Competition Effects of Mergers:  
An Event Study of the German Electricity Market*

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Abstract
This paper investigates the competition effects of the entry of Vattenfall into the German electricity market, which was supported by the competition authorities by approving three acquisitions of regional utilities. We first discuss two contrasting views with regard to horizontal mergers: the efficiency hypothesis that postulates pro-competitive effects due to economies of scale and learning, and the market power hypothesis that postulates anti-competitive effects due to increased concentration. By analysing the stock prices of relevant competitors in the market using an event study approach, we achieve a combined assessment of the two contrary hypotheses. We then compare the stock market reaction with the view of the competition authorities. While we find no evidence that increasing market power benefited the large competitors E.ON and RWE, there is some indication that potential increases in efficiency of the new player harmed the competitors. This result supports the view of the competition authorities, suggesting an overall positive effect for consumers from the entry and formation of Vattenfall in the German electricity market.

Keywords: electricity, Germany, market power, event study, horizontal merger  
JEL-code: L13, L41, L94, G14

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1 Introduction

During the period 1999-2002, the Swedish company Vattenfall entered the German electricity market by subsequently acquiring three regional utility companies (HEW, VEAG and Bewag). The German competition authority (Bundeskartellamt) and the European Commission both appreciated the entry because the German electricity market was dominated by E.ON and RWE with over 50% market share. The Bundeskartellamt expressed the view that Vattenfall as an efficient new player and a “Fourth Power” in the German electricity market (beside E.ON, RWE and the third power EnBW) would be able to compete in prices against the existing big players. It was a precondition by the competition authorities to create such a new power to approve the requested mergers by Veba and Viag to form E.ON and by RWE and VEW in 1999/2000. However, it is a controversial issue today whether the formation of Vattenfall in the German market indeed enhanced competition or whether it even increased the market power of the new oligopoly by reducing the number of players.

Against the background of rising electricity prices, several empirical studies recently analysed whether power generation in Germany is a competitive market (e.g. Schwarz et al., 2007; Weigt and von Hirschhausen, 2007; Ockenfels, 2007). Although there is some indication that the utilities possess market power, it is controversial whether prices charged for power generation are indeed set above competitive levels. Given this dissent and the difficulties in estimating price-cost margins due to limited data availability, it is even more difficult to assess whether the entry of Vattenfall into the German market had a pro-competitive or an anti-competitive effect.

We use a novel approach in tackling this specific question by applying an event study, which analyses the reaction of the stock market to the merger announcements by Vattenfall. We consider the three cases when Vattenfall acquired regional utility companies and identify ten event dates, on which important news about the takeovers were released. In the tradition of Eckbo (1983) and Stillman (1983), we expect that an analysis of the stock returns of the merging parties’ competitors, E.ON and RWE, can reveal the competition effects of the merger.
We find no indication that the formation of Vattenfall had anti-competitive consequences, which is in support of the view of the competition authorities.

The paper is organised as follows. Chapter 2 presents the background of the liberalisation process in the German electricity market. Chapter 3 describes the competition effects of horizontal mergers. Chapter 4 derives our methodology and the data used to create the event study. Chapter 5 presents the results and compares them to three hypotheses created from the view of the competition authorities. Chapter 6 concludes.

2 Liberalisation of the electricity market

2.1 Liberalisation and market power

The electricity sector can be subdivided into four vertically linked stages: generation, transmission, distribution and retailing. While stages two and three represent classical network industries and will continue to be regulated throughout Europe, competition has been introduced at both the generation and the retail stage. The European Commission started the EU-wide policy of liberalisation in 1996 with Directive 96/92/EC and speeded up the formal process of introducing competition with Directive 2003/54/EC. The economic rationales for liberalisation are expectations for lower prices and higher efficiency in the electricity industry, which would lead to an economic surplus through direct and indirect consumer price effects (see e.g. Martin et al., 2005). Although the potential benefits from competition are well acknowledged, oligopolistic market structures with only few players represent a major obstacle. This is especially the case for the stage of generation, which we consequently examine in more detail.

For an initial examination of the effects of an oligopolistic market structure on prices, we employ the standard Cournot-Nash equilibrium. Although its application to electricity markets is controversial and alternative concepts like Supply Function Equilibrium (SFE) exist, the Cournot framework provides a reasonable approach and it is still widely used in electricity
market modelling due to its advantages in computational manageability (Ventosa et al., 2005). Proceeding from the Cournot oligopoly, the Lerner index for firm $i$, measuring how strong price exceeds marginal cost, is given by:

$$\frac{p - C'_i}{p} = \frac{s_i}{\eta},$$  \hspace{1cm} (1)

where $p$ is the price of power in the wholesale market, $C'_i$ is the marginal cost of firm $i$, $s_i$ is the share of firm $i$ in total output and $\eta$ is the price elasticity of demand. It is obvious from the equation that the margin over marginal cost is higher when the market share of a company is high and when the price elasticity of demand is low. An aggregate Lerner index over all firms weighted by market shares can be related to the Herfindahl-Hirschmann Index (HHI) of market concentration (see e.g. Vives, 1999):

$$\sum_{i=1}^{n} \left( s_i \frac{p - C'_i}{p} \right) = \frac{HHI}{\eta} \quad \text{with} \quad HHI = \sum_{i=1}^{n} s_i^2$$  \hspace{1cm} (2)

Thus, increasing concentration in the market, measured by the HHI, pushes the price further away from marginal cost. The price elasticity of demand is typically low in the electricity market, increasing the potential to raise price over marginal cost. This tendency is aggravated by the lack of real-time billing to end-users, which causes a severe lack of demand elasticity in the short-run (see Stoft, 2002). Another issue, which can potentially strengthen market power in generation, is its close relation to transmission and distribution networks that connect generation and final demand. A transmission service operator (TSO) has to manage transmission and allocate capacity to generators. If a generator owns the network or especially the TSO, this integrated company has the possibility to exercise market power and discriminate against other generators. Furthermore, it has an incentive to reallocate profits from generation to transmission in order to keep margins at the generation level low and deter new entrants.
In general, two issues can restrict the potential for exercising market power: competition from abroad via imports and the existence of contestable markets. In power supply, competition from abroad or outside specific regions is typically insufficient due to regional networks and limited capacity of interconnections. At the European level, the relevant geographic markets for electricity are still of limited size, often coinciding with national borders. This is due to few and congested interconnections at the borders of the national states. The theory of contestable markets claims that even if firms possess large market shares and thus market power, they may be deterred from setting price above marginal cost because this would attract new entries into the market. In power generation, however, new entrants are typically discouraged by large sunk costs and a complicated approval procedure so that incumbents are able to set prices higher than marginal costs up to a certain extent.

We conclude from this first examination that in the case of market power, the prediction of falling prices due to liberalisation might turn out to be premature. Since the German electricity market after its liberalisation experienced several mergers, there are suppositions that increasing concentration resulted in considerable market power. Newbery (2007) claims that electricity restructuring in Europe – as opposed to the US – has tended to overlook issues of market power.

### 2.2 Market power in the German electricity market

Several indicators can be used to analyse market power in the German electricity market. The market shares reveal that the largest producers exceed the shares defined by German antitrust law as thresholds for the supposition of market power.\(^1\) As shown in Figure 1, the five largest producers in Germany, among them Vattenfall, have a cumulative share in generation capacity

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1 These thresholds are: 33% market share of the biggest supplier, 50% market share of the 3 biggest suppliers together, and 66% market share of the 5 biggest suppliers together (Gesetz gegen Wettbewerbsbeschränkungen, §19, 3).
of about 68% and in actual power generation of about 87% (Zimmer et al., 2007). Similarly, the Herfindahl-Hirschmann Index (HHI) of 1,840 points indicates high concentration (Zimmer et al., 2007). When taking criticism into account that these conventional measures of market power are inadequate and underestimating the potential market power in the electricity market due to inelastic demand (see e.g. Stoft, 2002), the numbers trigger even higher concerns. A different indicator, the Residual Supply Index (RSI), measures the potential market power of a single company. It determines if and for how long the capacity of one producer is essential to satisfy final demand, thus if the company is a pivotal supplier. Schwarz et al. (2007) calculate the RSI values for the two biggest German companies RWE and E.ON and find a high potential for the exertion of market power.

Figure 1: Market shares in the German wholesale electricity market 2006

![Market shares chart](chart.png)

Source: Zimmer et al., 2007

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2 Part of this difference can be explained by the wind power sector, where capacity and generation differ significantly due to varying wind conditions. Since most wind turbines are owned by small and independent companies, the share of “other suppliers” in capacity is higher than in actual generation.

3 While the German authorities mention no explicit thresholds of the HHI, the US Department of Justice considers a market to be highly concentrated for a HHI of more than 1,800 points.
While the previous indicators assess only potential market power, a different approach uses a simulation model of marginal costs to calculate price-cost-margins as an indicator for the actual exertion of market power. Schwarz and Lang (2006) have calculated such a model for the German wholesale electricity market in the period 2000-2005 and come to the conclusion that while in 2000 marginal cost pricing could be assumed, prices rose above marginal costs in 2003 and thereafter. Weigt and von Hirschhausen (2007) find in their analysis that market prices were systematically above marginal costs between 2004 and summer 2006. Though appealing, studies simulating price-cost-margins of power generators are criticised for the difficulties in identifying true cost structures and in coping with the dynamics on electricity markets (Ockenfels, 2007).

Besides the concentration at the producer level, it should be annotated that the four large utilities in Germany are integrated companies that produce electricity, own the network and are active as retailers. Although authorities regulate the transmission, the activity as a transmission system operator can strengthen the possibility of the utilities to discriminate against independent generators or retailers.

From the evidence presented for the German market, it can be supposed that the major utilities, especially E.ON and RWE, possess considerable market power. There is also some indication that they at least partially exert this power to set prices above marginal costs. However, it is unresolved whether the formation of Vattenfall, which was actively supported by the competition authorities, enhanced competition through the presence of a large and efficient competitor or, in contrast, it harmed competition through the increased market power of the oligopoly. Before approaching this question, we first report on the history of Vattenfall’s entry into the German market.
2.3 The entry of Vattenfall into the German market

Shortly after the German electricity market was liberalised in 1998, the market experienced a big change. New electricity retailers and foreign companies entered the market and retail prices declined strongly, especially for large industrial customers (see e.g. Christiansen, 2005). However, the German companies reacted soon and a merger wave changed the industry structure significantly. Especially remarkable are two large merger cases that were announced in autumn 1999: the acquisition of VEW by RWE and the merger between VIAG and VEBA to create E.ON. After these transactions, the two major utilities controlled more than half of the market, rising serious concerns about the exertion of market power. Nevertheless, the European Commission (in the case of VEBA/VIAG) and the German Bundeskartellamt (in the case of RWE/VEW) both approved the deals in 2000 conditioned to remedies, which included the sale of the companies’ stakes in the regional utilities HEW, VEAG/LAUBAG and Bewag. Although other foreign companies were also interested in acquiring the regional utilities, Vattenfall was successful in creating its subsidiary Vattenfall Europe during 1999-2002 by taking over HEW, VEAG/LAUBAG and Bewag. In the following, we describe important events concerning these acquisitions.

The entry of Vattenfall into the German market started with the takeover of the Hamburger Electricitäts-Werke (HEW). After an announcement by the city of Hamburg to sell 25.1% of its utility, Vattenfall declared its interest in September 1999 and acquired the stake in November. In October 2000, Vattenfall announced that it would acquire another 37.2% in HEW from E.ON and Sydkraft and 7.8% from other investors. Vattenfall finalised the deal with the acquisition of the remaining 25.1% in June 2002, which were until then still owned by the city of Hamburg.

The second acquisition by Vattenfall was the East German utility VEAG and its partner LAUBAG. In April 2000, when it became clear that RWE and E.ON would have to sell their stakes in VEAG/LAUBAG due to obligations imposed by the competition authorities, HEW
confirmed its interest in the company with the support from Vattenfall. Other potential investors appeared as well, but in December 2000, it was announced that HEW/Vattenfall would acquire VEAG.

The third company that was later integrated into Vattenfall Europe was the Berlin utility Bewag. In August 2000, E.ON announced that it would sell its 49% stake in Bewag to Vattenfall and not, as expected from many market participants, to Mirant (at that time called Southern Energy) which already owned a stake in Bewag. However, Mirant blocked this deal with a veto one day later and afterwards quarrelled with Vattenfall over the control of Bewag. In March 2001, the two companies agreed to control Bewag collectively, each owning a 45% stake, but they soon disagreed again on the future strategy. In December 2001, it came to some surprise that Mirant announced to sell its stake in Bewag to Vattenfall. This last deal opened the way for Vattenfall to form a new large utility in the North and East of Germany in 2002, named Vattenfall Europe. Both the Bundeskartellamt and the European Commission welcomed the creation of a strong competitor in the German market.

3 Competition effects of horizontal mergers

In the third chapter, we review the possible effects of horizontal mergers on competition and how event studies are used to test for these effects empirically. We treat the mergers of Vattenfall with regional German utilities as horizontal mergers because all companies involved (HEW, VEAG/LAUBAG, and Bewag) as well as the large competitors E.ON and RWE were active in all stages of electricity supply. None of the mergers was an explicit vertical integration and furthermore, our focus lies on the stage of generation, which triggers the largest competition concerns.
3.1 Efficiency gains versus increasing market power

For our examination, we express the competition effects of a horizontal merger by the effects that the merger has on relevant competitors in the market. The idea behind it is that a merger that harms competitors tends to be pro-competitive and vice-versa, a merger that benefits competitors tends to be anti-competitive. Using this insight, Eckbo (1983) and Stillman (1983) started to analyse changes in stock prices of competitors at the announcement date of a merger, an event study, to test whether there is a pro- or anti-competitive effect. The theoretical underpinnings for the competitive effects of horizontal mergers on rivals’ present discounted value, as measured by stock prices, are changes in efficiency and market power that influence product prices. In the following, we present both types of hypotheses.

Efficiency Hypothesis

Increased efficiency due to a merger that leads to the reduction of average costs can put downward pressure on product prices. According to the Cournot oligopoly model of horizontal mergers by Farrell and Shapiro (1990), this is possible for mergers with economies of scale and for mergers with learning, i.e. when knowledge or technology is transferred within the new merged entity. The efficiency hypothesis predicts that the stock prices of rival firms decrease if the market expects that the merged company produces more efficient since this would lead to a falling market price (Eckbo, 1983). However, as noted by Eckbo (1983) and Eckbo and Wier (1985), the news of a merger might also spread the information to competitors that they are able to benefit from efficiency gains as well in future mergers. The consequence of this in-play effect is that share prices of rivals could increase. Therefore, either positive or negative abnormal returns to rivals can be consistent with the efficiency hypothesis.

Market Power Hypothesis

Under the market power hypothesis, events that make the merger more likely will cause rivals’
share prices to rise, reflecting increases in expected future cash flows. In the Cournot model, the new merged entity with an increased market share will typically restrict its combined output. As shown in equation (2), a higher concentration of market shares at a single firm leads at unchanged costs to an increase in equilibrium price, from which competitors of the merging firms benefit. As Duso et al. (2006, p. 10) mention, “the change in the value of competitors’ equity can then be taken as a measure of the (discounted) additional profits that is expected to accrue to them as a consequence of the merger.” It is then obvious that events that make a proposed merger less likely will be associated with a share price decline for rivals (Eckbo 1983).

**Consequences**

To evaluate the consequences of a merger for consumer surplus and thus consumer prices, it is necessary to check which of the two hypotheses dominates. Schumann (1993, p. 680f.) points out that “whether a merger that creates efficiencies results in higher or lower prices depends on how large those efficiencies are and to what extent increased concentration may affect how the firms in the industry interact to determine market prices.” Combining this insight with the consequences of a merger for the stock prices of non-merging competitors, positive stock returns to competitors would harm consumers while negative stock returns would benefit them (see also Duso et al, 2006). One problem of this approach is, as outlined above, that positive returns to rivals at the merger announcement might not only signal market power, but also the possibility for competitors to become more efficient in the future, which would then benefit consumers. We take up this issue in the next chapter where we examine whether the criticism of event studies that analyse the competition effects of mergers apply also to our study.

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4 The Herfindahl-Hirschmann Index of market concentration used in equation (2) always rises in consequence of a merger in the relevant market since the squared market share of the merged entity is higher than the sum of squares of the market shares of the individual entities.
3.2 Criticism of event studies in merger cases

Since the time event studies were first employed to analyse competition effects of horizontal mergers, the methodology has also been criticised (e.g. by McAfee and Williams, 1988; Fridolfsson and Stennek, 2006). This criticism is often related to problems arising from studies that cover a large number of mergers in different industries and over a long time horizon, where it is not possible to consider merger specific information. In contrast to these large-sample studies, we focus in our analysis on three mergers in the German electricity market and are able to include case-specific information.

The criticism by McAfee and Williams (1988) focuses on the problem that many companies are multi-product companies. A merger in an area where only one of the various products of a competitor is involved might not have any influence on its share price. This problem is not relevant in our analysis because the utilities we consider are focused mainly on the electricity business and furthermore, electricity is a homogenous good without product differentiation. Therefore, a horizontal merger has a direct influence on the competitors in the market and their share prices.

Another drawback, which was mentioned in the last section, is the possibility of an in-play effect and positive abnormal returns to rivals, which are not consistent with the market power hypothesis. In our case, however, the large competitors E.ON and RWE were already in the process of consolidation themselves, so the merger announcements by Vattenfall provided no new information regarding future efficiency gains through mergers. Moreover, it was clear that the competition authorities would take up a very rigid stance on any further horizontal merger proposal by E.ON or RWE.

As pointed out by Fridolfsson and Stennek (2006), “event studies are sensitive to the exact anticipations and uncertainties present in the stock market prior to the merger” (p.26). This is the case when existing rumours about a merger, which are already incorporated in the stock
prices, lead to a different interpretation of the actual merger announcement than if it would have come as a complete surprise. As an example, suppose that a rumour of a merger already exists, but the allocation of roles regarding the merging parties is still uncertain. Then the announcement of the specific merger can lead to an out-of-play effect for the competitors who are not involved in the merger. The stock prices would decline because market expectations that the respective company is involved in the merger are now disappointed. It is necessary to consider this out-of-play effect and therefore, detailed information about each event is needed. In our study, we include rumour dates as well as announcement dates of a merger. Furthermore, the out-of-play effect has no influence in the cases of VEAG and Bewag because it was clear that neither E.ON nor RWE would be allowed to control those companies due to the obligations of the competition authorities who actually required them to divest their stakes. Only in the case of HEW might have existed an out-of-play effect for the competitors when Vattenfall started to bid for HEW. We will consider this possibility in the interpretation of the results.

4 Methodology

In this chapter, we present the data selection and the methodology of our event study. The application of an event study is based on the validity of the semi-strong form of the efficient market hypothesis, i.e. that stock prices represent an unbiased estimate of a firm’s future profits and that all new information is reflected by corresponding changes in stock prices. As indicated in the previous chapter, the change in expected future profits of competitors can be used as an indicator for the competitive consequences of a merger.\footnote{We do not attempt to quantify the changes in expected future profits, but are only interested in the sign: a negative sign indicates a pro-competitive effect of the proposed merger while a positive sign indicates an anti-competitive effect.} Hence, it will be possible to use the changes in stock prices of competitors due to a merger announcement as a proxy for the competition effects of the respective merger. Regarding the entry of Vattenfall into the German
market, we identify three major cases with altogether ten event dates. The first case includes important dates with respect to the acquisition of HEW by Vattenfall, the second case treats the takeover of VEAG, and the third case covers the Bewag acquisition. Each event date that we examine is presented in Table 1 together with a short description. The event dates have been received from the financial press via the FACTIVA database. If an event took place on a weekend, we employ the following trading day as the event day. As relevant competitors, we identify E.ON\(^6\) and RWE since they are the two largest players in the German market and it can be expected that their stock prices react to competitive or anti-competitive effects that take place in the German electricity market. In addition, the share prices of E.ON and RWE are well suited for an event study since they exhibit frequent trading activities and thus react instantaneously to new information.

Since rumours about a merger can alter the abnormal stock returns of the competitors at the announcement date of a merger, we also take into account the existence of rumours by including event dates when the market anticipated a merger the first time. This approach of looking in detail on each merger case and identifying several event dates differentiates our study from many other event studies which simply employ the announcement day of a merger and thus lose important information from many merger cases.

\(^6\text{E.ON was officially created in June 2000 out of VEBA and VIAG but merger talks started already in July 1999 and were officially confirmed in the beginning of September 1999. Since E.ON shares were not yet traded at our first event dates, we then use the share price of VEBA, which brought the majority of capital into the new company. VEBA shares were renamed as E.ON in June 2000.}\)
Table 1: Event dates for the entry of Vattenfall into the German electricity market

<table>
<thead>
<tr>
<th>No</th>
<th>Date</th>
<th>Case 1: Vattenfall-HEW</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>29-Sep-99</td>
<td>Vattenfall announces interest in 25.1% of HEW</td>
</tr>
<tr>
<td>1b</td>
<td>16-Nov-99</td>
<td>Vattenfall’s bid is accepted and it buys 25.1% in HEW</td>
</tr>
<tr>
<td>1c</td>
<td>19-Oct-00</td>
<td>Vattenfall acquires 45% in HEW from E.ON, Sydkraft and others</td>
</tr>
<tr>
<td>1d</td>
<td>11-Jun-02</td>
<td>Vattenfall buys the remaining 25.1% in HEW from the city of Hamburg</td>
</tr>
</tbody>
</table>

Case 2: Vattenfall-VEAG

<table>
<thead>
<tr>
<th>No</th>
<th>Date</th>
<th>Case 2: Vattenfall-VEAG</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a</td>
<td>18-Apr-00</td>
<td>HEW, supported by Vattenfall, declares interest in VEAG</td>
</tr>
<tr>
<td>2b</td>
<td>12-Dec-00</td>
<td>HEW/Vattenfall will take over VEAG from RWE and E.ON</td>
</tr>
</tbody>
</table>

Case 3: Vattenfall-Bewag

<table>
<thead>
<tr>
<th>No</th>
<th>Date</th>
<th>Case 3: Vattenfall-Bewag</th>
</tr>
</thead>
<tbody>
<tr>
<td>3a</td>
<td>09-Aug-00</td>
<td>HEW/Vattenfall announces the acquisition of 49% in Bewag from E.ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(one day later Mirant, another shareholder of Bewag, blocks the deal)</td>
</tr>
<tr>
<td>3b</td>
<td>27-Mar-01</td>
<td>HEW/Vattenfall and Mirant agree on joint ownership of Bewag</td>
</tr>
<tr>
<td>3c</td>
<td>26-Sep-01</td>
<td>Dispute between Vattenfall and Mirant over Bewag strategy</td>
</tr>
<tr>
<td>3d</td>
<td>03-Dec-01</td>
<td>Mirant sells stake in Bewag to Vattenfall</td>
</tr>
</tbody>
</table>

To measure the event-induced changes in stock prices, we follow the market model of the event study methodology as presented in MacKinlay (1997). First, to estimate normal performance, the daily stock returns of company $i$ (adjusted for dividend payments) are regressed on a constant and the market return during an estimation window that starts and ends before an event:

$$ R_{it} = \alpha_i + \beta_i DAX_{it} + \epsilon_{it} $$

(3)

For the market return we employ the DAX, which is the German primary index measuring the performance of the 30 largest Prime Standard companies. The residuals $\epsilon_{it}$ are assumed to be normally distributed with the properties:
\[ E(\varepsilon_{it}) = 0 \quad (4) \]
\[ \text{VAR}(\varepsilon_{it}) = \frac{1}{L-2} \sum_{t=T_0}^{T_f} (\varepsilon_{it})^2 \quad (5) \]

where \( L \) is the length of the estimation window and \( T_0 \) and \( T_f \) are the first and the last day of the estimation window, respectively. Our estimation window includes 90 trading days: it starts 100 days and ends 11 days before each event. This gives a reasonably large estimation window while ensuring that potential information leakage before the event itself has no impact on the regression. The coefficients \( \alpha_i \) and \( \beta_i \), which are estimated by equation (3), can then be used to calculate the abnormal return \( AR \) by company \( i \) for each event day \( t \):

\[ AR_{it} = R_{it} - \alpha_i - \beta_i DAX_{it} \quad (6) \]

This means that the abnormal return is calculated as the difference between actual return \( R_{it} \) and the return predicted by the market model. We employ an event window that ranges from two trading days before to four trading days after the event day and calculate abnormal returns for each of the seven days. This extension is useful to incorporate insider knowledge that may influence the stock return prior to the announcement of the event as well as to incorporate delays in the reaction of the market due to uncertainties. At the same time, it is necessary to assure that there is no overlap of the event window with other events, which could distort the reaction of the share price. We checked the financial press and found three overlaps at events 1d, 2b and 3b, which we will consider in the interpretation of the results. As an additional robustness check, we alternatively reduce the event windows to four days, ranging from one day before to two days after the event. Figure 2 displays the time path and our windows around an event day.

To test whether an event has a statistically significant influence on the stock returns, we follow the strategy proposed by MacKinlay (1997). Under the null hypothesis of no influence of the
event on stock prices, the abnormal returns on the days of an event window are jointly normally distributed with zero conditional mean and conditional variance $\text{VAR}(AR_t)$. As discussed in MacKinlay (1997), under $H_0$, the conditional variance can be approximated by the disturbance variance from the estimation of the market model $\text{VAR}(\varepsilon_t)$, as expressed in (5). This approximation is valid as long as the estimation window is large, which is the case in our study.

Figure 2: Time path around an event day

Next, the abnormal returns of each day during the event window are aggregated to draw an overall inference for the respective event. The variance has to be adjusted by multiplication with the number of event days. From the cumulative abnormal returns and the variance, we calculate the test statistics to check whether the abnormal returns of a company’s stock price during the event window are significantly different from zero.

For a second test, we construct a portfolio equally weighting the daily returns of E:ON and RWE and repeat the above described testing procedure for each event. Hence, we get a combined assessment of the share price reactions of both companies. The resulting test statistics verifies if the cumulative abnormal return of the portfolio during the event window is significantly different from zero.
5 Results and analysis

For our analysis, we propose a hypothesis for each of the three major cases. All hypotheses assume that the acquisitions by Vattenfall had pro-competitive effects and harmed the competitors E.ON and RWE. Therefore, they are consistent with the view that the competition authorities advanced at that time. The German authority stated that it expected no formation of a dominant oligopoly including Vattenfall but rather, that the new player will make competitive efforts to increase its market share at the expense of the existing duopoly (Bundeskartellamt, 2001). However, since this reasoning assumes a specific behaviour of Vattenfall, which is at least questionable from a theoretical point of view, we rather regard the efficiency hypothesis with increasing returns to scale and learning as the main argument for pro-competitive effects from the acquisitions.\(^7\) In the following, we report the estimation results of the event study and compare them to the hypotheses of pro-competitive effects.

\(^7\) The Bundeskartellamt does not explicitly mention the efficiency hypothesis in its decisions since existing German antitrust law does not consider the so-called efficiency defence for the assessment of merger proposals (see e.g. Bundeskartellamt, 2004).
5.1 Case 1: Vattenfall - HEW

**Hypothesis 1:** *The entry of Vattenfall into the German electricity market via HEW created pro-competitive effects and harmed E.ON and RWE because a more efficient player in the market increases competition.*

<table>
<thead>
<tr>
<th>Event</th>
<th>E.ON</th>
<th>RWE</th>
<th>Portfolio</th>
<th>Market</th>
<th>Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>-7.33 (-1.47)</td>
<td>-6.33 (-1.30)</td>
<td>-6.83* (-1.69)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1b</td>
<td>1.37 (0.24)</td>
<td>4.47 (1.00)</td>
<td>2.92 (0.70)</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>1c</td>
<td>-2.55 (-0.52)</td>
<td>-0.23 (-0.07)</td>
<td>-1.39 (-0.43)</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>1d</td>
<td>4.58* (1.90)</td>
<td>2.13 (0.88)</td>
<td>3.36* (1.66)</td>
<td>(+)</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: t-statistics in parentheses; * denotes significance at the 10% level.

At the first event date 1a, when Vattenfall announced its interest to buy 25.1% in HEW, which were offered by the city of Hamburg, the cumulative abnormal return of the portfolio of E.ON and RWE was significantly negative and amounted to almost 7%. When using the shorter event window of 4 days, this result is even more significant (see Appendix, Table 5). The negative returns might be explained by a pro-competitive effect, caused by the possible creation of a more efficient competitor in the German electricity market. Still it is important to point out that also an out-of-play effect could have influenced the market reaction, since the possibility that E.ON or RWE would be able to acquire the stake in HEW decreased significantly. Nevertheless, this explanation is rather unlikely because at the time of this event, it was already becoming clear that neither E.ON nor RWE would have good prospects to acquire the majority in HEW due to concerns of the competition authorities.

Actually, if the out-of-play effect was important, it should have played a role at the second event
when Vattenfall’s bid was accepted because then, E.ON and RWE were definitely out of play. However, there is no significant result at this event and it is neither possible to identify an out-of-play effect nor, as we would assume, a pro-competitive effect empirically in this case.

At event 1c, when Vattenfall obtained the majority in HEW with further acquisitions, there is a negative but statistically insignificant tendency of the share prices of E.ON and RWE. One possible explanation could be that the market already anticipated these acquisitions and that the change in expected future profits due to this event was already included in the share price.

Event date 1d, when Vattenfall finalised the acquisition of HEW and took over the whole company, delivers a robust positive abnormal return for E.ON, which would indicate an anti-competitive effect of this event. However, there is an overlap of the event with the takeover of the British company Powergen by E.ON, which was enabled on June 12 by a decision of the U.S. Securities and Exchange Commission (SEC), allowing the takeover of a U.S. affiliate of Powergen. We suppose that the positive abnormal return for E.ON is rather caused by this decision, which was more important for E.ON. This conjecture is confirmed by the stock price of RWE, which shows no significant abnormal return. Furthermore, the new information at event 1d was rather limited since the market expected the complete takeover of HEW by Vattenfall to take place some day.

In general, the expectations of the stock market do not oppose the first hypothesis, which proposes pro-competitive effects from the implementation of a fourth large and efficient player in the German electricity market.
5.2 Case 2: Vattenfall - VEAG

Hypothesis 2: *The interest of HEW/Vattenfall to buy VEAG created pro-competitive effects in the German electricity market because it guaranteed that Vattenfall had a long-term interest in the German electricity market.*

Table 3: VEAG-Case, 7-day cumulative abnormal returns in percentage points and comparison of the market reaction to the hypothesis

<table>
<thead>
<tr>
<th>Event</th>
<th>E.ON</th>
<th>RWE</th>
<th>Portfolio</th>
<th>Market</th>
<th>Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a</td>
<td>-1.09 (-0.13)</td>
<td>0.91 (0.14)</td>
<td>-0.87 (-0.01)</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>2b</td>
<td>-2.80 (-0.65)</td>
<td>-9.07* (-2.40)</td>
<td>-5.94* (-1.89)</td>
<td>()</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: t-statistics in parentheses; * denotes significance at the 10% level.

When HEW/Vattenfall announced that they are interested in acquiring VEAG at event date 2a, it is not possible to identify any significant abnormal behaviour on the stock market. A possible explanation could be that many companies beside Vattenfall declared interest in VEAG.

At event date 2b, when HEW/Vattenfall took over VEAG by acquiring the shares from E.ON and RWE, which had to divest their stake as a precondition for their own merger interests, we identify a significant negative abnormal return to RWE. In this case, however, the negative return might have been caused by the overlapping announcement of RWE one day prior to the event date to sell its chemical division in order to focus on the core business. Nevertheless, according to the financial press, the accomplishment of this deal and the price of sale were in line with expectations. The stock price of E.ON shows a negative but statistically not significant abnormal return. From these findings, we infer a slight negative tendency of the stock returns of Vattenfall’s competitors in the German market. This is consistent with the hypothesis following the view of the Bundeskartellamt, which announced that it appreciated the deal.
5.3 Case 3: Vattenfall - Bewag

Hypothesis 3: The final takeover of Bewag created a new stable big player in the German electricity market, namely HEW/Vattenfall (later Vattenfall Europe), and secured that E.ON and RWE would face an efficient competitor even in the long run.

Table 4: Bewag-Case, 7-day cumulative abnormal returns in percentage points and comparison of the market reaction to the hypothesis

<table>
<thead>
<tr>
<th>Event</th>
<th>E.ON</th>
<th>RWE</th>
<th>Portfolio</th>
<th>Market</th>
<th>Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>3a</td>
<td>-3.81 (-0.70)</td>
<td>3.36 (0.83)</td>
<td>-0.23 (-0.65)</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>3b</td>
<td>14.41* (3.28)</td>
<td>14.53* (2.81)</td>
<td>14.47* (3.43)</td>
<td>(+)</td>
<td>+</td>
</tr>
<tr>
<td>3c</td>
<td>3.48 (1.10)</td>
<td>7.61* (2.10)</td>
<td>5.55* (1.92)</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3d</td>
<td>-7.62* (-1.90)</td>
<td>-6.99* (-1.70)</td>
<td>-7.31* (-1.98)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: t-statistics in parentheses; * denotes significance at the 10% level.

Event date 3a is closely connected to the VEAG-Case. Mirant (at that time called Southern Energy), a shareholder of Bewag, was also interested in taking over VEAG and was one of HEW/Vattenfall’s competitors in the acquisition. At event date 3a, HEW/Vattenfall announced to buy 49% of the shares of Bewag from E.ON. The estimation result shows no significant abnormal stock market reaction of the relevant competitors. However, it is likely that the formal objection by Mirant against this acquisition one day later is an explanation why no significant abnormal returns to rivals occurred.

A significant reaction followed at event date 3b, when Mirant and Vattenfall agreed on a joint ownership of Bewag. The abnormal returns of the competitors’ stocks during the event window amounted to more than 14% at a 1% significance level. This would imply a large anti-competitive effect as the consequence of this agreement. Indeed, this result is consistent with
hypothesis 3 because a joint ownership of Bewag is *not* consistent with the implementation of a fourth large and efficient player in the German electricity market. A caveat to this interpretation is the announcement of the annual results by E.ON on the same day as event 3b, which could have caused the abnormal return just as well. However, since the annual results were according to the financial press in line with expectations and furthermore, RWE’s stock return exhibits a similarly strong positive abnormal reaction, we presume that event 3b indeed had a positive influence on the market values of RWE and E.ON.

The estimation result of the dispute between Mirant and Vattenfall over Bewag at event date 3c shows positive abnormal returns to rivals, which might reflect the relief that the creation of the new efficient competitor faces several hurdles. That the positive reaction is not statistically significant when using the shorter 4-day event window (see Appendix, Table 7) might be caused by difficulties in determining the exact date when the market attached importance to the dispute between the companies. Therefore, the larger event window seems to be the better choice in this case.

At event date 3d, when Mirant sold its shares in Bewag to Vattenfall and hence paved the way for the creation of the new player, the negative abnormal return to the rivals was around 7% during the 7-day event window. This negative reaction is consistent with the view of the Bundeskartellamt that the final creation of a new big player in the German electricity market had pro-competitive effects and harmed the competitors.

### 6 Conclusion

In our event study, we analyse the competition effects resulting from three acquisitions of German regional utilities by the Swedish utility company Vattenfall. We first discuss two contrasting views with regard to horizontal mergers: the efficiency hypothesis that postulates pro-competitive effects due to economies of scale and learning, and the market power
hypothesis that postulates anti-competitive effects due to increased concentration. Based on the overall influence of these two effects on competitors of the merging firms and the validity of the semi-strong form of the efficient market hypothesis, it is possible to infer the consequences of a merger on consumer welfare by means of an event study. For our analysis, we propose a hypothesis for each of Vattenfall’s acquisitions. All three hypotheses assume pro-competitive effects resulting from the formation of a new large and efficient player at the expense of the main competitors E.ON and RWE. This view follows the assessment of the acquisitions by the German competition authority (Bundeskartellamt) as well as the European Commission.

The results of our event study could not reject the three pro-competitive hypotheses and the expectations of the stock market were largely consistent with the assessment by the Bundeskartellamt: While there is no evidence that increasing market power benefited the large competitors E.ON and RWE, there is some indication that potential increases in efficiency of the new player Vattenfall Europe harmed the competitors. The result of our study therefore suggests that the entry and formation of Vattenfall Europe in the German market had an overall positive effect for consumers.

While the event study methodology for evaluating competition effects of mergers was rightly criticised since its emergence in the 1980s, our case study approach to specific mergers in the German electricity sector can largely resolve the criticism: First, in the case of multi-product companies and product heterogeneity, it would not always be obvious that a merger actually affects the competitors. However, the utilities we consider are focused mainly on the electricity business, which is furthermore a market for homogenous goods. Next, it is possible that an event contains no new information or that existing information biases the interpretation of an event by the market. Therefore, in our analysis, we take rumours and potential in-play and out-of-play effects into account for each event. Finally, if an event window overlapped with other events that influence the examined companies, abnormal returns might be wrongly attributed to a merger announcement. We check for overlapping events in the financial press and consider
them in our interpretation.

There is one potential caveat to this study that has not yet been addressed. It is possible that the announcements, reports and interviews of the competition authorities influenced stock market expectations about the competition effects of the mergers. Since the Bundeskartellamt explicitly welcomed the formation of Vattenfall Europe, it might have influenced the market with this view and created a bias in expectations about future profits. This influence would be especially relevant if the competition authority had a high credibility in the public.

Our analysis also has a policy implication regarding mergers in the electricity sector. Although market power is an important issue, our analysis suggests that it should not be considered as the only one. Besides the increased market power resulting from mergers, there is also the possibility that the merging companies become more efficient. This argument might be especially relevant if small regional utilities merge to a larger entity as in the case of Vattenfall Europe. Therefore, the competition authorities should not a priori rule out the efficiency defence in the assessment of mergers. Concerning this matter, it would furthermore be very helpful if future research on a firm-level basis would be able to quantify efficiency gains of mergers in the electricity market.

References


### Appendix

#### Table 5: HEW-Case, 4-day cumulative abnormal returns in percentage points and comparison of the market reaction to the hypothesis

<table>
<thead>
<tr>
<th>Event</th>
<th>E.ON</th>
<th>RWE</th>
<th>Portfolio</th>
<th>Market</th>
<th>Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>-9.17* (-2.43)</td>
<td>-3.87 (-1.05)</td>
<td>-6.52* (-2.13)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1b</td>
<td>-5.09 (-1.19)</td>
<td>2.29 (0.68)</td>
<td>-1.40 (0.44)</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>1c</td>
<td>-1.99 (-0.54)</td>
<td>-3.85 (-1.47)</td>
<td>-2.92 (-1.19)</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>1d</td>
<td>4.56* (2.69)</td>
<td>0.82 (0.45)</td>
<td>2.69* (1.76)</td>
<td>(+)</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: t-statistics in parentheses; * denotes significance at the 10% level.

#### Table 6: VEAG-Case, 4-day cumulative abnormal returns in percentage points and comparison of the market reaction to the hypothesis

<table>
<thead>
<tr>
<th>Event</th>
<th>E.ON</th>
<th>RWE</th>
<th>Portfolio</th>
<th>Market</th>
<th>Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a</td>
<td>2.29 (0.38)</td>
<td>-2.94 (-0.58)</td>
<td>-0.32 (-0.07)</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>2b</td>
<td>-1.77 (-0.54)</td>
<td>-6.58* (-2.30)</td>
<td>-4.17* (-1.76)</td>
<td>(-)</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: t-statistics in parentheses; * denotes significance at the 10% level.

#### Table 7: Bewag-Case, 4-day cumulative abnormal returns in percentage points and comparison of the market reaction to the hypothesis

<table>
<thead>
<tr>
<th>Event</th>
<th>E.ON</th>
<th>RWE</th>
<th>Portfolio</th>
<th>Market</th>
<th>Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>3a</td>
<td>-4.23 (-1.03)</td>
<td>2.55 (0.83)</td>
<td>-0.84 (-0.32)</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>3b</td>
<td>9.64* (2.90)</td>
<td>7.00* (1.79)</td>
<td>8.32 (2.61)</td>
<td>(+)</td>
<td>+</td>
</tr>
<tr>
<td>3c</td>
<td>-0.75 (-0.31)</td>
<td>5.52* (2.02)</td>
<td>2.38 (1.09)</td>
<td>0</td>
<td>+</td>
</tr>
<tr>
<td>3d</td>
<td>-5.11* (-1.68)</td>
<td>-3.70 (-1.19)</td>
<td>-4.41 (-1.58)</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: t-statistics in parentheses; * denotes significance at the 10% level.