# The role of technology, ownership and origin in M&A performance

by

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## Abstract

The massive value destruction for the acquiring firm shareholders found in recent studies on M&A performance puts a big question mark over M&A as a corporate growth strategy. However, not all M&A destroy value, which makes identification of the deal and firm characteristics that affect value creation and destruction in M&A a major issue in corporate strategy. This dissertation focuses on three such characteristics: (1) type of M&A (technological or non-technological), (2) ownership (private equity or industrial acquirer), and (3) the origin of the focal firms (cross-border M&A or domestic M&A). Particularly, I suggest that technology commercialization and leveraging of the innovation capabilities of the acquiring firm are two sources of value creation that are only available in technological M&A and have different value to different acquirers, which results in higher potential for value creation in technological M&A relative to non-technological ones. Further, I argue that industrial acquirers are better positioned to create value in technological M&A than private equity firms due to the availability of complementary production, marketing and distribution assets necessary for profitable technology commercialization. At the same time, strong managerial incentives and restructuring undertaken by private equity firms fits better non-technological targets. Finally, I suggest that acquirers gain more in technological cross-border M&A than in non-technological cross-border M&A and in technological domestic M&A because of the higher potential to gain from internally exploiting the technology assets of the target firm in a foreign setting, access to a larger and more diverse pool of technology assets and local knowledge spillovers. The obtained results support the arguments and are robust to alternative explanations.

## Acknowledgements

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This dissertation is written as a monograph, but with an intention to be developed into three independent empirical articles in the future. This ambition is reflected in the structure of the dissertation and leads some repetitions on the role of technology, which is a uniting theme. I apologize to the readers for that inconvenience, but it is the result of the iterative process of making tradeoff decisions and I believe that it reinforces the major arguments and allows keeping the holistic picture in mind when reading this work.

# Introduction

Over the last decade we have witnessed a merger wave reaching its peak in 2007 at the announced M&A volume of US$ 4.5 trillion worldwide. This surge was followed by a collapse in 2008-2009, and a restored growth in 2009-2012 with the worldwide M&A volume reaching US$ 2.6 trillion in 2012 (Primack, 2013). This amount of investment in M&A is difficult to reconcile with the empirical finding that the acquiring firm shareholders lost on average 12 cents per dollar invested in M&A in 1998-2001 (Moeller, Schlingemann, & Stulz, 2005).

One answer can be that not all M&A destroy value. Consistent with this line of reasoning, a substantial body of literature has focused on different acquirer, target and deal characteristics to explain the variance in M&A performance (for an extensive review see Zollo & Meier, 2008). The three most commonly used explanatory variables are relatedness (Chatterjee, 1986; Lubatkin, 1987; Singh & Montgomery, 1987; Gretland, 1991; Anand & Singh, 1997), experience (Lubatkin, 1983; Fowler & Schmidt, 1989; Bruton, Oviatt & White, 1994; Hayward, 2002; Kim & Finkelstein, 2009), and the method of payment (Travlos, 1987; Andrade, Mitchell & Stafford, 2001; Heron & Lie, 2002; Savor & Lu, 2009) . However, a meta-analysis done by King and colleagues (2004) has shown that none of these variables are significantly related to M&A performance on average.

Another stream of literature focuses on the specific sources of gains in M&A and conditions under which firms can actually benefit from them. Anand and Singh (1997) argue, for instance, that generally scarce opportunities to achieve economies of scale through M&A become substantial in declining industries. Seth and colleagues (2002) show that acquirers gain predominantly from the reverse internalization of the acquired intangible assets in cross-border M&A. Sapienza (2002) reports the evidence of gains from the increased market power in M&A involving banks with substantial local market share, while studies with samples encompassing different industries do not find significant gains to the acquiring firm from the increased market power (Eckbo, 1983; Fee & Thomas, 2004).

In this dissertation I follow the latter approach by distinguishing technological M&A as a type of M&A with two mechanisms for value creation that (1) are unavailable in non-technological M&A and (2) allow avoiding symmetrically competitive bidding process. These mechanisms are leveraging the innovation capabilities of the acquiring firm (Ranft & Lord, 2002; Graebner, 2004; Puranam & Srikanth, 2007; Makri et al., 2010) and commercializing the target's technology (Chaudhuri & Tabrizi, 1999; Puranam, Singh & Zollo, 2006). They are unavailable in non-technological M&A because such transactions do not provide technology inputs for the acquiring firm (Ahuja & Katila, 2001) and they allow avoiding the symmetrically competitive bidding because their value to different acquirers depends on the degree of asset complementarity.

Following this reasoning, I attempt to answer the question to what extent the type of M&A (technological or non-technological) explains the variance in the M&A performance of

the acquiring firm. Doing this, I contribute not only to the broad literature on M&A performance discussed above but also to the growing body of literature on technological M&A (Ahuja & Katila, 2001; Ranft & Lord, 2002; Graebner, 2004; Cassiman et al., 2005; Kapoor & Lim, 2007; etc.). The latter has traditionally viewed technological M&A as an R&D strategy and focused on their innovation outcomes. By contrast, this study focuses on the shareholder value creation and contrasts performance outcomes of technological and non-technological M&A as transactions with fundamentally different mechanisms for value creation.

Next, I consider the role of ownership in M&A performance. Prior literature considers the impact of the public or private ownership of the acquiring and target firms on M&A performance from the perspective of the associated agency costs (Chang, 1998; Fuller et al., 2002; Bargeron et al., 2008; Goranova et al., 2010). In this dissertation, I focus on the relative parenting advantages (Campbell et al., 1995) of different types of acquirers instead, i.e. I try to find out what kind of acquirers have better opportunities to create value in M&A in general and in technological vs. non-technological M&A in particular. Doing this, I consider two kinds of acquirers: private equity firms and industrial companies. Earlier literature in finance argues that private equity firms have lower agency problems and are less likely to engage in value-destroying M&A (Jensen, 1986) and finds substantial returns to private equity firms (for a review see Cumming et al., 2007). I suggest a boundary condition for this agency costs argument. Particularly, I argue that industrial companies are superior acquirers in technological M&A. One reason is that profitable commercialization of the technology developed by the target firm requires complementary production, marketing, and distribution assets (Teece, 1986; Reve, 1990), which private equity firms have less access to. Another reason is that high leverage used by private equity firms has a negative impact on innovation, a key value driver in technological M&A (Long & Ravenscraft, 1993).

Finally, I consider the impact of the origin of the acquiring and target firms (cross-border M&A or domestic M&A) on M&A performance. Doing this, I draw on three streams of international business literature. The first stream argues that market imperfections between countries allow foreign acquirers to extract rents by internally exploiting valuable firm-specific assets of the acquiring firm (Hennart, 1982; Harris & Ravenscraft, 1991; Markides & Ittner, 1994; Teece, 2000) or the target firm (Seth et al., 2002) in a foreign setting. The second stream argues that the opportunities for such internal exploitation of firm-specific assets are limited due to the institutional differences (Kogut & Singh, 1988; Jandik & Kali, 2009; Dikova et al., 2010) and the geographical distance (Kang & Kim, 2010) between locations. The third stream of literature argues that institutional differences can be a source of competitive advantage for a foreign acquirer (Morosini et al., 1998; Schneider et al., 2010). This dissertation contributes to this literature in two ways. First, it tests the alternative arguments empirically by contrasting M&A performance of US acquirers in cross-border and domestic M&A. Second, it attempts to identify the boundary conditions for the above arguments. Particularly, I argue that acquirers gain more in cross-border technological M&A than acquirers in cross-border non-technological M&A and domestic technological M&A. The reasons are advantages of internal exploitation of intangible technology assets (Hennart, 1982), access to more diverse repertoires related to new product development (Morosini et al.,

1998), and opportunities to benefit form the local knowledge spillovers (Schneider et al, 2010; Reve, 2011).

The core of this dissertation are three self-contained empirical parts (Sections 3, 4, and 5). In Section 3, I focus on the role of technology in M&A performance, develop and test the hypotheses on the impact of the type of M&A (technological or non-technological) on the performance of the acquiring firm, present the empirical findings, discuss their implications for research and practice, limitations and areas for future research. Section 4 is devoted to the role of ownership (industrial acquirers or private equity firms) in M&A performance in general and when taking into account the type of M&A (technological or non-technological) in particular. In Section 5, I address the impact of origin (cross-border or domestic M&A) and the interactions between the origin and the type of M&A on the performance of the acquiring firm. The structure of analysis in Sections 4 and 5 are similar to that in Section 3. In the next part (Section 2), I establish the common theoretical background for the following empirical analyses by discussing the generic sources of value creation and value destruction in M&A and presenting the conceptual model. Section 6 concludes the dissertation.

# 1. Theoretical background and conceptual model

## 1.1. How can the acquiring firms create value for their shareholders in M&A?

The managers of acquiring firms create value in M&A if the associated synergy effects are greater than the premium paid for the target firm. Thus, identification of potential synergies and the extent to which acquirers can actually benefit from them is the first step of this analysis. Prior literature considers three major groups of synergies that the acquiring firm may achieve: (1) improved productive efficiency (Palich, Cardinal, & Miller, 2000; Seth, 1990; Shleifer & Vishny, 1991; Singh & Montgomery, 1987), (2) increased market power (Eckbo, 1983; Shahrur, 2005; Stigler, 1964) and (3) purely financial synergies (Amit & Livnat, 1988; Shleifer & Vishny, 2003; Williamson, 1975). We discuss these in detail below.

*Productive efficiency*

The acquiring firm can create value in M&A by improving its productive efficiency. Prior literature identifies two major mechanisms behind such improvements: (1) economies of scale (Eckbo, 1983; Eckbo & Wier, 1985; Fee & Thomas, 2004; Shleifer & Vishny, 1991) and (2) economies of scope (Barney, 2011; Penrose, 1959; Porter, 1998; Teece, 1982; Williamson, 1979). Achieving a more efficient scale of operations allows the firm to reduce its average costs of production, R&D, marketing, distribution, etc. Economies of scope arise due to the opportunity to share indivisible resources, firm specific assets and activities across a larger number of projects.

However, the opportunities to create and capture value in M&A by realizing economies of scale and economies of scope are limited. Particularly, strategic management literature suggests that scale economies are generally scarce (Anand & Singh, 1997), difficult to realize because of the integration problems (Seth, 1990), and disappear quickly as the environment changes (Capron, Dussauge, & Mitchell, 1998). If present, the economies of scale should result in improved premerger- and industry-adjusted operating performance of the acquiring firm. Many studies report no significant changes in the operating performance of the acquiring firm (Ghosh, 2001; Maksimovic & Phillips, 2001; Ravenscraft & Scherer, 1987). Other do find significant operating improvements (Fee & Thomas, 2004; Healy, Palepu, & Ruback, 1992; Heron & Lie, 2002). But Fee and Thomas (2004) show that the value created by the productivity gains is captured almost entirely by the target firm's shareholders as a result of the bargaining and bidding. Thus, the available empirical evidence does not allow us to conclude that acquirers generally benefit significantly from the economies of scale.

Potential economies of scope exist only in related M&A (Christensen, Berg, & Salter, 1976; Kim & Finkelstein, 2009; Porter, 1980; Rumelt, 1974, 1979; Williamson, 1985). Depending on the theoretical perspective, related M&A can be defined in several ways. From the resource-based view, M&A are related if the acquiring and target firms possess similar or complementary resources (Kim & Finkelstein, 2009). However, financial economics literature (Walker, 2000), transaction cost economics (Williamson, 1985), and activity perspective

(Porter, 1998) define relatedness based on the industry-level vertical and horizontal linkages between the acquiring and target firms. It is worth noting that the present analysis follows the latter approach. In addition to the potential economies of scope, related M&A are characterized by a better strategic fit between the two firms that leads to an asymmetrically competitive bidding and thus higher ability of the acquirer to capture the value potential of the deal (Christensen et al., 1976; Porter, 1980; Rumelt, 1974, 1979). However, if acquirers in related M&A actually gained from economies of scope, we would expect a significant positive relationship between relatedness and M&A performance other things being equal. While some researchers (Anand & Singh, 1997; Lubatkin, 1987; Singh & Montgomery, 1987; Walker, 2000) provide evidence supporting the positive relationship, others fail to do so (Chatterjee, 1986; Chatterjee, Lubatkin, Schweiger, & Weber, 1992; Matsusaka, 1993; Seth, 1990). The meta-analysis of King, Dalton, Daily, and Covin (2004) reveals no significant correlation of relatedness with abnormal announcement returns to the acquiring firm. These imply that "relatedness may be a necessary but not sufficient requirement for superior performance" (Zollo & Singh, 2004) or, in other words, the potential gains from the economies of scope are also limited. An implication is that it is possible to better explain the variance in the acquiring firm performance by identifying specific types of transactions where the acquiring firm is relatively better positioned to realize and capture economies of scale and scope.

*Market power*

A horizontal merger of two large companies can potentially create synergies through the increased market power of the combined firm (Eckbo, 1983; Eckbo & Wier, 1985; Fee & Thomas, 2004; Jensen & Ruback, 1983; Kim & Singal, 1993; Palich et al., 2000; Sapienza, 2002; Seth, 1990; Shahrur, 2005; Stigler, 1964). The increased market power allows the combined firm to coordinate the reduction in industry output and increase in the product prices to customers as well as to bargain more effectively with the suppliers to lower input prices (Fee & Thomas, 2004).

Though Kim and Singal (1993) report the increased fares by the merged airlines and Sapienza (2002) shows that target banks with substantial local market share do not decrease interest rates following the merger despite the possibility to do this due to the increased efficiency, generally empirical research has not found evidence of the increased market power following horizontal M&A (Eckbo, 1983; Eckbo & Wier, 1985; Fee & Thomas, 2004; Seth, 1990; Shahrur, 2005). These findings are not particularly surprising given the antitrust regulations that preclude horizontal deals resulting in significant reduction of the competition in the market. They indicate that the opportunities to gain in M&A from the increased market power is limited to the cases when it is challenging for regulators to precisely delineate the appropriate market boundaries and evaluate the consequences of the transaction for the competition accordingly.

*Financial benefits*

M&A can offer purely financial synergies in the form of efficient diversification, tax shields, and exploitation of the capital market relative mispricing.

Transaction cost economics (Williamson, 1975; Williamson, 1985) suggests that unrelated M&A may create benefits of internal capital markets as the central office can allocate resources more efficiently than the capital market due to information asymmetry (Shleifer & Vishny, 1991). However, Lang and Stulz (1994) show that diversified firms significantly underperform non-diversified ones in terms of Tobin's Q and Berger and Ofek (1995) report existence of significant diversification discount.

M&A can allow the acquiring firm to utilize tax shields created by the target's net operating loss carry forward, unused tax credits, increased leverage and higher depreciation expense (Amit & Livnat, 1988; Hayn, 1989; Jensen & Ruback, 1983). Hayn (1989), in fact, reports evidence that merger gains are related to the tax characteristics of the target firm.

Following Shleifer and Vishny (2003) and Rhodes-Kropf and Viswanathan (2004), Savor and Lu (2009) argue that rational managers may time a market to buy the relatively undervalued targets at the effective discount and thus create value for the acquirer's shareholders. They find that unsuccessful stock acquirers significantly underperform the successful ones, though both experience negative long-run returns.

This brief review of the sources of synergies in M&A leads to two important conclusions. First, the upside potential for the value-creation by the acquiring firms is on average limited. This is perfectly consistent with the non-significant average announcement returns to the acquiring firm shareholders (Jensen & Ruback, 1983; Moeller, Schlingemann, & Stulz, 2005). Second, some studies identify particular contexts where the acquiring firm is better positioned to benefit from the economies of scale (Anand & Singh, 1997), economies of scope (Kim & Finkelstein, 2009; Seth, Song, & Pettit, 2002), market power (Kim & Singal, 1993; Sapienza, 2002), tax shields (Hayn, 1989) and market timing (Savor & Lu, 2009). This calls for identifying types of M&A where acquirers have higher potential synergies. This work argues that technological M&A are one type of such high-potential deals. But, to remain systematic, we should first consider why many acquirers overpay in M&A and what other factors may negatively impact M&A performance.

### 1.2. Why do many M&A fail?

Prior literature explains overpayment in M&A and the associated value re-distribution from the acquiring to the target firm shareholders by either (1) the agency problems of free cash flows (Jensen, 1986) or (2) biased decision-making by the managers of acquiring firms (Jemison & Sitkin, 1986; Roll, 1986). In addition, negative abnormal stock performance of the acquiring firm is often attributed to (3) the stock price adjustment to the information about the inherent value of the acquiring firm conveyed by the chosen method of payment (Heron & Lie, 2002; Myers & Majluf, 1984; Travlos, 1987) and (4) merger arbitrage pressure (Mitchell, Pulvino, & Stafford, 2004). Finally, extensive literature in strategic management (Cording, Christmann, & King, 2008; Datta, 1991; Zollo & Singh, 2004) focuses on (5) the pitfalls of the post-merger integration and their detrimental impact on the M&A performance. Though it

is an important argument, post-merger integration process is outside the scope of the present analysis. Hence, the following review focuses on the first four mechanisms for value-destruction in M&A.

*Free cash flow hypothesis*

The managers of firms that generate cash in excess of its needs to support operations and have no positive-NPV investment opportunities have incentives to use these free cash flows for value-destroying M&A rather than to distribute them among the shareholders who then could invest them more productively. These incentives include empire building motives or risk reduction through the diversification of the earnings streams (Jensen, 1986).

Following the free cash flow hypothesis, Lang, Stulz, and Walkling (1991) argue that firms with Tobin's q lower than 1 are unlikely to have positive-NPV projects and thus should pay out the free cash flows to the shareholders instead of engaging in the wealth-destroying acquisitions. Consistently, they find significant negative returns to such bidders in tender offers with the magnitude of the effect increasing with the free cash flows generated by the bidder. Servaes (1991) reports similar findings for a sample of M&A consisting of both tender offers and M&A.

Leverage can reduce the propensity of managers to invest in value-destroying M&A as obligatory payments associated with debt effectively reduce the free cash flows under the managerial control, make the managerial investment decisions subject to the scrutiny of the capital markets where they have to raise the capital (Jensen, 1986, 1989; Maloney, McCormick, & Mitchell, 1993).

Alternatively, blockholders are better positioned and have higher incentives to monitor management than owners with insignificant stake and thus can reduce the agency problems in M&A. Bargeron, Schlingemann, Stulz, and Zutter (2008) find substantial differences in the target premiums paid by public companies (46.5%), private operating companies (40.9%) and private equity firms (28.5%). Bargeron et al. (2008) suggest that private bidders tend to pay less for the similar companies in similar deals because the are less reluctant to quit the negotiations and face less agency problems. Goranova, Dharwadkar, and Brandes (2010) consider overlapping ownership and argue that portfolio considerations of the institutional owners with stakes in both the acquirer and target firms lead to compromised monitoring and increase agency problems adversely affecting the acquirer's performance.

*Biased decision-making in M&A*

Prior literature argues that irrational M&A decisions by the management of the acquiring company can be a major reason for value-destruction in such deals. Particularly, the hubris hypothesis suggests that managers overestimate their ability to manage M&A (Roll, 1986). Rau and Vermaelen (1998) present evidence suggesting that the long-run underperformance of acquiring firms is driven by the poor performance of the "glamour" low book-to-market acquirers due to the over-extrapolation of the past performance on the ability to extract value of the focal acquisition contrasting with the more prudent deal assessment for

the firms with worse track records. However, Seth et al. (2002) report that managerial hubris does not have significant impact on acquirers' expected performance.

Alternatively, Jemison and Sitkin (1986) and Haspeslagh and Jemison (1991) argue that the inherent characteristics of the M&A process – activity segmentation, momentum escalation, expectational ambiguity – can lead to overbidding and thus destroy value in M&A. Two mechanisms that can mitigate the negative impact of these factors are learning-by-doing and learning-by-observing.

Based on the learning curve argument (Alchian, 1963; Arrow, 1962), a number of researchers (Bruton, Oviatt, & White, 1994; Fowler & Schmidt, 1989; Hoskisson, Hitt, Johnson, & Moesel, 1993; Lubatkin, 1983) propose that prior acquisition experience improves target selection and negotiation skills that positively impact acquiring firms' performance.

An alternative mechanism that enables acquirers to better execute the deal and integration process is learning-by-observing. Beckman and Haunschild (2002) suggest that firms learn in networks by sampling the experiences of their partners. Similarly, Delong and Deyoung (2007) find that as the number of acquisitions made in a particular industry increases, information generation and spillover occur, which results in better deal valuation and execution and, hence, performance.

However, empirical findings do not show on average significant positive correlation between M&A experience and the performance of acquiring firms (King et al., 2004). Moreover, experience can also have a detrimental impact on the combined firm performance depending on the deal similarity, time span and prior M&A performance (Haleblian & Finkelstein, 1999; Hayward, 2002; Kim & Finkelstein, 2009; McDonald, Westphal, & Graebner, 2008).

*Signalling effects and merger arbitrage pressure*

Stock-financed M&A combine essentially two transactions: stock issue and acquisition. The stock issue conveys a negative signal regarding the acquirer's value to the stock market (Myers & Majluf, 1984). Consistently, prior literature finds significantly negative announcement returns to the acquirer in stock-financed M&A (Andrade, Mitchell, & Stafford, 2001; Travlos, 1987; Walker, 2000). Several studies also report significant long-run underperformance of the stock-financed M&A (Agrawal, Jaffe, & Mandelker, 1992; Heron & Lie, 2002; Loughran & Vijh, 1997).

Chang (1998) finds the opposite results for stock-financed takeovers of privately owned targets. The owners of the latter face less information asymmetry and their acceptance of the bid sends a positive signal to the capital market. Consistently with the signalling and monitoring hypotheses, Fuller, Netter, and Stegemoller (2002) find a "hierarchy" of the bidders' announcement returns with the highest for the stock-financed acquisitions of privately-held firms or subsidiaries, the lowest for the stock-financed acquisitions of public targets and the intermediate for the cash-financed acquisitions.

However, Mitchell et al. (2004) show that about half of the negative abnormal announcement returns in stock-financed M&A is attributable to the merger arbitrage pressure on the acquirer's stock price. This can be another mechanism for value-destruction in M&A.

To summarize, managers can undertake M&A that are detrimental for their shareholders' value to get personal benefits or because they overestimate the potential of the deal (see Figure 1). In addition, the negative M&A performance of the acquiring firm can be the result of the capital market reaction as it attempts to gauge the acquirer's intrinsic value or to benefit from the merger arbitrage opportunity. These are important factors that we control for in this analysis.

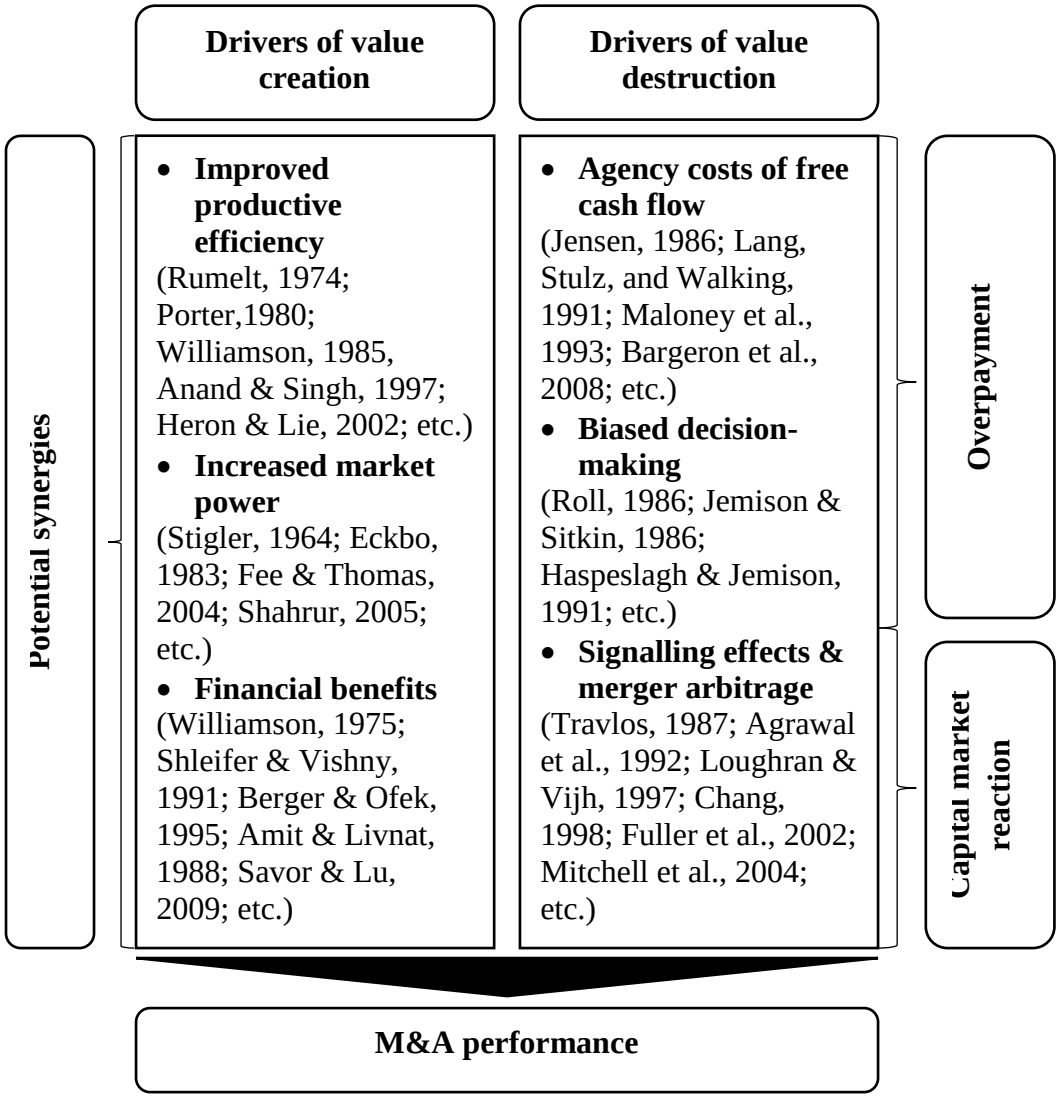


*Figure 1 A summary of M&A performance drivers discussed by prior literature*

### 1.3. Conceptual model

*Prior literature* on M&A performance discussed in previous section identifies major sources of gains and losses in such transactions. On the one hand, *potential synergies* in the

forms of improved productive efficiency, increased market power, and purely financial benefits have a positive impact on *M&A performance*. On the other hand, *overpayment* resultant from agency problems and biased decision-making as well as the negative *capital market reaction* driven by either the adjustment to the information conveyed by the chosen method of payment or the merger arbitrage pressure have a negative impact on *M&A performance* (see Figure 2).

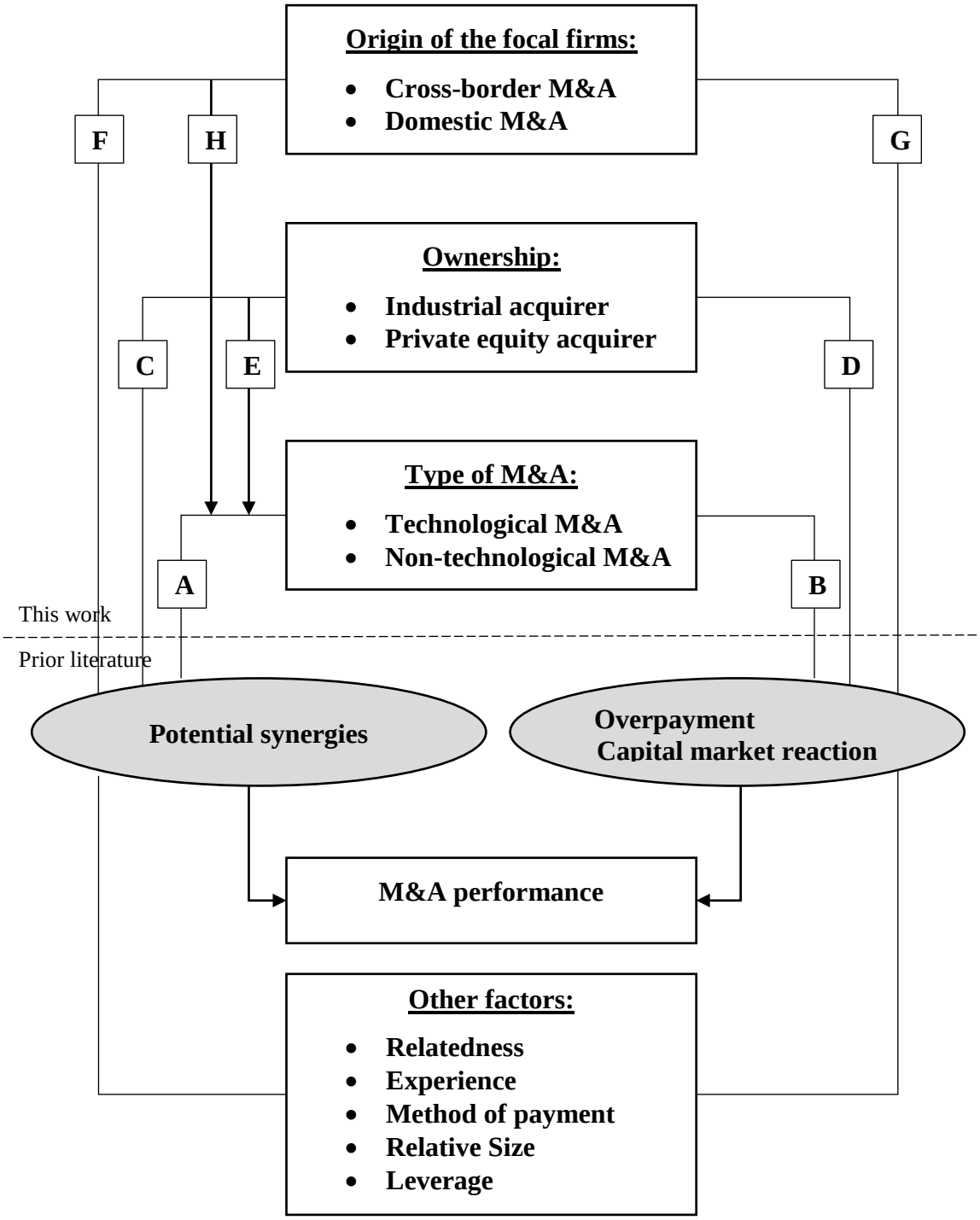


*Figure 2 Conceptual model*

*This work* builds on and extends the prior literature by considering the impact of the type of M&A (technological or non-technological), ownership (industrial acquirer or private equity acquirer) and the origin of the focal firms (cross-border M&A or domestic M&A) on M&A performance.

*Type of M&A* (technological or non-technological M&A) affects M&A performance in two ways (marked "A" and "B" on Figure 2) that I will discuss in detail in section 3 of this dissertation ("3.Technological vs. non-technological M&A"). At this point, I will present only the major reasoning for the relationships that is necessary to convey the logic behind the proposed conceptual model.

**Arrow A.** Following prior research (Ahuja & Katila, 2001), I define technological M&A as those where technology is a part of the acquired assets. Earlier studies (Dosi, 1982; Teece, 1986; Kapoor & Lim, 2007; Makri, Hitt, & Lane, 2010) identify three major groups of technology assets: (1) applied research embedded in products, (2) technology embodied in processes, and (3) the technical knowledge of inventors. These assets are developed through R&D projects with specific commercial objectives regarding either products or processes (Makri, Hitt, & Lane, 2010) and manifest often in patents (Ahuja & Katila, 2001; Kapoor & Lim, 2007, Puranam & Srikanth, 2007; Makri, Hitt, & Lane, 2010). Unpatented technology is sometimes revealed in the M&A rationale provided by the management team (Ahuja & Katila, 2001). The acquired technology assets can be used in three ways. First, the acquiring firm can combine them with its complementary technology assets and in this way leverage its innovation capabilities by achieving the economies of scale and scope in R&D (Ahuja & Katila, 2001; Ranft & Lord, 2002; Graebner, 2004; Puranam, Singh, & Zollo, 2006; Makri, Hitt, & Lane 2010). Second, the acquiring firm can achieve economies of scope by profitably commercializing the technology developed by the target firm through its combination with the complementary production, distribution, marketing and financial assets of the acquiring firm (Teece, 1986; Graebner, 2004; Puranam, Singh, & Zollo, 2006; Puranam & Srikanth, 2007). Moreover, if the acquiring firm decides to keep the target as a relatively autonomous R&D engine, such economies of scope can be realized on continuous basis. Third, the acquiring firm can simply run the competing acquired technology to the grave and thus increase its market power. Since non-technological M&A do not provide technology assets, the above mechanisms for value creation are not available in such transactions (Ahuja & Katila, 2001). By contrast, technological M&A can benefit from synergies available in non-technological transactions. Hence, the type of M&A is associated with potential synergies offered by the transaction and in this way affects M&A performance.

**Arrow B.** The potential to both leverage the innovation capabilities of the acquiring firms and add value by commercializing the target's technology depend, as it will be discussed in more detail in section 3, on the asset complementarity (Teece, 1986; Reve, 1990; Makri, Hitt & Lane, 2010). Since the degree of asset complementarity varies across the bidding firms, the bidding process in technological M&A is likely to be asymmetrically competitive, i.e. the value of the target's technology assets will vary for the different bidding firms. This reduces the likelihood of overpayment in such transactions and should result in their better performance.

*Ownership*. Unlike prior literature that considers whether the acquiring and target firm are private or public, this dissertation focuses on the distinction between industrial acquirers and private equity acquirers. They differ in terms of their strategic core (Reve, 1990; Gretland, 1991) and owner influence (Connelly et al., 2010), which results in different effects on M&A performance.

Reve (1990) defines the strategic core of a firm as the combination of specialized assets and incentives. The strategic core of private equity firms consists of specialized managerial competence and strong performance incentives given by a significant managerial equity stake and high financial leverage. By contrast, the strategic core of industrial acquirers can be characterized by specialized assets related to procurement, R&D, production, marketing and distribution.

**Arrow C.** These differences in the strategic core lead to different influence strategies available for industrial and private equity acquirers. Industrial acquirers can create value by realizing the synergies in the different parts of the value chain stemming from the combination of the two firms. By contrast, private equity firms can add value to the target firm through its restructuring and removing inefficiencies on the stand-alone basis (Connelly et al., 2010). The difference in the value creation potential of these two owner influence strategies should lead to different M&A performance.

**Arrow D.** Significant managerial equity stakes and high leverage are associated with a lower likelihood of overpayment by private equity acquirers relative to industrial ones and thus should lead to better M&A performance (Jensen, 1986).

**Arrow E.** Profitable technology development and commercialization requires complementary technological, production, marketing and distribution assets (Teece, 1986) that industrial acquirers possess. In addition, the short-term orientation and high leverage used by private equity firms are associated with reliance on financial controls, higher managerial risk-aversion and decreased R&D funding and thus have a negative impact on the innovation performance (Long & Ravenscraft, 1993). These factors can create parenting advantages for industrial acquirers in technological M&A, while strong performance incentives and restructuring undertaken by private equity firms may be a superior strategy for adding value to targets in non-technological M&A. These arguments are discussed in more detail and developed into hypotheses in section 4 of this dissertation.

*The origin of the focal firms* (cross-border M&A or domestic M&A) can impact M&A performance in three ways represented by relationships “6”, “7” and “8” on Figure 2.

**Arrow F**. Abundant literature in international business argues that market imperfections that exist between countries create relative advantages for foreign acquirers, which should positively affect M&A performance (Harris & Ravenscraft, 1991; Markides & Ittner, 1994; Seth, Song, & Petit, 2002; Conn et al., 2005).

**Arrow G.** Some authors (Jandik & Kali, 2009; Kang & Kim, 2010) argue that cultural distance between countries aggravates the adverse selection problem for foreign acquirers

relative to domestic ones. This may result in the higher likelihood of overbidding by foreign acquirers and thus negatively impact their M&A performance.

**Arrow H.** Other researchers suggest that cultural distance allows foreign acquirers to benefit from a more diverse pool of complementary capabilities, especially those related to new product development (Morosini, Shane, & Singh, 1998), and local knowledge spillovers (Reve, 2011). Such advantages are likely to be more valuable for technological M&A rather than non-technological ones. Hence, we can expect different M&A performance of foreign and domestic acquirers in technological and non-technological M&A. I focus on the impact of the origin of the focal firms on M&A performance and develop the arguments in section 5 of this dissertation.

In addition, prior literature identifies some *factors* ("other factors" in Figure 2) that are associated with *potential synergies*, *overpayment* and *capital market reaction* and thus affect *M&A performance*. These factors include relatedness, experience, method of payment, relative size and leverage. *Relatedness* is a prerequisite for the economies of scope associated with improved productive efficiency and thus it is predicted to have a positive impact on M&A performance (Lubatkin, 1987; Singh & Montgomery, 1987; Anand & Singh, 1997; Walker, 2000). *Experience* is argued to improve target selection, valuation and negotiation capabilities that are negatively related to the propensity to overpay and thus have a positive impact on M&A performance (Fowler & Schmidt, 1989; Bruton, Oviatt, & White, 1994; Haleblian & Finkelstein, 1999; Hayward, 2002; Kim & Finkelstein, 2009). The chosen *method of payment* may convey among other things the beliefs of the acquiring firm's managers on its intrinsic value relative to the stock price (Travlos, 1987; Agrawal, Jaffe, & Mandelker, 1992; Walker, 2000; Andrade, Mitchell, & Stafford, 2001). Particularly, stock issues to finance M&A are associated with the negative capital market reaction and thus have a negative impact on M&A performance. The *relative size* of the target firm affects the magnitude of the synergy, overpayment and capital market reaction effects. *Leverage* is argued to mitigate agency problems and thus to reduce the managerial incentives to invest in value-destroying M&A, which has a positive impact on M&A performance (Maloney, McCormick, & Mitchell, 1993).

The arguments mentioned above lead to the conceptual model presented on Figure 2. This conceptual model provides a unifying framework for the three studies M&A performance in the following sections. The central elements of the suggested conceptual model are the type of M&A (technological or non-technological), the ownership (industrial or private equity acquirer) and the origin of the focal firms (cross-border M&A or domestic M&A). In the three independent empirical sections that follow, I will further develop and test the arguments A-H that these variables are associated with the potential synergies and the propensity of the acquiring to overpay in M&A, two major drivers of M&A performance. Doing this, I will control for relatedness, experience, the method of payment, relative size and leverage that are commonly used explanatory and control variables in earlier studies on M&A performance.

# 2. Technological vs. non-technological M&A

## 2.1. The definitions of technological and non-technological M&A used in this study

Earlier studies define M&A where technology is a component of the acquired firm's assets as technological (Ahuja & Katila, 2001). This definition requires two further clarifications. First, M&A are transactions through which the acquiring firms obtains a controlling equity interest in the target firm (Chang & Moore, 2012). Second, though technology on the firm level can be defined in general terms as an assemblage of any practices and components used by the firm to produce products or provide services (Arthur, 2009), the literature on technological M&A (Granstrand & Sjolander, 1990; Ahuja & Katila, 2001; Kohers & Kohers, 2001; Ranft & Lord, 2002; Graebner, 2004; Puranam, Singh,& Zollo, 2006; Makri, Hitt, & Lane, 2010) focuses on high-technology, i.e. technology assets developed through R&D projects with specific commercial purposes (Makri, Hitt, & Lane, 2010). Such technology assets encompass high-technology embodied in products and processes as well as "disembodied technology", i.e. the aggregate technical knowledge of inventors (Dosi, 1982; Teece, 1986; Kapoor & Lim, 2007; Makri, Hitt, & Lane, 2010). We follow the same approach to defining technology as the prior studies on technological M&A.

Since technological M&A provide, among other things, technology inputs for the acquiring firm's innovation process (Ahuja & Katila, 2001), they are a means of technology sourcing (Nicholls-Nixon & Woo, 2003) or an external R&D strategy (Hitt, Hoskisson, Johnson, & Moesel, 1996) aimed at gaining and sustaining superior performance through continuous product innovations in high-technology industries (Brown & Eisenhardt, 1997; Graebner, 2004; Kapoor & Lim, 2007; Puranam & Srikanth, 2007; Makri, Hitt, & Lane, 2010).

Consistent with the prior literature mentioned above, we define technological M&A as acquisitions of the controlling interest in high-technology firms with technology being a part of the acquired assets. Further, we consider M&A that cannot be classified as technological following the above definition as non-technological.

## 2.2. The unique mechanisms for value-creation in technological M&A

The major distinction between technological and non-technological M&A is that technological deals provide technology inputs for the acquiring firm while non-technological M&A do not (Ahuja & Katila, 2001). These technological inputs allow the acquiring firm in technological M&A to benefit from two types of synergies unavailable in non-technological deals: (1) leveraging the acquirer's ability to innovate continuously by combining the technology assets of the two firms(Ahuja & Katila, 2001; Graebner, 2004; Makri et al., 2010; Puranam & Srikanth, 2007; Ranft & Lord, 2002) and (2) profiting from commercializing technology developed by the target firm (Chaudhuri & Tabrizi, 1999; Puranam, Singh, & Zollo, 2006). We consider both in more detail below.

*Leveraging innovation capabilities*

Technological M&A allow the acquiring firms to "graft the knowledge base of the target firm" (Ahuja & Katila, 2001; Cloodt, Hagedoorn, & Van Kranenburg, 2006; Desyllas & Hughes, 2010), through access to its people, practices and intellectual property (Kapoor & Lim, 2007). This expansion of the knowledge base provides scale, scope and recombination benefits and improves the absorptive capacity of the acquiring firm increasing the number of elements of external knowledge that becomes available (Ahuja & Katila, 2001; Makri et al., 2010). These effects enhance the ability of the acquiring firm to introduce innovations continuously in the future.

The potential risks of this strategy are (1) disruption of the routines of the target firm (Ahuja & Katila, 2001; Graebner, 2004; Kapoor & Lim, 2007; Puranam & Srikanth, 2007), (2) monitor replacement and thus aggravated moral hazard problems (Kapoor & Lim, 2007), and (3) excessive absorption of the managerial attention by the integration rather than innovation process (Ahuja & Katila, 2001; Hitt, Hoskisson, Ireland, & Harrison, 1991; Hitt et al., 1996). However, empirical literature (Cassiman, Colombo, Garrone, & Veugelers, 2005; Makri et al., 2010) finds that combining complementary technology assets of the acquiring and target firms has a positive impact on the innovation output of the acquirer. In addition, leveraging technological capabilities by combining the two knowledge bases can also create serendipitous value in the forms of new strategic ideas, improved product development techniques and unexpectedly useful technologies (Graebner, 2004).

*Technology commercialization*

Another source of gains unique for technological M&A is profitable commercialization of the technology developed by the target firm by combining it with the specialized complementary non-technology assets of the acquiring firm. In order to understand the nature of this synergy, we first need to consider competitive dynamics and strategic choices available for different types of competitors in R&D-intensive industries.

Competition in high-technology industry revolves around R&D policies, successes and failures (Nelson & Winter, 1982). Here, successful innovations followed by technology commercialization enables firms to achieve growth and profitability through capturing existing and developing new markets, reducing costs, improving quality, learning from customers and accumulating the knowledge necessary for future innovation (Zahra & Nielsen, 2002). Failure to do this quickly and on a large scale, makes the competitive position vulnerable in the face of imitators and new entrants (Dosi, 1988; Henderson & Clark, 1990; Nelson & Winter, 1982; Teece, 1986).

Abernathy and Utterback (1978) model of technological development suggests that there are two stages of product competition in R&D-intensive industries. First, there is competition around prospective product designs. This is essentially the competition among inventors who envisage and develop an innovative product or service with substantial market opportunity. Competing companies make a number of irreversible investment and design decisions facing substantial uncertainty regarding the future of the product in the market. Once the dominant product design emerges, the focus of competition shifts towards gaining

scale in order to capture maximum value from the product innovation in the mass market. At this second stage of product competition, access to complementary manufacturing, distribution, service and finance are crucial (Nelson & Winter, 1982; Teece, 1986; Zahra & Nielsen, 2002).

We commonly observe that the are two major groups of competing inventors in high-technology industries: (1) large established companies and (2) small innovative start-up firms (Dosi, 1988). Small technology-based start-ups are better positioned to invent new prospective products (Puranam & Srikanth, 2007). Particularly, they have less bureaucratic controls (Nelson & Winter, 1982) and associated risk-aversion, stronger links between rewards and performance (Kapoor & Lim, 2007), innovative culture (Reve, 2011). By contrast, established firms possess the complementary manufacturing, marketing and financial assets (Puranam & Srikanth, 2007), access to suppliers and distribution channels, complementary technologies.

Given the abovementioned, established firms in R&D-intensive industries have to choose between three generic innovation strategies: (1) internal R&D, (2) strategic R&D alliances and (3) acquisition of targets possessing the needed technology. Internal R&D process tends to be time-consuming, path-dependent and uncertain (Puranam & Srikanth, 2007). Moreover, established firms have the mentioned organizational disadvantages in terms of their ability to innovate internally.

In these circumstances, strategic R&D alliances can be preferred to technological acquisitions only as long as the partners can effectively manage the dilemma of knowledge-sharing and protection (McEvily, Eisenhardt, & Prescott, 2004). This often requires limiting the scope of the alliance (Oxley & Sampson, 2004). At the same time, successful technology commercialization requires cross-functional teams having some experience of working together with gatekeepers disseminating information from other business areas and project leaders with significant power in the organization (Brown & Eisenhardt, 1995). Such teams are problematic to form if the scope of alliance is narrow. Moreover, successful product commercialization involves cooperation in R&D, manufacturing, marketing, after-sales service (Teece, 1986), which also requires broad alliances. When the opportunities to develop new products internally or in alliances are limited, as in the mentioned cases, technological M&A become the preferable innovation strategy for established firms in R&D-intensive industries.

Simultaneously, technological M&A add value to the innovations developed by small start-up firms that lack the complementary assets needed for their commercialization (Granstrand & Sjolander, 1990; Teece, 1986). Once an innovation is developed, the start-up firm has several alternative strategies to capture value from it. One strategy is technology licensing. However, it is feasible only as long as the start-up can effectively protect the technology from imitation by the established firms for a relatively long period and complementary assets are in competitive supply. Otherwise, imitators or complementary asset suppliers will appropriate most of the profits associated with the innovation. If the complementary assets are not in the competitive supply, then the potential hold-up problems make the start-up to either build the needed assets, a costly and time-consuming option, or sell

the business to capture maximum value from the technology. Otherwise, the suppliers are in a better position to appropriate most of the value. If the start-up cannot effectively protect the innovation from imitation, then selling the business to an established firm, which has the complementary assets needed to commercialize and profit from the technology before imitators follow becomes the best strategic option for the start-up company (Teece, 1986).

Established firms in high-technology industries have two additional strategic options. First, they can turn the acquired firm into a relative autonomous subsidiary that will function as a long-run research engine (Puranam et al., 2006). This will create long-term economies of scope arising from the relative advantages of the parent company and its R&D-subsidiary in commercializing and developing new technologies provided that the acquiring firm can minimize adverse selection problems when picking the targets (Graebner, 2004) as well as retain and motivate the key inventors in the target firm (Ernst & Vitt, 2000; Kapoor & Lim, 2007). Second, the acquiring firm does not necessarily have to develop the target's technology. It can simply run it to the "grave" and in this way remove a potential competitor. This is likely to result in the increased market power of the acquiring firm.

### 2.3. Hypotheses

Since non-technological M&A do not provide technology inputs for the acquiring firm, the latter cannot benefit from the economies of scope and scale in technology development and commercialization discussed in previous section. At the same time, nothing prevents the acquiring firms in technological M&A from benefiting on average from the productive efficiency gains, increased market power and financial synergies available for their counterparts in non-technological deals.

Further, given that the degree of asset complementarity varies across the potential bidders due to the path dependent process of developing capabilities and different market positioning, the value of the target's technology should also vary for different bidders. This leads to an asymmetrically competitive bidding process, where the acquiring firm is able to capture the value of synergies. Hence, the acquiring firms are better positioned to create and capture value for their shareholders in technological than in non-technological M&A. This leads to Hypothesis T1.

> *Hypothesis T1. Acquirers in technological M&A are expected to create higher shareholders' value than acquirers in non-technological M&A*

This increase in the shareholder's value created by technological M&A comes primarily from the economies of scope and scale in the R&D function of the combined firm that manifest in the improved operating performance. By contrast, the opportunities to improve operating performance in non-technological M&A through the economies of scale, the economies of scope and increase in the market power are limited. First, the opportunities to benefit from the increased market power are limited by antitrust regulations (Eckbo, 1983) and disappear quickly due to competitive entries, product-market redefinitions and regulatory changes that happen continuously in many modern industries (Capron, Dussage, & Mitchell, 1998). Consistently, numerous empirical studies (Eckbo, 1983; Seth, 1990; Fee & Thomas, 2004; Shahrur, 2005) do not find significant market power effects on the M&A performance.

Second, the economies of scale and scope in production, marketing and distribution require persistent underutilization of these assets, a condition that holds predominantly in declining industries and makes these sources of gains in non-technological M&A generally scarce (Anand & Singh, 1997). Consistently, Maksimovic and Phillips (2001) in their study of manufacturing industries do not find significant improvements in the operating performance following M&A. This leads to Hypothesis T2.

*Hypothesis T2. Acquirers in technological M&A have larger improvements in operating performance than acquirers in non-technological M&A after the deal completion.*

The above differences in the realized operating performance should lead to corresponding differences in the realized overall financial performance:

*Hypothesis T3. Acquirers in technological M&A realize higher overall financial performance than acquirers in non-technological M&A after the deal completion.*

Prior research on technological M&A generally views them as a means for leveraging innovation capabilities of the acquiring firm and in this way achieve superior performance (Ahuja & Katila, 2001; Graebner, 2004; Puranam et al., 2006). However, Hitt et al. (1991) argue that technological M&A merely substitute the internal R&D of the acquiring firm. Comparing the changes in the R&D intensity of the acquiring firms in technological and non-technological M&A after the deal completion allows testing whether acquirers in technological M&As invest in further technology development. If the acquiring firms use technological M&A as purely a means to substitute internal R&D and merely exploit the technology developed by the target firm, we should not expect any difference in the changes in the R&D-intensity between the acquirers in technological and non-technological M&A after the deal as the first will invest in M&A instead of R&D. In the previous section, we argued that both leveraging innovation and the target's technology exploitation are important sources of value creation in technological M&A. Hence, we advance the following hypothesis:

*Hypothesis T4. Acquirers in technological M&A spend more on R&D than acquirers in non-technological M&A after the deal completion.*

## 2.4. Methods

### 2.4.1. Sample

My sample of M&A comes from Zephyr database of M&A provided by Bureau van Dijk. It contains detailed deal and company information, including: announcement and completion dates, deal type, deal value, deal financing, method of payment, deal rationale, initial and acquired stakes, company identifying information such as ticker symbols, SIC codes and country codes. Zephyr database encompasses M&A that have been announced in the period from January 1997.

I extract all transactions characterized by Zephyr as acquisitions, M&A and institutional buy-outs that were announced between January 1, 1997 and December 31, 2012 and that had been completed by US acquirers before December 31, 2012. This results in a preliminary sample of 75246 observations. However, I need a five year history of M&A

activity to measure M&A experience, which reduces my sample to the period from January 1, 2002 to December 31, 2012 with 61428 observations.

I am interested only in the transactions that result in obtaining the controlling interest in the target firm, i.e. those with the initial stake of less than 50% and the stake after the deal of 51% or more. 55787 transactions satisfy the criteria.

Further, I require the acquirer be a publicly traded company with the stock price data available in the Center for Research in Security Prices (CRSP) database 252 trading days before deal announcement and 10 days after the deal announcement. To match data with Zephyr database I use company ticker symbols. This procedure leaves 2889 observations.

In addition, I require the acquirer have data available from COMPUSTAT one fiscal year before the announcement and at least one fiscal year following the announcement. Again, I use ticker symbols for matching databases. This trims the sample further to 2000 observations.

Finally, I restrict the sample to deals whose value exceeds 1% of the market cap of the acquiring firms 11 trading days before announcement (Harford, Humphery-Jenner, & Powell, 2012). As a result, 1004 observations remain in the effective sample (see Table 3.1 for an overview of the sampling procedure).

**TABLE 3.1**

**The Number of M&A Announced and Completed by US Publicly Traded Acquirers**

The column labeled “Announced” lists the number of M&A announced in the given year by US publicly traded companies. The column labeled “Completed” lists the number of transactions completed in the given year. The column labeled “Data” indicates the number of M&A that resulted in gaining the controlling interest in the target firm and satisfy the data availability criteria for the acquirers. The column labeled “Sample” lists the 1271 transactions that also satisfy the other sampling criteria. The columns labeled “Data” and “Sample” are based on the announcement year.

| Year | Announced | Completed | Data | Sample |
|---|---|---|---|---|
| 2002 | 298 | 217 | 2 | 1 |
| 2003 | 369 | 333 | 51 | 22 |
| 2004 | 420 | 423 | 316 | 161 |
| 2005 | 433 | 418 | 324 | 162 |
| 2006 | 472 | 446 | 307 | 143 |
| 2007 | 520 | 563 | 269 | 140 |
| 2008 | 323 | 386 | 211 | 92 |
| 2009 | 276 | 260 | 151 | 71 |
| 2010 | 325 | 309 | 201 | 115 |
| 2011 | 315 | 311 | 168 | 97 |
| 2012 | 254 | 300 | 0 | 0 |
| Total | 4005 | 3966 | 2000 | 1004 |

### 2.4.2. Distinction between technological and non-technological M&A

Following the prior research, I define technological M&A as acquisitions of high-technology targets with technology being a part of the acquired assets (Ahuja & Katila, 2001; Graebner, 2004; Kapoor & Lim, 2007; Puranam & Srikanth, 2007). I operationalize this definition using the following algorithm.

Firstly, I identify high-technology targets using the three-digit SIC code combinations recommended by Kile and Phillips (2009) for sampling high-technology firms. These include: 283 (drugs), 357 (Computer and Office Equipment), 366 (Communication Equipment), 367 (Electronic Components and Accessories), 382 (Laboratory, Optic, Measure, Control Instruments), 384 (Surgical, Medical, Dental Instruments), 481 (Telephone Communications), 482 (Miscellaneous Communication Services), 489 (Communication Services, NEC), 737 (Computer Programming, Data Processing), 873 (Research, Development, Testing Services). Kile and Phillips (2009) have shown that these codes, commonly used to identify high-tech firms in empirical research, most closely match their classification benchmark based on the descriptions of the firms' revenue generating processes and business operations. 354 targets in my sample satisfy this criterion.

Secondly, prior research argues that technology manifests in patents, which represent its outcomes (Ahuja & Katila, 2001; Kapoor & Lim, 2007; Makri et al., 2010). Thus, I require that targets in technological M&A have registered at least 1 patent before the announcement date. This requirement is consistent with prior research on technological M&A (Ahuja & Katila, 2001; Puranam et al., 2006; Puranam & Srikanth, 2007) and reflects the requirement that technology be part of the acquired assets. I use Orbis database provided by Bureau van Dijk for tracking the patenting activity of the target firm. I match the data on patents with the sample using the unique target BvD ID numbers common for Zephyr and Orbis databases. In my sample, 187 targets had registered at least 1 patent before the acquisition.

Finally, Ahuja and Katila (2001) recognize that not all technologies are patentable and use news stories associated with the M&A in their sample to check whether some non-patented technology was a part of the acquired assets. I follow a similar approach and check the deal rationales provided by Zephyr database mention "technology", "R&D", or "innovation" of the target firm as motivating factors for or components of the acquired assets. Then I classify M&A as technological if the target has a high-technology SIC code and either has some patenting activity before the announcement or technology was reported to be part of the deal motivation or acquired assets. 356 out of 1106 transactions in the sample report technology, R&D, and innovation capabilities as a motivation or part of the acquired assets. The total number of M&A classified as technological is 249 (see Table 3.2 for a more detailed sample distribution).

**TABLE 3.2**

**Sample Distribution by Year and Type of M&A**

This table contains the time-series distribution of a sample of M&A conducted by US publicly traded companies in 2002-2011 from Zephyr. The transactions are classified into years based on announcement dates. The column labeled "All deals" lists the number of M&A in a given year that are included into the sample. The column labeled "Technological" lists the number of deals from the sample where the target operated in a high-tech industry, as defined by (Kile & Phillips, 2009) based on its 3-digit SIC code, and either the target had at least one patent in the fiscal year preceding the acquisition or "technology", "R&D", and "innovation" were reported as part of the deal motivation. The column labeled "Non-technological" indicates the number of M&A that do not satisfy the abovementioned classification criteria.

| Year | All deals | Technological | Non-technological |
|---|---|---|---|
| 2002 | 1 | 1 | 0 |
| 2003 | 22 | 5 | 17 |
| 2004 | 161 | 28 | 133 |
| 2005 | 162 | 33 | 129 |
| 2006 | 143 | 36 | 107 |
| 2007 | 140 | 38 | 102 |
| 2008 | 92 | 27 | 65 |
| 2009 | 71 | 20 | 51 |
| 2010 | 115 | 32 | 83 |
| 2011 | 97 | 29 | 68 |
| Total | 1004 | 249 | 755 |

### 2.4.3. Measures

Table 3.3 provides the list and definition of variables that I use in this study and describe below.

**TABLE 3.3**

**Variable Definitions**

| Variable | Definition |
|---|---|
| *Dependent variables* | |
| CAR (3,5,11) | 3(5 or 11)-day cumulative abnormal returns to acquirers, calculated using the market model. I estimate the market model parameters over days (-262,-11) using an OLS model |
| ACAR (3,5,11) | 3(5 or 11)-day cumulative abnormal returns to acquirers, calculated using the market-adjusted model. |
| ROA (1,2,3) | Industry- and premerger-adjusted return on assets in fiscal years 1, 2, and 3 following the completion year 0: item ni (t)/ average item at (t) and at (t-1) |
| OCF/S (1,2,3) | Industry- and premerger-adjusted operating cash flow to sales in fiscal years 1, 2, and 3 following the completion year 0: item oancf (t)/ item sale (t) |
| EBITDA/S (1,2,3) | Industry- and premerger-adjusted EBITDA to sales in fiscal years 1, 2, and 3 following the completion year 0: item ebitda (t)/ item sale (t) |
| R&D/S | Industry and premerger adjusted R&D intensity in years + 1, + 2, + 3 relative to the completion year (0): item xrd (t)/ item sale (t) |
| *Independent variable* | |
| Tech | Dummy variable which takes the value of 1 for technological M&A. The deals are classified as technological if the target has the three-digit SIC suggested by Kile and Phillips (2009) for sampling high-technology firms ( 283 (drugs), 357 (Computer and Office Equipment), 366 (Communication Equipment), 367 (Electronic Components and Accessories), 382 (Laboratory, Optic, Measure, Control Instruments), 384 (Surgical, Medical, Dental Instruments), 481 (Telephone Communications), 482 (Miscellaneous Communication Services), 489 (Communication Services, NEC), 737 (Computer Programming, Data Processing), 873 (Research, Development, Testing Services)) and has either registered at least one patent before the announcement date or technology is reported as part of the deal motivation. |
| *Control variables* | |
| Experience | Number of M&A conducted by the acquirer during five years before the focal deal |
| All cash | Dummy variable taking the value of 1 if the consideration has been paid 100% with cash |
| All stock | Dummy variable taking the value of 1 if the whole consideration has been paid with common shares of the acquiring company |
| Relative size | Deal value reported by Zephyr to the market cap of the acquiring firm on day –11 relative to the announcement date obtained from CRSP |
| Leverage | The sum of long-term debt (dltt item) and debt in current liabilities (dlc item) to the common equity (ceq) of the acquiring firm |
| Related | Dummy variable that takes the value of 1, if the two-digit SIC codes of the acquired and target are the same |

**Dependent variables**. *Cumulative abnormal announcement returns (CARs)* represent gains to the shareholders upon M&A announcement. They are commonly used as a measure of expected M&A performance (Bargeron et al., 2008; Haleblian & Finkelstein, 1999; Harford et al., 2012; Seth et al., 2002; Zollo & Meier, 2008). To construct the variable I use daily return data for each of the acquirers from CRSP. Following the event study methodology (MacKinlay, 1997), I estimate CARs as sums of the market model residuals over a given event window:

$$CAR_i = \sum_{t=\tau}^{T} \left( R_{it} - \left( \hat{\alpha}_i + \hat{\beta}_i R_{mt} \right) \right)$$

where $CAR_i$is the cumulative abnormal return for transaction $i$, event window $t\epsilon[\tau, T]$, $R_{it}$ stands for the acquirer's return for transaction $i$ and day $t$, the term $\left( \hat{\alpha}_i + \hat{\beta}_i R_{mt} \right)$ is the expected return predicted by the market model. I estimate the market model parameters by the OLS regression over the estimation window from trading day – 262 to day – 11 relative to the deal announcement date (0):

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

where $R_{it}$ stands for the acquirer's return for transaction $i$ and day $t$ , $R_{mt}$ is the daily return to the CRSP value-weighted market index. For robustness, I use three event windows (all dates are trading days relative to the announcement date (0)): day - 1 to day + 1, day - 2 to day + 2, day - 5 to day + 5. Further, I denote CARs corresponding to the event windows listed above as CAR (3), CAR (5) and CAR (11).

For robustness, I complement the market model based cumulated abnormal returns (CARs) with the market-adjusted model based ones. The market adjusted model assumes the intercept of 0 and beta value of 1. Inclusion of these abnormal return measures is aimed to account for biases in the estimated beta coefficients. I denote the market-adjusted model based abnormal returns corresponding to the three event windows as ACAR (3), ACAR (5) and ACAR (11).

CARs and ACARs as measures of M&A performance have the underlying assumption that the stock market quickly and rationally infers the future performance of a merger from all the public information available at its announcement. As long as this assumption holds, the cumulative abnormal returns possess significant advantages over accounting measures of performance: (1) they reflect all aspects of performance, (2) they "see through" managerial attempts to manage earnings, (3) they are objectively reported and (4) they are adjusted for the market performance and the firm's market risk (Chatterjee et al., 1992). Moreover, they have been shown to be correlated with ex post performance measures, which indicates their predictive validity (Haleblian & Finkelstein, 1999). However, this performance measure has several shortcomings. By construction, CARs and ACARs do not incorporate the material information released after the announcement and measure expected rather than actual performance.

By contrast, *return on assets (ROA)* captures the realized overall financial performance of M&A (Delong & Deyoung, 2007). The data I use to calculate all the accounting measures in this study comes from COMPUSTAT. I calculate ROA as the ratio of Net Income (ni item in COMPUSTAT) to the average Total Assets (at item) in the fiscal years + 1, + 2, + 3 relative to the completion year (0). I normalize both ratios by subtracting industry-average and premerger (fiscal year - 1) values of these ratios (Delong & Deyoung, 2007; Healy et al., 1992). I use 2-digit SIC codes to identify industry for this purpose.

However, ROA is sensitive to the acquisition accounting methods, capital structure, depreciation, the practices to restate earnings and assets (Healy et al., 1992; Kusewitt, 1985). When using this measure, it is also difficult to separate the impact of extraneous factors (Anand & Singh, 1997). Thus, I use also operating income and operating cash flow based measures of performance, which are less sensitive to variations in accounting practices and capital structure.

*Operating cash flow to sales (OCF/S)* is a measure of operating synergies standardized by sales that is unaffected by depreciation, goodwill, interest payments and the method of accounting for acquisition (Anand & Singh, 1997; Fee & Thomas, 2004; Heron & Lie, 2002). Following prior research (Delong & Deyoung, 2007; Fee & Thomas, 2004; Healy et al., 1992), I calculate OCF/S as the industry- and premerger-adjusted ratio of Operating Activities Net Cash Flow (oancf) item to Sales (sale) item in the fiscal years + 1, + 2, + 3 relative to the completion year (0).

*Operating income (EBITDA) to sales (EBITDA/S)* is another measure of operating synergies standardized by sales that is used in M&A performance research (Heron & Lie, 2002). I calculate EBITDA/S as the industry- and premerger-adjusted ratio of EBITDA (ebitda) item to Sales (sale) item in the fiscal years + 1, + 2, + 3 relative to the completion year (0).

M&A can be viewed as a source of innovation (Hitt et al., 1991; Hitt et al., 1996; Nicholls-Nixon & Woo, 2003), which makes it a critical aspect of performance. In this study, I focus on innovation inputs.

*R&D-intensity (R&D/S)* is a measure of innovation inputs (Hitt et al., 1991). I calculate R&D intensity as industry and premerger adjusted ratio of R&D expenses (xrd item) to Sales (sale) item in COMPUSTAT in years + 1, + 2, + 3 relative to the completion year (0).

**Independent variable.** I use a dummy variable (Tech) which takes the value of 1 for M&A classified as technological following the algorithm developed in the previous section as the independent variable in this study. Alternatively, I could have defined the independent variable as one taking different discrete values reflecting the relative importance of technology as the value driver. But this would require assigning weights to different factors like the number of patents, the size of the target firm, etc. In the absence of a valid procedure to accomplish this, I follow the established approach of separating two categories of M&A: technological and non-technological (Ahuja & Katila, 2001; Kohers & Kohers, 2001; Puranam, Singh, & Zollo, 2006; Makri, Hitt, & Lane, 2010).

**Control variables**. I control for several acquirer, target and deal characteristics that may influence M&A performance.

*Recent M&A experience* is the number of M&A conducted by the acquiring firm prior to the focal deal. A number of studies (Bruton et al., 1994; Fowler & Schmidt, 1989; Haleblian & Finkelstein, 1999; Puranam et al., 2006; Zollo & Singh, 2004) report "learning-by-doing" effect in M&A that manifests in superior target selection, deal execution and integration capabilities of frequent acquirers. I use data from Zephyr to count the number of M&A completed by the acquirers over the five year period preceding the focal deal.

*Method of payment* classifies deals in the sample into three categories: all cash offerings, all stock offerings, and other offerings based on the data from Zephyr. The choice of the method of payment can reflect the acquirer's uncertainty about the value of synergies and relative overvaluation of the acquirer's equity (Martin, 1996; Myers & Majluf, 1984; Rhodes-Kropf & Viswanathan, 2004; Shleifer & Vishny, 2003). Both lead to more favorable valuations of all cash offerings relative to M&A where a part of the consideration is paid in stock. Consistently, empirical literature finds a "hierarchy of announcement returns" where M&A paid for with stock significantly underperform all cash offerings (Fuller et al., 2002; Mitchell et al., 2004; Savor & Lu, 2009; Travlos, 1987; Walker, 2000).

*Relative size* is measured as the ratio of the deal value reported by Zephyr to the market cap of the acquiring firm on day – 11 relative to the announcement date obtained from CRSP (Harford et al., 2012). Prior literature shows that larger acquisitions suffer from worse monitoring abilities of the acquiring firm (Kang & Kim, 2008) and are characterized by higher risks (Hackbarth & Morellec, 2008). Consistently, it is observed a negative correlation between relative size and announcement returns (Moeller, Schlingemann, & Stulz, 2004).

*Leverage* is measured as the ratio of the sum of long-term debt (dltt item in COMPUSTAT) and debt in current liabilities (dlc item) to the common equity (ceq) of the acquiring firm (Duchin & Schmidt, 2013) in the fiscal year preceding the acquisition. Prior literature argues that high leverage serves as an effective monitoring device (Maloney et al., 1993) and a means to align managerial incentives with shareholder value maximization (Jensen, 1986). Empirical studies find a positive relationship between leverage and announcement returns to the acquiring company (Harford et al., 2012).

*Relatedness* in M&A literature serves as a measure strategic fit between the acquiring and target firm (Jemison & Sitkin, 1986; Lubatkin, 1987; Singh & Montgomery, 1987) and is widely argued to create opportunities for achieving economies of scale and scope (Barney, 2011; Porter, 1980; Rumelt, 1979; Teece, 1982; Williamson, 1979). Several studies find a positive relationship between relatedness and M&A performance (Anand & Singh, 1997; Walker, 2000). Following prior literature (Anand & Singh, 1997; Cannella & Hambrick, 1993; Chang, 1998; Chatterjee et al., 1992; Eckbo, 1983; Fowler & Schmidt, 1989; Fuller et al., 2002; Walker, 2000), I define relatedness as a dummy variable with the value of 1 for related M&A and 0 for unrelated ones, where M&A are classified as related if 2-digit SIC codes of the acquiring and the target firms coincide.

## 2.5. Results

### 2.5.1. Expected performance of technological and non-technological M&A

Hypothesis T1 predicts that the cumulative abnormal returns to the acquiring firm shareholders around the deal announcement will be higher for technological M&A than non-technological M&A. Table 3.4 displays means and medians of the cumulated abnormal returns to the acquiring firm in the two types of M&A and differences between them. Empirical evidence presented in Table 3.4 strongly supports the prediction of the Hypothesis T1.

Generally, means and medians of cumulated abnormal returns are significantly different from zero. Exceptions are abnormal returns measured over the event window from -5 to +5 days around the announcement: CAR (11) and ACAR (11) whose medians are positive but not significant. The mean CAR (11) for non-technological M&A is also positive but not significant. However, one can expect this in the semi-strongly efficient US stock market.

More importantly, all the differences between the mean cumulated abnormal returns are statistically significant. While the mean and median cumulated abnormal return are all positive for technological M&A, they are negative for non-technological M&A over the windows from -1 to +1 and from -2 to + 2 trading days. Moreover, the differences in means over these two event windows are highly significant at 1% level. Over the event window from -5 to +5 trading days around the announcement, the mean abnormal acquirers' returns are still significantly higher (10% level) for technological M&A. The economic magnitude of the difference in mean returns ranges from 0.9 to 1.4 percentage points depending on the measure and event window used. This indicates that the stock market demonstrates a significantly more favorable reaction on the announcement of technological M&A than on the announcement of non-technological ones.

**TABLE 3.4**

**Acquirer Cumulated Abnormal Announcement Returns By Merger Type**

This table contains means and medians (in brackets) of various measures of acquirer abnormal returns upon merger announcement classified by merger type ("Technological" and "Non-technological" columns) and their differences between the two types ("Difference" column). The column "Variable" lists the measures of the abnormal returns used in this study. CARs are the sums of the acquirer's daily raw market model residuals over a given event window. The number of days in the event window is shown in brackets and includes the announcement date as the middle day. Market model parameters are estimated by OLS regression over the period from -262 to -11 trading days. ACARs are the sums of the acquirer's daily raw market-adjusted model residuals over a given event window.***, **, and * indicate that mean, median abnormal returns and their differences between the two merger type are significant at 1, 5 and 10% level correspondently (t-test is used for means, Wilcoxon rank test for medians, and Welch F-test for differences in means). Abnormal returns are presented in %.

| Variable | Technological | Non technological | Difference |
|---|---|---|---|
| CAR(3) | 0.894** | -0.321*** | 1.216*** |
| | (0.158*) | (-0.215***) | (-0.057) |
| CAR(5) | 0.996*** | -0.436*** | 1.431*** |
| | (0.192**) | (-0.239***) | (0.430) |
| CAR(11) | 1.198** | 0.000 | 1.189* |
| | (0.322) | (0.040) | (0.283) |
| ACAR(3) | 0.996*** | -0.223** | 1.219*** |
| | (0.250**) | (-0.110**) | (0.360) |
| ACAR(5) | 1.120*** | -0.230* | 1.350*** |
| | (0.294**) | (-0.038) | (0.332) |
| ACAR(11) | 1.405** | 0.470** | 0.935* |
| | (0.364) | (0.176) | (0.188) |
| Number of observations | 249 | 755 | |

Further, it is necessary to verify that the significant differences between the mean cumulative abnormal returns to the acquiring firm in technological and non-technological M&A are not driven by other characteristics of the deal, acquirer or target.

Prior research indicates that acquirers' announcement returns are correlated with the acquirer's recent M&A experience, the deal price relative to the acquirer's market value, the acquirer's leverage, method of payment, relatedness and existence of blockholders. Table 3.5 compares these characteristics between technological and non-technological M&A.

**TABLE 3.5**

**Acquirer, Deal and Target Characteristics by Merger Type**

This table contains means and medians (in brackets) for various acquirer deal and target characteristics for technological M&A, non-technological M&A and difference between the two deal types. The column "Variable" lists characteristics, which are defined in Table 3.*** and ** indicate whether the means of the two groups are significantly different based on the Welch F-test at 1% and 5% levels correspondently

| Variable | Technological | Non technological | Difference |
|---|---|---|---|
| Recent M&A Experience | 11.710 | 7.730 | 3.980*** |
| | (6.000) | (5.000) | (1.000) |
| Relative size | 0.053 | 0.074 | -0.021 |
| | (0.018) | (0.037) | (-0.019) |
| Leverage | 0.198 | 0.229 | -0.031** |
| | (0.180) | (0.208) | (-0.028) |
| All cash | 104 | 343 | |
| % | 42.450 | 46.100 | |
| All stock | 5 | 14 | |
| % | 2.040 | 1.880 | |
| Other | 136 | 387 | |
| % | 55.510 | 52.020 | |
| Related | 102 | 199 | |
| % | 41.630 | 26.750 | |
| Blockholders | 239 | 715 | |
| % | 97.550 | 96.100 | |
| Number of observations | 249 | 755 | |

Table 3.5 shows that acquirers in technological M&A are significantly (at 1% level) more experienced with the average of 11.7 acquisitions completed during 5 years before the focal deal compared to the mean of 7.73 for the non-technological deals. The difference in medians is much smaller though with 50% of acquirers in technological M&A having completed 6 deals versus 5 for non-technological. The relative size of the deal is lower for technological transactions with the mean of 5.3% versus 7.4% for non-technological deals. However, the difference is not statistically significant. Finally, the proportion of related transactions of 41.6% is much higher in technological deals than that of 26.8% for non-technological ones. These three factors potentially can drive the positive difference in announcement returns between technological and non-technological M&A.

By contrast, acquirers in technological M&A have the average leverage of 20% that is significantly (at 5% level) lower than that of 23% for non-technological acquirers. Further, there is a lower proportion of all cash financed deals (42.5% vs. 46%) and a higher proportion of all stock financed deals (2% vs. 1.9%) among the technological M&A. These differences are inconsistent with the finding of significantly higher acquirers' returns in technological M&A.

Taken together, my univariate comparisons of the above characteristics are inconclusive whether the difference in acquirers' returns can be explained by factors other that technological vs. non-technological deal distinction.

To investigate this possibility further, I estimate ordinary least squares regressions in which I use the six return measures defined in Table 3.3 as the dependent variables. The indicator variable of interest is whether the merger is technological. Thus, the constant term represents the category of non-technological M&A. The other explanatory/control variables include: relative size, leverage, recent M&A experience, dummies for relatedness, all cash financed, all stock financed M&A, and existence of blockholders among the acquirer's owners. They have all been defined in previous section and are standard in M&A literature. In all regressions, I use heteroskedasticity-consistent standard errors. Table 3.6 summarizes the results of the regression analysis.

**TABLE 3.6**

**Multivariate Regressions Explaining Acquirer Returns**

This table contains the results of multivariate OLS regressions of acquirer announcement returns. All variables are defined in Table 3.3 and explained in the previous section. t-statistics are in brackets. ***, **, * indicate that regression coefficients are significantly different from zero at 1%, 5% and 10% level correspondently.

| | CAR (1) | CAR (2) | CAR (5) | ACAR (1) | ACAR (2) | ACAR (5) |
|---|---|---|---|---|---|---|
| Const | -0.008 | -0.021*** | -0.033*** | -0.002 | -0.012* | -0.013 |
| | (-1.557) | (-2.856) | (-2.880) | (-0.471) | (-1.756) | (-1.278) |
| Tech | 0.014*** | 0.016*** | 0.014** | 0.014*** | 0.015*** | 0.012* |
| | (4.221) | (4.076) | (2.099) | (4.374) | (3.968) | (1.823) |
| Relative size | 0.000 | 0.000 | -0.000* | 0.000 | 0.000 | -0.000* |
| | (0.200) | (0.884) | (-1.927) | (0.169) | (0.748) | (-1.943) |
| Leverage | 0.011 | 0.007 | 0.010 | 0.008 | 0.005 | 0.005 |
| | (1.301) | (0.658) | (0.630) | (0.899) | (0.447) | (0.308) |
| Experience | -0.000 | -0.000 | -0.001** | -0.000 | -0.000 | -0.001*** |
| | (-0.838) | (-0.594) | (-2.471) | (-1.414) | (-1.379) | (-3.284) |
| Related | -0.006** | -0.007** | -0.010* | -0.007*** | -0.006** | -0.009 |
| | (-2.452) | (-2.445) | (-1.810) | (-2.754) | (-2.227) | (-1.633) |
| All cash | 0.002 | 0.003 | -0.003 | 0.002 | 0.003 | -0.003 |
| | (0.816) | (1.133) | (-0.607) | (0.752) | (0.927) | (-0.633) |
| All stock | 0.010 | 0.010 | 0.026 | 0.013** | 0.011 | 0.024 |
| | (1.508) | (0.912) | (1.376) | (2.208) | (1.158) | (1.369) |
| Blockholders | 0.003 | 0.016** | 0.040*** | 0.001 | 0.011* | 0.027*** |
| | (0.831) | (2.455) | (3.839) | (0.127) | (1.730) | (2.868) |
| Observations | 1004 | 1004 | 1004 | 1004 | 1004 | 1004 |
| $R^2$ | 0.038 | 0.034 | 0.022 | 0.041 | 0.031 | 0.022 |
| Adjusted $R^2$ | 0.030 | 0.026 | 0.013 | 0.033 | 0.023 | 0.014 |
| F-stat | 4.680 | 4.259 | 2.640 | 5.085 | 3.847 | 2.654 |
| P(F-stat) | 0.000 | 0.000 | 0.007 | 0.000 | 0.000 | 0.007 |

All the regression models are highly significant. Moreover, the coefficients on the technological M&A indicator variable are significantly positive. They show that acquiring firm's shareholders gain from 1.41% to 1.6% higher returns upon the deal announcement in technological than in non-technological deals, and that the differences in the stock returns are robust to alternative explanations, the normal return model specifications and different event windows.

The coefficients on the control variables on Table 3.6 generally have signs and significance levels that are consistent with the prior research. The two exceptions are the coefficients on the experience, which are negative, and relatedness, which are negative and generally significant. However, King et al. (2004) show in their meta-analysis that on average experience has not been found significant. Also, Hayward (2002) shows that the effect of

experience is moderated by time and performance of prior acquisitions. Here I measure experience over a five-year period preceding the focal deal, which is shorter than that used in previous research. Neither control I for prior acquisition performance. All these factors can potentially explain the findings. I identify related deals by the overlap of the two-digit SIC codes. This measure is imperfect in at least two ways. First, it enables us to identify primarily horizontal M&A. Their major source of synergy is the scale economies, which are shown to be limited and generally overvaluated (Seth et al., 2002). Second, it is unable to find the acquisitions of firms which operate in different industries but have related technologies (for example fish farming and biotech) and complementary products. Such deals can have a good strategic fit and yet be classified as unrelated.

### 2.5.2. Realized financial performance of technological and non-technological M&A

Now I focus attention on the realized operating synergies and overall financial performance after the deal completion. Hypothesis T2 predicts that acquirers in technological M&A will have higher industry-adjusted operating performance compared to acquirers in non-technological M&A after the deal completion. Hypothesis T3 predicts that technological M&A will have higher industry-adjusted overall financial performance compared to acquirers in non-technological M&A after the deal completion. To test the hypotheses, I use the accounting performance measures summarize in Table 3.3. Table 3.7 displays industry-adjusted means and medians of changes in ROA, Operating Cash Flow to Sales and EBITDA to Sales relative to the pre-merger levels. The empirical data presented in Table 3.7. supports the predictions.

**TABLE 3.7**

**ROA, Operating Cash Flow and EBITDA Scaled by Sales**

This table displays the industry-adjusted means and medians (reported in brackets) of changes in ROA, OCF to Sales and EBITDA to Sales in fiscal years +1, +2, and +3 relative to their pre-merger values. (1), (2) and (3) stand for fiscal year +1, +2 and +3 correspondently relative to the merger completion year 0. These changes are reported separately for Technological and Non-technological M&A. In addition, I report Differences between the two groups. I use t-test for significance of means and their differences between Technological and Non-technological M&A. I use Wilcoxon signed ranks test for significance of medians and Chi-square test for medians for significance of differences of medians between the two groups. ***, **, and * indicate significance at levels of 1%, 5% and 10% correspondently.

| Variable | Technological | Non-technological | Difference |
|---|---|---|---|
| ROA(1) | 0.013** | 0.001 | 0.013* |
| | (0.016***) | (0.003***) | (0.013***) |
| ROA(2) | 0.011* | -0.001 | 0.012* |
| | (0.021***) | (0.003) | (0.018**) |
| ROA(3) | 0.006 | -0.001 | 0.007 |
| | (0.013***) | (0.003**) | (0.010**) |
| OCF to SALES(1) | 0.041*** | 0.012 | 0.029** |
| | (0.056***) | (0.003) | (0.053***) |
| OCF to SALES(2) | 0.046*** | 0.011 | 0.035*** |
| | (0.048***) | (-0.000) | (0.048***) |
| OCF to SALES(3) | 0.034*** | 0.010 | 0.024* |
| | (0.044***) | (0.003) | (0.040***) |
| EBITDA to SALES(1) | 0.050*** | 0.046 | 0.003 |
| | (0.054***) | (0.008***) | (0.046***) |
| EBITDA to SALES(2) | 0.042*** | 0.011* | 0.031*** |
| | (0.046***) | (0.006**) | (0.040***) |
| EBITDA to SALES(3) | 0.036*** | 0.000 | 0.035*** |
| | (0.038***) | (0.007) | (0.031***) |
| Number of observations | 249 | 755 | |

Generally, the means and medians are significantly positive for technological M&A. The only exception is the mean of change in ROA between year-1 and +3 relative to the deal completion year 0, which is positive but not significant. This indicates that acquirers in technological M&A demonstrate significantly higher operating and overall financial

performance than their counterparts from the same industry. Further, they suggest that their performance significantly improves relative to pre-merger levels and indicate that acquirers in technological M&A realize significant synergies. Moreover, medians are substantially larger than means, which strengthens this argument because non-parametric tests are shown to be significantly more powerful in studies of operating performance (Heron & Lie, 2002).

By contrast, the means and medians are generally not significant for non-technological M&A. Exceptions are industry-adjusted changes in ROA from year -1 to year +1 and from year-1 to year +3 with significantly positive medians of 0.3%, industry-adjusted changes in EBITDA to Sales from year-1 to year +1 with the significantly positive median of 0.8% and in EBITDA to Sales from year -1 to year +2 with significantly positive mean of 1.1% and median of 0.6%. These results suggest that acquirers in non-technological M&A do not realize significant synergies and do not demonstrate higher than average industry performance.

The differences in operating and overall financial performance between acquirers in technological and non-technological deals are statistically and economically significant. The differences in the medians of industry-adjusted changes in ROA ranges from 1% to 1.8% across fiscal years +1, +2 and +3, in OCF to Sales – from 4% to 5.3%, and in EBITDA to Sales – from 3% to 4.5%. All the values are significant at 1% or 5% level. This supports the predictions that acquirers in technological M&A realize (1) higher operating synergies and (2) higher overall financial performance compared to acquirers in non-technological M&A.

But I still need to investigate whether the reported differences in the realized financial performance are explained by some other deal, acquirer or target characteristics by regressing the above financial performance measure against the indicator variable which takes the value of 1 for technological M&A and the control variables identified in Table 3.3.

Table 3.8 displays the results of the regression analyses. Though all the regressions are highly significant, the coefficients on the technological M&A indicator variable are not. This suggests the absence of significant differences in operating and overall financial performance of acquirers in technological and non-technological M&A once we account for alternative explanations. The signs and significance levels of the coefficients on the control variables are generally consistent with prior literature. Hence, the regression analysis does not provide support to Hypotheses T2 and T3.

One reason behind the non-finding is likely to be that a three-year period is not long enough to realize the synergies in technological M&A. An example is the acquisition of FAST Search and Transfer company by Microsoft. It took 3 years to embed the enterprise search technology developed by FAST into Microsoft Office. This means that Microsoft will generate additional revenues only from fiscal year +4. In pharmaceuticals development cycles are even longer and may take up to 20 years before a new drug appears on the market. At the same time investments in R&D are made already from year +1, which may drag down the financial performance.

However, I follow the prior literature examining the impact of M&A on the accounting performance (Heron & Lie, 2002) and do not extend the period beyond year +3 because of the effects of subsequent corporate events on the financial performance.

**TABLE 3.8**

**Multiple Regressions of ROA, OCF and EBITDA Scaled by Sales**

This table presents the results of the regressions of industry-adjusted changes in ROA, OCF to Sales and EBITDA to Sales in fiscal years +1,+2 and +3 after the deal completion year relative to their pre-merger levels. All variables are explained in Table 3.3. t-statistics are presented in brackets. ***, **, * indicate 1%, 5% and 10% significance levels. All regressions use OLS estimation method and heteroskedasticity-consistent standard errors.

| | ROA (1) | ROA (2) | ROA (3) | OCF/S (1) | OCF/S(2) | OCF/S (3) | EBITDA/S(1) | EBITDA/S(2) | EBITDA/S(3) |
|---|---|---|---|---|---|---|---|---|---|
| Const | 0.009 | 0.009 | 0.019 | -0.046* | -0.021 | 0.015 | -0.089** | -0.028 | -0.025 |
| | (0.300) | (0.707) | (1.098) | (-1.754) | (-1.101) | (0.484) | (-2.325) | (-0.949) | (-0.793) |
| Tech | 0.001 | -0.000 | -0.007 | 0.009 | 0.012 | 0.002 | -0.000 | 0.012 | 0.014 |
| | (0.164) | (-0.015) | (-0.701) | (0.811) | (1.228) | (0.171) | (-0.013) | (1.356) | (1.213) |
| Relative size | 0.000 | 0.000* | 0.000* | 0.000* | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | (-1.182) | (-1.920) | (-1.699) | (-1.720) | (0.223) | (-1.184) | (-0.028) | (-0.195) | (-0.843) |
| Leverage | -0.096*** | -0.114*** | -0.055** | -0.051 | -0.087* | -0.126** | 0.203 | -0.000 | -0.041 |
| | (-4.569) | (-6.130) | (-2.294) | (-0.850) | (-1.777) | (-2.321) | (1.109) | (-0.007) | (-0.784) |
| Experience | 0.002*** | 0.002*** | 0.003*** | 0.003*** | 0.003*** | 0.004*** | 0.002 | 0.003*** | 0.004*** |
| | (6.604) | (6.489) | (7.204) | (5.463) | (6.539) | (7.636) | (1.151) | (9.017) | (7.376) |
| Relatedness | 0.009 | 0.001 | 0.000 | 0.032** | 0.034*** | 0.021* | -0.020 | 0.016* | 0.012 |
| | (1.396) | (0.210) | (0.002) | (2.430) | (3.289) | (1.687) | (-0.639) | (1.665) | (0.864) |
| All cash | 0.016** | 0.005 | 0.009 | -0.016 | -0.008 | -0.003 | -0.044 | -0.021** | -0.002 |
| | (2.240) | (0.782) | (1.113) | (-1.036) | (-0.735) | (-0.262) | (-0.978) | (-2.270) | (-0.107) |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| All stock | 0.019 | 0.005 | -0.020 | 0.022 | 0.014 | 0.086** | 0.007 | 0.074** | 0.077** |
| | (1.293) | (0.259) | (-0.513) | (0.736) | (0.495) | (2.097) | (0.177) | (2.552) | (2.429) |
| Blockholders | -0.010 | 0.001 | -0.031** | 0.047* | 0.021 | -0.014 | 0.106 | 0.023 | 0.009 |
| | (-0.357) | (0.120) | (-1.947) | (1.659) | (1.293) | (-0.477) | (1.620) | (0.823) | (0.295) |
| Observations | 967 | 828 | 706 | 967 | 827 | 706 | 967 | 827 | 706 |
| $R^2$ | 0.078 | 0.088 | 0.072 | 0.028 | 0.067 | 0.081 | 0.004 | 0.076 | 0.049 |
| Adjusted $R^2$ | 0.070 | 0.079 | 0.062 | 0.020 | 0.058 | 0.070 | -0.005 | 0.067 | 0.038 |
| F-statistic | 10.077 | 9.831 | 6.797 | 3.401 | 7.344 | 7.634 | 0.437 | 8.352 | 4.521 |
| P(F-statistic) | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.899 | 0.000 | 0.000 |

### 2.5.3. Innovation

Hypothesis T4 predicts that acquirers in technological M&A will have higher post-merger R&D-intensity relative to the pre-merger levels and industry peers than acquirers in non-technological M&A as they will focus on extracting the maximum value from the target's technology assets through innovation. The evidence summarized in Table 3.9 supports the prediction.

For technological M&A the means and medians of industry and pre-merger adjusted R&D expenses to Sales ratios are generally positive and significant for year +3 (see Table 3.9). This means that acquirers in technological M&A invest more in R&D than other companies in the same two-digit SIC code industry and themselves prior to the focal M&A. The only exception is the non-significant negative median for year +1. For non-technological M&A all the medians are negative but not significant. The means are negative and non-significant for years +1, +2 and significantly positive for year +3.

The differences in means are positive and significant for years +2 and +3 and positive but not significant for year +1, which shows that acquirers in technological M&A invest significantly more in technology development after the deal than acquirers in non-technological M&A and supports the argument that leveraging innovation capabilities is a major driver for value creation in technological M&A.

**TABLE 3.9**

**Industry and Pre-merger Adjusted R&D to Sales Ratios by Deal Type**

This table displays the industry-adjusted means and medians (reported in brackets) of changes in R&D to Sales in fiscal years +1, +2, and +3 relative to their pre-merger values. (1), (2) and (3) stand for fiscal year +1, +2 and +3 correspondently relative to the merger completion year 0. These changes are reported separately for Technological and Non-technological M&A. In addition, I report Differences between the two groups. I use t-test for significance of means and their differences between Technological and Non-technological M&A. I use Wilcoxon signed ranks test for significance of medians and Chi-square test for medians for significance of differences of medians between the two groups. ***, **, and * indicate significance at levels of 1%, 5% and 10% correspondently.

| Variable | Technological | Non-technological | Difference |
|---|---|---|---|
| R&D to SALES(1) | 0.411 | -0.317 | 0.728 |
| | (-0.003) | (-0.003) | (-0.000) |
| R&D to SALES(2) | 0.743 | -0.899 | 1.642** |
| | (0.004) | (-0.001) | (0.005) |
| R&D to SALES(3) | 2.050*** | 0.721** | 1.329** |
| | (0.008***) | (-0.000) | (0.008) |
| Number of observations | 203 | 374 | |

To investigate the effects of the control variables, I run OLS regressions of the industry and premerger adjusted R&D to Sales ratios in years +1,+2 and +3 on the explanatory variables defined in the measurement section. Standard errors are heteroskedasticity-consistent. Table 3.10 summarizes the results of the multiple regressions.

**TABLE 3.10**

**Multiple Regressions of Industry and Pre-merger Adjusted R&D to Sales Ratios by Deal Type**

This table presents the results of the regressions of industry-adjusted changes in R&D to Sales in fiscal years +1,+2 and +3 after the deal completion year relative to their pre-merger levels. All variables are explained in Table 3.3. t-statistics are presented in brackets. ***, **, * indicate 1%, 5% and 10% significance levels. All regressions use OLS estimation method and heteroskedasticity-consistent standard errors.

| Values | R&D/sales (1) | R&D/sales (2) | R&D/sales (3) |
|---|---|---|---|
| Const | 0.660 | 0.138 | 0.227 |
| | (0.897) | (0.144) | (0.270) |
| Tech | 0.955 | 2.083** | 1.975** |
| | (1.33) | (2.260) | (2.45) |
| Relative size | 0.000** | 0.000 | 0.000 |
| | (1.977) | (1.211) | (1.647) |
| Leverage | -1.431 | 0.965 | 3.189 |
| | (-0.679) | (0.421) | (1.842) |
| Experience | 0.005 | 0.017 | -0.027* |
| | (0.430) | (0.946) | (-1.681) |
| Relatedness | -0.804 | -0.768 | -1.469*** |
| | (-1.503) | (-0.940) | (-2.633) |
| All cash | -0.013 | -0.192 | -0.312 |
| | (-0.023) | (-0.237) | (-0.530) |
| All stock | -0.097 | 0.624 | -3.398 |
| | (-0.184) | (0.899) | (-1.410) |
| Blockholders | -0.708 | -1.503** | 0.531 |
| | (-1.788) | (-2.376) | (0.819) |
| Observations | 586 | 486 | 407 |
| $R^2$ | 0.036 | 0.027 | 0.087 |
| Adjusted $R^2$ | 0.023 | 0.011 | 0.068 |
| F-statistic | 2.714 | 1.680 | 4.725 |
| P(F-statistic) | 0.006 | 0.101 | 0.000 |

All the regressions are significant. As the Hypothesis T4 predicts, the coefficients on the technological M&A indicator variable are positive and significant for years +2 and +3, which shows that the finding of significantly higher pre-merger and industry-adjusted R&D intensity following technological M&A compared to those following non-technological M&A are robust to control variables.

## 2.6. Discussion and conclusions

The major motivation for this study was to explain the variance in the abnormal announcement returns to the acquiring firms' shareholders by distinguishing deals with different value drivers. The empirical results strongly support the prediction by showing significantly higher returns to the shareholders of the acquiring firm in technological M&A. These deals can create value by facilitating profitable commercialization of the target's technology and leveraging the capability to generate innovations continuously – two value-creation mechanisms that are unavailable for non-technological M&A. This result is robust to both different abnormal return measures and controls for common alternative explanations. I have also considered ex post performance effects over a three-year horizon following M&A completion. The results partially support the arguments. Particularly, the significant increase in industry- and premerger-adjusted R&D-intensity among acquirers in technological M&A confirms the hypothesized effect. However, I do not find significant differences in the operating and overall financial performance between acquirers in technological and non-technological deals once controlled for experience and size effects. These findings have implications for theory, research and practice, which I discuss below.

### 2.6.1. Implications for theory and research

The major contribution of this section is that it provides empirical evidence that the type of M&A (technological or non-technological) is highly significantly related to the average cumulative abnormal returns to the acquiring firm shareholders around the deal announcement and that this relationship is robust to alternative explanations such as relatedness, prior M&A experience, the method of payment, leverage and ownership concentration (existence of blockholders). In this way, it also addresses the problem of unidentified moderators (King et al.,2004) and shows that the key to explaining the variance in M&A performance lies in identifying deals where certain mechanisms for value creation and destruction are likely to dominate.

It shows that access to the technology assets of the target firm is a significant source of synergies in M&A. This is consistent with Seth and colleagues (2002) who report that reverse internalization of intangible assets is positively related to the gains of the acquiring firm in cross-border M&A. But this dissertation goes further in at least three ways. First, it shows that the argument holds not only for cross-border M&A, which are in many ways distinct form domestic deals (see Section 5 for a detailed discussion). Second, I specify the intangible asset (patented and unpatented technology). Third, I provide a more elaborated argument on how the economize of scope arise from combining the target's technology with technological and non-technological assets of the acquiring firm and why their value is not lost in the competitive bidding process.

Further, the significant increase in R&D-intensity following technological M&A compared to both non-technological M&A and industry peers provides an empirical indication that the value creation in technological M&A comes not only from the mere exploitation of the target's technology but also from its further development. Otherwise, R&D-related costs would be capitalized, not expensed. Hence, the argument that M&A are means for substituting internal R&D (Hitt et al., 1996) does not find empirical support.

Finally, this study has implications for measuring performance of technological M&A. While prior research in this area focused exclusively on realized innovation outcomes of such deals, this analysis emphasizes the importance of financial measures that are more directly related to value-creation than the number of patents or product launches. However, accounting performance measures may be inferior performance metrics for technological M&A. The three-year measurement period is inconsistent with the time needed to develop certain types of high-technology products, while its extension may lead to mixing the effects of the focal transactions with subsequent corporate events. They are also inappropriate for serial technological acquirers. Hence, the use of the announcement stock returns is a better complement for the currently dominating innovation measures.

### 2.6.2. Implications for practice

This work shows that the stock market distinguishes deals with different value drivers. Thus, it is important for the management team of the acquiring firm to assess the fit of the acquired assets with the company's strategy and specific mechanisms for value-creation through the transaction. This implies a disciplined approach to target selection and negotiations, resistance to institutional pressures, and careful strategic fit analysis and its implications for the transaction's financial model.

Further, announcement returns to the acquiring firm are negatively correlated with the relative size of the deal. This implies that the stock market is skeptical about the potential scale economies and takes into account the larger overpayment risk associated with larger deals. Thus, managers should benefit from focusing on smaller, better manageable and more pragmatic deals.

Finally, realized financial performance is positively correlated with M&A experience. This implies that post-merger integration (PMI) is a valuable capability that can give a company a competitive advantage and that it is important to develop PMI strategy for a particular target and secure the qualified managerial resources for managing PMI before deal completion.

### 2.6.3. Limitations and future research

This study is not without limitations. The first is the deliberate focus on premerger characteristics of the acquiring and target firm, which leaves post-merger integration management outside the scope of this study. This choice was driven mainly by research design and tractability reasons. Though post-merger integration process affects the realized performance, it has no impact on the abnormal announcement returns to the acquiring firm, which this study is most concerned.

Second, I employed a conservative strategy for identifying technological M&A, which may have mistakenly classified some transactions where targets owned a non-patentable technology and the deal rationale was not included in the database as non-technological. A problem this strategy can have caused is a non-significant difference in announcement returns between technological and non-technological M&A even if it is significant in reality. However, given the strong significance of the results, this identification strategy has no

detrimental impact on the validity. Moreover, this methodology is consistent with the prior literature on technological M&A, which makes my results comparable.

Third, I focused on whether the target has technology assets and did not consider technology assets of the acquiring firm. I leave this as a prospective area for the future research, which can further explain the variance in performance between different types of technological M&A.

Fourth, I used R&D-intensity as the measure of innovation performance. One reason behind this choice is the interest in the change of R&D investments following technological and non-technological M&A as Hitt and colleagues (1996) predicted that they would decrease in both cases but this would be inconsistent with the view of technological M&A as a strategy for leveraging internal innovation expressed by many authors (Ahuja & Katila, 2001; Ranft & Lord, 2002; Puranam et al., 2006). Another reason is that this is a standard measure used in the literature (Hitt et al., 1996; Ahuja & Katila, 2001), which makes my results comparable to earlier work. The limitation of this measure is that it does not show innovation outputs even though prior research shows that it is highly correlated with such innovation output measures as patents and new product launches (Ahuja & Katila, 2001). Innovation output measures of particular interest in the context of this study would be product innovations and incremental revenues from these product innovations after the deal completion. Such a study, however, would require a different dataset, richer in terms of available metrics and with a longer time horizon. A viable alternative could be using the innovation data for Norwegian companies gathered periodically by the Norwegian Central Statistical Bureau (SSB). But the tradeoff of conducting a study on a Norwegian dataset would be sacrificing the stock market data as only 161 companies are currently listed on the Oslo stock exchange. Since the focus of this study is on the overall value creation, I leave a more detailed study of the innovation performance as a task for the future research.

It is also worth commenting on the limitations related to the use of SIC codes for the classification purposes in this study, particularly for identifying high-technology industries and related M&A. The use of SIC codes for identifying high-technology industry is a common research practice (Kile & Phillips, 2009), especially in empirical literature on technological M&A (Granstrand & Sjolander, 1990; Kohers & bv, 2001; Hagedoorn & Duysters, 2002; Cloodt et al., 2006; Kapoor & Lim, 2007). It is based on the research by the Bureau of Labor Statistics that identifies industries in the US with the above-average number of workers engaged in R&D activity as well as the research by Kile & Phillips (2009) that matches SIC codes with the classification benchmark based on the revenue generation processes and business operations. Although this measure is conservative and may exclude some high-technology industries, the significance of the obtained results suggests that the predicted relationships can be expected to be even stronger if more fine-grained measures are used. Second, the use of SIC codes to identify related M&A is a stand-by practice in M&A performance research (Gretland, 1991; Walker, 2000). The shortcomings of this approach is that such measures do not capture the distinction between horizontal, vertical and related M&A (Reve, 1990) and between asset similarity and complementarity. However, it suits well the purposes of this large sample study where relatedness is merely a control variable. The

development of more fine-grained measures capturing the different forms of relatedness based on the degree of similarity and complementarity of specific assets or businesses of the acquiring and target firms and analyzing the impact of the various forms of relatedness on M&A performance are other prospective areas for future research.

Additional insights can be gained by further distinguishing different types of non-technological M&A according to the dominating drivers for value-creation and destruction. Such an effort requires identifying specific sources for the economies of scale, scope and other synergies and conditions when they are most likely to apply. Examples can be the economies of scale arising from the utilization of the excess production capacity in declining industries vs. those from spreading the fixed R&D costs or market power stemming from eliminating a competitor vs. that arising from the increased switching costs associated with an more comprehensive software solution. This is also a task for the future.

# 3. The impact of ownership in M&A

## 3.1. The ownership strategies of private equity and industrial acquirers

*Private equity acquirers*

Private equity firms rely on significant debt financing to acquire control in target firms with the aim of restructuring and subsequent reselling them at premiums through IPO or M&A. Private equity acquirers contribute their managerial and industry expertise (Kaplan & Stromberg, 2009) to "unlock" the potential value of the target firm by cutting its costs, re-positioning in the market, divesting redundant assets and unprofitable businesses (Green, 1992; Johnson, 1996; Connelly et al., 2010).

Financial leverage plays a central role in the strategy of private equity firms as the debt reaches up to 85% of the financing structure of a leveraged buyout (Jensen, 1989). It magnifies the shareholders' returns at exit, creates stimulus for the restructuring of the target firm, and mitigates agency problems.

In particular, debt increases the probability of default with the resultant reputational and employment consequences for the top management. This, in its turn, creates a crisis atmosphere in the firm that stimulates the necessary operational improvements. As Jensen (1989) writes:

> *Companies that assume so much debt they cannot meet the debt service payments out of operating cash flow force themselves to rethink their entire strategy and structure. Overleveraging creates the crisis atmosphere managers require to slash unsound investment programs, shrink overhead, and dispose of assets that are more valuable outside the company. The proceeds generated by these overdue restructurings can then be used to reduce debt to more sustainable levels, creating a leaner, more efficient and competitive organization (Jensen, 1989:12).*

In addition, managers of firms generating cash in excess of its needs to support operations and having no positive-NPV investment opportunities have incentives to use these free cash flows for value-destroying investments rather than to distribute them among the shareholders who then could invest them more productively (Jensen, 1986). The obligatory payments associated with debt effectively reduce the free cash flows under the managerial control, make the managerial investment decisions subject to the scrutiny of the capital markets where they have to raise the capital, and thus curb overinvestment (Jensen ,1986; Jensen, 1989).

Finally, the significant portion of debt in the capital structure allows private equity firms to provide more stock to the managers (Jensen, 1989), which mitigates agency problems (Jensen and Meckling, 1976). Jensen and Murphy (1990) find that the total wealth of the median public company CEO increases by $3.25 for a $1000 increase in the shareholder value, while the median business unit chiefs at private equity firms earn $64 for $1000 increase in the shareholder value not including bonuses and incentive plans. Hence, the substantial

leverage in private equity provides stronger performance incentives and more severely penalizes shirking by managers.

However, the ownership strategy of private equity firms has substantial shortcomings in managing technology assets, which include technology embodied in the products and solutions of the target firm, technology embedded in its processes and the human capital of its inventors (Dosi, 1982; Teece, 1986; Makri et al, 2010).

Specifically, the short-term orientation and high financial leverage of private equity firms lead to (1) their excessive reliance on financial controls, (2) absorption of managerial attention by corporate restructuring, (3) higher managerial risk-aversion, (4) decreased funding of R&D projects, (5) loss of tax breaks that turns the NPV of some R&D projects into negative (Hitt et al., 1991; Hitt et al., 1996; Long & Ravenscraft, 1993). Long and Ravenscraft (1993) show that, as a result, R&D-intensity drops by 40% following LBOs.

Further, these forces are likely to demotivate key inventors and force some of them to leave the firm, which has a devastating impact on R&D productivity and thus the innovation performance of the M&A (Ernst & Vitt, 2000; Kapoor & Lim, 2007).

Finally, Teece (1986) shows that profits stemming from utilizing technology assets go to the companies that possess complementary production, marketing and distribution assets. The major assets of private equity firms are managerial competence and financial capital, which limits their opportunities to add value to the target's technology assets.

*Industrial acquirers*

Industrial acquirers encompass acquiring firms for which investment management is not the primary business area. They rely on M&A as a corporate growth strategy or as a means to pre-empt competition. Industrial acquirers can add value to the target firms by realizing different types of synergies including economies of scale (Eckbo, 1983; Reve, 1990; Gretland, 1991; Shleifer & Vishny, 1991), economies of scope (Williamson, 1975; Porter, 1980; Teece, 1982; Reve, 1990), increased market power (Stigler, 1964; Eckbo, 1983; Fee & Thomas, 2004; Shahrur, 2005), corporate-level diversification (Williamson, 1975; Shleifer & Vishny, 1991; Lang & Stulz, 1994), and tax advantages (Amit & Livnat, 1988; Hayn, 1989).

The key source of the parenting advantage of industrial acquirers relative to private equity firms are unique economies of scope based on the complementary assets (Hitt et al., 1991; Kim & Finkelstein, 2009; Makri et al., 2010; Seth, 1990; Seth et al., 2002) and strategic fit between the acquiring and the target firms (Christensen et al., 1976; Datta, 1991; Jemison & Sitkin, 1986; Porter, 1980; Rumelt, 1974; Teece, 1982). Since private equity partnerships do not bring complementary assets, except for the managerial competence and financial capital, to the target firm, this important source of value creation is not available for them.

However, this synergy-based ownership strategy has several shortcomings. First, operational synergies stemming from the economies of scale, the economies of scope and the increased market power are generally scarce (Anand & Singh, 1997; Heron & Lie, 2002; Fee & Thomas, 2004), difficult to realize through post-merger integration (Seth, 1990), come at the cost of its disruptive effects on the business (Homburg & Bucerius, 2006), and are not

sustainable (Capron et al., 1998). Second, the corporate level diversification actually destroys the value of the target company (Berger & Ofek, 1995) because the acquiring firm lacks the competencies necessary to manage the acquired businesses that are not related to its strategic core (Reve, 1990; Campbell et al., 1995). Third, the tax advantages are limited. Finally, public industrial companies have more severe incentives and monitoring problems than private equity firms (Jensen & Meckling, 1976; Jensen & Murphy, 1990), which results in more inefficiencies (Jensen, 1989).

To summarize, private equity acquirers add value to the target firm by better aligning managerial incentives with the shareholder wealth maximization and unlocking the potential value through operational improvements and restructuring. At the same time, their ownership strategy and limited arsenal of complementary assets are likely to have a detrimental impact on the target's innovation performance. While private equity firms attempt to add value to the target firm on the stand-alone basis, industrial acquirers focus on leveraging the overlapping businesses of the acquiring and the target firms through their integration and optimization. Though the ability to contribute a large spectrum of complementary assets in R&D, production, marketing, and distribution to the target firm gives a relative parenting advantage to industrial acquirers, their ability to add value to the target firm is generally limited by the magnitude of the potential gains from economies of scale and increased market power as well as the challenges and costs associated with post-merger integration and weaker managerial incentives.

### 3.2. The role of technology

Following prior literature (Ahuja & Katila, 2001; Kapoor & Lim, 2007; Makri et al., 2010; Puranam, Singh, & Zollo, 2006; Puranam & Srikanth, 2007), I view technological M&A as acquisitions of the controlling interest in target firms operating in high-technology industries that possess technology assets. Technology assets include technology embodied in products, embedded in processes and the knowledge of inventors that typically manifest in patents (Dosi, 1982; Teece, 1986; Kapoor & Lim, 2007; Makri et al., 2010). M&A that do not provide such technology inputs to the acquiring firm are defined as non-technological (Ahuja & Katila, 2001).

The acquiring firm can increase the value of the acquired technology assets in two ways. First, the acquiring firm can profitably commercialize the technology developed by the target by adding the necessary complementary manufacturing, marketing and distribution assets (Puranam et al., 2006; Teece, 1986). This can be done continuously if the acquiring firm preserves the target firm as a relatively autonomous and highly productive R&D unit (Puranam et al., 2006). Second, the acquiring firm can leverage the target's technology assets by combining them with its own and achieving the economies of scale and scope in R&D (Ahuja & Katila, 2001; Ernst & Vitt, 2000; Graebner, 2004; Kapoor & Lim, 2007; Makri et al., 2010). The value creation potential of this second strategy is positively related to the degree of complementarity between the technologies of the acquiring and target firms (Makri et al., 2010).

These two mechanism for value creation in technological M&A have two important features. First, they require that the acquiring firm contributes complementary technology and

non-technology assets. This creates a parenting advantage for industrial acquirers relative to private equity firms whose assets are limited primarily to managerial competence and financial capital. Further, this advantage is likely to have a tremendos impact on the performance of technological M&A because the competition in high-technology indusries revolves around continuous innovations (Chaudhuri & Tabrizi, 1999; Graebner, 2004; McEvily, Eisenhardt, & Prescott, 2004; Puranam & Srikanth, 2007; Ranft & Lord, 2002).

Second, these two sources for value-creation are not available in non-technological M&A because they do not provide technology inputs to the acquiring firm (Ahuja & Katila, 2001). At the same time, nothing prevents the acquirers in technological M&A to benefit from the synergies offered by the combination of non-technology assets of the two firms that are available in non-technological M&A and were described in the previous section.

### 3.3. Hypotheses

Jensen (1989) argues that private equity firms are superior parents relative to industrial companies because they provide stronger performance incentives to the management team leading to improved corporate governance and realization of the operational improvements in the target firm. At the same time, a number of authors (Anand & Singh, 1997; Capron et al., 1998; Seth et al., 2002; Fee & Thomas, 2004) argue that the opportunities of the industrial acquirers to add value to the target firms in the form of synergies are generally limited. This relative advantage of private equity firms should lead to higher abnormal returns to the target firm shareholders upon the deal announcement since acquirers possessing parenting advantages should be able to offer higher bids, which leads to the following hypothesis:

> *Hypothesis O1. The returns to the target firm shareholders are higher for M&A conducted by private equity firms than for M&A conducted by industrial acquirers.*

Private equity firms have two major disadvantages as acquirers in technological M&A. First, they lack complementary R&D, production, distribution, and marketing assets that are necessary to leverage and profitably commercialize the target's technology (Teece, 1986; Reve, 2011). Second, their focus on short-term financial performance, higher risk-aversion, the absorption of the managerial attention by the restructuring and reduction of R&D investments negatively affect the productivity of inventors in the target firm and innovation performance (Long & Ravenscraft, 1993). Hence, we can suggest the following hypothesis:

> *Hypothesis O2. The returns to the target firm shareholders are higher for non-technological M&A conducted by private equity firms than for technological M&A conducted by private equity firms.*

Industrial acquirers in non-technological M&A cannot benefit from the economies of scope and scale in technology development and commercialization because the target firms in such deals do not provide technology assets. By contrast, industrial acquirers in technological M&A can on average benefit from the productive efficiency gains, increased market power and financial synergies based on the target's non-technology assets in the same manner as their counterparts in non-technological deals. The difference in the value creation potential between the two types of M&A leads to Hypothesis 3.

*Hypothesis O3. The returns to the target firm shareholders are higher for technological M&A conducted by industrial acquirers than for non-technological M&A conducted by industrial acquirers.*

Combining (1) the argument that private equity firms are likely to add more value on average to the target through restructuring and realizing operational improvements than industrial acquirers through synergies (behind Hypothesis 1) with (2) the argument that private equity firms are inferior acquirers in technological M&A (behind Hypothesis 2), yields Hypothesis O4:

*Hypothesis O4. The returns to the target firm shareholders are higher for non-technological M&A conducted by private equity firms than for non-technological M&A conducted by industrial acquirers.*

Industrial acquirers are relatively better positioned than private equity firms to add value to the targets in technological M&A. First, unlike private equity firms, they can provide complementary R&D, production, distribution, and marketing assets to the target's technology and create value through the economies of scale and scope in R&D (Teece, 1986; Puranam et al., 2006; Reve, 2011). Second, the industrial acquirers are less subject to the pressure to improve the short run financial performance, which is detrimental for innovation. This leads to Hypothesis O5.

*Hypothesis O5. The returns to the target firm shareholders are higher for technological M&A conducted by industrial acquirers than for technological M&A conducted by private equity firms.*

## 3.4. Methods

### 3.4.1. Sample

The sample of observations comes from Zephyr database of M&A provided by Bureau van Dijk. It includes transactions from January 1, 1996. I select transactions classified as M&A, acquisitions and institutional buyouts of publicly traded US companies that were announced and completed between January 1, 2000 and December 31, 2012. I require the deal value exceed US$1 million. In addition, I control that the deals in the sample result in gaining controlling interest in the target firm, i.e. the initial equity stake of the acquiring firm is less than 50% and the resulting equity stake is more than 51%. This process yields an initial sample of 2955 deals. Further, I match the dataset with CRSP database to ensure that I have stock price data available for each target for the period of at least 252 trading days before and 10 trading days after the announcement date. This leaves 2147 observations in the effective sample.

Institutional buy-out indicator reported by Zephyr allows me to separate non-industrial acquirers in the sample, leaving 1851 industrial acquirers. Further, I separate investment companies and holdings from other institutional investors by requiring that their two-digit SIC equals 67, and eliminate transactions characterized by Zephyr as "angel investment", "development capital", "venture capital", and "capital increases" to remove non-private equity investors. Finally, I check the business description of each remaining acquirer provided

by Zephyr to ensure that it is a private equity firm. This procedure leaves 186 deals completed by private equity firms.

Further, I distinguish technological and non-technological M&A. Following prior literature, I define technological M&A as acquisitions of high-technology targets with technology being a part of the acquired assets (Ahuja & Katila, 2001; Graebner, 2004; Kapoor & Lim, 2007; Puranam & Srikanth, 2007). I operationalize this definition using the following algorithm.

Firstly, I identify high-technology targets using the two-digit SIC code combinations commonly used for sampling high-technology firms (Kile & Phillips, 2009). These include: 28 (Chemicals and Allied Products), 35 (Industrial Machinery and Equipment), 36 (Communication Equipment), 38 (Instruments and Related Products), 48 (Communications), 73 (Business Services, incl. Computer Programming, Data Processing), 87 (Engineering, Accounting, Research, Management and Related Services).

Secondly, prior research argues that technology manifests in patents, which represent its outcomes (Ahuja & Katila, 2001; Kapoor & Lim, 2007; Makri et al., 2010). Thus, I require that targets in technological M&A have registered at least 1 patent before the announcement date. This requirement is consistent with prior research on technological M&A (Ahuja & Katila, 2001; Puranam et al., 2006; Puranam & Srikanth, 2007) and reflects the requirement that technology be part of the acquired assets. I use Orbis database provided by Bureau van Dijk for tracking the patenting activity of the target firm. I match the data on patents with the sample using the unique target BvD ID numbers common for Zephyr and Orbis databases.

Finally, Ahuja and Katila (2001) recognize that not all technologies are patentable and use news stories associated with the M&A in their sample to check whether some non-patented technology was a part of the acquired assets. I follow a similar approach and check the deal rationales provided by Zephyr database mention “technology”, “R&D”, or “innovation” of the target firm as motivating factors for or components of the acquired assets. Then I classify M&A as technological if the target has a high-technology SIC code and either has some patenting activity before the announcement or technology was reported to be part of the deal motivation or acquired assets.

This procedure leaves 435 technological M&A, 396 of which were conducted by industrial acquirers and 32 by private equity ones. Table 4.1 summarizes the sample distribution by year, acquirer and deal type. There is an increase in the number of acquisitions of publicly traded US companies from 2000 to 2007 followed by a dramatic decline in 2008-2009 related to the “credit crunch”, especially in the number of deals conducted by private equity firms, followed by a moderate corporate control market recovery in 2010-2013.

**TABLE 4.1**

**Sample distribution by year, acquirer type and deal type**

This table presents the time-series distribution of a sample of M&A of publicly traded US companies from Zephyr database. The deals are classified into years based on the announcement date. The classification into industrial and private equity acquirers is based on the deal and acquirer description provided by Zephyr. Deals are classified as technological if the target has the two-digit SIC code of 28 (Chemicals and Allied Products), 35 (Industrial Machinery and Equipment), 36 (Communication Equipment), 38 (Instruments and Related Products), 48 (Communications), 73 (Business Services, incl. Computer Programming, Data Processing), or 87 (Engineering, Accounting, Research, Management and Related Services) and has either registered at least one patent before the announcement date or technology is reported as part of the deal motivation.

| Year | All deals | | Industrial acquirers | | Private equity acquirers | |
|---|---|---|---|---|---|---|
| | Tech | Non-tech | Tech | Non-tech | Tech | Non-tech |
| 2000 | 4 | 44 | 4 | 41 | 0 | 1 |
| 2001 | 40 | 174 | 40 | 159 | 0 | 6 |
| 2002 | 40 | 112 | 39 | 101 | 1 | 7 |
| 2003 | 33 | 149 | 30 | 132 | 1 | 5 |
| 2004 | 25 | 162 | 23 | 144 | 2 | 8 |
| 2005 | 47 | 173 | 41 | 144 | 3 | 14 |
| 2006 | 39 | 184 | 35 | 144 | 4 | 28 |
| 2007 | 43 | 192 | 37 | 142 | 4 | 36 |
| 2008 | 40 | 88 | 39 | 77 | 1 | 7 |
| 2009 | 30 | 93 | 28 | 85 | 2 | 6 |
| 2010 | 39 | 131 | 35 | 106 | 4 | 21 |
| 2011 | 24 | 124 | 17 | 103 | 6 | 11 |
| 2012 | 32 | 85 | 28 | 77 | 4 | 4 |
| Total | 436 | 1711 | 396 | 1455 | 32 | 154 |

### 3.4.2. Measurement

I use cumulative abnormal returns to target shareholders around the deal announcement date to provide evidence on the expected value creation by private equity and industrial acquirers in technological and non-technological M&A. The argument is that acquirers possessing parenting advantages in the forms of higher potential operational improvements and synergies can offer higher bids. An alternative argument can be that higher announcement returns to the target shareholders are associated with overpayment by the acquirer. Thus, I control for variables that are associated with a higher propensity to overpay. I discuss the control variables later in this section.

To construct the variable I use daily return data for each of the acquirers from CRSP. Following the event study methodology (MacKinlay, 1997), I estimate CARs as sums of the market model residuals over a given event window:

$$CAR_i = \sum_{t=\tau}^{T} \left( R_{it} - \left( \hat{\alpha}_i + \hat{\beta}_i R_{mt} \right) \right)$$

where $CAR_i$is the cumulative abnormal return for transaction $i$, event window $t\epsilon[\tau, T]$, $R_{it}$ stands for the acquirer's return for transaction $i$ and day $t$, the term $\left( \hat{\alpha}_i + \hat{\beta}_i R_{mt} \right)$ is the expected return predicted by the market model. I estimate the market model parameters by the OLS regression over the estimation window from trading day – 262 to day – 11 relative to the deal announcement date (0):

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

where $R_{it}$ stands for the acquirer's return for transaction $i$ and day $t$ , $R_{mt}$ is the daily return to the CRSP value-weighted market index. For robustness, I use four event windows (all dates are trading days relative to the announcement date (0)): day - 1 to day + 1, day - 2 to day + 2, day - 5 to day + 5, and day -10 to day +10. Further, I denote CARs corresponding to the event windows listed above as MCAR (-1,1), MCAR (-2,2), MCAR (-5,5) and MCAR (-10,10).

In addition, I use two alternative normal return model specifications: market-adjusted model and Fama-French three factor model. The market adjusted model assumes the intercept of 0 and beta value of 1. Inclusion of these abnormal return measures is aimed to account for biases in the estimated beta coefficients. I denote the market-adjusted model based abnormal returns corresponding to the four event windows as ACAR (-1,1), ACAR (-2,2), ACAR (-5,5) and ACAR (-10,10).

To estimate the parameters of the Fama-French three-factor model, I regressed the daily excess returns from trading day – 262 to day – 11 relative to the deal announcement date (0) on the market, size and book-to-market factors from CRSP:

$$R_{it} - R_{ft} = \alpha_i + \beta_{1i}\left(R_{mt} - R_{ft}\right) + \beta_{2i} SMB_t + \beta_{3i} HML_t + \varepsilon_{it}$$

where $R_{it} - R_{ft}$ stands for the acquirer's excess return for transaction $i$ and day $t$ , $R_{ft}$ is the one-month Treasury bill rate,$\left(R_{mt} - R_{ft}\right)$ is the market factor, $SMB_t$ – size factor, and $HML_t$ – book-to-market factor. I denote the cumulative abnormal returns based on the Fama-French three-factor model as FCAR (-1,1), FCAR (-2,2), FCAR (-5,5) and FCAR (-10,10) corresponding to the event windows from day -1 to day +1, from day -2 to day +2, from day -5 to day +5 and from day -10 to day +10.

## 3.5. Results

### 3.5.1. Target returns by acquirer type

Hypothesis O1 predicts that the cumulative abnormal returns to the target firm shareholders will be higher in M&A conducted by private equity firms than in M&A conducted by industrial acquirers. Table 4.2 displays the averages and medians of cumulative abnormal returns to the target shareholders by the acquirer type as well as the differences between them. This data does not support the prediction.

The means and medians are generally significantly positive for industrial acquirers. The only exception is MCAR (-1,1) which has a not significant negative median. The means and medians are also generally positive and significant for private equity acquirer with the exceptions of MCAR (-1,1), MCAR (-2,2), which are insignificant and negative, and MCAR (-5,5), which has a positive but not significant median. An explanation of not significant values of these measures can be either biases related to the estimation of beta or the inferior ability of the market model to explain the cross-sectional variance in daily stock return series documented in prior studies (Barber & Lyon, 1997).

However, the means and medians of cumulative abnormal returns are generally lower for private equity acquirers. The difference in means is statistically significant for all measures and event windows except for MCAR (-1,1), MCAR (-2,2) and MCAR (-5,5). In terms of size, the differences in means between industrial and private equity acquirers range depending on the chosen event window from 0% to 7.4% for MCARs, 7.2% to 9.2% for ACARs, and from 0.7% to 6.4% for FCARs. This means that differences are also economically significant. This finding is opposite to the prediction of Hypothesis O1 and suggests that industrial acquirers are expected to add more value to the target firms than private equity firms.

Further, I investigate whether the difference in returns is explained by other observable variables. First, I take into account variables that indicate a higher propensity to overpay. Free cash flow hypothesis suggests that managers of public companies having excess cash are more likely to spend it on value-destroying M&A than distribute to the shareholders (Jensen, 1986). Thus, I expect acquirers paying with cash to be more prone to overpay. Hubris hypothesis (Roll, 1986) suggests that managers may overpay because of their inability to correctly valuate the target. It is natural to suggest that the more uncertain the target value is, the more likely it is that the acquirer will not be able to properly valuate the deal. To account for these effects, I use to variables: All cash and Prior 12-month volatility. All cash is a dummy variable that takes the value of 1 for all cash financed M&A. Prior 12-month volatility is the standard deviation of the daily stock returns of the target firm from day -262 to day -11 relative to the announcement day 0. It reflects uncertainty of the target's value.

Consistent with prior literature, I also control for target size, industry-adjusted EBITDA to Assets, leverage, prior 12-month BHAR and beta (Officer et al., 2010). Target size (Size) is measured as the market value of equity of the target firm (from CRSP) on day -11 relative to the announcement date. There is abundant evidence that target size is negatively related to target's returns (Officer et al., 2010).

**TABLE 4.2**

**Target cumulative abnormal returns by acquirer type**

This table displays the means and medians (in brackets) of cumulative abnormal returns to the target shareholders in M&A conducted by industrial and private equity acquirers as well as the differences in means and medians between these two groups. MCARs are sums of the market model residuals over the event windows shown in brackets. ACARs are sums of the market-adjusted model residuals over the event windows shown in brackets. FCARs are sums of the Fama-French three-factor model residuals over the event windows shown in brackets. ***,**,* indicate significance at 1%, 5% and 10% level correspondently. Abnormal returns are presented in %.

| Return measure | Industrial | Private equity | Industrial – Private equity |
|---|---|---|---|
| MCAR (-1,1) | 0.331** | -0.068 | 0.294 |
| | (-0.092) | (-0.358) | (-0.111) |
| MCAR (-2,2) | 0.694*** | -0.002 | 0.696 |
| | (0.066*) | (-0.385) | (0.451) |
| MCAR (-5,5) | 2.098*** | 1.283* | 0.816 |
| | (0.530***) | (0.894) | (-0.365) |
| MCAR (-10,10) | 21.872*** | 14.261*** | 7.611*** |
| | (14.879***) | (13.709***) | (1.170) |
| ACAR (-1,1) | 23.574*** | 16.181*** | 7.392*** |
| | (16.809***) | (10.460***) | (6.348) |
| ACAR (-2,2) | 24.073*** | 16.814*** | 7.259*** |
| | (17.570***) | (10.992***) | (6.578) |
| ACAR (-5,5) | 25.262*** | 18.108*** | 7.154*** |
| | (19.142***) | (15.184***) | (3.958) |
| ACAR (-10,10) | 26.575*** | 17.415*** | 9.160*** |
| | (21.109***) | (14.937***) | (6.172) |
| FCAR (-1,1) | 23.094*** | 16.149*** | 0.695*** |
| | (16.848***) | (10.742***) | (6.106) |
| FCAR (-2,2) | 23.012*** | 16.599*** | 6.413*** |
| | (17.356***) | (10.834***) | (6.523) |
| FCAR (-5,5) | 22.667*** | 17.163*** | 5.504** |
| | (18.535***) | (15.118***) | (3.417) |
| FCAR (-10,10) | 21.616*** | 15.355*** | 6.262** |
| | (19.517***) | (13.549***) | (5.968) |
| Number of observations | 1851 | 186 | |

Industry-adjusted EBITDA to Assets and prior 12-month BHAR are two measures of the target's pre-merger performance which can be correlated with the announcement returns. We can expect a more positive market reaction for M&A announcement for underperforming targets. I calculate industry-adjusted EBITDA to Assets by dividing the targets EBITDA 1 fiscal year prior to announcement (ebitda item in COMPUSTAT) by the average Total Assets 1 fiscal year prior to the announcement (at item in COMPUSTAT) and subtracting the industry-average ratio for the fiscal year preceding the announcement. I use two-digit SIC

codes to identify the industry. I calculate the prior 12-month BHAR as the market-adjusted buy-and-hold target stock return (from CRSP) from day -262 to day -11 relative to the announcement.

The difference in announcement returns can also be explained by the different systematic risk of the targets, which I measure with beta. I estimate the beta using the market model over the window from day -262 to day -11.

Finally, leverage is measured as the ratio of the sum of long-term debt (dltt item in COMPUSTAT) and debt in current liabilities (dlc item) to the common equity (ceq) of the target firm (Duchin & Schmidt, 2013) in the fiscal year preceding the acquisition. Prior literature argues that high leverage serves as an effective monitoring device (Maloney et al., 1993) and a means to align managerial incentives with shareholder value maximization (Jensen, 1986). Thus, managers of the target firms with higher leverage should have stronger incentives to negotiate for the higher bid.

**TABLE 4.3**

**Target and deal characteristics by acquirer type**

This table contains the means and medians (in brackets) of the control variables defined earlier in this section for industrial acquirers, private equity acquirers and differences between them. ***, **, and * indicate significance at 1%, 5% and 10% levels respectively.

| Control variable | Industrial | Private equity | Industrial – Private equity |
|---|---|---|---|
| Size ($ thousands) | 1371056 | 1359679 | 11377 |
| | (202559) | (358419.4) | (-155860.4) |
| Industry-adjusted EBITDA/assets | -0.117 | -0.103 | -0.014 |
| | (-0.018) | (-0.024) | (0.006) |
| Leverage | 0.393 | 0.182 | 0.211* |
| | (0.283) | (0.210) | (0.073) |
| Prior 12-month BHAR | 0.113 | 0.113 | -0.000 |
| | (-0.012) | (0.050) | (-0.062) |
| Prior 12-month return volatility | 0.037 | 0.032 | 0.005*** |
| | (0.030) | (0.024) | (0,006) |
| Beta | 0.600 | 0.546 | 0.054 |
| | (0.501) | (0.502) | (-0.001) |
| All cash | 676 | 107 | |
| % | (36.38) | (56.61) | |
| Number of observations | 1851 | 186 | |

Table 4.3 displays the abovementioned target and deal characteristics split by the acquirer type. The only two significantly different means are in leverage and prior 12-month return volatility. The difference in mean leverage has the positive value of 21% and the difference in mean prior 12-month volatility has the positive value of 0.5%. Hence, both can contribute to the higher returns to the targets in acquisitions conducted by industrial acquirers. Moreover, the significant positive difference in volatility can suggest higher likelihood of overpayment.

To further investigate the impact of these control variables, I regress the twelve return measures on them and the indicator variable Industrial, which takes the value of 1 for industrial acquirers. The results of the regression analysis are summarized in Table 4.4.

All the regressions in Table 4.4, except for those using MCAR (-1; 1) and MCAR (-2;2), are highly significant. The insignificant results for MCAR (-1;1) and MCAR (-2;2) are likely to be driven by the choice of the market model to measure the normal returns. Prior studies show that the three factor Fama-French model that accounts also for the market cap and book-to-market better explains the stock returns (Fama & French, 1992; Barber & Lyon, 1997). Further, as the beta of the target firm becomes more volatile close to the announcement date (Hackbarth & Morellec, 2008), the market-adjusted model, which sets the beta value equal to 1, becomes superior to the market model (McKinlay, 1997). The coefficients on the industrial acquirer indicator variable remain positive and generally significant even after controlling for the method of payment, uncertainty and other target characteristics. Moreover, the coefficients indicate that the difference in returns is economically significant. It ranges from 1% to 12.5% for MCARs, from 11.9% to 14.7% for ACARs and from 11.6% to 14% for FCARs. The signs and significance levels of the control variables are consistent with the predictions and prior literature. This evidence suggests that Hypothesis O1 predicting that private equity firms add more value to the target firm than industrial acquirers must be rejected. Moreover, the difference in the returns to the target firm shareholders is not simply driven by the higher propensity of the industrial acquirers to overpay, but rather parenting advantages.

**TABLE 4.4**

**Multivariate regressions of returns to target shareholders**

This table contains multivariate ordinary least squares regressions of the cumulative abnormal returns to target shareholders to the indicator variable Industrial (takes the value of 1 for industrial acquirers and 0 for private equity ones), Cash (takes the value of 1 for all cash financed M&A), Size (target size measured as the market cap on day -11 in $ thousands), Ind.-adjusted EBITDA to Assets (measured as the ratio of the target's EBITDA to average Total Assets in fiscal year -1 and normalized by industry-average value based on two-digit SIC codes), Leverage (measured as the ratio of the sum of the long-term debt and debt in current liabilities to the common equity of the target firm in fiscal year -1), Prior 12-month BHAR (buy-and-hold market adjusted returns of the target firm from day-262 to day -11), Prior 12-month volatility (standard deviation of the daily target stock returns from day -262 to day -11), Beta (estimated by the market model from day -262 to day -11). Standard errors are heteroskedasticity-consistent. t-statistics are in brackets. ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.

| | MCAR (-1;1) | MCAR (-2;2) | MCAR (-5;5) | MCAR (-10;10) | ACAR (-1;1) | ACAR (-2;2) | ACAR (-5;5) | ACAR (-10;10) | FCAR (-1;1) | FCAR (-2;2) | FCAR (-5;5) | FCAR (-10;10) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Const | -0.009 | -0.009 | -0.006 | -0.042 | 0.041 | 0.047 | 0.049 | 0.024 | 0.035 | 0.039 | 0.029 | -0.018 |
| | (-1.198) | (-0.975) | (-0.405) | (-1.109) | (1.426) | (1.616) | (1.640) | (0.736) | (1.156) | (1.247) | (0.769) | (-0.328) |
| Industrial | 0.010 | 0.014 | 0.015 | 0.125*** | 0.124*** | 0.119*** | 0.122*** | 0.147*** | 0.124*** | 0.116*** | 0.118*** | 0.140*** |
| | (1.388) | (1.591) | (1.243) | (5.437) | (5.649) | (5.337) | (5.638) | (6.684) | (5.530) | (4.999) | (4.584) | (3.831) |
| Cash | 0.004 | 0.002 | 0.009 | 0.114*** | 0.109*** | 0.105*** | 0.104*** | 0,105*** | 0.121*** | 0.125*** | 0.148*** | 0.190*** |
| | (1.069) | (0.486) | (1.125) | (5.485) | (5.718) | (5.495) | (5.323) | (5.156) | (5.769) | (5.203) | (4.035) | (3.058) |
| Size | 0.000 | 0.000 | 0.000 | 0.000 | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** |
| | (0.630) | (0.613) | (-0.304) | (-0.332) | (-2.719) | (-3.108) | (-3.194) | (-2.574) | (-2.698) | (-3.101) | (-3.008) | (-1.546) |
| Ind.-adj. EBITDA to Assets | -0.004 | 0.003 | -0.023 | -0.036 | -0.025 | -0.030 | -0.059* | -0.049 | -0.048 | -0.068 | -0.130* | -0.196 |
| | (-0.345) | (0.356) | (-0.861) | (-1.000) | (-0.578) | (-0.705) | (-1.715) | (-1.424) | (-0.913) | (-1.139) | (-1.677) | (-1.493) |
| Leverage | -0.001 | -0.002 | -0.005 | -0.004 | -0.002 | -0.003 | -0.002 | -0.003 | 0.005 | 0.008 | 0.021 | 0.038 |
| | (-0.552) | (-0.829) | (-1.013) | (-0.451) | (-0.237) | (-0.349) | (-0.215) | (-0.359) | (0.434) | (0.646) | (1.064) | (1.165) |
| Prior 12-m BHAR | 0.002 | 0.001 | -0.004 | -0.032*** | -0.018*** | -0.020*** | -0.020*** | -0.016** | -0.022** | -0.026** | -0.032** | -0.040** |
| | (1.604) | (0.657) | (-1.876) | (-3.568) | (-2.815) | (-2.785) | (-2.686) | (-2.251) | (-2.496) | (-2.472) | (-2.230) | (-1.976) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Prior 12-m volatility | 0.016 | 0.069 | 0.283 | 3.101** | 1.242** | 1.353** | 1.584** | 2.065*** | 1.133* | 1.127* | 1.079 | 1.068 |
| | (0.109) | (0.375) | (0.910) | (3.286) | (2.272) | (2.400) | (2.494) | (2.863) | (1.914) | (1.767) | (1.301) | (0.892) |
| Beta | 0.001 | -0.002 | -0.001 | 0.011 | 0.016 | 0.018 | 0.012 | 0.007 | 0.006 | 0.002 | -0.021 | -0.051 |
| | (0.278) | (-0.421) | (-0.129) | (0.647) | (1.119) | (1.313) | (0.804) | (0.453) | (0.356) | (0.124) | (-0.683) | (-0.950) |
| N | 1318 | 1318 | 1318 | 1318 | 1314 | 1312 | 1312 | 1310 | 1314 | 1312 | 1312 | 1310 |
| $R^2$ | 0.007 | 0.004 | 0.016 | 0.109 | 0.066 | 0.069 | 0.074 | 0.078 | 0.056 | 0.045 | 0.026 | 0.014 |
| Adj. $R^2$ | 0.001 | -0.002 | 0.010 | 0.104 | 0.060 | 0.064 | 0.069 | 0.072 | 0.050 | 0.039 | 0.020 | 0.008 |
| F-stat | 1.081 | 0.633 | 2.680 | 20.104 | 11.531 | 12.118 | 13.064 | 13.678 | 9.615 | 7.694 | 4.266 | 2.316 |
| P(F-stat) | 0.374 | 0.750 | 0.006 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.018 |

### 3.5.2. Target returns by acquirer and deal type

In this sub-section I proceed further to the analysis of the expected value-creation by industrial and private equity acquirers in technological and non-technological M&A. As before, I use the twelve cumulative abnormal returns measures for the purpose.

Table 4.5 displays the means and medians of MCARs, ACARs and FCARs for the four categories of M&A: technological M&A conducted by industrial acquirers, non-technological M&A conducted by industrial acquirers, technological M&A conducted by private equity acquirers and non-technological M&A conducted by private equity acquirers. It also reports differences in means and medians between these categories.

The average and median values of the cumulative abnormal returns to target shareholders are generally positive and significant for technological M&A conducted by industrial acquirers. The only exception is MCAR (-1,1) with a not significant positive mean of 0.5% and a not significant negative median of -0.08%. They are also economically significant with mean MCARs ranging from 0.5% to 31% across event windows, mean ACARs – from 33.1% to 37.5%, and mean FCARs - from 27.4% to 32.7%.

We observe the same pattern for non-technological M&A conducted by industrial acquirers.

**TABLE 4.5**

**Target cumulative abnormal returns by acquirer and deal type**

This table displays the means and medians (in brackets) of cumulative abnormal returns to the target shareholders in four categories of M&A: technological M&A conducted by industrial acquirers, non-technological M&A conducted by industrial acquirers, technological M&A conducted by private equity acquirers and non-technological M&A conducted by private equity acquirers. It also reports differences in means and medians between these categories. MCARs are sums of the market model residuals over the event windows shown in brackets. ACARs are sums of the market-adjusted model residuals over the event windows shown in brackets. FCARs are sums of the Fama-French three-factor model residuals over the event windows shown in brackets. ***,**,* indicate significance at 1%, 5% and 10% level correspondently. Abnormal returns are presented in %.

| Return measure | Ind Tech | Ind Non-tech | PE Tech | PE Non-tech | Ind Tech – Ind Non-tech | PE Tech – PE Non-tech | Ind Tech – PE Tech | Ind Non-tech – PE Non-tech |
|---|---|---|---|---|---|---|---|---|
| MCAR (-1,1) | 0.585 | 0.262 | 0.136 | -0.110 | 0.324 | 0.246 | 0.449 | 0.371 |
| | (-0.077) | (-0.095) | (0.218) | (-0.520) | (0.018) | (0.738) | (-0.295) | (0.425) |
| MCAR (-2,2) | 1.480*** | 0.481** | 0.694 | -0.144 | 0.999* | 0.838 | 0.786 | 0.625 |
| | (0.594**) | (0.010) | (0.187) | (-0.677) | (0.584) | (0.865) | (0.406) | (0.687) |
| MCAR (-5,5) | 3.288*** | 1.776*** | 2.571 | 1.020 | 2.199* | 1.552 | 0.717 | 0.756 |
| | (1.483***) | (0.349***) | (1.970**) | (0.502) | (1.135) | (1.468) | (-0.487) | -0.154 |
| MCAR (-10,10) | 31.080*** | 19.377*** | 13.239*** | 14.469*** | 11.703*** | -1.230 | 17.841*** | 4.908*** |
| | (23.416***) | (13.056***) | (5.883***) | (14.806***) | (10.360) | (14.806) | (17.533) | (-1.751) |
| ACAR (-1,1) | 33.117*** | 21.001*** | 12.879*** | 16.859*** | 12.116*** | -3.980 | 20.239*** | 4.142** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (23.492***) | (15.222***) | (5.521***) | (11.435***) | (8.271) | (-5.914) | (17.972) | (3.787) |
| ACAR (-2,2) | 33.482*** | 21.540*** | 13.541*** | 17.485*** | 11.941*** | -3.944 | 19.940*** | 4.055** |
| | (23.991***) | (15.826***) | (6.922***) | (11.592***) | (8.166) | (-4.671) | (17.070) | (4.234) |
| ACAR (-5,5) | 35.278*** | 22.564*** | 13.809*** | 19.001*** | 12.714*** | -5.193 | 21.469*** | 3.562* |
| | (0.2668***) | (17.375***) | (7.910***) | (15.503***) | (9.305) | (-7.593) | (18.771) | (1.873) |
| ACAR (-10,10) | 37.485*** | 23.623*** | 11.950*** | 18.558*** | 13.863*** | -6.608* | 25.536*** | 5.065*** |
| | (28.934***) | (18.369***) | (11.601***) | (15.677***) | (10.566) | (-4.077) | (17.333) | (2.691) |
| FCAR (-1,1) | 32.171*** | 20.615*** | 12.745*** | 16.844*** | 11.556*** | -4.099 | 19.426*** | 3.771** |
| | (23.821***) | (15.007***) | (6.598***) | (11.676***) | (8.814) | (-5.078) | (17.223) | (3.331) |
| FCAR (-2,2) | 31.375*** | 20.730*** | 14.048*** | 17.119*** | 10.645*** | -3.071 | 17.328*** | 3.611* |
| | (23.675***) | (15.613***) | (6.838***) | (11.390***) | (8.062) | (-4.552) | (16.837) | (4.223) |
| FCAR (-5,5) | 30.242*** | 20.598*** | 13.848*** | 17.848*** | 9.645* | -4.000 | 16.394** | 2.750 |
| | (26.790***) | (16.530***) | (7.838***) | (15.757***) | (10.260) | (-7.919) | (18.952) | (0.773) |
| FCAR (-10,10) | 27.381*** | 20.036*** | 11.165*** | 16.226*** | 7.345 | -5.062 | 16.216 | 3.810 |
| | (27.741***) | (16.987***) | (9.298***) | (14.047***) | (10.754) | (-4.749) | (18.443) | (2.940) |

However, the mean and median values are lower in this category. Particularly, the mean MCARs range from 0.3% to 19.4% across the four event windows, the mean ACARs – from 21% to 23.6%, and the mean FCARs – from 20% to 20.7%. Further, Table 4.5 shows that these positive differences in means between the two categories are generally significant. The two exceptions are MCAR (-1,1) and FCAR (-10,10). This evidence indicates that industrial acquirers are expected to add more value to the target firms in technological M&A than in non-technological M&A and thus supports Hypothesis O3.

The means and medians of the cumulative abnormal return measures are all positive and generally significant for technological M&A conducted by private equity firms. Exceptions are MCAR (-1,1), MCAR (-2,2) and MCAR (-5,5) which have not significant positive means and medians. The values are also economically significant. The mean values range from 0.1% to 13.2% for MCARs, from 11.9% to 13.8% for ACARs and from 11.2% to 14% for FCARs. However, they are generally economically and significantly lower than means for technological M&A conducted by industrial acquirers, which supports Hypothesis O5.

The means and medians of the cumulative abnormal returns in non-technological acquisitions conducted by private equity firms are generally significantly positive. The exceptions are mean and median values of MCAR (-1,1) and MCAR (-2,2) which are not significantly negative and MCAR (-5,5) which are not significantly positive. The mean values range from -0.1% to 14.5% for MCARs, from 16.9% to 19% for ACARs, and from 16.2% to 17.8% for FCARs. The differences between the means for technological and non-technological M&A conducted by private equity firms are not significant and generally negative. Only the differences in the mean MCAR (-1,1), MCAR (-2,2) and MCAR (-5,5) are positive. Thus, the signs of the differences are generally consistent with Hypothesis O2. The differences in means between non-technological M&A conducted by industrial and private equity firms are all positive and significant for MCAR (-10,10), ACAR (-1,1), ACAR (-2,2), ACAR (-5,5), ACAR (-10,10), FCAR (-1,1) and FCAR (-2,2). This is inconsistent with Hypothesis O4.

As in the previous sub-section, I further investigate whether the differences in return measures are driven by the method of payment, uncertainty and other target characteristics identified earlier. Table 4.6 reports the target and deal characteristics and their differences across the four categories of interest.

There are significant negative differences between technological and non-technological M&A conducted by industrial acquirers in the mean target size (-979872 $ thousand), industry-adjusted EBITDA to assets (-0.2), leverage (-0.33) and prior 12-month BHAR (-0.15).

**TABLE 4.6**

**Target and deal characteristics by acquirer and deal type**

This table contains the means and medians (in brackets) of the control variables defined earlier in this section for four categories of M&A: technological M&A conducted by industrial acquirers, non-technological M&A conducted by industrial acquirers, technological M&A conducted by private equity acquirers and non-technological M&A conducted by private equity acquirers. It also reports differences in means and medians between these categories. ***, **, and * indicate significance at 1%, 5% and 10% levels respectively.

| Control variable | Ind Tech | Ind Non-tech | PE Tech | PE Non-tech | Ind Tech – Ind Non-tech | PE Tech – PE Non-tech | Ind Tech – PE Tech | Ind Non-tech – PE Non-tech |
|---|---|---|---|---|---|---|---|---|
| Size ($ thousands) | 599585.9 | 1579457 | 894136 | 1459661 | -979872*** | -565525 | -294550.1 | 119796 |
| | (151371.5) | (225735) | (324113) | (358419) | (-74363.5) | (-34306) | (-172741.5) | (-132684) |
| Ind.-adj. EBITDA/Assets | -0.268 | -0.067 | -0.368 | -0.028 | -0.201*** | -0.340 | 0.100 | -0.038 |
| | (-0.120) | (-0.009) | (-0.073) | (-0.003) | (-0.111) | (-0.070) | (-0.047) | (-0.006) |
| Leverage | 0.143 | 0.472 | 0.278 | 0.302 | -0.329*** | -0.024 | -0.135 | 0.170 |
| | (0.009) | (0.403) | (0.210) | (0.307) | (-0.393) | (-0.097) | (-0.201) | (0.095) |
| Prior 12-m BHAR | -0.005 | 0.146 | 0.017 | 0.133 | -0.151* | -0.116 | -0.022 | 0.013 |
| | (-0.173) | (0.018) | (0.032) | (0.058) | (-0.191) | (-0.026) | (-0.206) | (-0.041) |
| Prior 12-m volatility | 0.048 | 0.035 | 0.036 | 0.031 | 0.013*** | 0.031 | 0.011** | 0.003* |
| | (0.040) | (0.028) | (0.028) | (0.023) | (0.013) | (0.005) | (0.012) | (0.005) |
| Beta | 0.819 | 0.540 | 0.558 | 0.544 | 0.279*** | 0.014 | 0.262 | -0.004 |
| | (0.775) | (0.424) | (0.521) | (0.483) | (0.351) | (0.038) | (0.255) | (-0.059) |
| All cash | 204 | 472 | 26 | 81 | | | | |
| % | (51.52) | (32.28) | (81.25) | (51.59) | | | | |
| N | 396 | 1462 | 32 | 157 | | | | |

There are also significant positive differences between technological and non-technological M&A conducted by industrial acquirers in the mean prior 12-month volatility (0.013) and beta (0.28). All of these, except for the difference in leverage, can potentially explain the observed positive differences in mean returns.

In addition, there are significant positive differences in the mean prior 12-month volatility between technological M&A conducted by industrial and private equity firms (0.01) and between non-technological M&A conducted by industrial and private equity firms (0.003). These can lead to positive differences in the mean returns.

To further examine whether the differences in the mean returns between the four M&A categories are explained by differences in some other variables I do multiple regression analysis. The return measures discussed earlier are the dependent variables in the OLS regressions. The dummy variables Industrial Tech (takes the value of 1 for technological M&A conducted by industrial acquirers), PE Tech ( takes the value of 1 for technological M&A conducted by private equity firms) and PE Non-tech ( takes the value of 1 for non-technological M&A conducted by private equity firms) are the three independent variables that identify the four categories of interest. The other explanatory/control variables were discussed earlier. Finally, I use heterskedasticity-consistent standard errors.

Table 4.7 displays the results of the multiple regression analysis where the non-technological M&A by industrial acquirers are the omitted category represented by the intercept. This model specification allows testing Hypothesis O3 and O4 and controlling for alternative explanations. All the regression models presented in the table, except for those where the dependent variables are MCAR (-1;1) and MCAR (-2; 2), are highly significant. The finding of non-significant regression models for MCAR (-1;1) and MCAR (-2; 2) are consistent with the results presented in Table 4.4 and are likely to be explained by the shortcomings of the use of the market model discussed earlier.

Hypothesis O3 predicts that the coefficient for the Industrial Tech dummy variable is positive, which shows higher average cumulative abnormal returns to the target firm shareholders in technological M&A conducted by industrial acquirers than in non-technological M&A conducted by industrial acquirers. Table 4.7 shows that this coefficient is positive for all definitions of the average cumulative abnormal returns, except for FCAR (-5;5) and FCAR (-10;10), but not statistically significant. Thus, the data provides only partial support to Hypothesis O3, and the results are sensitive to the chosen normal return model and event window.

Hypothesis O4 predicts that the coefficient for the PE Non-tech dummy variable is positive. But the regression analysis presented in Table 4.7 shows that it is significantly negative for all the specifications of the average cumulative abnormal returns, except for the models with the dependent variables MCAR (-1;1), MCAR (-2;2) and MCAR (-5;5) where it is not significant. Hence, Hypothesis O4 should be rejected. This shows that private equity firms generally pay significantly less for non-technological targets than industrial acquirers. But this is not explained solely by the lower propensity of the private equity firms to overpay as the agency theory-based literature suggests. This evidence indicates that industrial

acquirers are expected to add more value to the target firms than the private equity ones in non-technological M&A.

It is also worth noting that the coefficients for the PE Tech variable are generally negative and highly significant. The exceptions are the regressions using the market model as the normal return model with the event windows from -5 days to +5 days, -2 days to +2 days and -1 day to +1 day., where these coefficients are not significant. These results suggest that industrial acquirers in non-technological M&A are expected to add more value to the target firm than private equity firms in technological M&A.

**TABLE 4.7**

**Multivariate regressions of returns to target shareholders**

This table contains multivariate ordinary least squares regressions of the cumulative abnormal returns to target shareholders to the indicator variables Industrial Tech, PE Tech, PE Non-tech (defined earlier), Cash (takes the value of 1 for all cash financed M&A), Size (target size measured as the market cap on day -11 in $ thousands), Ind.-adjusted EBITDA to Assets (measured as the ratio of the target's EBITDA to average Total Assets in fiscal year -1 and normalized by industry-average value based on two-digit SIC codes), Leverage (measured as the ratio of the sum of the long-term debt and debt in current liabilities to the common equity of the target firm in fiscal year -1), Prior 12-month BHAR (buy-and-hold market adjusted returns of the target firm from day-262 to day -11), Prior 12-month volatility (standard deviation of the daily target stock returns from day -262 to day -11), Beta (estimated by the market model from day -262 to day -11). The omitted category is industrial non-technological M&A Standard errors are heteroskedasticity-consistent. t-statistics are in brackets. ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.

| | MCAR (-1;1) | MCAR (-2;2) | MCAR (-5;5) | MCAR (-10;10) | ACAR (-1;1) | ACAR (-2;2) | ACAR (-5;5) | ACAR (-10;10) | FCAR (-1;1) | FCAR (-2;2) | FCAR (-5;5) | FCAR (-10;10) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Const | 0.001 | 0.003 | 0.008 | 0.079*** | 0.161*** | 0.163*** | 0.167*** | 0.165*** | 0.155*** | 0.155*** | 0.149*** | 0.130** |
| | (0.201) | (0.534) | (0.839) | (2.572) | (8.153) | (8.083) | (7.722) | (6.875) | (7.229) | (6.539) | (4.499) | (2.460) |
| Industrial Tech | 0.004 | 0.012* | 0.008 | 0.040 | 0.042 | 0.034 | 0.041 | 0.055** | 0.026 | 0.007 | -0.020 | -0.069 |
| | (0.606) | (1.710) | (0.736) | (1.443) | (1.644) | (1.344) | (1.642) | (2.057) | (0.763) | (0.159) | (-0.235) | (-0.445) |
| PE Tech | -0.008 | 0.003 | -0.010 | -0.166*** | -0.165*** | -0.166*** | -0.182*** | -0.215*** | -0.177*** | -0.174*** | -0.203*** | -0.262*** |
| | (-0.634) | (0.178) | (-0.353) | (-3.929) | (-4.207) | (-4.135) | (-4.783) | (-5.722) | (-4.156) | (-3.729) | (-3.412) | (-2.837) |
| PE Non-tech | -0.010 | -0.014 | -0.013 | -0.099*** | -0.098*** | -0.093*** | -0.090*** | -0.108*** | -0.099*** | -0.097*** | -0.100*** | -0.130*** |
| | (-1.168) | (-1.484) | (-1.060) | (-3.836) | (-3.927) | (-3.697) | (-3.692) | (-4.340) | (-3.910) | (-3.605) | (-3.154) | (-2.817) |
| Cash | 0.004 | 0.001 | 0.008 | 0.110*** | 0.105*** | 0.102*** | 0.100*** | 0.100*** | 0.119*** | 0.125*** | 0.152*** | 0.199*** |
| | (0.984) | (0.191) | (0.992) | (5.248) | (5.383) | (5.211) | (5.060) | (4.818) | (5.326) | (4.706) | (3.502) | (2.611) |
| Size | 0.000 | 0.000 | 0.000 | 0.000 | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000* |
| | (0.644) | (0.658) | (-0.254) | (-0.253) | (-2.639) | (-3.041) | (-3.103) | (-2.479) | (-2.647) | (-3.090) | (-3.062) | (-1.701) |
| Ind.-adj. EBITDA to Assets | -0.003 | 0.007 | -0.021 | -0.029 | -0.018 | -0.026 | -0.053 | -0.041 | -0.045 | -0.070 | -0.139 | -0.218 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (-0.261) | (0.690) | (-0.745) | (-0.788) | (-0.432) | (-0.600) | (-1.616) | (-1.216) | (-0.833) | (-1.069) | (-1.486) | (-1.328) |
| Leverage | -0.001 | -0.002 | -0.004 | -0.003 | -0.001 | -0.002 | -0.001 | -0.002 | 0.005 | 0.007 | 0.019 | 0.035 |
| | (-0.485) | (-0.621) | (-0.935) | (-0.350) | (-0.139) | (-0.288) | (-0.141) | (-0.252) | (0.472) | (0.636) | (1.025) | (1.107) |
| Prior 12-m BHAR | 0.002 | 0.001 | -0.004* | -0.032*** | -0.018*** | -0.020*** | -0.019*** | -0.015** | -0.021** | -0.026** | -0.033** | -0.041* |
| | (1.627) | (0.767) | (-1.801) | (-3.499) | (-2.726) | (-2.718) | (-2.605) | (-2.139) | (-2.445) | (-2.446) | (-2.213) | (-1.926) |
| Prior 12-m volatility | 0.011 | 0.055 | 0.272 | 3.035*** | 1.175** | 1.295** | 1.513** | 1.973** | 1.085* | 1.106* | 1.091 | 1.142 |
| | (0.076) | (0.298) | (0.868) | (3.236) | (2.167) | (2.315) | (2.379) | (2.738) | (1.864) | (1.782) | (1.405) | (1.054) |
| Beta | 0.001 | -0.003 | -0.001 | 0.009 | 0.013 | 0.017 | 0.009 | 0.004 | 0.004 | 0.002 | -0.020 | -0.047 |
| | (0.215) | (-0.574) | (-0.198) | (0.515) | (0.955) | (1.174) | (0.650) | (0.261) | (0.281) | (0.118) | (-0.715) | (-1.000) |
| N | 1318 | 1318 | 1318 | 1318 | 1314 | 1312 | 1312 | 1310 | 1314 | 1312 | 1312 | 1310 |
| $R^2$ | 0.007 | 0.007 | 0.017 | 0.112 | 0.069 | 0.072 | 0.078 | 0.083 | 0.057 | 0.046 | 0.026 | 0.015 |
| $Adj.R^2$ | -0.001 | -0.000 | 0.009 | 0.105 | 0.062 | 0.065 | 0.071 | 0.076 | 0.050 | 0.038 | 0.018 | 0.007 |
| F-stat | 0.911 | 0.957 | 2.226 | 16.458 | 9.700 | 10.058 | 10.987 | 11.742 | 7.893 | 6.218 | 3.461 | 1.926 |
| P(F-stat) | 0.522 | 0.479 | 0.014 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.038 |

Table 4.8 displays the results of the multiple regression analysis where the technological M&A by private equity firms are the omitted category represented by the intercept. Consequently, I substitute the dummy variable PE Tech with the dummy variable Industrial Non-tech, which takes the value of 1 for non-technological M&A conducted by industrial companies. This model specification allows testing Hypothesis O2 and O5 and controlling for alternative explanations. All the regression models presented in the table, except for those where the dependent variables are MCAR (-1;1) and MCAR (-2; 2), are highly significant. The finding of non-significant regression models for MCAR (-1;1) and MCAR (-2; 2) are consistent with the results presented in Table 4.4 and Table 4.7 and are likely to be explained by the shortcomings of the use of the market model discussed earlier.

Hypothesis O2 predicts that the coefficient for the PE Non-tech dummy variable is positive, which shows higher average cumulative abnormal returns to the target firm shareholders in non-technological M&A conducted by private equity firms than in technological M&A conducted by private equity acquirers. Table 4.8 shows that this coefficient is positive for all definitions of the average cumulative abnormal returns, except for MCAR (-1;1), MCAR (-2;2), and MCAR (-5;5), and generally statistically significant. Thus, the data generally supports to Hypothesis O2 suggesting that private equity acquirers are better positioned to add value to non-technological targets. However, the significance of the results depends on the chosen normal return model and event window.

Hypothesis O5 predicts that the coefficient for the Industrial Tech dummy variable is positive. Consistently, Table 4.8 shows that it is positive for all the specifications of the average cumulative abnormal returns and generally significant at 1% level, except for the models with the dependent variables MCAR (-1;1), MCAR (-2;2) and MCAR (-5;5) where it is positive but not significant as well as FCAR(-10;10) where it is significant at 5% level. Hence, Hypothesis O5 predicting that industrial acquirers are expected to add more value to the target firms in technological M&A that private equity acquirers is strongly supported. Moreover, the finding is robust to control variables, alternative normal return models and event windows.

For completeness, it is also interesting to look at the coefficient for the Industrial Non-tech variable. It is generally positive and highly significant. The exceptions are the non-significant coefficients for the regressions using the market model and short event windows, which are most likely to be driven by the imperfections of the average cumulative abnormal returns based on the market model. These results further support the argument that private equity firms face substantial disadvantages in technological M&A.

**TABLE 4.8**

**Multivariate regressions of returns to target shareholders**

This table contains multivariate ordinary least squares regressions of the cumulative abnormal returns to target shareholders to the indicator variables Industrial Tech, PE Tech, PE Non-tech (defined earlier), Cash (takes the value of 1 for all cash financed M&A), Size (target size measured as the market cap on day -11 in $ thousands), Ind.-adjusted EBITDA to Assets (measured as the ratio of the target's EBITDA to average Total Assets in fiscal year -1 and normalized by industry-average value based on two-digit SIC codes), Leverage (measured as the ratio of the sum of the long-term debt and debt in current liabilities to the common equity of the target firm in fiscal year -1), Prior 12-month BHAR (buy-and-hold market adjusted returns of the target firm from day-262 to day -11), Prior 12-month volatility (standard deviation of the daily target stock returns from day -262 to day -11), Beta (estimated by the market model from day -262 to day -11). The omitted category is technological M&A conducted by private equity firms. Standard errors are heteroskedasticity-consistent. t-statistics are in brackets. ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.

| | MCAR (-1;1) | MCAR (-2;2) | MCAR (-5;5) | MCAR (-10;10) | ACAR (-1;1) | ACAR (-2;2) | ACAR (-5;5) | ACAR (-10;10) | FCAR (-1;1) | FCAR (-2;2) | FCAR (-5;5) | FCAR (-10;10) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Const | -0.007 | 0.006 | -0.001 | -0.087* | -0.004 | -0.003 | -0.015 | -0.050 | -0.021 | -0.019 | -0.054 | -0.133 |
| | (-0.529) | (0.361) | (-0.052) | (-1.722) | (-0.089) | (-0.067) | (-0.350) | (-1.147) | (-0.462) | (-0.395) | (-0.907) | (-1.537) |
| Industrial Tech | 0.012 | 0.009 | 0.018 | 0.205*** | 0.206*** | 0.200*** | 0.223*** | 0.269*** | 0.203*** | 0.181*** | 0.184*** | 0.194** |
| | (0.796) | (0.520) | (0.622) | (4.480) | (4.764) | (4.543) | (5.277) | (6.561) | (4.329) | (3.594) | (2.857) | (1.996) |
| Industrial Non-Tech | 0.008 | -0.003 | 0.010 | 0.166*** | 0.165*** | 0.166*** | 0.182*** | 0.215*** | 0.177*** | 0.174*** | 0.203*** | 0.262*** |
| | (0.634) | (-0.178) | (0.353) | (3.929) | (4.207) | (4.135) | (4.783) | (5.722) | (4.156) | (3.729) | (3.412) | (2.837) |
| PE Non-Tech | -0.001 | -0.017 | -0.004 | 0.066 | 0.067 | 0.073* | 0.092** | 0.107*** | 0.078* | 0.077 | 0.103* | 0.133 |
| | (-0.085) | (-0.940) | (-0.124) | (1.447) | (1.552) | (1.639) | (2.222) | (2.595) | (1.704) | (1.570) | (1.785) | (1.572) |
| Cash | 0.004 | 0.001 | 0.008 | 0.110*** | 0.105*** | 0.102*** | 0.100*** | 0.100*** | 0.119*** | 0.125*** | 0.152*** | 0.199*** |
| | (0.984) | (0.191) | (0.992) | (5.248) | (5.383) | (5.211) | (5.060) | (4.818) | (5.326) | (4.706) | (3.502) | (2.611) |
| Size | 0.000 | 0.000 | 0.000 | 0.000 | 0.000*** | 0.000*** | 0.000*** | 0.000** | 0.000*** | 0.000*** | 0.000*** | 0.000* |
| | (0.644) | (0.658) | (-0.254) | (-0.253) | (-2.639) | (-3.041) | (-3.103) | (-2.479) | (-2.647) | (-3.090) | (-3.062) | (-1.701) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ind.-adj. EBITDA to Assets | -0.003 | 0.007 | -0.021 | -0.029 | -0.018 | -0.026 | -0.053 | -0.041 | -0.045 | -0.070 | -0.139 | -0.218 |
| | (-0.261) | (0.690) | (-0.745) | (-0.788) | (-0.432) | (-0.600) | (-1.616) | (-1.216) | (-0.833) | (-1.069) | (-1.486) | (-1.328) |
| Leverage | -0.001 | -0.002 | -0.004 | -0.003 | -0.001 | -0.002 | -0.001 | -0.002 | 0.005 | 0.007 | 0.019 | 0.035 |
| | (-0.485) | (-0.621) | (-0.935) | (-0.350) | (-0.139) | (-0.288) | (-0.141) | (-0.252) | (0.472) | (0.636) | (1.025) | (1.107) |
| Prior 12-m BHAR | 0.002 | 0.001 | -0.004* | -0.032*** | -0.018*** | -0.020*** | -0.019*** | -0.015** | -0.021** | -0.026** | -0.033** | -0.041* |
| | (1.627) | (0.767) | (-1.801) | (-3.499) | (-2.726) | (-2.718) | (-2.605) | (-2.139) | (-2.445) | (-2.446) | (-2.213) | (-1.926) |
| Prior 12-m volatility | 0.011 | 0.055 | 0.272 | 3.035*** | 1.175** | 1.295** | 1.513** | 1.973*** | 1.085* | 1.106* | 1.091 | 1.142 |
| | (0.076) | (0.298) | (0.868) | (3.236) | (2.167) | (2.315) | (2.379) | (2.738) | (1.864) | (1.782) | (1.405) | (1.054) |
| Beta | 0.001 | -0.003 | -0.001 | 0.009 | 0.013 | 0.017 | 0.009 | 0.004 | 0.004 | 0.002 | -0.020 | -0.047 |
| | (0.215) | (-0.574) | (-0.198) | (0.515) | (0.955) | (1.174) | (0.650) | (0.261) | (0.281) | (0.118) | (-0.715) | (-1.000) |
| N | 1314 | 1312 | 1312 | 1310 | 1314 | 1312 | 1312 | 1310 | 1314 | 1312 | 1312 | 1310 |
| $R^2$ | 0.007 | 0.007 | 0.017 | 0.112 | 0.069 | 0.072 | 0.078 | 0.083 | 0.057 | 0.046 | 0.026 | 0.015 |
| $Adj.R^2$ | -0.001 | -0.000 | 0.009 | 0.105 | 0.062 | 0.065 | 0.071 | 0.076 | 0.050 | 0.038 | 0.018 | 0.007 |
| F-stat | 0.911 | 0.957 | 2.226 | 16.458 | 9.700 | 10.058 | 10.987 | 11.742 | 7.893 | 6.218 | 3.461 | 1.926 |
| P(F-stat) | 0.522 | 0.479 | 0.014 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.038 |

## 3.6. Discussion and conclusions

In this study, I analyzed the role of ownership in value creation in M&A, both in general and when distinguishing technological and non-technological M&A in particular. Doing this I considered two types of acquirers - industrial firms and private equity firms – as new parents for the target company. While the agency theory predicts that private equity firms are superior parents for the target firm relative to industrial acquirers in general, I argued that restructuring undertaken and performance incentives created by private equity partnerships have higher potential to add value in non-technological M&A. By contrast, adding value to the acquired technology requires access to complementary assets, willingness to take risk and longer-term R&D investments, which are inconsistent with the investment strategy and assets available to private equity firms and make them inferior acquirers in technological M&A relative to industrial companies.

The results show that the target firm shareholders earn significantly higher returns in M&A conducted by industrial acquirers than in M&A where the acquirer is a private equity firm. This finding does not support the argument that industrial acquirers add on average less value to the target than private equity firms. It is highly unlikely to be driven solely by the propensity of the managers of the industrial companies with excess free cash flow to overpay in M&A as the differences in the abnormal returns remain significantly positive when we control for all-cash deals. The results are also robust to controls for the target's pre-merger performance and uncertainty. The evidence indicates that the synergies expected by industrial acquirers justify the higher price paid for the target firm.

The finding of generally highly significant positive differences between the average cumulative abnormal announcement returns to the target firm shareholders in technological M&A conducted by industrial acquirers and those in technological M&A conducted by private equity firms provides a strong empirical support for the argument that private equity firms are relatively worse positioned to add value to high-technology target firms. The finding holds when controlling for all cash deals where industrial acquirers avoid the scrutiny of the stock market and thus are more likely to overpay. The finding of the generally significant positive differences between the average cumulative abnormal announcement returns to the target firm shareholders in non-technological M&A conducted by private equity firms and those in technological M&A conducted by private equity firms further supports the argument by indicating that the difference in abnormal returns in technological M&A by industrial and private equity firms is unlikely to be driven by the superior ability of the latter to negotiate lower deal prices. In addition, the analysis shows that private equity firms add generally significantly less value to the target firm in technological M&A than industrial acquirers do in non-technological M&A. This additional evidence is also consistent with the argument that private equity firms are not positioned well to add value in technological M&A.

The generally significant positive differences between the abnormal returns to the target firm shareholders in non-technological M&A by private equity firms and technological M&A by private equity firms provide a strong support for our prediction that private equity firms add more value to the target firm in non-technological M&A than in technological ones. These differences are robust to the control variables, which suggest that the ownership

strategy of the private equity firms makes them inferior parents for high-technology targets. Further, the results lead us to reject the hypothesis that private equity firms are expected to add more value to the target firm in non-technological M&A than industrial acquirers. This is unlikely to be explained by the systematic overpayment by industrial acquirers because the differences in the abnormal returns remain significant when controlling for all-cash financed M&A, which are associated with the higher likelihood of overpayment. The result is robust to other alternative explanations such as the differences in the target's pre-merger performance and uncertainty.

We find weak support to the hypothesis that industrial acquirers add more value to the target firm in technological M&A than in non-technological ones as the difference in the abnormal returns to the target firm shareholders between the two groups of M&A are generally positive but non-significant when we control for alternative explanations. If we look at this finding together with the evidence of significantly higher abnormal returns to the acquiring firm shareholders in technological M&A conducted by public companies presented in section 3 of this dissertation, the most reasonable explanation for non-significant results is that industrial acquirers manage to capture the additional synergies offered by the technology assets of the target firms. This can happen because the value of these synergies depends on the asset complementarity between the acquiring and target firms and thus is not equal across the competing bidding firms. To explore the argument further we would need to look at the announcement returns to the corresponding acquiring firm shareholders. However, many of the acquiring firms in our sample are private and thus do not have stock return data, which prevents us from conducting such an analysis.

It should be noted that while the obtained results are generally highly significant for the regression models using the market-adjusted and Fama-French models for measuring abnormal returns across all the event windows, they are generally not significant for the regressions where we use the market model for measuring abnormal returns. There are two possible explanations for these non-significant results. First, beta may be an inadequate measure of the systematic risk. Prior studies show that the three factor Fama-French model that accounts also for the market cap and book-to-market better explains the stock returns (Fama & French, 1992) and thus should be preferred as the normal return model in event studies (Barber & Lyon, 1997). Second, as the beta of the target firm becomes more volatile close to the announcement date (Hackbarth & Morellec, 2008), the market-adjusted model, which sets the beta value equal to 1, becomes superior to the market model (McKinlay, 1997). Otherwise, the obtained results are robust to different approaches to estimating abnormal stock returns. I discuss below their implications for theory and practice.

### 3.6.1. Implications for theory and research

The significant differences in the abnormal returns to the target firm shareholders across the type of M&A and acquirer (industrial or private equity) reported in this study show that the typical ownership strategy of private equity firms is adds more value for non-technological targets than for technological ones. This essentially provides a boundary condition to the agency theory based argument dominating in the literature on LBO performance that stronger performance incentives associated with debt financing combined

with the competent restructuring undertaken by private equity firms makes them “best owners” for the target firm. The evidence provided in this study indicates that the complementary assets of industrial acquirers dramatically increase the value-creation potential of technological M&A and make them superior parents relative to private equity firms in such deals.

Further, this work extends the literature on technological M&A by bringing into the discussion the impact of ownership on performance. Prior research on technological M&A focuses predominantly on the impact of the chosen integration strategy on the innovation outcomes of the deal. While this is a very important issue for industrial acquirers that add value by complementing the targets’ technology assets with their manufacturing, distribution, marketing and other resources, it is less relevant for private equity firms that merely contribute with capital and management team. Effectively this category of acquirers remains outside the scope of the prior literature on technological M&A, even though they account for a substantial portion of M&A activity in high-technology sectors. Hence, by considering both private equity and industrial acquirers this work contributes to building a more comprehensive theory that takes into account different types of acquirers and shows the contingent impact of different ownership strategies on M&A performance.

In addition, this study emphasizes the importance of analysis of ex ante M&A performance. While prior studies that focus on longitudinal innovation effects of technological M&A show their effectiveness as means for leveraging R&D, this analysis of announcement returns shows the expected total value-added by industrial and private equity firms to targets in technological and non-technological M&A. This shift of focus from the ex post innovation performance to ex ante value-creation also makes feasible comparison of private equity and industrial acquirers and study of performance effects not confounded by subsequent events like further M&A and changes of leadership.

### 3.6.2. Implications for practice

This work emphasizes the role of the so-called “best owner” mind-set for value-creation in M&A. The results show that gains to the shareholders of the target company vary significantly across different types of acquirers. This makes a disciplined process of strategic selection of potential acquirers key for maximizing gains in the transactions. Moreover, the obtained results indicate that the difference in the shareholder returns is driven largely by the availability of complementary assets. This implies that assessment of the acquirer’s asset mix and the fit of the target’s technology to the overall strategy of the acquiring firm should be important criteria for selection of acquirers. Similar arguments hold for acquiring firms as well.

# 4. Cross-border vs. domestic M&A

## 4.1. Value creation in domestic and cross-border M&A

M&A are expected to create value for the acquiring firm shareholders if the expected synergies are greater than the premium paid for the target firm. The abundant literature on domestic M&A considers three major groups of synergies: (1) improved productive efficiency resulting from the economies of scale and scope (Palich, Cardinal, & Miller, 2000; Seth, 1990; Shleifer & Vishny, 1991; Singh & Montgomery, 1987), (2) increased market power (Eckbo, 1983; Shahrur, 2005; Stigler, 1964) and (3) financial synergies such as tax advantages, the firm-level diversification benefits, and gains from the market-timing (Amit & Livnat, 1988; Shleifer & Vishny, 2003; Williamson, 1975).

Seth, Song, and Petit (2002) argue that even though most of the sources of synergies in cross-border M&A are similar to those in domestic deals, the acquiring firms benefit more from particular types of synergies in cross-border M&A than in domestic ones because "there exist different types and degrees of frictions across international markets compared with domestic markets" (Seth, Song, & Petit, 2002: p.924). Particularly, they argue that the acquiring firms benefit from the internalization of the proprietary knowledge and the firm-level diversification more in cross-border M&A than in domestic ones.

Transaction cost economics (Williamson, 1975; Hennart, 1982; Teece, 2000) suggests that the benefits from the internalization, i.e. internal exploitation, of the proprietary knowledge increase as the information, bargaining and enforcement costs associated with the market exchange of this proprietary knowledge grow. Higher information asymmetry and uncertainty related to selling or licensing, i.e. the market exchange, of the proprietary knowledge in international markets than in domestic ones (Hennart, 1982; Kang & Kim, 2010) lead to higher transaction costs and thus the higher benefits from the internalization of the proprietary knowledge in the cross-border setting (Seth, Song, & Petit, 2002).

Hence, the higher market frictions associated with the proprietary knowledge exchange in international markets create two sources of gains that have higher value in cross-border M&A than in domestic M&A, namely (1) gains from the internal exploitation of the acquirer's proprietary knowledge in a foreign country and (2) gains from the internal exploitation of the target's proprietary knowledge in the acquirer's domestic or other foreign markets (Seth, Song, & Petit, 2002). Naturally, these two types of synergies are particularly relevant in high-technology industries where the proprietary knowledge is the cornerstone of the competitive advantage (McEvily, Eisenhardt, & Prescott, 2004).

The firm-level diversification is another source of value creation in cross-border M&A that is commonly referred to in the international business literature (Hisey & Caves, 1985; Hymer, 1976; Markides & Ittner, 1994; Seth et al., 2002). Though prior empirical studies (Lang & Stulz, 1994; Berger & Ofek, 1995) show that diversified firms significantly underperform undiversified ones, Seth and colleagues (2002) argue that the diversification benefits should exist in cross-border M&A. The reason is that individual investors can diversify their portfolios more efficiently on their own in their domestic but not in foreign

capital markets. At the same time, the stock return correlations are much lower across countries than within countries, which suggests that it is not possible to obtain the same degree of risk reduction with domestic portfolios. This benefit of cross-border M&A relative to domestic ones should decrease with the integration of the capital markets though and is likely to be limited (Seth, Song, & Petit, 2002).

In addition, Harris and Ravenscraft (1991) follow Froot and Stein (1991) who argue that strong foreign currency creates a purchasing advantage for foreign acquirers relative to domestic ones as it increases their relative net wealth. This relative advantage becomes particularly important in industries with higher information asymmetries such as high-technology industries because higher information asymmetries make it more costly to purchase assets with external financing and thus make the acquirers rely more on their net wealth to pay for the deal.

To sum up, the literature on foreign direct investment and cross-border M&A suggests that the acquiring firms in cross-border M&A should outperform the acquiring firms in domestic M&A, especially in high-technology industries where the benefits from the internalization of the proprietary knowledge in the international setting and the purchasing advantages created by favorable exchange rate movements are likely to be higher.

The available empirical evidence is, however, mixed. While some authors report significant positive returns to foreign acquirers that indicate their superior performance when compared to the negative returns to domestic acquirers found in earlier studies (Markides & Ittner, 1994; Morck & Yeung, 1992), some find that foreign acquirers experience negative stock returns upon the announcement (Aybar & Ficici, 2009; Conn et al., 2005; Eckbo & Thorburn, 2000), and the others find insignificant returns to foreign acquirers (Eun, Kolodny, & Scheraga, 1996; Gregory & McCorriston, 2005). Similarly, some researchers report significant positive correlation between the R&D intensity and the returns to foreign acquirers (Conn et al., 2005; Eun et al., 1996; Morck & Yeung, 1992), whereas others do not find a significant relationship (Markides & Ittner, 1994). This indicates the need to revise the arguments discussed above in the light of forces that may have a detrimental impact on the acquiring firm performance in cross-border M&A.

### 4.2. The impact of institutional differences on cross-border M&A performance

*Cultural distance: incentives and monitoring problems vs. routines upgrading*

Prior literature in international business argues that institutional differences between the countries where the acquiring and target firms are located may present substantial challenges for cross-border M&A (Dikova, Sahib, & van Witteloostuijn, 2010; Jandik & Kali, 2009; Kang & Kim, 2010; Kogut & Singh, 1988). Researchers generally distinguish two types of institutional differences: informal and formal. In this subsection, I focus on the impact of informal institutions on the cross-border M&A performance leaving the discussion of the effects of formal institutions for the next subsection.

Informal institutions are those embedded in the national culture (Dikova et al., 2010; Kang & Kim, 2010; Kogut & Singh, 1988; Morosini, Shane, & Singh, 1998). Morosini et al.

(1998) define the national cultural distance as the discrepancy in "norms, routines and repertoires for organizational design, new product development, and other aspects of management that are found in the acquirer's and the target's countries of origin". Following the early work by Kogut and Singh (1988), researcher operationalize national cultural distance through Hofstede's (1993) model and focus particularly on: (1) the "individualism-collectivism" polarity related to innovation, inventiveness and entrepreneurship and (2) "uncertainty avoidance" and "power distance" associated with decision-making practices and control routines (Morosini et al., 1998).

The two major challenges associated with the national culture distance are: (1) incentives problem (Chari & Chang, 2009) and (2) monitoring problem (Kang & Kim, 2010).

Chari and Chang (2009) argue that significant cultural distance necessitates the use of local managers for running the target firm operations after the deal completion because they can better manage relationships with the local suppliers, customers, employees and the government. However, after the deal completion local managers are not directly subject to the stock market discipline, have a much weaker linkage between performance and reward, and can potentially hold up the transfer of valuable tacit assets.

This problem of providing performance incentives to the local managers is aggravated by the monitoring disadvantages of foreign acquirers. Kang and Kim (2010) show that cultural distance combined with the physical distance and language barriers makes it difficult and expensive for the headquarters to obtain accurate information about the foreign subsidiary, which compromises performance monitoring.

By contrast, Morosini et al. (1998) argue that significant cultural distance makes cross-border M&A a superior strategy for achieving human capital-based resource advantages by quickly accessing a set of routines and repertoires, particularly those related to new product development, that are different from those of the acquirer and are not easily imitable by competitors. Consistently, Bjorkman, Stahl, and Vaara (2007) show that a certain degree of cultural differences is positively related to complementary capabilities and Chakrabarti, Gupta-Mukherjee, and Jayaraman (2009) report a positive relationship between cultural distance and cross-border M&A performance.

*Formal institutions: uncertainty and adverse selection vs. institutional arbitrage*

Dikova et al. (2010) define formal institutions as the hierarchical system of rules or laws that jointly regulate business transactions. They argue that large differences in formal institutions lead to higher deal costs, time needed for completion, and uncertainty around the deals. Following Homburg and Bucerius (2006), I can further argue that the resultant prolonged period of uncertainty negatively impacts relationships with customers and employees and thus has a detrimental impact on M&A performance.

Jandik and Kali (2009) focus on the differences in the legal and accounting systems. The authors argue that these differences negatively affect the ability to evaluate the performance of the target firm. The absence or inferiority of the objective performance metrics exacerbates the adverse selection problem (Akerlof, 1970) due to the increased

information asymmetry between the acquiring and target firm and the resultant higher prescreening and valuation costs. This adverse selection problem can make cross-border M&A an inferior strategy for accessing complementary assets located abroad (Chari & Chang, 2009; Chen & Hennart, 2004).

The adverse impact of institutional differences is mitigated by cross-border acquisition experience institutionalized in the acquirers routines for screening, selecting, taking over and integrating a foreign company (Nadolska & Barkema, 2007).

Schneider, Schulze-Bentrop, and Paunescu (2010) add a twist into the previous discussion by arguing that certain combinations formal institutional conditions such as poor employment protection, weak collective bargaining, extensive university training and a large stock market are necessary for competing in high-tech industries with radical innovations. As a result, multinationals competing in high-technology industries can engage in cross-border M&A to benefit from the available opportunities for "institutional arbitrage".

4.3.Technological and non-technological M&A

Technological M&A encompass transactions in which technology is a component of acquired firm's assets (Ahuja & Katila, 2001). We can distinguish technology realized in products, technology embedded in processes and technological skills and experience of inventors. Prior literature argues that technology embodied in products and processes (Makri, Hitt, & Lane, 2010) as well as the aggregate technical knowledge of inventors (Kapoor & Lim, 2007) manifests in patents, which serve as an empirical indicator of technology among the assets of the target firm (Ahuja & Katila, 2001; Kapoor & Lim, 2007; Makri et al., 2010; Puranam, Singh, & Zollo, 2006; Puranam & Srikanth, 2007).

Technological M&A are a means of gaining a competitive advantage in high-tech industries by facilitating continuous product innovation (Chaudhuri & Tabrizi, 1999; Graebner, 2004; McEvily, Eisenhardt, & Prescott, 2004; Puranam & Srikanth, 2007; Ranft & Lord, 2002). Technological M&A enable the acquiring firm to: (1) benefit from the target's technology by adding the complementary manufacturing, marketing and financial assets necessary for its successful commercialization (Puranam et al., 2006; Teece, 1986) and (2) leverage its innovation capabilities by integrating the two knowledge bases (Ahuja & Katila, 2001; Ernst & Vitt, 2000; Graebner, 2004; Kapoor & Lim, 2007; Makri et al., 2010).

These two sources for value-creation are not available in non-technological M&A. Instead, the latter can potentially create value through operating synergies resulting from the economies of scale (Eckbo, 1983; Fee & Thomas, 2004; Heron & Lie, 2002; Shleifer & Vishny, 1991) and scope (Barney, 2011; Porter, 1980; Teece, 1982; Williamson, 1985), increased market power (Eckbo, 1983; Fee & Thomas, 2004; Jensen & Ruback, 1983; Sapienza, 2002; Shahrur, 2005),economies of internal capital markets (Williamson, 1975), tax advantages (Amit & Livnat, 1988; Hayn, 1989; Jensen & Ruback, 1983) and market-timing (Rhodes-Kropf & Viswanathan, 2004; Shleifer & Vishny, 2003).

However, the value-creation potential of M&A for the acquiring firm is limited by the competitive bidding process that allows the target firm capture most of the gains (Jensen & Ruback, 1983; Walker, 2000) and managerial failures in the deal process (Haspeslagh &

Jemison, 1991; Jemison & Sitkin, 1986) and post-merger integration (Cording, Christmann, & King, 2008; Datta, 1991; Datta & Grant, 1990; Zollo & Singh, 2004). In addition, some M&A are driven by managerial self-interest seeking (Jensen, 1986) and hubris (Roll, 1986) rather than synergy-seeking motives (Seth et al., 2002).

### 4.4. Hypotheses

The acquiring firms in non-technological domestic M&A cannot gain from commercialization of the target's technology assets or leveraging its own innovation capabilities by grafting the target's technology into its own technology base similarly to the acquiring firms in technological domestic M&A because the targets in non-technological domestic M&A do not provide technology inputs for the acquiring firm (Ahuja & Katila, 2001). However, nothing prevents the acquiring firms in technological domestic M&A from benefitting on average from the economies of scale and scope, the increased market power and financial synergies offered by the deal to the same extent as the acquiring firms in non-technological M&A do. Hence, there should exist two additional sources of gains for acquirers in technological M&A based on the target's technology assets.

The earlier empirical evidence of the significant positive abnormal returns to the target firms and non-significant returns to the acquiring firms upon the M&A announcement (Jensen & Ruback, 1983) suggested that the acquiring firms transfer the expected value of the synergies offered by the combination of the two firms to the shareholders of the target firm in the competitive market for corporate control. The value of the technology assets of the target firm for a potential bidder depends on the degree of their complementarity with the bidder's own technology, production, distribution and marketing assets. Given that the degree of asset complementarity varies across the bidding firms due to the path dependent process of developing capabilities and the different market positioning, the value of the target's technology assets should vary for different bidders. Hence, the bidding process in technological M&A should be asymmetrically competitive with the different value of the target firm for different potential acquirers. This asymmetrically competitive market for corporate control allows the acquiring firm to capture the value of the unique synergies offered by the target's technology assets. This reasoning leads to Hypothesis L1.

> *Hypothesis L1. Acquirers in technological domestic M&A are expected to create higher shareholders' value than acquirers in non-technological domestic M&A.*

Prior research in international business has established that institutional differences between the countries where the acquiring and target firms are located has a substantial impact on cross-border M&A performance (Chari & Chang, 2009; Kang & Kim, 2010; Kogut & Singh, 1988; Morosini et al., 1998; Schneider et al., 2010). Further, I argue that technological cross-border M&A are better positioned to take advantages of the institutional differences. First, Morosini, Shane and Singh (1998) provide a strong empirical support to their argument that cross-border M&A give multinational companies access to diverse routines and repertoires that enhance the performance of the combined firm over time. Particularly, they find that it is routines and repertoires "related to inventiveness, innovation, entrepreneurship, and decision-making practices" (Morosini, Shane, & Singh, 1998: p. 153) that are relevant for the performance improvements following cross-border M&A. These

routines and repertoires facilitate new product development and are difficult to develop and imitate across national cultures (Morosini, Shane, & Singh, 1998). Further, the positive impact of these diverse, location-embedded routines and repertoires accessed through cross-border M&A should be particularly significant in high-technology industries where the capabilities to develop new products are key for survival (McEvily, Eisenhardt, & Prescott, 2004). Though we could argue that the cultural distance may also have a negative effect on the M&A performance by impeding the transfer of these routines and repertoires related to new product development, Morosini and colleagues (1998) provide evidence that this argument does not hold in practice. The acquiring firms use rotations, training and communications to successfully transfer the routines and repertoires of the target firm. This is consistent with more recent studies (Bjorkman et al., 2007; Brannen & Peterson, 2009) that suggest that the acquiring firms mitigate the disruptive effects of the cultural distance on performance by using a number of available social integration tools. In addition, Bjorkman and colleagues (2007) find that the cultural distance is positively related to complementarity of capabilities and Makri et al. (2010) show that the latter is positively related to the post-merger innovation performance, a major value-driver in technological M&A.

Second, Schneider, Schulze-Bentrop and Paunescu (2010) show that cross-border M&A in high-tech industries "act as a functional equivalent to institutions that support knowledge production in the home economy" (p. 246). Essentially, the cross-border technological M&A give the acquiring firm access to foreign cluster "systems of innovation" where it can benefit from knowledge spillovers and access to the specialized complementary assets that are not available in the home economy (Nachum & Wymbs, 2005; Schneider, Schulze-Bentrop, & Paunescu, 2010; Reve, 2011).

*Hypothesis L2. Acquirers in technological cross-border M&A are expected to create higher shareholders' value than acquirers in non-technological cross-border M&A.*

Prior literature shows that cross-border M&A suffer from adverse selection, incentives and monitoring problems. Kapoor and Lim (2007) that these problems are equally present for technological M&A in the domestic context. First, information asymmetry surrounding the value of the target technology and its R&D capabilities combined with the absence of the long track-record make technological targets difficult to valuate ex-ante. Second, the ability to unlock value in technological M&A depends on the performance of the key inventors from the target firm who now get less of the value created and can opportunistically hold up the transfer of valuable tacit knowledge. Thirdly, monitoring inventors is both difficult due to their work nature and may be counter productive. At the same time, cross-border M&A provide access to a more diverse pool of valuable technology assets. In addition, developed in the local context these assets are more likely to be heterogeneous and thus complementary to those already possessed by the acquiring firm (Morosini, Shane, & Singh, 1998). This creates a larger potential for value-creating in cross-border technological M&A relative to domestic ones.

*Hypothesis L3. Acquirers in technological cross-border M&A are expected to create higher shareholders' value than acquirers in technological domestic M&A.*

Following Seth, Song, and Petit (2002), we suggest that the sources and value of synergies in cross-border and domestic non-technological M&A are not identical. Particularly, the benefits of the firm-level diversification are larger in non-technological cross-border M&A than in domestic ones due to the more segmented international capital market and the inability of the individual investors to replicate the international diversification benefits with domestic portfolios. Further, the acquiring firms can benefit from the favorable currency movements in non-technological cross-border M&A but not in non-technological domestic M&A (Harris & Ravenscraft, 1991). In addition, Hennart (1982) suggests that the internal exploitation of intangible assets such as brand name leads to higher benefits relative to its market exchange through, for example, franchising in the cross-border setting relative to the domestic because of the higher monitoring and enforcement costs. Thus, the acquirers in cross-border non-technological M&A have these three sources of additional value creation relative to the acquirers in domestic non-technological M&A.

Some authors suggest (Kogut & Singh, 1988; Chari & Chang, 2009; Jandik & Kali, 2009; Kang & Kim, 2010; Dikova et al., 2010), however, that the additional gains available for the acquiring firm in non-technological cross-border M&A relative to non-technological domestic M&A may be lost due to additional managerial problems created by the national differences, namely the cultural distance and the differences in the legal accounting systems. At the same time, Bjorkman and colleagues (2007) and Brannen & Peterson (2009) suggest that the social integration tools used by the foreign acquirers mitigate the negative impact of the cultural distance. Consistently, Morosini and collegues (1998) provide evidence that the acquiring companies successfully overcome the obstacles for managing the target firm in a culturally distant locations through social integration. Further, the adoption of IFRS accounting standards and the international proliferation of best practices make the differences in the legal and accounting systems lower. Thus, the negative effects of the national differences on the performance of non-technological cross-border M&A are likely to be limited. This leads to Hypothesis L4.

*Hypothesis L4. Acquirers in non-technological cross-border M&A are expected to create higher shareholders' value than acquirers in non-technological domestic M&A.*

## 4.5. Methods

### 4.5.1. Sample

My sample of M&A comes from Zephyr database of M&A provided by Bureau van Dijk. It contains detailed deal and company information, including: announcement and completion dates, deal type, deal value, deal financing, method of payment, deal rationale, initial and acquired stakes, company identifying information such as ticker symbols, SIC codes and country codes. Zephyr database encompasses M&A that have been announced in the period from January 1997.

I extract all transactions characterized by Zephyr as acquisitions, M&A and institutional buy-outs that were announced between January 1, 1997 and December 31, 2012 and that had been completed by US acquirers before December 31, 2012. This results in a preliminary sample of 75246 observations. However, I need a five year history of M&A

activity to measure M&A experience, which reduces my sample to the period from January 1, 2002 to December 31, 2012 with 61428 observations.

I am interested only in the transactions that result in obtaining the controlling interest in the target firm, i.e. those with the initial stake of less than 50% and the stake after the deal of 51% or more. 55787 transactions satisfy the criteria.

Further, I require the acquirer be a publicly traded company with the stock price data available in the Center for Research in Security Prices (CRSP) database 252 trading days before deal announcement and 10 days after the deal announcement. To match data with Zephyr database I use company ticker symbols. This procedure leaves 2889 observations.

In addition, I require the acquirer have data available from COMPUSTAT one fiscal year before the announcement and at least one fiscal year following the announcement. Again, I use ticker symbols for matching databases. This trims the sample further to 2000 observations.

Finally, I restrict the sample to deals whose value exceeds 1% of the market cap of the acquiring firms 11 trading days before announcement (Harford, Humphery-Jenner, & Powell, 2012). As a result, 1004 observations remain in the effective sample (see Table 5.1 for an overview of the sampling procedure).

**TABLE 5.1**

**The Number of M&A Announced and Completed by US Publicly Traded Acquirers**

The column labeled “Announced” lists the number of M&A announced in the given year by US publicly traded companies. The column labeled “Completed” lists the number of transactions completed in the given year. The column labeled “Data” indicates the number of M&A that resulted in gaining the controlling interest in the target firm and satisfy the data availability criteria for the acquirers. The column labeled “Sample” lists the 1271 transactions that also satisfy the other sampling criteria. The columns labeled “Data” and “Sample” are based on the announcement year.

| Year | Announced | Completed | Data | Sample |
|---|---|---|---|---|
| 2002 | 298 | 217 | 2 | 1 |
| 2003 | 369 | 333 | 51 | 22 |
| 2004 | 420 | 423 | 316 | 161 |
| 2005 | 433 | 418 | 324 | 162 |
| 2006 | 472 | 446 | 307 | 143 |
| 2007 | 520 | 563 | 269 | 140 |
| 2008 | 323 | 386 | 211 | 92 |
| 2009 | 276 | 260 | 151 | 71 |
| 2010 | 325 | 309 | 201 | 115 |
| 2011 | 315 | 311 | 168 | 97 |
| 2012 | 254 | 300 | 0 | 0 |
| Total | 4005 | 3966 | 2000 | 1004 |

### 4.5.2. Distinction between technological and non-technological M&A

Following the prior research, I define technological M&A as acquisitions of high-technology targets with technology being a part of the acquired assets (Ahuja & Katila, 2001; Graebner, 2004; Kapoor & Lim, 2007; Puranam & Srikanth, 2007). I operationalize this definition using the following algorithm.

Firstly, I identify high-technology targets using the three-digit SIC code combinations recommended by Kile and Phillips (2009) for sampling high-technology firms. These include: 283 (drugs), 357 (Computer and Office Equipment), 366 (Communication Equipment), 367 (Electronic Components and Accessories), 382 (Laboratory, Optic, Measure, Control Instruments), 384 (Surgical, Medical, Dental Instruments), 481 (Telephone Communications), 482 (Miscellaneous Communication Services), 489 (Communication Services, NEC), 737 (Computer Programming, Data Processing), 873 (Research, Development, Testing Services). Kile and Phillips (2009) have shown that these codes, commonly used to identify high-tech firms in empirical research, most closely match their classification benchmark based on the descriptions of the firms' revenue generating processes and business operations. 354 targets in my sample satisfy this criterion.

Secondly, prior research argues that technology manifests in patents, which represent its outcomes (Ahuja & Katila, 2001; Kapoor & Lim, 2007; Makri, Hitt, & Lane, 2010). Thus, I require that targets in technological M&A register at least 1 patent before the announcement date. This requirement is consistent with prior research on technological M&A (Ahuja & Katila, 2001; Puranam, Singh, & Zollo, 2006; Puranam & Srikanth, 2007) and reflects the requirement that technology be part of the acquired assets. I use Orbis database provided by Bureau van Dijk for tracking the patenting activity of the target firm. I match the data on patents with the sample using the unique target BvD ID numbers common for Zephyr and Orbis databases. In my sample, 187 targets had registered at least 1 patent before the acquisition.

Finally, Ahuja and Katila (2001) recognize that not all technologies are patentable and use news stories associated with the M&A in their sample to check whether some non-patented technology was a part of the acquired assets. I follow a similar approach and check the deal rationales provided by Zephyr database mention "technology", "R&D", or "innovation" of the target firm as motivating factors for or components of the acquired assets. Then I classify M&A as technological if the target has a high-technology SIC code and either has some patenting activity before the announcement or technology was reported to be part of the deal motivation or acquired assets. 356 out of 1106 transactions in the sample report technology, R&D, and innovation capabilities as a motivation or part of the acquired assets. The total number of M&A classified as technological is 249 (see Table 5.2 for a more detailed sample distribution).

**TABLE 5.2**

**Sample Distribution by Year and Type of M&A**

This table contains the time-series distribution of a sample of M&A conducted by US publicly traded companies in 2002-2011 from Zephyr. The transactions are classified into years based on announcement dates. The column labeled "All deals" lists the number of M&A in a given year that are included into the sample. The column labeled "Technological" lists the number of deals from the sample where the target operated in a high-tech industry, as defined by (Kile & Phillips, 2009) based on its 3-digit SIC code, and either the target had at least one patent in the fiscal year preceding the acquisition or "technology", "R&D", and "innovation" were reported as part of the deal motivation. The column labeled "Non-technological" indicates the number of M&A that do not satisfy the abovementioned classification criteria.

| Year | All deals | Technological | Non-technological |
|---|---|---|---|
| 2002 | 1 | 1 | 0 |
| 2003 | 22 | 5 | 17 |
| 2004 | 161 | 28 | 133 |
| 2005 | 162 | 33 | 129 |
| 2006 | 143 | 36 | 107 |
| 2007 | 140 | 38 | 102 |
| 2008 | 92 | 27 | 65 |
| 2009 | 71 | 20 | 51 |
| 2010 | 115 | 32 | 83 |
| 2011 | 97 | 29 | 68 |
| Total | 1004 | 249 | 755 |

### 4.5.3. Distinction between domestic and cross-border M&A

In this paper I identify domestic and cross-border M&A by matching the acquirer and target country codes reported by Zephyr. If both are US, then the deal is classified as domestic. Otherwise, I classify the deal as cross-border. This procedure results in 534 domestic and 470 cross-border deals. Table 5.3 displays the time series sample distribution by the target origin (domestic vs. cross-border) and deal type (technological vs. non-technological).

**TABLE 5.3**

**Sample Distribution by Year, Target Origin and Deal Type**

This table contains the time-series distribution of a sample of M&A conducted by US publicly traded companies in 2002-2011 from Zephyr. The transactions are classified into years based on announcement dates. The column labeled "All deals" lists the number of M&A in a given year that are included into the sample. The columns labeled "Domestic" list the number of deals from the sample where the target has the country code "US" (from Zephyr). The columns labeled "Cross-border" list the number of deals from the sample where the target does not have the country code "US" (from Zephyr). The column labeled "Tech" lists the number of deals from the sample where the target operated in a high-tech industry, as defined by (Kile & Phillips, 2009) based on its 3-digit SIC code, and either the target had at least one patent in the fiscal year preceding the acquisition or "technology", "R&D", and "innovation capabilities" were reported as part of the deal motivation. The column labeled "Non-tech" indicates the number of M&A that do not satisfy the abovementioned classification criteria.

| Year | All deals | | Domestic | | Cross-border | |
|---|---|---|---|---|---|---|
| | Tech | Non-tech | Tech | Non-tech | Tech | Non-tech |
| 2002 | 1 | 0 | 0 | 0 | 1 | 0 |
| 2003 | 5 | 17 | 4 | 9 | 1 | 8 |
| 2004 | 28 | 133 | 22 | 62 | 6 | 71 |
| 2005 | 33 | 129 | 22 | 66 | 11 | 63 |
| 2006 | 36 | 107 | 22 | 54 | 14 | 53 |
| 2007 | 38 | 102 | 32 | 48 | 6 | 54 |
| 2008 | 27 | 65 | 16 | 29 | 11 | 36 |
| 2009 | 20 | 51 | 16 | 19 | 4 | 32 |
| 2010 | 32 | 83 | 23 | 38 | 9 | 45 |
| 2011 | 29 | 68 | 23 | 29 | 6 | 39 |
| Total | 249 | 755 | 180 | 354 | 69 | 401 |

### 4.5.4. Measures

**Dependent variables**. *Cumulative abnormal announcement returns (CARs)* represent gains to the shareholders upon M&A announcement. They are commonly used as a measure of

expected M&A performance (Bargeron, Schlingemann, Stulz, & Zutter, 2008; Haleblian & Finkelstein, 1999; Harford et al., 2012; Seth, Song, & Pettit, 2002; Zollo & Meier, 2008). To construct the variable I use daily return data for each of the acquirers from CRSP. Following the event study methodology (MacKinlay, 1997), I estimate CARs as sums of the market model residuals over a given event window:

$$CAR_i = \sum_{t=\tau}^{T} \left( R_{it} - \left( \hat{\alpha}_i + \hat{\beta}_i R_{mt} \right) \right)$$

where $CAR_i$is the cumulative abnormal return for transaction $i$, event window $t\epsilon[\tau, T]$, $R_{it}$ stands for the acquirer's return for transaction $i$ and day $t$, the term $\left( \hat{\alpha}_i + \hat{\beta}_i R_{mt} \right)$ is the expected return predicted by the market model. I estimate the market model parameters by the OLS regression over the estimation window from trading day – 262 to day – 11 relative to the deal announcement date (0):

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

where $R_{it}$ stands for the acquirer's return for transaction $i$ and day $t$ , $R_{mt}$ is the daily return to the CRSP value-weighted market index. For robustness, I use four event windows (all dates are trading days relative to the announcement date (0)): day - 1 to day + 1, day - 2 to day + 2, day - 5 to day + 5, and day -10 to day +10. Further, I denote CARs corresponding to the event windows listed above as CAR (1), CAR (2), CAR (5) and CAR (10).

In addition, I complement the market model based cumulated abnormal returns (CARs) with the market-adjusted model based ones. The market adjusted model assumes the intercept of 0 and beta value of 1. Inclusion of these abnormal return measures is aimed to account for biases in the estimated beta coefficients. I denote the market-adjusted model based abnormal returns corresponding to the four event windows as ACAR (1), ACAR (2), ACAR (5) and ACAR (10).

**Independent variable.** I use three dummy variables identifying the four categories of interest as independent variables. Domestic tech is a dummy variable which takes the value of 1 for M&A classified as domestic technological. Cross-border tech is a dummy variable which takes the value of 1 for M&A classified as cross-border technological. Cross-border non-tech is a dummy variable which takes the value of 1 for M&A classified as cross-border non-technological. Thus the reference category is the domestic non-technological M&A.

**Control variables**. I control for several acquirer, target and deal characteristics that may influence M&A performance.

*Recent M&A experience* is the number of M&A conducted by the acquiring firm prior to the focal deal. A number of studies (Bruton, Oviatt, & White, 1994; Fowler & Schmidt, 1989; Haleblian & Finkelstein, 1999; Puranam et al., 2006; Zollo & Singh, 2004) report "learning-by-doing" effect in M&A that manifests in superior target selection, deal execution and integration capabilities of frequent acquirers. I use data from Zephyr to count the number of M&A completed by the acquirers over the five year period preceding the focal deal.

*Method of payment* classifies deals in the sample into three categories: all cash offerings, all stock offerings, and other offerings based on the data from Zephyr. The choice of the method of payment can reflect the acquirer's uncertainty about the value of synergies and relative overvaluation of the acquirer's equity (Martin, 1996; Myers & Majluf, 1984; Rhodes-Kropf & Viswanathan, 2004; Shleifer & Vishny, 2003). Both lead to more favorable valuations of all cash offerings relative to M&A where a part of the consideration is paid in stock. Consistently, empirical literature finds a "hierarchy of announcement returns" where M&A paid for with stock significantly underperform all cash offerings (Fuller, Netter, & Stegemoller, 2002; Mitchell, Pulvino, & Stafford, 2004; Savor & Lu, 2009; Travlos, 1987; Walker, 2000).

*Relative size* is measured as the ratio of the deal value reported by Zephyr to the market cap of the acquiring firm on day – 11 relative to the announcement date obtained from CRSP (Harford et al., 2012). Prior literature shows that larger acquisitions suffer from worse monitoring abilities of the acquiring firm (Kang & Kim, 2008) and are characterized by higher risks (Hackbarth & Morellec, 2008). Consistently, it is observed a negative correlation between relative size and announcement returns (Moeller, Schlingemann, & Stulz, 2004).

*Leverage* is measured as the ratio of the sum of long-term debt (dltt item in COMPUSTAT) and debt in current liabilities (dlc item) to the common equity (ceq) of the acquiring firm (Duchin & Schmidt, 2013) in the fiscal year preceding the acquisition. Prior literature argues that high leverage serves as an effective monitoring device (Maloney, McCormick, & Mitchell, 1993) and a means to align managerial incentives with shareholder value maximization (Jensen, 1986). Empirical studies find a positive relationship between leverage and announcement returns to the acquiring company (Harford et al., 2012).

*Relatedness* in M&A literature serves as a measure strategic fit between the acquiring and target firm (Jemison & Sitkin, 1986; Lubatkin, 1987; Singh & Montgomery, 1987) and is widely argued to create opportunities for achieving economies of scale and scope (Barney, 2011; Porter, 1980; Rumelt, 1979; Teece, 1982; Williamson, 1979). Several studies find a positive relationship between relatedness and M&A performance (Anand & Singh, 1997; Walker, 2000). Following prior literature (Anand & Singh, 1997; Cannella & Hambrick, 1993; Chang, 1998; Chatterjee, Lubatkin, Schweiger, & Weber, 1992; Eckbo, 1983; Fowler & Schmidt, 1989; Fuller et al., 2002; Walker, 2000), I define relatedness as a dummy variable with the value of 1 for related M&A and 0 for unrelated ones, where M&A are classified as related if 2-digit SIC codes of the acquiring and the target firms coincide.

### 4.6. Results

Table 5.4 displays the means and medians of the cumulative abnormal returns to the acquiring firm classified by the target origin and the deal type as well as the differences in the means and medians of the cumulative abnormal returns between the four resultant groups of M&A: (1) domestic technological M&A, (2) domestic non-technological M&A, (3) cross-border technological M&A and (4) cross-border non-technological M&A.

Hypothesis L1 predicts that the mean cumulative abnormal returns will be significantly higher for domestic technological M&A than domestic non-technological M&A. The data presented in Table 5.4 supports the hypothesis.

The mean cumulative abnormal returns are all positive for domestic technological M&A and generally negative for domestic non-technological M&A. The only two exceptions are the mean cumulative abnormal returns in domestic non-technological M&A measured with the market-adjusted normal return model and the event windows from -5 to +5 days and -10 to +10 days around the announcement (ACAR (5) and ACAR (10)), which are non-significantly positive, but still smaller than the corresponding mean returns in domestic technological M&A. Thus, we obtained positive differences between the mean cumulative returns in domestic technological and domestic non-technological M&A as predicted by Hypothesis L1. Moreover, these differences are strongly significant for the event windows from -1 to +1 and from -2 to +2 trading days around the M&A announcement.

Consistently, the differences in median cumulative abnormal returns are generally positive between domestic technological and domestic non-technological M&A. The exceptions are CAR (1), CAR (5) and ACAR (5) that are negative but non-significant.

Hypothesis L3 predicts that the mean cumulative abnormal returns will be significantly lower to acquirers in domestic technological M&A than to acquirers in technological cross-border M&A. The empirical evidence presented in Table 5.4 strongly supports the prediction.

Specifically, the mean and median cumulative abnormal returns to the acquiring firm in cross-border technological M&A are positive and highly significant across all the used normal return models and event windows. Further, they are both statistically and economically significantly larger than the corresponding returns to the acquiring firm in domestic technological M&A. This suggests that the acquiring firms create significantly more value for their shareholders in technological cross-border M&A than in technological domestic deals.

Hypothesis L2 predicts that the acquiring firms in technological cross-border M&A have higher abnormal returns to their shareholders upon the deal announcement than the acquirers in non-technological cross-border M&A. The evidence in Table 5.4 strongly supports the prediction.

**TABLE 5.4**

**Acquirer Cumulated Abnormal Announcement Returns By Target Origin and Deal Type**

This table contains means and medians (in brackets) of various measures of acquirer abnormal returns upon merger announcement classified by the target origin and deal type: domestic technological, domestic non-technological, cross-border technological and cross-border non-technological. It also shows differences between the groups. The column "Variable" lists the measures of the abnormal returns used in this study. CARs are the sums of the acquirer's daily raw market model residuals over a given event window. The number of days in the event window is shown in brackets and includes the announcement date as the middle day. Market model parameters are estimated by OLS regression over the period from -262 to -11 trading days. ACARs are the sums of the acquirer's daily raw market-adjusted model residuals over a given event window.***, **, and * indicate that mean, median abnormal returns and their differences between the two merger type are significant at 1, 5 and 10% level correspondently (t-test is used for means, Wilcoxon rank test for medians, and Welch F-test for differences in means). Abnormal returns are presented in %.

| Variable | Domestic tech | Domestic non-tech | Cross border tech | Cross border non-tech | Domestic tech – Domestic non-tech | Cross border tech – Cross border non-tech | Domestic tech – Cross border tech | Domestic non-tech – Cross border non-tech |
|---|---|---|---|---|---|---|---|---|
| CAR(1) | 0.343 | -0.341** | 2.278*** | -0.299** | 0.683** | 2.577*** | -1.935** | -0.0414 |
| | (-0.341) | (-0.192*) | (0.997***) | (-0.247**) | (-0.149) | (1.244) | (-1.337) | (0.0553) |
| CAR(2) | 0.421 | -0.480** | 2.506*** | -0.392** | 0.901** | 2.899*** | -2.085** | -0.088 |
| | (0.045) | (-0.373**) | (0.718***) | (-0.094) | (0.417) | (0.812) | (-0.673) | (-0.279) |
| CAR(5) | 0.151 | -0.224 | 3.867*** | 0.200 | 0.375 | 3.667*** | -3.716*** | -0.424 |
| | (-0.672) | (-0.156) | (1.778***) | (0.175) | (-0.516) | (1.603) | (-2.450) | (-0.331) |
| CAR(10) | 0.392 | -0.352 | 4.046** | -0.005 | 0.744 | 4.051** | -3.654** | -0.347 |
| | (-0.398) | (-0.526) | (1.949**) | (-0.070) | (0.128) | (2.019) | (-2.347) | (-0.456) |
| ACAR(1) | 0.553** | -0.296** | 2.101*** | -0.156 | 0.849*** | 2.257*** | -1.548** | -0.140 |
| | (0.002) | (-0.090) | (0.782***) | (-0.148) | (0.091) | (0.690) | (-0.780) | (0.058) |
| ACAR(2) | 0.605* | -0.309 | 2.453*** | -0.159 | 0.915** | 2.612*** | -1.847** | -0.150 |
| | (0.213) | (-0.038) | (0.765**) | (-0.050) | (0.251) | (0.815) | (-0.552) | (0.012) |
| ACAR(5) | 0.412 | 0.143 | 3.913*** | 0.745** | 0.269 | 3.169** | -3.502** | -0.602 |
| | (-0.512) | (-0.137) | (1.457***) | (0.598**) | (-0.375) | (0.859) | (-1.969) | (-0.735) |
| ACAR(10) | 1.052 | 0.416 | 4.516*** | 1.008** | 0.635 | 3.508** | -3.464** | -0.592 |
| | (0.159) | (-0.107) | (1.205***) | (0.616**) | (0.266) | (0.589) | (-1.046) | (-0.723) |
| N | 180 | 354 | 69 | 401 | | | | |

While the mean and median returns are positive and highly significant for technological cross-border M&A they are generally negative for non-technological cross-border M&A. The two exceptions are the significantly positive mean values for ACAR (5) and ACAR (10) in non-technological cross-border M&A. But they are significantly smaller than the corresponding return measures for technological cross-border M&A. As Hypothesis L2 predicts, we find highly significant positive differences in the mean cumulative abnormal returns between technological and non-technological cross-border M&A. Consistently, the differences in the median cumulative abnormal returns between the two groups of M&A are also positive. Further, the finding is robust to the different event windows and normal return models used.

Hypothesis L4 predicts that the acquiring firms in non-technological cross-border M&A have higher abnormal returns to their shareholders upon the deal announcement than the acquirers in non-technological domestic M&A. Consistently with the prediction, the differences in the mean cumulative abnormal returns between the domestic non-technological M&A and cross-border non-technological M&A are negative for all the used normal return models and event windows. However, the differences are not statistically significant and the differences in the median CAR (1), ACAR(1) and ACAR(2) are positive.

Next, I checked whether the differences in means can be explained by the control variables. Table 5.5 compares them across the four groups.

**TABLE 5.5**

**Acquirer, Deal and Target Characteristics by Target Origin and Deal Type**

This table contains means and medians (in brackets) for various acquirer deal and target characteristics for M&A classified by the target origin and deal type: domestic technological, domestic non-technological, cross-border technological and cross-border non-technological. It also shows differences between the groups. The column "Variable" lists characteristics, which are defined in earlier.*** and ** indicate whether the means of the two groups are significantly different based on the Welch F-test at 1% and 5% levels correspondently

| Variable | Domestic tech | Domestic non-tech | Cross border tech | Cross border non-tech | Domestic tech – Domestic non-tech | Cross border tech – Cross border non-tech | Domestic tech – Cross border tech | Domestic non-tech – Cross border non-tech |
|---|---|---|---|---|---|---|---|---|
| Recent M&A Experience | 11.840 | 7.340 | 11.380 | 8.030 | 4.500*** | 3.350** | 0.460 | -0.690 |
| | (6.000) | (5.000) | (7.000) | (5.000) | (1.000) | (2.000) | (-1.000) | (0.000) |
| Relative size | 0.107 | 0.176 | 0.161 | 0.123 | -0.070 | 0.038 | -0.054 | 0.054 |
| | (0.017) | (0.035) | (0.002) | (0.004) | (-0.018) | (-0.002) | (0.015) | (0.031) |
| Leverage | 0.187 | 0.219 | 0.227 | 0.238 | -0.032** | -0.011 | -0.040 | -0.018 |
| | (0.176) | (0.186) | (0.209) | (0.220) | (-0.010) | (-0.010) | (-0.033) | (-0.034) |
| All cash | 79 | 159 | 27 | 185 | | | | |
| % | 43.89 | 45.43 | 39.71 | 46.48 | | | | |
| All stock | 5 | 11 | 0 | 3 | | | | |
| % | 2.78 | 3.14 | 0 | 0.75 | | | | |
| Other | 96 | 180 | 41 | 210 | | | | |
| % | 53.33 | 51.43 | 60.29 | 52.76 | | | | |
| Related | 81 | 144 | 23 | 57 | | | | |
| % | 45 | 41.14 | 33.82 | 14.32 | | | | |
| Blockholders | 173 | 339 | 68 | 380 | | | | |
| % | 96.11 | 96.86 | 100 | 95.48 | | | | |
| N | 180 | 350 | 68 | 398 | | | | |

Table 5.5 shows that there significant differences in average recent M&A experience between domestic technological and non-technological M&A and cross-border technological and non-technological M&A which can be positively related to the positive differences in mean returns reported in Table 5.4.

I did multiple regression analysis to further examine the impact of the variance in the control variables. Table 5.6 displays the results of the regression analyses where domestic non-technological M&A are the omitted group. These regressions allow testing Hypotheses L1 and L4 controlling for alternative explanations. All the regressions presented in Table 5.6 are highly significant.

Hypothesis L1 predicts that the cumulative abnormal returns will be significantly higher for domestic technological M&A than domestic non-technological M&A. The results of the regression analysis provide a strong support to the prediction as the coefficients on the Domestic tech variable are all positive and significant for the event windows from day-1 to day+1 and from day-2 to day +2.

Hypothesis L4 predicts that the cumulative abnormal returns will be significantly higher for cross-border non-technological M&A than domestic non-technological M&A. The coefficients on the cross-border non-tech variable are generally positive (with the exceptions of CAR (1) and CAR (10)) but not significant. This does not provide a strong support for the prediction.

The signs and significance of the control variables are generally consistent with predicted. However, the negative and significant coefficients on the recent M&A experience and relatedness appear unusual. King, Dalton, Daily, and Covin (2004) show in their meta-analysis that on average experience has not been found significant. Also, Hayward (2002) shows that the effect of experience is moderated by time and performance of prior acquisitions. Here, I measure experience over a five-year period preceding the focal deal, which is shorter than that used in previous research. Neither control I for prior acquisition performance. All these factors can potentially explain the findings. I identify related deals by the overlap of the two-digit SIC codes. This measure is imperfect in at least two ways. First, it enables us to identify primarily horizontal M&A. Their major source of synergy is the scale economies, which are shown to be limited and generally overvalued (Seth et al., 2002). Second, it is unable to find the acquisitions of firms that operate in different industries but have related technologies (for example fish farming and biotech) and complementary products. Such deals can have a good strategic fit and yet be classified as unrelated.

Table 5.7 displays the results of the regression analyses where cross-border technological M&A are the omitted group. These regressions allow testing Hypotheses L2 and L3 controlling for alternative explanations. All the regressions presented in Table 5.6 are highly significant.

Hypothesis L2 predicts that the cumulative abnormal returns will be significantly higher for cross-border technological M&A than cross-border non-technological M&A. The results of the regression analysis provide a strong support to the prediction as the coefficients

on the Cross-border non-tech indicator variable are negative and highly significant in all the regressions in Table 5.7.

Hypothesis L3 predicts that the cumulative abnormal returns will be significantly higher for cross-border technological M&A than domestic technological M&A. The coefficients on the Domestic tech variable are negative and significant regardless the chosen abnormal return measure and the included control variables. This provides a strong empirical support for the prediction. The signs and significance of the control variables are generally consistent with predicted.

To summarize, the regression analysis provides a strong empirical support to the Hypotheses 1, 2, and 3 predicting that (1) the acquirers in domestic technological M&A create more value to their shareholders than the acquirers in domestic non-technological M&A; (2) the acquirers in cross-border technological M&A significantly outperform those in both domestic technological M&A and cross-border non-technological M&A. Moreover, these results are robust to the alternative measures of the abnormal returns as well as the control variables.

**TABLE 5.6**

**Multivariate Regressions Explaining Acquirer Returns**

This table contains the results of multivariate OLS regressions of acquirer announcement returns. All variables are explained in the previous section. t- statistics are in brackets. The omitted category is domestic non-technological M&A. Standard errors are heteroskedasticity-consistent ***, **, * indicate that regression coefficients are significantly different from zero at 1%, 5% and 10% level correspondently.

| | CAR (1) | CAR (2) | CAR (5) | CAR (10) | ACAR (1) | ACAR (2) | ACAR (5) | ACAR (10) |
|---|---|---|---|---|---|---|---|---|
| Const | -0.007 | -0.021*** | -0.036*** | -0.031* | -0.002 | -0.013* | -0.018 | 0.006 |
| | (-1.323) | (-2.777) | (-2.928) | (-1.699) | (-0.422) | (-1.770) | (-1.570) | (0.443) |
| Domestic tech | 0.009*** | 0.010** | 0.005 | 0.004 | 0.010*** | 0.011*** | 0.005 | 0.005 |
| | (2.705) | (2.505) | (0.677) | (0.444) | (3.321) | (2.625) | (0.643) | (0.534) |
| Cross-border tech | 0.026*** | 0.030*** | 0.043*** | 0.044*** | 0.025*** | 0.029*** | 0.041*** | 0.043*** |
| | (3.372) | (3.710) | (3.336) | (2.700) | (3.179) | (3.582) | (3.166) | (2.783) |
| Cross-border non- tech | -0.001 | 0.000 | 0.004 | -0.000 | 0.000 | 0.001 | 0.007 | 0.003 |
| | (-0.405) | (0.115) | (0.879) | (-0.061) | (0.002) | (0.405) | (1.398) | (0.539) |
| Relative size | 0.000 | 0.000 | 0.000** | 0.000* | 0.000 | 0.000 | 0.000*** | 0.000** |
| | (-0.260) | (0.422) | (-2.500) | (-1.933) | (-0.295) | (0.351) | (-2.628) | (-2.322) |
| Leverage | 0.010 | 0.006 | 0.007 | 0.007 | 0.007 | 0.004 | 0.002 | 0.001 |
| | (1.234) | (0.567) | (0.474) | (0.331) | (0.824) | (0.348) | (0.130) | (0.050) |
| Experience | -0.000 | -0.000 | -0.001*** | -0.001* | -0.000 | -0.000 | -0.001*** | -0.001*** |
| | (-0.853) | (-0.615 | (-2.596) | (-1.842) | (-1.448) | (-1.427) | (-3.439) | (-3.141) |
| Relatedness | -0.006** | -0.006** | -0.008 | -0.019** | -0.006** | -0.006* | -0.006 | -0.014** |
| | (-2.276) | (-2.186) | (-1.480) | (-2.524) | (-2.501) | (-1.912) | (-1.176) | (-2.052) |
| All cash | 0.002 | 0.003 | -0.003 | -0.002 | 0.002 | 0.003 | -0.003 | -0.002 |
| | (0.883) | (1.193) | (-0.540) | (-0.273) | (0.804) | (0.981) | (-0.570) | (-0.283) |
| All stock | 0.011 | 0.011 | 0.029 | -0.006 | 0.014** | 0.012 | 0.028 | 0.003 |
| | (1.628) | (1.017) | (1.574) | (-0.201) | (2.318) | (1.276) | (1.585) | (0.125) |
| Blockholders | 0.003 | 0.016** | 0.041*** | 0.039** | 0.000 | 0.011* | 0.028*** | 0.012 |
| | (0.756) | (2.448) | (3.786) | (2.501) | (0.099) | (1.728) | (2.831) | (0.991) |
| N | 1004 | 1004 | 1004 | 1004 | 1004 | 1004 | 1004 | 1004 |
| $R^2$ | 0.052 | 0.046 | 0.035 | 0.026 | 0.050 | 0.041 | 0.036 | 0.027 |
| $Adj.R^2$ | 0.042 | 0.036 | 0.025 | 0.016 | 0.040 | 0.031 | 0.026 | 0.017 |
| F-stat | 5.187 | 4.589 | 3.494 | 2.516 | 5.010 | 4.049 | 3.544 | 2.619 |
| P(F-stat) | 0.000 | 0.000 | 0.000 | 0.006 | 0.000 | 0.000 | 0.000 | 0.004 |

**TABLE 5.7**

**Multivariate Regressions Explaining Acquirer Returns**

This table contains the results of multivariate OLS regressions of acquirer announcement returns. All variables are explained in the previous section. t- statistics are in brackets. The omitted category is cross-border technological M&A. Standard errors are heteroskedasticity-consistent ***, **, * indicate that regression coefficients are significantly different from zero at 1%, 5% and 10% level correspondently.

| | CAR (1) | CAR (2) | CAR (5) | CAR (10) | ACAR (1) | ACAR (2) | ACAR (5) | ACAR (10) |
|---|---|---|---|---|---|---|---|---|
| Const | 0.020** | 0.010 | 0.007 | 0.013 | 0.022*** | 0.016* | 0.023 | 0.050** |
| | (2.423) | (0.987) | (0.399) | (0.587) | (2.774) | (1.677) | (1.346) | (2.487) |
| Domestic tech | -0.018** | -0.020** | -0.038*** | -0.039** | -0.014* | -0.018** | -0.036*** | -0.038** |
| | (-2.225) | (-2.339) | (-2.726) | (-2.267) | (-1.806) | (-2.128) | (-2.611) | (-2.301) |
| Domestic non-tech | -0.026*** | -0.030*** | -0.043*** | -0.044*** | -0.025*** | -0.029*** | -0.041*** | -0.043*** |
| | (-3.372) | (-3.710) | (-3.336) | (-2.700) | (-3.179) | (-3.582) | (-3.166) | (-2.783) |
| Cross-border non- tech | -0.027*** | -0.030*** | -0.039*** | -0.044*** | -0.025*** | -0.027*** | -0.034*** | -0.040** |
| | (-3.398) | (-3.597) | (-2.969) | (-2.702) | (-3.091) | (-3.360) | (-2.619) | (-2.545) |
| Relative size | 0.000 | 0.000 | 0.000** | 0.000* | 0.000* | 0.000 | 0.000*** | 0.000** |
| | (-0.260) | (0.422) | (-2.500) | (-1.933) | (-0.295) | (0.351) | (-2.628) | (-2.322) |
| Leverage | 0.010 | 0.006 | 0.007 | 0.007 | 0.007 | 0.004 | 0.002 | 0.001 |
| | (1.234) | (0.567) | (0.474) | (0.331) | (0.824) | (0.348) | (0.130) | (0.050) |
| Experience | -0.000 | -0.000 | -0.001*** | -0.001* | -0.000 | -0.000 | -0.001*** | -0.001*** |
| | (-0.853) | (-0.615) | (-2.596) | (-1.842) | (-1.448) | (-1.427) | (-3.439) | (-3.141) |
| Relatedness | -0.006** | -0.006** | -0.008** | -0.019** | -0.006** | -0.006* | -0.006 | -0.014** |
| | (-2.276) | (-2.186) | (-1.480) | (-2.524) | (-2.501) | (-1.912) | (-1.176) | (-2.052) |
| All cash | 0.002 | 0.003 | -0.003 | -0.002 | 0.002 | 0.003 | -0.003 | -0.002 |
| | (0.883) | (1.193) | (-0.540) | (-0.273) | (0.804) | (0.981) | (-0.570) | (-0.283) |
| All stock | 0.011 | 0.011 | 0.029 | -0.006 | 0.014** | 0.012 | 0.028 | 0.003 |
| | (1.628) | (1.017) | (1.574) | (-0.201) | (2.318) | (1.276) | (1.585) | (0.125) |
| Blockholders | 0.003 | 0.016** | 0.041*** | 0.039** | 0.000 | 0.011* | 0.028*** | 0.012 |
| | (0.756) | (2.448) | (3.786) | (2.501) | (0.099) | (1.728) | (2.831) | (0.991) |
| N | 1004 | 1004 | 1004 | 1004 | 1004 | 1004 | 1004 | 1004 |
| $R^2$ | 0.052 | 0.046 | 0.035 | 0.026 | 0.050 | 0.041 | 0.036 | 0.027 |
| $Adj.R^2$ | 0.042 | 0.036 | 0.025 | 0.016 | 0.040 | 0.031 | 0.026 | 0.017 |
| F-stat | 5.187 | 4.589 | 3.494 | 2.516 | 5.010 | 4.049 | 3.544 | 2.617 |
| P(F-stat) | 0.000 | 0.000 | 0.000 | 0.006 | 0.000 | 0.000 | 0.000 | 0.004 |

## 4.7. Discussion and conclusions

In this study, I assessed the extent to which the interactions between the type of M&A (technological or non-technological) and the target's origin (domestic or foreign) affect the acquiring firm's performance. Particularly, I argued that the combination of the target's technology with complementary assets of the acquiring firm and higher potential to benefit from sharing complementary assets in cross-border deals drove the differences in acquirers' performance across the four types of transactions. The obtained results confirm the hypothesized relationships for technological deals. However, I found no significant difference in performance between acquirers in domestic and cross-border non-technological transactions. The results are robust to different measures of abnormal announcement returns and alternative explanatory variables. Below I discuss the implications of these findings for theory and practice.

### 4.7.1. Implications for research

This analysis provides empirical evidence that the acquiring firms in cross-border technological M&A earn statistically and economically significant positive abnormal returns to their shareholders upon the deal announcement. In addition, this study shows that the abnormal returns to the acquiring firm in cross-border technological M&A are significantly larger than in cross-border non-technological M&A and domestic technological M&A. These significant and robust results obtained from including the interaction effects contrast sharply with the insignificant findings of prior studies that rely on the relatedness, experience and the method of payment as the explanatory variables (see King and colleagues (2004) for a meta-analysis). Further, they are important in the context of two ongoing discussions in M&A literature.

First, the finding of the significantly larger returns to the acquiring firm in cross-border technological M&A than in cross-border non-technological M&A combined with the significantly larger returns in domestic technological M&A relative to domestic non-technological M&A provides empirical evidence that the technology assets of the target firm are important sources of synergies. Further, the significantly larger returns in cross-border technological M&A than in domestic technological M&A suggest that the cross-border deal context increases the opportunities to benefit from the target's technology.

Second, these results call for a contingent view on the effects of the institutional differences on the cross-border M&A performance instead of the dominating arguments for their linear effects. Currently, one stream of research in international business points to the liability of foreignness and the negative effects of the institutional differences between countries on M&A performance. Another argues that such differences increase the opportunities for organizational learning, the degree of asset complementarity and the potential to benefit from the local institutional environments. My results suggest that the cross-border context and the associated institutional differences are beneficial for technological M&A, but have no significant impact on non-technological deals, implying that the latter either have less to gain from sharing the locally developed knowledge or are more exposed to the liabilities of foreignness.

### 4.7.2. Implications for practice

The results show that the acquiring firm shareholders gain significantly more from cross-boarder than domestic technological M&A. This implies that management of high-technology companies should not limit the scope of the target selection to the domestic context. Systematic screening of potential targets globally increases the chances of identifying deals with unique synergies in a larger and more diverse pool of complementary assets. In addition, such acquirers can leverage their long-term innovation capabilities by benefiting from local knowledge spillovers. This consideration implies that local business context should be an important consideration in the choice of targets and post-merger R&D location decision. Finally, I find that the stock market prices different types of synergies differently. Hence, both management and boards of the acquiring companies should carefully evaluate specific sources of value creation and the inherent risks against the offered bid before approving a transaction.

### 4.7.3. Limitations and future research

This study has several limitations, but they do not significantly impair the validity of conclusions. First, additional insights can be gained by studying more longitudinal performance effects and taking into account post-merger integration. However, the analysis of the stock returns to the acquiring firm done in this study gives the advantage of showing performance effects that are not confounded by subsequent corporate events not related to the focal deal or post-merger integration. At the same time post-merger integration has no impact on the market expectations that this work, for the sake of tractability, focuses on.

Second, I employed a conservative strategy for identifying technological M&A, which may have mistakenly classified some transactions where targets owned a non-patentable technology and the deal rationale was not included in the database as non-technological. A problem this strategy can have caused is a non-significant difference in announcement returns between technological and non-technological M&A even if it is significant in reality. However, given the significance of the results, this identification strategy has no detrimental impact on the validity. Moreover, this methodology is consistent with the prior literature on technological M&A, which makes my results comparable.

Third, this research can be extended in the future by (1) considering a more detailed classification of non-technological M&A by value drivers; (2) identifying and controlling for specific institutional differences between countries; and (3) adding the interaction effects between the origin and the ownership. Though such a research calls for a much larger sample size and a richer data set that is presently not available, it would allow further analysis of the different sources of gains and losses in M&A that is of particular theoretical and practical interest.

# 5. Conclusions

Companies have spent trillions of US dollars on M&A for the last ten years. While some of the deals were successful, many, especially large ones, resulted in significant losses for the acquiring firm shareholders. This raises a number of questions from managers and shareholders on both sides of the deal. What makes M&A a credible strategy? What kind of acquirers are better positioned to add value to a given target company? How can we distinguish winners and losers before the event?

Not surprisingly, an extensive body of strategic management and finance literature focuses on explaining M&A performance. The three most popular themes in these works are: (1) relatedness between the businesses of the acquiring and target firms that indicates potential synergies; (2) prior M&A experience that enhances the skills in target selection, valuation, negotiation and post-merger integration; and (3) the chosen method of payment that reveals managerial beliefs on the intrinsic values of the assets relative to the market ones. Unfortunately, earlier meta-analyses of this literature showed that M&A performance was not on average significantly related to those three variables.

Agency theory points to another shortcoming of the abovementioned literature, namely the failure to recognize that self-interest seeking managers will not necessarily pursue deals that create value for their shareholders. The management of the acquiring firm may use M&A for empire building, creating additional promotion opportunities and reducing their own employment risks. The managers of the target firm may be tempted by lucrative compensation packages and career opportunities in the combined firm. This literature views ownership concentration and managerial ownership on both sides of the deal as means of preventing negative-NPV M&A through better monitoring and incentives. Though it provides important insights on how value can be destroyed in M&A and why private equity firms can be superior acquirers, this agency theory-based research does not give full credit to the role of complementary assets and the ownership strategy of industrial acquirers in M&A.

International business literature focuses on cross-border M&A as a subset of deals where the market exchange imperfections and institutional differences between countries are major determinants of performance. While there is a relative consensus among researchers with respect to the role of market imperfections as a rationale for cross-border M&A, there is a disagreement regarding the direction of the influence of the institutional differences on cross-border M&A performance. Some authors argue that institutional differences exacerbate the adverse selection and monitoring problems. Others suggest that they are sources of competitive advantage for the acquiring firms that enrich their organizational repertoires and benefit from location-specific knowledge spillovers. I believe that a contingent perspective can reconcile the two arguments.

In the three empirical sections of this dissertation, I attempted to overcome some of the limitations of the three streams of research discussed above. Particularly, I focused on the role of technology, ownership and origin as well as the interactions between technology and ownership and between technology and origin in explaining the variance of M&A performance.

A major argument of this dissertation is that splitting the population of M&A by relatedness, prior M&A experience, and the method of payment does not allow identifying types of M&A with distinct drivers for value creation and, in this way, explaining why some acquirers perform better than others do. Instead, I suggest separating M&A according to the technology inputs provided by the target firms into two types: (1) technological M&A where the target-firm possesses technology assets and (2) non-technological M&A where technology is not a part of the acquired assets. The argument underlying this classification is that technological M&A have two sources of gains, in addition to those available in non-technological M&A, that are (1) unavailable in non-technological M&A and (2) produce synergies that are not equally available to all bidding firms and, hence, should result in superior performance of acquirers in technological M&A. These two mechanisms for value creation are (1) more profitable commercialization of the target's technology by complementing it with the acquirers production facilities, distribution channels and marketing capabilities and (2) leveraging the innovation capabilities through merging the two complementary technology bases. These synergies are not available in non-technological M&A because they, by definition, do not give technology inputs to the acquiring firm, and their value cannot be easily lost in the bidding process because it depends on the degree of complementarity.

Further, I revise the role of ownership and assess the extent to which private equity firms add value to the target firms relative to industrial acquirers in general and when taking into account the type of M&A (technological or non-technological) in particular. Recognizing the important role played by managerial incentives in M&A performance, I argue that access to complementary assets and alignment of the ownership strategy with the type of the deal are also critical. Particularly, I suggest that private equity acquirers are better positioned to add value in non-technological M&A while industrial parents are superior parents for technological targets because (1) profiting from innovations requires access to complementary knowledge base, production, marketing and distribution that private equity firms cannot provide to the same extent as industrial companies; and (2) focus on the short-term financial performance, high risk aversion, and low priority given to R&D investments by private equity firms negatively affects innovation performance.

Finally, I consider the role of origin in M&A performance. I suggest that acquirers gain more in cross-border technological M&A than acquirers in cross-border non-technological M&A and domestic technological M&A. The reason is that acquirers in cross-border technological M&A benefit from (1) internal exploitation of intangible technology assets, (2) access to more diverse repertoires related to new product development, and (3) the local knowledge spillovers. Acquirers in domestic M&A cannot benefit from these advantages, and they are limited for acquirers in non-technological cross-border M&A.

I tested the hypotheses on the impact of type of M&A and origin on the sample of M&A conducted by US publicly traded companies in 2002-2011 and hypotheses on the impact of ownership - on the sample of M&A, acquisitions and leveraged buyouts of US publicly traded target companies in the same period. I used abnormal announcement stock returns as the primary measure of M&A performance (complemented with accounting and

innovation performance measures to assess the impact of the type of M&A). Empirical findings provide support to the major arguments and are robust to control variables, alternative normal return model specifications and different event windows.

Consistent with the predictions, I find that acquirers create economically and statistically significantly more value for their shareholders in technological M&A than in non-technological ones. This finding suggests that (1) the economies of scope arising from the combination of the target's technology assets with the assets of the acquiring firm are an important source of gains in M&A and (2) that the stock market distinguishes deals with different mechanisms for value creation and destruction. Further, the regression analysis shows that acquirers gain more when they have accumulated certain M&A experience and thus transaction-specific competence and when they select smaller targets and thereby make the deal more tractable and reduce the overpayment risk.

Further, I find that industrial acquirers add significantly more value to technological than non-technological targets, while the opposite is true for private equity firms. Moreover, the results of my analysis suggest that industrial acquirers have parenting advantages over private equity firms in technological M&A. Consequently, access to complementary assets and focus of innovation are more important to create value in technological M&A than strong managerial incentives and elimination of inefficiencies in the target firms. This shows that agency theory-based perspectives on the role of ownership tell only part of the story, though an important one, calls for developing a contingent "best owner" perspective that also accounts for the complementarity of the strategic cores of the acquiring and target firms.

Finally, the undertaken analysis shows that acquirers in technological M&A create significantly more value for their shareholders in cross-border transactions than in domestic ones. This suggests that companies competing in high-technology industries gain a competitive advantage by acquiring technological targets abroad and in this way accessing a more diverse pool of technology assets and benefiting from the knowledge spillovers in the host country. An implication is that the target location should be an important consideration for M&A decisions in high-technology industries.

The analyses done in this dissertation have several limitations, which do not undermine the importance of the empirical findings discussed above though. First, the three empirical studies focused on the pre-merger characteristics of the target and the acquiring firms and left the post-merger integration process outside the scope of the analysis. This choice was driven by the research design and tractability reasons, especially the interest in the factors that affect the abnormal announcement returns. Moreover, this is a well-established approach in the strategic management and finance literature on M&A performance.

Second, we employed a conservative strategy for identifying technological M&A based on the combination of the industry codes, the target's patents and the reported deal rationale. Though this is the conventional approach in the prior literature, we may have mistakenly classified some of the M&A where the target possessed unpatented technology and the deal rationale was missing as non-technological. However, given the significant findings, this strategy did not have a detrimental impact on the validity of our findings.

Third, the use of SIC codes to identify high-technology industries and related M&A in this dissertation have certain limitations discussed in prior literature that calls for more fine - grained measures. But, the tradeoff would be the much smaller sample size and data reliability, which were of crucial importance for these empirical analysis. Thus, we chose to stick to the conventional approaches, despite their apparent imperfections.

Overcoming these limitations should be a task for future research. In addition, the present work can be extended in the future to: 1) include innovation output measures; 2) focus on the acquirer's technology assets in addition to those of the target firm and their relations (e.g. relatedness and complementarity); 3) distinguish different types of non-technological M&A; 4) control for specific national differences; and 5) consider the interactions between the type of M&A, the ownership, and the origin. Such research would give us additional insights in M&A performance drivers necessary to improve our theoretical understanding in the area as well as the practical decision-making.

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