

The role of power exchanges for the creation of a single European electricity market: market design and market regulation

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Summary

The electricity sector worldwide is undergoing a fundamental transformation of its institutional structure as a consequence of the complex interactions of political, economic and technological forces. The way the industry is organized is changing from vertically integrated monopolies to unbundled structures that favor market mechanisms. This process in Europe, known as the liberalization process, has had a wide impact on the European electricity industry. The focus of this dissertation is an analysis of the role of electricity power exchanges in the recently liberalized electricity markets of Europe. In the context of creating “a” competitive electricity market at a European level, the key questions considered are the functioning of these power exchanges with respect to electricity characteristics, market design and regulatory framework.

In Europe, very little attention has been paid to the role of these new marketplaces and to the issue of market design in general. Hence the main purpose of this work was to analyze how these marketplaces facilitate the trading of electricity and the role they can play in the construction of a pan-European competitive electricity market. An analysis of power exchange requires taking into account the “double-duality” of such institutions. One, power exchanges are both a market and an institution. As a market they facilitate the trading of electricity and determine an equilibrium price. As an institution power exchanges have their own objectives and constraints, and play a role in the market design of the

overall electricity market. Two, the relationship between electricity power exchanges and liberalization is neither linear nor one way: liberalization encourages the birth of such marketplaces yet marketplaces are more than the results of such process, they are also a driving force of the liberalization process.

This thesis is divided into three parts. The current situation in Europe and different existing theoretical approaches in the literature are presented as a starting point for the analysis in **part 1** of the thesis. The EU legal framework of the liberalization process, the role of electricity trading and the emergence of power exchanges is presented first (chapter 2). In this chapter we define a model including power exchanges which will be used as an analytical framework for the analysis. The theoretical concepts that will be used for the analysis are presented in the following two chapters. First, the different theoretical approaches of market design are presented (chapter 3). Then the economic theory models of market functioning and their application to electricity markets are discussed (chapter 4). This description led us to divide the analysis into two parts: power exchanges as organized market places (part 2 of the thesis) and power exchanges as institutions that are part of the global wholesale market design (part 3 of the thesis). In part 1 of the thesis we show that the emergence of power exchanges in Europe is a fundamental aspect of the actual design of European wholesale electricity markets; and that existing theoretical literature can provide guidance for an analysis, but that literature pertaining to the European situation is rather limited.

In **part 2** of the thesis power exchanges are considered as marketplaces with a specific type of functioning (chapter 5) which in turn involves interaction from participants (chapter 6). Finally the concrete output of these interactions is analyzed using empirical observations to estimate the level of competition on power exchanges (chapter 7). The main contribution of part 2 of the thesis is to provide a primer on the functioning of power exchanges in Europe which differ from other organized electricity markets and which have so far received little

attention. Looking at the electricity markets at the European level, it can be seen that most power exchanges have been designed separately and that they have been designed to function at a national level. Keeping in mind that the objective of the liberalization process in Europe is to create a single electricity market, the results derived in part 2 of the thesis are taken as the starting point for part 3 of the thesis in which we determine if such a piecemeal design process has resulted in the creation of a single integrated electricity market.

Part 3 of the thesis begins with an empirical estimation of the level of integration of European electricity markets. The level of integration is estimated using an econometric test based on power exchanges prices (chapter 8). Such an analysis shows a low level of market integration at the European level. In the next step of the analysis an attempt is made to explain the reasons for such low market integration. The hypothesis developed is that the actual wholesale market design at the European level lacks efficient transmission pricing (chapter 9). We then present some different theoretical approaches to transmission pricing (Nodal/Zonal) and an analysis of actual successful examples of integrated markets (PJM, Nord pool). We conclude by providing some empirical evidence of inefficient transmission pricing in Europe. Finally we argue that the creation of an integrated market requires design at the European level rather than national market design (chapter 10). We present the positive points and drawbacks of the recent works realized by the European Commission and other European bodies such as the European Association of Transmission System Operators and the Council of European Energy Regulators. Finally, we emphasize the importance of “market” regulation through monitoring market design developments with particular attention paid to market power concerns. The objective of this part of the thesis is to show that design is a major missing piece of the European liberalization process; and that the issues of transmission pricing and market power especially, while fundamental to the creation of competitive electricity markets, have been widely overlooked. The concrete output of this part of the thesis is a definition of the main principles of a “European framework for market

regulation” emphasizing the role of power exchanges through several recommendations for a step by step approach to the creation of an integrated market.