s) (X_i) by fitting a linear equation (Y) to the observed data using the ordinary least squares (OLS) method. The linear equation is composed by a linear relationship of the parameters (β_i) and the predictor variables (X_i) as the following:

$$Y = \alpha + \sum_{i=1}^{n} \beta i Xi \tag{9}$$

The intercept α represents the value of Y when Σ β_i equal 0 while the β_i build the slope of the regression line. The OLS is used to estimate the parameters (β_i) such that the sum of the squared distances between the observed data and the predicted values are minimized in an optimization problem as the following:

$$\hat{Y} = \hat{\alpha} + \sum_{i=1}^{n} \widehat{\beta\imath} * Xi \tag{10}$$

For the suitability of the multiple linear regression model, the relation between Y and each X_i must be linear. The X_i must also be uncorrelated among each other.

Furthermore the mean of the residual component $E(\varepsilon_i)$ must equal 0. No correlation can exist between the residual terms $Cov(\varepsilon_i, \varepsilon_j) = 0$, where $i \neq j$; as between the predictor variables and the residual term $Cov(\varepsilon_i, X_i) = 0$. The ε_i should follow a normal distribution and their variance constant $Var(\varepsilon_i)=\sigma^2$(Salgueiro, 2013).

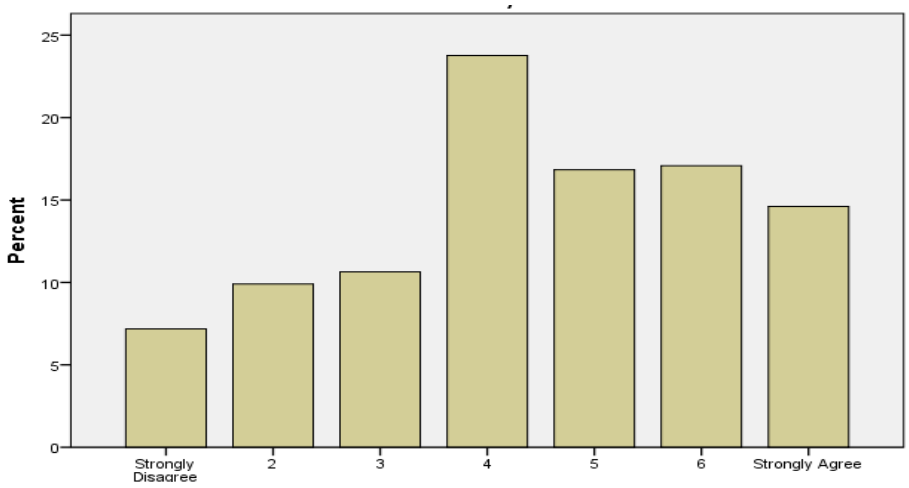
Other than in the logistic regression model which predicted the switching behavior based on the actual performed switches by the respondents, the multiple linear regression is used in

order to analyze the switching intention. As described in detail in chapter 3, many EU member states experience inert consumer behaviour which is considered as one of the main reasons for the rather sluggish development of the market liberalization. This reasons analyzing potential discrepancies between intended and actual behaviour. Moreover, energy suppliers can derive useful strategic conclusions for their retention strategies when knowing the consumers intentions.

5.4.1. The Dependent Variable

The dependent variable linear regression model "Switching Intention" was questioned by rating the following statement on a 7 point Likert scale: *It is very possible that I will change my operator in the near future*. The variable shows a high degree of indecisiveness with a mean score of 4.43 and a standard deviation of 1.77. This response pattern, of consumers' propensity to being passive and postponing the decisions is typical for inert consumers.

FIGURE 10 - RESULTS FOR SWITCHING INTENTION



5.4.2. The Model Results and Explanatory Variables

Column B in Table 5 represents the estimated parameters $\widehat{\beta\iota}$ of the multiple linear regression model $\hat{Y}$. While the sign of the parameters indicate the influence of the explanatory variable, the standardized Beta coefficient allows comparing the magnitude of each variable on the estimated model. As one can observe in the column "Sig.", all variables in the model are significant predictors of the switching intention at p-Values lower than 0.1.

TABLE 5 - MODEL RESULTS OF THE MULTIPLE LINEAR REGRESSION

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	2,347	,533		4,401	,000		
Price Sensitivity	,267	,051	,236	5,278	,000	,888	1,126
Market Knowledge MK2	,216	,050	,191	4,343	,000	,912	1,097
COM2	-,154	,071	-,142	-2,171	,030	,412	2,427
Satisfaction	-,155	,073	-,138	-2,142	,033	,426	2,350
Service 1	,118	,043	,126	2,772	,006	,859	1,164
Service 2	,106	,043	,110	2,452	,015	,880	1,136
Reliability	,364	,167	,093	2,173	,030	,975	1,026
PC1	-,175	,095	-,099	-1,835	,067	,611	1,637
PC2	-,270	,125	-,152	-2,162	,031	,356	2,806

a. Dependent Variable: Switching Intention

While the explanatory variables *Reliability* and *Price Sensitivity* are relevant for both model outcomes, the other predictors deviate in the linear model. However, the relevance of the two variables is different within the models. While the price sensitivity becomes the most important indicator for people who intend to switch, the reliability has the lowest impact (compared to the highest in the logit model).

Market knowledge was examined in two ways in the survey (see chapter 5.3.3 for more details). While the number of competitors known *(MK1)* was of relevance in the logit model it is non-significant in the linear model. However, the personal judgment about knowing the competitors' offers well *(MK2)* has the second strongest impact on the linear regression model. A one point increase on the Likert scale increases the level of switching intention by 0.216.

The second commitment variable *(COM2)* expresses the word of mouth intentions of the respondents. Its coefficient is negative meaning that greater commitment towards the current supplier decreases the intention to switch. The variable *Satisfaction* was examined by the statement: *I am satisfied with the services provided by my provider*, has a similar negative

impact on the switching intention. A one point increase in these variables would lead to an approximate 0.15 decrease in the switching intention.

The following two variables examined the service preferences of the respondents:

- *How attractive do you consider acquiring services which allow you to control/save your energy consumption* (variable labelled *Service1*)
- *Receiving only one invoice for electricity and gas seems appealing to me* (variable labelled *Service2*)

Although both variables have a lower impact on the model they positively contribute to the switching intention of customers. These variables were highly insignificant in the logit model, stating that Portuguese who have already switched care for other reasons then additional services as stated above. Both questions examine the relevance of convenience for the consumer and the positive coefficient indicates that there is a demand for additional convenience. Moreover, suppliers offering customers convenience improvements can also increase the switching costs. Wieringa and Verhoef found that the number of contracts a customer obtained from one supplier negatively contributed to the switching probability.

The Principle components PC1 and PC2 (described in detail in the following chapter) both have a negative impact on the switching intention. PC1 is composed by questions examining the informational transparency of the current provider (Table 6). The more information the supplier displays and the more transparent the supplier appears, the less likely it is for respondents to intend to switch. If suppliers are transparent and offer their customers sufficient information, their customers intend to reward them with loyalty. However, looking at the previous model's results which displays the true and not intended switching behaviour shows that this is not true. Customers who perceive their contract to be of very low transparency are less likely to switch their provider. This behavioural contradiction appears as a wishful thought of customers for fair contractual terms, however low transparency levels increase the switching costs which reduce the probability of switching.

The PC2 is labelled relationship quality and expresses the customer's price- and quality perceptions and commitment (see next chapter for details). Its influence is the same as for the PC1 however the impact of PC2 and its significance are greater. Higher levels of satisfaction lead to lower switching intentions which appears logical.

5.4.2.1. The Principle Component Analysis (PCA)

The respondents were asked another 9 questions revealing information about their current satisfaction, perception and interest towards alternative products, as demonstrated in detail in the following table. All 9 questions were rated on a seven point Likert scale ranging from *1 = strongly disagree to 7 = strongly agree*. The questions were later on grouped into four constructs which affect the switching behaviour: price perception, quality perception, informational transparency and commitment.

TABLE 6 - OVERVIEW OF THE QUESTIONS USED FOR THE PCA

Questions (1 = strongly disagree; 7 = strongly agree)	*Construct*
My energy supplier has competitive prices, as attractive proposals and promotions which interest me	Price Perception (PP1)
The price quality ratio offered by my supplier is good	Price Perception (PP 2)
My energy provider is reliable and that is important for me	Quality Perception (QP 1)
I made the right choice because my provider thinks about my necessities	Quality Perception (QP 2)
My supplier offers sufficient information for me to research information, make a selection of what I intend, make payments and receive after sales support	Transparency (TR 1)
The shop offers information which decreases the uncertainty of the purchasing experience and points out the reputation of the brand	Transparency (TR 2)
The services are presented to me in an appealing way (on the website and in stores)	Transparency (TR 3)
The website of my energy supplier offers sufficient information for the decisions I have to make	Transparency (TR 4)
I clearly prefer this provider compared to the others that I know	Commitment (COM 1)

All of the above variables were non-significant as individual variables in the linear regression. In order to find out, if these variables are capable of predicting the switching intention in a collective composition, a principal component analysis (PCA) was undertaken. The PCA is an interdependence technique of the multivariate analysis. The principal idea behind this analysis

is reducing the dimensionality of the data set by identifying common structures among the variables. Thus the primary assumption is that that there exists some degree of correlation among the selected variables. The PCA is a tool used to identify the highly interrelated variables and transforming these into principal components (PCs) which are uncorrelated (or orthogonal) while retaining as much as possible of the variation (Jolliffe, 2002). With this, the number of variables of the data set is reduced and the analysis of the explanatory variables is simplified. The PCs are ordered so that the first PC accounts for the greatest amount of variation, followed by the second PC and so forth. The advantage of the PCA, towards other methods of variable reduction, is that it allows using orthogonal factor scores which reduce the multicollinearity in the further analysis (Gatignon 2004).

The new PCs may also have greater explanatory value as it is composed by highly correlated variables which together, as a set of common perspectives, may describe a circumstance better than an individual variable (Hair et al., 2006). The PCA transforms the explanatory variables X_k to PC_i ($i<k$) by finding a linear function $\alpha_1 X$, where the variance among the explanatory variables X_i is maximized (Jolliffe, 2002). The function of the first linear combination is:

$$\alpha_1 X = \alpha_{11} X_1 + \alpha_{12} X_2 + \alpha_{1n} X_n = \sum_{i=1}^{n} \alpha_{1i} X_i \quad (11)$$

Thereafter, another linear function $\alpha_2 X$, subject to being uncorrelated with $\alpha_1 X$ is created, maximizing the variance among the remaining X_i and so forth. If 100 percent of the variation was to be explained, the number of PC would be equal to the number of variables, which is obviously senseless. The process of reducing the complexity of the data set must be traded off with a loss in variation. The fewer PCs are derived from the data set, the lower the total variation explained will be. In SPSS it is optional to either predefine a fixed number of PCs to be extracted or selecting an extraction based on Eigenvalues. The most common Eigenvalue chosen for extraction is greater than 1. Considering one of these constraints, the PCs are derived, as orthogonal linear transformations, from maximizing the variance such as:

$$\max_i var[\alpha_i X] \quad (12)$$

Before completing the analysis, the variables under consideration must be proven to be suitable for such a PCA. The Bartlett's Test, tests the hypothesis that the correlation coefficients are all 0, meaning that there is no correlation among the variables. The significance (see Table 7) is below a p-Value of 0.01 which requires rejecting the null

hypothesis and concluding that there are variables correlating. The Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) ranges from 0 to 1 and indicates whether a sample is suitable to perform a PCA. Values above 0.6 are considered to be sufficient. The KMO of 0.858 in the analyzed sample is a high value, signalizing that there is high degree of correlation among the considered variables. Both tests allow the conclusion that the variables in the analysis are highly suitable to perform a PCA.

TABLE 7 – TESTING THE VARIBALES SUITABILITY FOR THE PCA

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,858
Bartlett's Test of Sphericity	Approx. Chi-Square	2061,964
	df	36
	Sig.	,000

Using the PCA with a *varimax rotation* allows further identifying and analyzing the underlying structure of the data. Two PCs were extracted with Eigenvalues greater than 1, accounting for 68.2 percent of the total variance explained (Appendix Table 11). Table 8 shows the solutions (or loadings of each variable on each PC) of the PCA in the *Rotated Component Matrix* and the corresponding two new PCs. The new PCs were labelled according to the variation among the underlying variables as the following:

PC 1 = Informational Transparency, accounts for 36 percent of the variation and is composed by all four questions quantifying the customers' perceived level of the information provided by his supplier. The first question (TR1) covers the general transparency. The second (TR2) and fourth (TR4) deliver insights about the information provided to customers on the suppliers website and within the store, while the third (TR3) examines how appealing information is presented.

PC 2 = Relationship Quality, accounts for 32 percent of the variance explained and is composed by all variables analysing the commitment, price- and quality perceptions. The commitment is expressed by the degree of preference of the current supplier towards others. The price perception questions how competitive the prices are perceived and the level of the price quality ratio, whereas the quality perception corresponds to the satisfaction and reliability of the services offered by the current supplier.

TABLE 8 - PRINCIPAL COMPONENT ANALYSIS RESULTS

Rotated Component Matrix[a]

	Component	
	1	2
TR4	,866	
TR3	,850	
TR2	,849	
TR1	,732	
PP2		,833
PP1		,759
COM1		,749
QP2	,414	,701
QP1	,444	,575

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

The variances overlap by more than 0.4 for QP1 and QP2 which is comprehensible considering the relationship between service perception and the grade of transparency the supplier signalizes. Nevertheless, the result is clearly differentiable and as such generally intelligible.

5.4.3. Final Linear Regression Model

Plotting the explanatory variables (X_i) and the adjusted coefficients (β_i) into the final linear equation delivers the following estimated model ($\hat{Y}$):

EQUATION OF THE FITTED REGRESSION MODEL

$$\hat{Y} = 2.347 + 0.267 * \text{Price Sensitivity} + 0.216 * \text{MK2} - 0.154 * \text{CO2} - 0.155 * \text{Satisfaction} + 0.118 * \text{Service1} + 0.106 * \text{Service2} + 0,364 * \text{Reliability} - 0.175 * \text{PC1} - 0.270 * \text{PC2}$$

The results presented in Table 9 determine the model fit. The R Square value expresses that 30.3 percent of the variation of Y are explained by the variables in the model. The Durbin-Watson tests the correlation among the residual terms. Since the value is close to 2, one can conclude that no correlation exists ($Cov(\varepsilon_i, \varepsilon_j) = 0$, $i \neq j$) which is a necessary condition for the validity of the model.

TABLE 9 - LINEAR REGRESSION MODEL RESULTS

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,550[a]	,303	,287	1,496	1,916

a. Predictors: (Constant), PC1, PC2, Reliability, Price Sensitivity, MK2,Service1, Service2, Satisfaction, COM1

b. Dependent Variable: Switching Intention

The ANOVA test (Appendix Table 14) also allows conclusions about the validity of the model by testing if at least one explanatory variable used in the model explains the dependent variable switching intention. The value of the test statistic is 19.01 and it is significant at a p-Value < 0.01. Therefore the H_0 stating that no independent variable has explanatory power is rejected.

Checking the assumptions for the Final Model:

Looking at the mean of the residual components (Table 15) we can conclude that the $E(\varepsilon_i)$ equals 0. The independent variables are not correlated with the residual terms $Cov(\varepsilon_i, X_i) = 0$ and there is no correlation among the residual terms $Cov(\varepsilon_i, \varepsilon_j) = 0$, *where* $i \neq j$ (Table 10 – Durbin Watson close to 2). Figure 15 and 16 in the appendix show that residuals follow a normal distribution.

5.5. Concluding Remarks

The analysis of Portuguese switching behaviour reveals useful insights which in general terms support the common doctrine in customer utility switching, however some country specific deviations are also observed.

The analysis of the sample identifies a representative share of switchers which differentiate themselves from loyal customers in seven generalizable aspects. Other than comparable works in this field, the analysis does not examine the irrational behaviour of the respondents but rather indicates that rational actors are more likely to switch their supplier. This is expressed by the variables market knowledge, price sensitivity, expected savings and transparency. Also other significant explanatory variables such as gender indirectly allow this conclusion. The higher switching rates of men are most likely a result of higher education

levels again positively affects their market knowledge. The analysis also confirms prior findings of geographical differences within the country. A significant minority of 30 percent also greatly values reliability which is a rather common aspect in such markets.

Other than existing studies on customer utility switching, the analysis of this research allows to identify differences in switching decisions and intentions. The most common explanation of low switching rates in liberalized energy markets, besides the existence of switching costs, is inertia. Inertia expresses the attitudinal propensity of being *passive* or *inactive* and therefore maintaining the status quo. Consumers who intend to switch their provider but haven't are likely to belong to this segment. Inertia affected consumers purchase out of convenience and the analysis finds some proof for this conclusion. The demand for more convenience applies only to the "intenders" not to the "switchers". Low levels of consciousness involved with a purchase are also typical for inert consumers. This might explain why not the factual market knowledge but rather the own judgment of the markets offers is relevant for this segment. Intenders also value informational transparency of the supplier, however the prior analysis proves that less transparency increases the likelihood of loyalty. High switching intention is obviously also related to good price-quality ratios.

The findings suggest that it is useful for energy suppliers to carefully segment their customer groups and target these with differentiated offers, customized to their specific needs. In terms of retention policies, suppliers should focus on customers with better economic rationality as these are more likely to switch. This segment is specified by customers with better market knowledge which is likely to explain why they perceive their suppliers offer as more transparent. They're generally better educated people, belonging to higher social classes, and male. Other customers value reliability and care less about the costs and therefore turn out as a rather loyal and potentially profitable segment when targeted correctly. The communication should focus on the more densely populated regions. However, an additional examination of these customer groups using the latent class analysis could help specifying these customer segments closer.

The switching intenders are less focused in their decisiveness for what could eventually trigger a switch. Offering additional convenience at better price-quality ratios and higher transparency seems unfeasible, therefore a latent class analysis could also be useful in order to identify attractive segments for poaching or retention strategies. However, it is also

reasonable to believe that the variables in this model, except for reliability and price sensitivity which are relevant for both models, appear attractive to customers but don't actually affect a switch.

Policy makers objecting to stimulate the market should focus on the results of the logistic regression and consequently attempt to further increase the consumer's market knowledge in terms of saving opportunities and alternative offers. Regulations for greater transparency among the suppliers' offers and building trust in the market would further stimulate the switching activity of Portuguese consumers. The competition and hence the attractiveness of switching would be positively stimulated if the competitive component of the total price received greater weight, especially because Portuguese consumers have a low elasticity of demand but display high price sensitivity.

6. Deutsche Zusammenfassung

In dieser Arbeit werden die Resultate der portugiesischen Strom-und Gasmarktliberalisierung analysiert. Erfolgreich umgesetzte Marktliberalisierungen ermöglichen einen effizienten Marktwettbewerb, welcher sich durch faire Wettbewerbsbedingungen, eine gesteigerte Konkurrenten Anzahl und, eine durch das verbesserte Marktangebot, erhöhte Kunden-partizipation auszeichnet (Lewis, Bogacka, 2014, 2). Obwohl in vielen liberalisierten Energiemärkten Europas bereits ein Umschwung erkennbar ist, bleibt allen voran die geringe Wechselsrate der Kunden ein wesentliches Merkmal der beschränkten Effizienzgewinne in vielen Märkten. Das Ziel dieser Arbeit ist es, die portugiesische Wettbewerbssituation zu erkunden und das Wechselverhalten der Stromkunden zu untersuchen. Hierfür wird zunächst eine Marktanalyse hinsichtlich der Wettbewerbssituation, der Preisentwicklung und der regulativen Bestimmungen präsentiert. Danach werden die theoretischen Ansätze und Resultate zweier ökonometrischer Analysen der portugiesischen Stromkunden dargestellt. Dabei wird zwischen dem Wechselverhalten, welches mittels einer logistischen Regression modelliert wird, und den Wechselabsichten, welche mittels einer multiplen linearen Regressionsanalyse modelliert werden, unterschieden.

Vergleichbare Studien anderer Länder beziehen sich jeweils nur auf eine der beiden Verhaltensweisen von Konsumenten. Diese Unterscheidung ermöglicht es jedoch wertvolle Rückschlüsse, auf die in zahlreichen Studien festgestellte Trägheit im Wechselverhalten von Stromkunden, zu ziehen. Die Ergebnisse beider Modelle stehen weitgehend im Einklang mit den theoretischen Erkärungen und den Resultaten vergleichbarer Studien zum Wechsel-verhalten von Stromkunden und zeigen nur geringe länderspezifische Unterschiede auf.

Die für die logistische Regression als signifikant identifizierten Variablen führen zu der Erkenntniss, dass der Anbieterwechsel von ökonomisch rationaler handelnden Akteuren dominiert wird. Besseres Martwissen, höhere Preissensitivität und höhere jährliche Einsparungserwartungen sind Eigenschaften, welche die Wahrscheinlichkeit eines Anbieterwechsels steigern. Auch die höhere Wechselrate von Männern gegenüber Frauen, ist vermutlich auf die höhere Bildungsrate von Männern unter den Befragten zurückzuführen. Kunden die ihr Angebot als transparent erachten tendieren stärker zum Anbieterwechsel, was ebenfalls mit einem besseren Marktverständniss erklärt werden kann. Des Weiteren sind dichter besiedelte Gebiete in Portugal von höheren Wechselraten geprägt. Eine Minderheit

von etwa 30 Prozent weist eine deutlich geringere Preissensitivität auf, präferiert dafür eine hohe Zuverlässigkeit des Anbieters.

Die signifikanten Variablen der multiplen linearen Regression verdeutlichen, dass der Bedarf von Stromkonsumenten mit einer hohen Wechselabsicht sich vom Bedarf der bereits gewechselten Kunden unterscheidet. Preissensitivität und die Zuverlässigkeit des Anbieters bewirken auch in diesem Model eine Steigerung der Wechselabsicht. Darüberhinaus würden transparente Marktangebote mit verbesserten Serviceleistungen und besseren Preis-Leistungs-Konditionen auch positiv zur Wechselabsicht beitragen.

Die Resultate beider Analysen führen zu der Erkenntnis, dass portugiesische Stromkunden differenzierte Anforderungen an ihre Stromanbieter stellen. Eine präzise Segmentierung der Kunden und dementsprechend differenzierte Angebote sind daher für die Kundenbindung und Kundenaquise förderlich. Kundenbindungsstrategien sollten allen voran auf den ökonomisch rationaler agierenden Kundenstamm ausgerichtet werden, da deren Wechselwahrscheinlichkeit höher ist. Diese Kunden sind im Allgemeinen besser gebildet, entstammen höheren Gesellschaftschichten und sind männlich. Die Transparenz des Angebots führt im Allgemeinen zu geringerer Loyalität, da geringe Transparenz für den Kunden zusätzliche Wechselkosten darstellen. Energieanbieter sollten auch jene Kunden ausfindig machen die Verlässlichkeit schätzen, denn deren geringe Preissensitivität und hohe Loyalität erscheinen ein sehr profitables Segment zu bilden.

Kunden mit hohen Wechselabsichten sollten ebenfalls genauer segmentiert werden, da deren Nachfrage nach verbesserten Serviceleistungen, besseren Preis-Leistungskonditionen und transparenteren Angeboten ökonomisch schwer umsetzbar erscheinen. Es bleibt jedoch festzuhalten, dass diese Forderungen lediglich eine erhöhte Wechselabsicht, möglicherweise jedoch gar keinen Wechsel bewirken.

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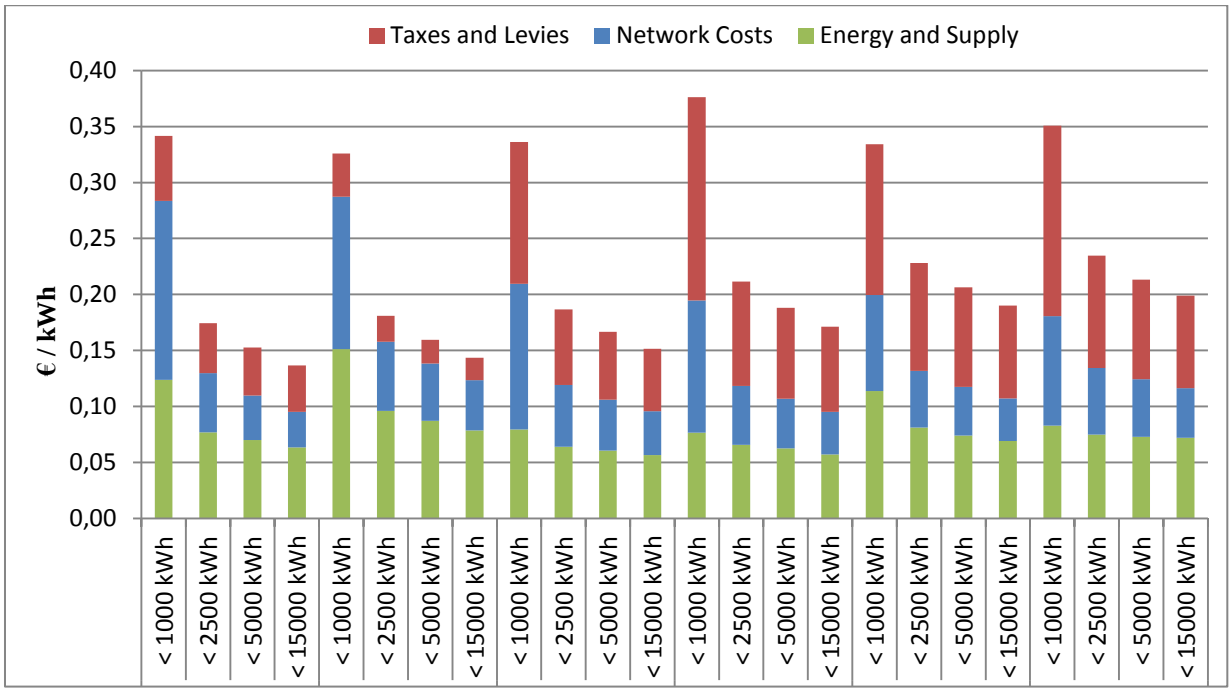
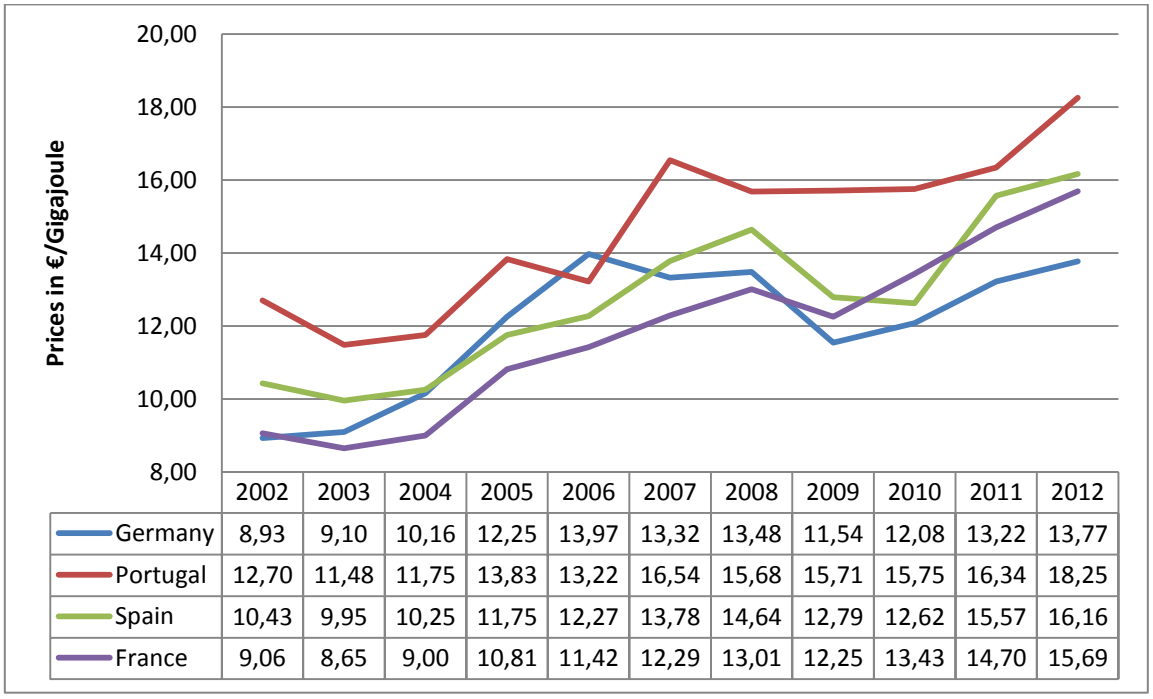
8. Appendix

FIGURE 11: ELECTRICITY PRICES BY COMPOSITION AND CONSUMPTION LEVELS



Source: Eurostat

FIGURE 12: GAS PRICES FOR DOMESTIC CONSUMERS INCLUDING TAXES AND LEVIES



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Germany	8,93	9,10	10,16	12,25	13,97	13,32	13,48	11,54	12,08	13,22	13,77
Portugal	12,70	11,48	11,75	13,83	13,22	16,54	15,68	15,71	15,75	16,34	18,25
Spain	10,43	9,95	10,25	11,75	12,27	13,78	14,64	12,79	12,62	15,57	16,16
France	9,06	8,65	9,00	10,81	11,42	12,29	13,01	12,25	13,43	14,70	15,69

Source: Eurostat

FIGURE 13: MEASURING THE DEGREE OF LOYALTY OF CUSTOMERS: IT IS VERY LIKELY THAT I WILL CHANGE MY OPERATOR IN THE NEAR FUTURE

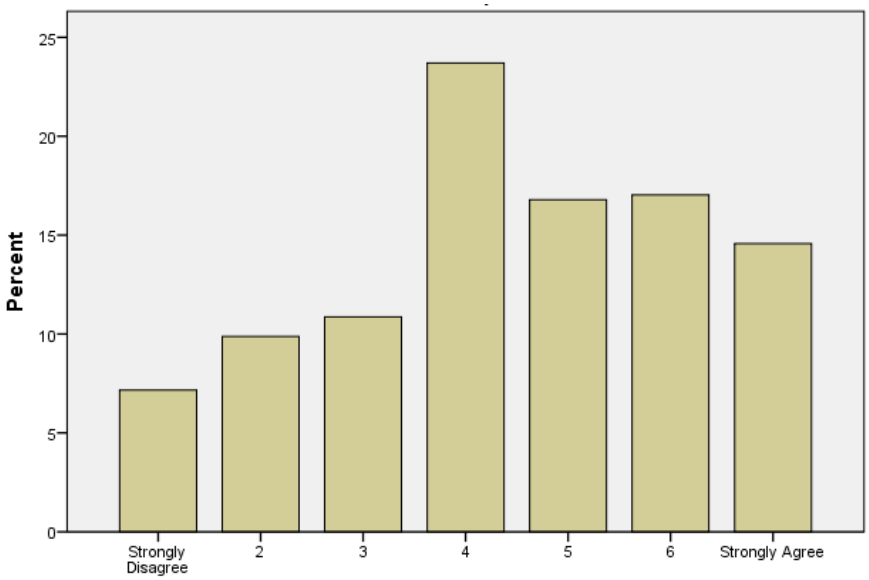


TABLE 10 - HOUSEHOLD INCOME DISTRIBUTION

What is your household's approximate monthly net-income?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 500 euros	55	13,6	13,6	13,6
	between 501 and 750 euros	77	19,0	19,0	32,6
	between 751 and 1000 euros	89	22,0	22,0	54,6
	between 1001 and 1500 euros	63	15,6	15,6	70,1
	1501 a 2000 euros	59	14,6	14,6	84,7
	more than 2500 euros	62	15,3	15,3	100,0
	Total	405	100,0	100,0	

TABLE 11 - TOTAL VARIANCE EXPLAINED OF THE 2 EXTRACTED PC

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4,873	54,141	54,141	4,873	54,141	54,141	3,215	35,727	35,727
2	1,263	14,036	68,177	1,263	14,036	68,177	2,921	32,450	68,177
3	,783	8,700	76,877						
4	,564	6,270	83,147						
5	,462	5,129	88,276						
6	,340	3,773	92,049						
7	,262	2,909	94,958						
8	,245	2,723	97,681						
9	,209	2,319	100,000						

Extraction Method: Principal Component Analysis.

TABLE 12 - CLASSIFICATION TABLE (VARIABLES NOT IN THE EQUATION)

Classification Table[a,b]

	Observed		Predicted		
			Switching		Percentage Correct
			Switcher	Loyal	
Step 0	Switching	Switcher	0	37	,0
		Loyal	0	362	100,0
	Overall Percentage				90,7

a. Constant is included in the model.

b. The cut value is ,500

TABLE 13 - PSEUDO R2 TESTS FOR GOODNESS OF FIT

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	196,571[a]	,117	,255

a. Estimation terminated at iteration number 6 because parameter estimates changed by less than ,001.

TABLE 14 - TESTING THE VALIDITY OF THE MULTIPLE LINEAR REGRESSION MODEL

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	382,974	9	42,553	19,010	,000[b]
	Residual	881,944	394	2,238		
	Total	1264,918	403			

a. Dependent Variable: Switching Intention

b. Predictors: (Constant), PC1, PC2, Reliability, Price Sensitivity, MK2,Service1, Service2, Satisfaction, COM1

FIGURE 14 - NIELSEN AREAS IN PORTUGAL

Figura 1 – Concelhos de Portugal

Área I
(Grande Lisboa)

Lisboa	Lisboa, Cascais, Loures, Oeiras, Sintra, Amadora, Odivelas
Setúbal	Almada, Barreiro, Seixal

Área II
(Grande Porto)

Porto	Porto, Gondomar, Maia, Matosinhos, Valongo, Vila Nova de Gaia

Área III-Norte

Viana Castelo	
Braga	
Porto	Total (excluindo Grande Porto)
Aveiro	
Coimbra	Coimbra, Cantanhede, Condeixa-a-Nova, Figueira da Foz, Mira, Soure, Montemor-o-Velho

Área III-Sul

Leiria	Leiria, Alcobaça, Batalha, Bombarral, Caldas da Rainha, Marinha Grande, Nazaré, Óbidos, Peniche, Pombal, Porto de Mós
Santarém	Santarém, Cartaxo, Rio Maior
Lisboa	Total (excluindo Grande Lisboa)
Setúbal	Setúbal, Alcochete, Moita, Montijo, Palmela, Sesimbra

Área IV

Bragança	
Vila Real	
Guarda	
Viseu	
Coimbra	Arganil, Góis, Lousã, Miranda do Corvo, Oliveira do Hospital, Pampilhosa da Serra, Penacova, Penela, Poiares, Tábua
Leiria	Alvaiázere, Ansião, Castanheira de Pêra, Figueiró dos Vinhos, Pedrógão
Castelo Branco	

Área V

Portalegre	
Santarém	Abrantes, Alcanena, Almeirim, Alpiarça, Benavente, Chamusca, Constância, Coruche, Entroncamento, Ferreira do Zêzere, Golegã, Mação, Salvaterra de Magos, Sardoal, Tomar, Torres Novas, Vila Nova da Barquinha, Vila Nova de Ourém
Setúbal	Alcácer do Sal, Grândola, Santiago do Cacém, Sines
Évora	
Beja	
Faro	

Source: http://markzone.files.wordpress.com/2007/02/trabalhoindividual.pdf

TABLE 15 - MEAN OF THE RESIDUAL COMPONENT

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	1,01	6,87	4,43	,975	404
Residual	-4,032	3,990	,000	1,479	404
Std. Predicted Value	-3,507	2,505	,000	1,000	404

FIGURE 15 - NORMALITY OF THE RESIDUALS 1

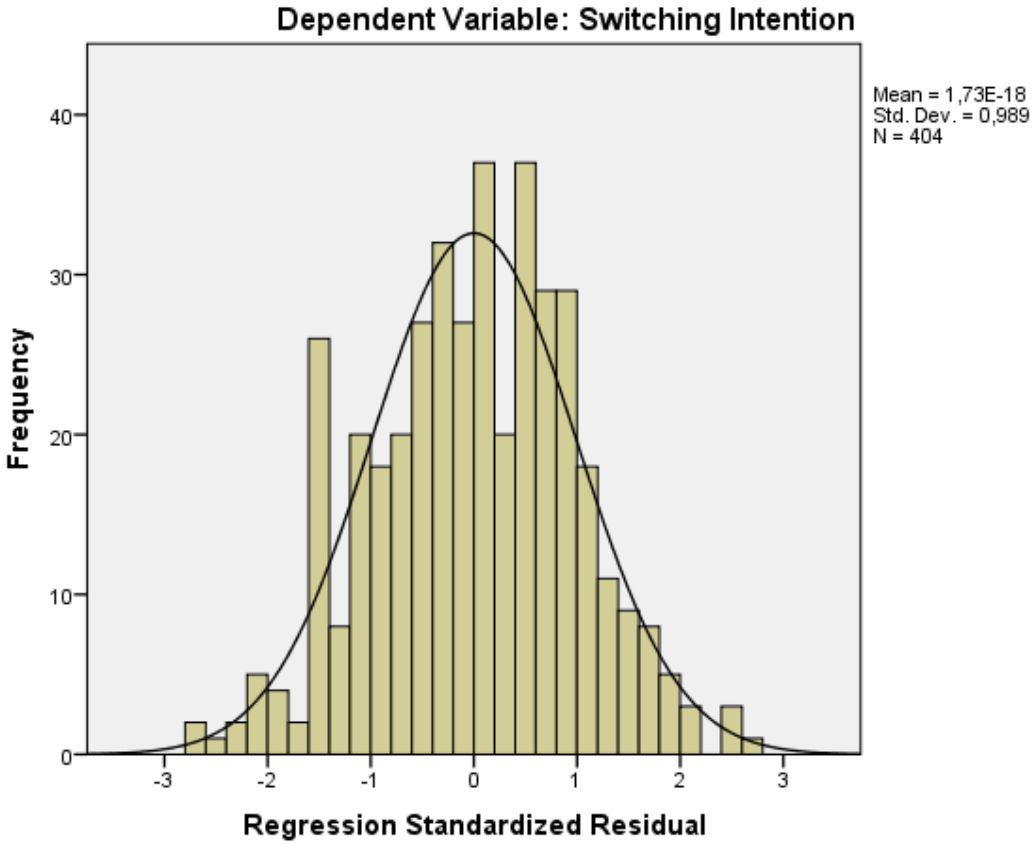
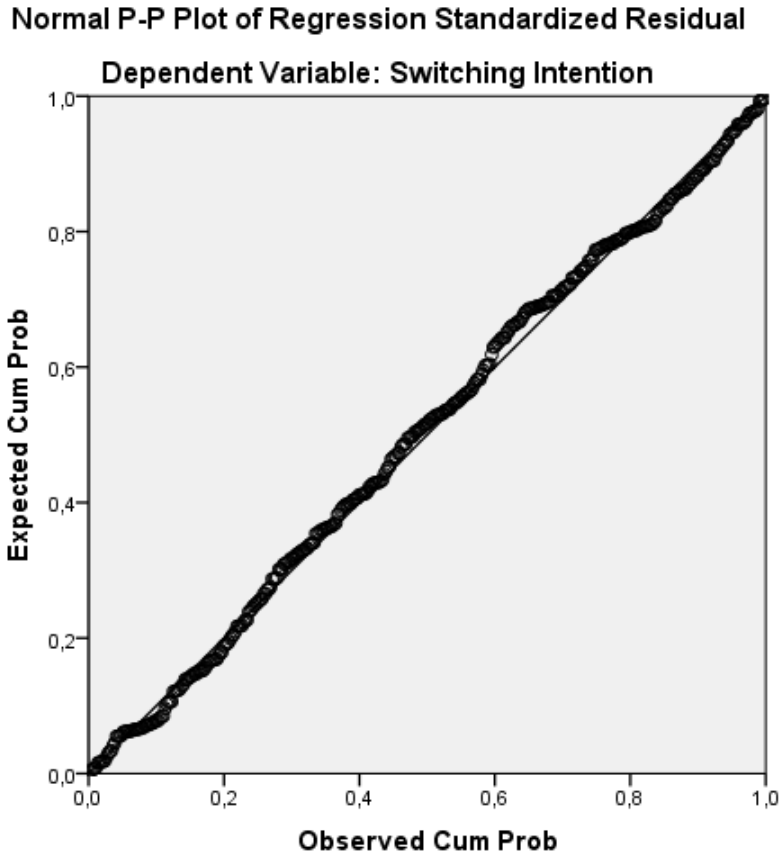


FIGURE 16 - NORMALITY OF THE RESIDUALS 2



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2011	Graduation as Bachelor in Business Administration
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	Die Auswirkungen der Pensionsreform 2006 und der Prämienbegünstigten Zukunftsvorsorge
2012 - 2014	Master Student of Business Administration at the University of Vienna emphasising on Energy- and Environmental Management and Industrial Management
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2014	Thesis Title: Consumer Utility Switching in Portugal

Working Experience

- 2004 – 2009: Professional Ice-Hockey Career
- July – Nov. 2012: Evaluation of real estate properties and sales support (Peak Properties)
- March – Sept. 2013: Business Consultant at Kloepfel Consulting

Language Skills

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Moderate written and spoken knowledge of Portuguese