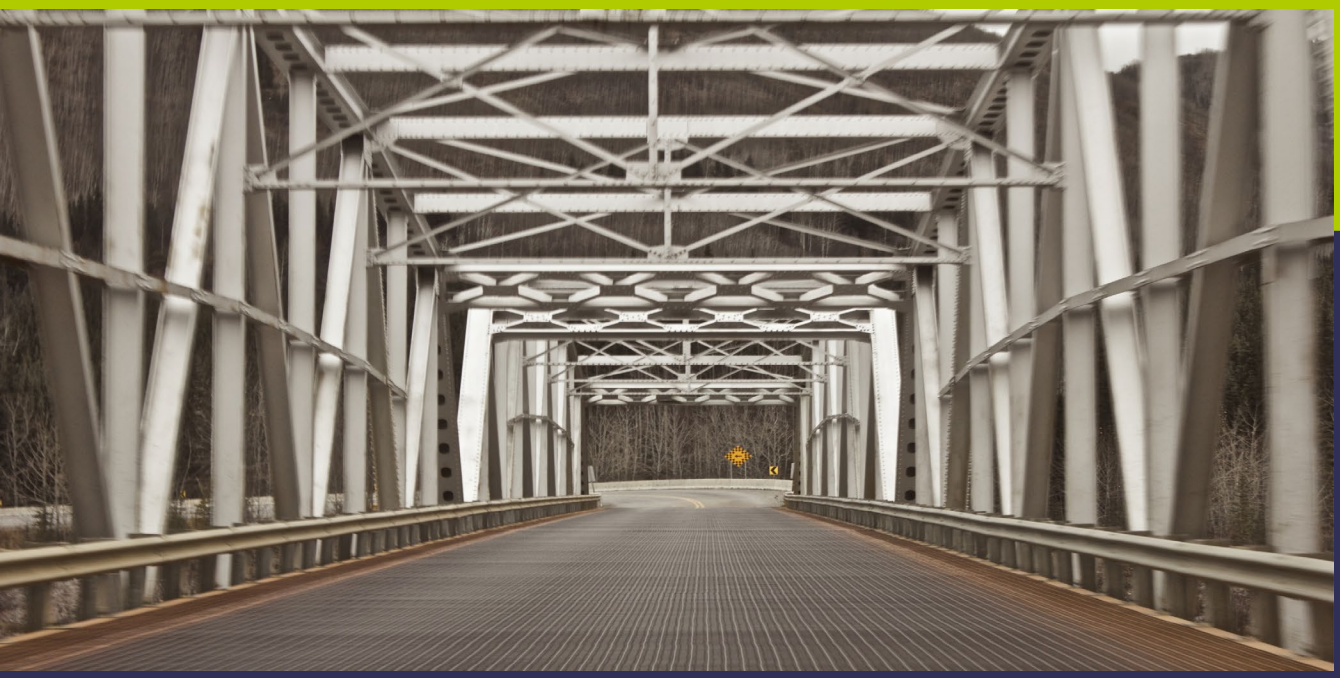
European Commission

EUROPEAN BARRIERS IN RETAIL ENERGY MARKETS



INDEX REPORT

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Energy

EUROPEAN BARRIERS IN RETAIL ENERGY MARKETS PROJECT: Index Report

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Client: European Commission, DG Energy

Title: Report on the European Retail Energy Market Barriers Index – Study on "Barriers to entry in retail energy markets"

Abstract:

European retail energy market liberalization is now well into its third decade in the most mature markets. Customers of electricity and gas are now free to choose their electricity and gas suppliers in nearly all markets across the EU and in a number of other European markets. In theory at least, the European retail energy market is a place where new suppliers and providers of retail services can enter the market and compete relatively freely and on equal terms for customers in the market; a place where formerly incumbent electricity suppliers can compete for gas customers and where gas suppliers can compete for electricity customers; a place where a supplier from one region or jurisdiction can compete in another, without facing unreasonable or excessive barriers; a place where a capacity aggregator or other innovative business model can compete to provide its services to retail energy customers.

The European Barriers in Retail Energy Markets project was established to research the extent to which the theory is the case in practice; the extent to which energy suppliers across Europe face a variety of barriers to enter and compete in the market; to identify which barriers exist and to provide some suggested solutions to those barriers. The project thereby aims to support the European Commission and Member States in developing policy and implementing actions to reduce barriers.

The project focuses on electricity and (in most cases) gas markets in 30 European countries, namely the EU27 states plus Great Britain, Norway and Switzerland. It was conducted over the course of more than a year with the cooperation and assistance of nearly all of the relevant national regulatory authorities (the report does not however claim to represent their views and its findings have not been officially endorsed by them), nearly 150 suppliers and many other stakeholder organizations, across all focus markets. Great Britain was included in the project and cooperation was received from numerous suppliers, the regulator (OFGEM) and other stakeholders. Switzerland and Malta were included to a lesser extent since they are not yet open markets for household customers.

The project focuses on retail (supply), including also demand aggregation services, other additional offerings and new model retail, especially relating to the household segment customers (in some markets households and smaller SMEs may be difficult to distinguish).

Many sources of information were used as part of the project, including an extensive literature review; interviews with national regulatory authorities (NRAs); feedback from market participants (suppliers and other competitors) through questionnaires, interviews, webinars and a major workshop; and extensive data gathering. Whenever possible, information from market participants was verified through further research.

The deliverables of the project are extensive: in addition to this Final Report, the project has produced 28 Country Handbooks (separate reports) as well as a stand-alone Barriers Index methodology/tool and a European Barriers Index Ranking (separate report). Additionally, as part of the process collaborative and dissemination channels were used extensively, including a stakeholder website (with 300 subscribers) and associated subscribed communications, two webinars (one with regulators and one with competitors, each with approximately 40 participants), a Stakeholder workshop with approximately 70 participants at the European Commission and a large number of face-to-face meetings with individuals and groups of stakeholders.

The extensive findings of the project indicate that while barriers are being reduced, and while retail energy markets are heading in the right direction, many serious barriers remain and need to be addressed if potential environment and social benefits from European retail energy markets are to be realized. Many such barriers are very specific to individual markets, but many are pan-European and would therefore benefit from Europe-wide policy to mitigate them.

The Barriers Index produced for the project, in combination with the other insight from the project, additionally provides a clear view on best-practice as well as a tool to map the evolving status of barriers across Europe in the years to come.

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INTRODUCTION & OUTLINE

European retail energy market liberalization is now well into its third decade in the most mature markets. Customers of electricity and gas are now free to choose their electricity and gas suppliers in nearly all markets across the EU and in a number of other European markets. At the same time, the European Commission and national European regulators have created a basis for non-discriminatory market access for energy suppliers through a series of regulations and directives.

In theory at least, the European retail energy market is a place where new suppliers and providers of retail services can enter the market and compete relatively freely and on equal terms for customers in the market; a place where formerly incumbent electricity suppliers can compete for gas customers and where gas suppliers can compete for electricity customers; a place where a supplier from one region or jurisdiction can compete in another, without facing unreasonable or excessive barriers; a place where a capacity aggregator or other innovative business model can compete to provide its services to retail energy customers.

Objectives

The European Barriers in Retail Energy Markets project was established to research the extent to which the theory is the case in practice; the extent to which energy suppliers across Europe face a variety of barriers to enter and compete in the market; to identify which barriers exist and to provide some suggested solutions to those barriers. The project thereby aims to support the European Commission and Member States in developing policy and implementing actions to reduce barriers.

This project has also designed and calculated a performance index that ranks different countries according to how easy it is to do business in the retail energy segment by combining a selection of measurements into a single score. The project is on the other hand, not intended as a measure or indicator of the 'competitiveness' of any given market, and it does not in this respect judge the effectiveness of regulatory authorities or governments, many of which have put great effort into developing their markets.

It is also important to note that all the markets included in this research are continuously evolving. Changes are being planned and improvements (and in some cases additional barriers) are possible as a result. While this project highlights and considers known future changes, it cannot make assumptions as to the effectiveness and outcomes of those changes. This project is therefore weighted in the present, based on the actual context in the market, whilst accepting that the present context may change, in some cases imminently.

Competitor Perspective

What sets this project apart from previous Europe-wide projects looking at the issue of barriers is above-all that it primarily takes the perspective of the competitor rather than any objective view of regulators, economists or academics. This is an important distinction since it requires an acceptance that even if the existence of specific barriers may not seem logical or rational, and even if they are not permitted or legal, even if they were supposed

to have been eradicated, those barriers are significant at least in the experience or expectations of competitors in the market.

Notwithstanding this however, the project does not simply accept whatever competitors claim. On the contrary, the researchers have gone to great lengths to ensure that claims are challenged and justified. Cooperation with regulatory authorities to understand the regulatory context of claims, along with survey and interview feedback from competitors (including incumbent suppliers) with alternative perspectives or points of view, have also been considered to ascertain a balanced evaluation of the barriers in any given market.

In some cases, claims by respondents have been made which cannot be corroborated. For instance, there have been claims by many respondents across Europe about integrated utility behaviours that represent barriers to independent suppliers in the markets. Barriers apparently resulting from a lack full ownership unbundling. Such behaviours may well be regulated against, may even be considered illegal, and authorities may have powers to investigate them – and maybe do so. They are impossible to prove given the mandate and resources of the researchers of this project, yet they are widely reported by respondents and broadly documented in other researches. Such barriers may be considered allegations by the respondents, but where they appear to merit further consideration they have been raised since their potential impact on competition is substantial.

Scope & Scale of Research

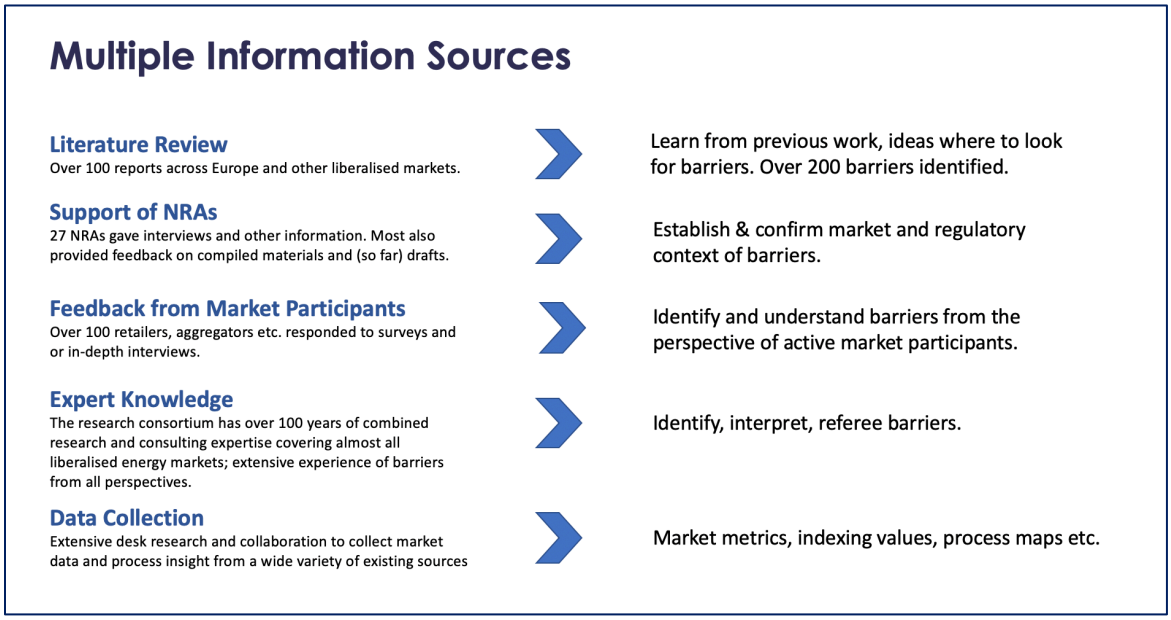
The project focuses on electricity and (in most cases) gas markets in 30 European countries, namely the EU27 states plus Great Britain, Norway and Switzerland. It was conducted over the course of more than a year with the cooperation and assistance of nearly all of the relevant national regulatory authorities (the report does not however represent their views and has not been ratified by them), around 150 suppliers and many other stakeholder organizations, across all focus markets. Great Britain was included in the project and cooperation was received from numerous suppliers, the regulator (OFGEM) and other stakeholders. Switzerland and Malta were included to a lesser extent since they are not yet open markets for household customers.

The project focuses on retail (supply), including also demand aggregation services, other additional offerings and new model retail, especially relating to the household segment customers (in some markets households and smaller SMEs may be difficult to distinguish). The project additionally concentrates primarily on barriers that are specific to the energy (electricity and gas) retail market – as opposed to barriers that are true of most markets, such as basic business costs and risk - and it gives priority to barriers for which a potential solution might be sought, as opposed to barriers which are a fact of any energy market and which could not realistically be overcome (such as the barriers relating to the core price volatility of energy as a commodity). The project does not aim to list every possible barrier in the market, however small.

Sources of Information

Many sources of information were used as part of the project. These included an extensive literature review of over 100 public reports, to assist in the targeting of survey questions; interviews with national regulatory authorities (NRAs) to understand the regulatory context in markets; feedback from market participants (suppliers and other competitors) and extensive data gathering for the purpose of collecting market metrics, market processes and index values. For the latter, the task of identifying sources that could deliver comparable and reliable index values was a key challenge of the researchers. The expert knowledge of the project consortium (which has extensive experience from the markets and issues concerned was also used to add judgement to the process. Specifically, the core project team comprised over a dozen researchers and experts from nine European countries, including international experts who have analysed Europe's energy markets since even before they liberalized.

Figure 1 – Multiple information sources



Confidentiality

The importance of data protection and anonymity within the project cannot be stressed enough. Most respondents provided information on condition of anonymity. It was promised by default to questionnaire respondents and was in most cases explicitly requested by interviewees. Many participants additionally stated that they were nervous to respond at all since they were active in a market where there were only a handful of suppliers (or at least independent suppliers) which they felt meant that their responses could easily identify them. This risk was perceived as even greater in cases where the participant had made public statements on issues that would be contained in the research (the risk of readers putting two and two together was a concern). In some cases, respondents stated that they even feared a backlash from other stakeholders if their identity was revealed, or (for e.g. a brand-new entrant in a market with one brand-new entrant) stated that if we revealed that they were a new entrant the market authority would instantly know who they were and that they were afraid it might inhibit their entry process.

Under such circumstances, it was decided that not only would all responses be anonymous, but also that the type of respondents would not be revealed in connection with given responses on a country level.

It has been claimed by a handful of market authorities that this policy reduces the value of the research. The researchers feel that it in fact increases the value of the research since it has allowed respondents to provide information in an uninhibited fashion in a European market where, by and large, independent suppliers – and especially independent new entrant suppliers – are few and far between.

METHODOLOGY

The development of the Barriers Index was accomplished in parallel with the work on the Country Handbooks. Therefore, the two kinds of deliverables are based on the same information sources and activities (literature review, supplier survey, interviews, data collection and desktop research), that have been carried out to explore the main barriers and to categorise them in a consistent way. The Final Report of the project provides detailed information on these activities. This report, however, focuses on the methodological issues of the Barriers Index, presenting the index-specific activities, while referring to the Final Report in case of the analysed barriers and their categorisation.

Our approach on the development of the methodology relies on the logic outlined in the *Handbook on Constructing Composite Indicators – Methodology and user guide* published by OECD and JRC (2008), which has been further refined later by the Composite Index Research Group (COIN) of the JRC (COIN, 2019). We also strongly build on IPA's study (2015) on constructing the ACER Retail Competition Index (ARCI), as it applied the OECD-JRC guidelines for retail energy markets. Thus, it serves as an important reference point regarding both its methodology and the analysed topic.

This chapter of the report provides detailed information on the methodology and on the process of the development. The chapter starts with a literature review on the methodology and best practices of composite indicators, focusing on the most relevant documents. In line with the OECD-JRC guideline, it is followed by the definition of the conceptual framework of the index, the selection of the individual indicators, the construction of the composite indicator, and finally, the suggestions for the presentation and interpretation of the results.

The results of the Barriers Index and the ranking of countries based on how easy it is to do business on retail energy markets will be presented in the next chapter.

Literature review on the methodology and best practices of composite indicators

Here, we provide a brief summary of the literature that has been found most relevant for our purpose. As mentioned above, our methodology follows the OECD-JRC Handbook and its refined version published by COIN, thus we start the summary by presenting the 10 steps guideline. Secondly, we outline how IPA applied this guideline to retail energy markets in order to develop the ACER Retail Competition Index and what indicators were found suitable for measuring competition-related issues on these markets. Finally, we present the methodology of The World Bank's Ease of Doing Business Score and Rankings, which is not only a well-known reference among composite indicators but in fact it is basically a barriers index summing up great variety of costs and hurdles a company faces when entering a market and starting to do business.

OECD-JRC and COIN: A 10 steps guide

The steps proposed by the Handbook as refined by COIN are summarised below (using a categorisation similar to IPA's):

- **Conceptual framework**: The theoretical framework provides the basis for the selection and combination of single indicators into a meaningful composite indicator.
- **Selecting indicators**:
    - Data selection: The goal of the selection process is to find the initial set of individual indicators, to discuss their strengths and weaknesses of each selected indicator, and to create a summary table on data characteristics, e.g., availability, source, type.
    - Data treatment: Adjustments are necessary in case of missing values, outliers or highly skewed indicators (imputation, transformation, e.g. taking logarithms of an indicator).
    - Data analysis: An exploratory analysis should investigate the overall structure of the indicators, the correlation between the indicators, assess the suitability of the data set and explain the methodological choices.
- **Combining indicators**:
    - Normalisation: Normalisation brings indicators onto a common scale, which renders the variables comparable. Generally, this involves directional adjustment, so that higher values correspond to better performance in all indicators and selecting a suitable normalisation method that respects the conceptual framework, the data properties and can be easily interpreted by users.
    - Weighting: When indicators are aggregated into a composite measure, they can be assigned individual weights. This allows the effect or importance of each indicator to be adjusted according to the concept being measured. Weighting methods can be statistical, based on public/expert opinion, or both.
    - Aggregation: Aggregation combines the values of a set of indicators into a single summary 'composite' or 'aggregate' measure. The most used methods are additive techniques that sum up weighted normalised indicators. However, the literature proposes other, less widespread aggregation methods (e.g. geometric aggregation that computes the product of weighted indicators) which outperform additive techniques in some aspects.
    - Sensitivity analysis: Analysis should be undertaken to assess the robustness of the composite indicator in terms of, e.g., the mechanism for including or excluding single indicators, the normalisation scheme, the imputation of missing data, the choice of weights and the aggregation method.
- **Presenting results**:
    - Links to other indicators: Attempts should be made to correlate the composite indicator with other published indicators, as well as to identify linkages.
    - Visualisation of the results: Composite indicators can be visualised or presented in a number of different ways, which can influence their interpretation. Coherent sets of presentational tools, visualisation techniques will be identified, and the results of the composite indicator shall be presented in a clear and accurate manner.

The 10-step guide may suggest that designing a composite indicator is a linear process, but in fact it is rather iterative, as executing latter steps (especially data and sensitivity analysis) may require changes in data selection, treatment, or methods for combining the indicators.

The Handbook also presents a quality framework for composite indicators, where it provides a summary on different quality dimensions used by various institutions. Regarding quality requirements for basic data used for creating indicator, the Handbook recommends considering the following:

- **Relevance**: "… relevance has to be evaluated considering the overall purpose of the indicator. […] Given the actual availability of data, "proxy" series are often used, but in this case some evidence of their relationships with "target" series should be produced whenever possible.";
- **Accuracy**: "…the data are perceived to be produced professionally in accordance with appropriate statistical standards and policies and that practices are transparent (for example, data are not manipulated, nor their release timed in response to political pressure). […] data produced by "official sources" (e.g. national statistical offices or other public bodies working under national statistical regulations or codes of conduct) should be preferred to other sources.";
- **Timeliness**: "…timeliness is especially important to minimise the need for the estimation of missing data or for revisions of previously published data. […] data covering different domains are often released at different points of time. Therefore, special attention must be paid to the overall coherence of the vintages of data used to build composite indicators (see also coherence)."
- **Accessibility**: "…accessibility of basic data can affect the overall cost of production and updating of the indicator over time […] the selection of the source should not always give preference to the most accessible source, but should also take other quality dimensions into account.";
- **Interpretability**: "The interpretability of data products reflects the ease with which the user may understand and properly use and analyse the data. The adequacy of the definitions of concepts, target populations, variables and terminology underlying the data and of the information describing the limitations of the data, if any, largely determines the degree of interpretability."; and
- **Coherence**: "…two aspects of coherence are especially important: coherence over time and across countries. Coherence over time implies that the data are based on common concepts, definitions and methodology over time, or that any differences are explained and can be allowed for. […] Coherence across countries implies that from country to country the data are based on common concepts, definitions, classifications and methodology, or that any differences are explained and can be allowed for."

IPA: ACER Retail Competition Index (ARCI)

The Agency for the Cooperation of Energy Regulation (ACER) asked IPA Advisory to develop and apply a methodology to access competition on energy retail markets. IPA completed the task and produced a detailed description of the applied methodology and the results of the first evaluation (IPA, 2015). Based on this material, ACER reviewed and overruled some parts of the methodology, so the published form of the "ACER Retail Competition Index" (ARCI) is slightly different from those that IPA suggested (ACER, 2015).

As market competition is a complex, multi-dimensional phenomenon, IPA created a theoretical framework that covers not only the process of competition but also the where context this process takes place, and the outcome of it. The structure of the index basically follows the Structure-Conduct-Performance paradigm:

- Structure and features of the market (e.g. market power, entry barriers, other features);
- Conduct and behaviour in the market (e.g. entry and exit activity, customer switching, innovation); and
- Outcomes from and performance of the market (e.g. price, quality, and costs and margins).

The selection of indicators was based on five criteria: relevance, accessibility, timeliness, coherence and accuracy. Next to the basic preferred indicator set, IPA identified some alternatives which could serve as a basis for comparison, but which were not completely ready for all countries at the moment of the evaluation yet could be useful alternatives in the future. The following table presents the preferred, alternative and future indicators as proposed by IPA.

Table 1 – Proposed indicators by IPA for ACER Retail Competition Index (ARCI)

	Structure / Features (30%)	Behaviour / Conduct (30%)	Outcomes / Performance (40%)
Preferred	**Market concentration (20%)**: - CR3 - Number of suppliers **Entry barriers to entry, participation (10%)**: - Ability to compare price easily	**Entry / exit activity (10%)**: - Annual entry/exit **Customer switching (15%):** - Switching rates - % who have not switched **Innovation (5%):** - Average offers per supplier	**Prices (13.3%):** - Price dispersion **Quality (13.3%):** - Does the market meet expectation **Costs & margin (13.3%):** - Average mark-up as %
Potential alternatives	- Suppliers with market share greater than 5% - Ease of switching		- Energy component of price - Satisfied with choice of supplier
Future indicators	- HHI - Market liquidity	- Gross entry and exit activity	

Source: IPA (2015)

Regarding entry barriers, the study concludes that the "ability to compare price easily", measured by the DG Justice and Consumers in the *Monitoring Consumer Markets In The European Union* Report is the most preferred option. Other considered indicators were the followings:

- Existence of barriers to entry (ACER ad-hoc survey)
- Existence of price reporting
- Liquidity (Traded volume as % of physical consumption)
- Wholesale price volatility
- Existence of standardised contracts
- Existence of end-user price regulation in a country

- Percentage of customers eligible to receive a regulated end-user price
- Percentage of eligible customers supplied under regulated end-user prices
- Existence of a route to compensation and complaint resolution for customers who cannot resolve a complaint with their supplier (e.g. Energy Supply Ombudsman)
- Percentage of foreign ownership
- Degree of technical openness of the market (the ratio of interconnection to installed capacity)
- Existence of price comparison websites
- Share of households with smart meters

The long list of indicators contains other indicators that could be relevant for measuring entry barriers in the broad sense as we use it in this study (additional to the proposed list):

- Customer Switching: factors influencing consumer switching (various published sources); savings available on incumbent's standard offer; rate of net loss of customers by electricity incumbents; number of renegotiated contracts for household customers as a percentage of customer numbers; ease of switching.
- Retail prices: energy (i.e. contestable) component of price; price volatility.
- Quality: number of delayed switches; number of failures in relation to the total switching rate.

A correlation matrix of the indicator values was generated to check if different indicators might capture the same patterns. Final indicator selection of the pilot project was the "preferred" indicator set as it was presented in the table above.

The values are normalized using the categorical scale method in which country performance in cardinal variables is converted to a score from 0 to 10. This method handles the presence of outliers, makes the values comparable between countries and allows the values to reflect the changes or variability related to the level of competition.

IPA decided to define the relative significance of each indicator by using the weighted average method to aggregate the indicators. Weights of the eight main aspects are presented in the table above in brackets.

The background data for the other individual indicators came from various sources like NRAs or Eurostat; there was no primary data collection in the project. To reflect data availability problems a so-called confidence score presents the reliability of data for each country. In case of missing values, the data was imputed with values from the previous year, or with similar (proxy) indicators. When it was not available, the weight of the other indicators within the same category have been increased.

Results of the project were presented in different ways and always in context to avoid misinterpretation. Ordinal ranking creates the same distance from each rank to the next one, which can reduce or magnify the actual score differences among countries. Cardinal presentation includes both the ranking and the actual score for each

country, so the relative differences are visible. A more sophisticated presentation is the illustration of the individual indicators to see their contribution to the overall score. In case of this ranking, all the above are available.

ACER reviewed the methodology and modified it in two aspects. Firstly, some indicators have been changed:

- number of suppliers was replaced by number of suppliers with market share > 5%;
- annual entry/exit was replaced by annual net entry (2012-2014);
- ACER adjusted average mark-up for proportion of consumers on non-regulated prices for 2012-2014 period;
- removed price dispersion indicator.

The second modification was using equal weights.

The World Bank's Ease of Doing Business Score and Ranking

The project aims to present objective measures of business regulation in 190 economies. The economies involved in the project are ranked on their level of ease of doing business from 1 to 190. (The World Bank, 2019a) The ranking is based on the countries' aggregate scores on 10 topics, giving equal weight to each topic.

The 10 topics cover the required procedures and relevant factors for an entrepreneur to start up and to operate a business (The World Bank, 2019b). Each topic's ranking is based on specific indicators mostly covering the complexity of regulation (procedures), cost and time factors and other topic-specific factors. The topics and the related indicators are the following (The World Bank, 2019c):

- Starting a business: number of procedures, time (days), costs (% of income per capita), minimum capital (% of income per capita);
- Dealing with construction permits: number of procedures, time (days), costs (% of income per capita), building quality control index;
- Getting electricity: number of procedures, time (days), costs (% of income per capita), reliability of supply and transparency of tariffs index;
- Registering property: number of procedures, time (days), costs (% of income per capita), quality of land administration;
- Getting credit: strength of legal rights index, depth of credit information index;
- Protecting minority investors: extent of disclosure, director liability, shareholder rights, ownership and control, corporate transparency indexes, ease of shareholder suits index;
- Paying taxes: number of payments, time (hours), total tax and contribution rate (% of profit), post filing index (4 time indices of tax correction and refund processes)
- Trading across borders: time and cost to export and import (documentary compliance and border compliance in hors)

- Enforcing contracts: time (days), costs (% of claim), quality of judicial processes index;
- Resolving insolvency: recovery rate, strength of insolvency framework index.

The project included labour market indicators as well, but they were excluded in the latest version.

Data collection is a standardized process based on a questionnaire designed by academic advisers. Questionnaires are sent to more than 10 000 local experts like lawyers, business consultants and government officials who have several interactions with the Doing Business team to clarify misunderstandings. There are also several rounds of data verification. (The World Bank, 2019d)

Overall, there are 41 individual component indicators which are normalized using linear 'minmax' transformation ((worst − y)/(worst − best)) to a common unit to be comparable. In this calculation the worst and the best performances, so the bases of the comparison are determined every five year and used as a fixed benchmark for this five-year period. Over this period, it is possible for a country to perform better than the benchmark of the best performance, in this case it gets the maximum score (100). In case of some indicators the data shows outlying values, so the worst performances are calculated after the removal of outliers. (The World Bank, 2019c)

The next step for calculating the overall score is the aggregation of individual indicators into one score, firstly for each topic and then for all topics. Doing Business Project uses the simplest method and weights all indicators and topics equally. More sophisticated methods, like principal components or unobserved components were tested for the aggregation but they presented nearly identical results. (The World Bank, 2019c)

The result of the ranking is available in its aggregated form but the rankings of the 10 topics are also available individually. It is very useful to see the individual values because the score and the related rankings can be significantly different across topics. Examining the correlation coefficient between the topics shows that it is atypical that a country scores very coherently on the 10 determined topics. (The World Bank, 2019c)

The detailed data set is published on the project's website to provide a basis for further research. (The World Bank, 2019d)

The conceptual framework of the Barriers Index

According to the OECD-JCR Handbook, the theoretical framework involves the followings:

- **Defining the concept**: The definition should give the reader a clear sense of what is being measured by the composite indicator.
- **Creating a structure by determining sub-groups**: A nested structure improves the user's understanding of the driving forces behind the composite indicator.
- **Identifying the selection criteria**: The selection criteria should work as a guide to whether an indicator should be included or not in the overall composite index.

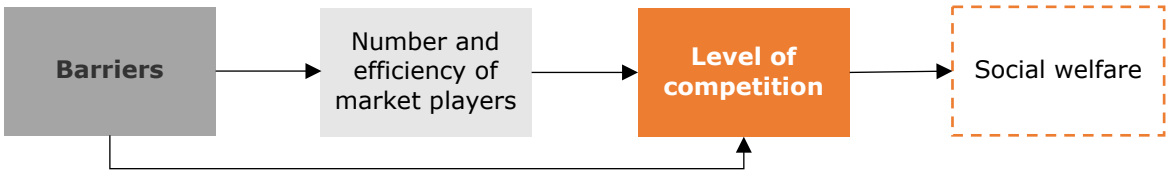
In the next sections we go through these topics.

The concept of Barriers Index

The general objective of the project is related to the enhancement of retail competition, consumer empowerment and protection. The Barriers Index supports this goal by giving an **easily understandable but comprehensive overview of the avoidable, sector-specific barriers that constrain the ability of actual or potential competitors to enter and compete effectively in the residential segment of the energy retail markets**. By providing structured information on the current market conditions and identifying best practices based on international comparisons, it aims to support regulators and also encourage them to tackle barriers.

The following chart illustrates the relationship between the phenomenon to be measured (barriers) and the general policy goal (enhancing competition).

Figure 1 - The relationship between barriers and competition



In our understanding, the effect of barriers on competition is mainly indirect. Barriers determine how many firms enter the market and how efficiently the firms in the market can operate in general, then the number and efficiency of market players influences the level of competition. Efficiency is used in a broad sense here, covering every factor from direct costs of operation to efficient pricing and product differentiation. There is, however, a direct effect too, because even the threat of entry can discipline the incumbents: if the barriers are so low that suppliers can enter very quickly and effectively, then even companies with a very high market share must set prices as they would in a competitive market, because the market is contestable (Baumol, Panzar & Willig, 1982).

In line with this, for the purpose of this study, barriers are defined as conditions that constrain the ability of actual or potential competitors to enter and compete effectively. This means that the index covers not only barriers related to the entry process, but also hurdles that hinder an established supplier in operating and growing in the market.

This concept is broad, in order to cover every important kind of barriers; however, it is still narrower than the most literal definition (a barrier to entry is anything that reduces the number of entries). This is because that the general goal of enhancing competition makes the situations out of scope where the intensity of competition itself deters entry by decreasing the attractiveness (margins) of the market. This is an important feature as **encouraging entry is not a goal but a tool**, and if margins on a market are low because of intensive competition, then it is not a problem to solve but a sign that the market works properly. Obviously, if margins are low because of other reasons (e.g. price regulation), then that can be a barrier.

In line with the requirements expressed by the Commission, the Barriers Index focuses on the barriers that are:

- energy sector-specific: not common to all or many markets;

- undue: not legitimate barriers that ensure e.g. high standards of consumer protection and system operation, and for which there are no better alternatives;
- solvable by regulation: not the given characteristics of the market, e. g. market size and purchasing power of the customers or technology-related investment cost and economies of scale.

The index has a similar approach to The Word Bank's Ease of Doing Business Score and Ranking in the sense that **it tries to capture the barriers directly, to measure the causes and not the consequences**. Many potential indicators, e.g. switching rates or number of entrants, could indicate that entry barriers are present on the market, but these metrics are unable to identify the individual barriers, the real causes. As the main goal of the index is to draw authorities' attention to key hurdles, the indicators must be well-targeted to measure specific obstacles (e.g. burdensome licencing or excessively complex switching processes).

The targeted market segment is the **residential segment**, where customers are the most vulnerable to suppliers with market power where there is a lack of effective competition. The index will be determined separately for the electricity and gas markets, but with an analogous methodology.

The Barriers Index is a composite indicator that combines single indicators, which capture different types of barriers, into one final score. To do this, the values of the single indicators must be transformed to a common scale, and directions must be adjusted to ensure that good performance is on the same end of the scale in all cases. As the index quantifies barriers, **high scores are attributed to high barriers**, and the best performing countries will be those that receive low indicator scores. Thus, every indicator will be transformed (or constructed) in a way that 0 means that the barrier in question is not present on the market, and 10 means that the barrier reaches its maximum value.

It is envisaged that the index may be produced **every second year**. This is the frequency which seems to be required to track changes in the market environment while not being too burdensome from a data collection point of view.

The structure of the Barriers Index

A nested structure improves the user's understanding but also helps to the developer to collect indicators for every important dimension of the phenomenon to be measured, and to reach a balanced composite indicator.

The structure of the Barriers Index follows the barrier categorisation that is used in the Country Handbooks. The categorisation was developed as part of the study, based on literature review, interviews, a supplier survey and the consultants' own analysis. The following four categories reflect different aspects of supplier activity from the overall environment down to day-to-day operations.

- **Regulatory disincentivisation**: Barriers arising as a consequence of the general regulatory framework of the natural gas and electricity retail markets. We address the impact of price regulation, regulatory burdens (network fees, taxes, and the collection of those payments), regulatory unpredictability and access to innovation. All these items may dis-incentivise competition within the natural gas and electricity retail markets, as well as entrance by new suppliers.

- **Market inequality**: Barriers arising from an uneven playing field for different types of suppliers. Often, certain market players already have a competitive advantage by being very close to the formerly integrated DSO (or still being vertically integrated in case the de-minimis unbundling rule is applied), controlling a large amount of generation capacity or having a large market share. If market rules do not prevent this, such players can exercise their market power to treat other market players in a discriminatory way, creating market barriers. We examine issues related to unbundling, historical roles and access to market mechanisms.
- **Operational and procedural hindrances**: Barriers arising as a consequence of the complexity and national/regional differences in standards and procedures in different process areas, affecting how easily new entrants can enter and operate in the energy retail market. We look at issues and differences in licensing, signing up and operations compliance, as well as data access, processes and data management from the suppliers' point of view.
- **Customer inertia**: Barriers arising due to market conditions which deter consumers' willingness and ability to switch supplier, and therefore make it harder for an entrant to attract consumers. For the energy market to function, end-users must be willing and able to switch supplier. If customers do not switch supplier, suppliers need not worry about losing customers, so there is no incentive for suppliers to improve their services, minimize prices or innovate to compete for customers. We examine barriers related to customer awareness and attitude, availability of information and comparability of offer, and difficulties of the switching process.

Each category contains 2 indicators to capture specific barriers, and the total of 8 indicators will be combined into one composite indicator in a later step. Each indicator is a single quantitative value, either taken from established databases or another quantitative source, or developed as a checklist of qualitative observations relevant to that indicator.

Selection criteria for the individual indicators

The selection criteria work as a guide to whether an indicator should be included or not in the overall composite index. Considering the criteria listed in the OECD Handbook and those mentioned during concept definition, the following selection criteria are set to assess potential indicators:

- **Solvable (barrier criterion)**: The barrier must be solvable or at least influence-able by regulation. It is preferable to include barriers that can be directly affected by regulatory actions, rather than those which can be only influenced indirectly.
- **Relevant**: The indicator must capture the barrier as directly and fully as possible. Indirect indicators (proxies) and indicators that captures only a small part on the barrier are less preferable. Surveys can directly and fully capture the barriers (if the questions are well-formulated), but can be less reliable.
- **Simple (interpretable)**: The indicator must be easily interpretable and understandable by the target audience. This requires the use of simple concepts and computation methods. There is often a trade-off between simplicity and relevance, as complex indicators tend to capture the barriers better (e.g. CR3 is simpler but HHI measures market concentration better).

- **Reliable**: The indicator must correctly measure what it is intended to. The criteria of accuracy (data have to be produced professionally in accordance with appropriate statistical standards) and coherence (data should be comparable across countries and over time) is covered here together.
- **Available**: Data must be accessible, affordable, and available in a timely manner.

We must note that many of the barriers listed in the literature review (in the Final Report) are qualitative by nature or at least quantifiable only with great difficulty. This has consequences for the reliability and availability of potential indicators as well as the possibility to measure the barriers directly.

As the project concluded 45 different barriers, which are classified into 9 areas and 4 blocks, the indicator-set cannot cover all barriers. The selection of the indicators is therefore also a selection of barriers that will be covered by the index. The coverage of the index can be enhanced by use of sub-indicators, which quantifies different specific barriers within a barrier category (or different aspects of a barrier), thus the indicator will be basically a mini-composite indicator. This approach provides flexibility in indicator selection within the fixed 4x2 structure of the Barriers Index.

The following table summarises the selection criteria and the meaning of the different grades that are attributed to barriers and indicators in the next section.

Table 1 – The assessment of potential indicators

Grade	Solvable by regulation	Relevant (indicator → barrier)	Simple	Reliable	Available
+++	Can be changed directly[1]	Captures directly and fully	The meaning is evident	Hard data from acknowledged source	Regularly updated database is available
++	Can be regulated	Captures directly but partially	Slightly complex concept or unclear details	Survey data from acknowledged source / New data collection	Required input information is easily available
+	Can be influenced by regulation	Captures indirectly (proxy) or marginally	Complex concept, many details to explain	New data collection and estimations, own survey	Complex and costly data collection is needed
-	(Cannot be influenced by regulation)	(Do not capture at all)	(Inexplicable)	(Not reliable)	(Not existing data)

Selection of individual indicators

Data selection

This section presents the assessment of potential indicators based on the above-defined selection criteria.

[1] Barriers that can be tackled without the involvement of another organisation. Eg. regulation on licencing or end-user prices, availability of information on legislation or market statistics. In contrast, tackling other type of barriers means regulating the behaviour of companies (eg. access regulation, data standardisation).

Regulatory disincentivisation

The barrier block of regulatory disincentivisation covers the following barrier categories and barriers:

- **Price regulation**: Discrimination of suppliers; high penetration of price regulation; low margin of the regulated offer (margin squeeze).
- **Regulatory burdens and burden sharing**: obligation to collect other payments on the top of energy on behalf of others (and the share of such payments within the bill); obligation to keep a minimum-security stock as a gas reserve.
- **Regulatory unpredictability**: Uncertainty regarding the future development of the regulatory framework; industry actors influencing legislation; uncertainty regarding future regulatory developments in the field of digitalization and new technology; attitude of authorities; uncertainty regarding environmental obligations and non-renewable generation capacity.
- **Access to innovation**: Data protection issues; lack of incentivisation for novel pilot projects or post-pilot market rollout; lack of data for innovative product development; no fit between new business models and existing regulation/obligations; lack of flexibility in tariff structures; lack of information and incentives for demand-side grid management; market structures that do not incentivize novel products (missing perceived value).

The following table present the list and assessment of the potential indicators that can be used in the Barriers Index. Indicators with light grey background are chosen.

Table 2 – Potential indicators to of Regulatory disincentivisation

Barrier area	Solvable by regulation	Potential indicator	Selection criteria			
			Relevant	Simple	Reliable	Available
Price regulation	+++	% of residential consumers with regulated price	+++	+++	+++	+++
		Margin of the regulated offer	+++	++	++	++
Regulatory burdens and burden sharing	+++	Regulation on burden sharing	+++	++	+	+
		Share of non-energy components of bill	++	+++	+++	+++
		Obligation on gas reserve	+++	+	+	+
Regulatory unpredict-ability	++	Number of regulatory changes	+	++	+	+
		Suppliers' opinion (Own survey)	+++	+++	+	+
Access to innovation	+++	Existence of regulation regarding novel products	+	+	++	+

Regarding the general regulatory framework, the most substantial question from a potential entrant's perspective is the extent to which the market is contestable at all. The part of the market eligible for **regulated prices** is not (or hardly) contestable for a new entrant. Consumers that have access to regulated tariffs are extremely difficult to reach with competitive offers. If this market segment is big (i.e. price regulation has a high penetration) only a small part of the market (generally non-household customers) is contestable. Another aspect of price regulation is the level of the regulated prices. If the regulated price is set at such a low level that only companies that can benefit of economies of scale are able to generate a sustainable margin, it can create a barrier to entry for new, smaller players. As the potential indicators for the penetration of price regulation and the margin of the regulated offer performs very well against the selection criteria, we define the first indicator as the combination of these, naming it **market foreclosure by price regulation.**

In relation to regulatory burdens and burden sharing, we found that the share of non-energy components of the bill is a good indicator. If the share of **regulated elements of the energy bills (taxes and network fees) are high**, that can constitute a barrier in two ways. First, it means that the suppliers have no influence on a significant part of the bill, so if they offer a discount to attract customers, the difference on the level of the total bill (expressed in %) will be much lower. Thus, the **price signals will be weaker** for the customers, which reduces the incentives to switch and therefore the market will be less attractive for a newcomer. Secondly, **energy suppliers across Europe are often required to collect these taxes and network fees**, and these regulatory burdens can pose a barrier for suppliers' operation by raising their costs and risk, as well as distracting focus from their core business. Alternative indicators are problematic especially from reliability and availability point of view.

The uncertainty created by the **regulatory unpredictability** is an important barrier as it makes strategic business planning difficult and discouraging them in entering a market or make investments. The uncertainty of future regulation also hampers **innovation**, thus this indicator can cover both type of barriers. We considered using the number of regulatory changes (per year), as a proxy, but we rejected it because it does not capture the barrier well as it does not reflect the content of the changes, and it would be hard to define which regulatory changes should be counted. Our view is that regulatory unpredictability is best measurable through a survey. Our supplier survey contained a question[2] which addressed this issue, therefore we use the average score of supplier responses as an indicator. In the future, however, it would be preferable to conduct other supplier or expert surveys, potentially using fixed panels of professionals (lawyers, business consultants and government officials), as in the case of The World Bank's Ease of Doing Business Score and Ranking.

In conclusion, we define and use the following indicators:

- Indicator 1: Market foreclosure by price regulation
    - 1A: Penetration of price regulation
    - 1B: Mark-up of the regulated offer
- Indicator 2: Regulatory burdens and unpredictability

[2] The question was formulated as follows: "Please evaluate how relevant the following potential regulatory barriers are to your activities on a five-point scale: uncertainty concerning future regulatory developments (e.g. unstable, political protection of status quo, high lobbying influence)"

- 2A: Regulatory burdens
- 2B: Regulatory unpredictability (based on the supplier survey responses)

Market inequality

The barrier block of market inequality covers the following barrier categories and barriers:

- **Unbundling and market power**: lack of brand unbundling; strategic behaviour of incumbent; unfair advantage of vertically integrated market players; discrimination against new and small market players in capacity and ancillary services markets;
- **Equal access to, and maturity of, the wholesale market**: discriminatory market platform access (standards, guarantees, etc.); low liquidity in the wholesale market; high price or volume risk in energy procurement.

The following table present the list and assessment of the potential indicators that can be used in the Barriers Index. Indicators with light grey background are chosen.

Table 3 - Potential indicators of market inequality

Barrier area	Solvable by regulation	Potential indicator	Selection criteria			
			Relevant	Simple	Reliable	Available
Unbundling and market power	+ (Market power) +++ (Unbundling)	Market share of vertically integrated suppliers	++	++	++	+
		Level of DSO unbundling	+++	++	++	+
Equal access to and maturity of wholesale market	+	Liquidity of wholesale markets (churn rate)	+++	++	++	++
		Concentration (CR3 or HHI) of wholesale market	++	++	++	+
		Costs of trading on exchanges	++	++	++	+

Indicators of the market inequality targets market conditions that create competitive disadvantages for small and/or independent suppliers against larger, established rivals, especially former incumbents and those who operate within a vertically integrated company/group.

The major effect of this handicap is that it makes it harder for a new entrant to acquire customers, and therefore to reach an efficient operating size. The presence of **market power and insufficient unbundling** enables former incumbents and the vertically integrated players to use strategic, unfair tactics to lock-in their customer base and block switching processes or data access by new suppliers. Although legal unbundling has been implemented throughout all EU member states, barriers arising from the vertical integration of distribution and supply activities can still be observed in many markets.

The vertically integrated players' abilities and incentives to foreclose their rivals are determined by the market situation (market power) and the legal framework. Therefore, the first part of the indicator is dedicated to measure their market power, with the market share of the vertically integrated players. The market share is also indicative of their competitive advantages and of the extent to which the customers are tied to them. The second part of the indicator quantifies the strictness of the DSO unbundling regulation, as it can reduce both the ability and the incentives to take advantage of that position.

The disadvantage of the market share indicator is that regulators have limited tools to influence it. Moreover, it is rather a proxy than a real problem. It means that it is not a goal to reduce the incumbents' market share, but lower market share is a sign of lower incumbent advantages. In case of the unbundling indicator, quantification is a challenge. Our approach is to transform the level of unbundling (only accounting, legal, brand and ownership) into an indicator score based on its strictness and effectiveness. If the strictness of unbundling varies across DSOs (mainly due to the presence of integrated local operators), the weighted average score can be calculated using the size of the customer bases. Even though these disadvantages are important, and data availability is also limited, we decided to use them, because we have found no better alternatives to quantify these important barriers.

A small player may face special difficulties in energy procurement as well, if the wholesale market does not function properly, is not stable, is volatile, or is restricted. This is because new entrants with small or non-existent customer bases often have poor access to primary sources and less bargaining power in bilateral negotiations, leading to higher sourcing costs and fewer risk management opportunities. Barriers related to the **access to wholesale markets** can be eased also only indirectly by regulation, for example with an obligation to execute every trade on a centralized platform.

The higher the **liquidity** of a market, the more likely that a supplier can find the optimal sourcing portfolio regarding prices and risks. For liquidity, churn rate is the most acknowledged indicator, which is calculated as the ratio between the traded volumes on the wholesale market and the consumption of the country. Traded volumes cover exchange executed spot and future trades, as well as the OTC (bilateral and cleared) volumes which are settled via a broker or trading platform. It is important that the indicator contains only volumes that are visible and accessible for an entrant (via a match-making intermediary player) and does not include direct and non-transparent trades. Alternative indicators are inferior regarding their relevance and availability.

As a conclusion, we define and use the following indicators:

- Indicator 3: Competitive advantages of vertically integrated players
    - 3A: Market share of vertically integrated suppliers
    - 3B: Strictness of DSO unbundling
- Indicator 4: Liquidity of the wholesale markets

Operational and procedural hindrances

The barrier block of operational and procedural hindrances covers the following barrier categories and barriers:

Sign-up & operations compliance: poor availability of information for market entrants & active participants; heavy administrative process for entry (registration / licensing); high financial requirements; excessive reporting requirements; excessive information requirements around billing and energy labelling; highly complex or country-specific systems & processes; regional differences or differences between DSOs within a country; cumbersome or biased switching process; unduly burdensome environmental obligations; unduly burdensome or insufficiently regulated market exit.

Data access & processes: lack of a data hub; complex, heterogenous IT infrastructure and/or low level of digitalisation; missing access or poor quality of operations-critical data.

The following table present the list and assessment of the potential indicators that can be used in the Barriers Index. Indicators with light grey background are chosen.

Table 4 – Potential indicators of Operational and procedural hindrances

Barrier area	Solvable by regulation	Potential indicator	Selection criteria			
			Relevant	Simple	Reliable	Available
Sign-up & operations compliance	+++	Number of procedures	++	+	+	+
		Time to get a supplier licence	++	+++	++	++
		Cost of licencing	+++	+	+	+
		Costs financial requirements	+++	+	+	+
		Checklist on availability of important information	++	++	+	+
Data access & processes	++	Smart meter rollout	+	+++	++	++
		Checklist on data processes	++	+	++	++
		Combined indicator on data processes and smart meter rollout	+++	+	++	++

The processes required to enter a market can constitute a large administrative burden. Overly complicated and time-consuming processes and requirements present a barrier in terms of the time and money that new entrants must invest. There are several options to quantify the **complexity of licencing procedures**. Based on the assessment criteria, we chose the time required to get a supplier licence. It can be assumed that the duration of the procedure is also related to its complexity.

In a well-functioning energy retail market, it is important that the information required to operate in the market is available to newcomers. This may include information on individual consumption or more specific meter details. This data is required for suppliers to carry out their market role, such as initiating a switch, or billing a customer. A

standardized approach to the provision and exchange of data creates a level playing field among stakeholders and helps to encourage new, challenging market actors to enter the market. Barriers relating to the quality of data access are also quantified with a checklist indicator, which focuses on the DSO's practices regarding data collection and access provision. The proposed indicator covers the following topics: **data standardisation, the ease of third-party access to the data (existence of data websites or hubs) and smart meter rollout**.

As a conclusion, we define and use the following indicators:

- Indicator 5: Time to get a supplier licence
- Indicator 6: Quality of data access

Customer inertia

The barrier block of customer inertia contains only one category, it covers the following barriers: lack of information regarding available offers and switching possibilities; low customer awareness or interest; changing supplier is cumbersome or has little pay-off for the customer; consumers prefer status quo; lack of trust in new or foreign suppliers and in new technology.

The following table present the list and assessment of the potential indicators that can be used in the Barriers Index. Indicators with light grey background are chosen.

Table 5 - Potential indicators of customer inertia

Barrier	Solvable by regulation	Potential indicator	Selection criteria			
			Relevant	Simple	Reliable	Available
Lack of information on offers	+++	Ability of consumers to compare offers (MPI survey)	+++	+++	+	+++
		Availability of comparison websites	+++	+	++	+++
Consumer attitude and awareness (Lack of interest and trust)	+	Suppliers' opinion (own survey)	++	+++	+	+
		Trust in suppliers (MPI survey)	++	+++	++	+++
Cumbersome switching process	++	Perceived ease of switching (MPI survey)	++	+++	++	+++
		Not switching because of difficulties (MPI survey)	++	+++	++	+++
		Combination of the above indicators	+++	++	++	+++
Low switching activity	+	Average switching rate	+	+++	+++	+++
		% of consumers who haven't switched from the incumbent supplier	+	++	++	++

Indicators in this block target the factors which deter consumers' willingness and ability to switch supplier, and therefore makes it harder for an entrant to attract consumers. Many of the potential indicators are available thanks to the regular survey performed for the purpose of the Market Performance Index published by *DG Justice and Consumers* (marked with 'MPI survey' in the table).

Among the potential indicators, we preferred those that are related to more **solvable barriers**. Customer attitudes are hardly affected by regulation, while switching activity can be influenced only indirectly. Moreover, the switching rate is rather an impact-type indicator which incorporates the effects of all the above-mentioned barriers (switching costs, consumer attitude, advantages of incumbents, price regulation, etc.) as well as other conditions like maturity of the market. As it is not targeted to specific barriers, its score is less informative for regulators or potential entrants. The ratio of consumers who haven't switched from the incumbent supplier suffers from the same problem. Furthermore, it is highly correlated with the market share of the vertically integrated suppliers, therefore its added value to the whole indicator-set would be low.

If there are price differences on the market, customers have to be aware of them and understand the differences across offers, to be able to choose the optimal solution. From that point, difficulties regarding the **comparability of different offers** can serve as an important barrier. There are two general ways to measure such difficulties, by asking customers (demand side approach) and by exploring the available tools that support comparison (supply side approach). The first method is more relevant, but distorted by the number of suppliers and offers (higher number of suppliers and offers are harder to compare, which makes monopoly markets the best performers). The second method is more objective, but tells little about the real usability of the tools. The combination of the two approaches may give the best estimate of the inability of customers to compare offers.

If a customer considers switching supplier, a slow or **burdensome switching process**, or having to pay to switch may discourage them. Effective price competition between suppliers requires a rapid, effective switching procedure, such that customers see the benefit to them in a short timeframe. This barrier is also measured based on the DG Justice's MPI Survey. The indicator incorporates the experience and opinions of customers who have switched, and also of those who haven't because they faced obstacles or thought it might be too difficult. The latter part is important because otherwise the deterrent effect of the switching process is not captured.

As a conclusion, we define and use the following indicators:

- Indicator 7: Comparability of offers
    - 7A: Consumer's inability to compare offers
    - 7B: Availability of comparison websites
- Indicator 8: Perceived difficulties of switching

Summary

The following table presents the structure of the index and the list of indicators.

Table 6 - Summary of indicators

Barrier category	Indicators	Metrics (sub-indicators)
Regulatory disincentivisation	Market foreclosure by price regulation	1A: Penetration of price regulation 1B: Mark-up of the regulated offer
	Regulatory burdens and unpredictability	2A: Regulatory burdens 2B: Regulatory unpredictability
Market inequality	Competitive advantage of vertically integrated suppliers	3A: Market share of vertically integrated suppliers 3B: Strictness of DSO unbundling
	Unequal access to wholesale markets	4: Liquidity of the wholesale market
Operational and procedural hindrances	Length of licencing procedure	5: Time to get a supplier licence
	Quality of data access	6: Quality of data access
Customer inertia	Comparability of offers	7A: Consumer's inability to compare offers 7B: Availability of comparison websites
	Perceived difficulties of switching	8: Perceived difficulties of switching

Data treatment and normalisation

Within data treatment, we present the methodology for imputation of missing data as well as for transformation and normalisation. The step of normalisation comes later in the OECD-JRC guideline, at the construction of the composite indicator. In our case, however, many indicators consist of two parts, thus normalisation is required to calculate these indicators.

Imputation of missing data

IPA (2015) presents many alternative ways to fill data gaps. The following simpler approaches were preferred by IPA: collection from other sources, using proxies (similar indicators), using data for previous years, using data from other countries with similar characteristics or average values from the available data. Complex methods (eg. using regression) can also be used. However, some gaps have not been filled, in this case the associated indicator has been skipped, and the weights of other indicators in the same category have been increased.

For the purpose of our study, we adopted the simpler approaches to IPA. To enhance data availability, we applied imputation methods for the individual indicators in the following order.

1. **Collection from other sources**: In many cases, data was collected from various sources (mainly national reports, websites of the NRAs, or direct data provision by the NRAs). Therefore, we regarded this approach as a standard data collection method and used imputation only in cases where the majority of data was available from one single database.

2. **Using data for previous years**: The indicator values are collected mainly for the year 2018, as data in the publicly available datasets (eg. Eurostat or CEER reports) are available until that year. If data for 2019 was available for most of the countries, we used it as being more relevant, but as a principle we used data for a same year for one indicator, to ensure comparability. MPI survey indicators are available only for 2017, and newer data weren't published during the project. Using 2017 data from the MPI survey was not considered as imputation but as standard data collection.

3. **Using proxies**: In some cases, data was not available with the intended content, so similar indicators, proxies were imputed. This approach was used for both parts of the 'Competitive advantage of vertically integrated suppliers' indicator. For the market share of vertically integrated suppliers, the market share of the large suppliers was used in some cases, if the number of suppliers in the two categories was similar. For the unbundling indicator, the share of the local, integrated DSOs was estimated based on the available data.

4. **Using data from other countries with similar characteristics**: This approach was rarely used, when the preferred methods were not appliable, and similar countries could be defined.

5. **Using average values from the available data (EU average):** This approach was also rarely used, only if the above-mentioned methods were not applicable, and using EU-average seemed meaningful.

In cases where none of the above-mentioned solution was found doable and acceptable, the associated performance indicators were not computed and presented. For the purpose of the Barriers Index, the following methods have been used:

- In case of two-part indicators: Imputation with the other part of the indicator.
- In case of one-part indicators, or if both parts are missing: Imputation with the average country score (identical to increasing the weights of the other indicators).

Transformation and normalisation

Each (sub)indicator value is transformed to a score between 0 and 10, where 0 means that the barrier in question is not present on the market, and 10 means that the barrier reaches its maximum value. The following table presents the threshold values for 0 and 10 scores. The scores increase linearly between the two thresholds.

Table 7 - Normalisation of indicators

Indicators and subindicators	Thresholds for normalisation	
	0 if	10 if
1A: Penetration of price regulation	0% (no price regulation)	100%
1B: Mark-up of the regulated offer	Double of the EU-wide competitive mark-up or higher	Equal to or below 0
2A: Regulatory burdens	50% or below	100%
2B: Regulatory unpredictability	1 (on a 1-5 scale)	5 (on a 1-5 scale)
3A: Market share of vertically integrated suppliers	0% (ownership unbundling)	100%
3B: Strictness of DSO unbundling	0 if ownership unbundling; 3 if legal and brand unbundling; 5 if legal unbundling; 10 otherwise.	
4: Liquidity of the wholesale market (churn rate)	Equal to or above 3	0
5: Time to get a supplier licence	0 (no licencing)	180 days (maximum in the sample)
6: Quality of data access	Data standards: 2 for national, 3 for international Access: 2 for website access, 3 for data hub Smart meter rollout: 0 for 0%, 4 for 100% Total score: 10 minus the sum of the above sub-indicators	
7A: Consumer's inability to compare offers	0	10
7B: Availability of comparison websites	Nr. of websites: 0 for 0, 2 for 1, 3 for 2, 4 for 3, 5 for 3+ Quality: 1 for authority-operated, 3 if 1 fulfils Directives criteria, 5 if 2 fulfils criteria	
8: Perceived difficulties of switching	0%	100%

In many cases, the normalisation thresholds are straightforward as the original indicator had already a 0-10 or 0-100% scale. In the other cases, the following considerations has been made:

- 1B: Price regulation can have a distortion effect even if the mark-up is close to the competitive levels. It is assumed that a double mark-up is high enough to be ineffective. EU-wide average competitive mark-up is used as benchmark instead of national averages, because price regulation can have an indirect effect on the competitive prices as well.
- 3B: Accounting unbundling is obligatory for all DSOs, therefore it is the minimum level of separation (10 points). Legal unbundling is assumed to be in the middle regarding effectiveness, while if supplemented with brand unbundling, it is more effective, but it is closer to the pure legal unbundling than full (structural) separation.
- 4: There is no ultimate threshold for sufficient liquidity, the churn rate of 3 is mentioned in the literature[3] as a potential threshold. Higher thresholds were considered to award the highly liquid markets but were

[3] ACER/CEER Annual Report on the Results of Monitoring the Internal Electricity Market in 2015, September 2016, p. 34

rejected in order to better differentiate between the low and medium performances, as most of the countries have a churn rate below 2.

- 5: For licencing, we used the maximum value (180 days) to define the upper threshold.
- 6: Quality of data access is a newly constructed mini-composite index. The aspects of standardisation and access are measured with a 3-grade scale, where the medium value (national standard, website-based access) are clearly closer to the best practices (international standard, data hub), than the worst practices (no standardisation, access upon request). These two aspects were assumed to be somewhat more important (max. 6 points in total), than the smart meter roll-out (max. 4 points).[4]
- 7B: The availability of comparison websites is also a mini-composite index, which is based on data published in ACER Market Monitoring Report. Scores are attributed non-linearly to reflect the higher added value of the first comparison website, and the fulfilment of Directive's criteria.

Data analysis

The role of this analysis is to explore connections between the metrics, to make a final decision on the used indicators, and to support the choice of weights. It must be checked whether the directions and strengths of the correlations are not contradictory. In this case, as every indicator is already normalised to a 0-10 scale, where higher values mean higher barriers, positive or close to zero correlations are expected.

However, very strong (>0.8) correlations would suggest that the indicators measure the same factors, so some of them can be neglected (as they have limited added value). Alternatively, lower weights can be assigned to the more correlated indicators to avoid hidden overweighting.[5] The following tables present the correlations between the indicators (correlations above 0.5 are highlighted).

Table 8 – Correlation matrix of the indicators (electricity)

		1	2	3	4	5	6	7	8
1	Market foreclosure by price regulation	1.00	0.17	0.50	0.23	0.31	0.51	0.43	0.56
2	Regulatory burdens and unpredictability		1.00	0.11	0.09	-0.02	0.06	0.39	0.31
3	Competitive advantage of VICs			1.00	0.34	0.22	0.29	0.37	0.58
4	Access to wholesale (liquidity)				1.00	0.44	0.08	0.38	0.05
5	Complex licencing procedure					1.00	0.59	0.43	0.09
6	Quality of data access						1.00	0.48	0.61
7	Comparability of offers							1.00	0.37
8	Burdensome switching process								1.00

[4] The indicator was based primarily on the study of Tractebel (2018) which was performed in the framework of the ASSET project.
[5] If two indicators are highly correlated, it brings to a similar result as only one of them is in the indicator-set with a double weight.

Table 9 - Correlation matrix of the indicators (gas)

		1	2	3	4	5	6	7	8
1	Market foreclosure by price regulation	1.00	0.42	0.37	0.47	0.08	0.35	0.46	0.20
2	Regulatory burdens and unpredictability		1.00	0.03	0.22	-0.09	0.26	0.45	-0.05
3	Competitive advantage of VICs			1.00	0.55	-0.35	0.21	0.11	0.44
4	Access to wholesale (liquidity)				1.00	-0.04	0.32	0.31	0.01
5	Complex licencing procedure					1.00	0.24	0.14	0.01
6	Quality of data access						1.00	0.52	0.00
7	Comparability of offers							1.00	0.10
8	Burdensome switching process								1.00

The tables show that there are no strong (>0.8) correlations, and most of the values are between 0.1 and 0.5, implying a weak positive connection between the barriers. The small number of negative values are close to zero. Therefore, we conclude that the indicator-set is sufficiently balanced, and that there is no need for change or special adjustment in weighting.

Construction of the Barriers Index

Weighting and aggregation

The OECD-JRC Guideline categorises the weighting methods into three types: equal weights, weighting based on statistical methods (eg. PCA, regression), and weighting based on participatory methods (eg. expert/public opinion, budget allocation, conjoint analysis. The second option allows reflection of the characteristics of the database (eg. correlations), while the third approach is advantageous if the different measured factors have different importance.

For aggregation, three methods are also presented: additive, geometrical and non-compensatory multi-criteria analysis. The additive approach is the most common (weighted indicator scores are just summed up), however, it has a significant disadvantage - full compensability: poor performance in some indicators can be compensated by sufficiently high values in other indicators. For example, market foreclosure by price regulation may be compensated for by installing comparison websites or shortening the licencing procedure. In case of geometric aggregation, the aggregated score is not the sum but the product of the weighted indicators. This approach rewards more balanced performances and punishes if a country has a low score in any dimension. Moreover, a country is more interested in enhancing those indicators with the lowest score in order to improve its position in

the ranking if the aggregation is geometric rather than linear. In case of multi-criteria analysis there is no compensation, but the methodology is highly complex.

Our general approach is to follow simple methods, to create an easily interpretable composite index, and to avoid arbitrary methodological decisions. Thus, our main results are based on equal weights and additive aggregation. Any solutions are however arbitrary in some way; therefore, it is important to check to robustness of the results (see next section).

Robustness

We perform sensitivity analysis for the weighting and aggregation methods. For the purpose of the analysis, 100 weight-set has been randomly generated, based on a normal distribution around 12.5% (equal weights), ensuring that the total is 100%. The 800 randomly generated weights are between 6.3 and 18.2%. The distribution of aggregated scores and the rankings will be presented.

Moreover, the ranking will be presented based on geometric aggregation (with equal weights).

Presentation of the results

Composite indicators can be visualised or presented in a number of different ways, which can influence the interpretation. Therefore, a coherent set of presentational tools must be defined and applied.

In the case of the individual indicators, cardinal ranking is preferred (simple bar charts), where both the ranking and the score is readable. For the composite indicator, however, a stacked bar chart is favoured as it shows the structure of the result in case of additive aggregation. (In case of geometric aggregation, only simple charts can be presented.) Additionally, ordinal ranking will be also presented, as it is even more interpretable and rankings in general are less sensitive to data and methodology changes than the scores.

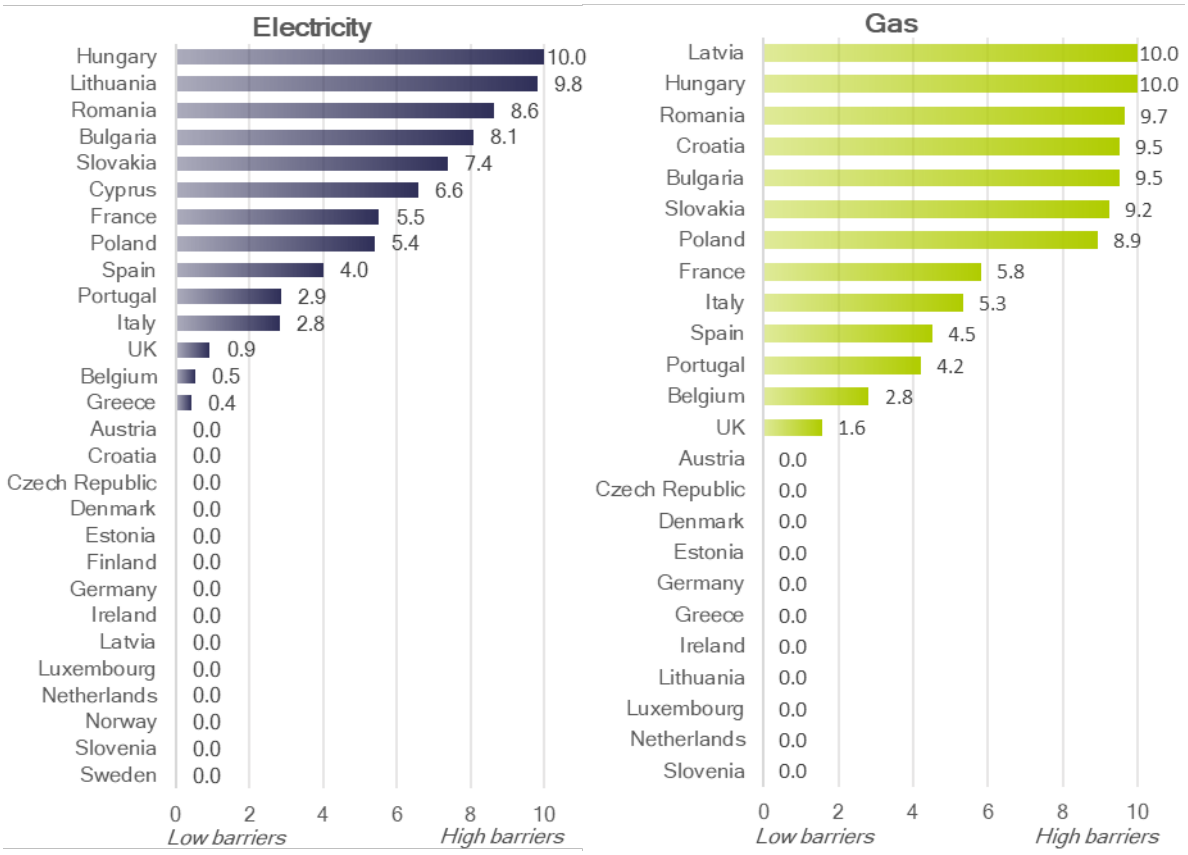
RESULTS

Performance indicators

Regulatory disincentivisation

Market foreclosure by price regulation is measured with two sub-indicators, the penetration of price regulation (among residual customers), and the mark-up of the regulated offer.

Figure 2 – Performance indicators - Market foreclosure by price regulation



Price regulation is present on 14 out of the 28 analysed electricity markets, therefore, the average score is quite low (2.6). Amongst the affected countries the average is much higher (5.2). The combination of the high share of the customers with regulated price and the low margin of the regulated offer may lead to market foreclosure in Hungary, Lithuania, Romania[6] Bulgaria, Slovakia and Cyprus[7]. In five countries, price regulation has a moderate penetration and/or the level of the regulated price can be matched by competitors, but this situation can also prevent entry by reducing the contestable part of the market. There are three markets where the low penetration

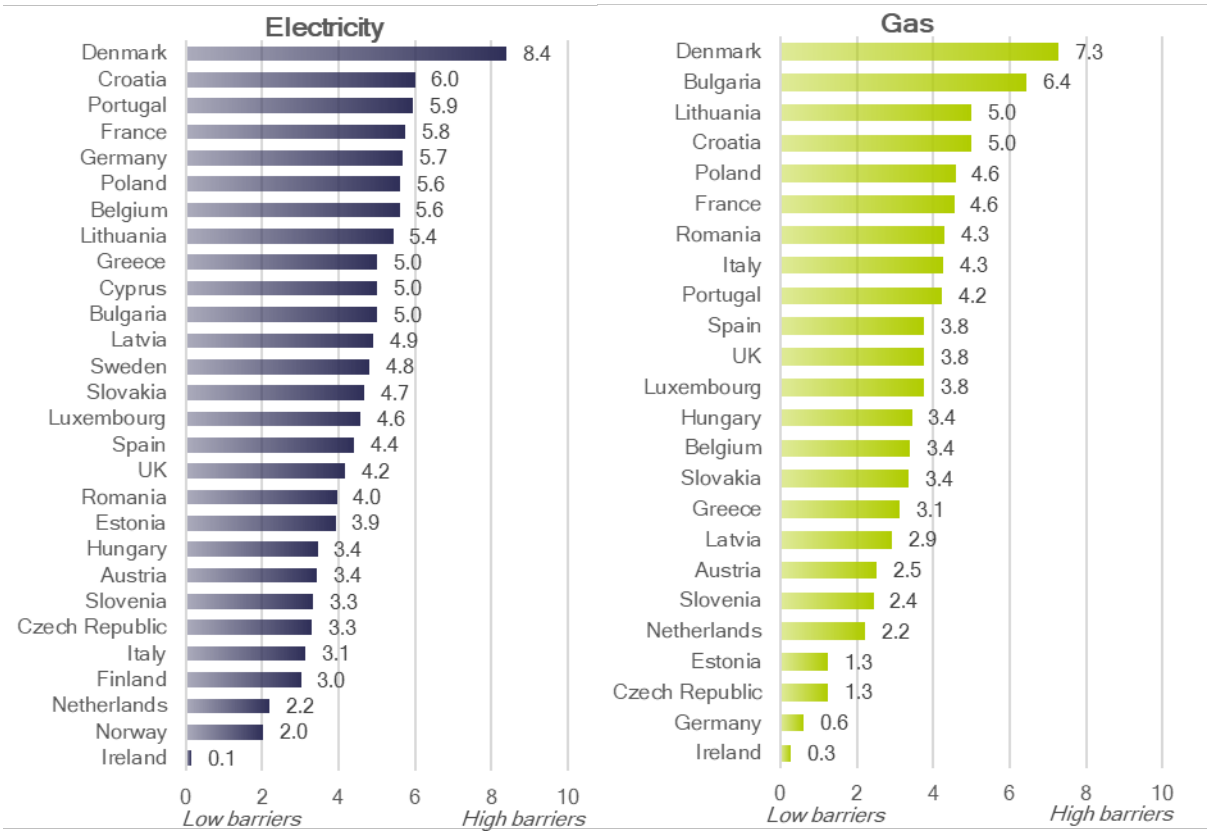
[6] Romania abolished price regulation in 2018, however it reintroduced it in 2019. According to the current plan it will eradicated by the end of 2020.
[7] In case of Cyprus mark-up data was not available therefore the average value have been imputed.

and the high mark-up of the regulated offer suggest that price regulation does not constitutes a severe entry barrier, while in fourteen countries such barrier is not present at all.

The indicator scores are higher in the gas markets (average: 3.8, amongst affected: 7.0), than in the electricity markets, especially because it is more common that the regulated price is set below competitive levels. Regulated offers are present in 13 out of 24 analysed markets, Price regulation is likely to foreclose the markets in Latvia, Hungary, Romania[8], Croatia, Bulgaria, Slovakia and Poland). In the other six counties, price regulation leaves some space for market competition but may deter entry by reducing the contestable part of the market. In eleven countries such barriers are not present at all.

The regulatory burdens and unpredictability indicator quantifies the non-energy share of the energy bill in an average household, and regulatory unpredictability that was measured via the supplier survey conducted for this project. For this barrier, gas markets received lower scores in average, then electricity markets (3.5 vs. 4.4). The reason is the higher average tax level on electricity, while the predictability scores are similar in the two markets.

Figure 3 – Performance indicators - Regulatory burdens and unpredictability



Denmark received the highest barrier scores in this category, regarding both electricity and gas markets. This is due to the topmost tax levels in Europe, in combination with the maximum scores received from the suppliers in relation to unpredictability of the regulatory framework. On the other hand, Ireland's top performance in both

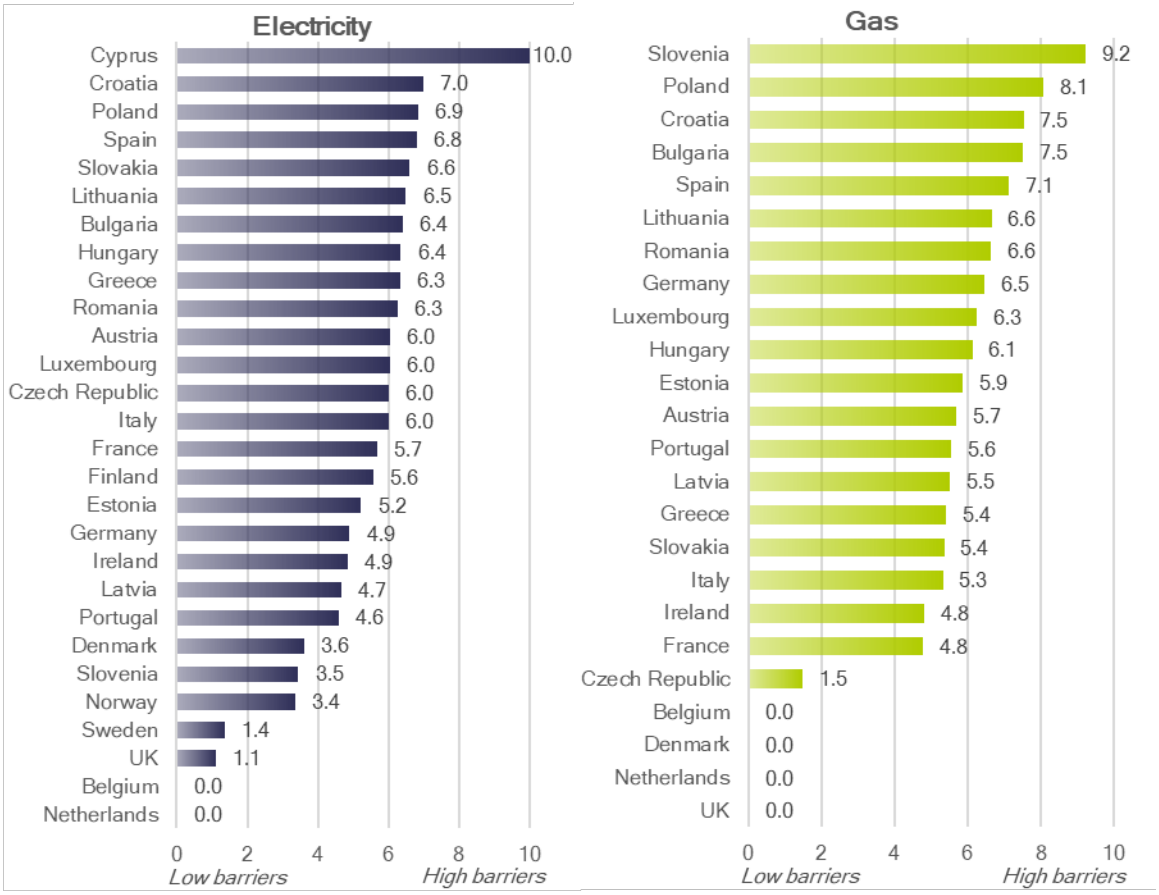
[8] As of March, price regulation will be phased out in July 2020 in the Romanian gas market.

markets is mainly a result of maximum satisfaction with the regulatory predictability, as the share of the non-energy components in the bill is close to the average value in both markets.

Market inequality

The competitive advantage of vertically integrated players – as measured by the market share of vertically integrated suppliers (on the residential market), and the strictness of DSO unbundling – is considerable in most of the countries (the average score is 5.1 in both markets). Vertically integrated suppliers have ca. 65% market share on average, but as legal unbundling is obligatory for larger DSOs (>100.000 customers), unbundling scores are lower in general.

Figure 4 – Performance indicators - Competitive advantage of vertically integrated suppliers



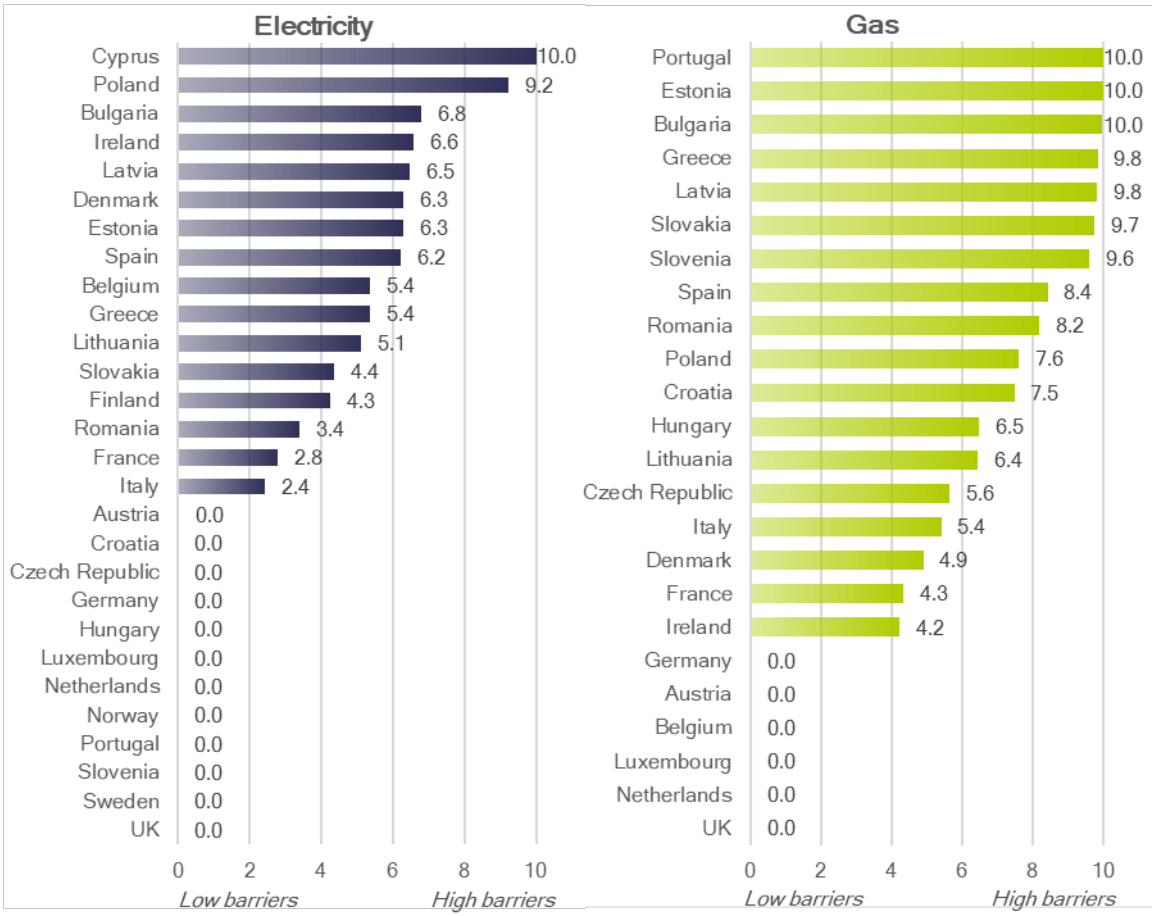
Cyprus has the maximum score because electricity customers are served by an integrated company. In gas, Slovenia is in similar situation, as the DSOs are small, integrated companies (exempt from the legal unbundling rules), and they supply the vast majority of the market.

On the other end of the scale, DSOs are fully independent companies in the Netherlands, Belgium, Denmark (only gas) and the UK (only gas), thus none of the suppliers are part of a vertically integrated group. Very few small integrated companies are present in the electricity markets of the UK and Sweden, while most of the suppliers are independent in the Czech gas market.

Access to wholesale markets is measured by quantifying the liquidity of wholesale markets. High score means that the accessible part of the wholesale traded volumes is relatively low compared to the consumption of the country.

Based on the data, access to wholesale markets is a much bigger issue in the gas markets (5.8) than in electricity markets (3.0). In electricity, 12 countries (out of 28) have no liquidity-related entry barriers, while only moderate barriers are observable in another 3-5 countries. Cyprus and Poland achieved the highest scores as the whole or majority of the wholesale traded volumes are traded outside of organised marketplaces (long-term contracts or other bilateral deals).

Figure 5 – Performance indicators – Unequal access to the wholesale market



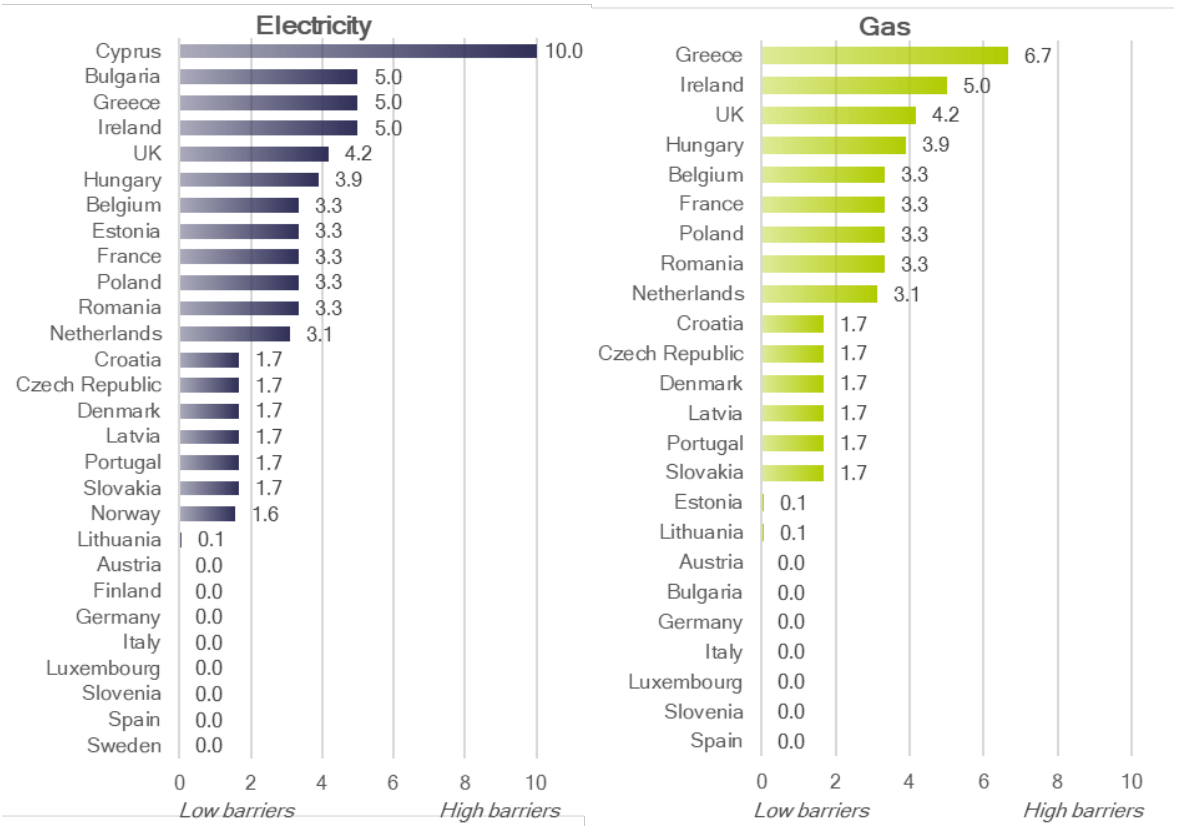
Six of the gas markets are liquid enough to receive zero score for that indicator, while the others have a striking 7.7 average score, suggesting that low gas hub liquidity (or non-existence of a centralized trading platform) is a widespread issue in Europe. The results suggest that suppliers face very severe barriers regarding energy procurement in seven countries, and there are other four countries also with high obstacles.

Operational and procedural hindrances

The complexity of the licencing procedure is quantified by the time that requires to get a supplier licence. It can be assumed that the length of the procedure is also related to its complexity. A higher score is attributed the longer the regulator's authorization period, while a score of 0 is attributed if there is no licensing obligation in the country.

The length of supplier licensing procedure is somewhat shorter in the gas markets (an average of 35 vs. 41 days), but the difference in mainly due to the fact that Cyprus (with a topmost value of 6 months) is only analysed regarding electricity.

Figure 6 – Performance indicators – Length of licensing procedure

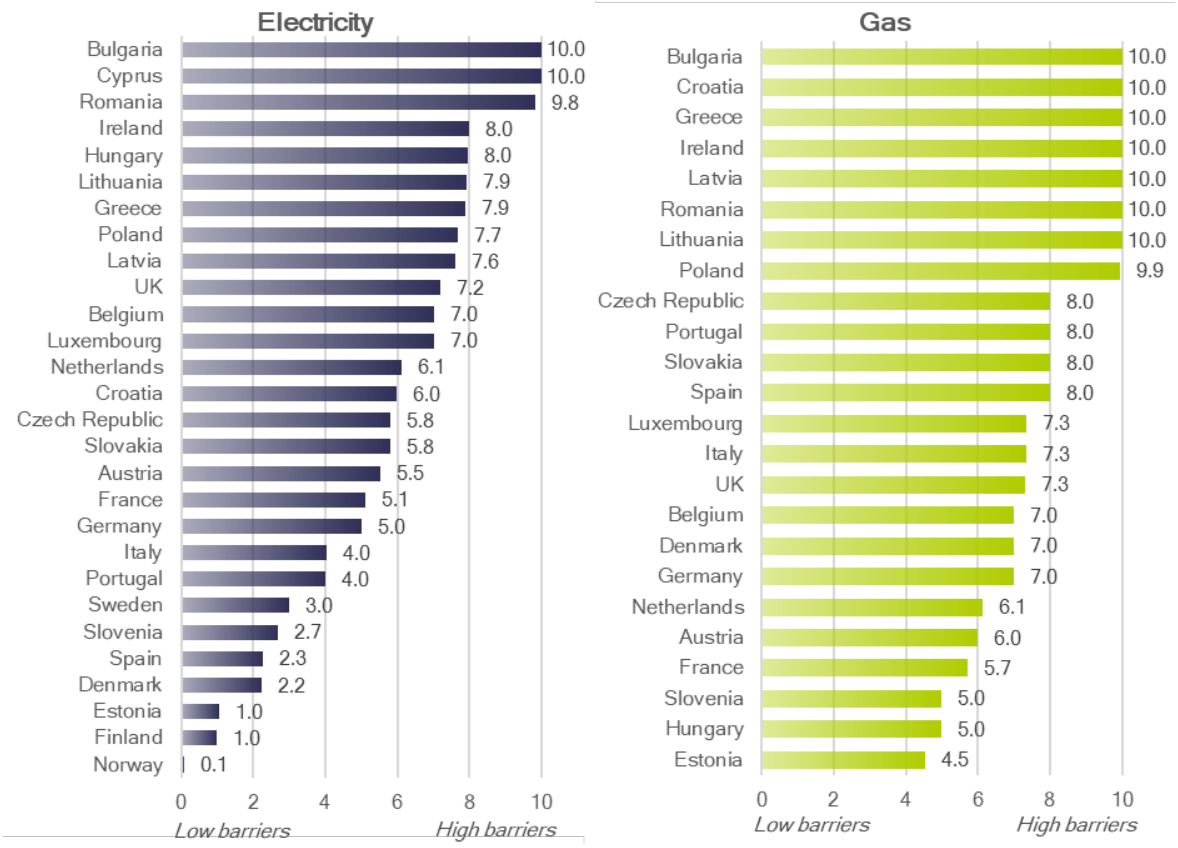


There is no licensing in eight electricity and seven gas markets. For the other countries, the average length is 58 days in electricity (52 days without Cyprus), and 49 days in gas markets. There is only a 1-day procedure in Lithuania (both markets) and Estonia (gas), while there are seven electricity and six gas markets where the licensing takes only 30 days. It can be concluded that licencing procedures longer than 60 days can constitute an entry barrier, but every country that maintains licencing could aim to reduce its length to approx. 30 days.

The barriers relating to the quality of data access are measured with a checklist indicator, which focuses on the DSO's practices regarding data collection and access provision to suppliers. A high score is attributed if the format of the data provision is not standardised, third party access is not available via a website or data hub, and smart meter rollout is limited.

Barriers relating the quality of data access are significantly more severe in the gas markets (7.8) than in the electricity markets (5.6). In addition, data availability and reliability was also lower in the gas sector. Out of the 28 electricity markets in the analysis, data format is standardised for billing and switching processes in 24 countries, but only five countries applies international standards. The situation is worse regarding data access, as website access or data hubs are present only in thirteen countries. The average smart meter rollout is ca. 40% in electricity, while only 5% in gas markets.

Figure 7 – Performance indicators - Quality of data access

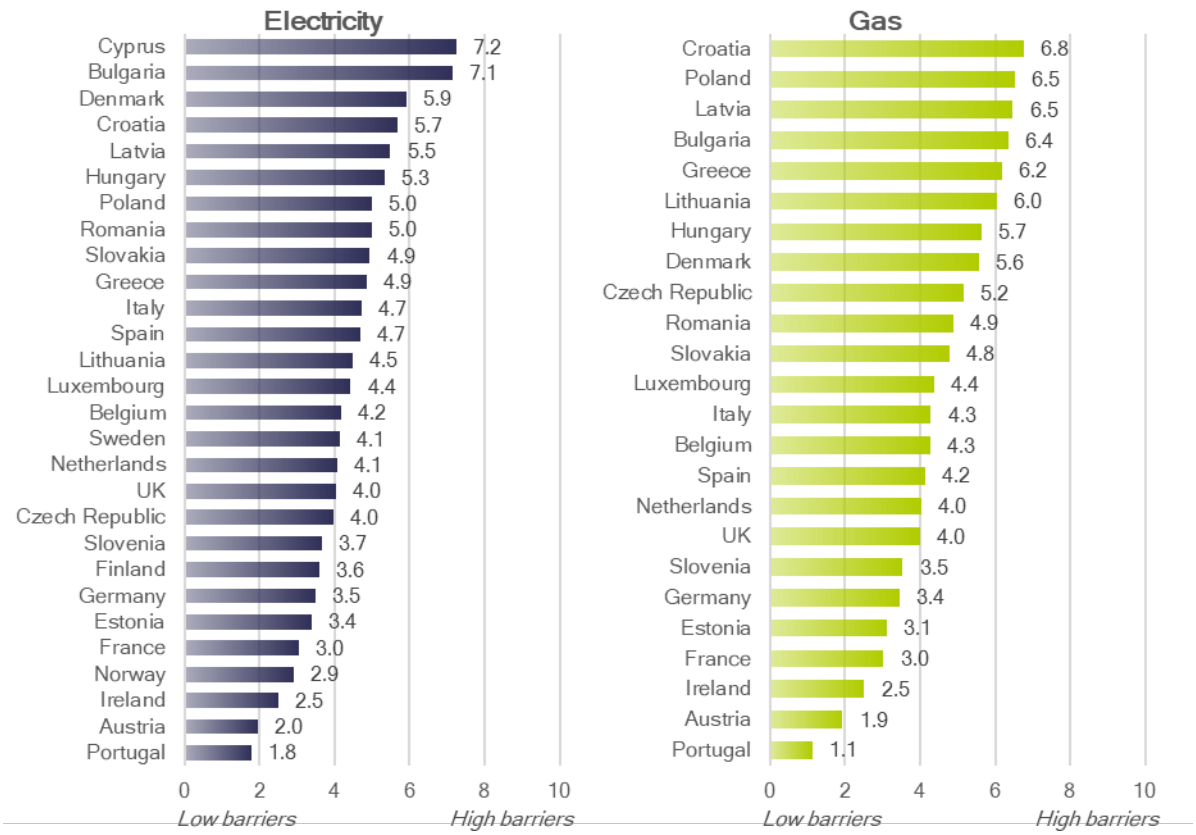


In relation to electricity, Bulgaria and Cyprus received 10 points, but Romania is also very close to the maximum score. For gas (at least) eight countries' performance are equal or very close to the maximum score. In general, Nordic countries perform very well regarding data access issues, as they mostly apply international data standards, operate data hubs, and have a near complete smart meter rollout.

Customer inertia

The comparability of offers is measured by combining two approaches. The customer's opinion is explored based on a survey commissioned by the DG Justice and Consumers. The supply side is quantified with a checklist indicator which covers the availability of comparison websites, based on their number and functionalities. In sum, a high score is attributed if the consumers gave low scores for comparability, and there are no comparison websites in the country.

Figure 8 – Performance indicators - Comparability of offers



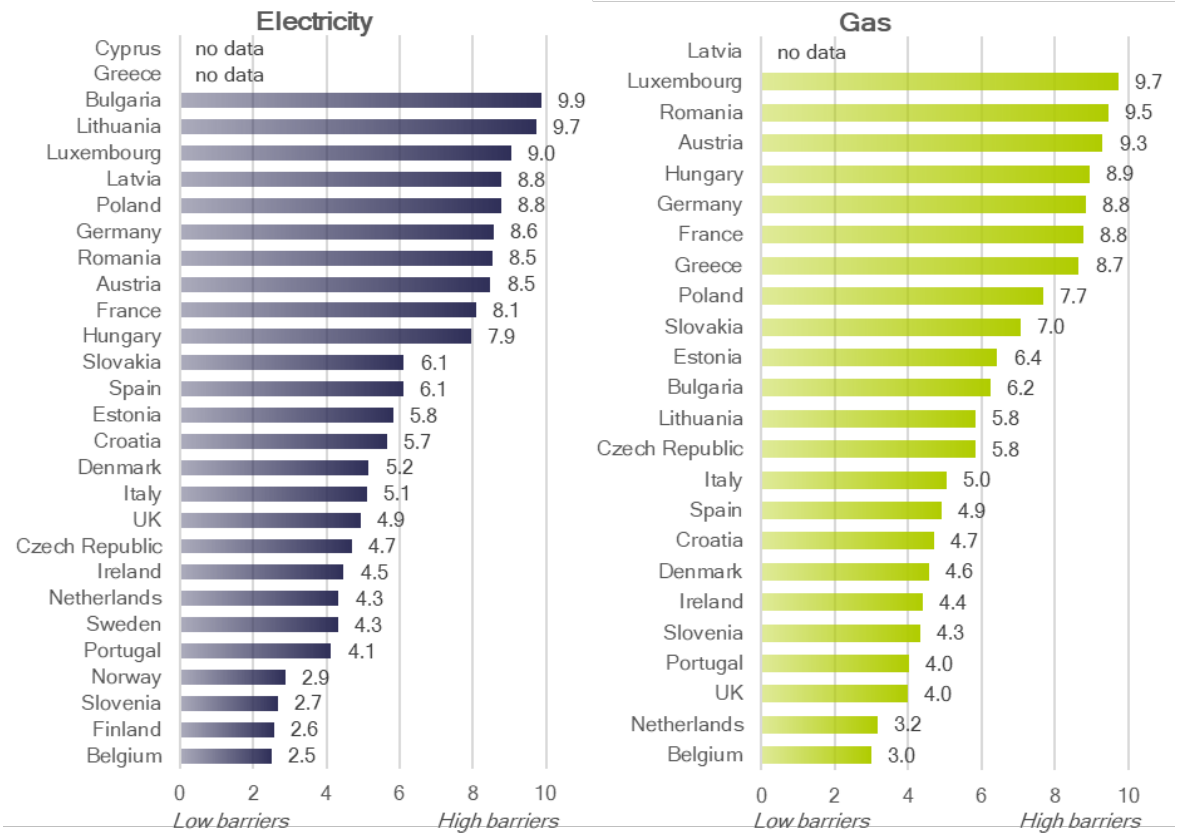
The indicator scores are similar for the two markets (4.3 and 4.5 in average), and the ranking is almost identical. It suggests that comparison websites mainly cover both markets, and the offers are also communicated in a similar way.

The top performer is Portugal in both markets, as many reliable comparison websites are available, and this is reflected in customers' opinions as well. Austria, Ireland, France, Estonia and Germany are also amongst the best performers in both markets.

The perceived difficulties of switching are also measured based on DG Justice's survey. The indicator incorporates the experience and opinions both of customers who have switched, and also of those who have not because they faced obstacles or thought it might be too difficult. A high score is attributed if the high share of consumers reporting bad experiences with, or a poor opinion of, the switching process, among all customers who considered switching.

On average, approx. 60% of the customers have had a bad experience or opinion of the switching process in both markets, which is a quite high number. In relation to electricity markets, three groups of countries can be separated based on the indicator score. Ten countries received close to, or above, 8 points (80%), twelve countries achieved an intermediate score of around 4-6 points, and there are four countries (Belgium, Finland, Slovenia and Norway) with between 2.5 and 3 points. Regarding the gas markets, the results are more continuous, but a similar categorisation can be made: seven countries has close to or above 9 points, while two countries (Belgium and Netherlands) achieved ca. 3 points.

Figure 9 – Performance indicators - Difficulties of switching



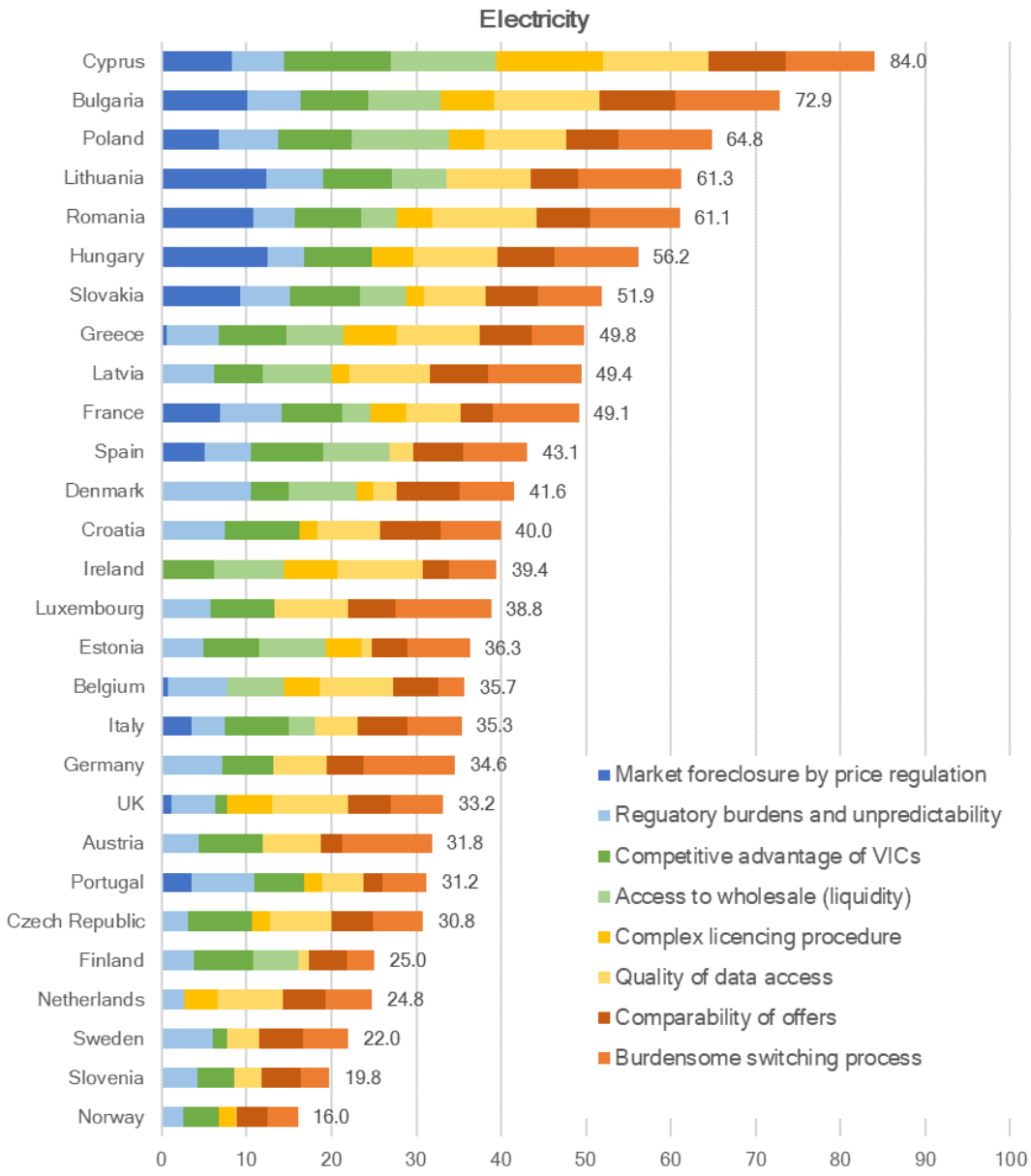
Barriers Index and Ranking

Electricity

Main results

The overall result of the Barriers Index on the electricity markets is presented below. According to the index, entrants to the Norwegian market faces the fewest barriers, but the electricity markets of Slovenia, Sweden, Netherlands and Finland are also outstandingly entrant friendly. The common feature of these countries that they do not regulate the end-user prices, and there is no licencing obligation for new suppliers (except in the Netherlands). On the other side, Cyprus is the toughest nut to crack for a supplier (reaching 84 point out of the maximum 100), while Bulgaria, Poland, Lithuania and Romania are also amongst the high-barrier countries. In general, countries with extensive price regulation (dark blue bar) are at the top of the list.

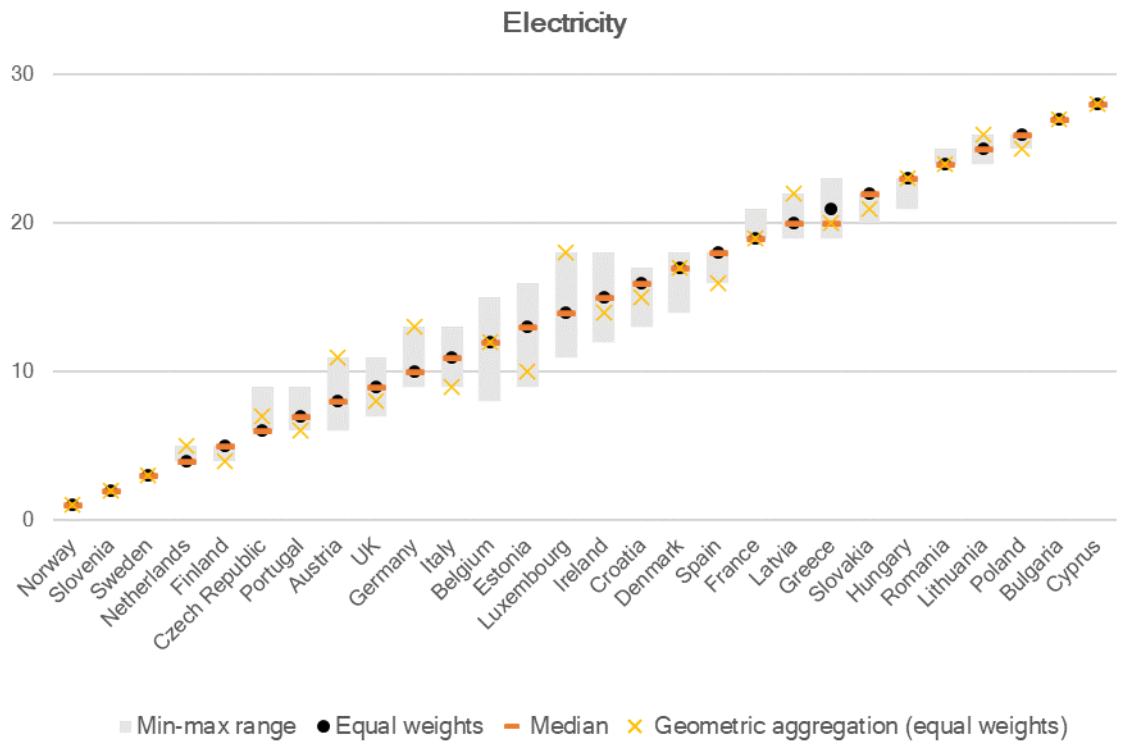
Figure 10 - Barriers Index - Electricity



Ranking and sensitivity analysis

The following table presents the robustness of the Barriers Ranking. The grey bars show the range of the rankings with different (randomised) weightings, the red lines present the median of the rankings, while yellow X shows the ranking position based on geometric aggregation (instead of additive aggregation).

Figure 11 - Barriers Index Ranking Sensitivity - Electricity



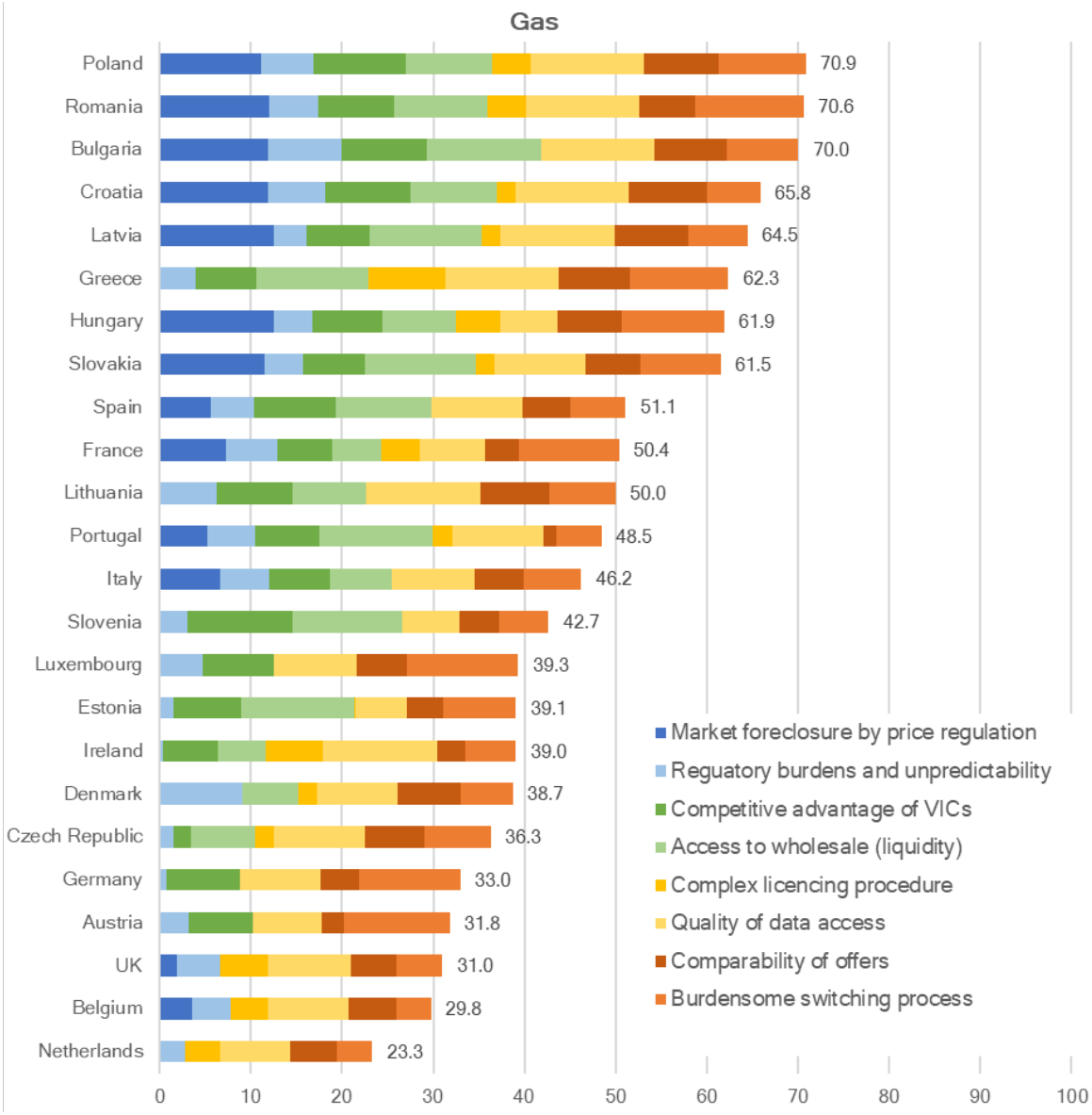
We can conclude that the ranking is highly robust, especially at the two ends: the best and the worst performer countries are the same, irrespectively of the chosen weights or aggregation method. The ranking shows greater sensitivity in the second and third quartile (5-15 positions), however, the main results and the median ranking are very similar for these countries as well. Geometric aggregation (which awards the more balanced performances) suggests that Italy and Estonia has a close to average score in every dimension, while Austria, Germany and Luxemburg received more extreme (very good and very bad) values for the different indicators. If we consider barriers as rather complimentary than substitutive conditions (a market has to be open from every aspect to attract entrants), the former situation is better than the latter.

Gas

Main results

Amongst gas markets, the Netherlands is in first place, while the Belgian, the British, the Austrian and the German markets are also open for new entrants. Poland, Romania and Bulgaria are mainly closed (achieving approx. 70 points out of 100), and suppliers face significant barriers in the gas markets of Croatia, Latvia, Greece, Hungary and Slovakia as well.

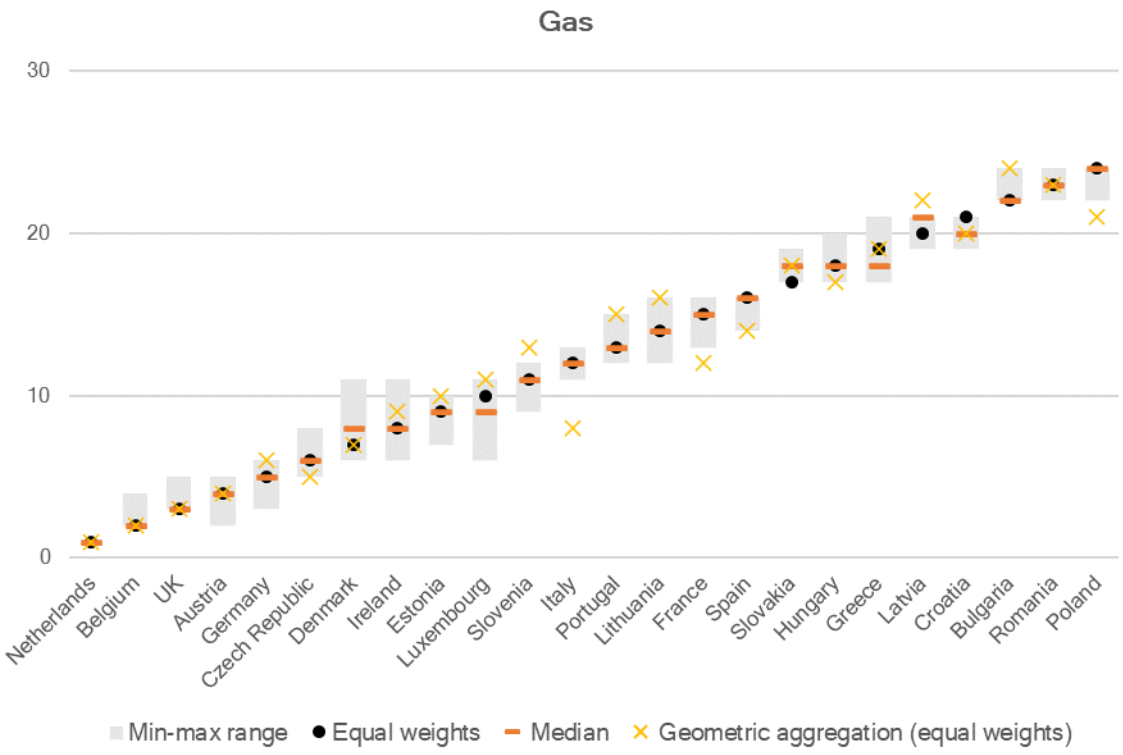
Figure 12 - Barriers Index - Gas



Sensitivity analysis

In general, the Barriers Ranking can be considered as robust for the gas markets too. In comparison with the electricity ranking, there are more countries where the exact ranking position would change with different weights. However, the min-max range for these countries are smaller. Netherland is the best performer with every weighting and aggregation method. The geometric aggregation would lead to better scores for Italy, and also France and Spain (for their more balanced performance), while Slovenia, Portugal and Lithuania reached their middle-range positions with a mix of low and high barriers.

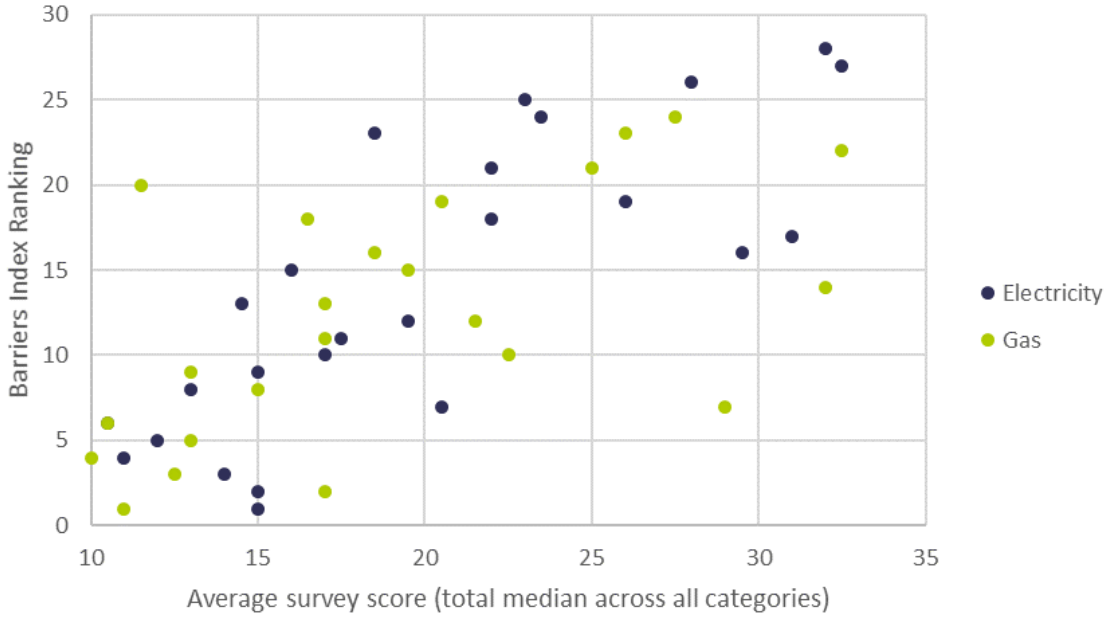
Figure 13 - Barriers Index Ranking Sensitivity - Gas



Connection with the survey results

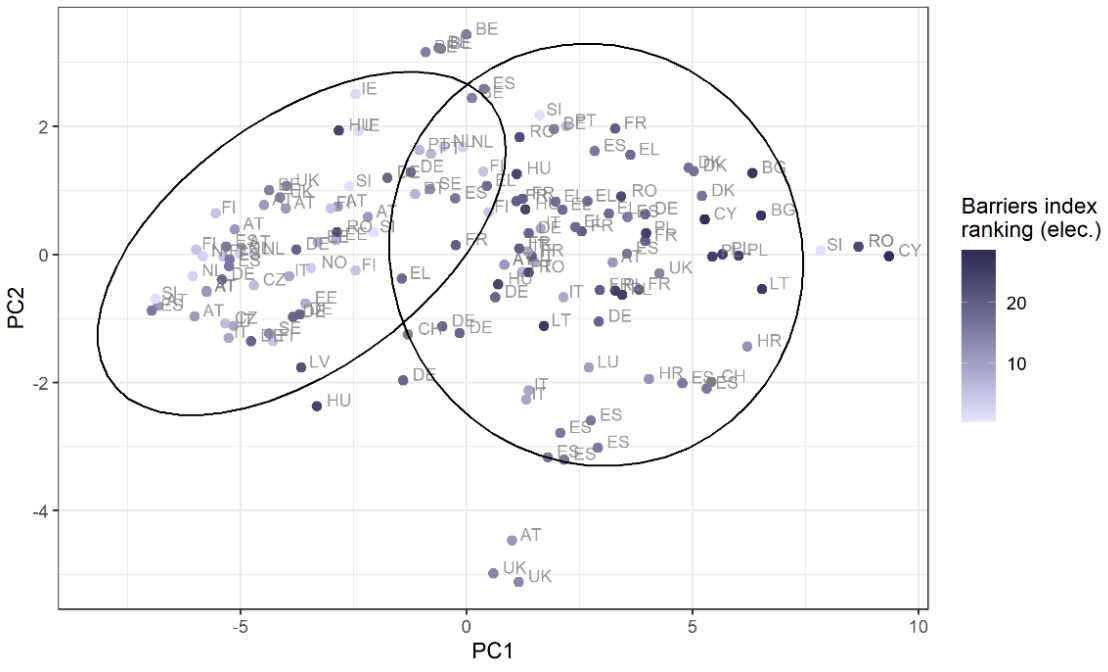
The Barriers Index Rankings were supported by the findings from the stakeholder survey. In both electricity and gas, countries that were ranked more highly in the Barriers Index (i.e. had higher barriers) also had higher average scores across all question categories. This connection was statistically significant for both products, although stronger in electricity (correlation is 0.8 in electricity and 0.58 in gas).

Figure 14 - Connection between the Barriers Index Rankings and the survey results



Similarly, the clustering analysis of the survey results showed that countries that fell within the first cluster (higher PC1, broadly reflecting that key barriers were perceived as more important) tended to be those with higher barriers rankings, i.e. greater barriers perceived across the market. This consistency between the questionnaire and Barriers Index suggests that countries with less favourable conditions regarding the five main areas above (i.e. those questions that tended to score similarly within a response) also have less favourable market environments overall, as shown by the index.

Figure 15 - Clustering of questionnaire responses in relation to country's Barrier Index ranking



Summary

The following table presents the ranking of European retail electricity and gas markets based on the Barriers Index.

Electricity markets	
Rank	Country
1	Norway
2	Slovenia
3	Sweden
4	Netherlands
5	Finland
6	Czech Republic
7	Portugal
8	Austria
9	UK
10	Germany
11	Italy
12	Belgium
13	Estonia
14	Luxembourg
15	Ireland
16	Croatia
17	Denmark
18	Spain
19	France
20	Latvia
21	Greece
22	Slovakia
23	Hungary
24	Romania
25	Lithuania
26	Poland
27	Bulgaria
28	Cyprus

Gas markets	
Rank	Country
1	Netherlands
2	Belgium
3	UK
4	Austria
5	Germany
6	Czech Republic
7	Denmark
8	Ireland
9	Estonia
10	Luxembourg
11	Slovenia
12	Italy
13	Portugal
14	Lithuania
15	France
16	Spain
17	Slovakia
18	Hungary
19	Greece
20	Latvia
21	Croatia
22	Bulgaria
23	Romania
24	Poland

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