RESPONSIVENESS TO MARKET OPPORTUNITIES AND PERFORMANCE: AN INTERNAL CAPITAL ALLOCATION PERSPECTIVE

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ABSTRACT

This paper assesses the responsiveness of firms' internal capital allocations to market opportunities and the implications of such responsiveness for firm performance in markets. Evidence from the generation segment of the U.S. electric power industry (1998-2010) suggests that geographically-diversified firms' internal capital allocations are responsive to market opportunities. Restrictions to the flow of financial resources within those firms – stemming from regulation – reduce this basic effect. Interestingly, we find that increased investment responsiveness to market opportunities is associated with weaker firm performance, measured as lower capacity utilization in a market than otherwise expected. Our evidence suggests that this result stems from the fact that investment responsiveness is associated with increased firm exposure to market-level investment bandwagons and resulting detrimental market overcapacity situations.

KEYWORDS: *Capital allocation; Capacity investments; Competitive Strategy; Bandwagons; Performance*

One of the central tenets of management literature is that building and sustaining corporate performance hinges on a firm's responses to environmental conditions (Andrews, 1971; Lawrence and Lorsch, 1967). In general, firms that are more responsive to changes in environmental conditions – either quicker at pouncing on emerging opportunities or in adapting to potential threats – are typically seen as being better positioned to achieve higher returns, and with increased survival chances compared to less responsive firms (*e.g.* Aggarwal and Wu, 2014; Burgelman, 1994; Levinthal, 1997; Nickerson and Silverman, 2003).

A similar belief is held by the literature that deals specifically with firms' internal capital allocations: investment responsiveness to environmental opportunities is typically assumed to be tantamount to superior firm performance (*e.g.* Haspeslagh, 1982; Henderson, 1979; Shaver, 2011), because theory predicts that responsiveness will allow a firm to reap higher returns by investing in those opportunities. In this context, a firm's presence in multiple businesses – and its ability to pool capital from those businesses and channel it to particular highest-yield uses – is often touted by this literature as a potential enhancer of investment responsiveness to environmental opportunities. As such, diversification could have a positive impact on firm performance (*e.g.* Stein, 1997; Williamson, 1975).

However, responsiveness of firms' internal capital allocations to environmental opportunities is not an *a priori* sufficient condition for superior performance. This is because many firm investments do not occur in a vacuum. Rather, they are situated in market contexts, in which interactions with competitors complicate matters.

A salient example of such market-embedded investments is a firm's decision to add productive capacity in a given market (*e.g.* Dixit, 1980; Gilbert and Lieberman, 1987; Henderson and Cool, 2003a). On the one hand, following the prevalent belief, investing (*i.e.* adding capacity) in response to market opportunities can enable a firm to reap higher returns due to underlying favorable market supply and demand conditions. On the other hand, investing in response to market opportunities might not be a guarantor of superior firm performance because the returns on a firm's investments in a market will be contingent on the investments of its competitors. Specifically, a firm's responsiveness to market opportunities might increase the likelihood of its involvement in market-level investment bandwagons, in which both the firm and its competitors add capacity in response to the same market opportunities in an uncoordinated way, potentially increasing that firm's exposure to situations with market overcapacity and lower returns (Gilbert and Lieberman, 1987; Henderson and Cool, 2003a, 2003b). Thus, taking the relevant market contexts into account can be informative about the relative desirability of responsiveness of firms' internal capital allocations.

This paper is an attempt to address that gap. In particular, we take firms that are present in multiple markets and we try to infer empirically the responsiveness of their internal capital allocations to specific market opportunities, by looking at those firms' capacity investments in market contexts. We then seek to examine the performance consequences of those investments. While diversification can involve either product or geography (*e.g.* Kumar, 2009), we chose to focus on geographically-diversified firms within a single industry, to ensure comparability of market contexts, and to better isolate firms' internal capital allocation mechanisms.

For our empirical setting, we use the generation segment of the U.S. electric power industry from 1998 to 2010, and analyze firms' capacity investments therein. The empirical results of our analysis of firm investments suggest that geographically-diversified firms' internal capital allocations are responsive to market opportunities. In addition, we also find that restrictions imposed to the flow of capital within those firms by regulation reduce this basic effect. In our analysis of the performance consequences of investments, we interestingly find that increased responsiveness to opportunities is associated with weaker firm performance, measured as lower capacity utilization in a market than otherwise expected. Our evidence suggests that this last result is due to market opportunities being associated with market-level investment bandwagons, which lead responsive firms to be potentially more exposed to detrimental market overcapacity situations.

Overall, our findings underscore the need for research that deals with firms' internal capital allocations to analyze firms' investments in their market contexts, so as not to mistake responsiveness for superior firm performance. More broadly, our findings speak to the importance of integrating aspects from competitive strategy – such as investment bandwagons – when evaluating firms' internal capital allocations.

The remainder of the paper is organized as follows. The next section presents some background on the U.S. electric power industry to familiarize the readers with our empirical setting. We then develop the theory and some hypotheses regarding firms' internal capital allocations in this setting. The subsequent sections describe the data and methods, and report the empirical results. We then discuss those results and provide some concluding thoughts.

THE U.S. ELECTRIC POWER INDUSTRY

Given that market contexts and their associated competitive considerations vary across industries due to economic and institutional conditions, we decided to focus on a single industry to examine empirically the link between firms' internal capital allocations, market opportunities, and performance. Among several potential empirical contexts, we chose the generation segment of the U.S. electric power industry from 1998 to 2010.

On the whole, the U.S. electric power industry is composed of three distinct vertical segments: electricity generation, transmission, and distribution (including retail). Traditionally, these segments were all integrated within investor-owned electric utilities, which operated as regulated natural monopolies in exclusive franchised areas (typically within states). The cost-of-service regulation applied to those activities determined the bundled rates – one single price for electricity generation, transmission, and distribution – that utilities were allowed to charge to end consumers. Those bundled rates were calculated to ensure utilities the recovery of their operating costs and a fair rate of return on invested capital (Joskow and Schmalensee, 1986). To facilitate the regulatory rate-setting process through transparency in regulated activities, the Public Utility Holding Company Act (PUHCA) has been in place since 1935, requiring individual state-level regulated businesses belonging to larger holding companies to have separate accounting statements with stringent reporting requirements.[2]

Against the backdrop of the described regulatory legacy, competition was slowly introduced in the U.S. electric power industry, mostly in the generation segment with policies at the federal level. The Energy Policy Act (EPACT) of 1992 effectively opened wholesale electricity markets – markets for transactions between generators and distributors – to competition between eligible generators. Following the EPACT of 1992, the Federal Energy Regulatory Commission (FERC) started enacting orders from the mid-1990s onward, establishing rules and regulations aimed at reforming electricity transmission – keeping it regulated, nonetheless – and putting in place clear wholesale market rules, both fundamental to the proper functioning of competitive wholesale markets.[3] As a result of this de-regulation process, two contrasting business models currently co-exist in the U.S. electric power industry: whereas transmission and most of the distribution segment remain regulated; in the generation segment competition has progressively become the norm (see Joskow (2006) for details).

The generation segment

We chose the generation segment of the U.S. electric power industry as our empirical setting. For several key reasons, it is an ideal setting for the identification of our effects of interest. First, the generation segment is structured around different but comparable geographic electricity wholesale markets, with many firms being present in multiple markets at the same time. As our relevant market definition, we use the ten North American Electric Reliability Corporation (NERC) regions, which comprise the whole of the U.S., are mutually exclusive, and have the overwhelming majority of wholesale electricity trade occurring within each of them.[4]

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[2] In effect, the PUHCA was aimed at breaking up the large pyramidal trusts that used to control utility networks in the U.S. and which, given their opaque structures, were being accused of abusive intra-firm practices (*e.g.* transfer-pricing, unfair intra-firm loans) that were aimed at extracting rents from activities subject to cost-of-service regulation (EIA, 2000).

[3] A detailed description of these orders can be found on the FERC website (FERC - Federal Energy Regulatory Commission, www.ferc.gov).

[4] Zhang and Gimeno (2010) and Kim (2013) use the same market definition. More information on the NERC regions is available from the authors upon request. Not included here due to space restrictions.

Second, electricity generation is a very capital-intensive activity, given that investments in power plants routinely reach billions of U.S. dollars, are long-lived – a power plant has typically a lifespan of multiple decades –, and take time to implement.[5] Thus, investment choices in electricity generation in effect represent crucial capital commitments for firms.[6]

Third, electricity is a homogeneous product that cannot be stored in large amounts in an economic way such that, in a given wholesale market, supply needs to match demand at all times. Wholesale electricity demand by utilities is very inelastic, given existing commitments to supply downstream retail customers. Similarly, wholesale electricity supply can be very inelastic in its highest ranges due to the relatively high marginal costs of peak-load power plants. In addition, changing weather conditions and economic cycles make demand very volatile and cyclical. As a result, catering to demand can easily impose a strain on the supply side of the market. Hence, the tightness of supply capacity relative to demand in a given market is a salient metric of opportunity – and therefore investment stimulus – that is shared by generators in that market, and reflects the returns that can potentially be reaped by generation capacity (*e.g.* Borenstein and Bushnell, 2015; Credit Suisse, 2013; SNL Energy, 2013).[7]

Lastly, the co-existence of regulated and non-regulated activities in generation presents an opportunity to look at intricate aspects of firms' internal capital allocations. In particular, some firms' involvement in both regulated and non-regulated activities allows us to infer the influence of the ownership and reporting requirements of the PUHCA on firms' internal capital allocations.

THEORY AND HYPOTHESES

The baseline

Following directly from the description of our empirical setting, our notion of high opportunities in a focal market is associated with tightness of supply relative to demand in that market.

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[5] We conducted interviews with industry insiders who told us that, on average for investments in new power plant capacity, there is a 2-year lag between a firm's decision to invest and the time that power plant becomes operational.

[6] Illustrating the relative importance of investments in electricity generation, in 2008 the generation segment was the largest individual component of total infrastructure spending in the U.S. electric power industry with a 36 percent share, ahead of distribution, transmission, and other components (source: EEI - Edison Electric Institute, www.eei.org).

[7] In face of such characteristics, theoretical research in economics has used the Cournot model of quantity competition as a good approximation of how competition plays out in electricity wholesale markets (*e.g.* Borenstein and Bushnell, 1999).

Because of this, high focal market opportunities reflect *current* focal market supply and demand conditions that signal high returns that can potentially be reaped by generation capacity. As a result, we expect high focal market opportunities to be conducive to the expectation that firms will be able to invest profitably in generation capacity in the focal market, in effect representing a stimulus for those investments. Thus, we predict that high opportunities in a focal market will be associated with a higher likelihood of firms investing in that market.

Firms' internal capital allocations

We contend that the basic predicted positive association between high focal market opportunities and firm investment will be influenced by a firm's presence in other markets through that firm's internal capital allocations. Broadly speaking, this is because firms often are constrained in their access to external sources of capital to fund their investments, and a firm's presence in other markets can have an impact on its overall availability of capital to invest in a focal market.

Explicitly, it is established in the finance literature that information asymmetries between firms and potential external capital providers make it either impossible or very costly for those external capital providers to fully and quickly understand the nature of the opportunities faced by a firm (*e.g.* Fazzari, Hubbard, and Petersen, 1988; Myers and Majluf, 1984). Due to this, for most firms, the external capital market is not a perfect substitute for internally-generated capital since the cost of external financing can be much higher than the cost of internal funds, *especially* in the short term (Fazzari *et al.*, 1988). These external financing constraints might force firms without enough internally-generated capital to forego valuable investment opportunities (Hoshi, Kashyap, and Scharfstein, 1991; Kaplan and Zingales, 1997; Myers and Majluf, 1984).

Following this rationale, the literature that deals with firms' internal capital allocations suggests that a firm's financial management of a portfolio of businesses – through the pooling and channeling of capital between those businesses – could in principle relax external financing constraints imposed on any of its businesses and lower a firm's overall need to resort to external capital markets (Billett and Mauer, 2003; Hill and Hoskisson, 1987; Maksimovic and Phillips, 2008; Stein, 1997; Williamson, 1975). In turn, this relaxing of external financing constraints could be value-enhancing for diversified firms by allowing those firms to finance investments in response to opportunities in any of their businesses more easily than focused firms.

This literature points out that the advantages of diversification in relaxing firms' external financing constraints would specifically stem from: (i) lower aggregate financial risks, due to diversity of cash flow sources (*e.g.* Bettis, 1983; Hirsch and Lev, 1971); (ii) greater financial flexibility, from internal reallocation of capital between different businesses (Williamson, 1975); and, (iii) due to the aforementioned lower aggregate financial risks, greater external fund-raising ability (*e.g.* Amit and Livnat, 1988; Lewellen, 1971; Shaver, 2011), especially when the general economic environment is bleak (Kuppuswamy and Villalonga, 2015; Lim, Das, and Das, 2009).This suggests that diversification can make a sizeable contribution to increasing a firm's available capital to fund specific investments.

Thus, *all else being equal*, it can be argued that the relaxing of external financing constraints and the lower need to resort to external capital markets to fund investments will constitute advantages of diversified firms over focused firms. First, a lower dependence on external capital markets will allow diversified firms to more fully leverage the informational advantages that their corporate headquarters have over external capital markets in terms of project evaluation and monitoring, and thus potentially lead to better investment choices compared to focused firms (Stein, 1997; Williamson, 1975). Furthermore, another potential benefit associated with diversified firms' lower dependence on external capital markets compared to focused firms (or any of their individual businesses) has to do with potentially faster investment timing (*e.g.* Fazzari *et al.*, 1988; Khanna and Tice, 2001). In this case, a lower likelihood of resorting to external capital markets for funding, which adds an extra step in a firm's capital allocation process, can arguably speed up diversified firms' investments in response to opportunities relative to those of focused firms.

In our empirical setting, from the standpoint of capacity investments in a focal market, the preceding arguments suggest that the investments of firms with greater presences in other markets will be more responsive to high focal market opportunities compared to the investments of firms that are more focused in the focal market. For starters, this would happen because, *all else being equal*, firms with greater presences in other markets will potentially be able to pool more capital for investments in a more timely way compared with firms that are more focused in that focal market.[8] In turn, within firms that are present in multiple markets, the internal competition for capital between different investment alternatives from different markets (Stein, 1997; Williamson, 1975) would lead those firms to invest in the focal market, given the expectation of high returns associated with high focal market opportunities. The combination of more – and more timely – available capital and the internal competition for that capital between investment alternatives would enable firms with greater presences in other markets to invest more responsively to high focal market opportunities compared to firms that are more focused in the focal market (Stein, 1997; Williamson, 1975).

In contrast with this rationale, some scholars have also stressed that diversified firms' internal capital allocations could potentially suffer from adverse selection and agency problems that would undermine the dynamics of internal competition for capital between different investment alternatives we just described, especially in the case of unrelated diversifiers. These problems would have to do, for example, with challenges in the relative assessments of different investment alternatives (Stein, 1997); managerial rent-seeking by managers (Scharfstein and Stein, 2000); or internal conflicts between different businesses (Rajan, Servaes, and Zingales, 2000). Most notably, these problems would introduce distortions in diversified firms' internal competition for capital, by making it more difficult for those firms' headquarters to select among different investment alternatives based on their expected returns. As a result of these distortions, the focal market investments of firms with greater presences in other markets could be less

[8] This rationale will hold if there is not too much variability of returns across the different markets in which firms are present – *i.e.* some markets experiencing enormous returns while other markets suffer great losses –, such that the size of a firm's activities across different markets can be an accurate proxy for that firm's availability of capital for specific investments. This is something that is reasonable to assume in the context of different geographic markets within the same industry, and is corroborated by a 0.86 correlation between firm cash flows and total firm assets in our final sample. Furthermore, the use of the size of a firm's activities as a proxy for capital availability is also in accordance with theoretical and empirical literature in finance, which suggests that a greater size of a firm's activities can make that firm less financially constrained (*e.g.* Fazzari *et al.*, 1988; Kadapakkam, Kumar, and Riddick, 1998; Stiglitz and Weiss, 1981).

responsive to high focal market opportunities than the focal market investments of firms that are more focused in the focal market.

Despite the two described opposing forces, our focus on geographic diversification within a single industry makes it such that potential distortions in firms' internal capital allocations are likely to be mitigated, for a few reasons.[9] First, Stein's (1997) seminal model shows that firm headquarters are able to rank the expected returns of different investment alternatives more accurately if those alternatives are more related. This suggests that the relative assessment of investment alternatives in different geographic markets is not likely to be a problem for firm headquarters. In addition, we also expect managerial rent-seeking to be more difficult within firms that are diversified into related settings (as is our case), since those firms' headquarters will be better at monitoring managers in a related set of activities. Furthermore, in the specific case of geographic diversification, there will arguably be less room for internal conflicts between a firm's activities in different markets, because those activities are more likely to be managed in tandem due to their relatedness. Corroborating this line of argument, some empirical studies have shown that relatedly-diversified firms can exhibit investment patterns that are relatively more responsive to economic conditions than those of focused firms (*e.g.* Guedj and Scharfstein, 2004; Khanna and Tice, 2001).

On the whole, this suggests that firms with greater presences in other markets are likely to invest more responsively to high focal market opportunities, compared to firms that are more focused in a focal market. Thus, a*ll else being equal*, we expect firms with greater presences in other markets to be more likely to invest in response to high opportunities in a focal market than firms that are more focused in that focal market.

[9] There is already an established body of literature trying to infer the shape of the relationship between the extent of *international* geographic diversification and performance (*e.g.* Contractor, Kundu, and Hsu, 2003; Hennart, 2007; Lu and Beamish, 2004). Although we acknowledge the importance of this literature, our focus is distinct since we look at geographic diversification within a single industry and country (the U.S.), and use it mostly as a means of ensuring comparability of market contexts, and to better isolate firms' relevant internal capital allocation mechanisms.

Hypothesis 1: Firms with greater presences in other markets will be more likely to invest in response to high opportunities in a focal market compared to firms that are more focused in that focal market.

We expect the internal capital allocation mechanisms described for Hypothesis 1 to generally hold for geographically-diversified firms in the generation segment of the U.S. electric power industry. Nonetheless, we also expect the characteristics of firms' other market activities to condition those firms' internal capital allocations. In our setting, the aforementioned stringent reporting and ownership structure requirements imposed by the PUHCA on regulated activities will establish barriers to the free pooling and channeling of capital within firms that are involved in those activities. In particular, *all else being equal*, it is likely that firms with higher shares of regulated activities in other markets will be more constrained in pooling and channeling capital from their other market activities to invest in capacity in a focal market compared to firms with lower shares of regulated activities in other markets.[10]

Furthermore, this prediction can also be substantiated on more theoretical grounds. Indeed, one of the central tenets of the resource dependence theory (RDT), is that firms depend on external actors to obtain the resources that will ensure their survival, and that this dependence makes those external actors hold power over firms (Pfeffer and Salancik, 2003). Given their power, those external actors are then able to influence firms' decisions and activities (*e.g.* Pfeffer, 1972; Salancik, 1979). In particular, it is plausible that those external actors could constrain firms' internal capital allocations. On this issue, Christensen and Bower's (1996) contribution is a telling example; the authors argue that the scope for strategic changes in firms can be constrained by external actors who provide the resources that firms need to survive (Christensen and Bower, 1996: 212). In their case, this explained why incumbent firms in the disk-drive industry focused on investing in technologies that served their current customers, and why they failed when new entrants emerged with disruptive technologies.

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[10] From the standpoint of the empirical phenomenon, studies have already shown empirically that government rules and regulations can constrain a firm's structure and strategy (*e.g.* Zey and Swenson, 1998) and, in particular, influence a firm's internal capital allocations (*e.g.* Natividad, 2013).

Transposing the RDT to our empirical setting, the government is the powerful external actor on whom a firm's regulated activities are dependent for resources. The government constrains pooling and channeling of capital within firms with regulated activities through the requirements of the PUHCA. These requirements will have a greater influence on a firm's internal capital allocations the higher the overall share of a firm's activities that is regulated. In particular, higher shares of regulated activities in other markets will constrain geographically-diversified firms' ability to pool and channel capital from other market activities to invest in a focal market. Thus, *all else being equal*, we expect firms with higher shares of regulated activities in other markets to be less likely to invest in response to high opportunities in a focal market, compared to firms with lower shares of regulated activities in other markets.

Hypothesis 2: Firms with higher shares of regulated activities in other markets will be less likely to invest in response to high opportunities in a focal market compared to firms with lower shares of regulated activities in other markets.

Besides high opportunities in a focal market, geographically-diversified firms will also potentially be exposed to high opportunities in the other markets in which they are involved. *All else being equal*, high opportunities in other markets in which a firm is involved will increase the attractiveness of investing in those markets relative to investing in a focal market. As a result, within a firm that is present in multiple markets, a potential investment in the focal market will face more internal competition for capital, given the higher likelihood that an investment in other markets will be ranked as a superior alternative (Stein, 1997). This will have a negative impact on a firm's investments in a focal market *if* the capital that ends up being invested by that firm in other markets would have otherwise been invested in the focal market. In our empirical setting, it is thus likely that high opportunities faced by firms in other markets in which they are involved will be associated with a negative effect on those firms' capacity investments in a focal market.

Hypothesis 3: High opportunities in other markets in which firms are involved will be associated with a lower likelihood of those firms investing in a focal market.

Investment responsiveness and performance

On the one hand, it can be argued that investment responsiveness to high market opportunities is good from a performance standpoint, since firms will be internally allocating capital to markets with high *current* – and expected future – returns. This rationale is in agreement with most of the finance literature on internal capital markets (*e.g.* Ozbas and Scharfstein, 2010; Rajan *et al.*, 2000; Shin and Stulz, 1998; Stein, 1997); as well as with corporate portfolio planning rationales put forward by frameworks such as the BCG matrix (Hall, Lovallo, and Musters, 2012; Haspeslagh, 1982; Henderson, 1979), which tend to equate increasing market shares in attractive markets with higher profitability (Baden-Fuller, 1990).

On the other hand, in reality things are not as clear: firms' internal capital allocations are inserted in market contexts (*e.g.* Boutin *et al.*, 2013; Khanna and Tice, 2001; Sengul and Gimeno, 2013), and the performance consequences of a firm's capacity investments in a market will be contingent on the investments of its competitors (Henderson and Cool, 2003a). Indeed, by being responsive to high market opportunities, a firm might increase the likelihood that it will be involved in market-level investment bandwagons, in which both the firm and its competitors simultaneously add capacity in response to the same market opportunities in an uncoordinated way. In these bandwagons, firms oftentimes use their capacity investments as a way of committing to keeping their competitive parities (*i.e.* market shares) *vis-à-vis* competitors,[11] in hopes that their investments will pre-empt competitors' expansions and capture increases in demand for years to come (Aaker and Day, 1986; Baden-Fuller, 1990; Lieberman and Asaba, 2006).[12] As a result of their lack of coordination and existing competitive interactions, firms sometimes end up over-investing as a whole in response to high market opportunities. In these cases, investment responsiveness may increase a firm's exposure to situations with market overcapacity and lower returns (Gilbert and Lieberman, 1987; Henderson and Cool, 2003a,

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[11] Given that our setting is a mature industry whose market contexts are well-defined, pre-emption and competitive parity rationales are *a priori* more appropriate explanations for investment bandwagons than rationales based on managers' information asymmetries (Banerjee, 1992; Scharfstein and Stein, 1990).

[12] The market pre-emption strategy has been often put forward theoretically by the literature on credible commitments, both as a way of discouraging competitors' investments (*e.g.* Ghemawat, 1984; Lieberman, 1987; Porter and Spence, 1982) and as a way of discouraging market entry (*e.g.* Dixit, 1980; Spence, 1977). However, large-scale empirical evidence of its success is limited (*e.g.* Lieberman, 1987; Smiley, 1988).

2003b), since all firms that add capacity will be mostly competing to capture a share of the overall increase in market demand.[13] This type of detrimental dynamic is likely to be magnified in a cyclical industry like ours (Heer and Koller, 2000). Thus, investment responsiveness to high market opportunities is not an *a priori* guarantor of superior firm performance.

DATA

Our main data source is a database from SNL on the electric power industry, which includes a dataset on power plant characteristics and operations in North America, mostly aggregated from governmental agencies in the U.S. – the Energy Information Administration (EIA) and the Federal Energy Regulatory Commission (FERC). In addition, SNL collects plant ownership information at multiple levels (from immediate to ultimate parent firms), and aggregates another dataset with firm financials at the level of the ultimate parent firm.

Besides SNL, we also collected data directly from public sources. We used EIA's 411 data file, from which we took data on market-level energy loads (demand levels) and available supply capacity resources, both instrumental for our operationalization of market opportunities. We also collected data on state-mandated or advised generation asset divestitures from the EIA website.

The final dataset integrates the described data sources matched at the level of the ultimate parent firm. We started with operational data at the power-plant level, aggregated it at the firm-market-year level, and finally merged it with firm-year level financial data and regulatory indicators. Given our single-industry focus, we mostly restricted ourselves to firms with reported SIC codes in electric power (4911, 4931, or 4991).[14] We also restricted ourselves to U.S. firms, whose coverage was found to be more consistent during our sample period.[15] Of the ten NERC regions, we dropped the ones corresponding to Hawaii and Alaska, since those were too small,

[13] The implicit assumption in this rationale is that there is some degree of stickiness between prior existing demand and its supply sources, such that capacity additions will not be able to automatically displace existing installed capacity as supply sources for prior existing demand. In our setting, this is justified by the existence of long-term contracts between some generators and purchasers of electricity (commonly known as *Purchasing Power Agreements*); and by the existence of non-negligible electricity transmission costs, which can make demand in some regions within a market captive of local supply sources (Borenstein, Bushnell, and Stoft, 2000; Joskow, 2005, 2006).

[14] There were a few exceptions of firms with different SIC codes (in particular, 4900, 4932, or no code reported), but for these firms, we individually checked that electricity generation was not a negligible component of their business portfolio.

[15] Foreign (mainly Canadian) firms were dropped from the sample, since their coverage was not as homogeneous.

concentrated, and heavily regulated to come close to functioning markets. This led to a consolidated sample consisting of an unbalanced panel with 1,776 firm-market-year observations, and 57 distinct firms followed from 1998 to 2012 in eight markets.

INVESTMENT ANALYSIS

Dependent variable

For economic and technical reasons, different generation technologies have different expected levels of capacity utilization. Besides that, different technologies also have different capital costs, and technologies with higher capacity utilization typically have higher capital costs.[16] To make different technologies more comparable in both of these regards, our dependent variable – called *Firm investment in the focal market* – is based on a metric of increases to *expected electricity generation*, rather than on simple increases to generation capacity.

For each firm i in market m and year t, we follow the standard in the literature on capacity additions (*e.g.* Gilbert and Lieberman, 1987) and use a categorical variable with the form:

$$y_{imt} = \begin{cases} 1 \; if \; \dfrac{I_{imt}}{K_{imt-1}} > 0.05 \\ 0 \qquad otherwise \end{cases}$$

I_{imt} is the *expected electricity generation increase* (in Megawatt hours – MWh) from gross capacity additions by firm i to market m in year t, and K_{imt-1} represents the *expected generation* (in MWh) from that firm's previous-year installed capacity in the same market. Thus, the ratio of I_{imt} to K_{imt-1} expresses firm i's *percentage expected electricity generation increase* from its gross capacity additions to market m in year t. A firm's expected generation in a given market-year is calculated as a weighted average of the capacity of that firm's plants in that market-year – with weights being the previous year's across-sample average capacity utilizations of each plant's respective generation technology – times 8,760 (the number of hours in a year).

Following prior research on capacity additions (*e.g.* Gilbert & Lieberman, 1987; Henderson & Cool, 2003a), the ratio of I_{imt} to K_{imt-1} is discretized using a 5-percent threshold

[16] For instance, the differences between nuclear and natural gas power plants are telling examples of this issue: whereas nuclear plants have an average capital cost around U.S. $5,500 per Kilowatt (KW) of capacity for 2010 and an expected capacity utilization of 83 percent for our empirical sample (1998-2010); the equivalent figures for natural gas plants are around U.S. $1,000 per KW of capacity and 24 percent. (sources: EIA - U.S. Energy Information Administration, www.eia.gov; our dataset)

in order to account for the "capacity-scaling" problem, by which the percentage increases in a firm's capacity (or, in this case, expected generation) take disproportionately large values for relatively new entrants settling into a market.[17]

Independent variables

As discussed before, the tightness of supply capacity to demand in a given wholesale electricity market is a salient indicator of the potential returns that can be reaped by generation capacity in that market (*e.g.* Borenstein and Bushnell, 2015; Credit Suisse, 2013; SNL Energy, 2013). Thus, our measure of *Focal market opportunity* is based on the tightness of supply capacity to demand in a focal market.

For market m and year t, we first calculate the *Focal market capacity tightness* ratio:

$$Focal\ market\ capacity\ tightness_{mt} = \frac{Market\ average\ hourly\ net\ energy\ for\ load\ (MW)_{mt}}{Market\ total\ summer\ capacity\ (MW)_{mt}}$$

The numerator in the above ratio is our proxy for the average demanded electricity in market m and year t, and corresponds to the average hourly net generation of that market's main generating units, plus energy receipts, minus energy deliveries (in Megawatts – MW). The denominator is our proxy for available supply capacity in market m and year t, corresponding to the existing net generation capacity in that market plus the addition and subtraction of capacity that either enters or leaves that market via purchases, sales, ownership, or entitlements (in MW).

The *Focal market opportunity* variable is then just a moving average of the *Focal market capacity tightness* ratio over the prior 2 years. Thus, for market m and year t we have:

$$Focal\ market\ opportunity_{mt} = \frac{\sum_{\tau\in\{t-1,t-2\}} Focal\ market\ capacity\ tightness_{m\tau}}{2}$$

This last transformation was done to make the profile of the variable smoother, and to make it reflect lags in the effective implementation of capacity additions in a market.

[17] We also built a similar variable, but using a 10 percent threshold instead. The results were qualitatively similar to those presented here, but the models with the 5 percent threshold produced a better fit.

The calculations for the *Index of opportunities that a firm faces in other markets* are similar to the ones just presented. For each firm i involved in market m in year t, we first calculate the following summation:

$$\sum_{m\prime \in M_{im\prime t}} share_{im\prime t} * Focal\ market\ capacity\ tightness_{m\prime t}$$

$M_{im\prime t}$ is the set of markets excluding the focal market m, and $share_{im\prime t}$ is the share of firm i's capacity in market m' relative to its total capacity in the set $M_{im\prime t}$ in year t. The *Focal market capacity tightness* measures for each other market in which a firm is involved are calculated analogously to the way the *Focal market capacity tightness* measure is calculated in the case of the *Focal market opportunity* variable. Also similarly to the *Focal market opportunity* variable, we use the moving average of the above expression over the prior 2 years as our *Index of opportunities that a firm faces in other markets*. This variable is not defined for firms that are only present in market m. We solve this issue by setting it equal to 0 for those firms; and by including in our models a dummy variable set equal to 1 for single-market firms, and equal to 0 for firms present in multiple markets (*Firm single-market dummy*).

Firm relative presence in other markets captures the size of a firm's activities outside of a focal market relative to its activities in the focal market. For each firm i in market m and year t, it is given by the following:

$$\frac{\sum_{p \in P_{iM_{im\prime t}t}} Plant\ capacity_{pit}}{\sum_{p \in P_{it}} Plant\ capacity_{pit}}$$

$M_{im\prime t}$ is the overall set of markets in which firm i is present in year t, excluding market m; P_{it} is the overall set of firm i's plants in year t; $P_{iM_{im\prime t}t}$ is the overall set of firm i's plants in markets other than m and year t; and $Plant\ capacity_{pit}$ represents plant p's capacity in year t.

The *Share of a firm's capacity in other markets that is regulated* operationalizes the relative weight of regulated activities in a firm's other market activities. For each firm i in market m and year t, we calculate the following expression:

$$\frac{\sum_{p \in P_{iM_{im't}t}} Plant\ capacity_{pit} * I[if\ regulated]_{pit}}{\sum_{p \in P_{iM_{im't}t}} Plant\ capacity_{pit}}$$

$M_{im't}$ is the overall set of markets in which firm i is present in year t, excluding market m; $P_{iM_{im't}t}$ is the set of firm i's plants in markets other than m in year t; $Plant\ capacity_{pit}$ is plant p's capacity in year t; and $I[if\ regulated]_{pit}$ is an indicator variable, coded 1 if plant p is regulated and 0 otherwise. Just like the *Index of opportunities that a firm faces in other markets*, this variable is not defined for firms that are only present in market m. We thus set it equal to 0 for those firms; and include the *Firm single-market dummy* variable in our models.

Control variables

Our models include different control variables for other relevant factors that can influence a firm's investments in a given market, described in detail in Table 1.

- Insert Table 1 about here -

Methods

Given the categorical nature of our dependent variable, a Logit discrete choice model is appropriate for our investment analysis. Our model allows the probability of investment to be influenced non-linearly by firm, market, and firm-market characteristics corresponding to independent variables and controls. The specifications include also dummy variables at the market, year, and (for the most demanding specification) firm level.

The tests of Hypotheses 1 and 2 involve interactions between continuous independent variables. For every interaction variable used, we followed the extant standard in the literature and centered the interacting variables to their sample means before building the interaction variable (Aiken and West, 1991). These transformations are helpful to interpret the main effects of each continuous variable that enters an interaction, which become readable as effects at the mean level of the other continuous interacting variable(s). Furthermore, given that non-linearity in Logit models makes it difficult to interpret the size and significance of interaction terms, we represent graphically our interaction effects of interest, as suggested by Hoetker (2007).

Our models use lagged covariates, since the dependent variable is based on firms' capacity additions, whose implementation is time-consuming. This way, we establish a clear time ordering from our covariates to the dependent variable. After trying different time lags, we chose specifications with a 1-year lag applied to most of the independent variables and controls.[18] We found that a 1-year lag provided the best model fit amongst the considered alternatives, although models with 2-year and 3-year lags yielded qualitatively similar results.

The conjunction of a 1-year lag, dummy variables, and the need for reliable market opportunity data contributed to reduce our final sample relative to the original 1,776 firm-market-year consolidated observations.[19] Our final sample is composed of 1,106 firm-market-year observations, corresponding to 40 distinct firms followed from 1998 to 2010 in eight different markets. In this final sample, 916 of the 1,106 firm-market-year observations belong to firms that are present in multiple markets, and the average number of markets in which a firm is present goes up from 2.28 in 1998 to 2.82 in 2010.

Descriptive statistics

To illustrate the link between our *Focal market opportunity* variable and firms' investments, we built Figure 1. For four of our eight markets, Figure 1 plots a graph with the evolutions of both the sum of total gross capacity additions (in MW) by all firms in a year, and our *Focal market opportunity* variable (the average of the *Focal market capacity tightness* measure for the prior 2 years), for our sample period (1998-2010).[20] In the graphs, the left vertical axes measure total gross capacity additions, and the right vertical axes measure *Focal market opportunity*. The graphs show that capacity investments co-move with *Focal market opportunity* – confirmed by

[18] The exceptions to the 1-year lag are our market opportunity and demand growth variables, which are calculated on the basis of the 2 prior years (as described before).

[19] More specifically, our sample initially dropped to 1,529 observations (but still the same 57 firms) since the final time frame for our analysis is 1998-2010 instead of 1998-2012. This is because the basic metrics with which we compute our market opportunity variables stop being reported by the EIA after 2009 for some of the markets, restricting the upper time limit for our analysis. In addition, the use of a 1-year lag for most of the independent variables further reduced our sample to 1,328 observations and 56 firms. Finally, the inclusion of firm dummies in our most demanding specifications reduced the sample to 1,106 observations and 40 firms, because 17 of the initial 57 firms did not invest in our sample period.

[20] We present graphs for four out of the eight markets only because of space restrictions. Since this figure only required simple aggregate calculations, we were able to use one of our interim samples (before regression estimation procedures) with 57 ultimate parents and 1,529 observations from 1998 to 2010, and collapsed it at the market-year level to construct our graphs.

their high correlation (0.2948) –, which ensures the face validity of the *Focal market opportunity* variable as an operationalization of investment stimulus for firms.

- Insert Figure 1 about here –

For further validation of the *Focal market opportunity* variable, we sought to connect its basic yearly component – the *Focal market capacity tightness* measure – to market returns. Thus, we calculated the market-year-level correlations of the *Focal market capacity tightness* measure with both average return-on-assets and average return-on-equity, considering only firm-market-year observations in which firms had 50 percent or more of their total capacity in a given market.[21] The obtained correlations were 0.4282 and 0.3315 respectively, vindicating the *Focal market capacity tightness* metric as a good proxy for market returns.

Variable summary statistics are shown in Table 2. The sample mean of the dependent variable is 0.167, meaning an average 16.7 percent probability of *Firm investment in the focal market* for our sample.

- Insert Table 2 about here -

Regression results

The regression models for the investment analysis are presented in Table 3. The two presented models differ in one regard: Model 1 only includes market and year dummy variables; whereas Model 2 also includes firm dummy variables.

- Insert Table 3 about here -

As a baseline, we expected investment to be positively associated with market opportunities. In this case, the presented regression results provide limited support for this conjecture: the *Focal market opportunity* variable has a positive estimated coefficient across both models, but it never reaches statistical significance. Nonetheless, this apparent lack of significance is only driven by our inclusion of year dummy variables, which absorb much of the

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[21] In this case, we chose to use only firm-market-year observations in which firms had 50 percent or more of their capacity in a focal market because the financial performance of this subset of observations is arguably more contingent on focal market conditions than the financial performance of observations for which a focal market is a relatively smaller component of firms' portfolios of activities.

variation of the *Focal market opportunity* variable. Indeed, we ran similar specifications to the ones presented with only firm and market dummy variables (not shown here),[22] and found that *Focal market opportunity* had always a positive and highly significant estimated coefficient (at the 1% level). For such a model specification, a one-standard-deviation increase in *Focal market opportunity* is associated with an average increase of 6.1 percentage points in the probability of a firm investing in a market.[23] Together with the presented descriptive statistics, this evidence supports the predicted positive association between *Focal market opportunity* and *Firm investment in the focal market.*

Hypothesis 1 predicted that a firm's greater presence in other markets would moderate positively the relationship between *Focal market opportunity* and *Firm investment in the focal market*. For Models 1 and 2 in Table 3, the coefficient of the interaction between *Firm relative presence in other markets* and *Focal market opportunity* is positive and statistically significant (at the 10% and 5% levels), supporting our predictions. To showcase the estimated effects for Hypothesis 1, the left-hand-side graph in Figure 2 displays the interaction effect between *Firm relative presence in other markets* and *Focal market opportunity*, using the predicted probabilities of *Firm investment in the focal market* from Model 1. Looking at that graph, we can see that a higher *Firm relative presence in other markets* is associated with more responsiveness of firm investments to *Focal market opportunity*, as predicted.

- Insert Figure 2 about here -

Hypothesis 2 predicted that a firm's higher share of regulated activities in other markets would moderate negatively the relationship between *Focal market opportunity* and *Firm investment in the focal market*. Corroborating this, the estimated coefficient for the interaction between *Share of a firm's capacity in other markets that is regulated* and *Focal market opportunity* is negative and statistically significant for Models 1 and 2 in Table 3 (at the 5% and

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[22] These model specifications with firm and market dummy variables are not presented here because of space constraints. They can be obtained from the authors upon request.
[23] This number is reached by multiplying the average estimated marginal effect of *Focal market opportunity* – obtained using the *margins* command in STATA 13 – by the sample standard deviation of the *Focal market opportunity* variable. All presented marginal effects are calculated in this way, unless mentioned otherwise.

1% levels, respectively). In this case, the right-hand-side graph in Figure 2 illustrates the interaction effect between *Share of a firm's capacity in other markets that is regulated* and *Focal market opportunity*. Taking the predicted probabilities of investment from Model 1, the graph shows that a higher *Share of a firm's capacity in other markets that is regulated* is associated with less responsiveness of *Firm investment in the focal market* to *Focal market opportunity*.

Hypothesis 3 predicted that opportunities faced by firms in other markets would be negatively associated with *Firm investment in the focal market*. For Model 1 in Table 3, the estimated coefficient for the *Index of opportunities that a firm faces in other markets* is negative, but not statistically significant. However, for Model 2 (which includes firm dummies) the estimated coefficient is both negative and statistically significant (at the 10% level), lending support to our prediction. For Model 2, using only the subsample of firms that are present in multiple markets, an increase of one standard deviation in the *Index of opportunities that a firm faces in other markets* is associated with a 3.2 percentage-point decrease in the probability of *Firm investment in the focal market*.

Few of the control variables have statistically significant effects in our models from Table 3. First, the *Firm "between-generation-technology" efficiency relative to focal market competitors* variable has a positive and statistically significant (at the 10% level) coefficient for Model 2, showing a positive association between efficiency and firm investment. Also for Model 2, the coefficient for *Focal market HHI index* is negative and significant (at the 10% level), so concentration shows up as negatively associated with investment. The *Share of a firm's capacity in the focal market that is regulated* has a positive and statistically significant (at the 10% level) estimated coefficient for Model 2, reflecting a higher probability of investment irrespective of *Focal market opportunity*. Furthermore, the *Share of a firm's capacity in other markets that is regulated* has a positive and significant estimated coefficient (at the 5% level) for Model 2. These last two effects may be due to the fact that firms with higher shares of regulated activities will face on average lower financial risks than firms with lower shares of regulated activities, and thus will probably be able to get more capital from external capital markets to fund their investments. The *cost of debt* variable has a negative and statistically significant estimated coefficient (at the 0.1% level) for both Model 1 and Model 2. This was expected, since firms with a lower *cost of debt* will have an increased ease in funding their investments in external capital markets. Lastly, the *Index of firm exposure to state--mandated/-advised divestitures in the focal market* has a negative and statistically significant estimated coefficient (at the 5% level) for Model 1, as expected.

PERFORMANCE ANALYSIS

Dependent variable

In this analysis, we are interested in inferring the consequences of investment responsiveness to market opportunities on firms' market-level performances. Our dependent variable is called *Firm ratio of deviation from expected capacity utilization in the focal market*, and corresponds to the difference between a firm's actual level of capacity utilization in a given market-year and the *Firm expected capacity utilization in the focal market* variable (described in Table 1), divided by the latter variable. *All else being equal*, higher-than-expected capacity utilization is reflective of better market performance than expected for a firm, since a firm's installed capacity will be generating more electricity, yielding higher returns as a result (Borenstein and Bushnell, 2015).[24]

Independent variables and controls

We built two basic interacting categorical variables to characterize a firm's investments. The first variable is called *Focal market opportunity dummy*, coded 1 for a given market-year if the *Focal market opportunity* measure we described for the investment analysis is above its within-market median, and 0 otherwise. The second variable is called *Firm investment in the focal market* and takes a value of 1 if a firm increased its expected generation in the focal market by more than 5 percent *via* gross capacity additions in the course of the current and prior year, and 0 otherwise.

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[24] For validation purposes, we sought to connect our dependent variable with firms' financial performances. For our sample period, we took only firm-market-year observations in which firms had 50 percent or more of their capacity in the focal market, so as to restrict ourselves to a subset of observations for which firm financial performance is arguably more contingent on focal market conditions. We then correlated the year-level averages of the *Firm expected capacity utilization in the focal market* variable with the year-level averages of firms' return-on-assets and return-on-equity. The obtained correlations were 0.1508 and 0.1769, respectively. These positive correlations act as a validation of the *Firm expected capacity utilization in the focal market* variable as our dependent measure of firm performance in a market.

This last variable is similar to the dependent variable of the investment analysis, but instead it is calculated over 2 years to match the time period of the interacting *Focal market opportunity dummy*.

Besides our main independent variables, in our models we include control variables such as *Focal market capacity tightness*, and *Firm efficiency relative to focal market competitors* variables, all for the current year. In addition, we also include as controls *Firm focal market share* (and its interaction with *Focal market capacity tightness*), *Focal market HHI index*, *Share of focal market generation that is regulated*, and *Share of a firm's capacity in the focal market that is regulated*, all lagged 1 year.

Methods

Due to the endogenous nature of *Firm investment in the focal market*, we use a two-step endogenous treatment selection model, taking *Firm investment in the focal market* as the treatment variable. For the first-stage Probit model, we regressed *Firm investment in the focal market* on the same set of variables used for Model 1 in Table 3, but using a 2-year lag applied to most independent variables and controls (instead of a 1-year lag).[25] In this case, we argue that the exclusion restrictions should be satisfied by our use of the *Firm single-market dummy*, *Firm relative presence in other markets*, and *Share of a firm's capacity in other markets that is regulated* variables, which influence *Firm investment in the focal market*, but are not likely to have a *direct* effect on a firm's focal market performance. All first- and second-stage models include market and year dummy variables.

We restricted our sample to the same firms that appeared before in our analysis of firm investments.[26] Variable summary statistics are shown in Table 4. The four estimated second-stage regression models are presented in Table 5.

- Insert Table 4 and Table 5 about here -

[25] We use 2-year lags instead of 1-year lags because, for the specific case of this performance analysis, *Firm investment in the focal market* is defined as investment over the current and prior year.

[26] The reason why the number of firm-market-year observations is different from that of the investment analysis has to do with our use of a different estimation procedure.

Regression results

We find that the *Focal market opportunity dummy* variable has a positive and statistically significant estimated effect on the *Firm ratio of deviation from expected capacity utilization in the focal market* for Models 3 and 4 in Table 5 (at the 5% and 10% level, respectively). In addition, the estimated coefficients for *Firm investment in the focal market* switch signs across models and are never statistically significant. Hence, on its own, *Firm investment in the focal market* does not seem to influence our dependent variable. Interestingly, however, we also find that the interaction of *Firm investment in the focal market* with the *Focal market opportunity dummy* has an estimated negative and statistically significant (at the 5% level) coefficient for Models 3 and 4. Taking the estimated coefficients for our independent variables and their interaction from Model 4, we can see that investments that occur in response to high market opportunities are associated with a 6.9 percentage-point drop in our dependent variable, compared to investments that occur at times of low market opportunities. This suggests that investment responsiveness to market opportunities can worsen firm performance in a market, in the form of a relative under-utilization of a firm's productive resources.

Some of the control variables show statistically significant effects. As expected, the *Focal market capacity tightness* variable has an estimated positive coefficient which, due to the year dummies, is only statistically significant (at the 5% level) for Model 1. Also as expected, the *Firm efficiency relative to focal market competitors* variables have both positive and highly statistically significant coefficients (at the 0.1% and 1% levels). The *Share of a firm's capacity in the focal market that is regulated* has an estimated negative and statistically significant coefficient (at the 5% level). Regarding the influence of market structure, *Firm focal market share* has a positive and statistically significant estimated coefficient (at the 5% level), whereas *Focal market HHI index* has an estimated negative and statistically significant coefficient (at the 1% level). Finally, the estimated coefficient for the *Lambda* variable – the inverse Mills ratio from the first-stage Probit regression – is always positive but never statistically significant, which suggests that endogeneity in *Firm investment in the focal market* was not worrisome.

DISCUSSION AND CONCLUSIONS

The broad purpose of this paper was to examine empirically the responsiveness of firms' internal capital allocations – through their capacity investments – to market opportunities, and to infer the performance consequences of such investment responsiveness. To ensure the comparability of different market contexts and to better isolate internal capital allocation mechanisms, we focused on geographically-diversified firms within a single industry. In particular, we chose the generation segment of the U.S. electric power industry from 1998 to 2010 as the empirical setting for our analysis.

Our analysis of firms' investments suggests that firms' internal capital allocations are responsive to market opportunities; supporting our hypotheses, capital appears to be flowing within geographically-diversified firms to fund capacity investments in markets with high opportunities. Specifically, we found that the investments of firms with greater presences in other markets were more responsive to high focal market opportunities than the investments of firms that were more focused in a focal market. We hypothesized that this effect is due to the relatively relaxed external financing constraints and lower need to resort to external capital markets of firms with greater presences in other markets; both of which enable those firms to pool and channel more capital in a more timely way in response to high focal market opportunities. In addition, we found that within-firm restrictions to the flow of capital that exist due to regulation reduce this basic effect, by lowering the focal-market investment responsiveness of firms with higher shares of regulated activities in other markets. Finally, we found that high opportunities in other markets in which a firm is involved are associated with a lower probability of that firm investing in a focal market.

In our performance analysis, we found that investing in response to high market opportunities was associated with lower capacity utilization by a firm in a market than otherwise expected. Although this result might *a priori* seem counter-intuitive, its justification may be that a firm's investment responsiveness increases the likelihood of its involvement in market-level investment bandwagons, in which both the firm and its competitors add capacity in response to the same market opportunities in an uncoordinated way. The combination of uncoordinated investments with firms' attempts to pre-empt each other to keep their competitive parities (*e.g.* Aaker and Day, 1986; Baden-Fuller, 1990; Lieberman and Asaba, 2006) is likely to engender situations with market overcapacity and lower returns (Gilbert and Lieberman, 1987; Henderson and Cool, 2003a, 2003b). Investment responsiveness is thus likely to increase a firm's exposure to these market overcapacity situations, because all firms that add capacity in response to high market opportunities will be mostly competing to capture a share of the overall increase in market demand. In our setting, the existence of investment bandwagons is suggested by both Figure 1, and by reports on the industry that document generalized over-investment in the generation segment and firms' subsequent difficult financial situations (Joskow, 2005).[27]

Furthermore, we also found that investing at times of low market opportunities was not associated with lower capacity utilization by a firm in a market. Although we cannot be sure, this result suggests that firms that invest in this way may be adding capacity in response to firm-specific opportunities – such as the fulfilment of a long-term electricity supply contract, or catering to captive demand within a market region – which therefore should not be easily eroded by competitive interactions.

Nonetheless, the results from the performance analysis should be taken with caution. This is because our measure of performance – a firm's capacity utilization in a focal market relative to expectations, in the periods immediately after a capacity investment – is naturally biased against capacity expansions. It can be obviously argued that firm performance is a broader and more long-term-oriented construct than a firm's market capacity utilization in any given period. In particular, adding capacity in excess of requirements can work as a commitment device for a firm to pre-empt its competitors, with potential long-term positive performance consequences in

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[27] Moreover, we also estimated ancillary regression models (not reported here) of firms' focal market investments with an independent variable based on the percentage of competitors that invested in the focal market in the same period. In general, the results showed that *Firm investment in the focal market* was positively and statistically-significantly associated with competitors' investments in the focal market.

settings in which firms' investments are strategic substitutes (*e.g.* Dixit, 1980; Fudenberg and Tirole, 1984).

Despite this, what our performance analysis also suggests is that it might be better for a firm to make such commitments by investing in an anticipatory way to market opportunities – instead of investing in response to those opportunities –, so as to desynchronize its investments from market-level bandwagons. This suggestion parallels the central prescription of the business-cycle management literature (Bromiley, Navarro, and Sottile, 2008; Mascarenhas and Aaker, 1989), which advocates that investing counter-cyclically can be a source of competitive advantage for a firm. This is because investing counter-cyclically can allow a firm to effectively pre-empt a market prior to its recovery.

Thus, the responsiveness of firms' internal capital allocations to market opportunities that we found may not be as desirable as one may originally have thought. Indeed, lower responsiveness might be a good thing for a firm, if it reduces the likelihood that its capacity investments will partake in market-level bandwagons.

Limitations

Since neither data on firm financials at the market level nor data on firms' internal capital flows were available, we needed to make some compromises in our empirical approach. As a first compromise, we used the share of a geographically-diversified firm's total capacity in different markets as our proxy for the relative size of that firm's activities in those markets, and the relative shares of its internally-generated capital stemming from those markets. Nonetheless, to the extent that a firm's relative scale of activities in different markets parallels the relative share of its cash flows coming from those markets,[28] we think that the face validity of our measure of relative presence in other markets is warranted. The same rationale applies to our measures of a firm's share of regulated activities. Another compromise had to do with our use of firms' capacity investments as a way of inferring firms' internal capital allocations across different markets. However, as mentioned before, our use of an investment metric based on expected

[28] This conjecture is vindicated by a high correlation of 0.86 between firm cash flows and total firm assets in our sample.

increases in electricity generation is likely to mitigate this problem by making different technologies more comparable in terms of investment costs.

Of course, whether our empirical evidence on investment bandwagons – and their potentially detrimental performance consequences – is generalizable to other settings is a valid question to ask. On this issue, although we acknowledge that the particular characteristics of our industry play a role in the effects we found, both scholarly and anecdotal evidence indicate that these bandwagon dynamics are widespread in cyclical industries such as oil refining, petrochemicals, paper, steel and iron ore, or airlines (*e.g.* Achi *et al.*, 1996; Baden-Fuller, 1990; Heer and Koller, 2000). This suggests that the phenomenon examined here may also occur in other industries.

Contributions

In spite of its limitations, this paper presents clear contributions to the literature that deals with firms' internal capital allocations. First, given the ownership and reporting requirements imposed on regulated activities, we were able to infer the role of restrictions to capital flows within firms with regulated activities in conditioning those firms' investments. To the best of our knowledge, this is the first paper to show empirically the effects of restrictions to capital flows within firms.

Second, and perhaps more importantly, our attempt to connect firms' investment responsiveness to performance in market contexts also provides a simple but powerful contribution to the literature. Namely, our results suggest that, when inferring the performance consequences of firms' internal capital allocations, it does not suffice for scholars and managers to consider responsiveness to opportunities in a vacuum: looking at how the investments of a firm and its competitors fit into their market contexts is also paramount (Zajac and Bazerman, 1991). Thus, firms' internal capital allocations should not be seen as analogous to situations in which financial investors optimize portfolios of securities, since there is an extra set of competitive dimensions that need to be taken into account in the former case.

On the whole, this work underscores the importance of integrating research on firms' internal capital allocations with aspects of competitive strategy such as market-level investment bandwagons. Doing so could improve our understanding of both observed patterns in firms' internal capital allocations, and the conditions under which responsiveness to environmental opportunities might be desirable for a given firm. This insight should serve as a guide for future work in this area.

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FIGURES AND TABLES

FIGURE 1: Market opportunities and total gross capacity additions by firms (in MW) for four of our eight considered markets (1998-2010)

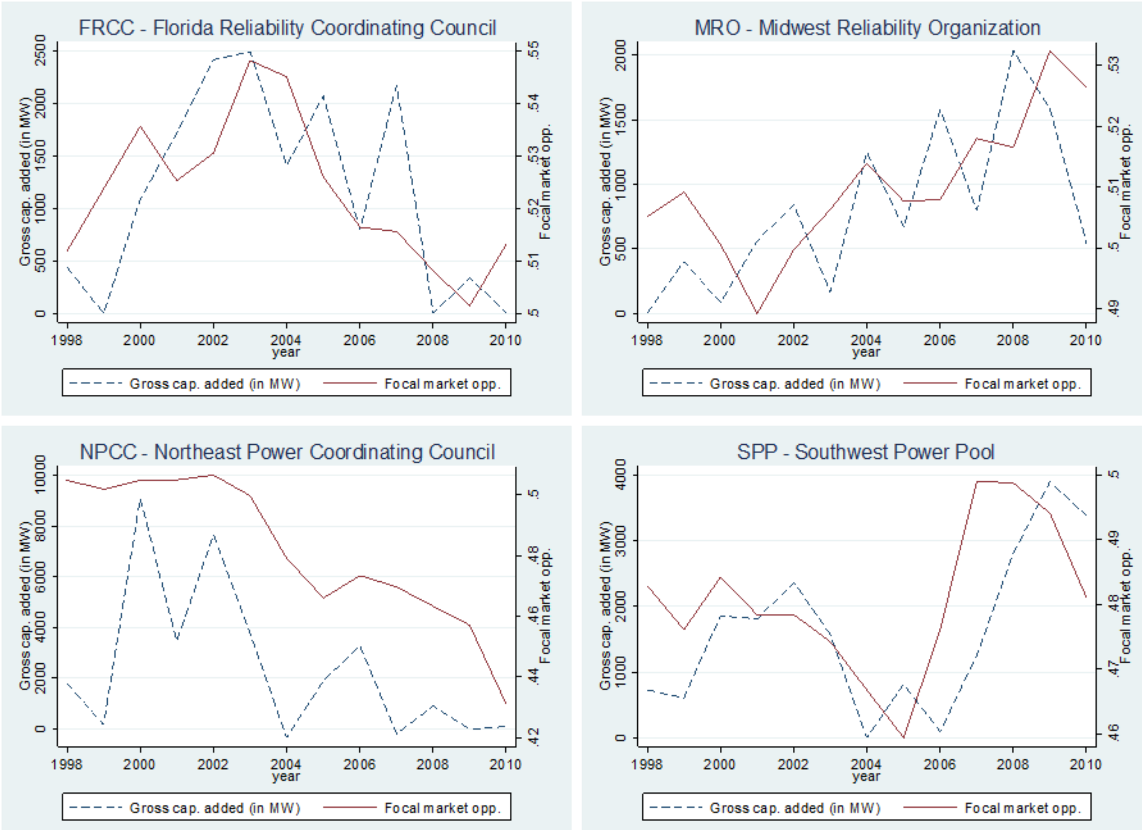
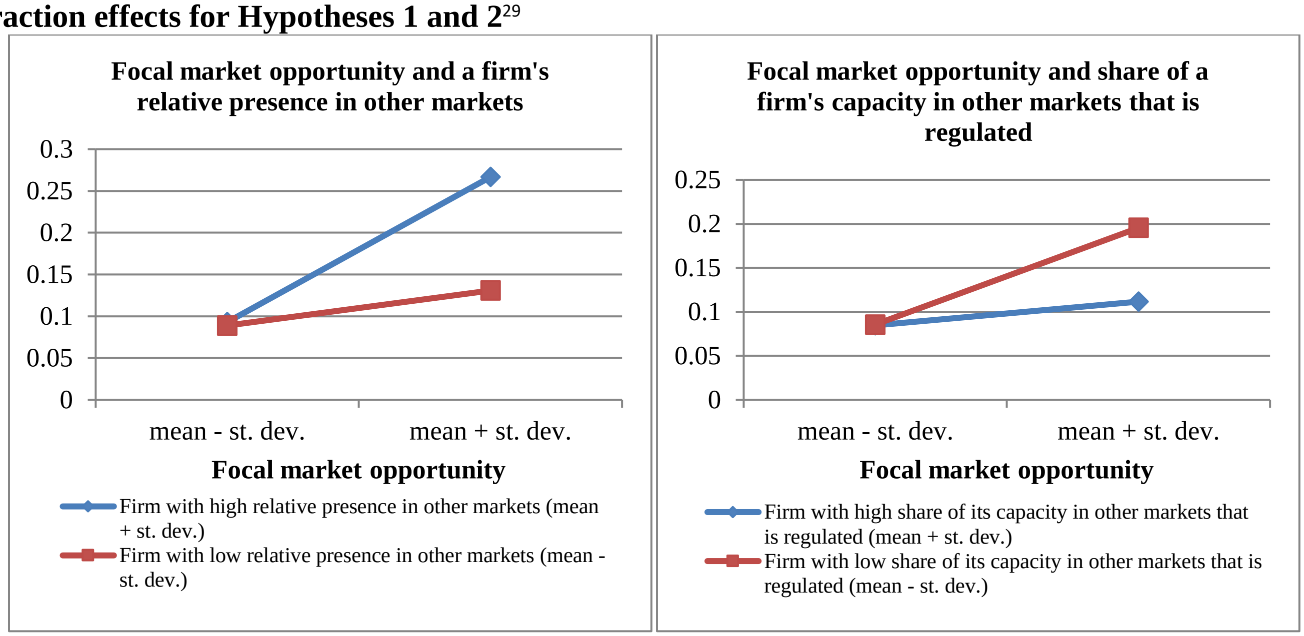


FIGURE 2: Logit regression models on firm investments in a focal market – Graphic representation of interaction effects for Hypotheses 1 and 2[29]



[29] Using Model 1 in Table 3 and the *margins* command in STATA 13, these two graphs display the predicted probabilities of firm investment at different values of the interacting variables. In both graphs, the *Firm single market dummy* variable was set to zero and the values of the interacted variables were evaluated by taking the mean and standard deviations for the subsample of firms that were present in multiple markets. The remaining variables were evaluated at their overall sample means.

TABLE 1: Logit regression models on firm investments in a focal market – Control variable descriptions

Variables	Descriptions
Demand growth in the focal market	This variable works as a proxy for the overall momentum of demand and cycles at the market level. It is the geometric average of the yearly growth of *Market average hourly net energy for load* (as defined before for the *Focal market opportunity* variable) over the prior 2 years.
Firm expected capacity utilization in the focal market	For each firm i in market m and year t, this variable is computed by the following expression: $$\frac{\sum_{p\in P_{imt}} Plant\ capacity_{pit} * Plant\ capacity\ utilization\ benchmark_{p\tau_p t}}{\sum_{p\in P_{imt}} Plant\ capacity_{pit}}$$ P_{imt} is the set of firm i's plants in market m and year t; $Plant\ capacity_{pit}$ is plant p's capacity in year t; τ_p indexes plant p's technological class; and $Plant\ capacity\ utilization\ benchmark_{p\tau_p t}$ represents the average across-sample capacity utilization for plants in technological class τ_p in year t.
Firm lumpiness in the focal market	This variable is the inverse of the count of the number of generating units (generators within a plant) that a firm has in a market. Lumpiness will detrimentally affect the ability of a firm to closely and smoothly match changes in demand with its capacity increases (Lieberman, 1987; Zhang and Gimeno, 2010).
Focal market HHI index	The Herfindahl-Hirschman Index (HHI) in each market, based on the electricity generated by the different firms present in a market.
Share of focal market generation that is regulated	This variable captures the share of regulated electricity generation out of overall electricity generation in a given market. For each market m and year t, it is calculated through the following expression: $$\frac{\sum_{p\in P_{mt}} Electricity\ generated_{pt} * I[if\ regulated]_{pt}}{\sum_{p\in P_{mt}} Electricity\ generated_{pt}}$$ P_{mt} is the overall set of plants in market m and year t; $Electrcity\ generated_{pt}$ is plant p's electricity generation in year t; and $I[if\ regulated]_{pt}$ is an indicator variable, coded 1 if plant p is regulated and 0 otherwise.
Firm focal market share	A firm's share of the total electricity generated in a market. We include both this variable and its interaction with *Focal market opportunity* in our model specifications.
Firm efficiency relative to focal market competitors variables	The technical and economic complexities of firms' technological mixes for generating electricity led us to build two separate variables aimed at capturing distinct nuanced aspects of a firm's relative efficiency in a market: *Firm "within-generation-technology" efficiency relative to focal market competitors*, which is meant to capture the average efficiency of a firm's plants relative to the average efficiency levels of each of those plants' respective generation technology classes in the focal market (hence the *within* mention); and *Firm "between-generation-technology" efficiency relative to focal market competitors*, which tries to operationalize the average efficiency of a firm's portfolio of plants across generation technologies relative to other firms' plant portfolios in the focal market (thus the *between* label). In other words, the former variable measures the average relative efficiency of a firm's plants compared to its focal market competitors, given the technological mix of its plant portfolio; whereas the latter variable looks at the overall average efficiency of a firm's plant portfolio, relative to its focal market competitors' plant portfolios. Together, these two variables provide a more complete picture of the relative efficiency differences between firms in our sample. - *Firm "within-generation-technology" efficiency relative to focal market competitors:* For each firm i in market m and year t we computed the following: $$\sum_{p\in P_{imt}} share_{pimt} * (1 - \frac{standardized\ avg.variable\ cost_{p\tau_p mt} - min\ standardized\ avg.variable\ cost_{\tau_p mt}}{max\ standardized\ avg.variable\ cost_{\tau_p mt} - min\ standardized\ avg.variable\ cost_{\tau_p mt}})$$ P_{imt} is the set of firm i's plants in market m and year t, $share_{pimt}$ is the share of plant p's generation relative to firm i's total generation in market m and year t, and τ_p indexes plant p's technological class. For each plant p in market m and year t, the $standardized\ avg.variable\ cost_{p\tau_p mt}$ component is the standardized measure of plant p's average variable expenditure in year t relative to its technological class τ_p in market m; obtained by subtracting from plant p's actual average variable expenditure (US$/MWh) in year t the mean of the average variable expenditure across all plants in the τ_p technological class in market m and year t, and then dividing that difference by the standard deviation of the average variable expenditure across all plants in the τ_p technological class in market m and year t. The $max\ standardized\ avg.variable\ cost_{\tau_p mt}$ and $min\ standardized\ avg.variable\ cost_{\tau_p mt}$ variables are, respectively, the maximum and the minimum standardized average variable expenditures across all plants from technological class τ_p in market m and year t; and are used to bound the within efficiency measure for each plant between 0 and 1. To obtain plant-market-year level within efficiency measures, we multiply the above ratios by -1 and we add 1 to them so that higher values reflect higher plant within efficiency levels. The final firm-market-year variable is just a sum of the plant-market-year within efficiency measures for plants belonging to the P_{imt} set, weighted by $share_{pimt}$. - *Firm "between-generation-technology" efficiency relative to focal market competitors:* For each firm i in market m and year t this variable takes the form: $$\sum_{p\in P_{imt}} share_{pimt} * (1 - \frac{standardized\ avg.variable\ cost_{pmt} - min\ standardized\ avg.variable\ cost_{mt}}{max\ standardized\ avg.variable\ cost_{mt} - min\ standardized\ avg.variable\ cost_{mt}})$$ P_{imt} is the set of firm i's plants in market m and year t, and $share_{pimt}$ is the share of plant p's generation relative to firm i's total generation in market m and year t. For each plant p in market m and year t, the $standardized\ avg.variable\ cost_{pmt}$ component is the standardized measure of plant p's average variable expenditure in year t relative to *all* other plants in market m; obtained by subtracting from plant p's actual average variable expenditure (US$/MWh) in year t the mean of the average variable expenditure across *all* plants in market m and year t, and then dividing that difference by the standard deviation of the average variable expenditure across *all* plants in market m and year t. The $max\ standardized\ avg.variable\ cost_{mt}$ and $min\ standardized\ avg.variable\ cost_{mt}$ variables are, respectively, the maximum and the minimum standardized average variable expenditures across *all* plants in market m and year t; and are used to bound the between efficiency measure for each plant between 0 and 1. To obtain plant-market-year level between efficiency measures, we multiply the above ratios by -1 and we add 1 to them so that higher values reflect higher plant between efficiency levels. We get to the final firm-market-year variable by summing the plant-market-year between efficiency measures for plants belonging to the P_{imt} set, weighted by $share_{pimt}$.
Share of a firm's capacity in the focal market that is regulated	This variable is meant to control for potential effects of a firm's involvement in regulated activities in the focal market. We include this variable and its interaction with *Focal market opportunity* in our model specifications. For each firm i in market m and year t, we calculate it through the following expression: $$\frac{\sum_{p\in P_{imt}} Plant\ capacity_{pit} * I[if\ regulated]_{pit}}{\sum_{p\in P_{imt}} Plant\ capacity_{pit}}$$ P_{imt} is the overall set of firm i's plants in market m and year t; $Plant\ capacity_{pit}$ is plant p's capacity in year t; and $I[if\ regulated]_{pit}$ is an indicator variable, coded 1 if plant p is regulated, and 0 otherwise.

Firm single-market dummy	This variable is coded 1 if, in the focal year, a firm was present in only one of the eight markets in our sample, and 0 if it was present in more than one of the eight markets.
Cash flow from operations	A firm's yearly cash flow from operations (in million US$).
Cost of debt	A firm's ratio of interest expenses to total debt.
Firm size	The natural logarithm of a firm's total assets (in million US$).
Index of firm exposure to state-mandated/-advised divestitures in the focal market	This variable is meant to capture a firm's exposure in a given market to specific regulations by state-level Public Utility Commissions (PUCs), demanding or advising the divestiture of the generating assets of firms involved in electricity retail in those PUCs' states of jurisdiction. For each firm i in market m and year t, it was calculated using the following formula: $\sum_{s \in S_m} share_{ismt} * State\ share_{ist} * Firm\ retail\ presence_{ist} * State\ level\ divestiture_{st}$ s indexes states, and S_m indexes the set of states comprised in market m. Since wholesale markets most often encompass more than one state, $share_{ismt}$ is the share of firm i's capacity in state s and year t out of firm i's total capacity in market m and year t. $State\ share_{ist}$ is a firm i's share of the total generating capacity that exists in state s in year t, reflecting the fact that firms with higher shares of overall state capacity were more likely to be targeted by PUCs' divestiture initiatives. $Firm\ retail\ presence_{ist}$ is a categorical variable coded 1 if a firm i was present in electricity retail in state s during year t, and 0 otherwise. Finally, $State\ level\ divestiture_{st}$ is a categorical variable coded 1 if the divestiture of generating assets was mandated or advised by a PUC to firms involved electricity retail in state s during year t, and 0 otherwise.

TABLE 2: Logit regression models on firm investments in a focal market – Variable summary statistics

		Nr. of Obs.	Mean	St. Dev.	Min.	Max.
1	*Firm investment in the focal market*	1106	0.1673	0.3734	0	1
2	*Demand growth in the focal market*	1106	0.0124	0.0403	-0.2278	0.2067
3	*Firm expected capacity utilization in the focal market*	1106	0.4198	0.1775	0.0531	0.8451
4	*Firm lumpiness in the focal market*	1106	0.1315	0.1906	0.0039	1
5	*Focal market HHI index*	1106	0.1725	0.0657	0.0787	0.4072
6	*Share of focal market generation that is regulated*	1106	0.5296	0.2352	0.1040	0.9257
7	*Firm focal market share*	1106	0.0507	0.0702	0.0000	0.5638
8	*Focal market opportunity*	1106	0.5041	0.0278	0.4249	0.5611
9	*Firm "within-generation-technology" efficiency relative to focal market competitors*	1106	0.8293	0.1586	0	1
10	*Firm "between-generation-technology" efficiency relative to focal market competitors*	1106	0.9359	0.0798	0	0.9996
11	*Share of a firm's capacity in the focal market that is regulated*	1106	0.4451	0.4424	0	1
12	*Firm single-market dummy*	1106	0.1718	0.3774	0	1
13	*Firm relative presence in other markets*	1106	0.5941	0.3804	0	0.9979
14	*Share of a firm's capacity in other markets that is regulated*	1106	0.3738	0.3781	0	1
15	*Index of opportunities that a firm faces in other markets*	1106	0.4210	0.1910	0	0.6023
16	*Cash flow from operations*	1106	1201.6250	1153.2510	-1043.3410	5281
17	*Cost of debt*	1106	0.0665	0.0250	0.0126	0.1953
18	*Firm size*	1106	9.5434	1.0160	6.2319	11.1375
19	*Index of firm exposure to state-mandated/-advised divestitures in the focal market*	1106	0.0144	0.0450	0	0.3570

TABLE 3: Logit regression models on firm investments in a focal market; standard errors clustered at the firm level – Results

		(1)	(2)
Demand growth in the focal market		3.9066	3.3899
		(3.2396)	(4.2321)
Firm expected capacity utilization in the focal market		-1.5438	-0.6908
		(0.9777)	(0.9500)
Firm lumpiness in the focal market		-0.3453	0.1611
		(0.5056)	(0.7464)
Focal market HHI index		-4.2162	-7.8493^{+}
		(3.3321)	(4.2823)
Share of focal market generation that is regulated		-1.2935	0.2686
		(6.2204)	(7.6147)
Firm focal market share		-2.4514	-3.1239
		(4.0254)	(3.4549)
Firm focal market share X Focal market opportunity		-0.4096	54.4103
		(95.5890)	(89.0566)
Focal market opportunity		11.1627	11.6442
		(7.2359)	(8.6243)
Firm "within-gen.-technology" efficiency relative to focal market competitors		-0.4877	-0.6039
		(0.7496)	(0.9659)
Firm "between-gen.-technology" efficiency relative to focal market competitors		2.7644	3.6547^{+}
		(1.8138)	(1.9128)
Share of a firm's capacity in the focal market that is regulated		-0.1272	1.0076^{+}
		(0.3570)	(0.5197)
Share of a firm's capacity in the focal market that is regulated X Focal market opportunity		13.5773	11.9609
		(9.2612)	(10.2724)
Firm single-market dummy		0.1518	-5.3259
		(2.6060)	(3.4078)
Firm relative presence in other markets		0.8537	0.2115
		(0.5241)	(0.8206)
Firm relative presence in other markets X Focal market opportunity	**H1** $\beta > 0$	25.9566^{+}	47.5164*
		(14.4447)	(21.1920)
Share of a firm's capacity in other markets that is regulated		-0.4773	1.5947*
		(0.4369)	(0.6834)
Share of a firm's capacity in other markets that is regulated X Focal market opp.	**H2** $\beta < 0$	-15.6187*	-21.2622**
		(6.3123)	(8.0276)
Index of opportunities that a firm faces in other markets	**H3** $\beta < 0$	-0.0614	-11.6600^{+}
		(4.9685)	(6.6698)
Cash flow from operations		0.0001	0.0002
		(0.0001)	(0.0001)
Cost of debt		-31.9552***	-28.4149***
		(5.4734)	(4.5698)
Firm size		-0.2384	-0.4335
		(0.1739)	(0.2704)
Index of firm exposure to state- -mandated /-advised divestitures in the focal market		-4.5193*	-2.7503
		(2.2914)	(2.9575)
Constant		-2.5629	-17.1161*
		(6.2760)	(6.9063)
Number of observations		1106	1106
Number of firms (clusters)		40	40
Firm dummies		No	Yes
Market dummies		Yes	Yes
Year dummies		Yes	Yes
Log-likelihood		-419.8221	-375.5213
Log-likelihood ratio test		159.1403	247.7417
- p-value		0.0000	0.0000
McFadden's pseudo R-squared		0.1593	0.2480

Standard errors in parentheses
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 4: Endogenous treatment effects linear regression models on firm performance in a focal market – Second-stage variable summary statistics

		Nr. of Obs.	Mean	St. Dev.	Min.	Max.
1	*Firm ratio of deviation from expected capacity utilization in the focal market*	953	0.0723	0.5196	-0.9995	2.9074
2	*Focal market capacity tightness (current year)*	953	0.5012	0.0316	0.4146	0.5871
3	*Firm "within-gen.-technology" efficiency rel. to focal market competitors (current year)*	953	0.8356	0.1461	0	1
4	*Firm "between-gen.-technology" efficiency rel. to focal market competitors (current year)*	953	0.9342	0.0807	0	0.9981
5	*Focal market opportunity dummy (over past 2 years)*	953	0.5845	0.4931	0	1
6	*Firm investment in the focal market (over 2 years before)*	953	0.2875	0.4528	0	1
7	*Firm focal market share (1 year before)*	953	0.0536	0.0714	0.000	0.5638
8	*Focal market HHI index (1 year before)*	953	0.1734	0.0659	0.0787	0.4072
9	*Share of focal market generation that is regulated (1 year before)*	953	0.5334	0.2338	0.1040	0.9257
10	*Share of a firm's capacity in the focal market that is regulated (1 year before)*	953	0.4694	0.4397	0	1

TABLE 5: Endogenous treatment effects linear regression model on firm performance in a focal market – Second-stage results[30]

	(1)	(2)	(3)	(4)
Focal market capacity tightness (current year)	1.5339*	1.2111	1.2105	1.2975
	(0.7810)	(0.8360)	(0.8340)	(0.8272)
Firm "within-gen.-technology" efficiency rel. to focal market competitors (current year)	0.4885***	0.5083***	0.5042***	0.5167***
	(0.1039)	(0.1034)	(0.1031)	(0.1029)
Firm "between-gen.-technology" efficiency rel. to focal market competitors (current year)	0.7902***	0.7091**	0.6799**	0.7391**
	(0.2220)	(0.2264)	(0.2262)	(0.2283)
Focal market opportunity dummy (over past 2 years)		0.0490	0.0924*	0.0829+
		(0.0402)	(0.0449)	(0.0447)
Firm investment in the focal market (over 2 years before)		-0.1497	-0.0285	0.0200
		(0.1038)	(0.1178)	(0.1277)
Firm investment in the focal market (over 2 years before) X Focal market opportunity dummy (over past 2 years)			-0.1524*	-0.1512*
			(0.0709)	(0.0704)
Firm focal market share (1 year before)				0.6318*
				(0.2752)
Firm focal market share (1 year before) X Focal market capacity tightness (current year)				12.2622
				(7.7247)
Focal market HHI index (1 year before)				-1.7849**
				(0.6656)
Share of focal market generation that is regulated (1 year before)				1.1103
				(1.1573)
Share of a firm's capacity in the focal market that is regulated (1 year before)				-0.1007*
				(0.0425)
Constant	-1.7313***	-1.5299**	-1.5359**	-1.9758
	(0.4776)	(0.4938)	(0.4926)	(1.2085)
Lambda	.	0.0498	0.0366	0.0046
	.	(0.0641)	(0.0642)	(0.0699)
Number of observations	953	953	953	953
Number of firms	40	40	40	40
Firm dummies	No	No	No	No
Market dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Adjusted R-squared	0.2271	.	.	.
F-statistic	14.3168	.	.	.
Chi-Squared statistic	.	360.5749	367.4275	398.7891
- p-value	0.0000	0.0000	0.0000	0.0000

Standard errors in parentheses
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

[30] Contrary to the rest of the models, Model 1 is just a regular ordinary least-squares regression, since it does not yet include firm investment as an independent variable.