Energy Economics 46 (2014) 102–111

Contents lists available at ScienceDirect

Energy Economics

journal homepage: www.elsevier.com/locate/eneco

The extent of European power markets ☆

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ARTICLE INFO

Article history:
Received 8 November 2012
Received in revised form 3 September 2014
Accepted 7 September 2014
Available online 16 September 2014

JEL Codes:
C13
L94
F15
Q41
Q48

Keywords:
Market structure
Spatial market delineation
Time series econometrics
Empirical industrial organization
Energy markets
Electricity
Europe

ABSTRACT

There is an ongoing debate on the degree of integration of European wholesale power markets. A major task of the European Union is the creation of a common market in Europe and a common power market is an important part of this goal. The literature analyzing the degree of integration of European energy markets is growing and provides mixed results. We add to this literature by using national holidays as exogenous demand shocks to measure integration of European energy markets. Our main findings indicate that integration of European wholesale energy markets has increased with regard to Germany and Austria as well as Belgium and the Netherlands.

1. Introduction

The creation of a common market in general and a common energy market specifically is an important goal of the European Union (EU). To reach this goal, transmission capacities between countries have been increased and a tendency towards more market integration in European wholesale energy markets can be observed. Additionally, the degree of market integration is also fostered by so-called market coupling between several countries. However, market integration in the sense of a common European wholesale energy market and antitrust markets are not necessarily the same. We discuss this issue in later sections in more depth. The extent of European power markets has been debated extensively over the last years. Are national energy markets still separated or do we observe convergence towards a common European wholesale energy market?

Many empirical studies conduct tests based on prices to test the degree of market convergence in energy markets (see e.g. De Vany and Walls, 1999; Nitsche et al., 2010; Robinson, 2007; Zachmann, 2008; Mjelde and Bessler, 2009; Kalantzis, 2010). Power markets and particularly power prices are driven by many factors and often these factors are common for several regional markets. Due to this reason, the search for exogenous shocks is an important task for market delineation and analysis of market integration. Our paper proposes a new method to test for market integration for wholesale electricity markets based on national holidays as a source of exogenous demand shocks. Most European countries have their own national holidays, which differ from national holidays in neighboring countries. On holidays demand for power decreases significantly, creating free generation capacities which could be bid into power exchanges in other countries. As a result, in other countries there is ceteris paribus a given demand facing a much higher supply, which should have significant effects on prices. Using national holidays as shocks has the advantage that these shocks are clearly exogenous to wholesale power prices in neighboring countries.[1]

The remainder of the paper is as follows: In the next section we give a short overview about European wholesale power markets as

☆ We thank two anonymous referees for their very thoughtful comments. This paper has also greatly benefited from discussions with the participants of the EALE 2012, Mannheim Energy Conference 2012, CRESSE 2012 and Dice Brown Bag Seminar. We are grateful for the comments by Justus Haucap.

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[1] See Platts (2014) for an example of price drops in Germany due to a holiday in France.

http://dx.doi.org/10.1016/j.eneco.2014.09.004
0140-9883/

background information for our empirical analysis. Section three describes price-based tests for market delineation and their strengths and weaknesses. The following chapters discuss our empirical strategy and the data. In the subsequent sections the results are presented and section seven concludes.

2. Integration of European power markets

2.1. Constitution of an internal electricity market

The liberalization phase of European electricity wholesale markets was initiated between 1990 and 2000, with different kinds of market designs and degrees of privatization as part of an effort to create the single European Internal Energy Market (IEM) by 2014 (European Commission (COM), 2012), which incorporates electricity and other primary energy sources, e.g. gas.[2] The principles of the IEM see a process of increasing competition and market integration, so the common market should increase cross-border energy trade, foster security of supply as well as decrease costs of electricity (Padgett, 1992). This necessitates a common set of rules which firms have to follow. Directive 96/92/EC introduced these common rules for an internal electricity market in Europe. Since then, further additions and changes such as legal and functional unbundling have been implemented. The geographical extent of the future IEM is indicated by Fig. 1.

The IEM expands over the entire Western, Southern, and Northern European countries as well as the EU member states of Central-Eastern Europe. Despite efforts to increase competition after the first stage of liberalization, e.g., unbundling of vertically integrated companies, the majority of wholesale electricity markets is still dominated by few major generation companies[3] and competition authorities as well as regulatory agencies still delineate markets on a national basis.[4] If structural conditions on a national level do not facilitate competition, remedies could be increasing competitive pressure by facilitating access to the market for foreign suppliers. A precondition for competition is the reduction of geographical and commercial barriers to entry such as insufficient physical transportation facilities, discriminatory rules for the allocation process of cross-border electricity exchange or barriers to cross-border activities in national legal frameworks, as different trading hours or product definitions (Cornwall, 2008).

The lack of cross-border transmission capacities is obviously an important reason for a potentially low level of cross-border competition, because in grid-bound markets transportation of electricity between different areas would be impossible. The second element refers to the economically efficient utilization of additional generation capacity via allocation rules and matching of commercial rules of respective power markets. Today, market coupling is often introduced as an efficient way to utilize the cross-border trade potential between two areas (ACER/CEER, 2012). Market coupling takes cross-border transmission capacities and the bids and asks of two or more power exchanges into consideration and allocates them efficiently.[5] As a result, two market areas that share enough transmission capacities also share the same price. Many markets have been coupled on a regional level already and this can be seen as a step-wise process towards the IEM:

- Northern Region: Sweden and Norway (1996), followed by Denmark (1998) and Finland (2000) and, recently, Estonia and Poland.
- Central Western European (CWE) Region: France, Belgium, and the Netherlands (2006), Germany (2010) and UK (2011).
- Both regions are also linked since 2010 between the Netherlands and Norway as well as Germany and Denmark and Germany and Sweden.
- Other coupled areas such as Italy and Slovenia, Spain and Portugal, or the Czech Republic and Slovakia are not considered in this paper.

3. Empirical market delineation and power markets

In this section, we discuss two topics which are important to our analysis. First, we explain why the concept of market integration and the relevant antitrust market do not necessarily mean the same. In the second part of this section, we then describe the most popular empirical methods of market delineation in the context of energy markets.

In antitrust economics, the definition of the relevant market touches two different dimensions: product characteristics and geographical size. Inside this framework, firms are constraint in their behavior through competitive pressure, which means that transaction and switching costs are low enough to facilitate demand- or supply-side substitution. In the case of electricity, this means that the product characteristics of the good are close to perfect homogeneity, differentiated only through time, e.g., balancing power vs. long-run commitment. The geographical size depends on whether suppliers of different regions can physically and economically challenge one another.

Market integration here refers to the implementation of joint commercial trading rules and sufficient physical connections to enable an efficient balance of power consumption and production between market areas. Perfect integration thus means that production happens at minimum costs and that both price areas exhibit equal prices. Still, both terms market integration and the relevant antitrust market are not necessarily congruent, i.e. a relevant antitrust market, and hence sufficient competition, does not necessitate perfect market integration (see also Padgett, 1992).[6] Sufficient pricing constraints in a relevant energy market translate into sufficient supply from outside the national borders. Inside the peak-load pricing framework, these constraints can already be strong enough if there are only a few suppliers that facilitate competition in the most important hours, i.e., during hours of tight supply–demand ratios.[7] So while prices between two candidate markets may not be equal all the time, they do not diverge systematically, e.g. due to persistent use of market power.

The elimination of economic and physical barriers through market coupling and expansion of physical transmission capacities is an important task in European energy policy. However, the current process of market integration does not necessarily result in an inter-regional antitrust market which is exemplified by a statement of the Bulgarian State Energy and Water Regulatory Commission (SWERC, 2012):

> "*The electricity market in Bulgaria can be characterized as national and at the same time, well-integrated with the neighboring countries.*"

Apparently, there may still be a discrepancy between what is regarded as a well-integrated market and a single antitrust market. It is the subject of our paper to contribute to the literature on market integration using exogenous shocks for identification. This leads us to the second important part of this section, i.e., the discussion of the set of empirical market delineation methods. An empirical delineation often includes a discussion of the trade-off between identification accuracy on the one side and data requirements as well as model assumptions on the other.[8]

[2] See Sioshansi (2008) and Sioshansi and Pfaffenberger (2006) for a thorough introduction to the subject.

[3] However, the dominance is changing in some countries due to the introduction of renewable energies which nowadays often have significant shares of power generation capacities.

[4] See European Commission (2007) or ACER/CEER (2012) for reports on this topic.

[5] The necessary condition is the absence of discriminatory practices or other abuses of market power of the operator.

[6] An example from another liberalized market is the substitution between fixed and mobile telecommunications with regard to access as well as usage or traffic. On a regulatory level, both markets are still regarded as distinct despite a growing literature which shows that there are competitive constraints between them (see Barth and Heimeshoff, forthcominga, forthcomingb).

[7] A tight supply–demand ratio means that supply barely exceeds demand due to very high demand, supply shortages or a combination of both.

[8] Davis and Garcés (2010) provide a good overview on the most popular set of methods.