

Chapter 11
Conclusion

11-1 Research results

The creation of competitive electricity markets raises complex economic and public policy issues that are not amenable to an easy solution(s). Contrasted results of international experiences show the difficulty of the task. In this context, this work presents a first attempt to analyze the role of power exchanges in the creation of a single competitive European electricity market. We have tried to combine the contribution of general economic theory, more precisely of industrial organization, with the available literature on electricity markets and have used as many lessons as possible drawn from international experiences in the field.

In the first part of this work (chapters 2-3-4) we have presented the current developments of electricity markets in Europe and the different theoretical approaches in the literature. In this part we have seen that the emergence of organized markets, such as electricity power exchanges, is an important feature of the design of the actual European electricity market, though not mentioned in the initial electricity Directive. Hence, paradoxically the design of the “European” electricity market has been left to each national country (chapter 2). We have then identified three levels of market design. Interestingly, it appears that only the general level of market design (industry structure, i.e. unbundling, third party access, market opening) has been addressed by the Directive 96/92 and that the two other levels (wholesale market design and marketplace design) have not been considered (chapter 3). Subsequently, we have presented an overview of the alternative market models present in the economic literature and their applications in electricity markets. We have divided the analysis into two parts: power exchanges as organized marketplaces (part 2) and power exchanges as part of the wholesale market design (part 3). The survey of existing literature showed that little work has been done, to date, on this issue in Europe due mainly to the fact that most power exchanges have only recently been created. Hence one of the main interests of this work has been to look at a very recent and important issue of the European liberalization process, i.e. the creation of

organized marketplaces, that is power exchanges, and to provide an analysis at the European level. To date most existing works have been conducted at the national level. This makes this work a primer on several aspects with all interest and (unfortunately) shortcomings of a primer.

Since little attention has been paid to the role of power exchanges in Europe, the second part of this work (chapters 5-6-7) starts with a detailed description of the functioning of electricity power exchanges as marketplaces with special attention to the price determination process. We have presented the different types of product traded on power exchanges and how prices are determined based on player's bids. The contributions and shortcomings of auction theory have been discussed. Since spot trades on a power exchange lead to physical delivery we have identified the relationship between these two aspects. In contrast with other models power exchanges in Europe do not take into account technical constraints such as congestion within the hub they cover (chapter 5). Subsequently, we focused our attention on how market participants use power exchanges. A typology of strategies according to the nature of players and different types of bidding behaviors were defined, and an analysis of arbitrage strategies described in the Enron memos was presented to help us understand the diversity and complexity of behaviors on power exchanges (chapter 6). Finally, since individual behavior on power exchanges is not directly observable we looked at the results of such behavior on competition through an analysis of two types of market structure and a direct analysis of price and volumes traded on several major power exchanges in Europe. Such analysis shows the low level of interconnection between countries with respect to national demand and important differences between the "physical" market structure (generators) and the "commercial" market structure (participants on the exchanges) and also the difference between countries. The direct analysis of price and volumes showed strong deterministic cycles including, intraday and day of week effects. In general several similarities between price developments on the different power exchanges studied, especially with respect to the variations of demand over time,

were identified. However, some differences between countries remain such as the volumes traded on these markets (chapter 7).

While the focus of the second part of this work was the individual functioning of power exchanges, the third part of this work (chapters 8-9-10) deal with the role of power exchanges at the European level. Using different quantitative techniques, we tested the level of integration of the European market for the year 2002. Our study made four new contributions to the literature by analysing wholesale prices for the year 2002, the first year when power exchanges in France and in the UK were operational, which allowed us to take into account the central geographical position of France. We reduced the impact of seasonality by differentiating different periods (weekdays/weekends; baseload/peakload.) We estimated different levels of integration (national and international) by comparing results based on power exchange prices with bilateral market prices. The analysis demonstrated that a good level of integration exists at the national level between power exchanges and bilateral markets while the level of integration at the international level is relatively low. This shows that power exchange prices provide a reliable source of information for price developments in national markets and that the objective of an integrated market has not been reached (chapter 8). In the following chapter we tried to explain the reasons for such low market integration. The hypothesis we developed is that the actual wholesale market design at the European level lacks efficient transmission pricing which hampers the development of an integrated market. Comparison with international experiences showed that it appears to be fundamental to electricity markets that a single institution combines system operation (TSOs) and market operation (power exchange). In Europe transmission pricing and energy trading are treated separately, leading to the need for a physical transmission rights system. Such a system presents serious limitations with respect to efficient usage of the system and loop flows. This finding is supported by empirical evidence that suggests that the outcome of actual transmission pricing, based on separated auctions of interconnector capacity, is far from what should be expected in an efficient

market (chapter 9). Several measures need to be taken with respect to market design and with respect to “market regulation” in general to improve the functioning of the market. We thus considered a broad definition of regulation which included promoting competition through market design and preventing unfair trading practices through market monitoring. In markets characterised by short-term inelasticity of demand, a concentrated structure and a design in transitional phases, opportunities for abuse of market power represent the main reasons for effective market monitoring. The Directive 96/92 defines a very basic framework for the creation of a European electricity market but does not provide guidance on the details of what the market should look like. To date the European Commission has focused its monitoring on the implementation of the Directive and has not paid due attention to wholesale market design and wholesale market performance. Moreover, recent work by the EC and ETSO seems to show a lack of a clear perspective on what the European electricity market should look like. To move forward, we have suggested a practical approach, and recommendations for improving the actual functioning of the European electricity market, by defining what kind of indicators need to be constructed using power exchanges as a source of information to ensure effective market monitoring and to improve market design (chapter 10).

11-2 Follow up research

This work shows how the lack of market design represents a barrier to the construction of a single European electricity market. This issue has been widely overlooked in Europe. An important body of theoretical literature is available in the US on this topic but few applications to the European context are available¹. Market design is a very recent issue that covers a wide area of topics. Our approach has combined empirical observations, international comparisons and theoretical literature. As such, it will hopefully pave the way for further research and can always be extended. It can be completed using other approaches such

¹ In this respect, the paper of Boucher and Smeers (2001) and Smeers (2001a) should be noted as exceptions that represent the principal and most valuable contributions on the topic

as simulations of how market participants behave and the use of models to estimate market outcomes. Moreover, several theoretical questions and practical problems are still unsolved. Further research may include:

- Power exchanges are organized around auctions to determine prices. However, little is known about the relationships between auction format and bidding behavior. Further research into auction theory should help us to understand how bidding formats affect the degree of competition. Moreover, the advantages of other types of auctions other than marginal pricing and pay-as-bid should be considered (e.g. Vickrey auctions).
- Actual European electricity markets are a combination of several markets (power exchanges, OTC, balancing markets, and auctions for interconnector capacities). As showed by the Enron memos the existence of several markets opens these markets to a large range of behaviors. It would be interesting to investigate to what extent such a combination of markets affects the behavior of participants with respect to the relationships between the different markets. Modeling might be considered for this purpose.
- In parallel to the creation of an integrated electricity market, the European Commission is dealing with other important issues such as the promotion of renewable energies, the Kyoto protocol, and the question of a public/universal service level, which may have important impacts on the functioning of wholesale markets. For instance, it would be interesting to analyze the impact of incentive mechanisms for the promotion of renewable energy sources on competition to avoid systems that create distortion of competition.
- The central role of a transmission operator is a common feature in different market designs for creating wholesale competitive markets, and one of the fundamental assumptions is its neutrality and efficiency. However due to its

monopoly position, the strategic behavior of the TSO should be considered and the extent of its neutrality should be challenged.

- The analysis presented in this work focuses on the major power exchanges in Europe. As soon as power exchanges exist in all European countries, it would be interesting to extend the analysis of market integration. Moreover, other econometric techniques may be considered to analyze the evolution of market integration and the efficiency of bilateral auctions for interconnector capacities.
- Some market designs incorporate market power mitigation features such as price caps, bid caps, and reserve prices in several electricity markets, due to potential market power abuse. To date there is no clear consensus as to whether such measures really mitigate market power or whether they create perverse incentives. Theoretical and empirical research in this area would be of particular interest.

11-3 Final remarks

The introduction of competition in the European electricity industry in Europe, initiated by the EU Directive 96/92, has involved a massive transformation of the industries organization but has not lead, to date, to the creation of a single market. Liberalization in the electricity industry is a complex process because it needs to account for political considerations, interest groups, technical constraints and economic efficiency aspects. An additional difficulty in Europe is that the objective is not just to introduce competition in each country, it is also to integrate the different markets. A major obstacle is the different starting points, i.e. market structure, institutions, and histories, that exist in the various countries. However, since the physics and the economics of power systems are the same, solid economics and technical expertise can be used to underpin the process of integrating the European electricity markets.

Paradoxically, while the peculiarities of electricity are well-known, e.g. non-storability and loops flows, the creation of a single European electricity market is based on the assumption that electricity is like any other good which means that no specific market design is required. To date most attention has focused on market opening and increasing of interconnector capacity while the issue of market design, which is at the heart of market functioning, has been widely overlooked. The assumption behind the European process is that opening access to networks and increasing interconnection capacities will be sufficient to create an integrated market. Such assumption appears to be incorrect. Opening access to networks alone is of little use in the absence of institutions that facilitate access to these networks and in the absence of consistent rules that facilitate trading. Increasing interconnection capacities, although it definitely would support the liberalization process by increasing the number of players competing against each other and would dilute market power, is not a realistic solution in the short and medium term for several reasons. One, interconnectors are large infrastructures that take time to build. Two, the cost of building a new line between two countries may need more investment than just that needed to put in the new line because it would require national grids to be reinforced. Three, there is the question of who will pay for such large investments when return is regulated and will be spread out over a period of 30 to 50 years. Last but not least, licensing procedures and environmental constraints make it very difficult in practice for potential investors to obtain authorization. Instead of focusing exclusively on new investments in interconnection capacities, effective market design needs to be considered because it can provide the necessary coherent scheme for trading arrangements and market institutions to support network access. On its own an efficient market design is not sufficient to create a single competitive market, because transmission constraints create separate markets, but at least efficient market design would support optimal use of the existing infrastructure.

Short-term markets provided by electricity power exchanges are of particular interest because, though imperfect, they represent the beginnings of market design. Efficient short-term markets are critical because short-run signals are essential for providing incentives for additional investments. Moreover, they facilitate trading for market participants and facilitate monitoring for public policy makers. Power exchanges are now part of the initial conditions for further reforms and represent a powerful tool that can be used to develop a really competitive European wholesale electricity market. As the role of power exchanges is likely to change significantly in the next few years, the present analysis is intended to be a useful benchmark against which to compare further changes.

In conclusion, efficient monitoring based on empirical observations and combined with theoretical considerations appears to be a well-suited approach for improving market design. An important issue in designing electricity markets is the ability of the policy makers to take into account the fact that each market is part of a larger system. In Europe especially, where the final objective is to constitute a pan-European market, each Member State should avoid designing its electricity market while disregarding developments taking place in other countries. This is particularly important with the coming EU enlargement. Finally, one risk for public policy makers, when looking at market design issues, is to consider such issues as details. Yet details matter in vital markets such as electricity markets where supply and demand interact instantaneously and continuously, and where any major failure has disastrous economic and social costs, as illustrated by the major blackout that took place in North America in 2003.

