

Erasmus University Rotterdam

Erasmus School of Economics

Bachelor Thesis Financial Economics

Putting a Price on Innovation: Shareholder Reaction in High-Tech Acquisitions

Govert Wessels 389293

Dr. Ran Xing

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Abstract

The distinct characteristics of technology firms raise questions around their value creating potential to acquiring parties. When comparing the three subsets of the high-tech industry, Biotechnology & Pharmaceuticals, Computer & Electronics and (Tele-) Communications, to traditional acquisitions, acquirers of (Tele-) Communications targets experience 4.3 percentage point lower returns before the announcement. This is being offset by substantially higher returns during and post-announcement, showing 2.4 and 5.3 percentage points higher returns, respectively. This dynamic could follow from investor concerns around cultural or political constraints being addressed in the official announcement of a transaction. Returns to Biotechnology & Pharmaceuticals acquirers follow a similar pattern, showing lower returns leading pre-announcement, compensated by higher returns during and after. Transactions in the Computer & Electronics space generated lower returns pre- and during announcement, and generated negligibly higher returns in the post-announcement period.

Introduction

Previous research on the topic of mergers and acquisitions, and more specifically, market reactions at the time, shows that investors generally have mixed feelings about the potential benefits to acquiring parties. However, research also shows that several factors, i.e. payment method, significantly impact the way these investors perceive acquisitions. The Institute for Mergers, Acquisitions & Alliances (IMAA) reports that, during 2007 and 2015, total M&A value rose to unprecedented heights, with worldwide total deal values reaching \$5.0 and \$4.8 trillion, respectively. During the most recent wave in 2015, activity in the financial industry, which accounted for a significant portion of the activity in the past, fell sharply, whereas activity in the Software and Biotechnology sectors, which one could perceive as ‘high-tech’, skyrocketed. High-tech firms differ from conventional companies in the sense that their goal is to create or discover new technologies and processes, which naturally poses a greater risk than, for instance, a traditional food-processing company. Therefore, given that these technology, or ‘high-tech’, firms generally exhibit greater growth potential at a higher risk, one could assume that investor skepticism is also present in the case of the acquisition of a high-tech target, which raises questions around share price reaction around acquisitions of such companies.

Even though high-tech acquisitions have been extensively covered in the media and by investors and analysts, academic literature on this topic is scarce. This research is an extension of ‘The Value Creation Potential of High-Tech Mergers’ by Kohers and Kohers (2000) and the research question at the center of this paper is: “Do high-tech acquisitions show different acquirer shareholder returns than conventional acquisitions before, during and after the announcement period?” Returns have been analyzed over three separate periods, as figure 1 shows that share price movements are different between the different types of acquisitions. This is also partially supported by later findings by Kohers & Kohers in 2001, who found that acquirers of high-tech firms generally underperform benchmarks in the post-transaction period, and by other research on the topic of information leakage and insider information, which will be discussed extensively in the literature review section.

This research analyses bidder firms’ returns, relating to acquisitions between 1 January 2014 and 31 December 2016, in a 25-day window around the announcement of a transaction. This window has been split in three parts: pre-announcement period (from day -12 to day -3), announcement

period (day -2 to day 2) and post-announcement period (day 3 to day 12), with day 0 denoting the day the official announcement of the transaction took place. Furthermore, target companies have been split into four groups: Biotechnology & Pharmaceuticals, Computer & Electronics, (Tele-) Communications and Non High-Tech, with the former three groups composing high-tech target firms. Additionally, several other factors of interest, namely payment method, relative size of the transaction, ownership structure of the target (whether it is privately or publicly held) and overlap in activity between the target and the acquirer, have been controlled for when analyzing returns during these three periods, using a multi-factor linear model.

Shareholder returns to acquiring parties show some striking dynamics: (Tele-) Communications acquirers experience returns that are, on average, 4.3 percentage points lower, in the period leading up to the announcement of a transaction. However, around announcement date and in the period thereafter, (Tele-) Communications acquisitions provide shareholders with substantially larger returns, showing returns that are 2.4 percentage points higher during the announcement period and as much as 5.3 percentage points higher during the post-announcement period. These dynamics could possibly stem from investor concerns around political or cultural problems being addressed in the official announcement. Acquirers of Biotechnology & Pharmaceutical firms show a similar pattern in shareholder returns, although in diminished fashion: acquiring parties experience a 1.7 percentage point lower return leading up to the announcement, compensated by returns that are 0.05 and 0.84 percentage points higher during and post-announcement, respectively. These movements could indicate investor concerns around the added value of the target to the acquirer's portfolio of activities being dealt with by the announcement. Transactions in which the target company is active in the Computer & Electronics industry did not generate favorable returns for investors: such transactions showed 1.4 and 0.99 percentage points lower returns before and during the announcement period, only to be slightly offset by a negligible return that is 0.07 percentage points higher in the post-announcement period. Even though earlier research suggested that such transactions increase shareholder returns, it is possible that in present times, companies that try to upgrade their IT infrastructure through acquisitions (as is commonly a motive for such transactions) are perceived as being 'old-fashioned' and too late to innovate.

Because of the distinct nature of technology firms and their growing importance in the present economic and financial landscape, this research fills a gap in current M&A literature. Hagedoorn and Duysters (2002) have researched the impact of high-tech mergers and acquisitions on technological performance, which is expressed as the number of patents produced. Their main conclusion is that strategic and organizational fit are key to deliver strong technological performance. Even though one could argue this will translate into higher shareholder values, these variables are extremely hard to measure and the connection to shareholder value creation is opaque. As stated before, this paper aims to be an extension of ‘The Value Creation Potential of High-Tech Mergers’ by Kohers and Kohers (2000). They have researched the market reaction of bidder companies in 1,634 high-tech transactions between January 1987 and April 1996, while distinguishing between stock- and cash-financed deals. They find that, on average, acquirers of high-tech target companies show significant abnormal returns that are positive during the announcement of a merger or acquisition. Furthermore, they took the impact of several other factors, such as pre-merger bidder performance or growth stage of the target, into account. Even though the motivation behind their research and this paper is largely the same, the methodology is different. This paper adds the dimension of being able to compare shareholder reaction dynamics in a 60-day window around the announcement date between high- and low-tech firms. Besides the insight in the impact of target industry in an M&A transaction, this research also sheds more light of the impact of payment method, degree of diversification, relative size and public status of target companies in the present M&A environment on acquirer firms’ shareholder value creation before, during and after the announcement of a transaction.

Literature Review

Recently, technology companies have conquered a very prominent place in the economy, with companies such as Tesla, Apple or Alphabet consistently realizing double-digits growth over the past years. These impressive performances could be attributed to these companies' job growth creation and their cutting-edge production processes, contributing to efficiency gains (Kohers & Kohers, 2000). Investors worldwide have been very appreciative of such characteristics, resulting in Tesla being the world's most valuable car company with a market capitalization of \$51.4 billion as of April 10, 2017 (Thielman, 2017).

Not surprisingly, the 2016 M&A report by the Boston Consulting Group finds that the high-tech firms, on average, were acquired for a price of 18 times EBITDA in 2016, which is a 2.5 point increase over the already relatively high multiple of 15.5 in 2007. For comparison, the average Consumer & Retail or Industrial company was acquired for 12 times EBITDA in 2016. These relatively high prices could be perfectly justified by the nature of the high-tech industry because of the greater growth potential embedded in such firms. However, this greater growth potential also comes with a greater uncertainty, as most of these companies rely on future developments or discoveries to realize such growth. As these companies' value depends heavily on their future accomplishments, many of the target companies in M&A transactions in this sector are currently not generating any cash flows or even net profits. Because of very nature of the high-tech industry, transactions executed in this sector pose some unique risks, which may not be desired by (risk-averse) investors as the attractive growth opportunities of some of these high-tech target companies come at a hefty price tag.

Mergers and acquisitions and their value-creating potential have always been a key topic in academic financial economics. M&A activity has historically shown cyclical movement, which is not uncommon as one might argue that such activity is often closely linked to broader economic conditions. Bower (2001) identifies five major reasons for acquisitions: 1) Maintaining competitive pricing power in a consolidating market through economies of scale, 2) Way to entry a new region in a strongly geographically divided market, 3) Fast way of entering new markets or adding new products to current portfolio of activities, 4) Creating new business opportunities by combining existing industries and 5) As an alternative for R&D to acquire innovative products, production processes, etc. One could easily see that especially the latter two might be

of great importance in a world where innovation and technology are quickly becoming essential in securing and maintaining competitive advantages. The research question posed in this paper is therefore very relevant in determining whether the high-tech target companies, which possess the ideas, knowledge and capabilities to create new business opportunities and competitive advantages for bidder companies, show different shareholder value creation when acquired.

Blonigen and Taylor (2000) find that there appears to be a negative relationship between a firm's tendency to acquire and R&D intensity when examining US firms in the electronics industry. This relationship might seemingly express the exclusivity of the two choices, as firms either choose to pursue innovation through acquisitions or choose to invest in R&D. The theory of absorptive capacity (Cohen & Levinthal, 1990), however, suggest that firms with better internal knowledge are also better at recognizing value of new (external) knowledge and absorbing and utilizing that information. Assuming investors would also be able to draw corresponding conclusions, this would translate into higher shareholder returns when both target and acquirer are active in the same industry. This is also visible when analyzing long-term acquirer performance, with acquirers engaging in diversifying transactions generating an average 9% decrease in firm value over three years (Megginson, Morgan & Nail, 2004). This would suggest that the negative impact of diversifying acquisitions is visible during and after the announcement.

After a company decides to engage in an acquisition, it needs to decide on a desired method of payment. Generally, a bidder firm would make a purchase using cash, securities or a mix of both. Existing literature writes that acquiring companies in transactions, either partially and fully stock-financed, have shown to experience negative abnormal returns over the announcement period (Mitchell, Pulvino & Stafford, 2004), which is usually two days before and after the actual press release of such a transaction. This phenomenon is often used as an indication for investor skepticism of possible stock overvaluation when stock is being used as a payment method. On the other hand, these acquiring companies will experience small positive abnormal returns when the acquisition is paid for in cash (Andrade, Mitchell & Stafford, 2001). Furthermore, research by André, Kooli and L'Her (2004) finds that acquirer firms that engage in stock-financed transactions also underperform in the long run, which suggests that such

transactions not only generate negative abnormal returns during, but also after the announcement period.

One of the most common rationales for mergers and acquisitions, which was also mentioned earlier, is the realization of synergies when combining two entities. One could argue that bigger target companies are also able to provide more synergies, resulting in more value creation for shareholders. Previous studies, amongst which one by Asquith et al (1983), found that on average, a bid for a target firm that is half the size of the acquiring party generates a 1.8 percentage points higher cumulative excess return when compared to transaction in which the target firm is only a tenth of the size of the bidder company. Though, as stated earlier, the rationale for a high-tech acquisition is usually not related to geographical expansion, economies of scale or simply gaining market share. More often, these transactions aim to lock-in certain highly sophisticated technological knowledge or skilled individuals (Ranft & Lord, 2000). Therefore, one could argue that, as these sought-after characteristics in high-tech targets seem to be unrelated to its size, this effect could be absent when looking at such transactions. Also, earlier research by Franks, Harris and Titman (1991) found that larger transactions generate larger post-transactions results.

Furthermore, Hansen and Lott (1996) find that, on average, transactions in which the target company is a privately held firm generate a 2 percentage points higher cumulative abnormal return during the announcement period. However, evidence from a study by Dutta and Jog (2009) shows that bidder firms that acquire privately held companies do not show any significant differences in post-transaction performance from ones that acquire a publicly held company.

Even though extensive research on the topics of bidder (post-) announcement returns related to mergers and acquisitions has been conducted, very little has been documented on the bidder share price performance leading up to a transaction. Although not much is documented on the subject, one could reason that pre-announcement returns are based on rumors or information leakage and these would generally not be as detailed as the official announcement. Therefore, it seems logical to expect that the influence of the factors on share price reaction is diminished when looking at pre-announcement returns.

This research focuses on three groups that represent the high-tech industry together: Biotechnology & Pharmaceuticals, Computer & Electronics and (Tele-) Communications. Trillas (2002) found that transactions in the Telecommunications space do not generate shareholder returns that differ significantly from zero, mostly caused by problems with regard to cultural integration and political constraints. This suggests that investors, on average, do not have a very positive attitude towards such transactions. Furthermore, Park et al. (2002) found that in Telecommunications transactions, acquirer firms experience significantly negative returns in a 30 day window leading up to the announcement of the merger. Moreover, they found that, when looking a shorter window around the announcement, these returns do not significantly differ from zero anymore. They argue that, where firms usually justify such transactions by claiming there are synergies to be realized, it is very difficult for investors to objectively assess the validity of such claims, which is referred to as the “Synergy Trap”. Therefore, one could expect that (Tele-) Communications firms experience negative returns leading up to the announcement, as investors might be skeptical towards such acquisitions, and remain relatively stable during the announcement and afterwards.

Hassan et al. (2007) found that acquisitions in the pharmaceutical industry did not generate any significant returns during the 30-day window leading up to the announcement and during a 1 day window around the announcement. However, their research did show that such transactions significantly increase shareholder returns in the 30-day window after the announcement of such an acquisition. This would suggest that targets in the Biotechnology & Pharmaceuticals subgroup do not generate any significantly different returns before and during the announcement period, but do show an increase in returns in the post-announcement period. They reason that these findings make sense given that when a company acquires a Biotechnology or Pharmaceutical company, it is reasonably easy for investors to determine whether the addition to a company’s portfolio of activities from a strategic perspective.

Previous research by Khansa (2015) into acquirer value creation in the Information Security industry, which is a subset of the Computer & Electronics segment that is being investigated in this paper, found that mergers and acquisitions in that particular industry are generally associated with an increase in acquirer shareholder value. Her study focused on returns in a small window around the announcement date, however, and does not support any hypotheses around pre- or

post-announcement returns. Tanriverdi and Uysal (2011) argue that the generally positive reaction of markets to IT transactions is caused by the cost reductions that upgrading IT infrastructures offers, which could be achieved through acquisition of a company that specializes in the field.

As mentioned earlier, not much previous research has been done with a distinct focus on high-tech firms. The results from the study by Hagedoorn & Duysters are very difficult to extrapolate to derive implications for shareholder value creation. The 2000 research by Kohers and Kohers, however, did look into shareholder reaction in high-tech acquisitions and found that such transactions do significantly create shareholder value. It is important to note, however, that their research focused solely on high-tech acquisitions, and therefore it is not possible to draw the conclusion that high-tech acquisitions create more (or less) value than conventional transactions, based on their findings.

This research fills a niche in current M&A literature regarding high-tech acquisitions, as no previous study on the returns to acquirers of high-tech targets before, during and after announcement has been conducted before. Furthermore, it allows for a distinction between the performance of the subgroups within the high-tech industry, all of which have different characteristics but share their importance in the modern economic landscape. Lastly, it controls for payment method, relative size, diversification and public status of the target, all of which have shown to significantly influence bidder returns in mergers and acquisitions. As part of the research on these factors is either potentially outdated or ambiguous, this research will also provide more insight on their influence during the most recent M&A wave.

Hypotheses

The main purpose of this research was to map potential differences in shareholder value creation around the announcement of a merger or acquisitions between high-tech and conventional target companies. Following earlier research, the following influences on bidder returns before, during and after the announcement period were expected:

Biotechnology & Pharmaceuticals – Transactions in which the target company is active in the Biotechnology & Pharmaceuticals sector were expected to not show any significant influence on acquirer returns before and during the announcement period. However, it was previously found

that there is a positive effect when analyzing post-announcement performance. Therefore, it was hypothesized that the effect of a Biotechnology & Pharmaceuticals transaction is positive in the post-announcement period.

Computer & Electronics – Based on earlier research by Khansa (2015), it was also hypothesized that transactions in the Computer & Electronics space generate greater shareholder returns during the announcement period. Because investors generally react positively to such transactions, it was expected that pre-announcement returns are also positively impacted, while post-announcement returns were expected to remain flat, as it is well established that new information is usually quickly incorporated into share prices (Fama et al, 1969).

(Tele-) Communications – It was previously established that takeovers of targets in the Telecommunications space do not generate returns significantly different from zero, both during and after the announcement. Furthermore, it was found that these transactions generally cause negative shareholder returns before the announcement. Therefore, it was hypothesized that such transactions generate a negative return in the pre-announcement phase, and show relatively flat returns during and after the announcement.

Ownership structure – Based on the research cited earlier, a target company that was privately owned before was expected to deliver higher shareholder returns, before and during the announcement period. Based on earlier findings, this effect was expected to not be visible anymore in post-announcement returns.

Overlap in industry – Following the theory of absorptive capacity, it follows logically that bidder firms that are active in the same industry as the target are able to more adequately reap the benefits of a transaction. It was expected that this effect is consistently present when analyzing pre-and post- announcement returns.

Financing method – As earlier research found that investors are generally not appreciative of stock-financed acquisitions, such transactions were expected to deliver lower abnormal returns, both during and after announcement period. Because pre-announcement returns are sometimes based on rumors which are not very detailed, this effect was expected to be absent when examining pre-announcement returns.

Relative transaction size – Due to the traditional motives for mergers and acquisitions, such as economies of scale, larger transactions have historically delivered higher shareholder returns. It was expected that this effect was still present in recent years. Furthermore, based on earlier research, it was hypothesized that these transaction continue to provide shareholders with positive abnormal returns post-transaction.

Methodology

This research examines all 100% mergers and acquisitions by public companies that took place in the United States between 1 January 2014 and 31 December 2016. This means that the analysis only uses transactions in which both the bidder and target firm are US based. This was done to eliminate possible cross-border effects, as the main purpose of the research was to map possible implications of the target company being high-tech. The sample of relevant transactions, along with their announcement dates, was derived from the Thomson One database, which came down to 2,852 transactions during the relevant time period. However, as some of these transactions were poorly documented and did not provide enough information to be useful in the analysis, the actual sample used contained 2,426 transactions. The classification whether a transaction was high-tech or not was based on the target company's SIC code. In order to perform this identification, the optimal three-digit SIC Code Combination as recommended by Kile and Phillips (2009) has been used. However, in order to more precisely identify possible effects of being high-tech on shareholder reactions to transactions, high-tech firms have been divided into three subgroups: Biotechnology & Pharmaceutical, Computer & Electronics and (Tele-) communications. The final subgroups, based on the SIC codes, along with their respective industries, are visible in table 1.

Table 1: High-Tech SIC Code Classification for Firms Being Acquired Between 1 January 2014 and 31 December 2016

The total high-tech sample was based on the recommendation made by Kile and Phillips (2009). High-tech target firms have been split into three subgroups, which are visible in the left column, with the respective SIC codes visible in the middle column.

Subgroup	SIC Code	Industry
Biotechnology & Pharmaceuticals	2830 - 2839	Drugs
	3820 - 3829	Laboratory, Optic, Measure, Control Instruments
	3840 - 3849	Surgical, Medical, Dental Instruments
	8730 - 8739	Research, Development, Testing Services
Computer & Electronics	3570 - 3579	Computer and Office Equipment
	3670 - 3679	Electronic Components and Accessories
	7370 - 7379	Computer Programming, Data Processing, etc.
(Tele-)communications	3660 - 3669	Communication Equipment
	4810 - 4819	Telephone Communications
	4820 - 4829	Miscellaneous Communication Services.
	4890 - 4899	Communication Services, NEC

Abnormal returns on day t for company i during the announcement period ($t \pm 2$ days) were calculated using the market model adjusted returns, which are calculated as follows:

$$Abnormal\ Returns_{i,t} = R_{i,t} - (\hat{\alpha}_i + \hat{\beta}_i R_{m,t})$$

with $R_{i,t}$ denoting the actual return of the particular stock, $(\hat{\alpha}_i + \hat{\beta}_i R_{m,t})$ denoting the expected return of the stock, given a market return $R_{m,t}$ on day t . The parameters $\hat{\alpha}_i$ and $\hat{\beta}_i$ were derived by performing a regression of market returns with stock i 's returns, using an estimation period which spanned from day -365 to day -3, with day 0 being the announcement day. Also, the S&P500 index was used as a proxy for the market index. The obtained abnormal returns during the announcement period were then summed together to yield Cumulative Abnormal Returns.

In order to test the hypotheses around short-term shareholder value creation in mergers and acquisitions, which were presented in the previous section, the following model was used:

$$\text{Bidder Cumulative Abnormal Returns}_i (CAR_i) = \alpha + \beta_1 * [PUB] + \beta_2 * [DIV] + \beta_3 * [STOCK] + \beta_4 * [RELSIZE] + \beta_5 * [HT] + \beta_6 * \{[PUB] * [HT]\} + \beta_7 * \{[DIV] * [HT]\} + \beta_8 * \{[STOCK] * [HT]\} + \beta_9 * \{[RELSIZE] * [HT]\} + \varepsilon_i$$

The description of the variables used in the model is visible in table 2 below:

Table 2: Description of Factor Variables used in the Multifactor Models

The left column displays the different abbreviations for the factors used in the multi-factor model presented above. The right column provides a more detailed description of the relevant factor. CAR_i denotes bidder abnormal returns for transaction i .

Variable name	Description
CAR_i	Bidder Cumulative Abnormal Returns during the announcement period
PUB	whether the target company is publicly traded (1 = Publicly traded)
DIV	whether the transaction is diversifying for the bidder (1 = target and bidder have same SIC code)
$STOCK$	whether the transaction was partially or fully stock financed (1 = transaction involved stock financing)
$RELSIZE$	relative size of the transaction (= [transaction value] / [bidder market value on $t - 11$ days])
$BIOTECH$	whether the target company fits the Biotechnology & Pharmaceuticals group based on SIC codes or not (1 = target is in that group)
$COMP$	whether the target company fits the Computer & Electronics group based on SIC codes or not (1 = target is in that group)
$TELECOM$	whether the target company fits the (Tele-)Communications group based on SIC codes or not (1 = target is in that group)

In order to control for measurement and documentation errors, the RELSIZE variable underwent a 98% winsorization.

Results – Transactions Sample Analysis

Summary descriptive statistics are visible in table 3 below.

Table 3: Descriptive Statistics of acquisitions between 1 January 2014 and 31 December 2016

The left column lists the 4 different types of target firms that were distinguished in this research. On the right, transaction value, Cumulative Abnormal Bidder Returns, public status of the target, degree of diversification, payment method (STOCK) and relative size are visible per type of target. In total, 2,426 100% mergers and acquisitions that happened between 1 January 2014 and 31 December 2016 were investigated.

	Transaction value (USDm)		CAR		PUB	DIV	STOCK	RESIZE	
	n	Mean	Median	Mean	Median	Mean	Mean	Mean	
Non High-Tech	1787	551.9	75.1	0.013	0.006	0.16	0.30	0.27	0.25
BIOTECH	227	1603.1	124.1	0.016	0.005	0.19	0.42	0.24	0.30
COMP	371	887.7	80.2	0.004	-0.001	0.15	0.33	0.27	0.24
TELECOM	41	1224.6	225.9	0.036	0.017	0.17	0.24	0.24	0.29
Total Sample	2426	713.0	81.7	0.012	0.005	0.16	0.31	0.27	0.25

It follows from table 3 that the average transaction size in the sample is \$713 million. However, there seem to be large differences in size when looking at the subgroups within the high-tech transactions separately; for instance, the average transaction size when acquiring Bio-tech targets was almost \$1.6 billion, versus \$887.7 million and \$1.2 billion for Computer and Telecom targets, respectively. Meanwhile, non-high transactions averaged \$551.9 million. Furthermore, regardless of what industry the target firm is operating in, acquiring firms are experiencing positive abnormal returns, with the sample showing an average abnormal return of 1.2% during

the announcement period. It is interesting to note, however, that the median return for transactions in the Computer & Electronics space is negative.

Moreover, the sample shows that, during the relevant period, 16% of target firms were publicly held before being acquired, which negligible differences when distinguishing between the different types of high-tech and traditional target firms. Of all the transactions, 27% was either partially or fully financed with stock, again with very small differences visible between the four types of acquisitions.

Not surprisingly, when looking at diversification, Biotech transactions show a high degree of overlap with 42% of acquisitions showing overlap, possibly because their knowledge very specific and not broadly applicable. Transactions in which the target was active in the (Tele-) communications space only showed overlap in SIC codes in 24% of the cases, whereas Computer & Electronics target firms showed overlap more in line with the average, showing overlap in 33% of the cases versus the total sample average of 31%.

Surprisingly, the relative size of the transaction did not show large differences when comparing the different types of acquisitions. Given the relatively high average transaction value in the Biotechnology & Pharmaceuticals and (Tele-) Communications industries, one would have assumed that the relative size would have also been larger. Given that this does not show from table 3, one could draw the conclusion that the acquiring firms also have to be larger in order to arrive an average relative transaction size of around 0.25 across the total sample.

Results – Stock Returns Sample Analysis

The figure below shows the cumulative abnormal returns for the acquirer firms in the sample. Even though the main regression model only focuses on returns in a very narrow window around the announcement date, it is still informative to examine these returns over a longer time frame. Figure 4 shows the cumulative abnormal returns over the three relevant periods per target industry. The t-statistics indicate that there is a significantly positive shareholder reaction to transactions in which target is either non-high tech or (Tele-) Communications.

Figure 1 shows the returns during a 60-day window, representing the time period ranging from a month before announcement until a month after. Interestingly, although every group shows

similar patterns during the announcement period as defined earlier, they move in very different fashion when looking at a longer time span. Bidder firms engaging in an acquisition of a non-high-tech target show a notable spike in returns a few days before the official announcement date. This could point to the leakage of information around the transaction to investors. Furthermore, whereas firms that will acquire companies in the Biotechnology & Pharmaceuticals and the Computer & Electronics spaces show relatively flat returns during the days leading up to the announcement, companies engaging in a transaction in the (Tele-) Communications space seem to perform poorly in the last few days before an announcement. However, this performance seems to be reversed in the period after the announcement date, with Telecom acquirers outperforming all other subgroups in the sample in the first month after announcement.

Table 4: Acquirer Cumulative Abnormal Returns across Time Periods per Target Industry

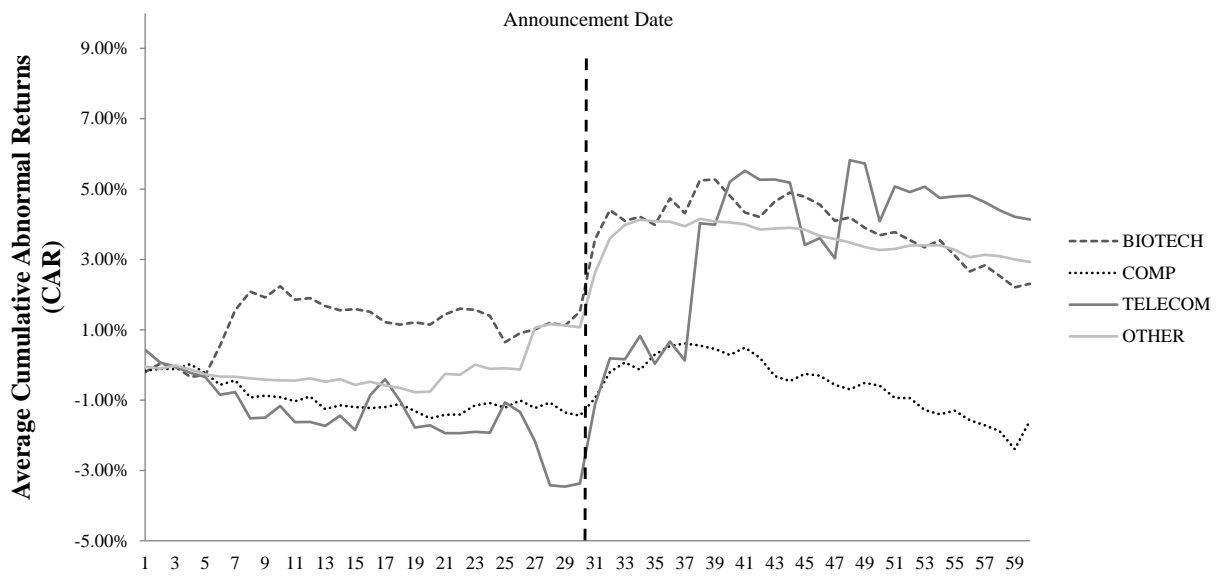
The left column lists the 4 relevant types of target firms. On the right, statistics for Bidder Cumulative Abnormal Returns (CAR) are visible for the period before, during and after the announcement. The first period denotes the days -12 until -3, the second period days -2 until +2 and the third period days +3 until +12, with day 0 denoting the day the official announcement took place. Cumulative Abnormal Returns were calculated by adding up all market model abnormal returns over the relevant period.

	CAR (before)		CAR (during)		CAR (after)	
	Mean	t-value	Mean	t-value	Mean	t-value
Non High-Tech	.014052	1.2345	.012989	6.0476	-.003374	-1.1379
BIOTECH	-.000412	-0.0584	.015562	1.7246	.005713	0.4751
COMP	-.001446	-0.2599	.003531	0.7037	-.003073	-0.3737
TELECOM	-.023911	-1.4915	.036371	2.8935	.051105	1.1489

Note: All reported t-statistics are reflecting a mean-comparison test with hypothesis Mean = 0

Figure 1: Acquirer Cumulative Abnormal Returns in a 60-day window around the announcement of a transaction

The numbers on the x-axis denote the particular day in a 60-day window. Day 0 denotes the announcement date. The numbers on the y-axis represent returns to acquiring firms' shareholders. Cumulative Abnormal Returns were calculated by adding daily market model abnormal returns.



Because of these apparent discrepancies in pre- and post-announcement returns, two additional regression models will be run. These models will be of the same form as the model discussed earlier, however, the dependent variables will be 1) the pre-announcement CAR, calculated by adding abnormal returns over the ten-day period [-12,-3] and 2) the post-announcement CAR, calculated by adding abnormal returns over the ten-day period [+3,+12].

Results – Regression

As stated before, the final analysis conducted used 2,426 transactions that occurred between 1 January 2014 and 31 December 2016. The results of the regression model, which was presented in the methodology section, are visible in table 5 below. Table 5 shows the output of the regression when excluding the interaction terms, whereas table 6 and 7 provide insight in the results of the pre- and post-announcement returns. It is important to note that the main regression model is significant, showing an F-statistic of 6.13.

As expected, public firms, on average, deliver negative shareholder returns during the announcement period. Public firms lower shareholder returns by as much as 2.7% during the announcement period, which is significant at the 1 percent level. This might be caused due to the fact that public firms have a greater possibility of possessing some kind of ‘internal advantage’ or proprietary knowledge that will generate greater value for the bidder, whereas for public firms this advantage may already have been fully exploited. As hypothesized, firms that show overlap with the target firm (implying the merger is not diversifying) generate positive shareholder returns of almost 1.4% during the announcement period, also significant at the 1 percent level.

Although not significant, stock-financed transactions generate positive shareholder returns of 0.9% during the announcement period. This finding suggests that the literature on this topic that was cited earlier might not be accurate anymore, and investors might be more appreciative of stock used as a source of financing. However, as these findings are not significant, further research is necessary on the topic. Furthermore, the relative size of a transaction was found to have a positive influence on shareholder returns, significant at the 1 percent level. This finding is supported by the traditional motives of merger activity, presented in the literature review section, as in many cases the size of potential gains are related to the size of the target firm.

Surprisingly, target firms in the Biotechnology & Pharmaceuticals industry do not significantly generate higher shareholder returns than firms in the more traditional areas. Transactions in which the company is active in the Computer & Electronics or (Tele-)Communications space do have a statistically significant impact on shareholder returns, however. The former type of transaction showed to lower shareholder returns by close to 1%, significant at the 10 percent level, whereas the latter type generates an additional 2.35% return for shareholders, significant at the 5 percent level. Because both types of transactions are considered high-tech in this research, it is striking that they show contrary influences on shareholder reactions. One possible explanation could be the very nature of the (Tele-) Communications industry, where competitive advantages are sometimes merely dependent on size, resulting in acquisitions being a very attractive growth strategy.

Table 5 – Regression of Acquirer Firms Announcement Period Returns on Target Public Status, Overlap in Industry with Target, Payment Method, Relative Size and Target Industry

The left column lists all factors controlled for in the multi-factor linear model as presented in the methodology section. The t-statistics and p-values reflect the outcome of a mean-comparison test to 0. The β -coefficient indicates the size and direction of the relationship between the relevant factor and the Cumulative Abnormal Bidder Return during the announcement period, which was the dependent variable.

Independent Variable	(β-)coefficient	t-Statistic	p-value
<i>constant</i>	0.0034	1.44	0.150
<i>PUB</i>	-0.0271	-5.09	0.000***
<i>DIV</i>	0.0136	3.16	0.002**
<i>STOCK</i>	0.0090	1.58	0.114
<i>RELSIZE</i>	0.0292	2.81	0.005***
<i>BIOTECH</i>	0.0005	0.06	0.954
<i>COMP</i>	-0.0099	-1.82	0.069*
<i>TELECOM</i>	0.0235	1.89	0.037**
<i>F-Statistic</i>	6.13		0.000***

Note: Total number of observations was 2,426. The t-statistics shown are obtained using robust standard errors to control for possible heteroscedasticity. Adjusted- R^2 : 0.0366

*=Significant at 10% level | **=Significant at 5% level | ***=Significant at 1% level

Interestingly, neither the pre- nor post-announcement returns regression models showed to be significant: F-statistics of 0.61 and 0.99 were found, respectively. Furthermore, in both multi-factor models, none of the factors show to have a statistically significant influence on returns, the only exception being (Tele-) Communications generating negative pre-announcement returns, significant at the 10 percent level. The complete overviews of the two models and their factors are visible in tables 5 and 6. It is important to note, however, that pre-announcement returns can generally be attributed to information leakages or insider trading (Aktas et al, 2007).

When looking at the different factors impacting the pre- and post-announcement returns, public targets seem to generate negative share price reactions, both in pre- and post-announcement period. This is in line with Luo (2005), who argues that proprietary technical information, such as a recipe for a product in a retail merger or new software code in a computer merger, is very important for the market to analyze a transaction. Usually, companies have the incentive to not disclose this kind of information in order to protect their ‘secrets’ from the competition. As it is generally easier for private firms to choose to disclose less information, one could argue that the acquisition of private firms also implies greater gains of information.

Although not significant, transactions in which the target and bidder share the same SIC code generate negative pre-announcement and post-announcement returns, opposite to the positive effect observed when looking at announcement period returns. Campa and Kedia (2002) argue that stockholders are generally not very appreciative of diversifying mergers, as they can easily diversify their own portfolio in a cheaper way. Furthermore, a diversified firm is usually harder to manage, as they are operating in different fields or markets. They also write that “failure to control for firm characteristics that lead firms to diversify and be discounted may wrongly attribute the discount to diversification instead of the underlying characteristics.” As past performance or other possible catalysts of diversifying acquisitions are outside the scope of this research, the inconsistency in shareholder reaction could be attributed to that.

The, also not significant, very small coefficient of the payment method might be caused by the fact that the information leakage or insider knowledge mentioned before do not include such detailed information on payment method. When comparing the after-announcement impact of stock financing to influence on announcement period returns, it shows that the small gain during the announcement period due to stock financing is offset by a negative abnormal return in de

post-announcement period. Both impacts are of approximately the same size, meaning that stock financing did not have any notable influence on the target share price when looking at a larger time frame. Even though the findings of this paper are not in line with older research such as that by Datta and Pinches (1992), a more recent paper by Savor and Lu finds support for the notion that stock-financed transactions do create value for bidder firms whose equity is overvalued.

The relative size of the transaction shows to have a very substantial influence on the share price reaction when looking at pre-announcement returns, showing returns that are almost 13 percentage points higher when a firm engages in a transaction with a firm of roughly equal size. A possible explanation would be that generally, for larger transactions, more parties are involved. Assuming every party involved increases the chances of information leakage, larger transactions would also suffer a greater information leakage prior to the official announcement, which would explain the large pre-announcement returns. Furthermore, also in post-announcement returns, relative size shows a relatively strong influence on returns.

As stated earlier, none of the subgroups within high-tech showed any significantly different behavior when looking at pre- and post-announcement bidder returns, despite the seemingly very different returns during the [-30, +30] window as visible in figure 1. Target firms in the (Tele-) Communications industry, however, do show a strong negative impact on pre-announcement returns, significant at the 10 percent level, followed by very solid returns during and after the announcement period of 2.4 and 5.3 percentage points higher than conventional firms, respectively. This dynamic might be caused by investor concerns around possible cultural integration problems or political constraints, which could be offset by additional information provide in the official transaction announcement, as previous research indicated that these factors are major determinants of a transaction's success.

Firms in the Biotechnology & Pharmaceuticals space generate returns following a similar pattern, displaying negative returns pre-announcement, offset by positive returns during and after the announcement period. This could be caused by skeptical investors around the role of the target company in the acquirer's current portfolio of activities being reassured by the official announcement, as earlier literature states that investors are generally appreciative of transactions that fill gaps in that portfolio.

Lastly, firms in the Computer & Electronics space generated lower returns in the pre-announcement period, as well as during the announcement period. Even though post-announcement returns were slightly higher, the effect is negligible when compared to the effects of the other two high-tech subgroups. Even though previous literature found that acquisitions of such companies are a good way of streamlining IT infrastructure, resulting in cost reduction, it is possible that in the current landscape such transactions might be an indication to investors that the acquirer is using outdated systems, as most companies already have updated IT solutions in place nowadays.

Table 6 – Regression of Acquirer Pre-announcement Returns on Target Public Status, Overlap in Industry with Target, Payment Method, Relative Size and Target Industry

The left column lists all factors controlled for in the multi-factor linear model as presented in the methodology section. The *t*-statistics and *p*-values reflect the outcome of a mean-comparison test to 0. The β -coefficient indicates the size and direction of the relationship between the relevant factor and the Cumulative Abnormal Bidder Return before the announcement period, which was the dependent variable.

Independent Variable	(β-)coefficient	t-Statistic	p-value
<i>constant</i>	-0.0080	-0.95	0.344
<i>PUB</i>	-0.0301	-1.10	0.270
<i>DIV</i>	-0.0201	-1.11	0.269
<i>STOCK</i>	0.0008	0.08	0.939
<i>RELSIZE</i>	0.1296	1.30	0.195
<i>BIOTECH</i>	-0.0169	-1.11	0.267
<i>COMP</i>	-0.0140	-1.18	0.238
<i>TELECOM</i>	-0.0436	-1.90	0.057*
<i>F-Statistic</i>	0.61		0.750

Note: Total number of observations was 2,426. The *t*-statistics shown are obtained using robust standard errors to control for possible heteroscedasticity. Adjusted- R^2 : 0.0221

*=Significant at 10% level | **=Significant at 5% level | ***=Significant at 1% level

Table 7 – Regression of Acquirer Post-announcement Returns on Target Public Status, Overlap in Industry with Target, Payment Method, Relative Size and Target Industry

The left column lists all factors controlled for in the multi-factor linear model as presented in the methodology section. The *t*-statistics and *p*-values reflect the outcome of a mean-comparison test to 0. The β -coefficient indicates the size and direction of the relationship between the relevant factor and the Cumulative Abnormal Bidder Return after the announcement period, which was the dependent variable.

Independent Variable	(β-)coefficient	t-Statistic	p-value
<i>constant</i>	-0.0050	-1.38	0.168
<i>PUB</i>	-0.0021	-0.34	0.732
<i>DIV</i>	-0.0050	-0.85	0.395
<i>STOCK</i>	-0.0097	-1.06	0.291
<i>RELSIZE</i>	0.0242	1.52	0.130
<i>BIOTECH</i>	0.0084	0.67	0.505
<i>COMP</i>	0.0007	0.07	0.940
<i>TELECOM</i>	0.0530	1.19	0.235
<i>F-Statistic</i>	0.99		0.435

Note: Total number of observations was 2,426. The *t*-statistics shown are obtained using robust standard errors to control for possible heteroscedasticity. Adjusted- R^2 : 0.0071

*=Significant at 10% level | **=Significant at 5% level | ***=Significant at 1% level

Conclusion

The very nature of the high-tech industry and the firms operating in it raises question about the extent to which shareholders appreciate mergers and acquisitions of such companies. Because the success of these companies depends largely on the successful development and exploitation of emerging technology, the high-tech industry can be characterized as high-risk and high-growth. This research examined transactions within the United States in which a target company active in the high-tech industry was fully acquired. Because the high-tech industry and their products are so interwoven with society nowadays, the respective companies were divided into three subgroups: Biotechnology & Pharmaceuticals, Computer & Electronics, and (Tele-) Communications. This research looks at returns during three different time frames related to the announcement of such a transaction, whilst controlling for payment method, public status of the target, overlap in industry and relative transaction size.

The results of this study show that, shareholders of companies that engaged in acquisitions of high-tech companies experienced different returns during the announcement period, as well as before and after. Specifically, firms acquiring a target in the (Tele-) Communications space experienced a significantly negative return during the pre-announcement period, which is consistent with previous literature. However, these acquirers then experienced very attractive returns during and after the announcement, showing average returns that were 2.4 and 5.3 percentage points higher, respectively.

Furthermore, targets in the Biotechnology & Pharmaceuticals industries generated acquirer returns which followed a pattern similar to that of targets in the (Tele-) Communications sector; Bidder firms acquiring a Biotechnology & Pharmaceuticals target firm experienced returns that were 1.7 percentage points lower than acquirers of conventional firms, and experienced returns that were 0.05 and 0.84 percentage points higher during and after the announcement, respectively.

Even though previous research suggested that transactions in the Computers & Electronics space are generally perceived positively by investors, the results of this research indicate that acquirers of target firms active in these industries experience lower returns than acquirers of conventional firms. Returns before and during the announcement period were 1.4 and 0.99 percentage points

lower than for acquirers of conventional firms. During the post-announcement period, they experienced returns that were 0.07 percentage point higher on average.

Public targets show to generate smaller bidder returns across all examined time frames, which is in line with other literature that emphasizes the importance of proprietary knowledge in generating potential benefits for acquirers. The role of overlap in industry is more ambiguous: during the announcement period, transactions in which overlap between the target and the bidder is present are perceived positively by investors. However, such transactions do show lower returns during the pre- and post-announcement periods. This ambiguity is also present in other literature, as previous research has shed light on both the positive and negative implications of diversifying transactions.

Other factors that impact bidder returns were payment method (with stock-financed transactions generating a positive return during the announcement period, offset by an almost equally large negative return during the post-announcement period) and relative size (with relatively larger transactions generating significantly higher returns across all time frames).

This research adds to the current literature the insight into the value creation of high-tech acquisitions, not only during, but also before and after announcement. Furthermore, it enables comparison between different subsets of high-technology target firms and the way in which they create value for acquiring firms. As mentioned multiple times in this paper, there are striking differences in value creation dynamics in the period around a transaction announcement. Especially the sizeable effects of (Tele-) Communications are notable, as they were hypothesized to be absent. This leaves room for further research, as it would be relevant to map out the long-term implication of high-tech acquisitions versus traditional ones. As this research found that, for instance, (Tele-) Communications acquisitions generate positive shareholder returns in the short-term, it would be interesting to examine whether this effect continues in the long-term or whether it was just a short-term sentimental reaction by investors.

Future research could also explore the discrepancies between the influences of the factors before, during and after the announcement period. As the findings of more recent literature, including this paper, contradict the findings of older literature as cited in this research, it might also be relevant to form a consensus on the impact of factors such as stock-financing or diversification.

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