

Cost and quality gains from diversification and vertical integration in the electricity industry: A DEA approach

Pablo Arocena *

Universidad Pública de Navarra, Dpto. Gestión de Empresas, Campus de Arrosadía, 31006 Pamplona, Spain

Received 27 December 2005; received in revised form 15 September 2006; accepted 15 September 2006

Available online 24 October 2006

Abstract

This paper analyzes the degree of economies of vertical integration, diversification and scale in the electricity industry by means of Data Envelopment Analysis. We estimate the impact that alternative forms of unbundling would have on the cost and quality of supply, measured as the number and duration of supply interruptions, in a group of Spanish electric utilities. We find evidence of the existence of cost and quality gains from integrating power generation and distribution in the range of 1.1 to 4.9%, whereas diversifying the source of power generation saves between 1.3 and 4.3% of costs and quality. Finally, the scale efficiency of the largest utilities could be improved by dividing them into smaller units, provided that their current vertical scope and generation-mix are preserved.

© 2006 Elsevier B.V. All rights reserved.

JEL classification: D24; L94; L11

Keywords: Economies of scope; Diversification; Vertical integration; Scale efficiency; Electricity; DEA

1. Introduction

As is well known, since the beginning of the 90s the electricity industry worldwide has been subjected to fundamental changes. The traditional structure of the industry, organized around monopoly and public ownership, was abandoned in order to open up the sector to competition. Hence, in the last fifteen years we have witnessed the break-up of public utilities before (and after) its privatization, the vertical separation of businesses (unbundling) and the creation of wholesale markets, to cite only the major cornerstones of the liberalizing reforms.

* Tel.: +34 948169684; fax: +34 948169404.

E-mail address: pablo@unavarra.es.

Nevertheless, soon after liberalization it was made evident that the scope of such structural reforms in some countries was insufficient to guarantee a competitive market performance. Basically, the problems arose because of the excessive market concentration, where major incumbents enjoyed substantial market power. To remedy such anticompetitive behavior, some regulatory authorities promoted the further partition of large firms in smaller units and thereby increasing the number of competitors. Thus, the British electricity regulator required the two major generators (privatized some years before) successive plant divestments in order to improve the efficiency of the wholesale power market (OFFER, 1994, 1998). In California, and other US States, financial incentives were introduced (e.g. higher allowed rate of return) to induce divestiture of 50% of the fossil-fuel generation assets owned by the largest utilities. In the same vein, the European Commission has followed a similar strategy in its recent decisions on problematic mergers by adopting policies that encourage entry and promote structural remedies (e.g. divestiture of upstream or downstream assets). For example the acquisition of German electricity company EnBW by Electricité de France was approved subject to the divestment of 6000 MWs of generation capacity located in France (EC, 2001).

Parallel to the pro-competitive dimension of the structural reforms, it is often claimed that there exist some cost advantages associated to vertical and horizontal integration because of the technological interdependencies between stages and the use of common inputs. Hence, the (technically) efficient number of firms as well as their degree of vertical integration depends on the magnitude of the economies of scale and scope. If scale and horizontal diversification economies are limited or negligible, the break-up of large firms in smaller units will have a positive effect in reducing market power without damaging the costs of the resulting firms. On the contrary, if such economies are significant, the partition will lead to efficiency losses and cost increases that could eventually counterweight the benefits derived from a more competitive functioning of the market. A similar argument applies to the vertical scope of the firm. If power could be efficiently supplied by means of specialized firms competing in their respective stages of the business, vertical separation could help to increase the competitive pressure in the market without cost penalties. Conversely, if vertical or scope economies across stages are substantial, potential benefits of unbundling could be counterbalanced by the loss of productive efficiency.

Hence, defenders of large firms and vertical integration allude to the significance of economies of scope and scale, while advocates of unbundling and divestiture remark the benefits of competition and deregulation. Therefore, as Pittman (2003) points out, the estimation of such economies has important policy implications on further restructuring, not only for the electricity industry but also for other infrastructure sectors (e.g. gas, water, railways). However, while a great deal of attention has been paid to the competitive effects of restructuring and divesting policies (e.g. Green, 1996; Day and Bunn, 2001, among others), the analysis of its potential costs in terms of productive efficiency losses has devoted considerable less attention in the literature.

The estimation of integration economies in the electricity industry is therefore a topic of unquestionable interest. Nevertheless, since the pioneering work by Kaserman and Mayo (1991) only a small bunch of studies addressed this question over the 1990s (Gilsdorf, 1994, 1995; Lee, 1995; Hayashi et al., 1997). Even though the topic has seen a revived interest in recent years (e.g. Kwoka, 2002; Nemoto and Goto, 2004; Jara-Díaz et al., 2004; Fraquelli et al., 2005), the empirical evidence is still scarce.

This paper contributes to this literature in two ways. First, while earlier studies estimate some form of multioutput cost function to calculate vertical and horizontal economies in the electricity industry, in this paper we estimate these economies by means of linear programming techniques based on Data Envelopment Analysis (DEA). Secondly, previous work exclusively focuses on the

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات