The Effects of Electricity Market Liberalisation in the European Union

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Abstract

Since the 1990s, the EU has been trying to liberalise electricity markets. The anticipated benefits were efficiency gains and lower prices for consumers while guaranteeing security of supply throughout the EU and promoting energy efficiency and the use of renewable energy resources. In other sectors, such as the telecommunications industry, liberalisation has led to substantial price decreases.

This thesis analyses the actual impact of liberalisation on competition and electricity prices. Based on a theoretical framework for electricity market liberalisation, the three liberalisation directives adopted by the EU are being examined. Subsequently, electricity prices for private and industrial consumers and competition in wholesale and retail markets in 15 EU Member States are being analysed. The analysis reveals that, although some progress has been made, markets still show a high degree of concentration and electricity prices have generally increased.

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List of Abbreviations

ACER	Agency for the Cooperation of Energy Regulators
CJEU	Court of Justice of the European Union
DG	Directorate-General
DSO	Distribution System Operator
ENTSO-E	European Network of Transmission System Operators for Electricity
ERGEG	European Regulators Group for Electricity and Gas
EU	European Union
HHI	Herfindahl-Hirschman Index
kWh	Kilowatt hour
MWh	Megawatt hour
MS	Member State
NTPA	Negotiated Third-Party Access
RTPA	Regulated Third-Party Access
TSO	Transmission System Operator
VIU	Vertically Integrated Utility

1. Introduction

1.1. Background

Since the beginning of the 1990s, the creation of a single European energy market has been on the EU's agenda. The central objectives of the EU's liberalisation efforts were to increase welfare by reducing electricity prices for consumers, to guarantee security of supply throughout the EU, and to promote energy efficiency and the use of renewable energy resource (Willems & Ehlers, 2008).

Liberalisation of the electricity market in the European Union began in the 1990s (European Commission, 2012a). Until then, electricity was provided by national organisations, which often held exclusive rights for supply. The EU's objective was to introduce freedom of choice for consumers by opening up the electricity markets to competition, similar to other sectors which had already been liberalised. The anticipated benefits were lower prices, a higher degree of efficiency and a more competitive economy. Previous research provides evidence that electricity market liberalisation does indeed have an effect on prices: Domah and Pollitt (2000), who examined the liberalisation of the electricity market in England and Wales, concluded that restructuring and privatisation have led to efficiency gains. However, they note that the degree to which consumers benefit largely depends on the regulatory structure.

Electricity market liberalisation has been an incremental process, with policies spread over three directives. The first liberalisation directive, adopted in 1996, granted third parties access to transmission and distribution networks, abolished restrictions on customers from changing suppliers, and introduced independent regulatory agencies.

As a reaction to this first directive, Newbery (2002) argued that the EU still lacked the necessary legislative and regulatory power and that if transmission capacity would not increase, liberalisation might actually lead to higher prices. After the directive had been transposed into national law, the European Commission launched an enquiry, which indicated that further measures were necessary to achieve full liberalisation, resulting in a second directive, adopted in 2003. This directive focussed on unbundling, requiring electric utilities to separate production and distribution. The second liberalisation directive was followed by a competition enquiry, which revealed that markets were still dominated by national or regional monopolies which held significant market power and could block new entrants to the market. Jamasb and Pollitt (2005) reach similar conclusions: They argue that although the first two directives have led to market opening, lower and converging prices and efficiency increases, interconnection capacities between Member States are often too low to reduce concentrations in national markets. In order to address these shortcomings, a third liberalisation directive was initiated in 2007 and adopted in 2009 after a long process of negotiations.

Although economic theory suggests that liberalisation would lead to more competition and hence lower electricity prices, only a few studies have studied the actual impact empirically. In addition, the conceptualisation of liberalisation is often not clear, and in some cases, no distinction is being made between liberalisation, privatisation and regulation (Arentsen & Künneke, 1996). This thesis is intended to address this knowledge gap by offering a clear conceptualisation of liberalisation and by studying its effects on electricity markets in the European Union, in order to determine whether the anticipated benefits did in fact occur.

1.2. Research Questions

The EU's general energy policy objectives are to ensure reliable energy supply at reasonable prices for businesses and consumers while minimising the environmental impact (European Commission, 2012a). This thesis focusses on the aspects of prices and competition, which is closely related: By introducing competition to electricity markets and distinguishing between competitive and non-competitive parts of the industry, the EU has been trying to meet the objective of ensuring reasonable prices (European Commission, 2012a). This leads to the following two research questions:

1. To what extent did liberalisation increase competition in wholesale and retail electricity markets?

2. To what extent did liberalisation reduce electricity prices for industrial and private consumers?

By analysing competition and electricity prices empirically, it will be possible to determine whether the EU's objectives have been met.

1.3. Research Design

The research design employed in this thesis is a longitudinal study of electricity markets in the Member States of the EU. Since the 2004 and 2007 Eastern Enlargements[1] occurred after the implementation of the first two liberalisation directives, it is not possible to assess the impact of liberalisation on these countries. The same applies to Croatia, which joined the EU in 2013. Accordingly, the analysis will focus on the EU-15 countries[2], which are the Member States of the EU before the 2004 enlargement.

Liberalisation will be operationalised using a conceptual framework. Based on this framework, the three directives adopted by the EU will be analysed in order to identify the relevant policy aspects, such as unbundling requirements, and their extent.

Subsequently, the impact of liberalisation on competition and electricity prices in the selected Member States will be assessed.

The analysis distinguishes between two levels, namely wholesale and retail markets. Wholesale refers to large-quantity trades between generators, suppliers and financial actors, such as hedge funds and investment banks. In simple terms, wholesale markets encompass generators, who sell the energy they produce, and retailers, who buy energy in order to re-sell it to end users. Retail markets, on the other hand, comprise all trades between suppliers and end users, such as consumers and private companies. The main difference between both market levels are voltage and quantity: While wholesale markets are being used to trade large quantities of high-voltage electricity, both quantity and voltage are much lower in retail markets.

[1] 2004 Enlargement: Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia; 2007 Enlargement: Bulgaria and Romania

[2] EU-15: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.

Competition refers to a firm's ability to influence prices (Stigler, 1972): If the firm's influence is zero, perfect competition exists. In this situation, prices are the result of supply and demand, and firms are price-takers.

In a competitive electricity market, none of these suppliers should have a dominant position, which is defined as a market share of more than 40 %. According to the Directorate-General for Competition, companies with a lower market share are unlikely to be dominant, whereas companies with a higher share may exercise market power and distort competition (European Commission, 2013).

To operationalise the competitiveness of wholesale markets, the market share of the largest generator, the number of main generators will be evaluated. By tracking changes in these values over time, it will be possible to determine whether liberalisation measures have contributed to more competitive electricity markets. In addition, the degree of market concentration, measured by the Herfindahl-Hirschman Index (HHI), will be examined.

Similarly, competition in retail markets will be operationalised as the total number of electricity retailers final consumers can choose from, the number of main retailers, and the HHI. A high number of retailers is a good indicator for a competitive market, since it allows consumers to choose the retailer which offers the lowest prices.

In the next step, electricity prices will be analysed. The analysis distinguishes between industrial and consumer prices. The distinction is being made because both groups have different consumption patterns: Eurostat defines several consumption bands for households and industrial users, which differ in terms of consumption volume (eurostat, 2015). These consumption bands are used in all Member States to classify electricity users.

The distinction between both groups is also important for other reasons: Industrial users are generally sensitive to reliable supply of electricity and price fluctuations. This is especially true for companies operating in the energy intensive industries, since for them, electricity prices are closely related to competitiveness and affect their position on the world market (European Commission, 2015). Consumers, on the other hand, are also influenced by additional factors, such as preferences for renewable energy: There is strong evidence that consumers are willing to pay significantly more for electricity from renewable sources (Roe, Teisl, Levy, & Russell, 2001).

The development of electricity prices for consumers will be analysed by examining prices per kWh for a medium-sized household over time. To analyse industrial electricity prices, expenses of medium standard industrial consumers will be examined.

Due to the lack of a control group, it is not possible to rule out the influence of other factors on the independent variables. This is especially true for electricity prices, which may be affected by taxes, technological developments and the availability of fuel. Furthermore, concerns about climate change and environmental protection have encouraged some countries, for example Germany[3], to prioritise the transition towards renewable energy, energy efficiency and sustainable development, which may contribute to initial price increases. However, the fact that there is considerable variation between Member States' energy mixes, the influence of changing fuel prices diminishes. Furthermore, electricity price data which excludes taxes and levies will be used. With these precautions, it should

[3] In September 2010, the Federal Government of Germany published a policy document outlining the planned Energy Transition (*Energiewende*). The central goals to be achieved until 2050 are a greenhouse gas reduction of 80-95%, a 60% share of renewable energy, and a 50% increase in energy efficiency.

be possible to identify trends over time and determine the effect of liberalisation on competition and prices.

The three liberalisation directives will be analysed in a qualitative manner by identifying their most important elements and the changes each directive introduces. The analysis of prices and competition will be based on quantitative data. Since it is not possible to quantify the liberalisation measures of the three directives, conclusions cannot be drawn from a numerical correlation between dependent and independent variables. Instead, changes in competition and prices over time will be examined while taking the date on which the directives entered into force into account. This way, it will be possible to link developments of prices and competition to the directives, which allows to determine their impact. This design comes close to a quasi-experiment featuring multiple interventions, and allows conclusions about the impact of each directive by comparing the period before and after it entered into force.

Data for this research will be provided by Eurostat. Data for electricity prices will cover the period between 1994 and 2014, which allows to assess the impact of all three directives. In other cases, data availability is more limited: Data for the market share of the largest generator only covers the period from 1999 to 2013. Similarly, data for the number of (main) retailers is only available for the period from 2003 to 2013. HHI values are only available for 2014 and will be used for a final assessment of the impact of liberalisation on the market structure of electricity markets.

1.4. Scientific and Social Relevance

Electricity market liberalisation is an important topic, as it affects both consumers and private companies. There is evidence for direct effects of liberalisation on consumers: In the markets for air transport and telecommunications, where liberalisation began in 1987 and 1988, the average prices dropped substantially (Boylaud & Nicoletti, 2000). Low electricity prices are especially important for energy-intensive industries, for which prices are directly linked to competitiveness on the international market. Furthermore, electricity price convergence between Member States can provide a level playing field for intra-European competition, shifting the focus from factors of production towards the innovative capacities of industries.

One of the central goals of electricity market liberalisation has been to ensure affordable prices (European Commission, 2012a). Decreasing prices are the most obvious indicator of successful liberalisation and affect both consumers and industries: For consumers, electricity is a necessary good with a relatively inelastic demand (Halvorsen & Larsen, 2001). Accordingly, their discretionary income will increase with decreasing electricity prices. For private companies, especially those operating in the energy intensive industries, prices are directly related to competitiveness and lower prices can improve their position on the world market (European Commission, 2015).

2. Theoretical Framework

The following chapter introduces the concept of liberalisation and competition. It consists of two parts, the first part discussing liberalisation, whereas the second part is dealing with competition.

The first part outlines the concept of electricity market liberalisation by introducing three different systems of economic coordination. Subsequently, the value chain of electricity will be used to illustrate the individual steps of electricity supply and the way in which liberalisation affects their organisation. The section concludes with an overview of the main steps of electricity market reform.

The second part examines the theoretical foundations of competition and the applicability of the concept to network industries. First, the expected benefits of competitive electricity markets will be described. Afterwards, ways of assessing the degree of competition in a market will be introduced.

2.1. Electricity Market Liberalisation and Reform

Economic liberalisation refers to a process of reorganising sectors by changing the dominant system of coordination (Arentsen & Künneke, 1996). Thompson *et al.* (as cited in Arentsen & Künneke, 1996) describe three basic systems for coordinating economic activity, which differ in terms of economic decision-making mechanisms, mechanisms of allocation and goals.

TABLE 1:
Characteristics of basic coordinating systems

Coordinating mechanism	Unit of decision making	Mechanism of allocation	Dominant economic goal
Market	Individual	Price setting	Individual profitability and continuity
Network	Group	Agreement	Collective profitability and continuity
Hierarchy	Public authority	Directive	National public interest

Source: Arentsen and Künneke (1996)

Market systems are characterised by individual actors, motivated by self-interest, which decide autonomously about their consumption and production behaviour. Prices are a reflection of supply and demand.

Networks are based on voluntary cooperation and collective decision-making. Instead of competing with each other, actors engage in consensus building, thereby reducing the degree of individual autonomy. The motivation behind cooperation is collective profitability.

Hierarchical systems rely on a public authority, forcing actors to operate the system in accordance with defined principles. These systems focus on the public good rather than individual or collective profitability.

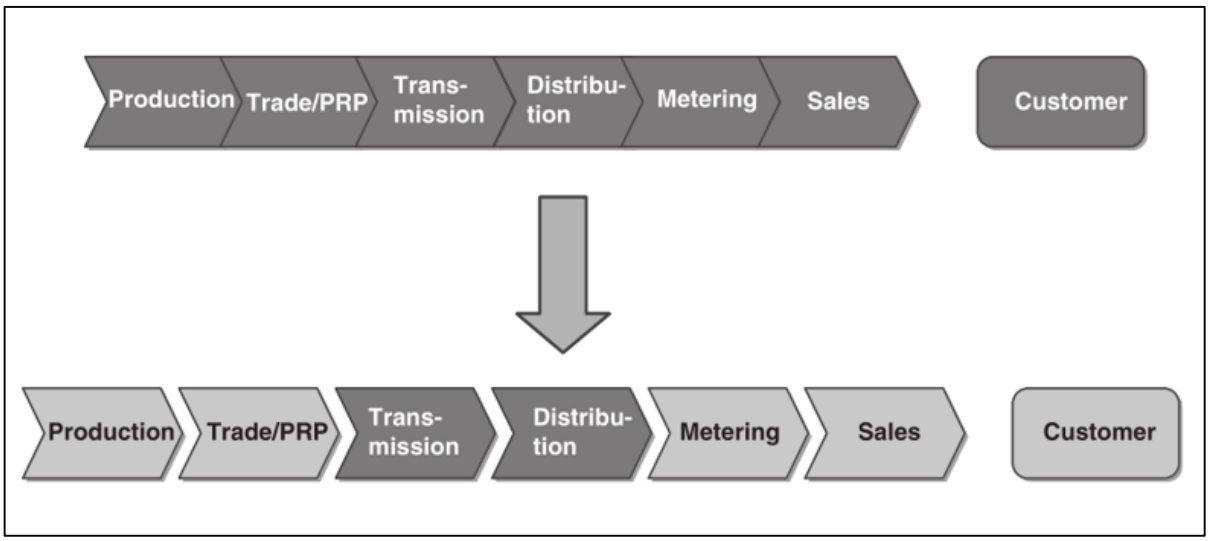
As Arentsen and Künneke (1996) note, electricity markets in Europe were traditionally organised hierarchically, dominated by national or regional monopolies in public ownership serving the general interest. They identify four economic and technical observations which were used to justify this extensive public involvement: First, electricity cannot easily be substituted by other energy sources and has a very low price elasticity. Accordingly, ensuring a constant, safe and efficient supply while

avoiding monopolistic pricing is an important public policy objective. Second, the electricity supply industry was assumed to be a natural monopoly in which significant economies of scale favour large-scale production. Third, electricity transmission and distribution rely on highly specialised infrastructure, requiring huge investments before any delivery of energy and hence posing a large investment risk. Fourth, electricity cannot be stored, requiring continuous balancing of supply and demand to ensure an uninterrupted supply.

Due to technological developments, several of these arguments no longer hold true: For example, the most efficient scale of electricity production has declined over the past decades, allowing a decentralisation of electricity production (Künneke, 1999). Furthermore, while transmission and distribution networks were traditionally considered to be "part of the integrated system of production and consumption", it is now possible to operate networks independently from other activities (Künneke, 1999).

The individual steps of electricity supply, ranging from production to retail sales, can be visualised as a value chain.

FIGURE 1:
The electricity value chain before and after liberalisation



Light shaded: market-based commercial functions; dark shaded: regulated monopolistic functions.

Source: Fens (as reproduced in Künneke, 2008)

Prior to liberalisation, electricity was provided by Vertically Integrated Utilities (VIUs), as shown in the top part of Figure 1. Vertical integration means that all elements of the value chain are controlled by one single organisation. Liberalisation requires unbundling of the value chain into independent entities, distinguishing between competitive parts (production, trade, metering, and sales) and network-related activities (transmission and distribution), which are natural monopolies, subject to sector-specific regulation (Künneke, 2008).

The individual elements of the value chain can be described as follows: Electricity generation, the first stage, refers to the conversion of primary energy, such as fossil fuels or solar energy, to electric power. The generated electricity is then being traded in the wholesale market, which comprises electricity producers, retailers and financial intermediaries, but also large industrial consumers. In this market, retailers buy electricity from producers in order to resell it to final consumers. The next step is transport of electricity via transmission and distribution networks. Transmission refers to

long-distance transmission of high voltage power, connecting generation facilities to points of consumption, whereas distribution networks supply electricity to final consumers.

Both transmission and distribution rely on networks, which can also cross national borders. In Europe, national grids are well-developed, but interconnection between these grids is often relatively weak, which limits the possibilities for trading electricity across borders (Meeus, Purchala, & Belmans, 2005). There are however some regional markets which show a high degree of integration, such as the Nordic electricity market (Amundsen & Bergman, 2006).

As van Koten and Ortmann (2008) note, there are several forms of vertical unbundling: Unbundling of accounts, the lowest level of unbundling, requires electricity companies to keep separate accounts for each of the electricity-related activities they engage in. Functional unbundling (also known as management unbundling) additionally requires management and operational activities to be separate for networks and generation or retail. Legal unbundling goes one step further, requiring networks to be operated by a separate company. The highest degree of unbundling is achieved with ownership separation. In this case, a separate company owns and operates transmission and distribution networks.

One motivation behind vertical unbundling is to prevent cross-subsidisation, meaning that VIUs use income generated by one activity to subsidise another activity within the value chain (Willems & Ehlers, 2008). Cross-subsidisation can be used by incumbent firms to prevent new actors from entering the market, and is therefore detrimental to competition.

Arentsen and Künneke (1996) note that liberalisation is conceptually distinct from both regulation and privatisation. As they explain, liberalisation only refers to changes of coordination systems, a choice that is independent from the structure of ownership and regulation. Nevertheless, they do acknowledge that liberalisation can result in a greater need for regulation. This observation is confirmed by Domah and Pollitt (2000), who studied liberalisation of the electricity market in England and Wales. They conclude that, despite the efficiency gains that resulted from liberalisation, the degree to which consumers benefit largely depends on effective regulation of the sector.

TABLE 2:
Main steps of electricity market reform

Restructuring	▪ Vertical unbundling of generation, transmission, distribution, and supply activities ▪ Horizontal splitting of generation and supply
Competition and Markets	▪ Wholesale market and retail competition ▪ Allowing new entry into generation and supply
Regulation	▪ Establishing an independent regulator ▪ Provision of third-party network access ▪ Incentive regulation of transmission and distribution networks
Ownership	▪ Allowing new private actors ▪ Privatising the existing publicly owned businesses

Source: Jamasb and Pollitt (2005)

Since the EU's liberalisation directives also cover other aspects of electricity market reform, such as regulation and competition, Table 2 provides a systematic overview, illustrating the necessary steps

for a transition from a vertically integrated, publicly owned monopoly to a competitive and regulated electricity market. The aspect of competition will be covered in the second part of this chapter.

As indicated, restructuring does not only entail vertical unbundling, but may also require to split generation and supply horizontally in order to break the dominant position of an incumbent monopolist. By doing so, the degree of market concentration can be reduced, making it easier for new actors to enter the market (Jamasb & Pollitt, 2005).

Since non-discriminatory third-party access to transmission and distribution networks is a necessary condition for competition in generation and retail, it is necessary to establish an independent agency responsible for network regulation (Brunekreeft, 2002). This agency has to make sure that companies comply with competition law and that third parties have access the electricity network. It is also responsible for creating incentives for electricity companies to reduce costs and ensure a high service quality (Joskow, 2006).

There are three different procedures for third-party access: Negotiated third-party access (NTPA), regulated third-party access (RTPA), and the single buyer procedure.

If NTPA is being used, there is no sector-specific regulator and no ex-ante regulation of network access (Brunekreeft, 2001). Instead, generators and retailers negotiate the conditions for the use of networks with TSOs and DSOs. The only actor which can prevent abuse of market power is the cartel office.

In the case of RTPA, networks access is based on tariffs which are published in advance. An independent regulator is responsible for setting or approving these tariffs, usually by means of a price cap (Brunekreeft, 2002). It is generally assumed that RTPA is the most effective approach to the provision of network access (Jamasb & Pollitt, 2005).

The third option for network access is the single buyer procedure, in which one legal person is responsible for the management of the transmission system and centralised buying and selling of electricity. The single buyer is responsible for supplying all customers within a specified area with electricity, but eligible customers can still conclude direct supply contracts with producers (Bier, 1999). This means that the single buyer procedure, if it is being used, will be supplemented by either NTPA or RTPA.

The last aspect is ownership, which can either refer to privatisation of state-owned electricity companies, or to new private actors entering the market. According to Domah and Pollitt (2000), who examined the effects of privatisation of 12 regional electricity companies in England and Wales in 1990, restructuring and privatisation have led to efficiency gains. However, they note that the degree to which consumers benefit largely depends on the regulatory structure, and that privatisation can also lead to higher electricity prices for consumers if the market is not regulated appropriately.

2.2. Competition

There has been some debate about whether or not competition should be introduced in network industries: Although in other sectors, such as the telecommunications industry, competition has led to lower prices (Boylaud & Nicoletti, 2000), it is not clear whether the same holds true for the electricity supply industry. In theory, competitive markets should lead to efficiency gains, thus reducing prices (Moreno, López, & García-Álvarez, 2012).

The idea of perfect competition originates from neo-classical microeconomic theory and is based on a number of assumptions: It requires a homogeneous product, hence a lack of product differentiation. Furthermore, a sufficiently large number of suppliers is necessary, so that suppliers do not have market power and cannot raise prices to increase their profits. In a market with perfect competition, prices will thus accurately reflect marginal costs. Since electricity is a necessary good for consumers with a relatively inelastic demand (Halvorsen & Larsen, 2001), their discretionary income automatically increases with lower electricity prices.

Although consumers have historically had a very limited range of options for purchasing differentiated electricity products, recent studies have identified various non-price attributes, such as power quality, level of reliability, time of use, volume of usage, maximum demand, and the level of environmental impact, which can be used as a basis for product differentiation (Woo et al., 2014). For example, there is strong evidence that consumers are willing to pay significantly more for electricity from renewable sources (Roe et al., 2001).

Since the focus of this research lies on competition and electricity prices, the possibility of product differentiation will not be taken into account. For the purpose of this thesis, electricity will be assumed to be a homogeneous good, with prices being the only relevant attribute.

In reality, perfect competition does almost never exist, but it is nevertheless possible to assess the competitiveness of markets using various indicators. The Herfindahl-Hirschman Index (HHI) is a measure for market concentration which is widely applied by competition authorities to assess the structure of a market (Rhoades, 1993). It is calculated by squaring the market shares of all firms in a market and then adding the squares:

$$HHI = \sum_{i=1}^{N} s_i^2$$

The result reflects the competitiveness of a market. A value of 100 or lower[4] suggests that a market is highly competitive, values above 2500 indicate high concentration and in cases where a market is being dominated by one absolute monopoly, the HHI will be 10,000.

It is also possible to assess competition using other indicators: For wholesale markets, the market share of the largest generator gives a good indication of the extent to which a transition from a monopoly to a competitive market has occurred. Since generation is the first step of the value chain, it can be expected that the existence of one monopolistic generator is detrimental to overall competition. Likewise, retail competition can be measured by the number of retailers. Competitive retail markets require the existence multiple retailers between which consumers can choose.

2.3. Summary

In this chapter, liberalisation and competition were conceptualised. Liberalisation refers to the reorganisation of a sector by changing the dominant system of coordination. For the electricity sector, this process can be visualised as a value chain: Prior to liberalisation, all elements of the value chain are controlled by a VIU, whereas after liberalisation, a distinction is being made between

[4] For the sake of clarity, HHI scores are often expressed in points. In this notation, which will also be used in the present thesis, the index ranges from 0 to 10,000.

monopolistic functions such as transmission system operation, and competitive functions such as generation and supply. This shift is also known as unbundling.

Competition in electricity markets refers to the existence of multiple generators or retailers trying to increase their profits. To assess the competitiveness of a market, various indicators can be used, such as the number of suppliers, the market share of the largest supplier, or the HHI.

Based on this conceptualisation, the following chapter examines the EU's liberalisation measures. Subsequently, competition and prices will be analysed.

3. EU Legislation on Electricity

In the following section, the content of the three electricity liberalisation directives will be analysed. Since each directive repeals the previous one, the analysis will be focussed on the main changes each directive introduces and the circumstances under which it was implemented. Subsequently, the relationship between elements of the directives and the process of liberalisation will be examined. The section begins by outlining the evolution of EU competences in the field of energy.

3.1. The Evolution of EU Energy Policy Competences

Despite the fact that the EU has implemented various policies in the field of energy over the past decades, there was no explicit legal basis for a EU energy policy before the introduction of the Treaty of Lisbon. Instead, competences were scattered across various treaties, with coal and nuclear energy being covered by the European Coal and Steel Community and Euratom Treaties, whereas other energy sources fell under the general Treaty provisions for the internal market, competition, commercial policy, development cooperation, the environment, and trans-European networks and research[5].

In addition, Art. 308 TEC (now Art. 352 TFEU), the so-called *flexibility clause*, has served as a legal basis in a number of cases. It can be used to attain Treaty objectives in cases where "the Treaties have not provided the necessary powers". As expressed by the CJEU[6], the provision cannot be used to widen the scope of EU competences. However, since the EU already had an energy policy for coal and nuclear energy, using the flexibility clause did not widen the scope of EU competences, but merely expanded existing competences.

The Treaty of Lisbon introduces some changes by explicitly defining the nature and scope of EU competences in the field of energy. As stated in Art. 194 TFEU, the four main objectives of the EU's energy policy are to ensure the functioning of the energy market, to ensure security of energy supply, to promote energy efficiency, energy saving and renewable energy, and to promote the interconnection of energy networks.

Furthermore, Art. 122(1) TFEU introduces a solidarity clause, allowing the Council, based on a Commission proposal, to decide

> in a spirit of solidarity between Member States, upon the measures appropriate to the economic situation, in particular if severe difficulties arise in the supply of certain products, notably in the area of energy.

This provision is closely related to the external dimension of the EU's energy policy and possible disruptions of energy imports, which is also reflected in the European Energy Security Strategy[7].

The adoption of directives and regulations in the field of energy follows the Ordinary Legislative Procedure (Art. 294 TFEU), according to which the Commission submits a legislative proposal to Council and Parliament, who act as co-legislators. Before measures are being adopted, the Economic and Social Committee and the Committee of the Regions must be consulted.

[5] Presidency Note, Conference of the Representatives of the Governments of the Member States (IGC), 2000, CONFER 4711/00

[6] Opinion 2/94 *Accession by the Community to the European Convention for the Protection of Human Rights and Fundamental Freedoms* [1996] ECR I-01759

[7] Communication from the Commission – European Energy Security Strategy, COM(2014) 330 final

According to Art. 4 TFEU, energy policy is a shared competence. This means that both the EU and Member States can adopt legally binding acts. The division of competences between the EU and Member States is governed by two principles, namely pre-emption and subsidiarity. The principle of pre-emption states that Member States may exercise their competence only in so far as the EU has not exercised, or has decided not to exercise, its own competence. The subsidiarity principle, on the other hand, states that "the Union shall act only if and in so far as the objectives of the proposed action cannot be sufficiently achieved by the Member States" (Art. 5 TEU). It exists as a safeguard to limit EU action to cases which cannot be resolved by Member States alone and in which action at the European level has clear advantages.

In addition, Art. 194(2) TFEU imposes further limitations on EU energy policy by allowing Member States to determine

- the conditions for exploiting energy resources
- the choice between different energy sources
- the general energy supply structure

Nevertheless, the EU can still adopt measures in these areas if they are primarily of a fiscal nature (Art. 194(3) TFEU). In this case, a special legislative procedure applies, requiring a unanimous vote of the Council and consultation of the European Parliament.

As Braun (2011) argues, the Lisbon Treaty formalised the division of competences between the EU and Member States, but also created certain legal shortcomings from a Union perspective. These shortcomings include the limitations created by Art. 194(2) TFEU, which stipulate that matters such as energy taxation are subject to unanimity. Furthermore, Member States retain the right to conduct bilateral energy relations with non-EU countries.

Since Art. 194(1) explicitly assigns the task of ensuring the functioning of the internal energy market, characterised by the free movement of goods and undistorted competition, to the EU, the limitations identified by Braun to not directly interfere with electricity market liberalisation.

3.2. Directive 96/92/EC

Although there are earlier directives which relate to transparency of electricity prices[8] and rules for the usage of transmission grids[9], this directive constitutes the first comprehensive piece of legislation on electricity liberalisation.

The preamble introduces the directive's main objective, namely the creation of a competitive internal market for electricity in the European Union which ensures security of supply, the competitiveness of the European Economy and the protection of the environment. It is also expected that this market will contribute to increases of overall efficiency in generation, transmission, and distribution.

The main obstacles that the directive identifies are differences between Member States' regulation systems for the electricity sector and issues related to interoperability and interconnectedness of

[8] Council Directive of 29 June 1990 concerning a Community procedure to improve the transparency of gas and electricity prices charged to industrial end-users (90/377/EEC)

[9] Council Directive of 29 October 1990 on the transit of electricity through transmission grids (90/547/EEC)

national transmission systems. The directive also acknowledges that liberalisation is a gradual process and that it is necessary to provide sufficient time for the electricity industry to adjust to changes.

As stated in Art. 1, the purpose of the directive is to establish common rules for the generation, transmission and distribution of electricity.

Art. 3(2) allows Member States to define public service obligations and rules for customer protection. Member States can impose obligations on the electricity sector which may relate to security, regularity, quality, prices or environmental protection. The directive requires Member States to define these obligations in a clear, transparent and non-discriminatory way.

According to Art. 4, Member States may choose between an authorisation procedure and/or a tendering procedure to increase generation capacities, which both have to be based on objective, transparent and non-discriminatory criteria. These criteria, as defined in Art. 5(1), may relate to security of the electricity system, protection of the environment, land use, use of public ground, efficiency, the nature of primary sources and characteristics particular to the applicant.

Art. 7 requires Member States to designate a Transmission System Operator (TSO) responsible for operation, maintenance and the development of interconnections with other systems. The TSO has to be independent of activities such as generation and distribution at least in management terms, which constitutes the weakest form of unbundling (Jamasb & Pollitt, 2005). The system operator has to ensure equal treatment and may not discriminate between system users.

Art. 10 contains analogue provisions for Distribution System Operators (DSO). DSOs operate and maintain distribution networks and are obliged to supply local customers. They also have to ensure equal treatment of all customers. Member States may requires DSOs to give priority to energy from renewable sources.

Article 14(3) introduces unbundling of accounts, requiring VIUs to keep separate internal accounts for different activities in order to avoid cross-subsidisation and distortion of competition. Member States have to ensure that companies comply with these requirements.

3.3. Directive 2003/54/EC

The second liberalisation directive addresses shortcomings identified after the implementation of the first directive, such as continuing market dominance and predatory behaviour. Furthermore, it seeks to ensure non-discriminatory network access on the basis of transparent tariffs published prior to their entry into force, and to protect the rights of small and vulnerable customers.

Art. 6 and 7 introduce two procedures for increasing generation capacity. The default procedure is authorisation, according to which Member States define criteria for the grant auf authorisations. The criteria, listed in Art. 6(2), are similar to those defined in Art. 5(1) of the first liberalisation directive, with the addition of protection of public health and safety. Additional criteria may relate to measures adopted pursuant to Art. 3. In order to make the authorisation procedure objective, non-discriminatory and transparent, Member States are required to publish the criteria and to inform applicants of the reasons for refusing authorisation.

If the capacities created via the authorisation procedure prove insufficient to ensure security of supply, Member States may launch a tendering procedure. In this procedure, Member States define the contract specifications, the procedure to be followed, and the criteria according to which tenderers will be selected. These criteria may relate to those defined for the authorisation procedure in Art. 6(2).

Member States are required to designate an authority to supervise the tendering procedure, which may either be a public body or a private body independent from generation, transmission, distribution and supply.

Although the provisions on Transmission System Operators resemble those defined in the first directive, there are some differences: As stated in Art. 8, Member States are required to designate one *or more* Transmission System Operators. TSOs are responsible for ensuring adequate transmission capacity and system reliability and coordinating interoperability with interconnected systems. The new directive also explicitly tasks TSOs with ensuring non-discrimination between system users. For cases in which the TSO is part of a vertically integrated utility, Art. 10(1) requires legal unbundling in order to ensure that organisation and decision making of the transmission system operation are independent of unrelated activities. A requirement for ownership unbundling is not part of the directive.

Art. 13 contains similar provisions for Distribution System Operators (DSO). Member States have to designate DSOs, which have to be legally unbundled from other activities (Art. 15). Furthermore, Art. 14(1) and (4) introduce additional requirements next to operating distribution networks and maintenance, which relate to protection of the environment and preferential treatment for renewable energy.

Article 20(1) requires TSOs and DSOs to ensure that third parties have access to networks, based on tariffs which have to be applied objectively and without discriminations. Tariffs have to be published by system operators in advance.

To ensure compliance with the rules defined in the directive, Art. 23 requires Member States to designate an independent regulatory authority, responsible for monitoring TSOs and DSOs, the effective unbundling of accounts and levels of transparency and competition. The regulatory authority submits reports on market dominance, predatory and anti-competitive behaviour to the European Commission.

3.4. Directive 2009/72/EC

Art. 3 (5) obligates Member States to ensure that customers can change their electricity supplier within three weeks.

Art. 35 (1) requires all Member States to designate a regulatory authority at national level. To ensure the full independence of this authority, it has to be legally distinct and functionally independent from other public of private entities, and it is not allowed to receive instructions from any public or private entity (Art. 33 (4)). National regulatory authorities report to and cooperate with the Agency for the Cooperation of Energy Regulators (ACER), established by a separate regulation[10] and replacing the European Regulators Group for Electricity and Gas (ERGEG). While ERGEG was an advisory group based on voluntary cooperation between national regulatory authorities, ACER has legal personality and clearly defined competences. Its main purpose is to issue non-binding opinions and recommendations to the national regulatory agencies, transmission system operators, and to EU institutions. ACER can also take binding decisions in specific cases, for example in matters which relate to the conditions for access to cross-border transmission networks.

[10] Regulation (EC) No 713/2009 of the European Parliament and of the Council of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators

Furthermore, ACER regulates certain technical issues and facilitates cooperation between national regulatory authorities. Similarly, a regulation[11] requires national transmission system operators to establish the European Network of Transmission System Operators for Electricity (ENTSO-E), which is tasked with coordinating the completion of the internal electricity market and facilitating cross-border trade.

The term network code may refer to any set of rules applying to one aspect of the energy sector (ENTSO-E, 2014). Network codes are developed by the Commission, ACER, ENTSO-E and market participants via an extensive consultation procedure. By adopting network codes on the Community level, compatibility of national transmission networks can be ensured and cross-border transmissions are being facilitated.

3.5. EU Competition Law

In addition to the previously introduced liberalisation directives, general EU competition law principles apply to electricity markets. This includes provisions for market dominance (Art. 101 and 102 TFEU), mergers (Regulation 139/2004) and state aid (Art. 107 and 108 TFEU). As expressed by Philip Lowe, at that time Director General of the DG Competition, the Commission uses "the full gamut of competition enforcement tools at [its] disposal to pursue individual cases that could significantly improve the level of competition in the market"[12].

Art. 101 TFEU prohibits agreements between undertakings which affect trade between Member States or distort competition within the internal market. In particular, this applies to practices such as price fixing, artificial scarcity, market sharing, discriminatory treatment of market participants, and tying arrangements. According to 101(3) TFEU, such agreements are automatically void.

As stated in Art. 102 TFEU, undertakings are prohibited from abusing a dominant market position. The abusive practices mentioned are similar to those listed in Art. 101 TFEU. The Directorate-General for Competition defines market dominance as follows: Companies with a market share of less than 40 % are unlikely to be dominant, whereas companies with a market share of more than 40 % may exercise market power and distort competition (European Commission, 2013).

Regulation 139/2004, the so-called *Merger Regulation*, grants the Commission the power to assess market concentrations, which may arise as a result of mergers and acquisitions. The regulations requires the involved parties to notify the Commission in advance about concentrations with a Community dimension, which may either be approved or rejected if the resulting market dominance would be too high. The regulation is however limited in scope: As stated in Art. 2, it does not apply to cases in which "each of the undertakings concerned achieves more than two-thirds of its aggregate Community-wide turnover within one and the same Member State". In such cases, national competition law applies.

[11] Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity

[12] Philip Lowe (Director General, DG Competition): 'Can EU competition policy create competition in the energy sector?' (Speech held at The Beesley Lectures, London, November 6, 2008). Retrieved May 19, 2015, from http://ec.europa.eu/competition/speeches/text/sp2008_09_en.pdf

Regarding market concentration, the DG Competition has defined certain HHI threshold levels[13] to identify competition concerns. Markets with a HHI of 1000 or less are assumed to be competitive and to not require extensive analysis. Similarly, HHI values between 1000 and 2000 indicate moderate concentration, but do not raise competition concerns. If the HHI exceeds the threshold of 2000, market concentration is above competitive levels.

3.6. Price Regulation

The Energy Community, an international organisation that coordinates cooperation between the EU and non-EU countries in the field of energy, defines price regulation as follows: "A regulated price is a price subject to regulation by a public authority, as opposed to a price set exclusively by supply and demand." (Energy Community, 2012). The directives to not address this issue specifically, but price regulations are often justified as public service obligations necessary for consumer protection.

The Court of Justice of the European Union (CJEU) has clarified its position towards price regulations in the *Federutility*[14] case. Although the case relates to the interpretation of the second liberalisation directive for natural gas[15], the reasoning employed by the CJEU is applicable to the regulation of electricity prices as well. The Court ruled that, although prices should be determined solely by supply and demand, price controls could be justified as long as they complied with the criteria defined in Article 3(2) (i.e. clearly defined, transparent and non-discriminatory). However, any price controls imposed by Member States should be limited in duration and should not go beyond what is necessary to achieve a defined objective, such as limiting the impact of increasing fuel prices on consumer prices.

In a position paper published in 2007, ERGEG emphasised that end-user price regulations distort the functioning of the market and prevent the development of effective competition (ERGEG, 2007). Hence, the group calls for an abolition of all price controls in both electricity and gas markets.

[13] Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings, 2004 O.J. C 31/5

[14] Case C-265/08 *Federutility and Others* v *Autorità per l'energia elettrica e il gas* [2010] ECR I-03377

[15] Directive 2003/55/EC of the European Parliament and of the Council concerning common rules for the internal market in natural gas

4. Empirical Findings

4.1. Competition

Wholesale Competition

Since the traditional organisation of electricity markets has been monopolistic in most countries, it seems reasonable to expect that the largest generator in the electricity market had a very high market share before liberalisation, and that this share decreased gradually after the liberalisation directives were implemented. To test this hypothesis empirically, market shares for the period between 1999 and 2013 will be analysed (Table 3). The analysis covers the EU15 countries minus Luxembourg and the Netherlands, which had to be excluded due to missing values. Ideally, market shares would all be below 40 %, since this is the threshold for market dominance as defined by the Commission.

The market share of the largest electricity generator has decreased in the majority of countries. In 1999, the average market share was 57.8 %, whereas in 2013, it was 46.2 %. However, the number of countries in which the largest generator has a market share of 40 % or more is virtually the same (9 in 1999, 8 in 2013).

Austria is one of the few countries in which the wholesale market has become less competitive, with the largest generator's market share being more than twice as high as initially (21.4 % in 1999, 55.5 % in 2013). This is the largest increase of all countries and detrimental to competition, since one generator had control over more than half of the wholesale market in 2013. A similar trend can be observed in the United Kingdom, where the wholesale market share was initially low (21 %), but peaked in 2012 at 51.7 %. However, by 2013 the share had dropped to 29.3 %, which is only a moderate decrease compared to the initial market situation.

The market share of Denmark's largest generator has fluctuated considerably over the analysed period: In 1999, it was 40 %, a value that decreased until 2002, when it reached a low point of 32 %. In the following years, the share is generally above 40 %, with the exception of 2004, 2005 and 2012. The market share peaks in 2008 at 56 %, but returns to the initial level in 2013 (41 %).

In Finland and Germany, the market share of the largest generator has been stable over the analysed period, with a slight decrease in Finland (from 26 % to 25.3 %) and a minor increase in Germany (from 28.1 % to 32 %). The degree of fluctuation has been low in both countries, and values remain well below 40 %.

For Sweden and Portugal, moderate decreases can be observed. In both countries, the largest generator initially had a market share of more than 50 % (52.8 % and 57.8 %, respectively), which decreased over the analysed period. Although in both countries the largest generator had a market share of less than 50 % in 2013 (44.8 % and 45.8 %), market dominance is still likely.

In several Member States, the wholesale market was initially dominated by one monopolist, with a market share of more than 90 %. These are Greece (98 %), Ireland (97 %), France (93.8 %), and Belgium (92.3 %). In all four countries, market shares have decreased, ranging from a moderate decrease in France (83.8 %) to substantial changes in Greece (70 %) and Belgium (67 %), with the most extreme case being Ireland, where the share dropped to 54 %.

Similar decreases can be observed in Spain and Italy. For both countries, there is strong evidence for market dominance in 1999, as the largest generator had a market share of 51.8 % and 71.1 %, respectively. By 2013, however, market shares had dropped below 40 % (to 24.5 % and 27 %), which

indicates that the market has become more competitive and that the threat of market dominance has decreased considerably.

These developments suggest that liberalisation has reduced the market share of the largest generator in the majority of countries, the exception being Austria and the United Kingdom. The largest decreases could be observed in Member States where the largest generator initially had a share of more than 90 %. However, the degree to which this share has been reduced over the analysed period differs considerably and in none of these countries it fell below 40 %.

To verify these findings, the HHI will be used to assess market concentration in power-generation markets (Table 4). In 2014, only Italy (HHI = 884) had an unconcentrated wholesale market, scoring a value of less than 1000. In five Member States, moderate market concentrations could be observed, namely in Finland (HHI = 1,102), Ireland (HHI = 1,150), Spain (HHI = 1,329), the United Kingdom (HHI = 1,483) and the Netherlands (HHI = 1,492). In seven other Member States, the HHI exceeded the threshold of 2000, although the degree of concentration differs considerably between these countries: While Germany's HHI is only slightly above 2000 (HHI = 2,021), other countries clearly exceed the threshold, including Luxembourg (HHI = 2,311), Sweden (HHI ≈ 2,650), Portugal (HHI = 3,567) and Belgium (HHI = 4,010). Two countries, namely Greece (HHI = 6,183) and France (HHI > 8,500), show very high degrees of concentration. Values for Denmark and Austria were not available.

The analysis reveals that, although liberalisation has contributed to higher degrees of competition, wholesale markets are still not perfectly competitive. In most countries, one generator still controls a large share of the market, which is detrimental to competition. Furthermore, with the exception of Italy, markets are moderately concentrated at best, and highly concentrated in a number of other countries.

Retail Competition

In order to establish competition in retail markets, consumers have to be able to choose between different suppliers. Accordingly, the number of suppliers consumers can choose from indicates the competitiveness of the retail market.

The right for private consumers to choose a retailer has been implemented at different points in time in the Member States.

TABLE 5:
Year of full retail market opening for private households

Austria	2001
Belgium	2007
Denmark	2003
Finland	1997
France	2007
Germany	1998
Greece	2007
Ireland	2005
Italy	2007
Luxembourg	2007
Netherlands	2004
Portugal	2006
Spain	2009
Sweden	1999
United Kingdom	1999

Source: ECME Consortium

In the following, the number of retailers available to consumers in the period between 2003 and 2013 will be analysed (Table 6).

The number of retailers has decreased considerably in Denmark (from 113 to 49) and Spain (from 375 to 162), meaning that in both countries the number of retailers consumers could choose from was more than twice as high at the beginning of the analysed period. In Denmark, the largest numerical decreases occurred between 2003 and 2004 (from 113 to 75) and between 2006 and 2007 (from 65 to 38), with a slight recovery between 2011 and 2012 (from 33 to 55). It is striking that the largest decrease occurred after household electricity retail market opening was implemented in 2003.
In Spain, the largest decrease happened between 2008 and 2009, when the number of retailers dropped from 459 to 142. Again, this decrease coincides with household retail market opening that took place in 2009.

In several countries, the total number of retailers has increased between 2003 and 2013. The most notable increases can be observed in Germany, where numbers increased from 940 in 2003 to more than 1177 in 2013; in Italy, where the number of retailers was 390 at the beginning of the period and increased to 472 by 2013; and in the United Kingdom, which shows an increase from 24 to 33 over the analysed decade. Since retail market opening for households already took place in 1998 in Germany and in 1999 in the UK, it is not possible to attribute these increases to liberalisation. In the UK, the number of retailers increased considerably between 2003 and 2005 (from 24 to 33), then

decreases in the following years, and begins to recover from 2010 onwards, reaching a peak value of 33 again in 2013. In Germany, the number of retailers was relatively stable until 2013 (around 940), with some fluctuations occurring between 2005 and 2008. Numbers increased between 2008 and 2009 (from 940 to > 1000), while the largest increase took place between 2012 and 2013 (from > 1000 to > 1177).

In Portugal, the initial number of retailers was 5, which doubled by 2005. When retail markets opened in 2006, the number of retailers dropped to four, but increased again from 2009 onwards and peaked at 13 in 2013.

A similar pattern can be observed in Greece, where 5 retailers existed in 2003, a number which decreased to 4 in 2004 and remained stable until 2006. When retail market opening occurred in 2007, the number of retailers dropped to 2, but reached high values in 2010 (11) and 2012 (14). In 2013, however, the number of retailers dropped to 7.

In Italy, where household retail market opening took place in 2007, the number of retailers increased between 2003 and 2005 (from 390 to 430), but has then shows an overall decrease from 2005 onwards, reaching an all-time low of 268 in 2010. After 2010, numbers have increased steeply, peaking in 2013 at 472.

In other Member States, the retail market structure has changed to a lesser extent. In Belgium, Ireland, France, Luxembourg, the Netherlands, no meaningful changes in the number of retailers took place between 2003 and 2013. Although all of these countries opened their retail markets during the analysed period, it did not seem to have a measureable effect on the number of firms operating in the retail market.

Similarly, in Austria and Finland, where market opening took place in 2001 and 1997 respectively, the number of retailers has remained rather constant during the analysed period. In Austria, some fluctuations occurred, but overall, the number of retailers has not changed much. Finland, on the other hand, only provided indicative values for the number of retailers, with values of over 100 between 2003 and 2010, and approximately 100 between 2010 and 2013. The lack of exact values does not allow an in-depth analysis of the Finnish retail market for electricity.

The large number of retailers in some Member States might suggest that retail markets are highly fragmented. However, a shift of focus on the main retailers (Table 7) reveals that the actual numbers are much smaller. Retailers are considered as main if they account for at least 5 % of the total national electricity consumption. In the majority of countries, the number of main retailers has been relatively constant. In five Member States, the amount of main retailers has been the same in 2003 and 2013, namely Denmark (4), Finland (4), France (1), Italy (3) and Spain (3). Both Luxembourg and the Netherlands[16] also seem to show an upward trend (≥3 to 4 and 5 to 7, respectively). The number of main retailers has decreased in three countries, namely from 6 to 4 in Germany, from 3 to 2 in Ireland and from 7 to 6 in the United Kingdom. At the same time, numbers have increased in several other countries, namely in from 2 to 5 in Austria, from 1 to 4 in Portugal, from 1 to 2 in Greece, and from 3 to 4 in Sweden. Values for Belgium were not provided.

Despite the large changes in the total number of retailers, retail markets are largely dominated by a small number of main retailers. The analysis reveals that the number of main retailers is relatively stable, apart from some small changes. It is not possible to identify a clear trend, i.e. a gradual

[16] For the Netherlands, no value was provided for 2003. Accordingly, the indicated number refers to the following year.

increase of the number of main retailers. Instead, the identified changes seem to be the result of market fluctuations which cannot be attributed to liberalisation.

The index values for market concentration confirm these findings (Table 8): Similar to wholesale markets, retail markets are relatively concentrated. In none of the analysed countries, retail markets had a HHI value of 1000 or less in 2014. In a small number of countries, namely the United Kingdom (HHI = 1,720), Austria (HHI ≈ 1,800) and Italy (HHI = 1,865), retail markets were moderately concentrated. All other Member States have HHI values of over 2000, including Spain (HHI = 2,240), the Netherlands (HHI = 2,338), Belgium (HHI = 3,000), Ireland (HHI = 4,759) and France (HHI > 4,500). For Portugal, two values were provided, one for industrial consumers (HHI = 2,815) and one for domestic consumers (HHI = 6,918). Both values indicate a high degree of concentration. The highest degree of retail market concentration could be observed in Greece (HHI > 9,604). The values for Denmark, Finland, Germany and Sweden were not provided. Market concentration in Luxembourg is described as *high*, but no exact value is available.

It is striking that there is no clear relationship between HHI values for wholesale and retail markets. Although in a number of countries, concentration is higher in retail markets, this observation does not hold true for all countries, suggesting that competitive wholesale markets do not guarantee competition in retail markets.

4.2. Prices

Data for electricity prices for the EU-15 countries were provided by Eurostat. To ensure comparability between Member States, all prices exclude taxes and levies. For data collection, two different methodologies were used, one until 2007, and a different one from 2007 onwards. Eurostat states that comparing the new methodology prices with old methodology prices is possible, although discrepancies may occur due to different methods of data collection.

The old methodology defines medium-sized households as households with an annual consumption of 3500 kWh, of which 1300 kWh is being used overnight. For industry prices, medium-sized users are defined as users with an annual consumption of 2000 MWh. The indicated prices refer to the price for one kWh on 1st January.

The new methodology defines medium-sized households as households with an annual consumption between 2500 and 5000 kWh. Medium-sized industrial users have an annual consumption between 500 and 2000 MWh. The indicated price is the average price for one kWh during the first semester of the year.

Prices for Household Consumers

Between 1994 and 2014, average electricity prices for consumers in the EU-15 countries have increased from 0.1020 € / kWh to 0.1429 € kWh, an increase of 40.1 % (Table 9). This is increase is however not a linear trend: From 1994 to 2000, electricity prices have decreased by 7 %. From 2000 onwards, prices begin to increase, most notably between 2006 and 2007 (+ 11.2 %), between 2008 and 2009 (+ 7.2 %).

Price changes vary considerably between the analysed countries: While in Ireland, electricity prices have increased by 267.4 %, from 0.0751 € / kWh to 0.2008 € / kWh, prices were almost stable in Portugal, changing from 0.1256 € / kWh to 0.1268 € / kWh, an increase of 1.0 %. Comparably stable prices can be observed in Italy (- 3.0 %) and France (+ 2.9 %). It is worth noting that in no country except Italy electricity prices have decreased. Nevertheless, the degree to which electricity prices have increased differs between Member States: After Ireland, the largest price increases can be observed in Denmark (+ 111.1 %), Greece (+ 89.3 %), Sweden (87.3 %) and the United Kingdom (81.5 %). In all other countries, price increases were more moderate, ranging from + 60.7 % in Spain to + 14.0 % in Germany. Price regulations, which were only used by Denmark and Spain (Table 10), do not show a clear price effect.

Economic theory would suggest that retail market opening for private households would lead to lower prices: If consumers are able to choose between different suppliers, they should be inclined to pick the supplier which offers the lowest prices. However, the data suggest that retail market opening has in fact led to a price increase in several countries. To assess the impact of market opening, a period of seven years was analysed for each Member State, covering three years before and after market opening for private households (Table 5) occurred. In seven Member States, namely Austria, Denmark, France, Germany, Luxembourg, Sweden and the United Kingdom, electricity prices were comparably stable (prices increased less than 10 %) in the first three years after market opening.

Two Member States show slightly decreasing prices: In Finland, prices were 11.3 % lower three years after market opening. Similarly, prices in Portugal dropped 19.9 % two years after market opening, but increased in the following year, reducing the total price decrease to 5.7 %.

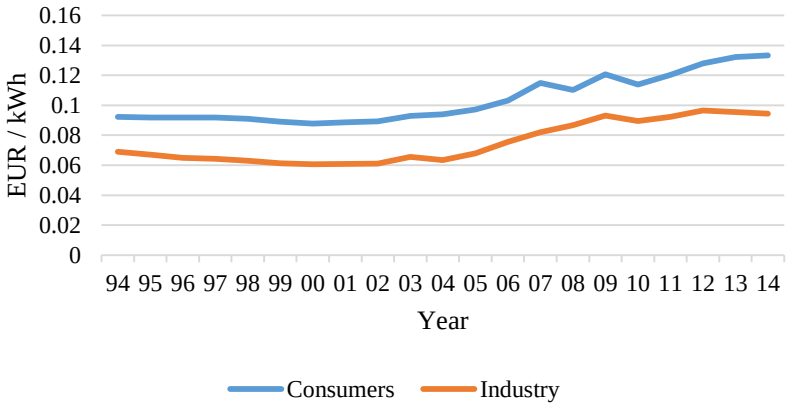
In five countries, prices have increased by more than 10 % in the years after market opening. These countries are Belgium (+ 22.1 % after one year), Greece (+ 59.6 % after two years), Ireland (+ 30.2 % after three years), the Netherlands (+ 35.8 % after three years) and Spain (+ 36.5 % after three years). In Ireland and Spain, price increases also occurred in the years before market opening, suggesting that these price increases might be a general trend for these two countries which are not necessarily related to market opening.

These findings indicate that consumers generally did not benefit from market opening. The anticipated electricity price decreases did not occur, instead, prices have increased considerably. Although consumers are now able to choose from a number of suppliers, they generally pay more for electricity than they did before liberalisation.

Prices for Industrial Consumers

Over the analysed period, electricity prices for industrial users have increased in almost all Member States (Table 11). There are however two exceptions: In Germany, prices decreased by 8.5 %, while in Austria experienced a negligible price increase of only 2.5 %. Several other countries witnessed moderate price increases, ranging from 14.3 % in France over 21.6 % in Portugal, 26.2 % in Belgium, 28 % in Luxembourg to 29.4 % in the Netherlands. More drastic increases could be observed in Finland (147.9 %), Spain (154.3 %), Italy (162.9 %), Sweden (170 %), and the United Kingdom (175.5 %). In Greece and Denmark, prices increased by more than 85 % (86.6 % and 89.5 %, respectively). The largest increase occurred in Ireland, where prices doubled between 1996 and 2014 (an increase of 102.3 %).

FIGURE 2: Average Electricity Prices for Consumers and Industry in the EU-15 Countries



Electricity prices for industrial end-users were generally lower than prices for private consumers over the analysed period (Figure 2): In 1994, industry electricity prices are 25.2 % below prices for private consumers, whereas in 2014, the difference is 29.1 %. The development of prices for both groups does however differ between countries: In Greece, prices for both consumers and industry increased by approximately the same degree (89.3 % and 86.6 % respectively), whereas in Germany, industry prices dropping by 8.5 % and consumer prices increasing by 14.0 %. In the majority of countries, consumer price increases are higher than industry price increases, the exception being France, Italy and Portugal.

The development of industry electricity prices is similar to the development of consumer prices. As illustrated by Figure 2, both groups have experienced similar price increases, suggesting that liberalisation has not been able to reduce prices for either of the two.

5. Conclusions

In this chapter, the main findings of this thesis will be summarised and discussed in order to answer the two research questions. Furthermore, possible limitations of the employed research design will be examined and possibilities for future research will be identified.

5.1. Discussion of Research Findings

This thesis examined the impact of the EU's three liberalisation directives on electricity prices and competition. For this purpose, the three directives and the development of competition and prices were analysed.

The analysis of the directives has shown that liberalisation of electricity markets has been an incremental process. After the adoption of each directive, the effects of electricity markets were investigated in order to identify legal shortcomings. Accordingly, each of the successive directives introduces additional requirements for unbundling and transparency or establishes new regulatory agencies.

As data analysis reveals, the success of liberalisation has been limited. Although competition in both wholesale and retail markets has increased in a number of countries, markets are often still dominated by a small number of suppliers, and market concentration remains high. At the same time, both consumers and industrial users have experienced rather steep price increases, contrary to the lower prices supporters of liberalisation anticipated.

One possible explanation is that the process of liberalisation is not complete yet. In a number of Member States, both wholesale and retail markets are still highly concentrated, which might indicate that generators and retailers are using their market power to maintain high prices in order to increase their profits. Furthermore, the absence of a requirement for ownership unbundling could have a negative impact on competition.

Lave, Apt, and Blumsack (2004) reach a similar conclusion: They argue that liberalisation does not result in lower prices if it fails to create a competitive market. If liberalised electricity markets are not competitive, prices will remain high.

Waterson (2003), who studied the role of consumers in competition, argues that consumers' reluctance to switch suppliers might be an additional factor. He argues that although consumers are generally aware of the possibility to switch suppliers, they overestimate both search costs and switching costs and thus tend to stay with one supplier despite the financial advantages switching could provide. Accordingly, consumer behaviour could partly explain the comparatively low degree of competition in a potentially competitive market.

Increasing electricity prices seem to be a general trend, even in countries with relatively competitive markets. Furthermore, price increases are not limited to private consumers, but did also occur for industrial users. Although it is possible that that new policies are necessary to increase competition and reduce market concentration, the limited success of the three directives seems to indicate that liberalisation of electricity markets does not necessarily result in competitive markets and lower prices.

5.2. Limitations and Future Research

In several cases, data availability limited the scope of the analysis. Especially the Herfindahl-Hirschman Index, which was only available for 2014, could have provided some important insights about the way in which liberalisation affected the structure of electricity markets in the analysed countries. Similarly, data about the number of retailers and the market share of the largest generator did not cover the entire period during which liberalisation occurred.

Furthermore, the fact that it is not possible to examine the counterfactual scenario, in which liberalisation did not occur, restricts the possibility of attributing these developments solely to liberalisation. In reality, electricity prices are the result of various factors, including fuel prices and network costs.

Nevertheless, the available data, and especially the development of electricity prices have provided a good overview of the impact liberalisation has had on electricity markets in Europe. The analysis has shown that liberalisation has not been able to live up to its promises. One objective for further research could be to identify the underlying reasons for the lack of success. For this purpose, studying individual Member States could be helpful: Since Member States enjoy some discretion in the implementation of liberalisation policies, it is possible that some of them implemented more effective policies than others, which have increased competition and limited price increases. The presented analysis has identified general trends, while an in-depth analysis of individual countries is beyond the scope of this thesis.

6. Appendix

Tables

TABLE 3:
Market share of the largest generator in the electricity market

	1999	2000	2001	2002	2003	2004	2005	2006
Austria	21.4	32.6	34.4	:	:	:	:	:
Belgium	92.3	91.1	92.6	93.4	92.0	87.7	85.0	82.3
Denmark	40.0	36.0	36.0	32.0	41.0	36.0	33.0	54.0
Finland	26.0	23.3	23.0	24.0	27.0	26.0	23.0	26.0
France	93.8	90.2	90.0	90.0	89.5	90.2	89.1	88.7
Germany	28.1	34.0	29.0	28.0	32.0	28.4	31.0	31.0
Greece	98.0	97.0	98.0	100.0	100.0	97.0	97.0	94.6
Ireland	97.0	97.0	96.6	88.0	85.0	83.0	71.0	51.1
Italy	71.1	46.7	45.0	45.0	46.3	43.4	38.6	34.6
Luxembourg	57.8	58.5	61.5	61.5	61.5	55.8	53.9	54.5
Netherlands	51.8	42.4	43.8	41.2	39.1	36.0	35.0	31.0
Portugal	52.8	49.5	48.5	49.0	46.0	47.0	47.0	45.0
Spain	21.0	20.6	22.9	21.0	21.6	20.1	20.5	22.2
Sweden	21.4	32.6	34.4	:	:	:	:	:
United Kingdom	92.3	91.1	92.6	93.4	92.0	87.7	85.0	82.3

Source: eurostat

TABLE 3 ***(continued)***:
Market share of the largest generator in the electricity market

	2007	2008	2009	2010	2011	2012	2013
Austria	:	:	:	:	55.3	56.6	55.5
Belgium	83.9	80.0	77.7	79.1	70.7	65.8	67.0
Denmark	47.0	56.0	47.0	46.0	42.0	37.0	41.0
Finland	26.0	24.0	24.5	26.6	25.6	25.2	25.3
France	88.0	87.3	87.3	86.5	86.0	86.0	83.8
Germany	30.0	30.0	26.0	28.4	:	:	32.0
Greece	91.6	91.6	91.8	85.1	:	77.0	70.0
Ireland	48.0	45.6	37.0	34.0	38.0	55.0	54.0
Italy	31.3	31.3	29.8	28.0	27.0	26.0	27.0
Luxembourg	55.6	48.5	52.4	47.2	44.9	37.2	45.8
Netherlands	31.0	22.2	32.9	24.0	23.5	23.8	24.5
Portugal	45.0	45.2	44.0	42.0	41.0	44.0	44.8
Spain	18.5	15.3	24.5	21.0	45.6	51.7	29.3
Sweden	:	:	:	:	55.3	56.6	55.5
United Kingdom	83.9	80.0	77.7	79.1	70.7	65.8	67.0

Source: eurostat

TABLE 4:
Market concentration in power-generation markets

	HHI
Austria	N/A
Belgium	4,010
Denmark	N/A
Finland	1,102
France	> 8,500
Germany	2,021
Greece	6,183
Ireland	1,150
Italy	884
Luxembourg	2,311
Netherlands	1,492
Portugal	3,567
Spain	1,329
Sweden	~ 2,650
United Kingdom	1,483

Source: European Commission Country Reports 2014

TABLE 6:
Total number of electricity retailers available to final consumers

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Austria	45	48	54	23	28	31	34	37	31	33	42
Belgium	113	75	70	65	38	36	33	33	33	55	49
Denmark	940	940	940	1042	1020	940	1000	1000	>1000	~1000	1177
Finland	6	8	9	9	9	9	9	8	6	6	7
France	5	4	4	4	2	2	3	11	:	14	7
Germany	375	383	382	375	394	459	142	202	188	121	162
Greece	166	166	166	160	>177	177	177	177	183	183	178
Ireland	390	400	430	380	400	350	360	268	347	412	472
Italy	11	11	11	12	13	14	11	11	11	11	9
Luxembourg	42	33	32	38	39	38	32	36	35	35	45
Netherlands	160	125	125	136	160	141	>140	129	155	152	154
Portugal	5	9	10	4	4	4	6	10	10	10	13
Spain	>100	>100	>100	>100	>100	>100	>100	>100	~100	~100	~100
Sweden	127	130	122	119	120	113	75	134	121	120	104
United Kingdom	24	32	33	26	23	23	21	22	29	29	33

Source: eurostat

TABLE 7:
Number of main electricity retailers

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Austria	2	3	3	3	3	3	3	3	4	4	5
Belgium	5	:	7	8	:	:	:	:	:	:	:
Denmark	4	4	3	3	3	3	3	3	4	4	4
Finland	4	4	5	4	3	4	5	5	4	4	4
France	1	1	1	1	1	1	1	1	:	:	1
Germany	6	6	6	4	3	3	3	4	5	5	4
Greece	1	1	1	1	1	1	1	1	1	1	2
Ireland	3	1	2	3	3	3	2	3	2	2	2
Italy	3	3	3	4	4	4	4	4	4	4	3
Luxembourg	≥3	5	5	5	4	4	4	3	3	3	4
Netherlands	:	5	6	8	7	6	6	6	6	6	7
Portugal	1	1	1	1	1	1	2	4	4	4	4
Spain	3	3	3	3	3	3	3	3	3	3	3
Sweden	3	3	3	3	3	3	3	3	3	3	4
United Kingdom	7	7	7	7	7	7	6	6	6	6	6

Source: eurostat

TABLE 8:
Market concentration in retail markets

	HHI
Austria	~ 1800
Belgium	3,000
Denmark	N/A
Finland	N/A
France	> 4,500
Germany	N/A
Greece	> 9604
Ireland	4,759
Italy	1,865
Luxembourg	*High*
Netherlands	2,338
Portugal	6,918 / 2,815[17]
Spain	2,240
Sweden	N/A
United Kingdom	1,720

Source: European Commission Country Reports 2014

[17] Portugal provided two values for retail market concentration, distinguishing between markets for domestic consumers and industrial consumers

TABLE 9:
Electricity prices for medium size households, EUR per kWh

	1994	1995	1996	1997	1998	1999	2000	2001	2001	2002	2003
Austria	:	:	0.1032	0.0984	0.0969	0.0979	0.0949	0.0945	0.0932	0.0926	:
Belgium	0.1162	0.1231	0.1237	0.1191	0.1186	0.1182	0.1171	0.1184	0.1137	0.1120	0.1162
Denmark	0.0624	0.0608	0.0646	0.0639	0.0673	0.0681	0.0718	0.0781	0.0865	0.0947	0.0624
Finland	:	0.0703	0.0770	0.0727	0.0706	0.0656	0.0645	0.0637	0.0697	0.0738	:
France	0.1034	0.1006	0.1022	0.1005	0.0962	0.0949	0.0928	0.0914	0.0923	0.0890	0.1034
Germany	0.1259	0.1298	0.1320	0.1270	0.1256	0.1277	0.1191	0.1220	0.1261	0.1267	0.1259
Greece	0.0636	0.0647	0.0609	0.0619	0.0627	0.0622	0.0564	0.0564	0.0580	0.0606	0.0636
Ireland	0.0751	0.0734	0.0717	0.0816	0.0795	0.0795	0.0795	0.0795	0.0883	0.1006	0.0751
Italy	0.1586	0.1509	0.1508	0.1671	0.1682	0.1570	0.1500	0.1567	0.1390	0.1449	0.1586
Luxembourg	0.1029	0.1067	0.1090	0.1071	0.1060	0.1076	0.1056	0.1120	0.1148	0.1191	0.1029
Netherlands	0.0833	0.0846	0.0869	0.0877	0.0868	0.0884	0.0938	0.0978	0.0923	0.0970	0.0833
Portugal	0.1256	0.1257	0.1259	0.1278	0.1250	0.1201	0.1194	0.1200	0.1223	0.1257	0.1256
Spain	0.1059	0.1056	0.1092	0.1050	0.0946	0.0929	0.0895	0.0859	0.0859	0.0872	0.1059
Sweden	:	:	:	0.0675	0.0673	0.0653	0.0637	0.0629	0.0701	0.0838	:
United Kingdom	0.1006	0.0946	0.0876	0.0971	0.1039	0.0966	0.1056	0.0996	0.1031	0.0959	0.1006

Source: eurostat

TABLE 9 *(continued)*:
Electricity prices for medium size households, EUR per kWh

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Austria	0.0981	0.0964	0.0894	0.1050	0.1271	0.1380	0.1427	0.1442	0.1433	0.1413	0.1321
Belgium	0.1145	0.1116	0.1123	0.1229	0.1500	0.1431	0.1449	0.1572	0.1590	0.1583	0.1673
Denmark	0.0915	0.0927	0.0997	0.1170	0.1203	0.1239	0.1168	0.1263	0.1314	0.1300	0.1317
Finland	0.0810	0.0792	0.0809	0.0877	0.0915	0.0974	0.0998	0.1081	0.1089	0.1102	0.1070
France	0.0905	0.0905	0.0905	0.0921	0.0914	0.0908	0.0940	0.0994	0.0986	0.1007	0.1064
Germany	0.1259	0.1334	0.1374	0.1433	0.1299	0.1401	0.1381	0.1406	0.1441	0.1493	0.1435
Greece	0.0621	0.0637	0.0643	0.0661	0.0957	0.1055	0.0975	0.1025	0.1065	0.1170	0.1204
Ireland	0.1055	0.1197	0.1285	0.1465	0.1559	0.1789	0.1589	0.1584	0.1850	0.1951	0.2008
Italy	0.1434	0.1440	0.1548	0.1658	:	:	:	0.1397	0.1445	0.1498	0.1539
Luxembourg	0.1215	0.1288	0.1390	0.1509	0.1442	0.1619	0.1433	0.1451	0.1468	0.1447	0.1431
Netherlands	0.1031	0.1102	0.1207	0.1400	0.1304	0.1470	0.1229	0.1251	0.1317	0.1322	0.1306
Portugal	0.1283	0.1313	0.1340	0.1420	0.1074	0.1264	0.1093	0.1015	0.1105	0.1210	0.1268
Spain	0.0885	0.0900	0.0940	0.1004	0.1124	0.1294	0.1417	0.1597	0.1766	0.1752	0.1702
Sweden	0.0898	0.0846	0.0876	0.1088	0.1085	0.1040	0.1195	0.1376	0.1312	0.1359	0.1264
United Kingdom	0.0837	0.0836	0.0971	0.1254	0.1394	0.1399	0.1321	0.1365	0.1603	0.1658	0.1826

Source: eurostat

TABLE 10:
Electricity price regulation in the EU-15 countries

	Regulated prices for households	Regulated prices for non-households
Austria	No	No
Belgium	No	No
Denmark	partly[18]	partly[18]
Finland	No	No
France	Yes	Yes
Germany	No	No
Greece	No	No
Ireland	No	No
Italy	No	No
Luxembourg	No	No
Netherlands	No	No
Portugal	No	No
Spain	Yes	Yes
Sweden	No	No
United Kingdom	No	No

Source: European Commission Country Reports 2014

TABLE 11:
Electricity prices for medium size industrial consumers, EUR per kWh

	1994	1995	1996	1997	1998	1999	2000	2001	2001	2002	2003
Austria	:	0.0807	0.0814	0.0765	0.0755	0.0763	:	:	:	:	:
Belgium	0.0726	0.0776	0.0775	0.0746	0.0746	0.0739	0.0734	0.0752	0.0760	0.0764	0.0726
Denmark	0.0438	0.0433	0.0473	0.0467	0.0512	0.0485	0.0504	0.0558	0.0639	0.0697	0.0438
Finland	:	0.0449	0.0481	0.0414	0.0401	0.0389	0.0377	0.0372	0.0401	0.0566	:
France	0.0650	0.0650	0.0650	0.0635	0.0596	0.0583	0.0567	0.0557	0.0562	0.0529	0.0650
Germany	0.0922	0.0944	0.0906	0.0845	0.0830	0.0791	0.0675	0.0669	0.0685	0.0697	0.0922
Greece	0.0584	0.0567	0.0571	0.0580	0.0588	0.0583	0.0571	0.0571	0.0590	0.0614	0.0584
Ireland	0.0644	0.0629	0.0615	0.0691	0.0662	0.0662	0.0662	0.0662	0.0768	0.0762	0.0644
Italy	0.0663	0.0634	0.0638	0.0713	0.0721	0.0646	0.0693	0.0919	0.0776	0.0826	0.0663
Luxembourg	0.0741	0.0765	0.0747	0.0737	0.0725	0.0736	0.0709	0.0632	0.0645	0.0675	0.0741
Netherlands	0.0596	0.0597	0.0608	0.0570	0.0566	0.0576	0.0669	0.0640	:	:	0.0596
Portugal	0.0846	0.0799	0.0756	0.0749	0.0712	0.0646	0.0643	0.0651	0.0665	0.0673	0.0846
Spain	0.0768	0.0731	0.0756	0.0703	0.0620	0.0624	0.0636	0.0550	0.0520	0.0528	0.0768
Sweden	:	:	0.0413	0.0430	0.0392	0.0348	0.0375	0.0313	0.0310	0.0666	:
United Kingdom	0.0710	0.0606	0.0544	0.0604	0.0627	0.0619	0.0664	0.0661	0.0614	0.0539	0.0710

Source: eurostat

[18] Since 2003, all Danish electricity consumers are free to choose whether to join the regulated market with regulated prices or the liberalised market where prices are not regulated.

TABLE 11 *(continued)*:
Electricity prices for medium size industrial consumers, EUR per kWh

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Austria	0.0553	0.0621	0.0653	0.0786	0.0897	0.0991	0.0922	0.0917	0.0906	0.0872	0.0827
Belgium	0.0755	0.0695	0.0830	0.0880	0.0988	0.1026	0.0943	0.0977	0.0950	0.0914	0.0916
Denmark	0.0631	0.0646	0.0724	0.0638	0.0785	0.0738	0.0848	0.0875	0.0829	0.0898	0.0830
Finland	0.0543	0.0527	0.0517	0.0542	0.0614	0.0663	0.0667	0.0686	0.0684	0.0679	0.0664
France	0.0533	0.0533	0.0533	0.0541	0.0599	0.0667	0.0687	0.0722	0.0809	0.0771	0.0743
Germany	0.0740	0.0780	0.0871	0.0946	0.0929	0.0975	0.0921	0.0900	0.0895	0.0860	0.0844
Greece	0.0630	0.0645	0.0668	0.0698	0.0861	0.0948	0.0855	0.0917	0.1006	0.1040	0.1090
Ireland	0.0787	0.0896	0.0998	0.1125	0.1302	0.1206	0.1118	0.1121	0.1293	0.1331	0.1303
Italy	0.0790	0.0843	0.0934	0.1027	:	:	:	0.1145	0.1193	0.1122	0.1080
Luxembourg	0.0690	0.0752	0.0845	0.0963	0.0927	0.1096	0.0956	0.0960	0.1007	0.0940	0.0949
Netherlands	:	0.0806	0.0855	0.0920	0.0910	0.0985	0.0865	0.0822	0.0805	0.0789	0.0771
Portugal	0.0684	0.0713	0.0817	0.0860	0.0782	0.0919	0.0896	0.0903	0.1050	0.1015	0.1029
Spain	0.0538	0.0686	0.0721	0.0810	0.0915	0.1098	0.1110	0.1082	0.1155	0.1165	0.1185
Sweden	0.0520	0.0462	0.0587	0.0626	0.0688	0.0662	0.0800	0.0887	0.0804	0.0799	0.0702
United Kingdom	0.0478	0.0570	0.0799	0.0950	0.0937	0.1077	0.0947	0.0939	0.1095	0.1124	0.1246

Source: eurostat

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