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Capacity, investment and market power in the economic value of energy firms☆

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ABSTRACT

Regulation of energy firms faces the complex problem of balancing private (earning a fair rate of return on investment) and public (assure safe and reliable supply of energy at the lowest possible costs) goals. Tobin's *q* is a forward looking indicator on investment opportunities and on market power of firms that energy regulators can use for more effective regulation. This paper presents the empirical evidence on the determinants of differences in observed values of Tobin's *q* for a sample of large listed energy firms from 10 different countries in the period 2000–2006. We find that adjustment costs represent around sixty percent of the difference between economic and book value of the assets for the representative firm, while rents from market power represent the other forty percent. Therefore, across countries there is room for regulatory actions aiming at reducing energy prices, but less than what may be inferred from the observed average *q* values.

1. Introduction

In competitive markets, profit maximizing investment and output decisions by firms will assure that product demand will always be satisfied at the minimum costs for the final buyers. However, there are markets where sufficient and effective levels of competition are unlikely to naturally arise and public authorities must intervene, imposing constraints to profit-driven decisions by firms so that the resulting behavior and performance are better aligned with general interests. In this process, both competition and regulation authorities will have to disentangle whether the superior economic performance of some firms compared with others reflects either "true" competitive advantages that stem from better management decisions, or if it reflects anti-competitive practices such as collusion or the creation of strategic entry barriers.[1] In energy markets there are factors such as scale economies, externalities, network effects, non-economic interests, and national security concerns, that justify intrusive regulatory actions whose implementation will require a knowledge of the drives of economic performance of firms as much as competition policy actions will do.[2]

A key issue for regulation of utilities in general and energy firms in particular has been and continues to be what indicators of economic performance of firms should be used to assess whether firms have sufficient incentives to invest and energy prices are sufficiently close to minimum production costs. During the period of rate of return regulation for public utilities (Averch and Johnson, 1962), the regulator would set a maximum on the return on assets (ROA) for the firm constraining their profit and value maximization decisions. The accounting ROA turned to be the key measure of economic performance. The change towards incentives based regulation in the eighties meant a shift from ROA to price–cost margins, return on sales (ROS), operating costs and productivity performance indicators (Newbery, 2003). Current regulatory priorities are changing again towards creating incentives for investment, innovation and dynamic efficiency, which require more forward-looking and comprehensive measures of economic performance than accounting ROA and ROS (Gilbert and Newbery, 1994; Gross et al., 2010;

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[1] Representative examples of these two views are Bain (1956) and Demsetz (1973).

[2] See Armstrong and Sappington (2006) and Vogelsang (2002) for an integrative approach to regulation that includes competition and liberalization policies.

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Vogelsang, 2002).[3] Tobin's q (Tobin, 1969) — the ratio between the contribution to economic value of the assets invested by the firm and the costs of these assets — appears to be the appropriate performance measuring tool in the dynamic framework. Although some recent papers model the investment behavior of energy firms as a function of Tobin's q (Lin and Huang, 2011; Saltari and Travaglini, 2011), there are no empirical papers explaining the observed differences in the q ratio among energy firms from making an assessment of the validity of the ratio for effective regulation. In this paper we provide this assessment. The research findings confirm the usefulness of Tobin's q in energy regulation and provide some guidance for more effective application.

For this purpose we calculate from public data sources a list of accounting and market based economic and financial ratios, including Tobin's q, for a sample of 32 energy firms, headquartered in 10 different countries, listed in the national stock markets and for the end of the years from 2000 to 2006. Since we are not aware of a data base like this one having been built before, previous to the main empirical analysis we provide detailed descriptive information on the observed values of the ratios and explain data sample variability as a function of time and country fixed effects. As said before, the main interest of the paper is in explaining the sources of variability in the values of Tobin's q. For this purpose we formulate and estimate an econometric model that comes out of the solution to a present economic value maximization investment and pricing decisions by a multi-assets firm that faces a price-inelastic product demand, and operates under adjustment costs in transiting from current to desired capital stocks. The model is based on that of Bond and Cummins (2000); however Bond and Cummins formulate the model for a price taking firm so we extend it to the most realistic case for our sample of energy firms, of market power from a price inelastic demand function for their products.

The empirical analysis provides estimates of the marginal contribution to the economic value of the firms of each class of assets hold in the balance sheet, together with the estimate of the potential contribution from rents attributed to market power. The estimated results show a substantial contribution to economic value of adjustment costs from investment in intangible assets in the firms in the sample, and the hypothesis that energy firms have market power in their product markets is not rejected by the data. More precisely, for a representative firm in the sample data, constructed with the median values of the stocks of tangible, intangible and financial assets and with the median value of revenues, we obtain that approximately 60% of the excess of economic value over book value is attributed to adjustment costs and the rest 40% to rents due to market power. We also find that energy firms in the sample, on average, destroy economic value investing in financial assets, in an amount equal to 7.5% of the economic value of the representative firm.

These results highlight the high costs that energy firms face to make their market purchased assets fully productive (installation delays, environmental concerns, safety, training people and so on); the actual detail of these costs does not show up in conventional accounting statements and our indirect estimates of these costs cannot be verified with data on actual costs, a step that would deserve further research. They also indicate that regulations do not prevent the energy firms in the sample from earning economic rents from market power. Regulators should weigh if our estimate of the relative importance of rents from market in the total economic value of the firms, around 14.5%, deserves further regulatory action or not. But, in any case, the figure of the relative contribution to economic value of rents from market power given in this paper is much lower than the figure obtained attributing to market power all the excess of value over cost, 37.5%.

The paper is also related to other studies that use financial ratios, including Tobin's q, and compare the performance of energy firms (Finnon and Midtum, 2004; Jandik and Makhija, 2005; Sueyoshi, 2005; Sueyoshi and Goto, 2012; Sueyoshi et al., 2009). We provide additional evidence on values of financial ratios for energy firms from ten different countries around the world so we can obtain estimates of country effects on the differences among ratios. Another line of research is the one on productivity and efficiency analyses of energy firms. With a few exceptions (Kim et al., 1999), the efficiency studies in the energy industry use data from national firms (see Sueyoshi and Goto, 2012 for an application to Japan's electric power industry and for a literature review). In this paper we estimate the production function that captures the underlying technology of energy production for the firms in the sample. Although the estimation is done for testing the technical conditions of linear homogeneity of the production function under which the valuation equation holds, the results provide estimates of the growth in the average total factor productivity over time for the firms in the sample.[4]

The present paper is organized as follows. Section 2 contains the derivation of the valuation equation used in the empirical analysis as a solution to the problem of a firm that decides on the investment and stock of capital services to maximize value. Section 3 contains a detailed description of the data collected for the empirical analysis, including the comparison across countries, over time and for the two energy industries — gas–electricity and oil — of selected operational and financial ratios. In Section 4 we estimate the parameters of the valuation equation for the sample of energy firms and we use these estimations to obtain the contributions to economic value of purchase costs of the assets, adjustment costs and rents from market power. Finally, in the Conclusion section the main results of the paper are highlighted and they are evaluated in the contexts of the new regulatory trends.

2. Capacity and investment value maximizing decisions by firms and optimal regulation

2.1. Tobin's q and regulation

Tobin's (1969) theory of investment states that firms will continue investing in production capacity as long as the marginal economic value of the investment is higher than the marginal cost. They will stop investing when these two are equal and they will divest when marginal cost exceeds marginal value. Later on this rule was formally demonstrated from a behavioral model of a firm that decides on the stock of capital and the flow of investment over time that maximize the present value of future cash flows, under adjustment costs from capacity expansion (Abel, 1979, 1985; Hayashi 1982). Further refinements extended the theory to situations of uncertainty (Abel, 1983; Lucas and Prescott, 1971), multiple assets (Bond and Cummins, 2000; Hayashi and Inoue, 1991; Wildasin, 1984) and irreversibility (Pindyck, 1991; Dixit and Pindyck 1994; Abel and Eberly, 1994). The marginal economic value of investment is rarely observable but, under certain conditions, it can be properly approximated by the average value of one unit of already installed capital stock. The average Tobin's q, the ratio between the economic value of the assets of a firm (calculated as the sum of market values of debt and equity), replaces

[3] Joskow (2008) and Helm (2009) offer a historic review of the dominant economic thinking on regulatory policies. The ROA regulation was abandoned because it created incentives to over investment (Averch and Johnson, 1962) and because it did not incorporate incentives to cost efficiency. Incentive regulation was instrumented through price caps and the RPI − x formula that translates to the regulated price the increment in the price of inputs (RPI) minus an efficiency target (x). The mechanism creates incentives for cost reduction but firms have incentives to lower the investment base to increase the return from investment for a given profit margin.

[4] The content of this paper is also related to the growing research that compares the different economic performances of some given firms from all economic sectors around the world (Bloom and Van Reenen, 2007).