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Cross-border stock-financed mergers and (over)valuation: an event study on acquisition performance

Abstract

This research contributes to the ongoing debate surrounding the effectiveness of mergers and acquisitions (M&A), specifically focusing on international acquisitions in the tech industry. The study examines a sample of completed cross-border tech acquisitions between 2000 and 2019, that are either 100% stock-financed or 100% cash-financed. Given the tech industry's prominence in M&A activities and its pursuit of knowledge and market expansion (Ma and Liu, 2017), the research aims to examine acquisition performance by investigating the (inter)relation between overvaluation, acquiring motives, financing-method and its consequences for shareholder value creation. The findings cast substantial doubt on the ability of firms to effectively leverage synergies through acquired technology and knowledge. Empirical evidence from this study reveals that acquisitions, regardless of the financing method employed, tend to turn out value destructive. While overvaluation among acquirers can lead to motive misguidance and negatively affect M&A performance (Shleifer and Vishny, 2003), the results of this research highlight that target overvaluation plays a more significant role in driving value destruction. This finding holds true across different deal types and time horizons.

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1 Introduction

Mergers and acquisitions (M&A) continue to be a critical strategy for firms to achieve growth, enter new markets, and gain a competitive advantage (Calipha, Tarba, & Brock, 2010). According to Statista (2023), the global M&A market in 2021 amounted to 3.8 trillion U.S. dollars, which is a significant increase compared to the previous year's market size of 2.4 trillion U.S. dollars. The total number of M&A deals also increased in 2021, with a total of 44,748 deals announced worldwide, up from 33,191 deals in 2020. Despite the short-term turbulent macro environment, Bain & Company among others foresee this trend to continue in their Global M&A Report (2022), with many companies looking to capitalize on the opportunities presented by an increasingly interconnected global economy (Mergermarket, 2022; Refinitiv, 2021; Duff & Phelps, 2022; Baker McKenzie, 2023; Deloitte, 2023; PWC, 2023). Ranft and Lord (2002) highlight this trend to be especially relevant in the tech industry, where acquisitions play a crucial role in facilitating firm aggressive expansion, entering new markets, and, more importantly, knowledge acquisition. This is reflected by tech acquisitions accounting for the largest proportion of total M&A, as demonstrated by 20% of the total M&A deal flow being attributed to tech acquisitions, totaling 1.1 trillion U.S. dollars (Baker McKenzie, 2023).

Despite the significant role that M&A plays in the business world, the success rate of M&A transactions remains low (Hitt, Harrison, & Ireland, 2013). Research has shown that a large proportion of M&A transactions fail to achieve their intended goals, often resulting in negative outcomes such as financial losses, decreased employee morale, and reputational damage (Cartwright & Schoenberg, 2006). To mitigate the risk of failure and maximize the potential benefits, it is crucial to identify the factors that contribute to the performance of M&A transactions. Shleifer and Vishny (2003) claim that many stock-financed acquisitions are driven by acquirer stock overvaluation, enabling them to purchase less overvalued targets at a discount. An empirical study by Ang and Cheng (2006) confirms this by finding evidence that in stock-financed acquisitions, acquirers are more overvalued than their targets before mergers and, additionally, that the level of acquirer's overvaluation increases probability of using stock-financed payment method. This thesis investigates the effect of overvaluation of stock-based acquirers on shareholder value creation through cross-border acquisitions in the tech industry.

While previous research has mostly focused on identifying factors that lead to overall success in M&A transactions (eg, Calipha, Tarba, & Brock, 2010; Levinson, 1970), this study contributes by examining the impact of critical factors during the pre-deal phase on the performance of cross-border M&A transactions (e.g. valuation, deal-financing method, motives). Angwin (2001) emphasizes the importance of understanding the phases leading up to the transaction. Hence, by being able to identify these specific phases in the acquisition process and understanding the corresponding factors that predict performance, executives can anticipate issues that may have a negative impact on M&A synergy realization and overall success prior to deal-completion (Calipha & Brock, 2019).

The primary objective of this study is to contribute to international M&A literature by focusing on firm-specific factors rather than regulatory factors. While previous research has successfully shed

light on the impact of a country's regulatory environment on the volume of international corporate transactions (Capron & Pistre, 2002), especially in the context of cross-border M&A, there exists a lack of understanding how firm- and industry- specific factors influence the performance of M&A transactions. By focusing on firm-specific factors, this study aims to provide key contributions to both researchers and practitioners in the field of M&A, enabling them to better understand acquisition motives and determinants of performance and make informed decisions. Ultimately, this will be done by answering the research question:

“Does overvaluation contribute to acquiring motives and deal-financing method and, ultimately, what effect does this have on shareholder value creation?”

This research question will be addressed through three sections, which all relate to an event study. First, the literature review section will demonstrate a comprehensive understanding of the existing research on cross-border M&A deals. It will provide extensive information on how international M&A deals are especially important in the Tech industry and how acquiring motives play a role here. Additionally, information about deal-financing and the concept of overvaluation will be elaborated on and its contribution to M&A performance. Subsequently, this section will provide a clear rationale for the current study, including its research objectives and hypotheses. The dataset used in this study is retrieved from Factset and consists of a sample of completed cross-border tech acquisitions between 2000 and 2019, where both the acquirer and the target are active in the technology industry and the deal is either 100% stock-financed or 100% cash-financed. To reach the desired research objectives, a two-fold methodological framework is applied. First, the Rhodes-Kropf, Robinson and Viswanathan's (2005) model is used to quantify the extent of misvaluation. Second, an event study will be employed to measure acquisition performance in terms of shareholder value creation, across different deal-types and (mis)valuation profiles. To achieve this, abnormal returns will be calculated using the cumulative abnormal returns (CAR) method, both for the short-term and long-term.

2 Literature review and Hypothesis

2.1 Cross-border M&A

2.1.1 *Defining international M&A and the acquisition process*

The existing literature proposes several approaches to M&A phases, with most studies focusing on pre-merger and post-merger stages (Bauer & Matzler, 2014; Boland, 1970). However, some studies divide the process into three stages, adding the ‘during-the-merger phase’ (Appelbaum, et al., 2000), while other studies propose more specific phases, such as strategic planning, screening candidates, due diligence, deal execution, and integration (Kazemek & Grauman, 1989; Parenteau & Weston, 2003). In this study, the overall principle of two broad phases (i.e. pre-merger and post-merger) will be followed. To this point, Gomes et al. (2013) identified M&A performance factors that are associated with each phase. In case of the post-merger stage, success factors include integration strategy, post-acquisition leadership, speed of implementation, post-merger integration team, the need to balance day-to-day business activities, communication during implementation, managing corporate and national cultural differences. These factors fall, although important, beyond the scope of this research; the pre-merger phase forms the ultimate point of attention. With respect to the latter phase, Gomes et al. (2013) state factors that affect performance to include the selection and evaluation of the strategic partner, motives, paying the right price and payment method. Tripathi and Lamba (2015) have identified five main motives behind mergers and acquisitions: value creation, improvement in efficiency, market leadership, marketing and strategic motives, and synergistic gains. When focusing on the strategic motive, the acquirer should consider strategic rationale such as increasing scale to become more competitive or adapting to technological changes (Aggarwal-Gupta, Kumar, & Upadhyayula, 2012; Gadiesh & Ormiston, 2002). However, there is no consensus on how particular motives behind acquisitions influence performance. Research shows that firm value decreases with the degree of diversification (Lang & Stulz, 1994; Comment & Jarrell, 1995). Goyal and Fan (2006) find that vertical mergers generate a positive average abnormal return for the combined acquirer and target firms, which is significantly larger than that for diversifying mergers. The success of mergers also depends on the time period (Morck, Shleifer, & Vishny, 1990; Servaes, 1996). Furthermore, diversification may be an efficient response to poor growth opportunities in a firm's main lines of business (Campa & Kedia, 2002; Graham, Lemmon, & Wolf, 2002). While these motives have been highlighted in domestic acquisitions, they are particularly noteworthy in the context of international mergers and acquisitions, given the elevated level of internal uncertainty and incomplete knowledge that firms encounter in such transactions (Gatignon and Anderson, 1988; Lee and Caves, 1998). Additionally, differences in factors such as cultural norms, legal frameworks, and accounting regulations can exacerbate transaction costs when conducting acquisitions abroad (Markides and Ittner, 1994; Datta and Puia, 1995).

International mergers & acquisitions have gained increasing popularity as a mode of internationalization in recent years, with M&As constituting a major route for global foreign direct

investment (UNCTAD, 2000). However, foreign acquisitions often suffer from the acquirer's 'liability of foreignness,' especially when the firm has little or no prior experience in international markets (Zaheer, 1995). One area of research on international M&A has examined the extent to which these transactions create value for the acquiring firms, particularly in the context of operational performance and shareholder value creation (Capron & Pistre, 2002). Similar to domestic M&As, the empirical evidence on whether international M&As generate value for the acquirers on average is mixed, as different studies have reported conflicting results (Doukas and Travlos, 1988; Cakici et al., 1996).

2.1.2 *M&A in the tech industry*

The mixed research findings on M&A performance could potentially be attributed to the variation in motives across different deal-types and sectors. In the tech industry, acquisitions are especially crucial for the purpose of gaining access to external knowledge, contributing significantly to the technological development of firms (Hagedoorn and Schakenraad, 1994). The past few years have seen a rapid advancement in technology, gradually exerting its influence on the international acquisition landscape (Sears and Hoetker, 2014; Asimakopoulos and Whalley, 2017). Subsequently, digitalization is transforming the economic landscape, forcing firms to invest in endeavors that create or enhance their technological capabilities to adapt to the changes (Kapoor and Lim, 2007; Hung and Tang, 2008). Kogut and Zander (1992) address that companies grow by effectively transferring knowledge within and across firms. In addition, Ma and Liu (2017) contend that certain M&A deals aim to acquire technology by expanding into a new sector, while others seek to improve existing technology. Larger acquirers, instead of investing in R&D, may prefer to assimilate the technological progress of a smaller target firm. The motives for technology-related M&A deals may be highly sector-specific. Ranft and Lord (2002) suggest that knowledge-intensive and innovation-driven sectors require specialized skills and expertise, thereby facing managerial challenges that could be resolved by a successful M&A strategy. Consequently, the study of international M&A in one of the knowledge intensive business sectors is especially intriguing. Hence, this research specifically focuses on the rapidly evolving technology sector.

While motives for acquiring such tech firms do not possess clear-cut boundaries, the creation of shareholder wealth post-acquisition may not necessarily be related to technological drivers. To this point, Shleifer and Vishny (2003) identify (over)valuation of firms and transaction payment method as alternative acquisition motivations. In terms of transaction methodology, using cash or stock are among deal-financing options. Prior finance research suggests that the decision to use these forms of consideration can have important performance implications for acquirers (Chang, 1998; Kohers and Ang, 2000). In fact, the performance of M&A is shown to be dependent on both payment methods (Martin, 1996) and market valuation (Rhodes-Kropf & Viswanathan, 2003), with both being interrelated. Stock payments are relatively more commonplace in domestic acquisitions, and studies on these indicate that bidders choose this form of payment in M&A deals subject to asymmetric information

(Hansen, 1987; Fishman, 1989). However, such payouts also suffer from the drawback of signaling to equity investors that the bidder's stock is overvalued (e.g., Eckbo et al., 1990), so the former benefit of mitigating the effects of asymmetric information regarding the target's resources needs to be weighed against the latter cost of signaling overvaluation of the acquirer's stock. Altogether, existing literature established a correlation between periods of overvaluation (in terms of high market-to-book ratios) and periods of increased merger activity, especially for stock-financed deals (Maksimovic & Phillips, 2001; Jovanovic & Rousseau, 2001). Hence, this will be examined for cross-border acquisitions in the tech industry through the first hypothesis.

Hypothesis 1: *Cross-border tech acquirers that pursue all-stock deals are more overvalued than cross-border tech acquirers that pursue all-cash deals.*

While Shleifer and Vishny (2003) propose that overvaluation serves as a motive for a firm to pursue a stock-financed acquisition, they do not investigate acquirer's overvaluation in comparison to the target. Fu et al. (2013) state that although the acquirer might be overvalued, if the target is equally- or more overvalued, this has to be accounted for. In fact, Savor and Lu (2009) provide evidence that targets in stock-financed acquisitions also tend to be overvalued, while targets in cash acquisitions appear to be fairly valued on average. To this point, Rhodes-Kropf & Viswanathan (2003) state that the initial rationale that high market-to-book (overvalued) buys low market-to-book (undervalued) is somewhat misguided; although high market-to-book firms buy lower market-to-book firms, these targets have above average valuation to begin with. This is a hint that mergers might occur when both firms are overvalued. Hence, through the second hypothesis, relative overvaluation compared to the target will be tested.

Hypothesis 2: *Cross-border tech acquirers that pursue stock deals are more overvalued than their targets*

2.2 Measuring performance of M&A activities

Despite numerous studies on the performance of mergers and acquisitions in finance literature (Netter, Stegemoller, and Wintoki, 2011), conclusions on how to measure performance of a takeover remain unclear. Much of the research has focused on the short-term shareholder wealth effects from the perspective of the target, bidder, or the combined firm (Kazemek & Grauman, 1989, Barber and Lyon, 1997). However, accurately measuring both short-run and long-run returns remains of utmost importance as short-term returns alone may not fully capture a deal's value creation effects due to factors such as cultural differences, stakeholder resistance, and market inefficiencies (Mitchell, Pulvino, and Stafford, 2004). Long-run performance can be measured in terms of stock returns or accounting measures, yet, both measures face challenges in isolating the takeover effect from other factors influencing the firm over the years following the transaction (Eckbo, 2011). Given the fundamental importance of measuring performance for this research, in this literature review section, the most widely

used methodologies for measuring performance will be evaluated. Specifically, methods for assessing long-term M&A performance will first be scrutinized in terms of shareholder value-creation, followed by a review of performance measurement techniques with respect to operating performance. Once the most appropriate approach for this research is determined, the focus will shift towards establishing well-defined parameters for identify and test M&A performance.

Research on the shareholder wealth effects of M&A typically employs the event study method. Renneboog and Vansteenkiste (2019) categorized event studies into two main groups: (i) studies that compare returns of event firms to a set of control firms matched by similar characteristics such as size, industry, or market-to-book ratio in cross-sectional models, and (ii) studies that use market-wide factor models such as the market model (MM), capital asset pricing model (CAPM), or Fama-French three/five-factor models (FF3/5), which may be augmented by momentum and liquidity factors, to obtain alpha coefficients from regressing event firm returns in time-series models (Fama, 1998). One commonly used approach for the initial group is the buy-and-hold abnormal returns (BHARs) method, this aggregates abnormal returns geometrically over the event period and allows for compounding (Barber and Lyon, 1997). This method was initially favored in early long-term event studies due to the belief that real investors hold assets for a specific time period. However, later studies indicate that BHARs are often insignificant once the biases in the methodology are corrected for (Kolari and Pynnönen, 2010). To account for these biases, researchers have adjusted the BHAR method and used different statistical techniques to estimate the abnormal returns, such as regression-based methods (Mitchell and Stafford, 2000). Alternatively, shareholder value creation can be measured through the cumulative abnormal returns (CARs) over a long event window, either prior to, at, or after the event. These studies have shown that the CAR approach is a more reliable measure of long-term abnormal returns, as it is less sensitive to the assumptions and biases of the BHAR method. In line with these establishments, in this research, the CAR method will be the preferred method to measure long-term abnormal returns more accurately. Through this event study, shareholder value creation will be investigated across deal types and valuation profiles. Building upon the existing body of knowledge that is available through prior research, our expectation foresees that M&A deals destroy value for acquirer shareholders rather than they create. For that reason, conceptually, the expectation of value destruction (i.e. negative CAAR) is followed and tested for in hypotheses three, four, and five.

Hypothesis 3: *Cross-border tech deals are value destructive in terms of shareholder value*

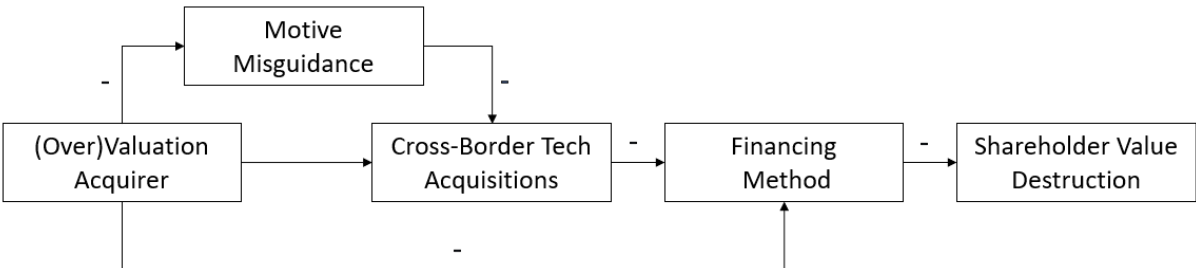
Hypothesis 4: *Cross-border tech deals that are stock-financed are more value destructive than cash deals*

Hypothesis 5: *Overvaluation among acquirers is the predominant factor to lead to value destruction in cross-border tech deals.*

According to Healy, Palepu, and Ruback (1992), examining stock market prices alone may not be sufficient to accurately capture real economic gains resulting from M&A transactions. As such, accounting-based performance measures such as return-on-assets (ROA), cash flows, sales, employee growth, or operating margins are considered more direct metrics of synergistic gains or losses (Fu, Lin, and Officer, 2013). However, studies based on long-term post-takeover operating performance using accounting data are subject to statistical properties and potential measurement errors (Fu, Lin, and Officer, 2013). Mergers often involve restatements, write-downs, special depreciation, or divestiture of acquired assets, resulting in challenges to isolate the effect of a merger event (Fu, Lin, and Officer, 2013). Furthermore, changes in accounting standards or operating performance measurements (e.g. operating earnings-based or cash-flow based measures) considerably affect the results (Ravenscraft and Scherer, 1989). In fact, M&A performance may show a decline based on earnings-based measures but an increase for cash-flow based measures (Ravenscraft and Scherer, 1989). For that reason, accounting-based performance is not within the scope of the remainder of this research.

After all, the purpose of this research is to build upon the controversiality around the performance of M&A deal making. Generally, academics find common ground in the bottom line statement that acquisitions destroy value rather than it creates. Yet, acquisitions still occur on frequent basis, proposing misalignment between industry participants and academic researchers. It is especially of key interest for the technology industry to facilitate enhancement of technological capabilities to be able to adapt to the rapidly evolving sector (for more information, refer to section 2.1.2.). This study aims to address this research gap and contribute valuable insights to both academic researchers and industry practitioners in the field of cross-border tech M&A. The theoretical framework depicting the scope of this research is presented in Figure 1 below. This framework identifies the factors that are expected to exhibit negative relationships and consequently impact shareholder value creation.

Figure 1: theoretical framework that the paper will follow and potential relationships that will be investigated



3 Data & Methodology

3.1 Data

Data is obtained from Factset and contains a sample of completed M&A deals between 2000 and 2019 to fully capture the performance in the technology industry after dotcom bubble up until covid. Not including years during covid allows for more reliable observations and generalizability. The selected deals match the following criteria: (i) both the acquirer and the target are active in the technology industry according to SIC industry index, (ii) the deal is either 100% stock-financed or 100% cash-financed, (iii) transaction value is bigger than 10 million USD to control for small caps, and lastly, (iv) the transaction is cross-border. The geographical representation is presented in [Table 1](#) below.

Table 1: Total sample is composed of 27 countries, table (1) provides an overview of locations that are represented most dominantly among acquirers or targets in this sample, based on transaction volume (m\$). Discrepancies between acquirers and targets within region's arise from the international focus of this research.

Top Region	Acquirers	Targets
<i>North-America</i>	108,106	193,823
<i>Europe</i>	148,515	115,610
<i>Asia</i>	80,269	7,436
<i>Middle East</i>	3,000	30,244
Top Countries		
<i>United-States</i>	91,777	175,358
<i>United-Kingdom</i>	14,923	63,224
<i>France</i>	55,395	7,211
<i>Japan</i>	50,373	2,043
<i>Canada</i>	16,328	18,465

With respect to the sample distribution of both financing methods, existing researchers observe different propensities. In a large research on financing method and domestic M&A by Fu et al. (2013), ranging from the 1980s to 2010, stock-financing formed the vast majority of the acquisitions (i.e., 67%). Alternatively, in a study by Dutta et al. (2012) on cross-border M&A and financing method, stock-financed deals only made up 10% of the sample. In line with this, in this sample distribution on cross-border M&A (presented in [Table 2](#)), stock-financed deals account for 18% of the sample, while the vast majority of the transactions related to cash-financed deals, i.e. 82%. Accordingly, the difference in the distribution of financing method across geographical scope are suggested to be a result of increased complexity in terms of legal issues and organizational shareholder challenges for cross-border transactions (Markides and Ittner, 1994).

Table 2: Total sample size amounts 410 deals. Specifically, 341 are 100% cash-financed and 69 are 100% stock-financed.

Years	Cash-financed	Stock-financed
2000	21	21
2001	13	9
2002	12	4
2003	8	6
2004	18	3
2005	20	3
2006	18	3
2007	32	2
2008	32	4
2009	11	1
2010	18	2
2011	17	-
2012	18	1
2013	12	-
2014	15	2
2015	21	1
2016	17	-
2017	18	3
2018	8	-
2019	12	4
Total	341	69
Distribution %	82%	18%

3.2 Methodology

This study employs a two-fold methodological approach to address the research question and hypotheses. Firstly, the fundamental method adopted in this study is based on Rhodes-Kropf, Robinson, and Viswanathan's (2005) model to quantify the extent of misvaluation. The authors of the model explicitly suggest decomposing a firm's log market-to-book equity ratio, denoted as $Ln\left(\frac{M}{B}\right)$. They state that by inserting a measure for fundamental fair value in the market-to-book ratio, it can be broken down into two components: a measure of market-to-fundamentals, $Ln\left(\frac{M}{V}\right)$, and a measure of fundamentals-to-book value, $Ln\left(\frac{V}{B}\right)$:

$$Ln\left(\frac{M}{B}\right) = Ln\left(\frac{M}{V}\right) + Ln\left(\frac{V}{B}\right) \quad (1)$$

Where M represents firm's market enterprise valuation and is measured through market capitalization, B represents its net book value, and V is a measure of fundamental fair enterprise value. Most importantly, Rhodes-Kropf et al. (2005) classify that in cases where market valuation deviates from true valuation, the natural logarithm of the ratio of "M" to "V" would be positive during periods of

overvaluation and negative during periods of undervaluation. However, they address that no perfect measure of V exists, so careful consideration of this parameter is of importance. Accordingly, the existing body of research follows two predominant intrinsic valuation techniques. Firstly, Lee, Myers, and Swaminathan (1999), Ang and Cheng (2006), and Dong, Hirshleifer, Richardson, and Teoh (2006) have employed a residual income model to estimate the intrinsic value of a firm. The principal model by Lee et al. (1999) proposed a two-stage approach for determining the intrinsic value of a firm. In the first stage, they explicitly forecasted earnings for the following three years. In the second stage, they implicitly forecasted earnings beyond the third year by gradually decreasing the return on equity from its period 1 to 3 value to the median industry return on equity for periods 1 to T using a "fade rate" to account for the gradual decline of abnormal return on equity over time. The terminal value for periods beyond T was estimated by considering the residual income for period T as a perpetuity, with the assumption that there would be no substantial growth in cash flows beyond period T that would significantly impact the value of the company. The respective equation is demonstrated below, with B_t being book value from most recent financial statement, r_e the cost of equity, $FROE$ mean analyst forecasted ROE, and TV the terminal value as a perpetuity:

$$V_t = B_t + \frac{(FROE_{t+1} - r_e)}{(1 + r_e)} B_t + \frac{(FROE_{t+2} - r_e)}{(1 + r_e)^2} B_{t+1} + TV \quad (2)$$

Various recent studies have examined the ability of the residual income model to explain expected returns and cross-sectional prices. Penman and Sougiannis (1997) utilized variations of the model by using forecasted earnings realizations as a proxy for future expectations. They discovered that the resulting value measure explains approximately 70 percent of the cross-sectional prices in the US. Frankel and Lee (1998) extended the model's application to international contexts and discovered similar results for cross-border valuations. These studies collectively suggest that the residual income model can be employed to generate intrinsic value estimates that are highly correlated with cross-sectional stock prices, both domestically and abroad. However, Fu et al. (2013) stress that this model is based on a set of strict assumptions, which could limit its applicability. Specifically, the utilization of analyst predictions to calculate residual income could introduce a predisposition towards large mergers and acquisitions transactions, which could potentially influence the results of the research.

Alternatively, Rhodes-Kropf et al. (2005) modify the residual income model by assuming that a firm's intrinsic value is a linear function of its book value of equity, net income and leverage:

$$\ln(V_{it}) = \alpha_{0it} + \alpha_{1it}\ln(B_{it}) + \alpha_{2it}\ln(|NI_{it}|) + \alpha_{4it}(LEV)_{it} + \varepsilon_{it} \quad (3)$$

where B_{it} is firm i 's book value of equity, $|NI_{it}|$ reflects firm i 's net income at time t (i.e. captures the growth of book value equity), LEV the leverage ratio, and the error term ε reflects the amount of

industry-year-specific mispricing (i.e. overvaluation / undervaluation). They stress that accounting for leverage allows for the fact that firms with higher or lower than industry-average leverage have different cost of capital resulting in differences in intrinsic valuation, testing for this in the model generated highly significant results. Rhodes-Kropf et al. (2005) suggests cross-sectional regression for each industry and year to estimate the parameters α_{it} through Fama and French (1997) industry classification, providing evidence of statistical significance of this model with an R-squared of over 80% among all industries. In this research, the method by Rhodes-Kropf et al. (2005) will be incorporated (equation 3), as it fits the purpose of the research best since it is less prone to assumptions. Since in this study the entire population is part of the same industry, the procedure will be simplified by solely applying the cross-sectionally regressing on the tech-industry. After the model parameters are determined and the firm intrinsic value can be retrieved by implementing the firm inputs, the market-to-fundamental ratio will be applied to measure misvaluation for both the acquirer and target firms, and specified based on the variable stock deal/cash deal.

The second methodological approach employed in this study aims to measure acquisition performance in terms of shareholder value creation. To achieve this, abnormal returns will be calculated using the cumulative abnormal returns (CAR) method. This method effectively measures M&A performance during the event window, which includes the anticipation period, the event date, and the adjustment period. With respect to the anticipation window, Schwert (1996) suggests that due to information leakage and market anticipation, stock prices of the merging firms could partially reflect the value implications of the merger in the two months prior to announcement. Selecting the appropriate length of the post-merger event window is a critical decision when estimating long-term returns. The event window must be long enough to capture the deal's relative over- or underperformance, while avoiding capturing confounding events, reducing the sample size, and biasing the results. To strike a balance, most empirical studies estimate a two-year post-merger event window, which will also be used in this research. It is crucial to acknowledge the trade-off between event window length and results comparability with other studies that use different event window lengths.

To do so, the daily excess returns for every company i and the benchmark m are computed using equation (4) and (5), respectively. By first retrieving the relative change of the stock price p on a given trading day t with the prior trading at $t - 1$, and, afterwards, subtracting the daily risk-free rate r_f (represented by the 3-month U.S. T-bill rate).

$$R_{i,t} = \frac{p_{i,t} - p_{i,t-1}}{p_{i,t-1}} - r_{f,t} \quad (4)$$

$$R_{m,t} = \frac{p_{m,t} - p_{m,t-1}}{p_{m,t-1}} - r_{f,t} \quad (5)$$

Equation (6) is next utilized to calculate the expected excess returns $R_{i,t}$, that regresses company i 's stock return and the return of the market portfolio (represented by the S&P 500 index), where alphas and betas are estimated based on the estimation period [-250, -11].

$$E(R_{i,t}) = \alpha - \beta_i R_{m,t} + \mu_t \quad (6)$$

To calculate the cumulative abnormal returns, we first compute the abnormal returns, which involves taking the difference between the actual returns and the expected returns, see equation (7). We then add up the abnormal returns within the event window to get the cumulative abnormal returns (8).

$$AR = R_{i,t} - E(R_{i,t}) \quad (7)$$

$$CAR_i = \sum_t^T AR_{i,t} \quad (8)$$

To determine the cumulative average abnormal return (CAAR), we sum up all the CARs and divide the result by the number of CARs, as shown in equation (9).

$$CAAR = \frac{1}{N} \sum CAR_i \quad (9)$$

Additionally, one can calculate the average abnormal returns by summing the abnormal returns and then multiplying the result by 1 over the number of observations, as demonstrated in equation (10).

$$AAR = \frac{1}{N} \sum AR_i \quad (10)$$

To answer hypothesis 3, 4 and 5: mean CAAR of different deal-types and valuation profiles will be compared, across a variety of event windows.

4 Results and Interpretation

4.1 Misvaluation and financing method

A crucial notion that is detrimental in this research is the concept of overvaluation. To detect instances of overvaluation, the before-mentioned decomposed misvaluation methodology by Rhodes-Kropf et al. (2005) is adopted. The obtained results from a regression analysis of the linear function described in equation (3) are presented in Table 3, using a supplementary dataset comprising comparable deals within the technology industry.

Table 3: this table presents the results of the regression equation (3) that employs firm i 's book value of equity, net income and leverage ratio at time t . The sample represents 3900 tech deals observed in the period 2000 – 2020. *, **, or *** indicates whether the result is significantly different from zero at the 10%, 5%, or 1% level, respectively.

Ln(V)	_cons	Ln(B)	Ln(NI)	Ln(LEV)
α_{it}	3.757***	0.333***	0.172***	0.001***

Consistent with the findings of Rhodes-Kropf et al. (2005) and Hertz and Li (2005), all the coefficients are positive and exhibit statistical significance at the 1% level. Consequently, they are reliable to estimate the unobservable intrinsic value for the primary sample under investigation. Therefore, they can be implemented in equation (3) so we get to the equation (3*) as expressed below:

$$\ln(V_{it}) = 3.757 + 0.333 * \ln(B_{it}) + 0.172 * \ln(|NI_{it}|) + + 0.001(LEV)_{it} \quad (3^*)$$

By substituting the actual financial figures of all the companies into the independent variables of this updated regression equation, a dependable estimate of intrinsic valuation is obtained. Table 4 presents the extent of misvaluation, expressed as market-to-fundamentals and fundamentals-to-book ratios, for both acquirers and targets across various financing methods.

Table 4: this table presents misvaluation where a value >1 indicates overvaluation, while <1 undervaluation. The statistical t-test is used to compare the mean misvaluation ratios of “Stock” deals with those of “Cash” deals, independently tested for both acquirers and targets. For “All” deal types, the mean misvaluation ratio of all acquirers is compared to that of all targets. *, **, or *** indicates whether the result is significantly different from zero at the 10%, 5%, or 1% level using a t-test, respectively.

Valuation metric	Acquirer			Target		
	All	Stock	Cash	All	Stock	Cash
Ln (M / V)	1.16***	1.07***	1.17***	1.85**	2.26**	1.78**
Ln (V / B)	1.04***	1.20***	1.00***	0.94**	1.00**	0.93**

The study conducted by Rhodes-Kropf et al. (2005) suggests that overvaluation serves as a key motivator for acquirers pursuing stock-financed deals. Consequently, we expect to observe values reflecting overvaluation, hence greater than 1. The results presented in Table 4 align with this expectation, as acquirers in both stock deals and cash deals demonstrate significant overvaluation according to the valuation ratios examined. Specifically, the mean fundamental-to-book valuation ratio for stock deals is 1.20, while the mean for cash deals it is 1.00. Similarly, the mean market-to-fundamentals valuation ratios are 1.07 for stock deals and 1.17 for cash deals. From these figures we can conclude that acquirers across both deal types are on average overvalued, with all results being statistically different from zero at the 1% level. Hence, it suggests that overvaluation plays a role in motivating M&A deals, particularly within the technology industry. However, when comparing the mean misvaluation of acquirers in stock deals to cash deals, the relative valuation metrics convey contradictory information across both valuation metrics. In terms of fundamentals-to-book ratios, acquirers in stock deals reach a higher level of overvaluation compared to those cash deals (1.20 versus 1.00). On the contrary, market-to-fundamentals valuation paints a different picture, indicating that acquirers in stock deals actually demonstrate a lower level of overvaluation compared to acquirers in cash deals (1.07 versus 1.17). As a guidance of interpretation, the conceptual framework proposed by Rhodes-Kropf et al. (2005) emphasizes the market-to-fundamentals metric as the primary indicator of market mispricing and overvaluation. Applying this framework, the results indicate that although acquirers involved in stock deals are indeed overvalued, acquirers in cash deals are subject to an even higher degree of overvaluation. This finding contradicts the existing literature, which suggests that stock deals are more susceptible to overvaluation. In other words, the results suggest that the level of overvaluation among acquirers in cash deals surpasses that of acquirers in stock deals.

Previous studies conducted by Shleifer and Vishny (2003) and Rhodes-Kropf et al. (2005) have established a dominant pattern of relative overvaluation among acquirers compared to their targets. They argue that this overvaluation, particularly in case of stock deals, serves as a misguidance of motivation that ultimately results in value destruction for shareholders. Respecting these valuable findings, the results of Table 4 provide a different perspective to be applicable to the tech industry. In terms of relative misvaluation, results indicate that while acquirers were indeed overvalued, their targets exhibited significantly higher levels of overvaluation under both deal types (i.e., 1.85 versus 1.16 for all deals; 2.26 versus 1.07 for stock deals; 1.78 versus 1.17 for cash deals). These differences in mean misvaluation were found to be statistically significant at the 5% level. Moreover, among the targets, stock deals demonstrated even greater levels of overvaluation compared to cash deals (2.26 versus 1.78). Based on these findings, it is proposed that overvaluation among acquirers may not be the primary determinant leading to value destruction in M&A deals. Alternatively, the role of overvaluation among targets might serve as the root cause and requires further investigation. This hypothesis will be thoroughly investigated in the subsequent section through an event study examining the creation of shareholder value.

4.2 Event study on shareholder value creation

In the event study analysis, no statistical evidence was found for cumulative average abnormal returns (CAARs) in the anticipation window for all deal types. Therefore, these results were excluded from further analysis. Table 5 presents cumulative average abnormal returns in the adjustment window under different time-horizons and deal types. Overall, the findings reveal that cross-border M&A transactions within the tech industry, across all-deals, are value destructive both in the short term and long term and differences among deal types and valuation profiles exist.

Table 5: this table presents short and long term stock returns to determine shareholder value creation. The sample is identical to the one before, for these 410 firms stock returns, market returns and risk-free rates are collected for the estimation window[-300,0]. For further elaboration on calculation methodology of the CAAR please view section 3.2 equation (4) to (10). *, **, or *** indicates whether the result is significantly different from zero at the 10%, 5%, or 1% level using a t-test, respectively.

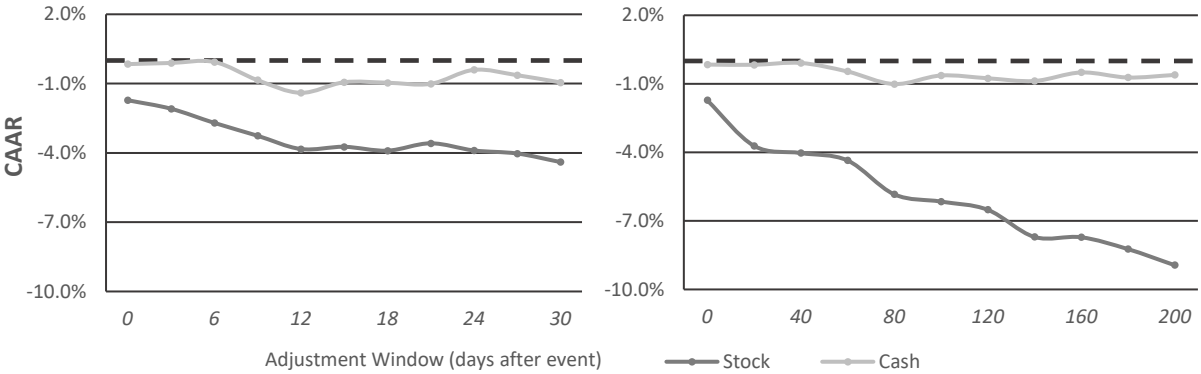
Short-term CAAR (%)	All-deals	Stock-deal			Cash-deal		
		All	Bidder OV	Target OV	All	Bidder OV	Target OV
[0, 10]	-0.93	-3.24	-2.84	-1.24	-0.32	-0.87*	-0.95
[0, 30]	-2.25***	-5.46	-2.69	-4.06	-1.40**	-1.21*	-2.48***
[0, 60]	-1.95**	-5.73	-3.20	-4.45	-0.95	-0.99	-2.27***
Long-term							
CAAR (%)							
[0, 100]	-1.57**	-6.89***	-6.41**	-5.99*	-0.17	-0.58	-0.79
[0, 200]	-2.07**	-8.90**	-6.29*	-10.80**	-0.26	-0.56	-1.09
[0, 300]	-2.37*	-11.00*	-5.72	-13.11	-0.09	-0.20	-1.30*

When not controlling for deal types and valuation profiles, the results indicate significant value destruction in cross-border M&A transactions within the tech industry. After 30 trading days, the cumulative average abnormal return was -2.25%, which was statistically significant at the 1% level. Similarly, after 60 trading days, the average abnormal return amounted to -1.95%, achieving statistical significance at the 5% level. These findings indicate a pronounced negative impact on shareholder value shortly following the completion of the M&A deals. Examining the long-term effects, our results demonstrate a persistent trend of value destruction. After 100 days, the average abnormal return was -1.57%, significantly different from zero at the 5% level. Subsequently, after 200 days, the average abnormal return stood at -2.07%, remaining significant at the 5% level. Finally, after 300 days, the average abnormal return reached -2.37%, signifying statistical significance at the 10% level. These outcomes indicate an enduring negative impact on shareholder value over an extended period following the completion of cross-border M&A transactions in the tech industry. As a next step, a set of control

variables is incorporated to address factors that are suggested to fulfill driving role in shareholder value destruction.

To gain deeper insights into the drivers of this value destruction, a breakdown analysis of the cumulative average abnormal returns is conducted for stock deals and cash deals. Prior research suggests that stock deals may be the primary driver of value destruction (Chang, 1998; Kohers and Ang, 2000). The results of this study support this claim, both in the long and short run, shareholders of stock-deals are exposed to a significantly greater amount of value destruction than cash deals. Figure 2 and 3 provide a graphical representation of the development of CAARs over time for both stock deals and cash deals, allowing for a clearer understanding of the factors contributing to the observed value destruction. Time window and scale is fixed among all figures in the remaining of the research with; (i) 30 days reflects short term and (ii) 200 days reflects long term. These windows are used for its statistical significance across a wide range of results and, moreover, allows for universal interpretation and resonation with the purpose of this research.

Figure 2 & 3: the below-presented figures (2) and (3) illustrate the 10 day moving average of the cumulative average abnormal returns of all stock and cash deals. The left figure (2) presents short term shareholder value creation and the right figure (3) presents long term shareholder value creation.

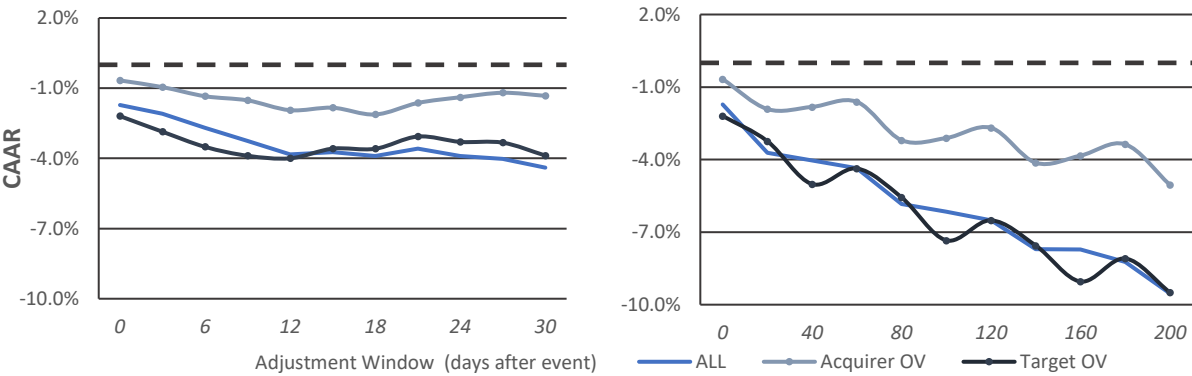


In the short term, results between stock-deals and cash-deals contradict in terms of their impact on shareholder value. Stock-deals exhibit clear negative effects, with average abnormal returns of -5.46% after 30 trading days and -5.73% after 60 trading days. However, it is important to consider that these results do not reach statistical significance. On the other hand, cash-deals show slightly negative effects, with average abnormal returns of -1.40% after 30 trading days and -0.95% after 60 trading days. The former result is significant at the 5% level. Examining the short-term development of cumulative average abnormal returns over time in Figure 2, a consistent trend emerges, demonstrating that stock-deals consistently underperform in terms of value creation compared to cash-deals. Turning to the long-term horizon, a continued convergence of CAARs can be observed over time across both financing methods, as illustrated in Figure 3. In the case of stock-deals, all long term CAARs are statistically different from zero, with significance levels at 1%, 5%, and 10%. Respectively, the values range from -6.89% after 100 days, -8.90% after 200 days, to -11.00% after 300 days. However, for cash-deals, none

of the long-term results are statistically different from zero. While cautious interpretation is warranted due to the lack of statistical significance with respect to cash deals, a visual analysis of the long-term CAAR development in [Figure 2](#) unmistakably highlights the substantial underperformance of stock-deals. Therefore, we fail to reject the (third) hypothesis that shareholder value destruction is more pronounced in stock-deals than in cash deals. The evidence suggests that both financing methods contribute to value destruction, with stock-deals exhibiting a significantly worse performance in terms of value creation.

Given that the cross border M&A tech deals in this sample are value destructive, and stock deals (in line with the literature) significantly underperform cash deals, it is of interest to identify key drivers of this phenomena within each deal-financing group. To this point, the existing literature emphasizes the consideration of overvaluation among either acquirers or targets. Specifically, academic research suggests that overvaluation of the acquirer is a primary driver behind motive misguidance in M&A transactions and, subsequently, leading to destruction of shareholder value (Fu et al., [2013](#); Shleifer and Vishny, [2003](#)). To test this claim, the CAARs of deals with overvalued acquirers or overvalued targets are (individually) evaluated in comparison to those of all firms within the same deal type (e.g. stock in this case). It is important to exercise caution in the interpretation of these results, as both subgroups are also included in the "ALL" deals group. The "ALL" deals category does not exclude deals with overvalued acquirers or overvalued targets. Conceptually, the valuation profile that drags down shareholder value creation of all deals what is sought to identify in this section. Visually, this causal relationship can be observed in [Figures 4 and 5](#) below.

Figure 4 & 5: the below-presented figures (4) and (5) illustrate the cumulative average abnormal returns of all stock deals and aims to identify the effect of overvaluation to negative CAAR. Figure (4) on the left hand side presents short term shareholder value destruction and figure (5) on the right presents long term shareholder value destruction.

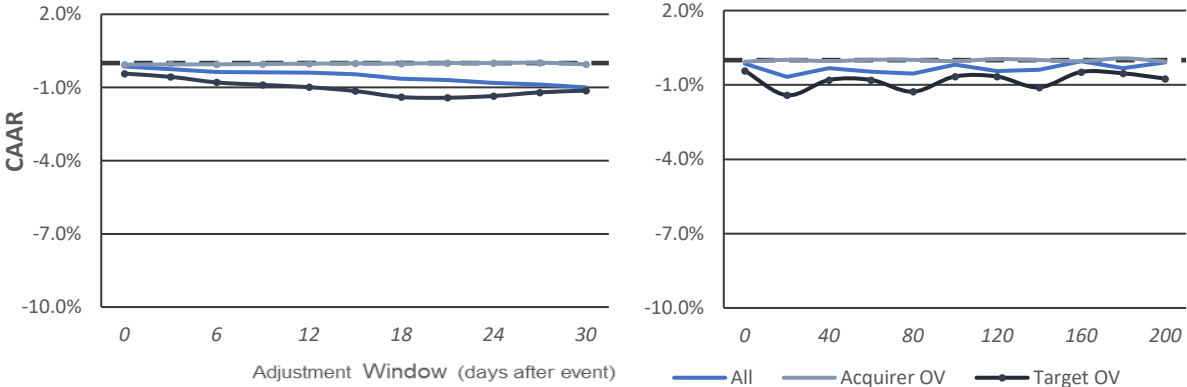


By examining the line that is closest to the ocean blue line that represents all deals, one can observe the valuation profile that drags down average shareholder value creation across all deals. This graphical visualization should be used as complementary material alongside the results of prior [Table 5](#) to form a reliable narrative. The overall findings indicate that, both in the short and long term, overvaluation among targets plays a more prominent role in driving value destruction in stock deals

compared to overvaluation among acquirers. However, it is important to consider the generalizability of these results through its statistical significance. In the short term, none of the results are statistically significant across any time horizon. In contrast, the long-term returns exhibit high statistical significance, and the regression CAARs presented in Table 5 support the observations depicted in Figure 5. Specifically, after 200 days, the CAAR for all deals is -8.90%, for Acquirers OV deals is -6.29%, and for Target OV deals is -10.89%. These results are statistically significant at the 5%, 10%, and 5% levels, respectively. These findings suggest that, in the long run, it is not acquirer overvaluation but rather target overvaluation that is the primary driver of value destruction in stock deals. This is not in line with prior research published by Shleifer and Vishny (2003) and Rhodes-Kropf et al. (2005), who stressed that acquirers are more overvalued than their targets and this leads to inappropriate motives and ultimately value destruction. This research shows, however, that (i) targets are on average more overvalued than their acquirers and (ii) target overvaluation is to a high extent related with value destruction for shareholders.

Finally, Figure 6 and 7 below present identical analyses with respect to cash deals. From the visual presentation a different narrative can be observed of a less rigorous order of magnitude. This is in line with the existing research on international M&A. Although the negative CAARs are significantly less prevalent than in stock deals, one can observe that in both time horizons target overvaluation is the primary valuation profile to drag down the CAARs among all deals.

Figure 5 & 6: the below-presented figures (5) and (6) illustrate the CAAR of all cash deals. Figure (5) on the left hand side presents short term shareholder value destruction and figure (6) on the right presents long term shareholder value destruction.



The above-presented Figures 5 and 6 standalone are not sufficient for interpretation purposes, one should take into account the statistical significance of these results in Table 5. Here, it becomes clear that one can more confidently extract generalized conclusions from the short time horizon, in comparison with long term results. In the short term, cash deals that include targets that are prone to overvaluation are significantly more value destructive than overall cash deals; -1.40% for all deals, while -2.48% in case target is overvalued, being statistically different than zero at the 5% and 1% level respectively. When

comparing the effect of overvaluation among targets to those of acquirers, one can observe that also in cash deals, target overvaluation is more prevalent factor to lead to shareholder value destruction (-2.48% versus -1.21%). In the long term, although a similar effect can be observed, one should be cautious to generalize and take conclusions from this since statistical significance is not widely apparent.

5 Discussion and Conclusion

5.1 Discussion

The results of this research paper are relevant for academic researchers, practitioners in the field of international tech M&A, and shareholders of tech companies that consider international acquisition(s). For all groups, its relevance can be attributed to careful evaluation of respected economic theories in the field of cross-border M&A. Additionally, the study is subject to a recent dataset, focus technology sector in specific, and extension of scope of research. On the one hand, the results of this research validate part of the existing body of knowledge. It confirms that (i) cross-border tech acquisitions generally destroy value rather than creating value, (ii) stock deals perform significantly worse than cash deals, (iii) overvaluation plays a significant role in shareholder value destruction. This provides useful insights for all three groups. For academics, the validation of the applicability of historical theories to more recent cross-border tech acquisitions is valuable, given the industry's volatile market conditions. This provides a foundation for further research in this area. To the benefit of M&A practitioners in the tech industry, this research provides another warning sign that on average acquisitions destroy value rather than they create. Especially, firms that consider using stocks as a currency to acquire another company should be careful in pursuing acquisitions, since these companies are most likely to do significantly worse in terms of shareholder value creation. Subsequently, the respective shareholders of such companies should be alert and ask questions about the motives behind an acquisition in order to prevent biased decision-making, resulting in value destruction.

In addition to validating existing knowledge, this research offers an alternative perspective on the impact of overvaluation in acquisition performance for shareholders. Contrary to the prevailing belief that acquirer overvaluation is the primary driver of value destruction, the findings suggest that target overvaluation has a more pronounced negative effect across all deal types and time horizons. Notably, targets are found to be significantly more overvalued than their acquirers, amplifying the potential for value destruction. These results emphasize the importance for M&A practitioners to exercise caution in the valuation process of target companies and carefully assess the possibility of overpaying. Specifically, in stock-deals where shares are used as currency, overpaying for a target that is relatively more overvalued than the acquirer can result in immediate value erosion for existing shareholders of the acquiring firm. In summary, this research reveals that (i) firms engaged in M&A deals in the tech industry are generally overvalued, but (ii) targets tend to be more overvalued than their acquirers on average, and (iii) target overvaluation is strongly associated with value destruction for shareholders. Furthermore, this effect is compounded by the standard acquisition premium paid to the target's shareholders.

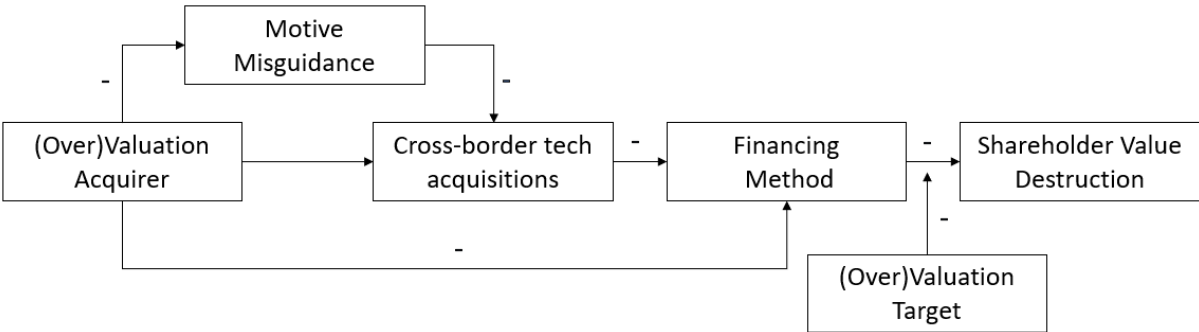
However, caution should be exercised in generalizing long-term trends due to external factors that may influence results. It is important to acknowledge the limitations of this study, stemming from the complexities inherent in cross-border M&A transactions. The lack of uniformity among deals and

the multitude of factors influencing acquisition intentions and performance pose challenges. Additionally, while overvaluation is identified as a potential motive for cross-border tech acquisitions and a driver of value destruction, the study recognizes that acquisition motives are not openly observable. There may be other undisclosed motives at play, warranting further research to explore the effect of (over)valuation on international tech deal-making behaviour and shareholder value destruction while controlling for other acquisition motives. Another limitation relates to the limited sample size of stock deals in the tech industry, as they have become less attractive in recent times. Future studies could benefit from larger sample sizes to enhance the robustness of findings. Finally, the impact of top tech giants should be acknowledged. These firms are serial-acquirers with strong integration capabilities, solid stock performance and tremendous cash generation leading them to pursue mostly cash deals. This multitude of characteristics and their dominant appearance in cash deals might explain why cash deals perform better in this research. Conducting similar research while excluding top five tech giants from the sample would be suggested for future research, to evaluate whether including these big tech firms might lead to biases in the results.

5.2 Conclusion

Contributing to the ongoing debate on the acquisition performance and value creation, this research provides valuable insights for the tech industry. The findings cast substantial doubt in the ability of firms to effectively leverage synergies through acquired technology and knowledge. Empirical evidence of this research clearly indicates that acquisitions, regardless of the method employed, tend to be value destructive. While overvaluation among acquirers can lead to motive misguidance and negatively impact M&A performance (Shleifer and Vishny, 2003), the study highlights that target overvaluation is the more significant driver of value destruction, affecting all deal types across various time horizons. To illustrate these findings, Figure 7 presents a revised theoretical framework that extends the existing body of knowledge with the learnings from this research. Specifically, the proposed role of overvaluation of the target is added.

Figure 7: Revised theoretical framework that includes finding of this study



Ultimately, this research sheds light on the controversial evolution of shareholder value over time in relation to the deal-financing method. While both stock and cash deals exhibit value destruction in the short term, there are notable differences in their long-term trends. Stock deals demonstrate a continued decline in value destruction, while cash deals experience a slowing negative trend and even generate positive returns development to approach neutral territory. It would be valuable for future research to explore CAARs for both deal types in an extended long-term time frame to determine if stock deals continue their downward trend and if cash deals eventually transition into positive CAARs.

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