

# HORIZONTAL AND VERTICAL TAKEOVER AND SELL-OFF ANNOUNCEMENTS: ABNORMAL RETURNS DIFFER BY INDUSTRY

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## Abstract

We begin with the hypothesis that shareholder-wealth effects of corporate transactions differ depending on (a) the specific industry, (b) whether they are horizontal or vertical, and (c) whether they are integrations (takeovers) or disintegrations (partial sell-offs). A standard event study analysis for cumulative abnormal returns based on the market model is conducted for 309 data-points from 227 transaction announcements. We find that abnormal returns indeed do significantly depend on the transaction profile (horizontal vs. vertical and integration vs. disintegration) and industry. One main result is the observation that the capital market shows distinctive preferences for either an integration or disintegration strategy for vertical as well as for horizontal transactions. The specific pattern of this preference differs according to industry.

**Keywords:** Horizontal and Vertical Transactions, Integration and Disintegration, Mergers and Acquisitions, Abnormal Returns, Industry Specific Event Study

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## 1. Introduction and literature review

Numerous event studies in recent years looked at transactions from the buyers' ('bidder') and the sellers' ('target') side and offered a great variety of theoretical and empirical explanations concerning the impact and motives of different takeover or sell-off activities. Most papers that evaluate the effects of corporate dis-/integration focus on potential factors which might have a direct influence on shareholder valuation criteria, such as differences in the regulatory, social, political and economic environment (Jarrell/Poulsen, 1989; Kiyamaz/Mukherjee, 2000), exchange rate variations (Kang, 1993), relative firms' size (Chatterjee, 2000) and debt ratios (Raad/Ryan, 1999) or the level of transfer of innovation and managerial resources (Capron/ Pistre, 2002). Although the majority of previous event studies have come to the conclusion that mergers and acquisitions generally increase value, there seems to be no consensus about the distribution of the synergistic benefits between the bidding and the selling firm.

In view of certain evidence for different industry dynamics in corporate dis-/integrating activities, one possible explanation of the asymmetric distribution of gains between the integrating and disintegrating firm could be aggregation bias, as most of the

previous empirical studies look at transactions across multiple industries. If valuation effects vary by industry and samples are distributed across these sectors, aggregation might either produce insignificant results or even lead to incorrect conclusions. In her analysis of takeover announcements by U.S. chemical and retail companies Dewenter (1995) states that industry (rather than time) aggregation bias might be the more likely explanation for the different results found in prior tests. Other event studies also indicate that the nature of the industry in which a transaction takes place might have a direct influence on stock market valuation criteria (Johnson/Abbott, 1991). Although several studies analyzed M&A activity and their corresponding wealth effects for specific industry segments, less attention has been paid to a comparative analysis of the financial consequences for takeover and sell-off announcements across various industries. Instead of analyzing valuation effects for a sample of mergers and acquisitions from all industries, we examine and compare value changes within five distinct industries.

As the main objective of this paper is the analysis of industry specific synergy distribution between the buyer and the seller, the diverging stock market reactions of related M&A activities within the same industry should further be explored in order

to explain potential compensation effects. Using this background we examine whether a transaction that increases corporate focus by disintegrating vertically (parts of the value chain) and horizontally (sale of a division or subsidiary) is valued differently than vertical or horizontal integration behaviour. In this context, focus-increasing transactions are ones that reduce the number of business areas a company operates in through a partial sell-off, thus concentrating corporate activities on the firm's core competencies (Comment/Jarrell, 1995). Integrating additional parts of the industry value chain or diversifying into new, but closely related products and markets via a corporate takeover corresponds to an expansion strategy within related business segments.

We particularly address the following general question: "In which industries do gains accrue to corporate shareholders of bidding and selling firms as a consequence of a merger, acquisition or sell-off announcement, and what is the impact of its dimension (vertically or horizontally) and its direction (integration or disintegration)?"

While valuation effects might differ both within as well as across industries, we test two specific hypotheses that could serve as further explanations for potential stock market valuation differences:

*Hypothesis 1.* Shareholders' wealth effects of horizontal and vertical transactions differ within industries leading to dissimilarities of cumulative abnormal returns.

*Hypothesis 2.* Stock market valuation patterns of dis-/integration announcements are different from industry to industry depending on the underlying industry dynamics.

In the rest of the paper, section 2 reviews the most important motives for dis-/integration activities. Section 3 describes the procedure used to select the transaction samples for this study and sketches the standard event-time methodology to analyze valuation effects of the selected takeover and sell-off announcements. An overview of our empirical findings is presented in Section 4, while Section 5 gives an interpretation of the results a little more detailed. The paper is completed in Section 6 with a short summary and conclusion followed by an appendix treating the statistical methodology.

## **2. Motives for integration and disintegration activities**

Numerous event studies have examined the effects of integration activities on bidder's stock prices around the time of announcement of merger attempts. Some studies cannot find significant wealth increases for bidding firms (e.g., Travlos, 1987) and attribute these negative effects to an imperfect capital allocation to projects with negative net present values. These value reducing market reactions may be a result of shareholders' concerns that a more diversified firm might cross-subsidize poorly

performing segments or overinvest in business areas with weak investment opportunities ("overinvestment problem"). The difficulty of coordinating separate lines of businesses intensifies as the integration level increases due to rising information asymmetries, e.g. between central management and divisional managers ("coordination problem"). In contrast, other empirical studies show evidence for synergistic gains from corporate integration activities, which are attributed to positive effects both on the cost and sales side of the bidding company ("synergy hypothesis"). While vertically integrated and horizontally combined operations could lead to economies of scale and scope (by reducing costs and eliminating redundancies and duplication), bidders might also be motivated by the opportunity to increase market power (by eliminating direct competition) and to diversify geographically to reduce overall risk of demand or cash-flows variations. According to the market power hypothesis, the bidding firm tries to reduce price competition in its existing market by acquiring some of its competitors, whereas the diversification hypothesis suggests that a combined firm can better hedge its risk exposures either geographically or through a greater product or service offering. Last but not least, integration could lead to an increased utilization of technology and management resources and to a reduction in production and agency costs (Jensen/Ruback, 1983).

Erwin/Perry (2000) show evidence for the market power hypothesis in their evaluation of analysts' prediction errors for 185 foreign takeovers by U.S. firms. They find significantly positive abnormal returns for the acquiring companies while their industry rivals show contemporaneous negative wealth effects. The results from Markides/Oyon (1998) also support the conclusion that international acquisitions, on average, create value for the shareholders of the bidding firm, but domestic takeovers appear to be viewed as a liability by investors. Markides et al. conclude that their overall findings support the hypothesis of the diversification theory, in which international takeover activities give the acquiring firm a competitive advantage because it minimizes its transaction costs and hedges risk especially in 'imperfect' markets (e.g. due to limited access and information). In summary, empirical studies on the overall effects of integration strategies are mixed. As most studies, however, they have examined valuation effects across industries and dimensions of integration without controlling these factors. It should further be examined whether industry specific criteria or any differences in horizontal or vertical transactions may have an influence on stock market reactions.

Previous event studies suggest that companies that focus on one specific area by disintegrating parts of their business operations through sell-off activities are more likely to outperform a more diversified firm (Bhagat et al., 1990). The underlying hypothesis is

that managerial talent is more effectively utilized in fewer operating areas so that focusing on core business by a firm has a beneficial impact on its stock price valuation (Roy/Manley, 1997). Specialist publications provide several explanations for these positive wealth effects, such as the specialization hypothesis, when divested assets interfere with the existing operations of the seller leading to efficiency improvements as the remaining functions can be focused on more lucrative parts of the business. John and Ofek (1995) find empirical evidence that companies that sell assets in order to concentrate on core business eliminate negative synergy (e.g. diseconomies of decision management and decision control inherent in diverse lines of business) between the divested assets and the remaining assets, which leads to better performance for the seller.

### 3. Data and methodology

In order to assess the valuation effects of international corporate takeover and sell-off activities, a sample of American and European mergers and acquisitions was taken from the Mergermarket und ComputaServe databases. Both datasets were had been extracted separately, validated (e.g. for identical announcement dates and transaction records) and consolidated before the index- and shareprices for each buying and selling company were obtained from Thomson Financial Securities Datastream. The industry specific portfolios were extracted and consolidated based on the following criteria:

(a) Both buying and selling firms operate in one of the following five industries: automotive, media, telecommunication, financial services and pharmaceuticals/chemicals.

(b) The public announcement date is between January 1st, 1998 and August 31st, 2001.

(c) No confounding events (e.g. dividend payments, share repurchases or the announcement of other deals) could be identified within the framework of the transaction event.

(d) Both the acquiring firm and the selling target company are listed on a U.S. or European stock exchange during a sufficient period before and after the publication date and show adequate frequent daily trading volumes to calculate abnormal returns.

(e) The transaction involves the purchase of a majority stake of the target firm (>50%) in order to ensure a definite shift of hierarchical power from the target to the bidder and to increase the possibility to pick up any abnormal returns as takeovers of minority interests most likely lead to less significant market reactions (Cornett/Tehrani, 1992; Roy/Manley, 1997). Selling 100% of the firms assets would be considered to be an extreme in the spectrum of sell-offs (total liquidations).

The above mentioned data sources and criteria bear a total of 227 transactions consisting of 227 bidder and target firms. Of 227 transactions, 145

were total liquidations and 82 represented partial sell-offs. Since shareholder-wealth effects for two parties occur in the cited partial sell-offs, we are left with a total of 309 data-points. In contrast to numerous prior event studies, we divided the selection of target firms into these two distinct subgroups in order to account for the differences in their underlying strategic motives. A complete liquidation of a firm cannot always be considered to be voluntary transaction (e.g. in case of bankruptcy) and in all cases it represents a horizontal divestment, as it covers (by definition) all parts of the target firm's value chain. For example, in case of a merger, a complete takeover of 100% of the target's assets can be regarded as horizontal integration which is already covered by the sample of bidding firms. Although we show the implications of total liquidations for target firms' shareprice performance, we focus our analysis and interpretation on the bidders' perspective, from which integration may involve either the takeover of additional elements of the value chain (vertical) or of existing business segments (horizontal) of the acquiring firms.

Partial sell-offs, on the other hand, can be considered to be 'refocusing' strategy, in which the selling company tries to reduce the scope of its activities in order to concentrate on the core business (Markides, 1995). This corporate specialization can also affect the seller in both the vertical and horizontal aspect, and, besides the analysis of bidding firms, is of particular interest here.

In order to assess the effects of publicized events, such as merger or acquisition activities, we use standard event-study methodology, where a firm's actual stock price close to the publication date is compared to the expected stock price that is calculated over an estimation period prior to the transaction announcement (see appendix). We calculate cumulative abnormal returns over a 4-day event window from two days before to one day after the announcement day  $t_0$ . Based on the suggested procedure from Brown/Warner (1980, 1985) we have tested the hypotheses of zero abnormal returns by using a two-sided t-test to assess the statistical significance of the average cumulative effects for each individual industry portfolio.

### 4. Empirical findings

Various event studies provided evidence for different shareholder valuation results depending on the respective industry segments of the assessed companies (Kang, 1993). For example, the results from Markides/Ittner (1994) suggest that the wealth generated by acquisition activities could be an inherent function of the bidding firm's industry (e.g. its concentration level and advertising intensity). The earlier event study from Doukas/Travelos (1988) also suggests "that it is important to divide the original sample into homogeneous subsamples before drawing any conclusions about the valuation

effects." By further developing these former empirical findings, we isolate the different case studies by industry segment and analyze the stock market reaction for each subgroup separately to avoid mitigating the potentially compensating effects of multiple variables (this procedure was also applied and proposed by Cakici et al., 1996).

When looking at all industry portfolios it seems clear that the average number of horizontal transactions outweighs the amount of vertical deals considerably. This distribution is in line with transaction data from other publications (e.g. UNCTAD) and should not be surprising as vertical deals (by definition) are limited to the number of elements of the respective industry value chain,

whereas horizontal transactions are only restricted to the amount of markets or product lines in which a company could invest (divest). Moreover, as vertical dis-/integration activities only involve parts of the value chain, the sold business operations tend to be relatively in small size and are often not publicly listed. Additionally, vertical disintegration is frequently undergone by spin-off and outsourcing activities without involvement of any acquisition activities by publicly listed firms. Table 1 shows the number of the analyzed transactions for each industry portfolio as well as the empirical results in terms of average cumulative abnormal returns and t-scores.

**Table 1.** Cumulative excess returns (CAR) for the five industries

AUTOMOTIVE	N	CAR <sub>(-2;1)</sub>	t-score
Integration (Bidding firms)	46	1,32%**	1,60
- Horizontal	40	1,98%**	2,21
- Vertical	6	- 3,06%***	-3,52
Disintegration (Partial sell-offs)	22	0,69%	0,82
- Horizontal	16	- 1,40%	-1,43
- Vertical	6	6,27%***	5,28
Total sell-offs	24	27,48%***	26,13

FINANCIAL SERVICES	N	CAR <sub>(-2;1)</sub>	t-score
Integration (Bidding firms)	62	-1,74%***	-4,08
- Horizontal	57	-2,08%***	-5,09
- Vertical	5	2,12%***	4,14
Disintegration (Partial sell-offs)	28	0,81%	1,43
- Horizontal	25	1,72%***	3,05
- Vertical	3	- 6,80%***	-12,06
Total sell-offs	34	16,99%***	19,25

MEDIA	N	CAR <sub>(-2;1)</sub>	t-score
Integration (Bidding firms)	41	3,12%***	5,13
- Horizontal	33	2,66%***	4,07
- Vertical	8	5,00%***	4,06
Disintegration (Partial sell-offs)	6	- 3,52%**	-2,57
- Horizontal	5	- 2,05%	-1,27
- Vertical	1	-10,85%***	-5,46
Total sell-offs	35	19,85%***	17,50

PHARMA/CHEMICALS	N	CAR <sub>(-2;1)</sub>	t-score
Integration (Bidding firms)	41	- 1,24%**	-2,13
- Horizontal	32	- 1,54%**	-2,59
- Vertical	9	- 0,14%	-0,15
Disintegration (Partial sell-offs)	13	- 1,73%**	-2,18
- Horizontal	7	1,81%	1,63
- Vertical	6	- 5,87%*	-4,85
Total sell-offs	28	27,32%***	20,48

TELECOM	N	CAR <sub>(-2;1)</sub>	t-score
Integration (Bidding firms)	37	2,91%***	4,05
- Horizontal	29	3,00%***	3,86
- Vertical	8	2,58%*	1,74
Disintegration (Partial sell-offs)	13	- 3,70%**	-2,40
- Horizontal	11	- 2,79%*	-1,74
- Vertical	2	- 8,70%**	-2,02
Total sell-offs	24	15,14%***	8,62

\* Denotes significance at the 10% level (within sample)

\*\* Denotes significance at the 5% level (within sample)

\*\*\* Denotes significance at the 1% level (within sample)

Since roughly two thirds of the mergers and acquisitions involve the complete takeover of a target company, the breakdown of partial sell-off activities across different industry segments leads, in some cases, to a quite small number of case studies within some industry portfolios. This should be considered by cautiously interpreting the empirical

results. Nevertheless, according to Brown/Warner (1985) even a small sample size of five securities does not dramatically alter the specification of test statistics within the given sample, although in such cases "stated significance levels should not be taken literally". Especially, the significances shown are of course restricted to the sample under analysis and

should not be taken as representative. However, within our qualitative scope, the results still seem interesting enough to justify the breakdown into the “mini-sub-samples”, and can be taken as an indication towards our hypothesis and the stated distinctive qualitative preferences of the capital market. This should be kept in mind during the interpretation of the results.

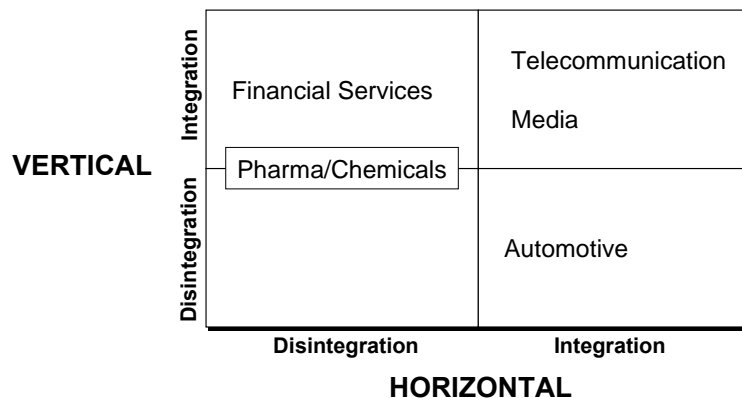
## 5. Interpretation of results

When looking at the average announcement effects of total sell-offs, the target firms realize relatively high significant cumulative abnormal returns in all industries, ranging from +15.1% (Telecommunications) up to +27.5% (Automotive). This result proves to be consistent with findings from previous event studies that also illustrated that a significant part of potential synergies are captured by the target firm. While Gosh (2000) demonstrates significant abnormal returns of +20.3% for 338 U.S. target firms, Pettway et al. (1993) also shows an average positive wealth gain of 37.0% for U.S. and Japanese target firms. Eun et al. (1996) analyzed 213 target companies by using the mean adjusted return model and calculated average abnormal returns of +37.0%. Previous studies from Jarrell/Poulsen (1989) and

Holland/Hodgkinson (1994), with +29.0% and +22.3% respectively, reach the similar conclusion that a complete takeover of a company's assets is associated with a significant wealth increase for the target firm's shareholders.

Furthermore, our results show a remarkable pattern for both vertical and horizontal transactions in all industries with only one exception (vertical transactions in the pharmaceuticals/chemicals-industry): Whenever a (vertical or horizontal) integration has been valued positively, the corresponding disintegration activities in the same industry show negative stock market reactions on average (and vice versa) – in most cases significant ones. Apparently the capital market shows distinctive preferences for either an integration or disintegration strategy (diversification or refocusing) for vertical and for horizontal transactions depending on the underlying industry conditions.

Based on the calculated positive cumulative excess returns, each industry portfolio can thus be plotted in a two-dimensional matrix, demonstrating the heterogeneous valuation dynamics for both vertical and horizontal dis-/integration types (see picture 1).



**Picture 1.** Industrie-specific types of transactions that on average were preferred by the capital market

### 5.1 Automotive

While horizontal takeover activities show a cumulative abnormal return of +2.0%, vertical integration efforts are significantly downgraded with –3.1% on average. Partial sell-offs also show an opposite price performance, in which companies announcing horizontal divestments lose on average –1.4%, but vertical disintegrations are associated with a significant +6.3% wealth increase, suggesting that shareholders support the recent industry trend to deconstruct the automotive value chain.

Our results indicate that the capital market rewards OEMs efforts to disintegrate vertically. At the same time, the capital market perceptibly

approves a horizontal integration (especially internalization) strategy, showing appreciation for taking over firms that operate on the same stage of the industry value chain. Apparently, shareholders believe that expanding an automotive firm's existing operations is associated with profitability improvements which might result from economies of scale in manufacturing, a broadened product and brand portfolio as well as an enlarged customer base.

### 5.2 Media

As this industry has been widely neglected in prior event study research, our empirical results offer an initial indication about the valuation effects of

integration and divestment strategies of media companies. Looking at a total of 41 takeover announcements, we observe an average wealth gain for the acquiring firm of +3.1% (significant at the 1%-level). This shareprice increase seems to be irrespective of the integration type, as both horizontal (+2.7%) and vertical (+5.0%) transactions show significant positive cumulative excess returns over our 4-day event period. Therefore, shareholders seem to believe in positive size effects and expect economies of scale and scope to materialize for integrating media firms. The average valuation effects of -3.5% show that partial sell-off activities are generally associated with negative market reactions, regardless of the dimension of divestment, as we could not find different trends between horizontal (-2.1%) and vertical (-10.9%) disintegrations in our small sub-samples of partial sell-offs. The limited sample size also might be an indication that the sale of subsidiaries and separate business segments might not be driven by the strategy to increase shareholder value.

### 5.3 Telecommunication

Our findings support the position that corporate takeovers in the telecommunication sector are associated with synergistic benefits. Regardless of the analyzed integration being horizontal (+3.0%) or vertical (+2.6%), we find a significant average cumulative excess return of +2.9% for bidding companies engaged in M&A activities similar to the pattern in the media industry within our sample. Also similarly, in contrast to the positive stock market reaction for integrating activities, shareprices of selling firms show a significant decrease in value of -3.7% on average. In line with the homogenous positive investors' responses for both types of takeovers, partial sell-offs lead to negative results both for horizontal (-2.8%) and vertical (-8.7%) divestments within the small sub-sample.

The positive valuation of integration activities and the negative stock market reaction due to partial sell-off announcements lead to the conclusion that economies of scale and scope, e.g., in the deployment and distribution of telecom products and services may be achievable through mergers and acquisitions from the capital markets perspective. Apart from cost synergies, large integrated telecom firms may also be able to exert greater influence on other companies in the telecommunications value chain.

### 5.4 Financial Services

While the overall sample of financial organizations shows average cumulative abnormal returns of -1.7% for bidding firms and insignificant +0.8% for partial sell-off announcements, the analysis of the various subgroups shows heterogeneous results.

The negative excess return of -2.1% of horizontal integration announcements indicates that investors, on average, have regarded a corporate takeover of financial institutions operating in the same areas of the value chain as an imprudent managerial decision. In contrast, horizontal sell-offs (e.g. the divestment of subsidiaries) lead to an average shareprice increase of +1.7%, suggesting that refocusing on specific business segments or geographical markets seems to be more favourable than an expansion or diversification strategy.

Contrary to horizontal integration activities, vertical takeovers show an average wealth gain of +2.1% for the shareholders of the bidding firm, while vertical sell-offs had a negative average share-price effect of -6.8% within the small sub-sample.

### 5.5 Pharmaceuticals/Chemicals

The general takeover effect of -1.2% mainly seems to be driven by horizontal transactions which show a significant negative excess return of -1.5%, while vertical integrations were on considered nearly neutral in terms of average shareprice effect (-0.1%). With an average negative cumulative return of -5.9% for vertically disintegrating firms, the sale of parts of the value chain also did on average not pay off within our sample. On the contrary, pharmaceutical and chemical firms that disintegrated horizontally by partially selling their business operations or product lines experienced a significant shareprice gain over the 4-day event period of +1.8% on average.

## 6. Summary and conclusions

We have examined the two hypotheses that shareholders' wealth effects of horizontal and vertical transactions differentiate within industry sectors (hypothesis 1), and that stock market valuation patterns of dis-/integration activities differ according to industry (hypothesis 2). Over a 44 month period from January 1, 1998 to August 31, 2001 we investigated industry specific valuation effects of a change in firms' scope for 309 data-points from 227 takeover, 145 total liquidation and 82 sell-off announcements by U.S. and European companies that operate in the automotive, media, telecommunication, financial service as well as the pharmaceutical and chemical industry. The market model was used to calculate average cumulative abnormal returns for a 4-day event window  $t(-2;1)$  surrounding the publication date.

Our results show that within our sample there are indeed significant valuation differences between industries and announcements are valued dissimilarly depending on the type of transaction. Heterogeneous industry dynamics induce different stock market reactions because investors clearly value horizontal and vertical dis-/integrations

differently. Altogether, the data supports our two hypotheses.

Furthermore, a remarkable pattern emerged: When a vertical or horizontal integration was valued positively, the corresponding disintegration activities in that same industry showed negative stock market reactions on average (and vice versa) – in most cases significantly within the sample. Although the sizes of our sub-samples or in some cases by far too small to justify taking this pattern for granted in general, there are indications that the capital market seems to show distinctive preferences for either an integration or disintegration strategy for vertical and for horizontal transactions in the respective industries.

In addition, prior research has revealed that target companies usually benefit from takeover announcements, while bidding firms show an inconclusive shareprice performance. Our empirical evidence reveals that positive wealth effects of target firms can be determined by relatively high cumulative abnormal returns of complete liquidations, whereas partial sell-offs show divergent, lower on average results depending on the underlying industry. With average positive cumulative excess returns from +15.1% to +27.5% for total liquidations across all analyzed industries, the relatively lower valuation effects of partial sell-offs would be superimposed when aggregating the two groups. Apparently, the stock market assessment of a disintegration strategy is based on a different value proposition, while complete liquidations may be associated with intense speculation effects. To evaluate, identify and interpret the implications of divestments, partial sell-offs and complete liquidations should, therefore, be analyzed separately. In addition to diverging results for target firms involved in partial sell-offs, we also observe different wealth effects for acquiring firms. As bidders' results would be compensated and lead to insignificant findings for the complete sample, we draw our conclusions for each industry sub-sample separately and notice that different industry dynamics and dis-/integration types do have a significant impact on stock market valuation.

Our results indicate that it is useful to distinguish between industries and horizontal vs. vertical transactions when analyzing announcements for abnormal returns. Otherwise evaluation may lead to ambiguous, inconclusive results due to aggregations bias. Event study methodology by its own design only accounts for shareholders' immediate reactions to transaction announcements. This is a limitation to conclusions targeted towards longer timeframes, even if we would assume an at least semi-efficient capital market in which all essential information is contained in the stock market's immediate reaction. As long as managers undertake transactions that are not fully transparent to market participants or that prove to deviate from previous expectations later on, additional long term valuation effects are always possible.

## Appendix: applied event study methodology

The difference between the actual and the 'normal' expected price performance is defined as the daily 'abnormal return' (AR) and expresses the shareholders' evaluation of the underlying transaction and its impact on the company's future performance and profitability. In a semi-efficient capital market (Fama, 1970) this announcement effect reflects the long-term consequences of the companies' takeover and sell-off strategy and gives an unbiased picture of the average stock market's valuation (Linn/Rozeff, 1984). The daily abnormal return for any company  $i$  in industry  $m$  is therefore, independently of the transactions' price, calculated as:

$$AR_{i,t}^m = R_{i,t}^m - E(R_{i,t}^m),$$

where  $R_{i,t}^m$  is the actual return and  $E(R_{i,t}^m)$  is the calculated expected return for a company's stock at a particular day  $t$ . In absence of a transaction announcement the actual and the calculated return should be equal on average, and the abnormal return is expected to be zero.

The calculation of abnormal returns is based on market model prediction errors described by Fama (1976), where the expected return is dependent on a parameter  $\beta_i^m$  for systematic risk that correlates linearly to the average daily return  $R^m$  of the market portfolio for industry  $m$  in the inspection period, and where a companies specific risk is contained in the parameter  $\alpha_i^m$ . The historical relationship of an index return and a company's stock price allows the consideration of exogenous events, where  $\beta_i^m$  corresponds to the gradient and  $\alpha_i^m$  to the axis intercept of the linear function:

$$E(R_{i,t}^m) = \alpha_i^m + \beta_i^m \times R_m.$$

According to Sharpe (1963) a market portfolio including the most important single influence should be used to determine the systematic parameter of the market model. In our study, we use industry-specific portfolios to determine market returns of U.S. and European industrial indices, thus to accounting for both geographical and industry related variations. The market model's parameters for each company are obtained by OLS regression analysis over a 200-day inspection period starting 249 days before the transaction was announced by either the bidding or the selling firm (day 0). Over the event period these parameters are considered as constant and form the basis to calculate the expected normal and, consequently, the abnormal returns for each day surrounding the publication date.

To capture the full effect of transaction publications the cumulative abnormal return (CAR) is calculated over a 4-day event window from two days before to one day after the announcement day  $t_0$ . To obtain the cumulative effect for each company

$i$  in industry  $m$ , the abnormal returns are accumulated from day  $-2$  to day  $+1$  over the event period:

$$CAR_{i;(-2;1)}^m = \sum_{t=-2}^1 AR_{i;t}^m$$

For each industry-specific portfolio the total valuation effect is calculated by averaging the cumulative abnormal returns across all  $N_m$  securities in the particular sample:

$$CAR_{(-2;1)}^m = \frac{1}{N_m} \times \sum_{i=1}^{N_m} CAR_{i;(-2;1)}^m$$

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