

George Alexandridis, ICMA Centre, Henley Business School, University of Reading, UK
g.alexandridis@icmacentre.ac.uk

Nikolaos Antypas, ICMA Centre, Henley Business School, University of Reading, UK
n.antypas@icmacentre.ac.uk

Yongyi Xue, ICMA Centre, Henley Business School, University of Reading, UK
y.xue@pgr.reading.ac.uk

Technology Mergers and Acquisitions Around the World: Boon or Bane?

Abstract

We investigate the performance of technology M&As using a global sample. We classify deals according to the technological distance of acquirers and targets. Technologically distant pairs lead to higher announcement returns for acquirer shareholders, especially when targets are private. In contrast, pure technology deals gain significantly less and can even destroy value. The positive wealth effect of technologically distant deals is more pronounced when the bidder is in a non-tech industry. We also investigate the long-term operating performance of technology M&As. Non-tech bidders acquiring tech targets have the highest positive change in operating performance among all acquisition types suggesting better integration and more efficient redeployment of assets.

JEL Classification: G34, G30, F21

Keywords: mergers and acquisitions, technology, post-acquisition performance, value creation

1. Introduction

Gaining access to new technology assets has been one of the most important strategic motives for M&As. For technology companies, assimilating external technologies serves to enhance their core tech portfolio and capabilities or to neutralise competition. Non-technology companies pursue acquisitions of technology assets primarily to transform their product or service offering as part of their digital strategy. The share of technology M&As has grown from 6% to 20% of total M&A volume during 2006-2018 indicating the increasing strategic importance of technology in the product and service markets. This trend has been amplified as a result of the COVID-19 pandemic since business operations and commerce adopt technology solutions to remain viable and competitive. After a short pause in most deal making during the early months of the pandemic, M&A activity, especially in tech, saw historical records in volumes and numbers (EY, 2021).

The uptrend in technology M&As is a global phenomenon. Developed and emerging economies alike have seen a surge in tech deals, while the Asian region, especially China and India, increasingly occupy the centre stage in high-tech-driven mergers. The extant literature in tech M&As has focused primarily on the U.S. market, and the various studies have investigated niche technology sectors. After the dotcom bubble period, when North America and Europe dominated the tech M&A market, a large proportion of tech deals have been taking place in emerging countries. For instance, the Chinese market ranks third in volume of all technology deals, and 20% of Chinese M&A targets are in the high-tech industry (BCG, 2019).

The profile of participants in tech M&As has changed dramatically as well. Until the end of the “DotCom Bubble”, tech acquisitions involved mostly tech firms as both acquirers and targets. In recent years, cross-industry acquisitions with tech firms as either acquirers or targets have increased in numbers and strategic importance. For instance, Walmart acquired Flipkart, India’s biggest e-commerce firm with \$16bil. in 2018 (Walmart, 2018); L’Oreal has taken the majority stakes of Modiface in 2018, a leading firm in augmented reality and artificial intelligence (Financial Times, 2018); McDonald’s signed merger contracts with an AI

company and an automated voice agent, Dynamic Yield and Apprente in 2019 (Financial Times, 2019; Bloomberg, 2019); Morgan Stanley bought ETrade, an online fintech brokerage, in 2020 (Financial Times, 2020).

The lack of recent, global, and industry wide evidence on the impact of tech M&As makes it paramount we investigate the value creation of the aggregate technology M&A market using a worldwide sample. In light of this, we utilise a novel and comprehensive data set to examine the impact and outcomes of technology M&As. Our sample comprises of 79,455 deals over the period 1990-2018, covering 52 countries.

This is the first study, to the best of our knowledge, to differentiate deals by the technological classification of acquirers and targets. Specifically, we categorise acquirers and targets as High Tech (Hi) companies and Non-High Tech (Non) companies. This results in four deal types per the technological classification of the acquirer-target pair: Hi-Hi, Hi-Non, Non-Non, Non-Hi. We proceed to study the characteristics, wealth effects, and overall performance of the four deal-type combinations. We hypothesise that higher technological distance between acquirers and targets (Non-Hi, Hi-Non) allows for the realisation of higher synergies and growth opportunities. For instance, Non-High-Tech firms acquiring High-Tech targets frequently obtain access and rights to disruptive technology, which could help them access new market segments, utilise novel logistics and communication channels, as well as improve efficiencies in production and operations. Similarly, High-Tech firms acquiring Non-High-Tech targets could augment the capabilities of the target company by expanding their sales network and increasing efficiencies versus competitors in both acquirer and target industries. In other words, acquirer and target firms can enable and facilitate success in each other's long-term strategic plans. This prediction is supported by the complementarity cornerstone theory (Makri et al., 2010; Colombo and Rabbiosi, 2014), which purports that fewer technological similarities between acquirers and targets lead to more wealth creation for shareholders. In contrast, deals with similar tech profile for acquirers and targets (Hi-Hi, Non-Non) are less likely to

emulate efficiencies and synergies of comparable nature and magnitude. We test our hypothesis by comparing value creation for the different deal types.

We find positive and statistically significant announcement returns for technologically distant deals (Non-Hi, Hi-Non) with an average acquirer CAR of 2.22% compared to 1.46% for technologically similar deals (Hi-Hi, Non-Non). The result is economically significant as well. The average technologically distant deal yields an increase of \$56.40mil. in the acquirer market capitalisation. The Non-Hi transactions display the highest gains among all deal types with a CAR of 2.69%. The results offer strong support to our hypothesis of higher synergistic potential and growth opportunities for technologically distant deals.

We proceed to repeat our analysis separately for private and public targets. Since most of the high-tech targets in our sample are young start-ups and not publicly listed, we expect the wealth effects to be more pronounced for technologically distant deals with Non-High Tech acquirers (Non-Hi). This is due to private targets not having a mark-to-market equity value, which can frequently reflect overoptimistic investor expectations. On a similar note, the literature suggests public firms can be over-valued (see e.g., Moeller et al., 2004), thus an acquisition of a high-growth tech target may prove expensive, which can obscure the value creation for technologically distant deals. The results confirm technologically distant deals with private targets have higher returns to acquirer shareholders, which is consistent with prior findings on the positive value effects of private deals (see e.g., Capron and Shen, 2007; Erel et al., 2012).

The synergies and operational improvements of successful M&As may not materialise until years after the deal conclusion due to integration and assimilation difficulties. This issue could be accentuated for technologically distant deals, where the combined companies usually differ not only in the sector they occupy, but also in management and labour force culture. In these cases, effective integration and dispersion of innovation can be long and uncertain processes, therefore the projected improvements in productivity and market power can take longer than expected (Bloom and Van Reenen, 2002). Nevertheless, if deal participants manage to integrate and strategically align soon after the deal conclusion, they should be able

to achieve significant gains in output and competitiveness. In light of this, we investigate the long-run operating performance of tech-related deals measured by changes in acquirer ROA before and after the deal.

Private Non-Hi deals see the highest improvement in ROA by an average of 2.45% immediately after the deal completion, after accounting for other factors, suggesting non-technological acquirers are ready to deploy the target's assets and realise synergies soon after deal completion. In contrast, Hi-Non technology deals have a negative change in ROA post deal-completion, which indicates the difficulty faced by high-tech acquirers in utilising the sales network and capabilities of targets, leading to increased integration costs. On a similar note, pure tech deals (Hi-Hi) show negative changes in ROA, highlighting difficulties in integrating different technological assets. By contrast, non-technology acquisitions (Non-Non) experience a positive change in operating performance. These results suggest investor expectations on deal success may not materialise immediately, while some promising tech-related deals can disappoint in operating performance for years after their completion.

This paper contributes to several strands of the M&A literature. First, our study contributes to the strand of technology M&As by providing evidence on the comprehensive performance of technology deals. For the first time in literature, we classify deals into technologically distant and technologically similar, and then examine and compare their value-creation profiles. The results suggest that technologically distant deals create more value for shareholders overall, but improvements in operational efficiency depend on the technological direction of the acquirer-target pair. Our findings support the complementarity perspective of mergers (Makri et al., 2010; Valentini and DiGuardo, 2012; Bena and Li, 2014), where acquirers benefit by obtaining competencies from technologically distant firms. Second, our study complements prior research that was focused in niche technology segments (i.e., computers, biotechnology, and pharmaceutical), pure technology M&As, and technology target acquisitions concentrated on the U.S. market (see, e.g., Kohers and Kohers, 2001; Dalziel, 2008; Lusyana and Sherif, 2016). Finally, our study contributes to the literature on factors of value-creation in M&As. Our study suggests that technological

distance between acquirers and targets can be a source of significant gains, and managers aiming at shareholder value maximisation can plan their acquisitions accordingly.

The rest of the paper is organised as follows. Section 2 offers a brief literature review on technology M&As. Section 3 describes the sample and summary statistics. Section 4 presents the univariate tests and main empirical results. Section 5 reports the results of the propensity score matching analysis. Section 6 discusses findings along with the additional robustness tests. Section 7 provides insight on synergy gains for public technology deals. Finally, section 8 concludes the paper.

2. Literature review

At present, the world has entered a new economic era dominated by technological advancements. Technology companies have been spearheading the economic expansion via innovation, as well as reshaping of more traditional sectors, such as commerce. It is not only retail and wholesale commerce that has been revamped by technological applications, but almost every sector of the economy. A representative example is the acquisition of AI company Dynamic Yield by McDonald's in order to improve its offering in real time (Financial Times, 2019). McDonald's is barely alone in its effort to employ high technological solutions in order to improve its operations and enhance its competitive advantage against industry peers.

Technology is either developed organically, i.e., internally, or inorganically, i.e., via M&As. In general, inorganic growth is deemed the most effective strategy for gaining faster access to different markets, competencies, and advantage over competitors (Hall, 1988; Hitt et al., 2000; Cartwright and Schoenberg, 2006). The technology sector can offer opportunities for even more accelerated growth compared to other industries and, thus, it is an attractive area for M&As. This strategic benefit is reflected on the tech sector's higher growth potential in the equity markets (Kogan et al., 2017).

Previous studies on technology M&As have shown mixed results. Some studies find that high-tech mergers enhance acquirer value and have a positive effect on the R&D process (Ahuja and Katila, 2001; Porrini,

2004), whereas others suggest acquirers perform poorly after deal-completion (Paruchuri et al., 2006). Technology acquisitions have also been found to improve performance in the short-run but negatively in the long-run (Kohers and Kohers, 2000, 2001). Tech acquisitions have not performed consistently over time as well. For instance, tech deals have performed better during the years 2007-2014 versus the period 1996-2006, which includes the “Dotcom Bubble” years (Lusyana and Sherif, 2016). Overall, the literature does not offer consensus on whether tech deals are consistently value-adding or value-destroying to acquirer shareholders.

Other strands of the tech M&A literature have focused on the R&D integration process. In this case, the consensus suggests longer integration processes lead to better R&D outcomes for both acquirer shareholders and target-firm inventors (Birkinshaw et al., 2000; Miller, 2004; Paruchure et al., 2006). The existing literature is primarily focused on specific geographies, such as the U.S., on limited time-frames, such as the “DotCom Bubble”, and on acquiring technology assets in niche technology industries, such as pharmaceutical, biotechnology, computers, and software (Dalziel, 2008; Ranft and Lord, 2002; Ahuja and Katila, 2001; Kohers and Kohers, 2000; Lusyana and Sherif, 2016). The lack of evidence with a focus on a global, recent sample and a broad perspective on tech M&As has incentivised our study.

3. Data and descriptive statistics

We collect global M&A data from Thomson Financial SDC for the period 1990-2018. We apply the following screening criteria: i) we exclude the minority stake purchases, recapitalisations, acquisitions of remaining interests, self-tenders, spin-offs, privatisations, reverse leverage buyouts, exchange offers, and repurchases; ii) The bidder is required to own less than 10% shares of the target prior to the announcement and seeking to own more than 50% after the acquisition; iii) the transaction value is at least \$1 mil in 2018 dollar terms. After applying these restrictions, the sample comprises of 220,910 transactions.

Subsequently, we limit our focus on deals where acquirers have available stock performance data on DataStream Worldscope (105,556 transactions are eliminated). Then, we remove transactions where the

acquirer and the target firms share the same ultimate parent. We also require relative deal size to be at least 1%. After applying these additional restrictions, 79,455 observations remain with an aggregate value of \$26.1tril., covering 52 different countries. Table 1 presents summary statistics of the full SDC sample and the sample of SDC merged with DataStream.

[Insert Table 1, summary statistics of sample]

We identify high-tech acquirers and targets by using the industry classification schematic provided by SDC¹, which is consistent with previous literature (Kohers and Kohers, 2001; Lusyana and Sherif, 2016). SDC utilises SIC codes, NAIC codes, and the business description to classify companies across different industries. The high-technology industry classification by SDC covers a wide spectrum of high-tech industries, including computers and peripherals, e-commerce and business-to-business, electronics, hardware, software, internet infrastructure, internet software & services, semiconductors, chemicals, pharmaceuticals, biotechnology, telecommunications, and other high-tech sectors.

The main objective of our study is to examine whether tech-related M&As, and more specifically technologically distant deals, create more value than non-tech deals. We first classify acquirers and targets into Hi-tech or Non-tech companies according to the SDC industry classification. Then, the deals are classified into four categories according to the deal's industry pairing. The four deal types are high-tech bidder to non-high-tech target (Hi-Non); non-high-tech bidder to high-tech target (Non-Hi); acquirer and target are both in the high-tech sector (Hi-Hi); neither acquirer nor target are in the high-tech sector (Non-Non). The Non-Hi and Hi-Non deals are technologically distant deals, which we expect to create more shareholder wealth.

¹ Alternative common method to classify technology industry are based on FF10 industry, Primary-business industry, Macro-level industry, and Ultimate parent industry. We also test the results on these four methods in robustness part, the results remain similar.

Table 2 reports the deal distribution of the top 20 nations on each deal type. Panel A is based on acquirer country and panel B is based on target country. The five most active acquirer nations are the United States (approximately 38% of total activity), United Kingdom (13%), Canada (9.5%), Australia (6.1%), and China (5.4%)². The US, UK, and China take the most active part in technology acquisitions (Hi-Hi, Hi-Non, and Non-Hi), followed by Japan, Canada, Australia, Germany, and South Korea.

The distribution of deals over the 29 years in our sample is presented in Table 3, Figure 1, and Figure 2. Figure 1a illustrates a highly cyclical merger activity in terms of total number deals and total transaction value (\$ billion). The period of 1993-2000 corresponds to the fifth merger wave, which ended with the recession after the “Dotcom bubble” (Moeller et al., 2005; Harford, 2005; Rhodes-Kropf et al., 2005). The sixth merger wave started in 2003, peaked in late 2006, and ended at the start of 2008 due to the Global Financial Crisis (Alexandridis et al., 2012). Global acquisition activity was reignited in 2010, while total deal values recovered after 2013. Over the last decade, deal numbers recovered faster than deal values, suggesting a temporary scarcity in mega deals. The recovery of total deal values reached near record levels with a total of \$2.31tril. in 2015. The average deal value in 2013-2018 is \$4.3bil, more than 1.5 times the average deal value in the last merger wave (2003-2008 average deal value \$2.7bil). The M&A activity stabilised after 2016, whereas the average transaction value grew larger (mean \$4.4bil of 2016 to 2018). This reflects the gradual shift towards larger deals, a trend observed near the peak of previous merger waves as well.

We also report the distribution of four deal types (Hi-Hi, Hi-Non, Non-Non, Non-Hi) separately in Fig. 1b and the proportion of each deal type in the entire M&A market over time in Fig. 2. In general, all deal types display similar wave patterns to the aggregate M&A activity in Figure 1a. In the tech-driven fifth merger wave over 1/3 deals are related to technology-intensive industries, mainly in the sector of information technology. This trend was supported by the rampant share price growth of high-tech firms during the

² The top five most targeted countries are US (40%), UK (11.6%), Canada (7%), China (6%) and Australia (5.9%).

“Dotcom Bubble”, attracting other companies to seek opportunities of technological innovation (Kohers and Kohers, 2000; Kleinert and Klodt, 2002).

As seen Table 2 Panel A, 36% of deals (Hi-Hi, 20%; Hi-Non, 11%; Non-Hi, 4.9%) are technology-related (1,662 deals) and have a total value of more than \$1.42tril, amounted to over 60 % of total deal value (\$2.37tril) in 1999. In 2000, at the peak of the wave, technology-related deals are even more than 50% of the total number (4,498 deals), taking up 51% of deal volume (\$1.77tril). The average deal value in our sample is \$1.55bil. (\$0.9bil.) for technology-related (tech-unrelated) deals during the early 1990s, then it rises to \$3.45bil. (\$2.85bil.) and (Non-Non) in the period of 1996-2001. This pattern also reflects two underlying trends. First, the high share price growth near the peak of the “Dotcom Bubble” and, second, increasing investor appetite for larger deals.

In the 2003-2008 period, non-tech deals (Non-Non) are more numerous than tech-related deals. They comprise the majority of deal value, comprising more than 73% (18.2 tril) during the last two years of the sixth merger wave. The growth in acquisition activity for non-technology acquirers is prevalent (Non-Non, 20%; Non-Hi, 25%) in the same period, while tech companies acquire at lower rates (Hi-Hi,12%; Hi-Non,16%). It could be explained by the sixth cycle is principally on the grounds of sufficient liquidity (Alexandridis et al., 2012). High-technology firms typically have substantial R&D expenditure. Thus, they are lack cash reserve and liquidity than other traditional firms, depressing their merger activities. Since 2010, the spring back of deal activities starts and continues into the present. Technology is the critical driver for M&A in this decades (Deloitte, 2018; Bain, 2020); over 40% of the deals are technology acquisitions. Similarly, an upward trend of the proportion of high-tech intensive firms involved transaction in deal volume in this decade, swelling their aggregated deal value four times than five years ago. They occupy more than 55% in the value of acquisitions in 2015, increasing 23% from the previous year, remaining at a 50% level afterward. A significant number of sizeable deals are focused on semiconductors, internet services, big & cloud data, and healthcare. Half of the ten biggest deals are technology acquisitions over

the past five years, for example, Dow Chemical's takeover of DuPont in \$130 bil, Walt Disney costs \$85bil to buy 21st Century Fox, CVs acquires Aetna with \$68 bil. After all, Non-Hi and Hi-Hi deals are in an upbeat trend over time, comprising more than 50% in the global M&A market (see Fig. 2).

A pattern that attracted attention is, to some extent, the high-tech targets are leading the M&A market curve in the most current cycle. For instance, in the Non-Hi and the Hi-Hi deals, their aggregated value growth rate accelerated fastest at 2014, 305% and 238% respectively, while the deals with targets in the non-high technology industry expedite in the year after with 134% for Hi-Non and 43% for Non-Non transactions. The average transaction value of Hi-Hi and Non-Hi in 2015 reaches the highest, \$10.6 bil and \$5.6 bil respectively, which is only \$3.2 bil and \$1.8 bil in 2010. The average deal value in the technology-intensive industry in recent three years, no matter the technology differential or pure technology-related deals (Hi-Non, \$4.5 bil; Non-Hi, \$3.7 bil; and Hi-Hi, \$7.1 bil), are higher than others (\$3.5 bil), indicating the scope deals are more frequently made, and the deal value rising phenomenon is more pronounced in these deals. It is also noted technology discrepancies deals (Hi-Non & Non-Hi) accelerated dramatically since 2013, the most significant increase over the last thirty years, given that more companies are trying to engage in new industries or add new capabilities to strengthen their positions.

[Insert Table 2, Table 3, Figure 1, and Figure 2, the deal value and deal number distribution. line chart & area chart and the top 20 countries table]

Further, deal characteristics are obtained from SDC, and annual financial performance information is from Thomson Financial DataStream. Table 4 exhibits deal and firm descriptive statistics for the above sample and classified in groups according to transaction technology category and differentials between technology discrepancies deals with others (the Hi-Non and the Non-Hi deals). Accounting ratios are winsorized at 1% and 99% levels to remove outliers. Variables are defined in the Appendix. Panel A presents summary statistics for public targets and Panel B for private targets. Deals in private targets comprise 87% of our

sample, consisting of the findings of Netter et al. (2011) that private targets are in the high proportion. In the sub-group of the technology differential deals (Hi-Non and Non-Hi), private targets occupy an even higher proportion, 91% and 89%. It is noteworthy that the Hi-Hi transactions have the highest average deal value among others, no matter the target is listed or unlisted. The average deal size is \$2,791 mil (\$194.46 mil) for public targets (private) when the acquirer and target are both in the hi-tech industry, almost 35% (18% for private target) higher than the rest, signalling mega-deals (at least \$500 mil) are more frequently made in this tech group. The technology giants, such as Accenture, Cisco Systems, Dell, and Amazon, are energetically involved in larger acquisitions of technology-intensive companies.

Relative deal size, calculated as the ratio of the deal value to the acquirer's market value one month prior to the announcement, is more remarkable for non-hi-tech bidders to hi-tech targets in both public and private targets, more than 65% (20% higher than other sub-sets), which is not surprising given the acquirer size tend to be relatively smaller in this tech group. Acquirers in the technology-intensive industry (Hi-Non and Hi-Hi) are supposed to be overvalued, as seen from the book-to-market ratio. The low book-to-market ratio is common as technology firms always do not have plenty of tangible assets and potentially indicate the investors are pleased to pay more for the projected future premiums generated by technology firms.

A notable finding is that acquirers in technology-intensive deals (at least one party is in the hi-tech industry) are more favoured to finance deals with pure cash than non-tech deals if the target is public, while they have a higher prevalence of using their own stocks as main currency when the target is private. On average, 33% of technology-intensive public deals are made in 100% cash, 7% higher than non-tech transactions, where the Non-Hi deals have the highest proportion, 36% are cash financing. For private deals, on average, 35% of technology deals are paid with stock, 22% financed by cash. Technology differential transactions financed with stock are 4.6% significantly than other sub-groups. Previous literature suggests mixed results of stock payment on return around transaction announcement. Commonly, stock swaps are seemed to be value-destroying, while in recent years, literature in the international M&A research back-up stock

financing had a positive effect on returns. It is interesting to detect how the payment method affects the technology deals based on targets' listed status.

In addition, the fraction of cross-border deals is higher for technology-intensive deals, with more than a quarter on average. The Non-Hi group is the most frequent subset acquiring cross-border public targets (28%), and the larger groups in the private cross-border deals are the Hi-Hi and Hi-Non (31% and 28%). It is possibly explained the technology industry focused on innovation capabilities, is more flexible with more intangible resources, and less restricted by geography. Interestingly, the synergy proxy representing deal motivation in the acquisition statements is significantly greater for pure technology deals. It would be considered as the integration process would be more straightforward and generate more synergistic gains if the acquirer and target have a similar industry technology level.

[\[Table 4 shows descriptive statistics for the above sample.\]](#)

4. Main Regression Results

3.1 Univariate analysis.

A key objective of our empirical analysis is to study how the high-tech intensive M&A deals perform. Table 5 reports the announcement period excess returns and long-run operating performance. We first start to compare stock market reactions to the four different technology deal types. To examine the returns of acquisition announcements, the bidders are required to have available daily stock prices and corresponding market indices data in Thomson Financial DataStream. There are 79,455 transactions in 52 countries that satisfy the criteria. The three-day cumulative abnormal returns (CARs) are computed as the sum of market-adjusted return of acquirers over the event window (-1,+1) around the announcement date with the

parameters estimated over 301 to 30 days prior to the deal announcement date (e.g., Brown and Warner, 1985; Alexandridis et al., 2010; Bris and Cabolis 2008; Golubov, 2015)³. The market return as the benchmark is the corresponding value-weighted market index daily return of the acquirers' nation⁴. The returns are winsorized at the 1% and 99% levels to remove extreme values.

The first panel of Table 5 provides the average and median univariate tests of the three-day CARs by the technology deal groups⁵ and target listed status. We also estimate the difference between public and private targets by each tech deal type. The mean and median acquirer CARs are 1.58% and 0.56% for all transactions, and both significantly more than zero at the 1% level. The positive returns are stem from the private target transaction once we segregated deals by target public status, which are comparable to results discussed in prior studies that public targets do not generate additional value for acquiring firms' shareholders (Fuller et al., 2002; Moeller et al., 2004). Public deals have -0.42% (-0.43% median) returns; however, the picture in private targets transactions is different, where they create 1.90% (0.71%) extra wealth for shareholders. Regarding the segregated transactions by technology type, all the other deals in the public deals have statistically significant negative abnormal returns at the 1% level, except the Non-Hi subset, with 0.05% gains on average. The median of the Non-Hi public deals is also more remarkable than the remaining bidders of the public target, which is -0.09%, while the Hi-Hi public deals have the lowest value creation -0.7% (also lowest in mean, -1.06%).

In the private target mergers, the deals occurring in the technology differential transactions, the Non-Hi and Hi-Non, have greater abnormal returns among other private targets. The average acquirer excess gains are 3.05 and 2.23 percentage points of the Non-Hi and Hi-Hi, respectively. The Non-Hi, similar to public Non-Hi deals, are accrued with the largest gains, whose additional value creation around announcement is almost 1.5 times larger than the others. The difference in means and medians between technology differential deals

³ We also measure the CARs over the event window (-2,+2) and (-22,+1). The results remain similar.

⁴ The value-weighted market index returns are obtained from the Thomson Financial DataStream.

⁵ We also create a new group put the technology differential deals together, the Hi-Non and Non-Hi deals.

(Hi-Non & Non-Hi) and homogeneous technology level deals (Hi-Hi & Non-Non) is positively significant at the 1% level. The CARs in Non-Hi & Hi-Non are 2.47% greater than Hi-Hi & Non-Non. One could suggest that this supports the complementarity theory. If the resources are complementary but differ to a certain extent, the two involved parties would absorb benefits from each other, where the resources would be better utilised and potentially lead to greater synergistic benefits (Makri et al., 2010). When acquiring hi-tech dependent targets, non-technology bidders gain more returns after the deal announcement, indicating the shareholders have consensus on the complementarity. The technology deals are worthy for acquiring in the short-run period. We further find that the technology differential deals (Non-Hi & Hi-Non) generate higher additional returns for acquirers when compared to private targets with public targets. The mean (median) return difference between the private and public targets in technology differential transactions is 2.63% (1.11%), strongly significant ($p < 0.01$). Overall, no matter the listed status of the target, the findings suggest that technology differential deals outperform than remaining's. Non-Hi transactions are the most outperformed among all, which could be attributed to the fact that markets value the importance of technology assets transformation role to the acquirer's business. The accelerating technology-altering effect brings new ways into the traditional business.

[\[Insert Table 5. Univariate analysis of acquisition gains.\]](#)

To gain further insight into the value creation of the technology deals, we then examine post-acquisition operating performance changes - whether the outstanding wealth creation around the announcement continues in terms of improving operational efficiency. It may not adequately reflect the effect of technology deals as the stock reaction exclusively reflect short-term acquisition value. Generally speaking, existing studies use return on assets as the proxy of operating performance (Kaplan, 1989; Harford, 1999; Makismovic et al., 2013), where the ROA indicates how effectively the acquirers utilise assets to generate

earnings. Following Golubov and Xiong (2020), we computed the changes of return on asset of the first three years post-merger to examine improvements of bidders operating efficiency. The ROA in year t is defined as net income before extraordinary items scaled by total assets at the end of fiscal t year, and the 1st and 99th percentiles are trimmed to remove extreme values. We then adjust the absolute value of ROA with the ROA mean of bidders in the same Fama-French 10 industry in year t . The primary variable, $\Delta ROA(t-1, t+1)$ (or $t+2$ or $t+3$), is the bidder's industry average adjusted return on the asset in the post-one year minus the operating performance in the last available year before the transaction announcement, where the t is the announcement year. The t year performance is excluded as it is difficult to classify it as pre or post; accounting measures may not reflect actual performance due to adjustment issues, and the operating performance needs time to be reflected.

Panel B of Table 5 presents three-year post-merger changes in ROA for public targets and private targets by technology deal types⁶. Changes in ROAs are negative for all public deals. We find that Non-Hi public deals experience better operating performance enhancement than other types. The Non-Hi transactions in public deals have the slightest negative change on operating performance, signalling acquiring technology assets is the least harmful for wealth creation. Turning the focus bidders with private targets, the improvement in efficiency is primarily driven by technology differential deals. Particularly, the Non-Hi private deals performance improves highest during the post-acquisition three years, 7.26%, 6.02%, and 5.59% respectively, all significantly above zero. It is almost ten times higher than other transaction types, suggesting the technology could create superior performance improvements and evidence its disruptive and transformative capacity. The positive changes in operating performance are majorly attributed to Non-Hi deals. The Hi-Non transactions provide significantly positive changes in the first year, while the magnitudes decrease in the following years.

⁶ The results are similar if we use operating income as the nominator on the ratio of return on assets. We also find the similar results if we use return on equity as a measure for operating performance.

Consistent with the announcement period gains, it reports that, on average, private targets create greater operating performance improvement than public targets. Improvements in ROAs for private target deals are higher than the public, 2.59%, 2.39%, and 2.41% higher in the first three years, as shown in the bottom of Panel B, all significantly different from zero at 1% level. Hence, we report the superior acquirer gains and advance operating performance changes for Non-Hi deals, especially in private deals. The Hi-Non deals exhibit higher wealth creation around the announcement and no more than two years during the post-merger period. Analysis on acquirer stock returns and operating performance on technology deals are further analysed following.

3.2 Acquirer gain regressions.

In this subsection, we conduct several cross-sectional regressions to estimate the relationship between technology deal types and the flow and performance of acquisitions to obtain a comprehensive understanding. The main explanatory variable is the technology deal indicator, taking the value of one if the acquirer and target are classified in the specific technology deal type and zero otherwise. Table 6 reports our multivariate analysis results in which the dependent variable is the acquirer three-day CARs (-1,+1). Panel A reports the full sample results; private target deals are in Panel B, and public deals are in Panel C. The baseline specification estimate as follows:

$$ACAR_i = \alpha + \beta * Technology\ dummy + \mu_i + \varepsilon_i$$

We employ varieties of control variables that are known as correlated with acquisition returns evidenced by existing literature. In our findings, the acquirer size, natural logarithm of the acquirer's market cap one month before the announcement date negatively affect the acquirer returns at the 1% significant level for all deals (Moeller et al., 2004; Alexandridis et al., 2010). The coefficient of relative size, as proxied to target-to-bidder relative size, is positive and significant at the 1% level for private target deals, and at least

not negative and significant on public deals, indicating larger private target deals have excess returns. The public deals are associated with lower returns than private when the transaction is larger, but not so harmful than early year studies documented in which demonstrated acquisition gains decreased with the increase in relative size in public deals (Jensen and Ruback, 1983; Travlos, 1987; Alexandridis et al., 2013). The negative effect mainly on U.S. public deals, the rest of the world exhibit no significant adverse effect on larger deals (Alexandridis, 2010). Moreover, as Alexandridis (2017) documented, returns on larger deals and mega-deals (more than \$500 mil) create advanced wealth no matter private or public deals in the U.S. during the last decades, particularly private larger deals generate greater gains. Our results demonstrate similar results with the international sample that sizeable acquisitions are linked to higher returns with the worldwide acquisition sample, reflecting the reason why the trend of making scale deals is more frequent in recent years. It has been noted the acquirers with a higher book-to-market ratio do not perform better than glamour firms with a lower book-to-market ratio (Rau and Vermaelen, 1998; Megginson et al., 2004). We find the negative but insignificant effect of hostile deals on stock gains (Schwert, 2000; Alexandridis, 2017). For the target's listed status, we use the private target dummy to catch the positive effect of private targets on acquirer returns (Fuller et al., 2002). The transactions with private targets outperform 2.23% returns than the public target on one standard deviation increase. On the coefficient of the method of payment including stocks, which takes the value of 1 if it has a proportion of share offering and zero otherwise, we find it has a negative and significant effect on acquisition abnormal returns in public deals (Travlos, 1987; Loughran and Vinjh, 1997; Alexandridis, 2010), while the positive and significant effect on private target transactions. Investors would consider it is a good indicator that target shareholders would hold stocks of the acquirers to share future growth. Further, the cross-border dummy variable, equalling to 1 if the bidder and target are not in the same country, reveals the cross-border transaction create higher wealth (e.g., Rossi and Volpin, 2004; Erel et al., 2012), where the effect is more pronounced in technology deals (Hi-Non, Non-Hi, and Hi-Hi) reflecting the accelerating increase speed in cross-border technology deals in last two decades. The coefficient of leverage, defined as the acquirer debt to equity ratio, is negative

and significant for private target deals but positive and significant for public deals. In public deals, lower leverage brings less burden to the transaction, while in private target deals, the better financing ability with lower constraints would be worthy. In addition, we find that synergy, as the motivation of acquisition proxied by the dummy variable if the announcement statements have stated the synergy gains as the aim could bring positive gains only on private target deals. Lastly, the year and country fixed effects are controlled in all regressions to soak up unobservable variations across time and country. The coefficients for the firm and deal characteristics are remained similar among the four technology deal types, arguing that the superior acquirer gains are mainly driven by the different technology deal categories.

[Insert Table 6. Acquirer stock returns regression.]

In Table 6, regression (1) (6) (11) and (2) (7) (12) reports the coefficients on Hi-Non and Non-Hi technology variable, model (5) (10) (15) on the combination of technology differential deals for all sample, private targets, and public deals, respectively. In line with our univariate findings, the coefficients of technology differential dummies (Hi-Non and Non-Hi) are positive and statistically significant associated with acquirers excess returns at the 1% level, confirming our univariate results. In the full sample, acquirers' gains are approximately 0.336% higher for deals undertaken in differential technology level, comparing with the transactions in same level technology (Hi-Hi and Non-Non), where the private target deals are 0.309% significantly higher, and public deals are 0.114% higher but with no significance. Remarkably, the return improvement is most prominent in the private Non-Hi target transactions, roughly 0.454% greater compared to others, implying when the traditional non-hi-tech related firms buy the technology-intensive assets, they generate larger value creation than deals without hi-tech components or the deals in the same extent of technology. Turning to the Hi-Non private deals, it also presents approximately 0.211% higher on the announcement period returns, supporting the complementarity acquisitions effects – the hi-tech firms

already have the technology and innovation ability. They are acquiring the resources lacked to achieve improvement in the market. Not surprisingly, there is no clear effect of Hi-Hi deals for private deals, while the Hi-Hi public deals underperform among all significantly at a 5% level.

[Insert Table 7. Acquirer stock returns regression with multiple technology dummies.]

To clearly detect the differences of the type of technology deal impact on the acquirer gains, we then examine the three and four technology dummy variables into one regression. Model (1) (3) and (5) in Table 7 present the three technology dummies, Hi-Non-tech, Non-Hi-tech, and Hi-Hi-tech, with the constant in the same regression, and model (2) (4) and (6) display the regressions of four technology dummies (Hi-Non, Non-Hi, Hi-Hi, and Non-Non) without the intercept. Panel A reports results for the full sample, Panel B is for the private targets, and Panel C is related to public deals. In model (5), there are no significant parameters of the technology dummies on public deals, except the Hi-Hi, which have a significant but negative impact on gains, while the estimates of the Non-Hi is the only positive estimator compared with Hi-Hi and Hi-Non. In regression (1) and (3), both Hi-Non-tech and Non-Hi-tech coefficients are positive and statistically significant at the 5% level; Hi-Hi is above zero but without significance. The Non-Hi-tech dummy's coefficient is 0.509%, and the Hi-Non-tech dummy is 0.263%, reflecting the fact that technology differential deals are creating higher wealth than rest transactions which the Non-Hi-tech effect is even more substantial, generating roughly one-time advanced returns than the Hi-Non deals. All in all, the results shown on the acquirer stock returns confirm that technology differential with private target transactions can create superior value among others, specifically the Non-Hi transactions.

3.3 Operating performance changes analysis.

We have presented the wealth creation effect of technology differential transactions on the acquirers' stock market. To provide further evidence on the performance of technology deals in the long-term, we use the same control variables instead of replacing the dependent variables with the operating performance changes.

$$\Delta ROA_{i(t-1,t+n)} = \alpha + \beta * Technology\ dummy + \mu_i + \varepsilon_i \quad (t = 1,2,3)$$

[Insert Table 8. Acquirer operating performance changes regression.]

Table 8 reveals the estimation results segregated by the private and public targets. Panel A displays one-year post changes in operating performance. Panel B is the post two years, and Panel C is the post three years. On the whole, the effect of control variables on improvement efficiency remains homogeneous to short-term returns, as discussed. Acquirer size and book-to-market are negatively and significantly affecting the changes in return on assets. Relative size higher, the operating performance improvement is more remarkable, arguing the costs to acquire the scale assets are valuable. Cross-border transactions outperform than domestic deals in generating profits with available assets after mergers. The minor different results compared to acquirer stock returns are the coefficient of payment including shares and leverage, where they now have a positive and significant impact on improvement in operating performance of private and public target transactions. Operating performance improvements are greater for higher leverage and payment including share swaps. Payment with the stock exchange would reflect acquirer and target share the same synergy risk, and target shareholders believe that the combined company's value will be worth greater. It also implies that the sizeable transaction could generate higher wealth as stock financing is more prevalent in scale deals. For the estimates of leverage, it could be explained by the leveraged firms are manipulating earnings less before the acquisitions than the firms with a lower amount of financing by debt lenders

(Alsharairi and Slama, 2012). Thus, the leveraged firm could undertake the acquisition decisions more prudent and acquire healthy firms to facilitate its expansion.

In line with gains around the announcement date, we find that the Non-Hi private target deals deliver more tremendous changes in operating performance during the post-merger three years, 2.435%, 2.188%, and 2.454%, statistically significant at 1% level, realized higher improvement in ROA after controlling for the bid features. It indicates that when the non-technology bidders acquire hi-tech private targets, the asset reallocations are promoted more effectively and consequently increase shareholders' wealth by realizing synergies. However, the results of the Hi-Non deal are inconsistent with the short-term gains, where the coefficient for Hi-Non is enormously significant and negative on the improvement of operating performance. The superior premiums for Hi-Non deals are merely on the announcement period, yet the enhancements for shareholders' value are not elevated in operating performance. It would provide the side reflection of the importance of technology disruptive function on traditional and non-technology intensive business, as the advanced improvement in performance is pronounced in the Non-Hi transactions rather than the Hi-Non deals where both of these deals have the difference and complementariness in technology level. Although acquiring the technology assets are linked with high uncertainty, it could complement resources and innovation capacity and transform the non-technology firms' business in an efficient manner. In the next section, we use propensity score matching techniques to test our results rigorously.

5. Acquisition gains for the long-term and based on propensity score matching.

To control the uncaptured endogeneity of our M&A sample, we use the PSM approach to match the transactions involving technology differential deals (Hi-Non or Non-Hi) with other types of deals where they share similar characteristics. This method could match the Non-Hi (or Hi-Non) deals with the most identical deals and bidder characteristics but not in the same deal type group. Subsequently, we make comparisons of their stock gains and improvement in operating performance.

First, we run a probit regression where the Non-Hi technology deal variable (or the Hi-Non dummy) is the explained variable, and the independent variables are acquirer and deal characteristics. Next, we use the probit model estimates to calculate propensity scores and match the bidder with its comparables. The explained variable is the performance measures, acquirer CARs, and changes in return on assets during the three post-merger years. The PSM results are according to three different methods: the nearest-neighbour matching (one-to-one, one-to-five, thirty, and fifty neighbours), Radius Caliper matching, and Gaussian kernel matching.

[Insert Table 9. Propensity score matching on acquirer returns.]

Table 9 reports the probit regression in Panel A and matching results for acquisition gains around the announcement date of private deals and public deals in Panel B and Panel C, respectively. Liquidity is the current ratio of acquirers. We also include the Pre-BHR and Post-BHR as independent variables in baseline regression, defined as buy and hold return of bidders three years prior and post the acquisition. In Panel B (Panel C), the treated group is the acquirer CARs for Non-Hi (or Hi-Non) private (public) target transactions, and the control group is the CARs of the matched transactions. The results confirm that the excess returns of Non-Hi private target deals are higher than control samples. The differences between the treated and the control group are positive and significant at 1% level in all matching techniques, varying from 0.630% to 0.912%. For the group of public mergers, the returns of Non-Hi deals are positive while the control sample CARs are below zero, though their difference is insignificant. Besides, we find that Hi-Non bidder returns are higher but insignificant than control samples.

[Insert Table 10. Acquirer operating performance propensity score estimators.]

Further, in Table 10, we replicate our PSM procedures instead of replacing the dependent variable with operating performance changes. Since we only find enhancement of operating performance in Non-Hi mergers in Section 3, we assess the improvement of return on assets of Non-Hi mergers' three-year post-acquisition in this part. In the probit regression, we added the bidder's mean adjusted ROA to the ROA changes (-2, -1) in the last fiscal year prior to the announcement to measure the prior performance because the pre-acquisition operating performance should also be controlled (Healy et al., 1992). Table 10 Panel B displays that $\Delta ROAs$ of treated sample corresponded to Non-Hi private target is positive whereas the matched sample is all negative. The changes in return on assets for Non-Hi private target deals are always significantly greater than other deals, ranging from 1.473% to 3.377%, 1.345% to 3.065%, and 1.442% to 3.378% in first-, second-, and third-year post-merger, respectively. In the public Non-Hi deals, the changes in ROA are all negative; however, the treated sample performs better than other categories' takeovers.

Overall, the PSM results are comparable with the main multivariate regression findings in section 3, indicating the robustness of our findings. The announcement date returns are significantly higher for technology differential M&As if the target is private. In contrast, the long-run performance is relatively different across the two types of technology differential deals. The post-bid long-run performance of Hi-Non mergers is not obviously improved. The Non-Hi deals outperform than all other types of transactions, not only generate excess returns on the announcement period but also in the long-run improvement of asset utilisation and operating efficiency.

6. Robustness tests

In this section, we provide the robustness checks on our results with additional tests. We first investigate how the technology-intensive transactions perform and whether the technology differential effect exists if

the classification of the technology industry changes. We consider the four alternative proxies of the technology industry classification: the Fama-French 10 industry, the primary business, the macro industry, and the ultimate parent industry of companies. The detailed descriptions of the technology industry classification are in the Appendix. Next, the deals are analysed as the same procedure as the SDC hi-technology did in the main regressions, into Hi-Non, Non-Hi, Hi-Hi, and Non-Non types based on the acquirer and target industry. The results are consistent with the major part of our study, only with slight fluctuation on the estimators' magnitude, confirming that the Non-Hi deals can outperform others in the last three decades and create higher value to shareholders in short and long term after controlling for bidder and deal characteristics. The Hi-Non deals generated higher value to shareholders in the announcement period, while the Hi-Hi transactions are always negatively associated with the gains and operating performance.⁷

To provide further support for the findings, we separated the sample into two periods: 1990-2008 (38,082 deals) and 2008-2018 (25,291 deals). Such an analysis of assessing early-stage technology deals and late-stage after the financial distress will enhance our knowledge of potential sources of acquisition gains.⁸ Table 11 and Table 12 indicate that the relation between technology differential deals and bidders' performance does not depend on the time. Similar to the findings in section 3 and 4, the results in Table 11 reveal that the technology differential effect of Non-Hi deals deliver a positive impact on acquirer's wealth creation, and even more pronounced in latest deals after the financial distress, suggesting the more obvious technology-industry-specific complementarity effect takes place recently. The pure technology acquisitions are value-destroying. We further examine the post-merger improvement on return on assets into different periods in Table 12. The coefficients on Non-Hi-tech dummy are strongly positive and significant, while the Hi-Non estimates are negative and significant in the period before financial distress but turn into positive and insignificant in recent years. The Hi-Hi deal variable is negatively related to long-term performance.

⁷ The results of FF10, macro industry, primary-business industry, and ultimate parent industry are available if requested.

⁸ We also tested the results for 1990-2002, and 2002-2018, comparing the performance before and after dotcom bubble. The findings remain similar.

The difference is that the Non-Hi deals in the post-2008 period promote almost 1.5 times more improvement in acquirer operating performance than to 1990-2008. Overall, the results deliver strong supports for the technology differential deals, especially the Non-Hi, which have more substantial enhancement on shareholder value creation, and this phenomenon is more pronounced in post-2008.

[Insert Table 11. The bidders' CARs regressions of 1990-2008 vs. 2009-2018.]

[Insert Table 12. Changes in operating performance multivariate regression of 1990-2008 vs. 2009-2018.]

7. The post-bid performance for public technology M&As

To get a comprehensive understanding, we further examined how the technology deals affect the combined gains of acquirer and target. Table 13 reports regression results, using all public deals announced between 1990 and 2018 with a sample of 6,459 transactions, where targets have available stock data on DataStream. The dependent variable, defined as synergy gains, is the combined weighted average abnormal return of acquirer and target around the announcement (-1,+1).⁹ The weights are according to the acquirer's market value and target one month before the announcement date. The Hi-Non and Non-Hi dummy coefficients are positive but insignificant, while the Hi-Hi has a significant and negative estimator, and the Non-Non has a significant and positive coefficient. It is not surprising as the Non-Hi or Hi-Non tech special effects are not working on the combined returns since we find the positive and significant technology differential effect mainly on deals with private targets. The Non-Non deals are associated with less uncertainty and risky on the prospects of combined firms; therefore, the reaction of the deal announcement and the

⁹ We also test the synergy gains over the five-day event window, the (-2,+2) combined acquirer and target abnormal returns around announcement date. The results remain unchanged.

expectation can suddenly be reflected in the combined firm as the integration process of the combined firms is more confirming, indicating the synergistic gains are superior on the related M&As. Turning to the technology deals by the non-tech bidders, although the potential and benefits of the technology are enormous, it would require a longer time to materialise as they are accompanied by inherent uncertainties, which lowered the synergy returns. Considering the characteristics of public technology firms, they are always highly valued and entered into a mature stage. The prospectus of requiring them is supposed to be unpredictable; thus, the expected synergy gains are unable to be generated as the Non-Non transactions.

[Insert Table 13. Synergy gains for public deals by technology deal types.]

8. Conclusion

In this study, we examine the performance of technology M&As, analysing a sample of 77,549 M&A deals in 52 countries during 1990-2018. First, we classify the M&As according to the technological profile of acquirers and targets, and we proceed to investigate the wealth effects of each deal type on shareholder value. First, we find technologically distant deals experience significantly higher acquirer announcement gains than non-technology deals, especially when the target is private. In contrast, pure technology acquisitions have the lowest wealth creation for bidders. Second, we investigate the impact of acquirer-target technological distance on operating performance. Non-technology firms excel in digital transformation and industry convergence effectively after acquiring technology firms suggesting that disruptive technology assets have positive and immediate effects on the realisation of corporate strategy. Acquisitions by high-tech companies improve operating performance when the target is also a high-tech firm. The discrepancies in operating performance changes post-acquisition indicate material differences in the process of integration and assimilation of high- and low-tech systems.

Overall, our study is the first to document performance differentials per the technology profiles of deal participants. The findings suggest pure-tech deals are deemed less value-adding by investors, while tech-related deals can increase shareholder value and improve operating performance.

Table 1

Mergers and acquisitions sample summary statistics.

The table exhibits summary statistics on M&A announcements presented in the SDC database between 1990 and 2018. Deals must value at least \$1 million (in 2018 dollars), excluding the minority stake purchases, recapitalisations, acquisitions of remaining interests, self-tenders, spin-offs, privatisations, reverse leverage buyouts, exchange offers, and repurchases. The bidders must hold less than 10% control of the target before the announcement but must own more than 50% through the transaction. Panel A covers all deals that satisfy SDC filters. Further, the SDC acquirers are merged with available data from DataStream. The relative size of the target to the acquirer, calculated as deal value divided by the acquirer's market capitalisation, must at least 1% prior to the announcement. The market value of the bidder is no less than \$1 mil (in 2018 dollars). Deals with the same ultimate parent name of acquirer and target are then excluded. Panel B involves deals that satisfy all filters.

	Number of deals	Average deal size (in \$millions)	Median deal size (in \$millions)
Panel A: SDC sample			
All deals	220,910	271.65	23.46
Public acquirer	127,347	327.12	25.00
Private acquirer	93,563	196.16	21.66
Panel B: SDC sample merged with DataStream			
All deals	95,935	381.63	34.36
Public acquirer	12,847	1781.09	186.61
Private acquirer	83,088	164.32	27.80

Table 2

The number of M&A activities of top 20 countries.

This table shows the annual number of deals of the top 20 countries based on technology deal types as the sample described in Table 1. Panel A is the annual number of deals of the acquirer's origin, and panel B is of the target. Total is the total sample size covering 120 countries of each deal category.

Panel A: Top 20 acquirer's origin country									
All Deals		Non-Hi		Hi-Non		Hi-Hi		Non-Non	
Total 95,935		Total 4,593		Total 10,220		Total 20,082		Total 61,040	
Country	n	Country	n	Country	n	Country	n	Country	n
US	36,733	US	1,465	US	4,398	US	10,236	US	20,634
UK	12,392	UK	615	UK	1,274	UK	2,041	UK	8,462
Canada	9,095	China	563	China	702	Canada	1,082	Canada	7,201
Australia	5,852	Canada	336	Japan	624	China	985	Australia	4,444
China	5,223	Australia	284	Canada	476	Japan	739	China	2,973
Japan	4,066	Japan	235	Australia	434	Australia	690	Japan	2,468
South Korea	1,718	South Korea	207	South Korea	355	Sweden	451	Malaysia	1,321
Malaysia	1,558	Hong Kong	114	Hong Kong	202	France	394	Hong Kong	987
Sweden	1,552	Sweden	86	Sweden	171	South Korea	383	Singapore	844
Hong Kong	1,449	Singapore	59	France	133	Germany	283	Sweden	844
France	1,328	France	58	Singapore	126	India	260	South Korea	773
Singapore	1,165	Germany	50	Germany	117	Israel	237	South Africa	769
South Africa	993	South Africa	49	Malaysia	105	Taiwan	192	France	743
Germany	936	Malaysia	45	India	99	Norway	176	Italy	582
India	903	India	40	Taiwan	98	Italy	165	India	504
Italy	848	Israel	31	Ireland-Rep	93	Hong Kong	146	Spain	497
Netherlands	645	Italy	30	Norway	90	Singapore	136	Germany	486
Spain	623	New Zealand	27	Italy	71	Netherlands	124	Netherlands	425
Norway	620	Netherlands	26	Netherlands	70	Switzerland	122	Brazil	416
Ireland	582	Norway	23	Israel	64	Finland	119	Ireland	361

Panel B: Top 20 target's origin country									
All Deals		Non-Hi		Hi-Non		Hi-Hi		Non-Non	
Total 95,935		Total 4,593		Total 10,220		Total 20,082		Total 61,040	
Country	n	Country	n	Country	n	Country	n	Country	n
US	38,226	US	1,686	US	4,276	US	10,419	US	21,845
UK	11,148	China	614	UK	1,241	UK	1,807	UK	7,601
Canada	7,033	UK	499	China	766	China	1,068	Canada	5,491
China	5,776	Canada	271	Japan	543	Canada	873	Australia	4,044
Australia	5,347	Australia	238	Australia	418	Australia	647	China	3,328
Japan	3,542	South Korea	208	Canada	398	Japan	604	Japan	2,208
Germany	1,797	Japan	187	South Korea	353	Germany	511	Malaysia	1,247
South Korea	1,654	Germany	79	Germany	234	France	431	Germany	973
France	1,583	Hong Kong	73	Hong Kong	176	South Korea	374	France	930
Malaysia	1,475	France	60	Sweden	174	Sweden	364	South Africa	804
Sweden	1,279	Sweden	57	France	162	Netherlands	216	Hong Kong	752
Hong Kong	1,130	Singapore	49	Singapore	124	Israel	176	South Korea	719
South Africa	1,010	Malaysia	43	Netherlands	116	Norway	172	Sweden	684
Italy	955	South Africa	42	Italy	101	Taiwan	170	Italy	659
Singapore	904	India	41	Malaysia	98	Italy	164	Brazil	616
Netherlands	892	Netherlands	35	Taiwan	77	India	161	Singapore	612
Spain	783	Israel	31	Norway	66	Switzerland	148	Spain	572
Brazil	746	Italy	31	India	63	Denmark	134	Netherlands	525
India	678	Norway	31	Switzerland	62	Hong Kong	129	Mexico	449
Norway	637	Spain	28	Spain	61	Finland	127	India	413

Table 3

Sample distribution by year and technology deal type.

The table presents the annual deal number and aggregated transaction value (\$bil) by technology deal type. The sample covers all announced deals of listed bidders in the SDC from 1990-2018 with at least \$1 mil inflation-adjusted transaction value, and the target-to-acquirer relative size is no less than 1%, where the acquirer holds less than 10% shares of targets before the announcement and more than 50% shares following the transaction, excluding leverage buyouts, spin-offs, repurchase, recapitalisations, self-tenders, exchange offers and minority-stake purchases. The bidders are required to have an available standard security ticker in the DataStream. The targets are public or private firms. The Non-Hi represents non-hi-tech bidders acquire hi-tech targets. The Hi-Non is the hi-tech acquirers who take non-hi-tech targets. The Hi-Hi is the acquirer and target are both in the hi-tech industry; in contrast, the bidder and target of the Non-Non deals are not in the hi-technology related industry. Deal value (\$bil) is the sum of the deal value in the sample covering 120 countries by year. N is the number of deal activities in the world by year.

Year	All deals		Hi-Non deals		Non-Hi deals		Hi-Hi deals		Non-Non deals	
	n	Deal value (\$bil)	n	Deal value (\$bil)	n	Deal value (\$bil)	n	Deal value (\$bil)	n	Deal value (\$bil)
1990	1,058	1,512	176	305	19	41	67	193	796	974
1991	1,076	1,084	143	159	25	25	96	135	812	764
1992	1,273	1,026	166	152	41	47	146	60	920	767
1993	1,715	1,912	222	344	31	42	173	578	1,289	948
1994	2,279	2,253	279	433	63	71	255	391	1,682	1,358
1995	2,429	3,795	340	568	63	89	303	835	1,723	2,302
1996	3,150	5,571	444	648	98	171	433	1,392	2,175	3,360
1997	4,129	8,238	438	749	120	151	613	1,463	2,958	5,874
1998	4,795	15,075	495	804	139	323	867	4,651	3,294	9,297
1999	4,157	23,698	459	1,731	162	1,147	1,041	11,526	2,495	9,295
2000	4,498	17,675	518	978	258	668	1,485	6,955	2,237	9,074
2001	3,135	9,493	357	886	169	121	934	3,082	1,675	5,404
2002	2,711	4,547	297	287	114	159	694	1,366	1,606	2,735
2003	2,686	4,119	256	317	103	42	732	1,002	1,595	2,759
2004	3,430	8,799	330	308	172	161	923	2,850	2,005	5,480
2005	3,918	10,631	439	534	172	237	979	3,371	2,328	6,488
2006	4,602	15,476	416	464	238	431	1,055	4,011	2,893	10,570
2007	5,090	15,537	459	600	230	382	1,168	3,261	3,233	11,294
2008	3,752	9,982	352	419	188	299	864	2,485	2,348	6,778
2009	2,834	7,304	260	490	110	223	631	2,609	1,833	3,982
2010	3,523	8,749	335	497	137	248	722	2,364	2,329	5,640
2011	3,529	8,871	347	519	135	725	731	1,985	2,316	5,642
2012	3,372	7,268	331	764	153	395	678	1,820	2,210	4,288
2013	3,270	7,627	298	526	168	288	632	2,406	2,172	4,406
2014	4,137	17,724	394	672	248	1,167	832	8,122	2,663	7,763
2015	4,232	24,527	436	1,573	340	1,897	937	9,965	2,519	11,092
2016	3,712	15,737	390	2,127	311	731	702	5,402	2,309	7,478
2017	3,820	15,958	392	1,911	301	1,459	676	4,088	2,451	8,500
2018	3,623	16,521	451	1,519	285	1,062	713	5,302	2,174	8,638
Total	95,935	290,707	10,220	21,284	4,593	12,802	20,082	93,672	61,040	162,950

Figure 1

Merger waves by technology deal types.

This figure provides the distribution of the deal number and the aggregated deal value (\$bil) through time for the sample described in Table 3.

Figure 1a

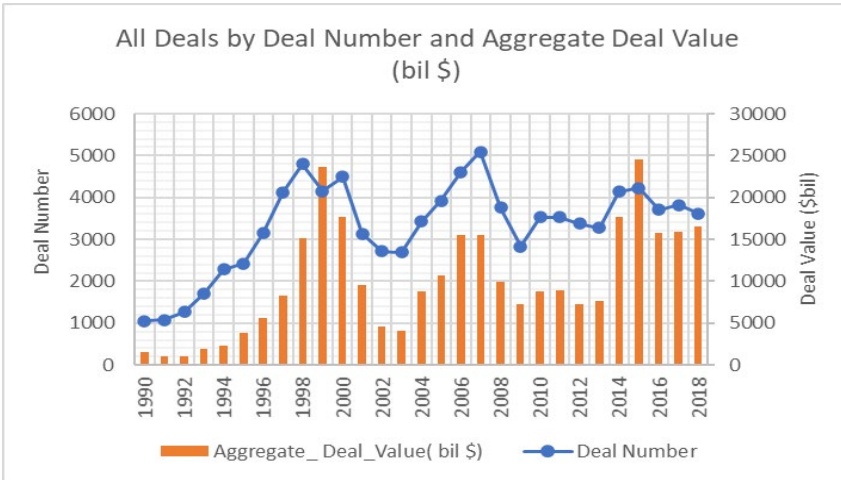


Figure 1b

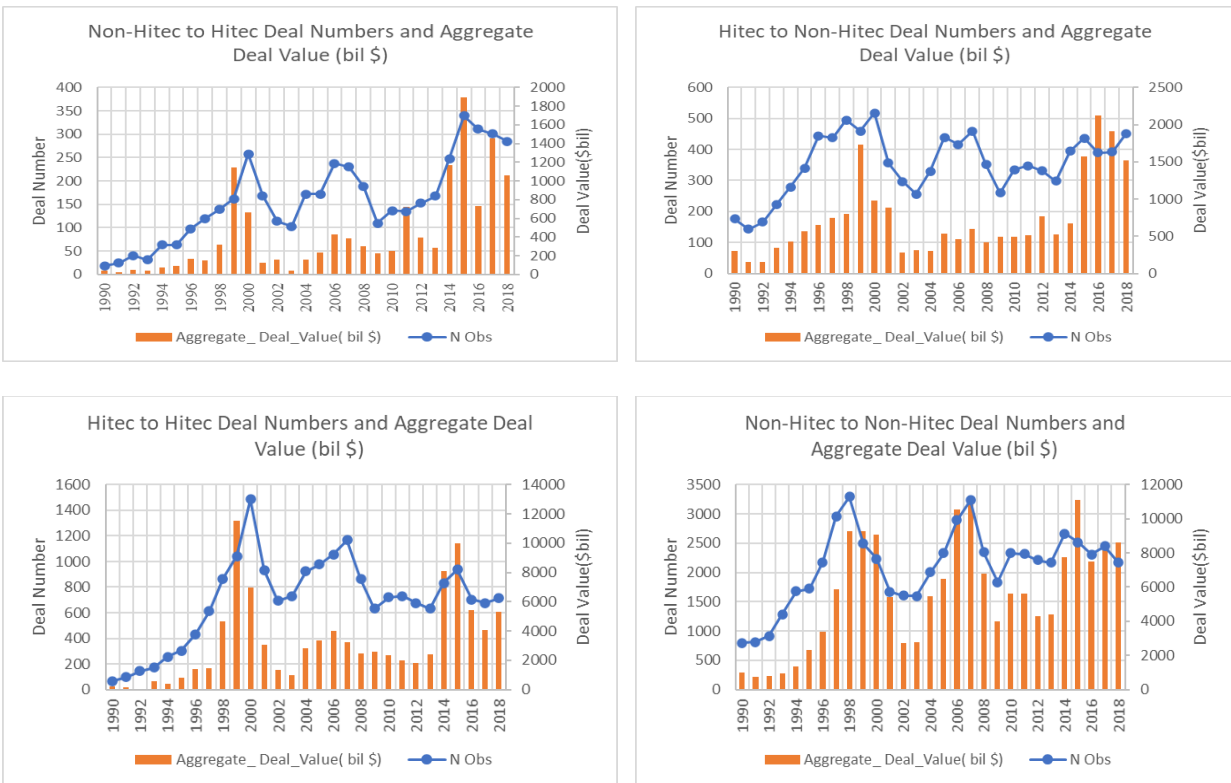


Figure 2

The area charts of four technology deal types.

This figure exhibits the proportion of each technology deal type on the whole M&A markets by deal number and transaction value during 1990-2018, respectively, where the sample is described in Table 1.

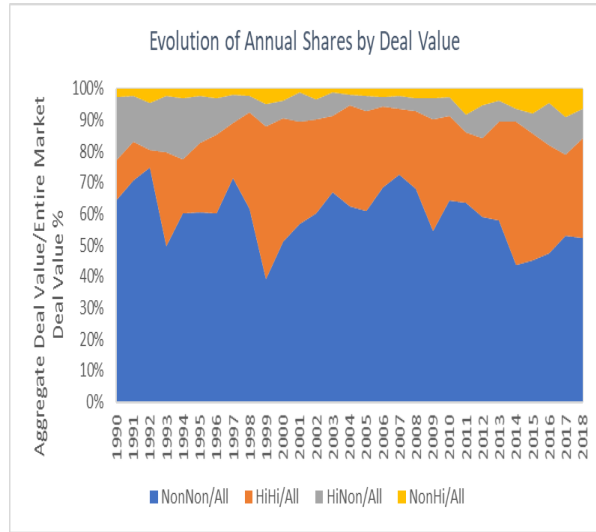
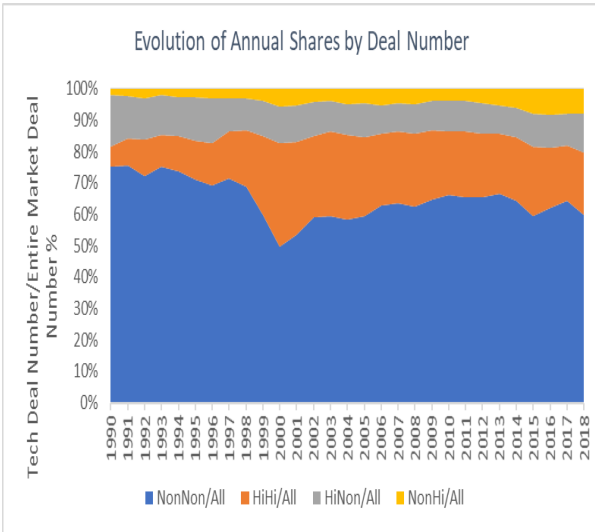


Table 4

Summary Statistics.

The table presents means, medians, and sample size for bidder and deal characteristics of the primary sample described in Table 1, including 95,935 deals undertaken by public bidders, of which 12,847 deals are on public targets, and 83,088 deals are on private firms, segregated into different technology deal types. Panel A indicates private targets deal characteristics, and Panel B is private targets deal characteristics. The difference column reports the statistically significant differences between Hi-Non & Non-Hi deals and the rest of public deals. The symbols *, **, *** denote the significance levels of 10%, 5%, and 1%, respectively. The definition of all variables is in the Appendix.

		All	Hi-Non	Non-Hi	Hi-Hi	Non-Non	Hi-Non& Non-Hi	Difference
		(1)	(2)	(3)	(4)	(5)	(6)	(6)-other deal
Panel A: Public Targets								
Deal Value(\$mil)	mean	1,781.09	1,613.72	1,778.91	2,791.16	1,445.52	1,676.56	-123.82***
	median	186.61	211.16	186.66	268.01	161.66	203.00	17.48
	n	12,847	855	525	3,024	8,443	1,380	
Size (\$mil)	mean	8,280.21	8,923.74	6,251.05	15,461.17	5,704.07	7,888.59	-438.45
	median	1,029.57	1,363.74	898.70	1,744.89	866.14	1,163.91	88.15
	n	11,507	753	476	2,763	7,515	1,229	
Target Size (\$mil)	mean	1,190.39	924.68	1,060.93	1,448.59	1,112.50	980.63	-235.50**
	median	167.24	168.00	125.89	179.91	166.73	144.59	25.56*
	n	8,243	531	370	2,264	5,078	901	
Relative Size%	mean	51.19	49.01	72.33	40.46	54.01	58.04	7.67**
	median	24.04	18.16	24.07	18.41	27.39	20.46	-3.97
	n	11,507	753	476	2,763	7,515	1,229	
Book-to-Market	mean	0.73	0.57	0.61	0.47	0.85	0.58	-0.17***
	median	0.56	0.43	0.44	0.37	0.67	0.43	-0.15***
	n	9,854	651	398	2,364	6,441	1,049	
Leverage	mean	1.05	0.88	0.89	0.65	1.23	0.88	-0.19***
	median	0.51	0.42	0.48	0.26	0.64	0.44	-0.07***
	n	10,697	699	425	2,564	7,009	2,235	
Hostile %	mean	7.00	7.37	7.24	5.59	7.33	7.32	0.45
	n	12,847	855	525	3,024	8,443	1,380	
Tender %	mean	25.66	28.89	29.33	27.11	24.57	29.06	3.81***
	n	12,847	855	525	3,024	8,443	1,380	
All Stock %	mean	39.09	34.27	36.57	36.11	40.80	35.14	-4.42***
	n	12,847	855	525	3,024	8,443	1,380	
All Cash %	mean	27.51	32.98	35.62	35.25	23.68	34.00	7.26***
	n	12,847	855	525	3,024	8,443	1,380	
Incl. Stock %	mean	58.63	51.35	50.48	53.77	61.61	51.01	-8.53***
	n	12,847	855	525	3,024	8,443	1,380	
Cross-border %	mean	21.27	22.00	28.19	25.99	19.07	24.35	3.45***
	n	12,847	855	525	3,024	8,443	1,380	
Competing Bid%	mean	8.24	8.77	5.90	8.23	8.34	7.68	0.63
	n	12,847	855	525	3,024	8,443	1,380	
Synergy Proxy %	mean	12.91	9.60	14.48	16.07	12.01	11.45	-1.63*
	n	1,2847	855	525-	3,024-	8,443-	1,380	
Hi-Non & Non-Hi%	mean	10.74	-	-	-	-	-	-
	n	12,847	-	-	-	-	-	-
Hi-Non%	mean	6.66	-	-	-	-	-	-
	n	12,847	-	-	-	-	-	-
Non-Hi%	mean	4.10	-	-	-	-	-	-
	n	12,847	-	-	-	-	-	-
Hi-Hi%	mean	23.54	-	-	-	-	-	-
	n	12,847	-	-	-	-	-	-
Non-Non%	mean	65.72	-	-	-	-	-	-
	n							

	n	12,847	-	-	-	-	-	-
Panel B: Private Targets								
Deal Value(\$mil)	mean	164.32	142.01	145.14	194.46	159.99	142.96	-25.47***
	median	27.80	23.23	23.59	25.45	30.11	23.32	-5.51***
Size (\$mil)	n	83,088	9,365	4,068	17,058	52,597	13,433	
	mean	2,096.61	2,125.98	1,672.66	2,855.31	1,867.80	1,989.87	-127.27
	median	333.40	294.81	230.61	351.04	340.666	273.43	-75.94***
Relative Size%	n	73,975	8,350	3,583	15,571	46,471	11,933	
	mean	39.06	36.63	68.46	27.66	41.05	46.18	8.49***
	median	9.08	7.85	12.00	7.65	9.72	8.89	-0.23
Book-to-Market	n	73,975	8,350	3,583	15,571	46,471	11,933	
	mean	0.74	0.61	0.66	0.52	0.84	0.63	-0.13***
	median	0.56	0.45	0.47	0.40	0.65	0.46	-0.12***
Leverage	n	59,753	6,830	2,883	12,551	37,489	9,713	
	mean	0.86	0.70	0.76	0.51	1.01	0.72	-0.16***
	median	0.41	0.31	0.33	0.12	0.54	0.31	-0.12***
Hostile %	n	66,200	7,440	3,041	13,984	41,735	10,481	
	mean	0.79	0.08	0.05	0.05	0.09	0.07	-0.01
Tender %	n	83,088	9,365	4,068	17,058	52,597	13,433	
	mean	0.26	0.23	0.10	0.09	0.33	0.19	-0.07*
100% Stock %	n	83,088	9,365	4,068	17,058	52,597	13,433	
	mean	11.00	12.44	16.03	14.44	9.07	13.53	3.14***
100% Cash %	n	83,088	9,365	4,068	17,058	52,597	13,433	
	mean	23.52	25.10	19.89	24.87	23.08	23.51	0.01
Incl. Stock %	n	83,088	9,365	4,068	17,058	52,597	13,433	
	mean	27.97	30.00	36.11	36.12	24.35	31.80	4.57***
Cross-border %	n	8,088	9,365	4,068	17,058	52,597	13,433	
	mean	26.43	27.88	24.14	31.22	23.79	26.75	0.38*
Competing Bid%	n	83,088	9,365	4,068	17,058	52,597	13,433	
	mean	0.295	0.22	0.15	0.23	0.34	0.20	-0.11**
Synergy Proxy %	n	83,088	9,365	4,068	17,058	52,597	13,433	
	mean	5.93	6.47	8.43	8.15	4.91	7.06	1.36***
Hi-Non & Non-Hi%	n	83,088	9,365	4,068	17,058	52,597	13,433	
	mean	16.17				-		
Hi-Non%	n	83,088						
	mean	11.27						
Non-Hi%	n	83,088						
	mean	4.90						
Hi-Hi%	n	83,088						
	mean	20.53						
Non-Non%	n	83,088						
	mean	63.30						

Table 5

Univariate tests of acquirers' stock return performance and operating performance changes around the transaction.

This table reports mean and median of acquirer three-day cumulative abnormal return in percentage (Panel A), ACAR, and operating performance changes in percentage (Panel B), % Δ ROA(-1,+*i*) (*i*=1,2,3), by target public status and technology deal group. Year - 1 is the last fiscal year before the deal announcement. Year + *i* is the *i*th fiscal year after the announcement. T-tests are used for means and Wilcoxon test for medians of ACARs and ROA changes (%). The variables are defined in the Appendix. The ***, **, and* are used to denote statistics are significantly above zero at 1%, 5%, and 10% levels, respectively.

<i>Target listed Status</i>	<i>Technology Deal Type</i>						
	<i>All</i>	<i>Hi-Non</i>	<i>Non-Hi</i>	<i>Hi-Hi</i>	<i>Non-Non</i>	<i>Hi-Non& Non-Hi</i>	
Panel A: 3-day % ACAR							
1) All Targets	mean	1.58***	2.01***	2.69***	1.49***	1.45***	2.22***
	median	0.56***	0.77***	0.75***	0.71***	0.48***	0.76***
	n	79,455	8,520	3,778	17,064	50,093	12298
2) Public Targets	mean	-0.42	-0.28	0.05	-1.06	-0.23	-0.16
	median	-0.43	-0.33	-0.09	-0.70	-0.38	-0.24
	n	11,075	728	451	2,681	7,215	1179
3) Private Targets	mean	1.90***	2.23***	3.05***	1.96***	1.73***	2.47***
	median	0.71***	0.85***	0.91***	0.97***	0.61***	0.87***
	n	68,380	7,792	3,327	14,383	42,878	11,119
3) - 2)	mean	2.32***	2.51***	3.00***	3.02***	1.96***	2.63***
	median	1.14***	1.18***	1.00***	1.67***	0.99***	1.11***
Panel B: % Δ ROA							
1) Public Targets							
Δ ROA(-1,+1)	mean	-2.55	-1.30	-0.67	-4.44	-2.07	
	median	-4.59	-4.91	-4.06	-9.37	-3.52	
	n	10,137	681	402	2,501	6,553	
Δ ROA(-1,+2)	mean	-2.79	-1.95	-0.70	-4.86	-2.22	
	median	-4.47	-4.90	-3.92	-9.44	-3.35	
	n	9411	650	365	2,320	6,076	
Δ ROA(-1,+3)	mean	-3.14	-3.48	-1.49	-5.28	-2.39	
	median	-4.46	-4.89	-4.04	-9.52	-3.24	
	n	8,676	596	331	2,130	5,619	
2) Private Targets							
Δ ROA(-1,+1)	mean	0.046	0.75**	7.26***	-0.06	-0.60	
	median	-5.61	-6.12	-4.04	-8.86	-4.86	
	n	62,809	7,180	2,998	13,474	39,157	
Δ ROA(-1,+2)	mean	-0.40	0.027	6.02***	-0.75	-0.83	
	median	-5.53	-6.08	-4.21	-8.94	-4.74	
	n	57,346	6,518	2,637	12,167	36,024	
Δ ROA(-1,+3)	mean	-0.74	-0.52	5.59***	-1.28	-1.04	
	median	-5.49	-6.15	-4.18	-9.05	-4.63	
	n	51,535	5,902	2,306	10,827	32,500	
3) - 2)							
Δ ROA(-1,+1)	mean	2.59***	2.05*	7.93***	4.38***	1.47***	
	median	-1.02***	-1.21**	0.02	0.51**	-1.34***	
Δ ROA(-1,+2)	mean	2.39***	1.98*	6.72***	4.11***	1.39***	
	median	-1.06***	-1.18**	-0.29	0.50**	-1.39***	
Δ ROA(-1,+3)	mean	2.41***	2.96**	7.07***	4.00***	1.35***	
	median	-1.03***	-1.26**	-0.14	0.47*	-1.39***	

Table 6

Acquirer stock returns regression analysis.

The table reports multivariate regression coefficient estimates of the acquirer three-day cumulative abnormal return (ACAR%) on technology dummy, acquirer, and deal characteristics. The technology dummy variable takes the value of 1 if the deal was in the specific technology deal type and 0 otherwise. Panel A shows the results for all the 63,373 deals with available information. Panel B and Panel C presents estimates for deals with private targets and public targets, respectively. All regressions are controlled by the year and country-fixed effects. The sample criteria are described in Table 1. Definitions of the variable are explained in Appendix. The *, **, and *** denote statistical significance levels of 10%, 5% and 1% respectively.

3-day ACARs (%)	Panel A: All targets					Panel B: Private targets					Panel C: Public targets				
	Hi-Non	Non-Hi	Hi-Hi	Non-Non	Hi-Non& Non-Hi	Hi-Non	Non-Hi	Hi-Hi	Non-Non	Hi-Non& Non-Hi	Hi-Non	Non-Hi	Hi-Hi	Non-Non	Hi-Non& Non-Hi
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Technology dummy	0.223*** (0.008)	0.503*** (0.006)	-0.016 (0.869)	-0.194** (0.033)	0.336*** (0.000)	0.211** (0.029)	0.454*** (0.002)	0.000 (0.998)	-0.197** (0.042)	0.309*** (0.001)	-0.028 (0.894)	0.322 (0.342)	-0.584** (0.011)	0.430** (0.036)	0.114 (0.598)
Log(Size)	-0.419*** (0.000)	-0.418*** (0.000)	-0.420*** (0.000)	-0.416*** (0.000)	-0.417*** (0.000)	-0.423*** (0.000)	-0.423*** (0.000)	-0.424*** (0.000)	-0.421*** (0.000)	-0.422*** (0.000)	-0.359*** (0.000)	-0.359*** (0.000)	-0.356*** (0.000)	-0.357*** (0.000)	-0.359*** (0.000)
Relative size	1.083*** (0.000)	1.076*** (0.000)	1.082*** (0.000)	1.085*** (0.000)	1.080*** (0.000)	1.189*** (0.000)	1.185*** (0.000)	1.189*** (0.000)	1.193*** (0.000)	1.187*** (0.000)	0.206 (0.317)	0.201 (0.330)	0.202 (0.330)	0.212 (0.307)	0.203 (0.323)
Book-to-Market	-0.194*** (0.009)	-0.197*** (0.008)	-0.201*** (0.003)	-0.177*** (0.007)	-0.189*** (0.010)	-0.181*** (0.010)	-0.185*** (0.009)	-0.187*** (0.005)	-0.165*** (0.010)	-0.177** (0.012)	-0.157 (0.240)	-0.152 (0.250)	-0.219* (0.085)	-0.217 (0.103)	-0.153 (0.256)
Hostile	-0.379 (0.103)	-0.380 (0.102)	-0.379 (0.104)	-0.378 (0.105)	-0.381 (0.102)	-0.658 (0.571)	-0.647 (0.576)	-0.655 (0.573)	-0.667 (0.564)	-0.655 (0.573)	-0.261 (0.260)	-0.260 (0.259)	-0.277 (0.235)	-0.274 (0.242)	-0.260 (0.260)
Tender	0.690*** (0.001)	0.686*** (0.001)	0.695*** (0.001)	0.676*** (0.001)	0.683*** (0.001)	0.177 (0.803)	0.181 (0.798)	0.181 (0.799)	0.182 (0.797)	0.176 (0.804)	-0.096 (0.535)	-0.098 (0.526)	-0.069 (0.659)	-0.070 (0.657)	-0.098 (0.527)
Private target	2.227*** (0.000)	2.237*** (0.000)	2.237*** (0.000)	2.227*** (0.000)	2.221*** (0.000)										
Payment incl. stock	0.310** (0.034)	0.309** (0.033)	0.311** (0.033)	0.298** (0.040)	0.309** (0.034)	0.785*** (0.000)	0.784*** (0.000)	0.786*** (0.000)	0.768*** (0.000)	0.783*** (0.000)	-2.054*** (0.000)	-2.047*** (0.000)	-2.075*** (0.000)	-2.086*** (0.000)	-2.048*** (0.000)
Cross-border	0.325*** (0.001)	0.330*** (0.001)	0.331*** (0.001)	0.311*** (0.001)	0.323*** (0.001)	0.265** (0.011)	0.270*** (0.010)	0.270** (0.012)	0.250** (0.019)	0.263** (0.012)	0.091 (0.727)	0.088 (0.734)	0.114 (0.660)	0.113 (0.659)	0.089 (0.732)
Competing bidder	-0.028 (0.905)	-0.019 (0.935)	-0.025 (0.914)	-0.026 (0.909)	-0.025 (0.914)	0.598 (0.256)	0.598 (0.256)	0.597 (0.258)	0.600 (0.257)	0.599 (0.255)	0.079 (0.773)	0.084 (0.760)	0.083 (0.764)	0.080 (0.770)	0.079 (0.773)
Leverage	-0.023 (0.298)	-0.023 (0.278)	-0.025 (0.254)	-0.016 (0.481)	-0.021 (0.327)	-0.050** (0.044)	-0.051** (0.039)	-0.052** (0.036)	-0.043* (0.083)	-0.049** (0.048)	0.127** (0.046)	0.128** (0.046)	0.105* (0.082)	0.108* (0.069)	0.128** (0.045)
Synergy dummy	0.566*** (0.003)	0.563*** (0.003)	0.567*** (0.003)	0.555*** (0.003)	0.563*** (0.003)	0.814*** (0.000)	0.812*** (0.000)	0.816*** (0.000)	0.802*** (0.000)	0.811*** (0.000)	-0.142 (0.631)	-0.142 (0.630)	-0.128 (0.663)	-0.135 (0.645)	-0.141 (0.633)
Intercept	0.456***	0.479***	0.471***	0.664***	0.452***	2.695***	2.727***	2.720***	2.903***	2.688***	7.750*	7.738*	7.796*	7.426*	7.726*
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	63,373	63,373	63,373	63,373	63,373	54,065	54,065	54,065	54,065	54,065	9,308	9,308	9,308	9,308	9,308
Adj. R ² (%)	5.60	5.61	5.59	5.61	5.62	5.42	5.43	5.42	5.43	5.44	5.27	5.27	5.37	5.33	5.27

Table 7

Acquirers return regressions with three and four technology dummies.

The table presents OLS regressions of ACAR on technology deal indicators and other control variables. The technology deal indicator is a dummy equal to one if the acquirer and target are in the corresponding technology industry. Panel A is all deals satisfied the criteria in Table 1, panel B is the unlisted target deals, and panel C is the transaction with listed targets. Model (1), (3), and (5) are regressions with three technology dummies and the constant. Model (2), (4), and (6) include four technology type indicators without constant. We use *, **, *** to denote statistical significance at the 1%, 5%, and 10% levels, respectively.

3-day ACARs (%)	<i>Panel A: All targets</i>		<i>Panel B: Private targets</i>		<i>Panel C: Public targets</i>	
	(1)	(2)	(3)	(4)	(5)	(6)
Hi-Non-tech dummy	0.273*** (0.004)	0.736 (0.862)	0.263** (0.015)	-0.258 (0.972)	-0.201 (0.371)	7.624 (0.012)
Non-Hi-tech dummy	0.553*** (0.004)	1.017 (0.810)	0.509** (0.014)	-0.012 (0.999)	0.129 (0.724)	7.953 (0.009)
Hi-Hi-tech dummy	0.068 (0.533)	0.531 (0.900)	0.083 (0.471)	-0.438 (0.952)	-0.598** (0.014)	7.226 (0.017)
Non-Non-tech dummy		0.463 (0.913)		-0.521 (0.943)		7.824 (0.010)
Log(Size)	-0.416*** (0.000)	-0.416*** (0.000)	-0.421*** (0.000)	-0.421*** (0.000)	-0.356*** (0.000)	-0.356 (0.000)
Relative size	1.079*** (0.000)	1.079*** (0.000)	1.187*** (0.000)	1.187*** (0.000)	0.201 (0.333)	0.201 (0.065)
Book-to-Market	-0.184*** (0.005)	-0.184*** (0.000)	-0.171*** (0.007)	-0.171*** (0.000)	-0.223* (0.091)	-0.223 (0.065)
Hostile	-0.380 (0.102)	-0.380 (0.197)	-0.656 (0.570)	-0.656 (0.561)	-0.278 (0.234)	-0.278 (0.359)
Tender	0.676*** (0.001)	0.676*** (0.000)	0.178 (0.801)	0.178 (0.782)	-0.067 (0.669)	-0.067 (0.727)
Private target	2.224*** (0.000)	2.224*** (0.000)				
Payment incl. stock	0.305** (0.036)	0.305*** (0.000)	0.776*** (0.000)	0.776*** (0.000)	-2.078*** (0.000)	-2.078 (0.000)
Cross-border	0.319*** (0.001)	0.319*** (0.000)	0.258** (0.016)	0.258*** (0.001)	0.115 (0.657)	0.115 (0.590)
Competing bidder	-0.022 (0.924)	-0.022 (0.932)	0.600 (0.255)	0.600 (0.338)	0.087 (0.752)	0.087 (0.752)
Leverage	-0.019 (0.390)	-0.019 (0.328)	-0.046* (0.065)	-0.046** (0.031)	0.104* (0.079)	0.104 (0.021)
Synergy dummy	0.559*** (0.003)	0.559*** (0.000)	0.805*** (0.000)	0.805*** (0.000)	-0.130 (0.657)	-0.130 (0.568)
Intercept	0.463***	No	2.699***	No	7.824*	No
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	63,373	63,373	54,065	54,065	9,308	9,308
Adj. R ² (%)	5.62	8.89	5.44	10.41	5.37	5.94

Table 8

Operating performance changes around takeover multivariate regressions private targets vs. public targets.

The table reports cross-sectional regression estimates of change in operating performance before and after the M&A transaction. The dependent variable, $\Delta ROA(-1,+i)$ ($i=1,2,3$), is the change of return on assets adjusted by the industry average between the post-announcement and pre-announcement. Year-1 is the last fiscal year prior to the deal announcement. Year $+i$ is the i th year post the announcement. Panel A shows the estimates of $\Delta ROA(-1,+1)$, panel B reports results of $\Delta ROA(-1,+2)$, and panel C is on the $\Delta ROA(-1,+3)$. The regressions are controlled with year and country fixed effects. P -values are presented below regression estimates. All variables are described in Appendix. Symbols *, **, *** corresponds to statistical significance levels at the 10%, 5%, and 1% respectively.

<i>Panel A: % $\Delta ROA(-1,+1)$</i>								
	<i>(1) Private targets</i>				<i>(2) Public targets</i>			
	<i>Hi-Non</i>	<i>Non-Hi</i>	<i>Hi-Hi</i>	<i>Non-Non</i>	<i>Hi-Non</i>	<i>Non-Hi</i>	<i>Hi-Hi</i>	<i>Non-Non</i>
Technology dummy	-0.709** (0.018)	2.435*** (0.000)	-2.234*** (0.000)	1.444*** (0.000)	-0.028 (0.969)	1.256 (0.177)	-2.043*** (0.000)	1.462*** (0.000)
Log(Size)	-3.684*** (0.000)	-3.673*** (0.000)	-3.705*** (0.000)	-3.709*** (0.000)	-2.843*** (0.000)	-2.843*** (0.000)	-2.835*** (0.000)	-2.839*** (0.000)
Relative size	2.788*** (0.000)	2.768*** (0.000)	2.731*** (0.000)	2.762*** (0.000)	1.135*** (0.000)	1.123*** (0.000)	1.119*** (0.000)	1.147*** (0.000)
Book-to-market	-3.668*** (0.000)	-3.637*** (0.000)	-3.825*** (0.000)	-3.808*** (0.000)	-1.996*** (0.000)	-1.980*** (0.000)	-2.212*** (0.000)	-2.197*** (0.000)
Hostile	2.433 (0.481)	2.452 (0.478)	2.569 (0.457)	2.526 (0.465)	-0.485 (0.508)	-0.491 (0.502)	-0.553 (0.450)	-0.532 (0.468)
Tender	1.517 (0.444)	1.496 (0.451)	1.458 (0.462)	1.509 (0.447)	-1.334*** (0.004)	-1.340*** (0.004)	-1.242*** (0.007)	-1.244*** (0.007)
Payment incl. stock	4.645*** (0.000)	4.628*** (0.000)	4.815*** (0.000)	4.771*** (0.000)	1.678*** (0.000)	1.703*** (0.000)	1.602*** (0.000)	1.563*** (0.000)
Cross-border	3.876*** (0.000)	3.861*** (0.000)	4.035*** (0.000)	4.007*** (0.000)	2.668*** (0.000)	2.662*** (0.000)	2.741*** (0.000)	2.737*** (0.000)
Competing bidder	1.026 (0.584)	1.034 (0.581)	1.039 (0.579)	1.025 (0.584)	-0.887 (0.183)	-0.871 (0.190)	-0.879 (0.186)	-0.883 (0.184)
Leverage	0.371*** (0.000)	0.380*** (0.000)	0.298*** (0.000)	0.312*** (0.000)	0.653*** (0.000)	0.656*** (0.000)	0.577*** (0.000)	0.588*** (0.000)
Synergy dummy	-1.701*** (0.000)	-1.730*** (0.000)	-1.588*** (0.000)	-1.606*** (0.000)	-1.579*** (0.004)	-1.580*** (0.004)	-1.524*** (0.006)	-1.558*** (0.005)
Intercept	25.816	-1.289	-1.465	-2.688	17.991**	17.983**	18.034**	16.763**
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	54,274	54,274	54,274	54,274	9,135	9,135	9,135	9,135
Adj. R^2 (%)	15.81	15.85	15.93	15.88	14.84	14.86	15.04	14.96

<i>Panel B: % $\Delta ROA(-1,+2)$</i>								
	<i>(1) Private targets</i>				<i>(2) Public targets</i>			
	<i>Hi-Non</i>	<i>Non-Hi</i>	<i>Hi-Hi</i>	<i>Non-Non</i>	<i>Hi-Non</i>	<i>Non-Hi</i>	<i>Hi-Hi</i>	<i>Non-Non</i>
Technology dummy	-0.743** (0.016)	2.188*** (0.000)	-2.339*** (0.000)	1.593*** (0.000)	-0.299 (0.683)	1.144 (0.230)	-2.154*** (0.000)	1.671*** (0.000)
Log(Size)	-3.620*** (0.000)	-3.610*** (0.000)	-3.643*** (0.000)	-3.647*** (0.000)	-2.737*** (0.000)	-2.737*** (0.000)	-2.727*** (0.000)	-2.731*** (0.000)
Relative size	2.905*** (0.000)	2.887*** (0.000)	2.843*** (0.000)	2.875*** (0.000)	1.146*** (0.000)	1.135*** (0.000)	1.131*** (0.000)	1.157*** (0.000)

Book-to-market	-3.570*** (0.000)	-3.539*** (0.000)	-3.735*** (0.000)	-3.726*** (0.000)	-2.006*** (0.000)	-1.984*** (0.000)	-2.231*** (0.000)	-2.235*** (0.000)
Hostile	2.475 (0.486)	2.479 (0.485)	2.609 (0.463)	2.585 (0.467)	-0.530 (0.473)	-0.534 (0.470)	-0.606 (0.412)	-0.588 (0.426)
Tender	1.494 (0.452)	1.471 (0.459)	1.416 (0.476)	1.479 (0.456)	-1.315*** (0.005)	-1.324*** (0.005)	-1.227*** (0.009)	-1.218*** (0.009)
Payment incl. stock	4.381*** (0.000)	4.364*** (0.000)	4.560*** (0.000)	4.521*** (0.000)	1.625*** (0.000)	1.651*** (0.000)	1.552*** (0.000)	1.506*** (0.000)
Cross-border	3.938*** (0.000)	3.923*** (0.000)	4.100*** (0.000)	4.080*** (0.000)	2.837*** (0.000)	2.833*** (0.000)	2.903*** (0.000)	2.905*** (0.000)
Competing bidder	0.946 (0.618)	0.945 (0.618)	0.941 (0.619)	0.942 (0.619)	-0.734 (0.274)	-0.727 (0.278)	-0.746 (0.265)	-0.739 (0.270)
Leverage	0.403*** (0.000)	0.412*** (0.000)	0.326*** (0.000)	0.338*** (0.000)	0.635*** (0.000)	0.640*** (0.000)	0.555*** (0.000)	0.559*** (0.000)
Synergy dummy	-1.917*** (0.000)	-1.947*** (0.000)	-1.794*** (0.000)	-1.806*** (0.000)	-1.304*** (0.020)	-1.300*** (0.020)	-1.226*** (0.029)	-1.269*** (0.023)
Intercept	3.876	3.922	3.626	2.141	20.090**	20.035**	20.145**	18.701**
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	49,754	49,754	49,754	49,754	8,498	8,498	8,498	8,498
Adj. R ² (%)	15.97	16.00	16.10	16.05	14.83	14.85	15.06	14.99

Panel C: % Δ ROA(-1,+3)

	(1) Private targets				(2) Public targets			
	Hi- Non	Non- Hi	Hi- Hi	Non- Non	Hi- Non	Non- Hi	Hi- Hi	Non- Non
Technology dummy	-0.810** (0.012)	2.454*** (0.000)	-2.532*** (0.000)	1.712*** (0.000)	-0.425 (0.561)	1.337 (0.160)	-2.200*** (0.000)	1.716*** (0.000)
Log(Size)	-3.567*** (0.000)	-3.557*** (0.000)	-3.592*** (0.000)	-3.596*** (0.000)	-2.565*** (0.000)	-2.566*** (0.000)	-2.554*** (0.000)	-2.556*** (0.000)
Relative size	2.767*** (0.000)	2.750*** (0.000)	2.701*** (0.000)	2.733*** (0.000)	1.330*** (0.000)	1.315*** (0.000)	1.310*** (0.000)	1.341*** (0.000)
Book-to-market	-3.527*** (0.000)	-3.494*** (0.000)	-3.703*** (0.000)	-3.692*** (0.000)	-1.660*** (0.000)	-1.635*** (0.000)	-1.884*** (0.000)	-1.885*** (0.000)
Hostile	3.542 (0.350)	3.523 (0.352)	3.715 (0.326)	3.708 (0.328)	-0.807 (0.269)	-0.810 (0.267)	-0.873 (0.232)	-0.855 (0.242)
Tender	1.370 (0.499)	1.339 (0.509)	1.260 (0.534)	1.346 (0.506)	-1.326*** (0.004)	-1.342*** (0.004)	-1.242*** (0.008)	-1.226*** (0.009)
Payment incl. stock	4.347*** (0.000)	4.323*** (0.000)	4.536*** (0.000)	4.499*** (0.000)	1.592*** (0.000)	1.624*** (0.000)	1.535*** (0.000)	1.485*** (0.000)
Cross-border	3.972*** (0.000)	3.956*** (0.000)	4.144*** (0.000)	4.123*** (0.000)	2.890*** (0.000)	2.887*** (0.000)	2.954*** (0.000)	2.956*** (0.000)
Competing bidder	0.661 (0.735)	0.657 (0.736)	0.653 (0.738)	0.654 (0.737)	-1.080 (0.106)	-1.077 (0.107)	-1.098* (0.100)	-1.084 (0.104)
Leverage	0.444*** (0.000)	0.453*** (0.000)	0.358*** (0.000)	0.373*** (0.000)	0.604*** (0.000)	0.612*** (0.000)	0.525*** (0.000)	0.523*** (0.000)
Synergy dummy	-1.862*** (0.000)	-1.892*** (0.000)	-1.731*** (0.000)	-1.743*** (0.000)	-1.361*** (0.015)	-1.358*** (0.016)	-1.287*** (0.022)	-1.321*** (0.019)
Intercept	17.959	17.614	17.638	16.695	18.425**	18.372**	18.471**	16.965**
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	44,849	44,849	44,849	44,849	7,844	7,844	7,844	7,844
Adj. R ² (%)	15.78	15.81	15.93	15.87	15.55	15.57	15.80	15.74

Table 9

Propensity score matching ACARs.

The table reports the acquisition gains differences by comparing the three-day acquirer % ACAR of Non-Hi deals or Hi-Non with other deals using a propensity score matching estimator, conditional on the target's listed status. Panel A reports logit estimation results where the dependent variable equals one if the deal is in the Non-Hi or the Hi-Non technology type and zero otherwise. Panel B presents ACAR for the Non-Hi or the Hi-Non deals (Treated group) and propensity score-matched firms in other deals (Control group). The difference is the % ACAR of control samples minus treated samples. Symbols *, **, *** denote statistical significance at the 10%, 5%, and 1% level. All variables are defined in the Appendix.

<i>Panel A: Probit estimation</i>								
			<i>(1)Private targets</i>		<i>(2)Public targets</i>			
			<i>Non-Hi</i>	<i>Hi-Non</i>	<i>Non-Hi</i>	<i>Hi-Non</i>		
Leverage			0.001 (0.972)	-0.013 (0.348)	-0.041 (0.492)	0.033 (0.380)		
Liquidity			-0.012 (0.115)	-0.014*** (0.006)	-0.061 (0.116)	-0.036* (0.100)		
Cash to total assets			0.011 (0.948)	0.498*** (0.000)	-1.068** (0.045)	0.148 (0.662)		
Tobin's q			0.001** (0.013)	0.000 (0.678)	-0.003 (0.748)	-0.004 (0.440)		
Relative size			0.128*** (0.000)	-0.008 (0.703)	0.170** (0.024)	0.009 (0.901)		
Log(Size)			0.001 (0.523)	0.006 (0.533)	0.011 (0.755)	-0.016 (0.549)		
Acquirer nation			-0.002*** (0.000)	0.003*** (0.000)	0.003* (0.086)	0.010*** (0.000)		
Pre-BHR			-0.032 (0.166)	-0.001 (0.561)	0.036 (0.215)	0.010 (0.408)		
Post-BHR			-0.098*** (0.005)	0.018 (0.400)	-0.085 (0.266)	-0.025 (0.522)		
Cross border			-0.313*** (0.000)	0.007 (0.847)	0.188 (0.219)	-0.018 (0.885)		
Intercept			-2.748	-2.231	-3.216	-3.159		
N			31,460	31,460	5,327	5,327		
Adj. R ² (%)			0.78	0.39	2.02	1.43		

<i>Panel B: Propensity score matching of private target deals</i>								
			<i>One-to-one</i>	<i>5 Nearest</i>	<i>30 Nearest</i>	<i>50 Nearest</i>	<i>Radius Caliper</i>	<i>Gaussian Kernel</i>
<i>Non-Hi</i>								
3-day ACARs	Treated	mean	2.885	2.885	2.885	2.885	2.885	2.885
	Control	mean	1.987	2.241	2.255	2.299	2.192	1.973
	Difference		0.898***	0.644***	0.630***	0.586**	0.693***	0.912***
<i>Hi-Non</i>								
3-day ACARs	Treated	mean	2.026	2.026	2.026	2.026	2.026	2.026
	Control	mean	1.778	1.921	1.935	1.952	1.920	1.981
	Difference		0.248	0.106	0.091	0.074	0.107	0.045

Panel C: Propensity score matching of public target deals (Continued)

			<i>One-to-one</i>	<i>5 Nearest</i>	<i>30 Nearest</i>	<i>50 Nearest</i>	<i>Radius Caliper</i>	<i>Gaussian Kernel</i>
Non-Hi								
3-day ACARs	Treated	mean	0.172	0.172	0.172	0.172	0.172	0.172
	Control	mean	-0.535	-0.413	-0.503	-0.535	-0.522	-0.519
	Difference		0.708	0.585	0.676	0.707	0.695	0.692
Hi-Non								
3-day ACARs	Treated	mean	-0.430	-0.430	-0.430	-0.430	-0.430	-0.430
	Control	mean	-0.679	-0.454	-0.483	-0.526	-0.598	-0.594
	Difference		0.249	0.024	0.053	0.096	0.168	0.164

Table 10

Propensity score estimation of changes in ROAs.

The table reports the acquisition gains differences by comparing the changes in operating performance of Non-Hi deals with other deals using a propensity score matching estimator, conditional on the listed status on the target. Panel A reports logit estimation results where the dependent variable equals 1 if the deal is in the Non-Hi or the Hi-Non type and zero otherwise. Panel B presents changes in operating performance for the Non-Hi or the Hi-Non deals (Treated group) and propensity score-matched firms in other deals (Control group). The difference is the $\Delta ROA(-1, +i)$ ($i=1,2,3$) of control samples minus treated samples. Symbols *, **, *** denote statistical significance at the 10%, 5%, and 1% level. All variables are defined in the Appendix.

Panel A: Probit estimation						
<i>Non-Hi = 1</i>	<i>(1) Private targets</i>			<i>(2) Public targets</i>		
	$\Delta ROA(-1, +1)$	$\Delta ROA(-1, +2)$	$\Delta ROA(-1, +3)$	$\Delta ROA(-1, +1)$	$\Delta ROA(-1, +2)$	$\Delta ROA(-1, +3)$
Leverage	-0.041** (0.030)	-0.040** (0.046)	-0.048** (0.027)	-0.031 (0.506)	-0.090 (0.121)	-0.188** (0.015)
Liquidity	-0.016** (0.014)	-0.018*** (0.009)	-0.022*** (0.003)	-0.074** (0.028)	-0.092** (0.018)	-0.103** (0.017)
Cash to total assets	0.155 (0.260)	0.155 (0.291)	0.203 (0.193)	-0.278 (0.537)	-0.291 (0.546)	-0.275 (0.589)
Tobin's q	0.001** (0.026)	0.001** (0.028)	0.002*** (0.002)	-0.002 (0.700)	-0.001 (0.888)	0.000 (0.933)
Relative size	0.109*** (0.000)	0.116*** (0.000)	0.108*** (0.000)	0.080 (0.272)	0.056 (0.481)	0.100 (0.209)
Log(Size)	0.011 (0.382)	0.006 (0.647)	-0.002 (0.889)	0.000 (0.987)	0.005 (0.877)	0.019 (0.579)
ΔROA pre (-2,-1)	0.102 (0.277)	0.117 (0.238)	0.094 (0.376)	-0.233 (0.586)	-0.349 (0.482)	-0.525 (0.349)
ROA pre-industry-adjusted	-0.102 (0.269)	-0.117 (0.234)	-0.094 (0.371)	0.232 (0.584)	0.350 (0.479)	0.525 (0.346)
FF10 acquirer	0.109*** (0.000)	0.105*** (0.000)	0.106*** (0.000)	0.102*** (0.000)	0.113*** (0.000)	0.113*** (0.000)
Acquirer nation	-0.003*** (0.000)	-0.003*** (0.000)	-0.003*** (0.000)	0.005*** (0.002)	0.005*** (0.005)	0.004** (0.019)
Intercept	-3.341***	-3.310***	-3.286***	-3.759***	-3.767***	-3.772***
N						
Adj. R^2 (%)	1.21	1.22	1.29	1.85	2.14	2.34

Panel B: Propensity score matching of private target deals			<i>One-to-one</i>	<i>5 Nearest</i>	<i>30 Nearest</i>	<i>50 Nearest</i>	<i>Radius Caliper</i>	<i>Gaussian Kernel</i>
$\Delta ROA(-1, +1)$	Treated	mean	0.691	0.691	0.691	0.691	0.691	0.691
	Control	mean	-2.189	-0.914	-0.782	-0.818	-1.366	-2.686
	Difference		2.881***	1.606**	1.473**	1.510**	2.058***	3.377***
$\Delta ROA(-1, +2)$	Treated	mean	0.398	0.398	0.398	0.398	0.398	0.398
	Control	mean	-1.432	-1.127	-0.947	-0.953	-1.566	-2.667
	Difference		1.830**	1.526**	1.345**	1.352**	1.964***	3.065***
$\Delta ROA(-1, +3)$	Treated	mean	0.445	0.445	0.445	0.445	0.445	0.445
	Control	mean	-0.999	-0.997	-1.093	-1.155	-1.585	-2.933
	Difference		1.445*	1.442*	1.538**	1.601**	2.031***	3.378***

Panel C: Propensity score matching of public target deals		
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			<i>One-to-one</i>	<i>5 Nearest</i>	<i>30 Nearest</i>	<i>50 Nearest</i>	<i>Radius Caliper</i>	<i>Gaussian Kernel</i>
$\Delta ROA(-1,+1)$	Treated	mean	-3.021	-3.021	-3.021	-3.021	-3.021	-3.021
	Control	mean	-6.274	-5.214	-5.172	-5.109	-5.236	-5.192
	Difference		3.253**	2.193*	2.151**	2.088*	2.215**	2.171**
$\Delta ROA(-1,+2)$	Treated	mean	-3.491	-3.491	-3.491	-3.491	-3.491	-3.491
	Control	mean	-6.476	-6.129	-5.428	-5.361	-5.727	-5.443
	Difference		2.985**	2.639**	1.937*	1.870*	2.236**	1.952*
$\Delta ROA(-1,+3)$	Treated	mean	-3.696	-3.696	-3.696	-3.696	-3.696	-3.696
	Control	mean	-7.173	-5.974	-6.141	-5.953	-6.109	-5.724
	Difference		3.477**	2.277*	2.445**	2.257**	2.412**	2.028*

Table 11

Acquirer stock returns regression analysis 1990-2008 vs. 2009-2018.

The table reports multivariate regression coefficient estimates of the acquirer three-day cumulative abnormal return (ACAR%) on technology dummy, acquirer, and deal characteristics. The technology dummy variable takes the value of 1 if the deal was in the specific technology deal type and 0 otherwise. Panel A shows the results for all the 38,082 deals with available information during the 1990-2008 period. Panel B presents estimates for deals in 2009-2018. All regressions are controlled by the year and country-fixed effects. The sample criteria are described in Table 1. Definitions of the variable are explained in Appendix. The *, **, and *** denote statistical significance levels of 10%, 5% and 1% respectively.

<i>Three-day ACAR %</i>	<i>Panel A: 1990-2008</i>				<i>Panel B: 2009-2018</i>			
	<i>Hi-Non</i>	<i>Non-Hi</i>	<i>Hi-Hi</i>	<i>Non-Non</i>	<i>Hi-Non</i>	<i>Non-Hi</i>	<i>Hi-Hi</i>	<i>Non-Non</i>
	Technology dummy	0.323*** (0.007)	0.345* (0.078)	-0.158* (0.098)	-0.098 (0.235)	0.275* (0.083)	0.581*** (0.005)	0.158 (0.192)
Log(Size)	-0.482*** (0.000)	-0.483*** (0.000)	-0.485*** (0.000)	-0.482*** (0.000)	-0.478*** (0.000)	-0.480*** (0.000)	-0.479*** (0.000)	-0.476*** (0.000)
Relative size	0.951*** (0.000)	0.950*** (0.000)	0.948*** (0.000)	0.953*** (0.000)	1.112*** (0.000)	1.103*** (0.000)	1.113*** (0.000)	1.113*** (0.000)
Book-to-market	-0.154*** (0.008)	-0.162*** (0.005)	-0.178*** (0.002)	-0.151*** (0.010)	-0.296*** (0.000)	-0.299*** (0.000)	-0.290*** (0.000)	-0.263*** (0.000)
Hostile	-1.230*** (0.000)	-1.238*** (0.000)	-1.235*** (0.000)	-1.234*** (0.000)	-0.438 (0.433)	-0.429 (0.442)	-0.437 (0.434)	-0.433 (0.438)
Tender	-0.775*** (0.000)	-0.784*** (0.000)	-0.770*** (0.000)	-0.783*** (0.000)	-0.633* (0.053)	-0.649** (0.047)	-0.667* (0.042)	-0.703** (0.031)
Private target	0.303*** (0.000)	0.307*** (0.000)	0.313*** (0.000)	0.303*** (0.000)	0.203** (0.042)	0.196** (0.050)	0.196* (0.051)	0.170* (0.090)
Payment incl. stock	-0.390*** (0.000)	-0.390*** (0.000)	-0.378*** (0.000)	-0.398*** (0.000)	0.308*** (0.009)	0.300** (0.011)	0.299** (0.011)	0.299** (0.011)
Cross-border	0.369*** (0.000)	0.378*** (0.000)	0.390*** (0.000)	0.368*** (0.000)	0.373*** (0.002)	0.376*** (0.001)	0.364*** (0.002)	0.341*** (0.004)
Competing bidder	-0.476 (0.107)	-0.470 (0.112)	-0.473 (0.109)	-0.473 (0.110)	-0.754 (0.126)	-0.748 (0.128)	-0.767 (0.119)	-0.768 (0.118)
Leverage	-0.020 (0.393)	-0.023 (0.337)	-0.029 (0.222)	-0.018 (0.447)	-0.029 (0.378)	-0.029 (0.377)	-0.026 (0.436)	-0.017 (0.607)
Synergy dummy	-0.205 (0.291)	-0.206 (0.289)	-0.198 (0.309)	-0.212 (0.276)	0.605*** (0.000)	0.600*** (0.000)	0.599*** (0.000)	0.582*** (0.000)
Intercept	2.181	2.215	2.205	2.309	5.414***	5.432***	5.423***	5.719***
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	38,082	38,082	38,082	38,082	25,291	25,291	25,291	25,291
Adj. R ² (%)	3.96	3.95	3.94	3.94	5.88	5.90	5.88	5.92

Table 12

Operating performance changes after takeover multivariate regressions for the period of 1990-2008 vs. 2009-2018.

The table reports cross-sectional regression estimates of change in operating performance before and after the M&A transaction. The dependent variable, $\Delta ROA(-1,+i)$ ($i=1,2,3$), is the change of return on assets adjusted by the industry average between the post-announcement and pre-announcement. Year-1 is the last fiscal year prior to the deal announcement. Year $+i$ is the i th year post the announcement. Panel A shows the estimates of $\Delta ROA(-1,+1)$, panel B reports results of $\Delta ROA(-1,+2)$, and panel C is on the $\Delta ROA(-1,+3)$. The regressions are controlled with year and country fixed effects. P -values are presented below regression estimates. All variables are described in Appendix. Symbols *, **, *** corresponds to statistical significance levels at the 10%, 5%, and 1% respectively.

<i>Panel A: $\Delta ROA(-1,+1)\%$</i>								
	<i>(1)1990-2008</i>				<i>(2)2009-2018</i>			
	<i>Hi- Non</i>	<i>Non- Hi</i>	<i>Hi- Hi</i>	<i>Non- Non</i>	<i>Hi- Non</i>	<i>Non- Hi</i>	<i>Hi- Hi</i>	<i>Non- Non</i>
Technology dummy	-1.011*** (0.002)	2.054*** (0.000)	-1.982*** (0.000)	1.593*** (0.000)	0.453 (0.346)	2.969*** (0.000)	-1.460*** (0.000)	0.106 (0.740)
Log(Size)	-2.939*** (0.000)	-2.928*** (0.000)	-2.953*** (0.000)	-2.962*** (0.000)	-4.579*** (0.000)	-4.582*** (0.000)	-4.587*** (0.000)	-4.583*** (0.000)
Relative size	2.743*** (0.000)	2.726*** (0.000)	2.696*** (0.000)	2.720*** (0.000)	2.072*** (0.000)	2.035*** (0.000)	2.049*** (0.000)	2.070*** (0.000)
Book-to-market	-2.501*** (0.000)	-2.456*** (0.000)	-2.653*** (0.000)	-2.677*** (0.000)	-4.731*** (0.000)	-4.728*** (0.000)	-4.844*** (0.000)	-4.751*** (0.000)
Hostile	-1.005 (0.291)	-1.020 (0.285)	-0.993 (0.297)	-0.994 (0.297)	-0.045 (0.980)	-0.014 (0.994)	-0.052 (0.976)	-0.042 (0.981)
Tender	-0.529 (0.283)	-0.562 (0.255)	-0.435 (0.377)	-0.432 (0.381)	0.289 (0.773)	0.228 (0.819)	0.532 (0.595)	0.298 (0.766)
Private target	-1.274*** (0.000)	-1.296*** (0.000)	-1.231*** (0.000)	-1.214*** (0.000)	-2.199*** (0.000)	-2.253*** (0.000)	-2.101*** (0.000)	-2.184*** (0.000)
Payment incl. stock	3.483*** (0.000)	3.486*** (0.000)	3.639*** (0.000)	3.605*** (0.000)	5.467*** (0.000)	5.448*** (0.000)	5.494*** (0.000)	5.460*** (0.000)
Cross-border	3.049*** (0.000)	3.018*** (0.000)	3.166*** (0.000)	3.185*** (0.000)	5.009*** (0.000)	5.013*** (0.000)	5.129*** (0.000)	5.025*** (0.000)
Competing bidder	-0.901 (0.272)	-0.895 (0.275)	-0.916 (0.263)	-0.914 (0.265)	-1.144 (0.448)	-1.106 (0.463)	-1.059 (0.482)	-1.149 (0.446)
Leverage	0.634*** (0.000)	0.645*** (0.000)	0.564*** (0.000)	0.564*** (0.000)	-0.056 (0.574)	-0.054 (0.589)	-0.100 (0.323)	-0.062 (0.537)
Synergy dummy	-0.857 (0.109)	-0.847 (0.113)	-0.737 (0.168)	-0.771 (0.149)	-2.150*** (0.000)	-2.181*** (0.000)	-2.075*** (0.000)	-2.141*** (0.000)
Intercept	26.303	26.251	28.290	25.994	19.972***	20.114***	20.252***	19.948***
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	37,722	37,722	37,722	37,722	25,687	25,687	25,687	25,687
Adj. R^2 (%)	11.50	11.52	11.61	11.60	20.20	20.26	20.24	20.20

<i>Panel B: $\Delta ROA(-1,+2)\%$</i>								
	<i>(1)1990-2008</i>				<i>(2)2009-2018</i>			
	<i>Hi- Non</i>	<i>Non- Hi</i>	<i>Hi- Hi</i>	<i>Non- Non</i>	<i>Hi- Non</i>	<i>Non- Hi</i>	<i>Hi- Hi</i>	<i>Non- Non</i>
Technology dummy	-1.145*** (0.001)	1.771*** (0.001)	-2.116*** (0.000)	1.802*** (0.000)	0.661 (0.204)	2.801*** (0.000)	-1.488*** (0.000)	0.098 (0.775)
Log(Size)	-2.875*** (0.000)	-2.864*** (0.000)	-2.889*** (0.000)	-2.900*** (0.000)	-4.576*** (0.000)	-4.582*** (0.000)	-4.587*** (0.000)	-4.582*** (0.000)

Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	33,606	33,606	33,606	33,606	19,087	19,087	19,087	19,087
Adj. R^2 (%)	11.48	11.48	11.66	11.64	21.08	21.15	21.11	21.07

Table 13

Synergy gains.

Synergy gains are calculated as the sum of weighted average combined CARs of acquirer and target, where the weight depends on the market value of the acquirer and target one month prior to the announcement.

% Synergy Gains	<i>Hi-Non</i> (1)	<i>Non-Hi</i> (2)	<i>Hi-Hi</i> (3)	<i>Non-Non</i> (4)
Technology dummy	0.270 (0.480)	0.231 (0.577)	-0.934*** (0.001)	0.686*** (0.008)
Log(Size)	-0.299*** (0.000)	-0.299*** (0.000)	-0.303*** (0.000)	-0.304*** (0.000)
Relative size	1.398*** (0.000)	1.396*** (0.000)	1.381*** (0.000)	1.401*** (0.000)
Book-to-Market	0.158 (0.438)	0.157 (0.436)	0.047 (0.817)	0.052 (0.794)
Hostile	1.136*** (0.002)	1.138*** (0.002)	1.112*** (0.003)	1.117*** (0.003)
Tender	0.358 (0.141)	0.359 (0.143)	0.405 (0.093)	0.401 (0.094)
Payment incl. stock	-1.834*** (0.000)	-1.836*** (0.000)	-1.884*** (0.000)	-1.901*** (0.000)
Cross-border	0.356** (0.041)	0.354** (0.042)	0.402** (0.023)	0.393** (0.027)
Competing bidder	0.028 (0.937)	0.034 (0.923)	0.028 (0.938)	0.022 (0.950)
Leverage	0.085 (0.128)	0.084 (0.130)	0.049 (0.364)	0.055 (0.295)
Synergy dummy	0.432 (0.122)	0.430 (0.121)	0.452* (0.099)	0.440 (0.109)
Intercept	-5.989	-5.929	-5.798	-6.418
Country fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
N	6,459	6,459	6,459	6,459
Adj. R^2 (%)	6.72	6.72	6.98	6.88

Appendix 1. Variable definitions

Variable	Definition
Key dependent variables	
% ACAR	Acquirer cumulative abnormal returns in the 3-day event window around the acquisition announcement day (-1,+1). The abnormal returns are calculated by the market model. The model parameters are estimated with 200 trading days, starting 215 trading days and ending 15 trading days prior to the announcement. The Worldscope's country market index return is employed as the market benchmark return.
% Δ ROA(- 1,+ i)	Changes in operating performance in percentage format are the acquirer's ROA(t+i) minus ROA(t-1), where year t is the deal announcement year, and i equals 1, 2, and 3 (1 year, 2 years, and 3 years following the deal announcement). ROA is defined as net income before extraordinary items scaled by total assets at the end of the fiscal year. Then ROA in year t is adjusted by the mean of this ratio for companies in the same Fama-French 10 industry.
Firm and deal characteristics	
Deal Value (\$mil)	Value of transaction from Thomson Financial SDC with inflation-adjusted in the 2018-dollar term.
Size (\$mil)	Acquirer market value 30-days prior to the announcement in millions of dollar terms.
Log(Size)	The nature logarithm of the acquirer's market value one month before the announcement.
Target Size(\$mil)	Target market value 30-days prior to the announcement in millions of dollar terms.
Relative Size	(Deal value) / (Acquirer market value one month prior to the deal announcement)
Book-to-Market	Acquirer total book value of equity over market value at the last fiscal year-end prior to the announcement.
Leverage	(Acquirer's long-term debt + short-term debt) _{t-1} / (Common equity) _{t-1}
Private Target	Dummy variable if the target is a private firm, it equals one, zero otherwise.
Hostile	Dummy variable takes one for deals defined as hostile or unsolicited, zero otherwise
Tender	Dummy, one for tender offers, zero otherwise.
All Cash	Dummy variable that takes the value of 1 if the deals use 100% cash for the transaction.
All Stock	Dummy variable that equals 1 for deals when the transaction is made with pure stock payment.
Incl. Stock	Dummy takes the value of one when deals include a percentage of the stock payment, 0 otherwise.
Cross-border	Dummy variable takes 1 if the acquirer and the target are not from the same country.
Competing Bidders	Competing bidder, dummy variable takes the value of 1 if the deal has competitors bidding against with the acquirer, zero otherwise.
Liquidity	Current ratio of the acquirer, the ratio of total current assets to total current liabilities at the year-end of the fiscal year t-1.
Synergy	Dummy variable takes one if the acquisition purpose in the deal announcement states synergy gains, with the code 'SYN' in the Deal Purpose Code in SDC, zero otherwise.
Tobin's q	The ratio of acquirer market value scaled by the book value of total assets in the last available end of the fiscal year prior to the announcement.
Pre-BHR	Acquirers buy-and-hold return calculated over 3 years (36 months) prior to the deal announcement.
Post-BHR	Acquirer 3 years (36 months) buy-and-hold abnormal return after the deal announcement.
Δ ROA pre (-2,-1)	The operating performance change of the previous year before the transaction. It is acquirer changes of return on assets one year before the last year-end of the fiscal year prior to the deal announcement. The mean industry adjusted ROA at t-1 minus the ROA at t-2, where t is the transaction year.
ROA pre-industry adjusted.	Return on asset of the acquirer at the end of fiscal year t-1 minus the average of ROA in the same Fama-French 10 industry at year t-1.
Technology dummy	
Hi-Hi	Tech dummy variable, 1 if the acquirer and target are both hi-tech firms, 0 otherwise.
Hi-Non	Tech dummy variable, 1 if the acquirer is a hi-tech firm and the target is a non-hi-tech firm, 0 otherwise.
Non-Hi	Tech dummy variable, 1 if the acquirer does not belong to the hi-tech industry and the target is a hi-tech company, zero otherwise.

Non-Non

Hi0-Non & Non-Hi

Tech dummy variable, 1 if the acquirer and target are both non-hi-tech firms, 0 otherwise.

Tech dummy variable, 1 if the acquirer is in hi-tech and the target is not a hi-tech firm, or acquirer is classified as non-hi-tech with a hi-tech target, 0 otherwise.

Appendix 2. Technology Classification

Classification	Description
SDC Industry	Thomson SDC industry code. It classifies the high-tech industry of the acquirer (AHTECH) and target (THTECH) if its business line involves in high technology areas, based on SIC codes, NAIC codes, and overall firm business description, consisting much more detail on business industry classification than only using the Standard Industrial Classification (SIC) codes. It constitutes computers & peripherals, e-commerce & B2B, electronics, hardware, internet infrastructure, internet software & services, semiconductors, software, biotechnology, chemicals, pharmaceuticals, communications, and other high technology.
FF10 Industry	Using the Fama-French 10 industry portfolios to categorize the acquirers and target industry based on SIC codes. The Hi-technology industry includes computers, software, and electronic equipment.
Macro Industry	Thomson Financial SDC proprietary macro-level industry. There exist 13 macro-level industry classifications covering more than 86 mid-level industry categories. The thirteen-macro industry includes consumer products and services, consumer staples, energy and power, financials, government and agencies, healthcare, high technology, industrials, materials, media and entertainment, real estate, retail, and telecommunications.
Primary Business Industry	The SDC code for industry classification of a firm's primary business. It defines biotechnology, computers & computer equipment, electronics, communications, and all other high technology as the primary high-tech industry (AHITECHP for acquirers and THITECHP for targets).
Ultimate Parent Industry	The ultimate parent industry code on SDC, describing the high technology industry on the firm's ultimate parent primary business.

SDC High Technology	Detail
Biotech and Health Care	<ul style="list-style-type: none"> Artificial organs/limbs Drug delivery systems General medical instruments/supplements General pharmacies Genetically engineered products (human) Health care services In-vitro diagnostic products Lab equipment Medical imaging systems Medical lasers Medical monitoring systems Medical chemicals Nuclear medicines Nuclear chemicals (excluding medicals) Other biotechnology Over-the-counter drugs Rehabilitation equipment Surgical instruments/equipment Vaccines/specialty drugs
Communications	<ul style="list-style-type: none"> Alarm systems Cellular communications Data comms (excluding networking)

	<ul style="list-style-type: none"> Facsimile equipment Internet services and software Messaging systems Microwaves communications Other telecommunications equipment Satellite communications Satellite (Non-Communications) Telephone interconnect equipment Telecommunications equipment
Computer Hardware	<ul style="list-style-type: none"> CAD/CAM/CAE/graphics systems CD-ROM drives Disk drives Mainframes and supercomputers Microcomputers(PCs) Modems Monitors/terminals Networking systems (LAN, WAN) Other computer systems Other peripherals Portable computers Printers Scanning devices Turnkey systems Workstations
Computer Software & Service	<ul style="list-style-type: none"> Applications software(business) Applications software (home) Communication/network software Computer consulting services Database software/programming Data-processing services Desktop publishing Operating systems Other computer-related services Other software(including games) Programming services Utilities/file management software
Electronics	<ul style="list-style-type: none"> Precision or measuring test equipment Printed circuit boards Process control systems Search, detection, navigation Semiconductors Superconductors Other electronics
Other	<ul style="list-style-type: none"> Advanced manufacturing systems Advanced materials Defense-related technology Lasers Propulsion systems Research and development firm Robotics Other

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