Essays in Mergers & Acquisitions and Leveraged Buyouts

by

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Declarations

This thesis is submitted to the University of Warwick in support of the requirements for the degree of Doctor of Philosophy. I confirm that I have not submitted the thesis for a degree at another university.

All work contained in thesis is my own. I further declare that Chapter 2 of this thesis is co-authored Jana Fidrmuc and Peter Roosenboom. Chapter 3 is co-authored with Jana Fidrmuc and Chendi Zhang.

Abstract

This thesis consists of three essays in empirical corporate finance. Chapter 2 investigates what motivates acquisition by public firms and why the ownership form of targets matter for acquisition decision. We find that firms are more likely to acquire public (private) targets when they face higher (lower) competitive pressures in their product markets. After taking over public targets, acquirers increase their market shares, differentiate their products from close peers, and gain cost savings. In contrast, acquirers of private targets tend to increase capital and R&D expenditures, and PPE. These results suggest that acquirers of public (private) targets aim at consolidation (expansion). Firms' choice for a public versus private target aligns with different strategic motivations that can potentially explain differences in announcement returns between public- versus private-target acquisitions.

Chapter 3 examines the impact of acquiring public versus private targets on acquirers' innovation outcomes. Our analysis shows an increase in innovation outcomes post-acquisitions for private target acquirers relative to matched firms and public target acquirers. Public target acquirers do not increase innovation post deals. Acquiring private targets improves also innovation efficiency. We also find that acquiring private targets with existing patents is associated with a larger increase in exploitative innovation, but no additional effect for exploratory innovation. The 5-day CARs are higher for private target acquirers with the largest improvement in innovation. The higher expectation of improvement in innovation for private targets contributes to explaining the puzzle of announcement-return differences.

Chapter 4 studies spillover effects of LBOs on peers. I show that LBOs are associated with a decrease in profitability, market shares, operating efficiency, and savings in net working capital for peers. LBOs are likely to create pressures, which correspond to peers' adverse outcomes. I find that the improvement in market shares and asset turnover at LBO targets corresponds to a further deterioration on peers' profitability. The adverse effects due to LBOs, however, disappear when individual peers have initiated improvement in a similar way as target firms. As peers respond to the pressures by improving their profitability margin, product differentiation, and capital expenditures, peers are able to mitigate the worse outcomes post LBOs. Lastly, I document that negative spillover effects on industry dynamics are more pronounced in less competitive industries and industries with lower entry barriers.

Abbreviations

ATP Antitakeover Provisions

CAR Cumulative Abnormal Returns

Capex Capital Expenditures

CFO Cash Flows from Operation

CIQ Capital IQ

DiD Difference-in-differences

EBIT Earning before Interest and Tax

EBITDA Earning before Interest, Tax, Depreciation, and Amortization

HDPL Hobers-Phillips Data Library

HFA Hedge Funds Activism

HHI Herfindahl-Hirschmann Index

IQR Interquartile Range

KPSS Kogan, Papanikolau, Seru, and Stoffman

LBO Leveraged Buyout

M&A Mergers and Acquisitions

NBER National Bureau of Economic Research

NWC Net Working Capital

ROA Return on Asset

R&D Research and Development

obs. Observations

PE Private Equity

PPE Property, Plant, and Equipment

Priv-to-Priv Private-to-Private

Pub-to-Priv Public-to-Private

SIC Standard Industry Classification

TNIC Text-based Network Industry Classifications

Chapter 1

Introduction

This thesis consists of two chapters in mergers and acquisitions (M&As) and one chapter in leveraged buyouts (LBOs). The first chapter on the M&As aims to contribute in addressing the debate on why acquiring public target creates less value for acquirer shareholders compare to acquiring private targets. The second M&A chapter examines the impact of acquiring public versus private targets on acquirers' long-run innovation outcomes. The LBO chapter investigates spillover effects of LBOs on individual peers and major channels for the spillovers. The three chapters are organized in the form of papers. Chapter 2 is co-authored with Jana Fidrmuc and Peter Roosenboom, Chapter 3 is co-authored with Jana Fidrmuc and Chendi Zhang, and I am the sole author of Chapter 4.

The debate on why acquiring a public target creates less value for acquirer shareholders compared to acquiring a private target is still inconclusive and therefore intriguing (Faccio et al., 2006; Jaffe et al., 2015). The list of potential explanations for these valuation differences between acquisitions of public versus private targets is long and includes differences in the method of payment (Chang, 1998), blockholder creation (Chang, 1998), size of acquirer (Moeller et al., 2004; Faccio et al., 2006), target valuation uncertainty (Chang, 1998; Koeplin et al., 2000; Capron and Pistre, 2002), synergy (Jaffe et al., 2015), and target financial liquidity (Fuller et al., 2002;

Officer, 2007). Despite the existing explanations for the puzzle in announcement return differences, the fundamental factors behind the valuation differences are still elusive (Faccio et al., 2006). In Chapter 2, we take an alternative approach and we argue that valuation differences may stem from different strategic motivations of acquiring firms to pursue the acquisitions in the first place. In particular, we hypothesize that the choice for a public versus private target aligns with different strategic motivations to engage in acquisitions that can potentially explain why these valuation differences exist.

Our analysis first explores whether the odds of acquiring public versus private targets align with different motivations as measured by product market conditions and the acquiring firm's position within its product market. Second, we consider a wide set of acquisition outcomes and test whether acquisition outcomes vary depending on whether the target firm is public or private. Significant differences in acquisition outcomes would indicate distinctive strategic motivations for the two types of deals. We conclude our analysis by examining announcement abnormal returns. We link valuation differences between public and private targets with differences in product market conditions.

We first show that public target acquisitions are associated with more competitive product markets than both private target acquisitions and no-deal firm-years. At the same time, the odds of acquiring a public target are higher when rivals' products are changing. In contrast, private targets are more likely to be acquired when the acquirer operates in a less competitive product markets. To a large extent, our results support the idea that as firms face high uncertainties in their product markets, they are more likely to acquire public targets to resolves these uncertainties and consolidate their position within their industries. In contrast, as firms reside in a more stable environment, they are more likely to acquire private targets to potentially facilitate business expansion within their product markets. Second, we document that acquisitions of public versus private targets are not

associated with the same acquisition outcomes. After taking over public targets, acquiring firms tend to significantly increase their market share, differentiate products from their close peers, gain cost savings, decrease net working capital, and maintain their operating income. In contrast, acquirers of private targets tend to increase their investment in fixed assets, capital and R&D expenditures, while also suffer a decrease in profitability. We also find that both types of acquisitions are associated with a decrease corporate taxes paid. Altogether, we find significant and meaningful differences between public versus private acquisitions. We can see that acquirers of public targets pursue acquisitions that aim at consolidation of their position within their competitive product markets. Acquirers of private targets, in contrast, seem to aim for innovation or expansion in less competitive product markets.

As our results indicate that public target acquisitions are associated with consolidation within competitive product markets while private target acquisitions are associated with expansion in lose product markets, our final analysis in Chapter 2 focuses on acquirer announcement abnormal returns. We examine whether product market conditions can contribute in explaining differences in announcement returns between public versus private target acquisitions. Complementing results in the literature, we show that the 7-day cumulative abnormal returns are significantly lower for public target acquirers with the highest competitive pressures and threats in their product markets. To a large extent, our results seem to suggest that market is able to sort out acquirers into those that operate in higher competitive pressures versus those that are in lower competitive pressures. As public target acquirers are firms under higher competitive pressures and aiming at consolidating their position within their industries, markets react more negatively. Conversely, as private target acquirers are firms in more stable environment and aiming at expansion and exploration within their product markets, markets react more positively.

In Chapter 3, we examine the impact of acquiring public versus private targets on acquirers' innovation outcomes and link the improvement in innovation

outcomes with valuation differences between public and private target acquisitions. Innovation reflects companies' efforts to develop and accumulate knowledge, and it has long been recognized as a key factor of firm growth in today's knowledge economy (Hall, 1993; Cockburn et al., 2000). While existing literature establishes that innovation is an important factor in generating growth and value, we need to ask where does innovation come from. It has been argued that merger and acquisition (M&A) activity is an important channel for firms to enhance their innovation output (Bena and Li, 2014). Sevilir and Tian (2012) show that M&As are positively associated with contemporaneous and future innovation outcomes. The existing literature, however, focuses mostly on public target acquisitions. The 3rd chapter investigates whether innovation outcomes differ when firms acquire public versus private targets.

We argue that differences in acquiring a public versus private target are closely associated with an acquiring firm looking for specific attributes in a target firm that fit acquirer's strategic choice for the acquisition. Different acquirers from different environments pursue different goals for their deals and these motivations align with attributes of public versus private targets. Public versus private targets differ also concerning innovation activities. Publicly listed firms are large and established entities (Koeplin et al., 2000; Maksimovic et al., 2013). Furthermore, an easy access to public equity markets relaxes financial constraints and potentially allows public firms to get involved in risky investments and long-term innovation. However, public firms are often pressured to deliver near-term results (Gao et al., 2018). They may sacrifice long-term risky investments and innovation in order to meet short-term earnings targets. Private firms, in contrast, are smaller, younger, riskier, and less transparent (Koeplin et al., 2000; Ferreira et al., 2014). Private firms lack financial slack due to their weaker access to public equity markets. But because private firms face less short-term pressures from financial markets, they may be more willing to pursue a long investment horizon and engage in risky innovation

(Ferreira et al., 2014). These differences in attitudes towards innovation in private versus public firms are likely to impact on the choice to acquire public versus private targets, which then impacts innovation outcomes of the two types of acquisitions.

Our results show that innovation outcomes increase significantly more post-acquisition of private targets than in matched firms. This increase is also larger than for acquisitions of public targets. Private target acquisitions are associated with a significant increase in the number of new patents as well as exploratory innovation, which requires new knowledge or a departure from existing knowledge, and exploitative innovation, which builds only on existing knowledge. These results suggest that firms are more likely to acquire private targets when they search for innovation. In contrast, we find insignificant innovation changes post-acquisition of public targets relative to control firms. This suggests that firms acquire public targets for other strategic purposes that are, on average, unrelated to innovation. Altogether, we find significant and meaningful differences in innovation outcomes between public versus private target acquisitions. We also show that these innovation effects are persistent over at least 5 years after acquisition announcements.

Our next analysis focuses on investigating whether acquiring firms are able to attain innovation outputs at a reasonable cost. Existing literature argues that an increase in innovation output is due to an equally large increase in innovation input – R&D investment (Chang et al., 2019; Brav et al., 2018; Hirshleifer et al., 2013). Intuitively, one expects that an increase in R&D spending helps firms produce more patents and generate more citations. However, the key questions is whether firms are able increase innovation output per unit of R&D input, i.e. increase innovation efficiency. Our results show that relative to matched firms, private target acquirers are indeed able to increase their innovation efficiency significantly. In contrast, innovation efficiency does not change after acquisitions of public targets. Acquiring private targets enhances innovation outputs both on extensive and intensive margin.

As a next step, we test whether innovation outcomes increase more when

firms acquire targets with a proven ability to innovate. Aghion and Tirole (1994) suggest that established firms that are not very good at innovating themselves can obtain innovation by acquiring targets which are more efficient at innovation. Moreover, Sevilir and Tian (2012) find that a positive relationship between M&A activity and innovation is primarily driven by deals involving firms that own patents before becoming a target. Hence, we expect that acquisitions involving targets with existing patents result in a greater improvement in acquirers' innovation outcomes.

Our results suggest that acquiring targets with existing patents brings no additional increase for the patent count, neither for public nor for private target acquirers. Interestingly, acquiring private targets with existing patents is associated with a larger increase in exploitative innovation outcomes, while exploratory innovation outcomes do not change. These results are somewhat surprising as a combination of acquirers and targets with patents generates a larger increase in innovation within existing expertise. It seems that acquired private targets own innovative ideas regardless whether they do or do not file them as patents. It is likely that acquiring firms chose the particular target that already owns patent because the target existing expertise exhibits high technological overlap with the acquirer. The acquisition then aims to exploit deeper the existing area (Mei, 2019). Therefore, we observe that acquiring private target with existing patent is associated with a larger increase in exploitative innovation. In contrast, acquired innovative ideas that are not yet formalized into patents seen to encourage somewhat more exploration into new areas. It is important to note, however, that acquiring private targets without any existing patents is still associated with an increase in patent count and exploratory innovation - in addition to exploitative innovation. We next show that innovative outcomes of public target acquisitions do not increase post-acquisition even for targets with existing patents. This further supports our argument that firms acquire public targets for innovation unrelated reasons.

Overall, our evidence shows that acquisitions of private targets are associ-

ated with an increase in innovation outcomes. We also show that the reason why we observe an increase in innovation outcomes at private target acquirers is due to an increase in innovation efficiency. We propose two explanations for why we see an increase in innovation outcomes at private target acquirers. First, from the acquiring firms point of view, our results seem to suggest that firms are likely to acquire private targets when they search for innovation. This is due to the innovative nature of private firms as they are on average younger, smaller, and face less pressures from their shareholders to deliver short term results (Koeplin et al., 2000; Ferreira et al., 2014). Private target acquisitions facilitate the combined firms to use their complementary assets and knowledge to improve innovation outcomes. We find some evidence that both acquirers and private targets exhibit some degree of technological similarity in their patents. Second, we also find that acquiring private targets without existing patents are still associated with an increase in acquirers' innovation outcomes. This further suggests that even when private targets' innovative ideas are not formalized into a patent, the combination between the two firms generates synergies from asset complementarities that allow acquirers to improve their innovation.

As our results suggest that innovation outcomes for private target acquirers are significantly higher than for their matched firms and public target acquirers, our final test focuses on acquirer announcement abnormal returns. Complementing results in the literature, we show that the 5-day abnormal returns are significantly higher for private target acquirers with the largest increase in new patents. Our results suggest that higher announcement returns when firms acquire private targets can be explained by a higher expectation of improvement in innovation.

In Chapter 4, I investigate spillover effects of LBOs on individual peers and the major channels for the spillovers. The LBO literature shows evidence on the improvement of outcomes at target firms following LBOs (Acharya et al., 2013; Gong and Wu, 2011; Lerner et al., 2011; Jensen, 1989). Despite the existing evidence on

post-deal improvements at target firms, little is known about how LBOs impact individual peers within the same industries. Bernstein et al. (2016) show that industries with at least one PE transaction in the past five years grow faster in terms of total production and employment and are less exposed to aggregate shocks. However, the focus on Bernstein et al. (2016) is the aggregate industry performance rather than individual peers. Therefore, it is unclear if the effects are driven by the improvement at target firms or individual peers. Aldatmaz and Brown (2020) document that an increase in PE investment is associated with higher labor productivity, employment, profitability, and capital expenditures for publicly-listed peers. The analysis in Aldatmaz and Brown (2020), however, does not take into account private-to-private LBOs that occur within an industry. Private-to-private LBOs account for more than 80% of the total buyout transactions. Excluding private-to-private LBOs does not give an accurate representation of buyout activity in a given industry.

I investigate to what extent public-to-private and private-to-private LBOs contribute in explaining spillover effects for individual peers. My analysis builds on the industrial organization and competitive strategy literature which predicts that the improvement in cost efficiency and product differentiation at target firms is likely to impact oligopolistic industry equilibrium through various channels. First, I explore how public-to-private and private-to-private LBOs in a given industry impact individual peer's outcomes. Spillovers are likely to exist as firms compete and interact with each other and as knowledge is transferred trough employees or technologies (Blomström and Kokko, 1998). The existing evidence from the industrial organization literature shows that cost efficiencies, technological advancements, and productivity gains at some firms are likely to spill over other firms within the same industries. Harford et al. (2016) study three plausible explanations on how LBOs impact the target's industry: (1) PE firms select into industries where real changes will occur regardless of whether LBOs take place; (2) LBOs tend to signal private industry-wide information about the target's industry; and (3) LBOs impact the

competitive pressures of the target's industry, causing individual peers to undergo operational, governance, or strategic changes. Second, I investigate what are major channels to explain spillover effects. A related literature in Hedge Fund Activism (HFA) suggests three possible channels for product market spillovers, i.e, the nature of intervention, peer firms' response, and the type of the industry (Aslan and Kumar, 2016).

I summarize the results in three following ways. First, the DiD coefficients show that, post-LBOs, peer firms experience lower profitability and market shares compare to non-LBO peers. These findings seem to suggest that LBOs create pressures within the industry which subsequently associated with adverse outcomes for individual peers. One plausible explanation is that target firms may be able to expand their scales and operate more efficiently post-LBOs. Indeed, Boucly et al. (2011) show that private-to-private LBOs are associated with a significant expansion of target firms. Such expansion by LBO targets could result in an increase in target's market shares which subsequently corresponds to a deterioration in profitability and market shares at peer firms. Second, I find that peer firms decrease their inventory turnover and increase operating expenses post-LBOs, suggesting that peers operate less efficiently. Notably, an increase in operating expenses is not reflected in an increase in R&D expenditures or advertising expenses. This indicates that, post-LBOs, peer firms do not attempt to improve their innovation or product differentiation. Third, I document that peer firms have less savings in net working capital relative to non peer firms. The results give us an indication that peer firms do not invest their excess cash optimally in favor of maintaining liquidity, potentially due to higher pressures within their industry. To a large extent, my overall results tend to support competitive effect hypothesis (Harford et al., 2016). Due to professional expertise and skill of PE firms, LBOs have shown to impact target's operating performance, which subsequently increase competitive pressures for individual peers.

Overall, my findings contradict with the existing evidence in Bernstein et al. (2016) and Aldatmaz and Brown (2020), but consistent with Harford et al. (2016). Bernstein et al. (2016) study the relationship between PE investments and the growth rates of total production, employment, and capital formation across 20 countries in 26 countries. The focus in Bernstein et al. (2016) is in country-industry-year, whereas my study focuses on firm-year. Hence, the effects we observe in Bernstein et al. (2016) may be driven by the performance of LBO targets as they focus in the aggregate industry performance rather than in individual peers. Aldatmaz and Brown (2020) study the impact of public-to-private LBOs on labor productivity, employment, profitability, and capital expenditures at publicly listed peers in 19 industries across 52 countries. One reason for why my results are different from Aldatmaz and Brown (2020) is because their study focuses on worldwide PE buyouts which include developed and developing nations. In addition, they use different industry classifications, i.e., Industry Classification Benchmark (ICB) which has different level of aggregation with the four-digit Standard Industry Classification (SIC). My results are consistent with Harford et al. (2016) where they use a sample of US public-to-private LBOs over the period 1991-2012 and they find evidence consistent with LBOs shocking the competitive environment of the target's industry and associated with a decrease in peer's profitability.

My next analysis attempts to shed lights on the channels for spillovers. How large the spillover effects of LBOs within an industry will depend on the nature of intervention, peer firms' response, and the type of the industry. Following Aslan and Kumar (2016), I investigate target specific, peer specific, and industry specific channels. The existing literature has shown that LBOs are associated with the improvement in target firm's operation, financial, and governance (Bernstein and Sheen, 2016; Acharya et al., 2013; Gong and Wu, 2011; Lerner et al., 2011). The improvement at target firm is likely to represent a significant competitive pressures on its industry. Target specific channel links post-LBO improvement at target firms

to individual peers' outcomes. Next, Aslan and Kumar (2016) argue that when HFA peers compete on the basis of strategic complement against target improvements, negative spillover effects tend to be weaker if peers respond by improving their operating efficiency and product differentiation and they refer that as peer specific channel. Therefore, I conjecture that when individual peers can improve their profitability margin, increase investment in capex, or improve their product differentiation, peers are able to mitigate the worst outcomes from post-LBO pressures. Lastly, the existing literature suggests that how much the spillover effects are realized by individual peers is likely depend on the characteristics of the industry (Aldatmaz and Brown, 2020). Industry specific channel addresses to what extent industry characteristics have an impact on how much spillovers are absorbed by peer firms.

I show that post-LBO improvement at target firms is associated with more adverse outcomes for peers. The results suggest that post-LBO increase in asset turnover at target firms is associated with a decrease in peers' profitability. I also find that the improvement in market shares at target firms corresponds to a larger decrease in peers' market shares. To a large extent, these results are expected. As target firms are able to capture larger market shares post-LBOs, individual peers significantly lose their own market shares. The increase of asset turnover and market shares at targets do not have significant effects on peers' operating efficiency and net working capital.

Next, I find that individual peers that have initiated improvement in a similar way as target firms are able to mitigate the worse outcomes post-LBOs. As peer firms respond to LBO pressures by improving their profitability margin, capex, or product differentiation, the overall negative spillover effects disappear. In particular, I show that individual peers that are able to improve their operating and/or EBITDA margins post-LBOs can increase their overall profitability and market shares. Notably, the improvement in EBITDA margin is most beneficial to peer

firms in protecting their market shares. My findings are, to some extent, consistent with Aslan and Kumar (2016).

I then document that industry characteristics play a significant role in explaining spillover effects within individual peers. I use industry concentration and capital intensity to study industry specific channels. I show that the adverse spillover effects of industry LBO are stronger in more concentrated industries. A higher industry concentration is associated with a further decrease in peers' profitability and market shares. The results are somewhat surprising as more concentrated industries experience more adverse outcomes. The existing literature suggests that managerial slack is a major issue in concentrated industries (Giroud and Mueller, 2010), therefore, the present of LBOs is likely to increase competitions and subsequently mitigates managerial slacks. One plausible explanation for my results could be that in more concentrated industries, firms face issue of managerial entrenchment or private benefit of controls. The decrease in managerial slacks may not be able to curb problems that arise from entrench managers. Hence, I find that negative spillover effects are more severe in highly concentrated industries. I further find that, on average, a higher industry capital intensity is associated with a smaller decrease in profitability and market shares. A highly capital intensive industry requires a large investment in capital expenditures which reflects a high entry barrier. On the one hand, targets may increase their investment in capital expenditures following LBOs which subsequently brings pressures for individual peers. But on the other hand, a higher industry entry barrier may protect peers from a threat of new entrants. As a result, peer firms in highly capital intensive industries suffer less deterioration in their profitability and operating efficiency.

Chapter 2

Product Market Conditions and Motivations for Acquiring Public versus Private Targets

2.1 Introduction

The debate on why acquiring a public target creates less value for acquirer shareholders compared to acquiring a private target is still inconclusive and therefore intriguing (Faccio et al., 2006; Jaffe et al., 2015).[1] The fundamental factors behind the valuation differences are still elusive (Faccio et al., 2006). Our paper takes an alternative approach and argues that valuation differences may stem from different strategic motivations of acquiring firms to pursue the acquisitions in the first place. In particular, we hypothesize that the choice for a public versus private target aligns with different strategic motivations to engage in acquisitions that can potentially

[1] The list of potential explanations for these valuation differences between acquisitions of public versus private targets is long and includes differences in the method of payment (Chang, 1998), blockholder creation (Chang, 1998), size of acquirer (Moeller et al., 2004; Faccio et al., 2006), target valuation uncertainty (Chang, 1998; Koeplin et al., 2000; Capron and Pistre, 2002), synergy (Jaffe et al., 2015), target financial liquidity (Fuller et al., 2002; Officer, 2007), shareholder overlap (Hansen and Lott, 1996), acquisition predictability (Faccio et al., 2006) and target bid resistance (Jaffe et al., 2015).

explain why these valuation differences exist.

Our analysis first explores whether the odds of acquiring public versus private targets align with different motivations as measured by product market conditions and the acquiring firm's position within its product market. We take advantage of new dynamic measures of product market similarity due to Hoberg and Phillips (2016). Second, we consider a wide set of acquisition outcomes and test whether acquisition outcomes vary depending on whether the target firm is public or private.[2] Significant differences in acquisition outcomes would indicate distinctive strategic motivations for the two types of deals. We conclude our analysis by examining announcement abnormal returns. We link valuation differences between public and private targets with differences in product market conditions.

Using a sample of all publicly listed firms covered by the Hoberg-Phillips Data Library over the period from 1994 to 2019, combined with completed acquisitions of stand-alone public and private targets,[3] we first show that public target acquisitions are associated with more competitive product markets than both private target acquisitions and no-deal firm-years. At the same time, the odds of acquiring a public target are higher when rivals' products are changing. In contrast, private targets are more likely to be acquired when the acquirer operates in a less competitive product markets. To a large extent, our results support the idea that as firms face high uncertainties in their product markets, they are more likely to acquire public targets to resolves these uncertainties and consolidate their position within their industries. In contrast, as firms reside in a more stable environment, they are more likely to acquire private targets to potentially facilitate business expansion within

[2]Economic theory has provided many possible reasons for why mergers may occur (Andrade et al., 2001). Acquiring firms pursue efficiency improvements involving economies of scale or scope (Devos et al., 2008); complementarities (Rhodes-Kropf and Robinson, 2008; Hoberg and Phillips, 2010); acquisition of innovation (Bena and Li, 2014); increase in market power (Stigler, 1950; Fathollahi et al., 2019), removal of incompetent management (Jensen and Ruback, 1983); taxation optimization (Devos et al., 2008) and financing efficiencies (Cornaggia and Li, 2019).

[3]The Hoberg-Phillips data is available at http://hobergphillips.tuck.dartmouth.edu/. We end up with 102,516 firm-year observations for 12,858 firms over 26 years. We compare public and private target acquisition firm-years to firm-years without any deals.

their product markets.

Second, we document that acquisitions of public versus private targets *are not* associated with the same acquisition outcomes. After taking over public targets, acquiring firms tend to significantly increase their market share, differentiate products from their close peers, gain cost savings, decrease net working capital, and maintain their operating income. In contrast, acquirers of private targets tend to increase their investment in fixed assets, capital and R&D expenditures, while also suffer a decrease in profitability. We also find that both types of acquisitions are associated with a decrease corporate taxes paid. Altogether, we find significant and meaningful differences between public versus private acquisitions.

We can see that acquirers of public targets pursue acquisitions that aim at *consolidation* of their position within their competitive product markets. Acquirers of public targets operate in more competitive product markets and have recently experienced weakening of their strong position relatively to their peers. They also aim at outcomes that consolidate their position within their industry. Publicly listed firms are large, established and high quality entities (Koeplin et al., 2000; Maksimovic et al., 2013). Moreover, they publish large quantity of good quality information in regular intervals (Capron and Shen, 2007). Given the public firm quality of assets and availability of information about their assets and activities, acquisitions of public targets lead to more predictable outcomes associated with re-establishment of their position. Also, the bigger scope of public firms should help consolidation to a larger extent (Moeller et al., 2004). Finally, this pattern is in line with higher competitiveness in the product market exerting more disciplinary pressures for more visible, shorter-term outcomes. This is broadly in line with Bhattacharyya and Nain (2011) who show that horizontal mergers increase acquirers' market power and their bargaining position (buying power) with their suppliers. Acquirers of private targets, in contrast, seem to aim for *innovation or expansion* in less competitive product markets. This fits the profile of private targets that are in

general smaller, younger, less transparent and riskier (Koeplin et al., 2000; Ferreira et al., 2014). Small firms are often associated with new ideas and innovation (Ferreira et al., 2014). Looser product markets with weaker disciplinary power allow the firms to focus on longer-term goals and pursue deals that are more risky and deliver outcomes further in the future. A negative relationship between competition and innovation is also suggested by Marshall and Parra (2019). They show that such a relationship prevails in an industry with the leader's profits from innovation increasing with industry concentration and with the number of small firms without easy access to to the product market. This fits our setting: fewer large firms in the product market increase the reward of the innovative leader and motivate the leader firm to acquirer small innovative firms, which have difficulties to introduce results of their innovation into the product market.

As our results indicate that public target acquisitions are associated with consolidation within competitive product markets while private target acquisitions are associated with expansion in lose product markets, our final analysis focuses on acquirer announcement abnormal returns. We examine whether product market conditions can contribute in explaining differences in announcement returns between public versus private target acquisitions. Complementing results in the literature, we show that the 7-day cumulative abnormal returns are significantly lower for public target acquirers with the highest competitive pressures and threats in their product markets. To a large extent, our results support the idea that market is able to sort out acquirers into those that operate in higher competitive pressures versus those that are in lower competitive pressures. As public target acquirers are firms under higher competitive pressures and aiming at consolidating their position within their industries, markets react more negatively. Conversely, as private target acquirers are firms in more stable environment and aiming at expansion and exploration within their product markets, markets react more positively.

Our paper contributes to three streams in the literature. First, we con-

tribute to the unresolved discussion concerning the valuation differences puzzle as summarized in Faccio et al. (2006). The literature has so far focussed on explaining differences in the market reaction to acquisition of public versus private targets, but this route has not resulted in satisfactory explanations to the puzzle (for example, Chang, 1998; Fuller et al., 2002; Moeller et al., 2004; Faccio et al., 2006; Jaffe et al., 2015; Golubov et al., 2016). We take an alternative approach and show that the two types of acquisitions are associated with different types of outcomes. This suggests different strategic motivations for the two types of deals and highlights their different attributes. The conclusion of differing strategic motivations for public versus private target acquisitions is further reinforced as firms in different product markets make different choices. Firms in more competitive product markets choose public targets, while firms in more concentrated industries tend to acquire private targets. Differences in announcement returns are perhaps driven by these qualities rather than the target ownership type per se. Put it differently, it may well be that acquiring a private target instead of a public target would have resulted in an even lower announcement return. Similarly, not every acquirer would increase its value by acquiring a private target.

Second, we contribute to the literature on the relationship between industry conditions and acquisitions (Mitchell and Mulherin, 1996; Andrade et al., 2001; Andrade and Stafford, 2004; Harford, 2005; Maksimovic et al., 2013). The early references in this literature highlight that firms react to industry level shocks by restructuring via mergers and acquisitions. Examples of shocks include technological innovations, supply shocks and deregulation (Andrade et al., 2001). Harford (2005) introduces a general economic shock variable and Maksimovic et al. (2013) show that acquisitions by public firms are more prone to waves than acquisitions by private firms. More recent literature discusses effects of product market conditions. Hoberg and Phillips (2010) show that product similarity is associated with a higher likelihood of acquisitions and a post-merger increase in product differen-

tiation. Fathollahi et al. (2019) show that industry product similarity positively impacts a firm's propensity of making a horizontal acquisition and argue that these acquisitions are aimed to reduce competition intensity. We also take advantage of the recently developed product market measures, which define firm-specific peers and reflect dynamics of industries over time (Hoberg and Phillips, 2010, 2016), and add to this literature by showing that acquirer industry competitive nature plays an important role in influencing the decision to acquire public versus private targets. We also highlight the dynamics of the acquirer's position within its product market as another important determinant of the decision to make acquisitions.

Finally, we contribute to the literature on acquisition outcomes (Andrade et al., 2001; Devos et al., 2008; Hoberg and Phillips, 2010; Bena and Li, 2014, among others). Most papers summarize overall M&A outcomes through abnormal returns around deal announcements because it is a suitable and objective measure of value creation. However, some papers focus on particular channels through which value is created across deals. Devos et al. (2008), for example, compare taxes, market power and efficiency improvements as possible underlying sources of acquisition gains. Using ValueLine forecasts for 264 large mergers, they show that acquisitions generate gains by improving resource allocation through cutbacks in investment expenditures rather than by reducing tax payments or increasing the market power of the combined firm. Hoberg and Phillips (2010) use newly developed measures of product market differentiation and show that transaction stock returns, ex-post cash flows and growth in product descriptions all increase for transactions with similar product market language for the target-acquirer pair, especially in competitive product markets. Bena and Li (2014) consider R&D expenses and patent portfolios as acquisition outcomes and conclude that synergies obtained from combining innovation capabilities are important drivers of acquisitions. We contribute to this literature by considering a relatively wide set of acquisition outcomes and showing that public versus private acquisitions are associated with different outcomes. We relate the

different outcomes to varying strategic motivations for public versus private target acquisitions and product market conditions. Firms in industries with higher competitive pressures and deteriorating market power are motivated for consolidation. They achieve an increase in product differentiation and market share and a decrease in operating cost. In contrast, firms in more concentrated product markets aim for expansion, which better fits with acquiring private firms. Their acquisitions result in increased investment and innovation.

The remainder of the paper is organized as follows. Section 2.2 describes the data, variables, and summary statistics. Section 2.3 presents and discusses our results and Section 2.4 concludes.

2.2 Data

Our sample consists of all US publicly listed firms on Hoberg-Phillips Data Library (HPDL), which covers the period between 1994 and 2019. We also require that firms in our sample have annual financial data available in Compustat. To form our M&A sample, we start with all announced and completed US public and private target acquisitions with announcement dates between 1994 and 2019 that are covered by the SDC M&A database. We require that the acquirer is a publicly listed US firm. We exclude the deal is categorized a leveraged buyout, spinoff, recapitalization, exchange offer, self-tender, repurchase acquisition, and privatization. Due to limited information on the deal characteristics of private target acquisition, we do not filter our M&A sample based on total transaction value. We also have limited information on private target's financial data. Hence, we do not have any filter on the value of target firm's total assets. Deals are matched to the population of listed firms in HPDL by their announcement year. We end up with $102,516$ firm-year observations for $12,858$ public firms over 26 years. Table 2.1 presents the distribution of firm-year observations as well as public and private target acquisitions across Fama-French

12 industries. The largest representations of industries in our sample are finance, business equipment, and healthcare. A large proportion of public target acquisitions, 31%, takes place in finance sector, followed by 20% in business equipment and 11% in healthcare sectors. Business equipment represents the largest sector for private target acquisitions - 26%. Finance and others represent the second and third largest sectors for private target acquisitions. The smallest proportions for public and private target acquisitions, between 1 and 2%, take place within consumer durable, chemicals, and utilities sectors.

In Table 2.2, we show that, on average, 4 percent of firm-years in the sample represent acquisitions of public targets, while 15 percent represent acquisitions of private targets. We measure product market conditions using five alternative measures: (i) close similarity score based on ten closest peers, (ii) the Herfindahl-Hirschmann (HH) Index based on market shares by sales, (iii) product market interquartile range (IQR) based on market shares by sales, (iv) Lerner Index based on EBITDA over sales, and (v) fluidity based on how rival's products are changing relative to the firm's products. All five measures are computed based on dynamic industry classifications in HPDL (Hoberg and Phillips, 2016). The close similarity and fluidity increase with industry competitiveness, whereas HH Index, product market IQR, and Lerner Index decrease with industry competitiveness. Overall, our measures of product market competitions capture the competition among public firms within their industries. However, the Lerner Index is likely to show the level of competition for all public and private firms as it represents the average industry EBITDA margin. A lower industry EBITDA margin suggests severe competitions among all types of firms in the industry. We add the product market rank to the group of product market condition variables. This is a measure that characterizes a firm's position within its industry rather than the industry itself. It is computed as the relative rank of the firms within its TNIC-3 peers by sales market share. It has a value between zero and one and lower values denote higher market share in the

industry. All definitions are provided in Appendix 2.5.1.

We use ten acquisition outcomes: (i) product distance, (ii) market shares, (iii) operating expenses, (iv) net working capital, (v) sales over assets, (vi) EBIT over assets, (vii) R&D expenditures, (viii) capital expenditures, (ix) profitability and (x) tax paid. The reference category for the first two measures is the group of close peers – the ten firms with the highest pairwise similarity with the firm (Hoberg and Phillips, 2016). Product distance, a proxy for product differentiation, measures the average distance between firm's product descriptions and product descriptions of its close peers. A high product distance score indicates that the firm's products are different from products of its close peers. Market share is the ratio of firm's sales (total revenue) relative to the overall sales for the firm and its close peers. Following the literature, the remaining eight variables – operating expenses, net working capital, sales over assets, EBIT over assets, R&D and capital expenditures, and tax paid – are computed using Compustat items. Again, for detailed variable definitions consult Appendix 2.5.1.

Table 2.2 shows mean, standard deviation, median and first and second quartile for all the product market conditions, outcome variables, and the changes from one year before to one, two and three years after the reference year. The changes in outcome variables are dependent variables in the outcome regressions in our analysis. Note that these are overall averages for the full (unbalanced) panel. The last part of Table 2.2 shows summary statistics for our control variables. The two variables for public and private M&A activity control for takeovers by close peers in the previous year. The averages are close to the takeover frequency reported at the top of the table. Number of peers show how many total peers that each firm has within its TNIC-3 industry. The remaining variables follow the literature.

Table 2.3 shows differences in product market conditions and changes in outcome variables across three different groups of firm-year observations: public target acquirers, private target acquirers, and the remaining firms without any acquisi-

tions in a given year. In Panel A, we can see that public target acquirers have higher close similarity and fluidity; and lower HH Index and product market IQR than private target acquirers and the remaining firms without any deals. These significant differences suggest that, on average, public target acquirers face high competitive pressures and threats in their product markets. Private target acquirers exhibit the lowest close similarity and fluidity; and the highest levels for the HH Index, product market IQR, and Lerner Index also when compared to the other two groups. In terms of product market rank, public target acquirers have the lowest rank relative to the other two groups, suggesting that public target acquirers have a better position in their market shares compare to the other groups. We can also see that public target acquisitions take place more often following higher public target activities, whereas private target acquisitions happen more often following higher private target activities of firms' peers.

Panel B compares the changes in the outcome variables within three different windows across three groups. We document that increases in product distance and market shares in all three windows are the highest for public target acquirers. We also show that public target acquirers have the largest reduction in operating expenses, R&D expenditures, and PPE. In terms of profitability, we find that public target acquirers have the largest decrease in sales compare to private target acquirers and the remaining firms without any deals. However, if we take into account EBIT over assets, public target acquirers have a larger improvement in EBIT relative to private target acquirers. We next find that both public and private target acquirers have a larger reduction in tax paid compare to firms without deals. In the shortest window, the decrease in tax is significantly higher for public target acquirers compare to private target acquirers.

In summary, these univariate differences give an early indication that public target acquirers are firms from changing and competitive industries as they have high similarity with close peers, low industry concentration, severe industry competitions,

and high product market fluidity. In contrast, acquirers of private targets are firms in more protected industries as they have lower similarity with close peers, high industry concentration, low competition, and low fluidity. Table 2.3 shows also some evidence of consolidation (expansion) in product market position following public (private) target acquisitions. Public target acquirers significantly improve their product differentiation and market shares, decrease their operating expenses, and maintaining their operating income. Conversely, private target acquirers increase their investment in PPE, R&D and capital expenditures, while also suffer from a decrease in operating income.

2.3 Results

2.3.1 Acquisition likelihood

In this section, we investigate how product market conditions affect the likelihood of firms acquiring public versus private targets. Our hypothesis suggests that competitive pressures and product market threats affect whether firms acquire public or private targets. Table 2.4 reports regression results for multinomial logistic regressions with three outcomes: public target acquisition, private target acquisition and no acquisition activity. Note that all explanatory variables are lagged one year relatively to the acquisition year. The group of no acquisitions is the reference category and, therefore, the reported coefficients show the effect of the explanatory variable on the probability of public and private target acquisitions relatively to no acquisition activity. Due to high correlations across product market conditions[4], we run five specifications: we include close similarity in specification 1, HH Index in specification 2, product market IQR in specification 3, Lerner Index in specification 4, and fluidity in specification 5. All specifications include industry and year fixed effects. Panel A of Table 2.4 summarizes the effects of yearly product market conditions on

[4]We show correlation across our product market conditions in Table 2.12

the likelihood of acquiring public versus private targets. Panel B decomposes the effects of product market conditions into their effects due to overall average across all years in the data set and the deviation in each year from the average[5]. Splitting the effects into two parts allows us to study which of these two factors explains the likelihood of the acquisitions the most. In Table 2.5 , we report the average marginal effects for all measures of product market conditions.

Specification 1 in Panel A documents that effects of close similarity are significantly positive for public target acquisitions and negative for private target acquisitions. In economic terms, a one standard deviation increase in close similarity is associated with a change of $+0.8$ and -1 percentage points in the probability of acquiring public and private targets, respectively. This is large relative to the unconditional probabilities of 4% and 14.8%, respectively. The next results from specifications 2 and 3 show that high industry competitions are associated with an increase in acquiring public targets. A one standard deviation increase in HH Index and product market IQR are associated with a decrease of 0.3 percentage point the likelihood of acquiring public target. The likelihood of acquiring private targets increases with HH Index and Lerner Index, suggesting that firms are more likely to acquire private when industry competitions are low. Specification 5 confirms the conclusion that higher product market threats as measured by fluidity are associated with higher likelihood of public target acquisitions. The effects of product market rank are significantly negative for both public and private target acquisitions. This suggests that firms are more likely to become acquirers when they have larger market shares within their close peers.

The results for the control variables are in line with the literature (Andrade et al., 2001; Hoberg and Phillips, 2010; Fathollahi et al., 2019). The likelihood of public target acquisitions is higher when public and private M&A activities within the industry are higher, whereas the likelihood of private target acquisitions is higher

[5]We show statistics for average product market conditions across years and deviation from the average in Table 2.13

only when private M&A activity is higher. We also find that lower leverage and capital intensity increase the probability of private target acquisitions, while lower net income increases the likelihood of public target acquisitions. Large firms, firms with growing sales, high Q firms, and firms with lower R&D and capital expenditures are more likely to acquire any type of target.

In Panel B, we find that the average product market conditions across all years have significant effects in predicting the likelihood of public versus private target acquisitions, while yearly deviations from the average do not seem to affect the acquisition likelihood.[6] Firms are more likely to acquire public targets if they have higher average close similarity and fluidity and lower average HH Index and product market IQR across years. In contrast, firms are more likely to acquire private targets when they have lower average close similarity and higher average Lerner Index.

To study the effects of product market conditions on the likelihood of public target acquisitions relative to private target acquisitions, we use private target acquisitions as the reference category. The results are tabulated in Table 2.6. We find consistent results. Relative to private target acquisitions, the likelihood of public target acquisitions is higher when firms have close similarity and fluidity. In contrast, the likelihood of public target acquisition is smaller when firms have higher HH Index and product market IQR. The effect of product market rank is significantly negative for public target acquisitions, which suggests that public target acquirers have a better position in terms of market shares relative to private target acquirers.

In summary, the results in this section suggest that competitive pressures and threats in the product market influence acquirers' target selections. Higher competitive pressures and product market threats are associated with higher likelihood to acquire public targets. Firms facing high uncertainties in their industry

[6] In addition to the 1-year deviation from the average across all years, we also study the 2 and 3-year deviations from the average. The effects of these longer term deviations on the likelihood of public and private target acquisitions are not significant.

environment aim to resolve these uncertainties and consolidate their position within their industries. Acquiring a public target fulfills these aims better. In contrast, we show that firms in product markets with lower pressures and threats are likely to acquire private targets. As acquirers reside in a more stable environment, they aim to explore and expand. Our results suggest that private target acquisitions facilitate firms to do so.

2.3.2 Acquisition outcomes

This section investigates acquisition outcomes. We conjecture that public target acquisitions are associated with outcomes that consolidate the acquirer's position within its industry. In line with this hypothesis, we expect that public target acquisitions are associated with a significant improvement in product differentiation, market shares, and operating income; and a significant decrease in operating expenses and net working capital. Tables 2.7 shows all the results for changes in ten outcome variables. Three specifications always show results for the change in the respective outcome up to one, two and three years after the acquisition year, respectively. Note that all specifications include all publicly listed firms over the period from 1994 to 2018 and control variables are lagged by one year. All regressions include year and firm fixed effects.

The first part of Tables 2.7 considers product distance effects. It shows that the coefficients for public target acquirers are significantly positive in all three specifications. Acquiring public targets is associated with an increase in product differentiation. The economic significance of the effect is switching from no to public target acquisition in a given year results in an increase of 0.19, 0.16 and 0.18 percent in the product distance within one, two and three years, respectively.[7] The coefficients for private target acquirers are statistically insignificant, which suggests

[7]Note that in our outcome regressions, we rescale our dependent variables by multiplying them by 100 except for the changes in net working capital, sales and EBIT over assets. Therefore, the proportion of the increase in product distance following public target acquisitions in the first window is equal to 0.167÷100 scaled by 0.88 (the unconditional mean of product distance).

that acquirers of private targets do not improve their product differentiation. We also test significant differences in the effects of public and private target acquisitions on the changes in product distance. We find that the effects of public deal are significantly higher than private deal in all windows, suggesting that public target acquirers have a significantly larger improvement in their product differentiation than private target acquirers.

The coefficients for fluidity and HH Index show that tight product market conditions have a positive significant effect on product differentiation. Higher threats and more competitions motivate firms to increase their distance from their close peers. Higher private M&A activity has a negative effect on product differentiation. Concerning other control variables, we can see that higher capital intensity and smaller cash holding, Tobin's Q, and industry sales growth are all associated with higher product differentiation.

The second part of Table 2.7 shows results for changes in the market shares. The results show that both public and private target acquisitions are associated with an increase in market shares. Still, the coefficients for public target acquisitions are almost three times higher than the coefficients for private acquisitions and the differences are statistically significant, suggesting that public target acquisitions are better at consolidating their positions within the product market. In economic terms, switching from no to public target acquisition in a given year results in an increase of 13.76, 14.36, and 12.47 percent in market shares within one, two and three years, respectively. In contrast, switching from no to private target acquisition in a given year results in an increase of 4.64, 5.18, and 5.37 percent in market shares within one, two and three years, respectively.

The third part of Table 2.7 document the changes in operating expenses to measure cost efficiencies. It shows that both public and private target acquisitions are associated with decreases in operating expenses in all three windows. The coefficients on public target acquisitions are significantly larger than private target

acquisitions. These differences suggest that the improvement in cost efficiency for public target acquirers is higher than for private target acquirers. In economic significance terms, public target acquisitions result in a drop of 5.51, 6.86, and 10.04 percent in operating costs from one year before to one, two, and three years after the current year relatively to firms with no acquisitions.

Next, we show that public target acquisitions are associated with a decrease in net working capital. In contrast, the effects of private target acquisitions are not significant. We find that the coefficients on public target are significantly different from the coefficients on private target particularly in the medium and longer-term windows. Our results suggest that public target acquirers are able to improve their savings in the net working capital. (Devos et al., 2008).

The fifth and sixth parts of Table 2.7 focuses on the profitability outcomes, measured by changes in sales and EBIT over assets. We find that both public and private target acquisitions are associated with decreases in sales. However, the coefficients for public targets are significantly larger than private targets in all three windows, suggesting that public target acquirers experience a larger decrease in sales compare to private target acquirers. This larger decrease in sales seems to make sense considering public target acquirers are firms who face higher competitive pressures and product market threats within their industries. The effects of public target acquisitions on the changes in EBIT are not significant, while the effects of private target acquisitions are significantly negative in all three windows. The results suggest that even though public target acquirers face significant decline in their sales, they are able to operate more efficiently. As a result, public target acquirers are able to maintain their operating income.

Overall, our results on the changes in product distance, market share, operating expenses, net working capital, sales and EBIT over assets support our hypothesis. Public target acquisitions are associated with outcomes that facilitate firms to consolidate their positions within their industries: increase in product differen-

tiation, market shares, operating cost efficiency, and saving in net working capital. Our results support the idea that acquiring public targets facilitate acquirers to consolidate their positions post-deals. The characteristics of public firms seem to fit acquirers' goals. Publicly listed firms are large, established and high quality entities (Koeplin et al., 2000; Maksimovic et al., 2013). In addition, they publish large quantity of good quality information in regular intervals (Capron and Shen, 2007). Given the public firm quality of assets and availability of information about their assets and activities, acquisitions of public targets lead to more predictable outcomes associated with re-establishment of their position. Also, the bigger scope of public firms should help consolidation to a larger extent (Moeller et al., 2004).

Our next discussion emphasizes primarily on the outcomes associated with private target acquisitions. Our hypothesis suggests that private target acquisitions are associated with outcomes aiming at business expansion trough innovation and exploration for new products. We associate private target acquisitions with increases in R&D expenditures, capital expenditures, and PPE. We also expect that innovation and expansion are associated by lower profitability due to their risky and long-term nature. Consistent with our hypothesis, Table 2.7 shows that acquiring private targets is associated with increases in the R&D expenditures for all three windows. The effects are also large in economic terms – R&D expenditures increase by 3.6, 5.8, and 8.7 percent within one, two and three years, respectively when comparing firms without acquisitions and acquirer of public targets. The effects of public deal on R&D expenditures are not significant.

The next part of Table 2.7 focuses on the changes in capital expenditures as the outcome variable. It shows that private target acquisitions are associated with increases in capital expenditures in particular for the shorter window. Acquirers of private targets increase their capital expenditures by 4.1 percent when compared to firms without any acquisitions in specification 1. In contrast, the coefficients for public target acquisitions are significantly negative in all three windows, suggesting

that public target acquirers decrease their spending on capital expenditures. Our results are line with Devos et al. (2008), acquirers of public targets consolidate their fixed assets and invest less. Consistent with the results on capital expenditures, we find that the effects of private target acquisitions on the changes in PPE are significantly positive, suggesting that private target acquirers increase their investments in fixed assets. In contrast, we find that public target acquisitions are associated with a decrease of 3.4, 3.1, and 2 percent in PPE within one, two and three years, respectively.

In summary, we show, consistent with our hypothesis, that acquiring private targets is associated with innovation or expansion outcomes in less competitive product markets. Looser product markets with weaker disciplinary power allows private target acquirers to focus on longer-term goals and pursue deals that are more risky and deliver outcomes further in the future. A negative relationship between competition and innovation is also suggested by Marshall and Parra (2019). They show that such a relationship prevails in an industry with the leader's profits from innovation increasing with industry concentration and with the number of small firms without easy access to to the product market. In addition, acquiring private targets seems to facilitate acquirers' goals as private targets that are in general smaller, younger, less transparent and riskier (Koeplin et al., 2000; Ferreira et al., 2014). Small firms are often associated with new ideas and innovation (Ferreira et al., 2014).

Our last outcome variable is the changes in tax paid because the literature highlights the increase in tax shields as one of reasons for takeovers (Devos et al., 2008). Table 2.7, shows that both public and private target acquisitions are associated with decreases in income tax paid. Public target acquirers pay between 13 and 18 percent less tax and private target acquirers pay around 8-18 percent less tax within three windows. The coefficient for public target acquirer is significantly larger in magnitude than the coefficient for private target in the first window. This

may be because public target acquirers incur more depreciation expenses as the size of public firms is bigger than private firms. While in the the second and third windows, the coefficients on both public and private targets are not significantly different. Our results support the idea that acquisitions play important roles in reducing future tax payments.

2.3.3 Outcome with matching

In this subsection, we provide further evidence supporting different outcomes between public and private target acquisitions. We are aware that the assignment of acquirers and non-acquirers is not random. Many factors determine a firm's likelihood to become acquirers. Because the determinants of becoming an acquirer may correlate with our outcome variables, we build a sample of control firms such that they have similar characteristics with acquirers. We also require that they do not make any acquisitions in the same year as the announcement year. We use propensity score matching. As a first step in the procedure, we model the firm-level probability of becoming acquirers of public or private target in a given year as a function of acquiring firms' characteristics as follows:

$$\begin{aligned} Prob(Public_{i,t}) &= \alpha_1 + X_{i,t-1}\beta_1 + \gamma_1 Log\ sales_{i,t-1} + \delta_1 Net\ income_{i,t-1} + \\ &\quad \zeta_1 Leverage_{i,t-1} + \eta_1 Q\ firm_{i,t-1} + a_{1,i} + d_{1,t} + \varepsilon_{1,i,t}, \quad (2.1) \\ Prob(Private_{i,t}) &= \alpha_2 + X_{i,t-1}\beta_2 + \gamma_2 Log\ sales_{i,t-1} + \delta_2 Net\ income_{i,t-1} + \\ &\quad \zeta_2 Leverage_{i,t-1} + \eta_2 Q\ firm_{i,t-1} + a_{2,i} + d_{2,t} + \varepsilon_{2,i,t} \quad (2.2) \end{aligned}$$

where $Public_{i,t}$ ($Private_{i,t}$) is equal to 1 if a firm i is an acquirer of public (private) target in year t and zero otherwise; $X_{i,t-1}$ is a matrix of product market condition measures (close similarity, HH Index, product market IQR, Lerner Index, fluidity, and product market rank), M&A activity, and log number of peers; $Log\ sales_{i,t-1}$ is the natural logarithm of total sales; $Net\ income_{i,t-1}$ is net income scaled by total

assets, $Leverage_{i,t-1}$ is long term debt divided by shareholder equity; $Q\ firm_{i,t-1}$ is sum of the market value of equity and liability over total assets. $a_{1,i}$ ($a_{2,i}$) and $d_{1,t}$ ($d_{2,t}$) are industry and year fixed effects, respectively.

The logit regressions of estimating the probability of becoming public and private target acquirers are tabulated in Table 2.8 in columns 1 and 4, respectively. We next calculate predicted probability of becoming public and private target acquirers based on the estimate coefficients from our logit specifications. For each public and private target acquirer, we find a-matching firm that has the closest propensity score. To find a-matching sample for public target acquirer, we choose a-matching firm from the same industry that does not acquire public and/or private target in the same year as the acquisition year. Similarly, to find a-matching sample for private target acquirer, we choose firm from the same industry that does not acquire any target in the same year as the year of acquisition.

Columns 2 and 3 (5 and 6) compare the mean values of firms' characteristics that are used in the logit regressions for public (private) target acquirers and their matched firms, respectively. The results indicate that prior to the year of acquisitions, both types of acquirers and their corresponding matched firms are very similar in product market conditions and all of other characteristics. These suggest that firms' characteristics are unlikely to drive the difference in outcomes after acquisitions. While private target acquirers and their matched firms are slightly differ in close similarity, Lerner Index, and log number of peers, they have similar probability of acquiring private target as indicated by the insignificant difference in propensity score.

The first six outcomes shown in Table 2.9 focus on the outcomes associated with public target acquisitions. The first part of Table 2.9 considers the effects of acquisitions on product distance. All specifications include year and firm fixed effects. The same as our main specifications in Section 2.3.2, we see that the coefficients for public target acquirers are significantly positive in all three windows. In contrast,

the coefficients for private target acquisitions are significantly negative, suggesting that private target acquirers decrease their distance with their close peers. We test significant differences on the coefficients on public and private deals and the effects are significantly higher for public deal. These results confirm that acquiring public target is associated with an increase in product differentiation compare to both matched firms and private target acquirers.

The second part of Table 2.9 considers the effects on market shares. It shows that both public and private target acquisitions are associated with an increase in market shares. Consistent with the main specifications, the coefficients on private target are significantly smaller than the coefficients on public target. This suggests that the increase in market shares is significantly larger for public target acquirers.

Next, Table 2.9 shows the results on the effects on operating expenses. We find that public target acquisitions are associated with a significant decrease in operating expenses across three windows. The results confirm that public target acquirers aim to improve their cost efficiency. Interestingly, the effects of private deal are significantly positive within second and third windows, suggesting that private target acquirers increase their operating costs over the medium and longer term windows. Consistent with the main specifications, we next document that public target acquirers are able to improve their savings in net working capital, whereas the effects of private target acquisitions are not significant. In terms of profitability outcomes, we show that both public and private target acquirers suffer from a decline in sales, but the effects are larger for public deal. More importantly, we find that public target acquirers are able to maintain their operating income through efficiently cutting their operating costs.

The next parts of Table 2.9 focus on the outcomes associated with expansion and innovation. We find that public target acquisitions are associated with a decrease in R&D expenditures. The effects of private target acquisitions on R&D expenditures are significantly positive in the first and second windows. We fur-

ther show that private target acquisitions are associated with an increase in capital expenditures specifically in the shorter term window. In contrast, public target acquisitions are associated with a decrease in capital expenditures. Consistent with the results on capital expenditures, we show that public target acquisitions are associated with lower PPE, which indicates that public target acquirers invest less in fixed assets.

The final measure of acquisition outcomes in Table 2.9 focuses on tax paid. We find, consistent with the main specifications, that both types of acquisitions are associated with a decrease in tax paid all windows. The effects are significantly more negative for public target acquirers than private target acquirers in the first window. This suggest that the reduction in tax paid are larger for public target acquirers which potentially due to a larger depreciation expenses of public target acquirers. Over the longer term window, the decrease in tax paid is higher for private target acquirers. One reason for this could be because private target acquirers suffer from a decline in operating income, which is not the case for public target acquirers.

2.3.4 Acquirer announcement abnormal returns

Our final analysis is to examine whether product market conditions can contribute in explaining differences in acquirer announcement abnormal returns. Table 2.10 regresses the acquirer 7-day cumulative abnormal return around deal announcement, adjusted by value-weighted market index return, on a dummy of public target, product market conditions, and a set of control variables following M&A literature (Faccio et al., 2006; Fuller et al., 2002). Note that the product market condition corresponds to each of the five measures indicated in columns 1 to 10. We add a set of dummy variables indicating quartile by each of the product market condition. The first quartiles for close similarity and fluidity represent a group of acquirers with the lowest competitive pressures and threat in product markets, respectively. The first quartiles for HH Index, product market IQR, and Lerner Index represent a group of

acquirers in industry with the lowest competition (highest concentration). We drop the first quartile of each product market condition as a reference category. Using the set of dummy variables for each measure of product market condition, we assume that market is able to sort out acquirers into those that operate in higher competitive pressures versus those that are in lower competitive pressures. All regressions include year and firm fixed effects. We can see that in column 1, for instance, the public target dummy is significantly negative, indicating that acquisitions of public targets creates less value for the acquiring firm shareholders. In columns 2, 4, 6, 8, and 10, we add interaction terms between the quartiles for each of the product market condition and public target dummy to separate the valuation effect of competitive pressures between public and private target acquirers. We can see that the inclusion of interaction terms is important. The market reaction is significantly lower for public target acquirers in industries with the highest competitive pressures and threat. In contrast, private target acquirers that operate in industry with the highest competitive pressures enjoy the highest market reactions. The effects of a plain public target dummy is smaller than in the baseline regression as shown in columns 1, 3, 5, 7, and 9. The value differences between public and private firms are partly explained by the differences in their product market conditions.

In Table 2.10, we find evidence that differences in product market condition contribute in explaining differences in acquirer announcement abnormal returns. However, as indicated in Section 2.3.3, the determinant of becoming acquirers and non-acquirers is not random. Firms may self-select to acquire public target rather than private target. In other words, firms that choose to acquire public targets may differ from firms choose to acquire private target or choose not to acquire at all. For example, firms with high competitive pressures are more likely to undertake public target acquisitions at higher rates than firms with low competitive pressures because competitive pressures motivate firms to consolidate their industry positions. Assume that high competitive pressures are associated with higher

(unobserved) post-integration capabilities. Sample selection bias will be an issue when non-random sample also includes some firms with low competitive pressures, but they choose to undertake public target acquisitions despite their low pressures (Certo et al., 2016). The firms with lower pressures that are most likely to undertake an acquisition, and thus enter the sample are those that have higher (unobserved) post-acquisition integration capabilities. This omitted variable, i.e., post-integration capabilities, that is likely to lead to a bias. Certo et al. (2016) explain that a non-random sample will bias the results when an omitted variable influences both (1) the probability of entering the sample, e.g., acquiring other firms, and (2) the dependent variable of interest, e.g., stock market reactions. In such case, the omitted variable creates a correlation between the two error terms in the 1st and 2nd stages of the regressions (Certo et al., 2016).

To obtain unbiased estimates of the effect of target ownership on acquirer returns, we follow Heckman (1979) two-stage estimation procedure (Capron and Shen, 2007). In the 1st stage, we model the acquirer's selection between public and private targets as a function of product market conditions and other firm's characteristics. Specifically, we used a probit model to estimate the likelihood of public target acquisition as follows:

$$\begin{aligned} Prob(Public_{i,t}) &= \alpha + X_{i,t-1}\beta + \gamma Capex_{i,t-1} + \delta RD_{i,t-1} + \zeta Log\ sales_{i,t-1} + \\ &\quad \eta Net\ income_{i,t-1} + \theta Leverage_{i,t-1} + \lambda Cash\ holdings_{i,t-1} + \\ &\quad \mu Q\ firm_{i,t-1} + \nu Sales\ growth_{i,t-1} + a_i + d_t + \varepsilon_{,i,t}, \end{aligned} \tag{2.3}$$

where $Public_{i,t}$ is equal to 1 if the target i is a public firm in year t and zero if the target is a private firm; $X_{i,t-1}$ is a matrix of product market condition measures (close similarity, HH Index, product market IQR, Lerner Index, fluidity, and product market rank), M&A activity, and log number of peers; $Capex_{i,t-1}$ is capital expenditures divided by total assets; $RD_{i,t-1}$ is R&D expenditures over total assets;

$Log\ sales_{i,t-1}$ is the natural logarithm of total sales; $Net\ income_{i,t-1}$ is the ratio of net income over total assets, $Leverage_{i,t-1}$ is long term debt divided by shareholder equity; $Cash\ holdingss_{i,t-1}$ is the ratio of cash over total assets; $Q\ firm_{i,t-1}$ is sum of the market value of equity and liability over total assets; $Sales\ growth_{i,t-1}$ is the growth of total sales from $_{t-2}$ to $_{t-1}$. a_i and d_t are industry and year fixed effects, respectively. We use log number of peers as an exclusion restriction in the 1st stage. We argue that total number of peers within the industry influences the probability of a firm to become an acquirer of public or private targets, but do not influence our dependent variable of interest in the 2nd stage. In the 2nd stage of Heckman procedure, we estimate a model of acquirer announcement abnormal returns by incorporating the correction from endogeneity bias (*Lambda*) that is obtained from the 1st stage.

To complement our analysis on the endogeneity bias, we follow Capron and Shen (2007) by including a variable that captures the fit between acquirer's actual choice between public or private target and what the selection model predicts. Given that the dependent variable in the selection model is equal to 1 (0) if the target is a public (private) firm, the "fit" variable is defined as p, i.e., the probability of choosing public target if the target is a public firm or $1-p$ if the target is a private firm. The "fit" variable is designed to address the issue of the economic significance of the acquirer's choice between public and private targets (Capron and Shen, 2007). It represents the probability of a realized target type.

Table 2.11 summarizes the results for the two-step estimation procedure to correct for the endogeneity bias. In column 1 of Panel A, we present the coefficient estimates from the selection model. Column 2 shows the regression for the acquirer 7-day cumulative abnormal return on the deal characteristics, the correction from endogeneity bias, product market conditions, other firm characteristics. In column 2, we find that the *Lambda* coefficient is significantly positive which may suggests that sample selection bias is an issue. However, after controlling for endo-

geneity bias, we find that public deal dummy is negatively associated with acquirer's announcement returns. In column 3, we present the results by including the "fit" variable to capture the fit between acquirer's actual choice and the prediction from the selection model. We find that the coefficient on "fit" variable is not significant. However, when we add an interaction term between "fit" and public target dummy in column 4, the effect is significantly negative. Moreover, the plain public target dummy becomes insignificant and smaller in magnitude. The market reaction is significantly lower for public target acquisition with the highest probability of a realized type as predicted by the selection model. The selection model suggests that the likelihood of acquiring public target is higher when acquirers' competitive pressures and product market threats are higher.[8] To a large extent, the results suggest that market is able to sort the acquirers based on their product market conditions. The lower announcement return explains the fact that public target acquirers operate under high competitive pressures and threat within their product markets. It is also important to recognize that sample selection bias is not only the main source of endogeneity. Certo et al. (2016) explain that even though sample selection bias induces endogeneity, the correlation between the independent variable and the error term in the final sample may result from other sources, such as measurement error, autoregression, and simultaneous causality. As we find an evidence that the *Lambda* coefficient is significantly positive, that gives us an indication that sample selection could be an issue. Therefore, we we employ Heckman model in this context.

It is important to note that the five measures of product market conditions are highly correlated. To solve the collinearity among our product market condition variables, we implement a principal component analysis. In column 1 of Panel B, we replace all measures of product market conditions using the first principal com-

[8]The coefficient estimate for HH Index seems to suggests that the likelihood of acquiring public targets is higher when industry concentration is higher. The main reason is because the five measures of product market conditions are highly correlated. Therefore, including them altogether in a regression may give a contradictory result from our previous finding. In the Internet Appendix, we run regressions on the selection model separately for each measure of product market condition and we do not find any conflicting results.

ponent. Using the first principal component in the selection model, the results in columns 2 to 4 remain consistent. Overall, our results suggest that the lower announcement return can be attributed to firms that operate under high competitive pressures within their product markets.

2.4 Conclusion

This paper studies different motivations and outcomes when firms acquire public versus private targets. We argue and show that product market conditions influence acquirers' target selection. Using 102, 516 firm year observations of the US firms from 1994 until 2019, we show that public target acquisitions are associated with more competitive product markets than both private target acquisitions and no-deal firm years. We also show that the likelihood of acquiring public target is higher when rival's products are changing. By contrast, we find that the probability of acquiring private targets is higher when firms operate in less competitive product markets and when rival's products are not changing. Our results support the idea that as firms face high uncertainties in their product markets, they tend to acquire public targets to possibly resolves these uncertainties and consolidate their position within their industries. Conversely, as firms reside in a more stable environment, they are more likely to acquire private targets to facilitate exploration and expansion within their product markets.

Next, we document that after taking over public targets, acquiring firms tend to significantly increase their market share, differentiate products from their close peers, gain cost savings, decrease net working capital, and maintain their operating income. In contrast, acquirers of private targets tend to increase their investment in fixed assets, capital and R&D expenditures, while also suffer a decrease in profitability. We also find that both types of acquisitions are associated with a decrease corporate taxes paid. Altogether, we find significant and meaningful

differences between public versus private acquisitions. We can see that acquirers of public targets pursue acquisitions that aim at consolidation of their position within their competitive product markets. Acquirers of private targets, in contrast, seem to aim for innovation or expansion in less competitive product markets.

We conclude our analysis by examining whether product market conditions can contribute in explaining differences in announcement returns between public versus private target acquisitions. Complementing results in the literature, we show that the 7-day cumulative abnormal returns are significantly lower for public target acquirers with the highest competitive pressures and threats in their product markets. As public target acquirers are firms under higher competitive pressures and aiming at consolidating their position within their industries, markets react more negatively. In contrast, as private target acquirers are firms in more stable environment and aiming at expansion and exploration within their product markets, markets react more positively.

Taken together, our paper documents that competitive pressures and threats in product market are likely to have effects on acquirers' target selection. Furthermore, we show that private target acquisitions serve different purposes from public target acquisitions conditional on the intensity of industry competitive threats and pressures in product market. More importantly, the results on differences in acquirer announcement returns indicate that market is able to sort out acquirers into those that operate in higher competitive pressures versus those that are in lower competitive pressures. The announcement returns reflect market perception towards acquirers' product market conditions. Our results add to the understanding of the selections of target acquisitions and provide further insights in different roles of acquisitions.

2.5 Appendix

2.5.1 Variable Definition

Variable	Definition	Source
Main variables:		
Public deal	A dummy variable equal to one if a firm acquires a public target in the given year and zero otherwise.	SDC, HPDL
Private deal	A dummy variable equal to one if a firm acquires a private target in the given year and zero otherwise.	SDC, HPDL
Close similarity	The average of the ten highest pairwise similarity scores for the given firm.	HPDL
HH Index	A measure of industry concentration that calculated as a sum of squared market shares based on sales for all firms in the TNIC-3 industry.	HPDL
Product market interquartile range (IQR)	The difference between the first and third quartile of the market share based on sales of all peers in the TNIC-3 industry.	HPDL, Compustat
Lerner Index	The average of the ratio EBITDA over sales for all peers in the TNIC-3 industry.	HPDL, Compustat
Fluidity	Measures how rivals are changing their products relative to the firms' products.	HPDL
Product market rank	The rank of the firm among its TNIC-3 peers by the sales market share, scaled by the number of peers in the TNIC-3 industry. A low relative rank denotes a dominant position.	HPDL, Compustat
Pub. M&A activity	Total public target acquisitions by close peers over 10 (the number of closest peers).	HPDL
Priv. M&A activity	Total private target acquisitions by close peers over 10 (the number of closest peers).	HPDL
Product distance	The average pairwise distance with the ten closest peers. The pairwise distance is calculated as one minus pairwise similarity for each pair of firms.	Compustat
Market shares	The ratio of the firm's sales (total revenue) to the sum of sales for the firm and its ten closest peers (based on pairwise similarity).	HPDL, Compustat
Operating expenses	Operating expenses over total assets.	Compustat
Net working capital	The ratio of current assets over current liabilities.	Compustat
Sales over assets	Total sales scaled by total assets.	Compustat
EBIT over assets	Earning before interest and tax (EBIT) scaled by total assets.	Compustat

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Variable	Definition	Source
R&D expenditures	Research and development expenses scaled by total assets. Missing values are replaced by zeros.	Compustat
Capital expenditures	Capital expenditures scaled by total assets.	Compustat
PPE	Property, plant, and equipment (PPE) scaled by total assets.	Compustat
Tax paid	Total income tax paid scaled by total assets.	Compustat
Control variables:		
Total sales	Firm's total assets.	Compustat
Log sales	The logarithm of firm's total sales.	Compustat
Net income over sales	Net income scaled by total sales.	Compustat
Leverage	Long-term debt divided by shareholder equity.	Compustat
Cash holdings	Total cash scaled by total assets.	Compustat
Capital intensity	Total property, plan, and equipment (PPE) of a firm and its closest peers over total assets of a firm with its 10 closest peers.	Compustat
Q firm	For a given firm, Q firm is calculated as = (market value of equity + total liability)/total assets.	Compustat
Q industry	For a given firm with its closest peers, Q industry is calculated as = (market value of equity + total liability)/total assets.	Compustat
Sales growth	For a given firm, sales growth is calculated as = (total revenue at t - total revenue at *(t-1)*)/total revenue at *(t-1)*.	Compustat
Industry sales growth	For a given firm with its closest peers, industry sales growth is calculated as = (total revenue at t - total revenue at *(t-1)*)/total revenue at *t-1*.	Compustat
Number of peers	The number of firms in the TNIC-3 industry, in regressions used as a natural logarithm.	HPDL

Table 2.1 Distribution of acquirers by industries

This table reports distribution of firm-year observations, public target acquirers, and private target acquirers across Fama-French 12 industries.

	(1)	(2)	(3)
Fama-French 12 industries	#Obs.	#Public deal	#Private deal
Consumer NonDurables	4,789	129	618
Consumer Durables	2,236	50	261
Manufacturing	8,906	263	1,431
Oil, Gas, and Coal Extraction and Products	4,499	177	514
Chemicals and Allied Products	2,133	64	240
Business Equipment	19,156	845	3,986
Telephone and Television Transmission	2,885	181	500
Utilities	2,811	100	203
Wholesale, Retail, and Some Services	9,607	240	1,482
Healthcare, Medical Equipment, and Drugs	11,978	440	1,411
Finance	20,944	1,295	2,493
Other	12,572	356	2,016
Total	102,516	4,140	15,155

Table 2.2 Summary statistics

This table reports the mean, standard deviation, 25th, 50th and 75th percentiles for deal frequencies, product market conditions, outcome variables, changes in outcomes, and control variables. All variables are defined in Appendix 2.5.1 and winsorized at the 1th and 99th percentiles.

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	# Obs.	Mean	St.dev.	25th perc.	Median	75th perc.
Deal frequencies						
Public deal	102,516	0.040	0.197	0.000	0.000	0.000
Private deal	102,516	0.148	0.355	0.000	0.000	0.000
Product market condition						
Close similarity	102,364	0.121	0.085	0.058	0.101	0.159
HH Index	102,397	0.230	0.231	0.070	0.136	0.306
Product market IQR	102,516	0.093	0.191	0.002	0.012	0.075
Lerner Index	102,500	-0.864	2.972	-0.203	0.089	0.174
Fluidity	102,516	7.548	3.753	4.768	6.880	9.670
Product market rank	102,516	0.505	0.305	0.250	0.500	0.754
Outcome variables						
Product distance	102,364	0.879	0.085	0.841	0.899	0.942
Market shares	102,516	0.076	0.107	0.011	0.035	0.093
Operating expenses	85,800	1.033	0.915	0.414	0.866	1.409
Net working capital	86,577	1.971	3.170	0.209	1.089	2.431
Sales over assets	102,516	0.908	0.825	0.272	0.730	1.284
EBIT over assets	85,800	-0.032	0.331	-0.033	0.030	0.092
R&D expenditures	102,516	0.051	0.125	0.000	0.000	0.044
Capital expenditures	102,516	0.049	0.065	0.008	0.028	0.062
PPE	102,516	0.228	0.242	0.035	0.133	0.342
Tax paid	85,550	0.017	0.025	0.001	0.007	0.025
Changes in outcomes						
ΔProduct distance [-1,1]	95,586	0.002	0.026	-0.009	0.002	0.013
ΔProduct distance [-1,2]	84,277	0.003	0.030	-0.010	0.003	0.016

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Variable	(1) # Obs.	(2) Mean	(3) St.dev.	(4) 25th perc.	(5) Median	(6) 75th perc.
ΔProduct distance [-1,3]	74,491	0.004	0.033	-0.011	0.004	0.019
ΔMarket shares [-1,1]	97,964	0.003	0.033	-0.005	0.000	0.007
ΔMarket shares [-1,2]	87,917	0.008	0.047	-0.005	0.001	0.013
ΔMarket shares [-1,3]	78,854	0.014	0.060	-0.005	0.001	0.019
ΔOperating expenses [-1,1]	81,248	0.023	0.550	-0.104	0.001	0.122
ΔOperating expenses [-1,2]	72,566	0.068	0.572	-0.071	0.021	0.192
ΔOperating expenses [-1,3]	64,853	0.172	0.914	-0.062	0.049	0.301
ΔNet working capital [-1,1]	82,590	-0.009	1.926	-0.280	0.000	0.242
ΔNet working capital [-1,2]	73,919	-0.021	2.124	-0.338	0.000	0.279
ΔNet working capital [-1,3]	66,125	-0.031	2.272	-0.389	0.000	0.304
ΔSales over assets [-1,1]	97,987	0.004	0.371	-0.098	0.000	0.108
ΔSales over assets [-1,2]	87,942	0.000	0.426	-0.129	-0.003	0.123
ΔSales over assets [-1,3]	78,876	-0.005	0.467	-0.153	-0.007	0.134
ΔEBIT over assets [-1,1]	81,259	-0.018	0.317	-0.044	-0.002	0.030
ΔEBIT over assets [-1,2]	72,577	0.002	0.285	-0.046	0.001	0.045
ΔEBIT over assets [-1,3]	64,860	0.005	0.364	-0.048	0.004	0.059
ΔR&D expenditures [-1,1]	98,069	0.001	0.083	0.000	0.000	0.000
ΔR&D expenditures [-1,2]	88,028	0.001	0.087	0.000	0.000	0.000
ΔR&D expenditures [-1,3]	78,961	0.003	0.106	0.000	0.000	0.000
ΔCapital expenditures [-1,1]	98,069	-0.005	0.050	-0.013	0.000	0.008
ΔCapital expenditures [-1,2]	88,028	-0.006	0.053	-0.016	0.000	0.007
ΔCapital expenditures [-1,3]	78,961	-0.008	0.053	-0.018	-0.001	0.007
ΔPPE [-1,1]	97,789	-0.002	0.076	-0.023	-0.001	0.019
ΔPPE [-1,2]	87,683	-0.005	0.089	-0.032	-0.002	0.021
ΔPPE [-1,3]	78,592	-0.007	0.098	-0.039	-0.002	0.023
ΔTax paid [-1,1]	80,287	-0.002	0.023	-0.008	0.000	0.005
ΔTax paid [-1,2]	71,648	-0.003	0.025	-0.009	0.000	0.005

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Variable	(1) # Obs.	(2) Mean	(3) St.dev.	(4) 25th perc.	(5) Median	(6) 75th perc.
ΔTax paid [-1,3]	64,085	-0.003	0.027	-0.011	0.000	0.005
Control variables						
Pub. M&A activity	102,516	0.044	0.071	0.000	0.000	0.100
Priv. M&A activity	102,516	0.144	0.140	0.000	0.100	0.200
Number of peers	102,364	291.534	279.967	66.000	192.000	448.000
Total sales (in millions)	102,516	1984.641	6670.625	44.241	206.539	1016.882
Log sales	102,516	19.141	2.347	17.605	19.146	20.740
Net income over sales	102,516	-0.913	7.456	-0.041	0.039	0.103
Leverage	102,516	0.634	1.940	0.001	0.245	0.799
Cash holdings	102,516	0.125	0.164	0.019	0.058	0.167
Capital intensity	102,516	0.235	0.226	0.058	0.157	0.348
Q firm	102,516	2.021	1.941	1.048	1.377	2.188
Q industry	102,516	1.969	1.365	1.164	1.561	2.243
Sales growth	102,516	0.257	0.911	-0.018	0.090	0.255
Ind. sales growth	102,516	0.462	15.152	0.030	0.107	0.227

Table 2.3 Group comparisons

This table reports means for product market conditions and M&A activity in Panel A and changes in outcome variables in Panel B for three different groups of firm-year observations: public target acquirers in column 2, private target acquirers in column 3, and the remaining firm-year observations without acquisitions in column 4. The table shows differences in means between public target acquirers and no deals in column 5, private target acquirers and no deals in column 6, and public versus private target acquirers in column 7. All variables are defined in Appendix 2.5.1 and winsorized at the 1st and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	#obs	Public deals	Private deals	No deals	Public vs. no deals	Private vs. no deals	Public vs. private
Panel A: product market conditions and M&A activity across groups							
Close similarity	102,364	0.158	0.107	0.122	0.035***	-0.015***	0.051***
HH Index	102,397	0.166	0.244	0.230	-0.064***	0.014***	-0.078***
Product market IQR	102,516	0.053	0.097	0.095	-0.041***	0.002	-0.043 ***
Lerner Index	102,500	-0.620	-0.489	-0.939	0.319***	0.450***	-0.131***
Fluidity	102,516	8.389	7.187	7.574	0.815***	-0.387***	1.202***
Product market rank	102,516	0.335	0.442	0.525	-0.191***	-0.083***	-0.107***
Pub. M&A activity	102,516	0.070	0.050	0.042	0.027***	0.007***	0.020***
Priv. M&A activity	102,516	0.145	0.200	0.134	0.011***	0.066***	-0.055***
Panel B: changes in outcomes across groups							
ΔProduct distance [-1,1]	95,586	0.003	0.001	0.002	0.001**	-0.001***	0.002***
ΔProduct distance [-1,2]	84,277	0.005	0.002	0.003	0.001**	-0.001***	0.003***
ΔProduct distance [-1,3]	74,491	0.006	0.003	0.004	0.002***	-0.001***	0.003***
ΔMarket share [-1,1]	97,964	0.017	0.008	0.002	0.015***	0.006***	0.009***
ΔMarket share [-1,2]	87,917	0.027	0.015	0.006	0.021***	0.009***	0.012***
ΔMarket share [-1,3]	78,854	0.036	0.022	0.011	0.025***	0.011***	0.014***
ΔOperating expenses [-1,1]	81,248	-0.058	0.003	0.030	-0.088***	-0.027***	-0.061***
ΔOperating expenses [-1,2]	72,566	-0.016	0.071	0.071	-0.087***	0.000	-0.087***
ΔOperating expenses [-1,3]	64,853	0.049	0.183	0.175	-0.126***	0.008	-0.134***
ΔNet working capital [-1,1]	82,590	-0.065	-0.023	-0.004	-0.061	-0.019	-0.043
ΔNet working capital [-1,2]	73,919	-0.094	-0.021	-0.016	-0.078	-0.005	-0.073
ΔNet working capital [-1,3]	66,125	-0.115	-0.034	-0.026	-0.089	-0.007	-0.082

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ΔSales over assets [-1,1]	97,987	-0.060	-0.019	0.012	-0.072***	-0.030***	-0.041***
ΔSales over assets [-1,2]	87,942	-0.057	-0.026	0.007	-0.064***	-0.033***	-0.032***
ΔSales over assets [-1,3]	78,876	-0.057	-0.029	0.002	-0.059***	-0.031***	-0.028***
ΔEBIT over assets [-1,1]	81,259	-0.009	-0.025	-0.016	0.008	-0.009***	0.017***
ΔEBIT over assets [-1,2]	72,577	0.002	-0.010	0.004	-0.002	-0.015***	0.012**
ΔEBIT over assets [-1,3]	64,860	0.003	-0.005	0.007	-0.004	-0.012***	0.008
ΔR&D expenditures [-1,1]	98,069	-0.003	0.001	0.001	-0.004**	0.000	-0.004***
ΔR&D expenditures [-1,2]	88,028	-0.003	0.002	0.001	-0.004*	0.001	-0.005***
ΔR&D expenditures [-1,3]	78,961	-0.001	0.002	0.004	-0.005**	-0.001	-0.004**
ΔCapital expenditures [-1,1]	98,069	-0.007	-0.003	-0.005	-0.002*	0.002***	-0.004***
ΔCapital expenditures [-1,2]	88,028	-0.008	-0.006	-0.006	-0.002	0.000	-0.002**
ΔCapital expenditures [-1,3]	78,961	-0.009	-0.008	-0.008	-0.002	-0.001	-0.001
ΔPPE [-1,1]	97,789	-0.008	-0.001	-0.002	-0.007***	0.001	-0.008***
ΔPPE [-1,2]	87,683	-0.010	-0.002	-0.005	-0.005***	0.002***	-0.008***
ΔPPE [-1,3]	78,592	-0.010	-0.005	-0.007	-0.003	0.003***	-0.005***
ΔTax paid [-1,1]	80,287	-0.005	-0.003	-0.002	-0.003***	-0.001***	-0.002***
ΔTax paid [-1,2]	71,648	-0.005	-0.005	-0.002	-0.003***	-0.003***	0.000
ΔTax paid [-1,3]	64,085	-0.006	-0.007	-0.003	-0.003***	-0.004***	0.000

Table 2.4 Predicting public and private target acquisitions: multinomial logistic regressions

This table reports coefficient estimates for multinomial logistic regressions. The dependent variable is set to zero for all non-deal firm-year observations, to one for all public target acquisitions, and two for all private target acquisitions. No deals is the reference category. Panel A focuses on effects of product market conditions and Panel B decomposes the effects of product market conditions into their effects due to overall average across all years in the data set and the deviation in each year from the average. Due to high correlations among product market conditions, we run five specifications for each measure separately. All specifications include industry and year fixed effects. Standard errors at firm level are reported in parentheses. All variables are defined in Appendix 2.5.1 and winsorized at the 1st and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)		(2)		(3)		(4)		(5)	
	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private
Panel A: product market conditions										
Close similarity	2.390***	-0.992***								
	(0.272)	(0.183)								
HH Index			-0.288***	0.127***						
			(0.101)	(0.047)						
Product market IQR					-0.494***	-0.042				
					(0.130)	(0.055)				
Lerner Index							0.009	0.014**		
							(0.010)	(0.006)		
Fluidity									0.017***	0.001
									(0.005)	(0.003)
Product market rank	-0.783***	-0.279***	-0.826***	-0.264***	-0.819***	-0.250***	-0.852***	-0.276***	-0.814***	-0.252***
	(0.098)	(0.047)	(0.097)	(0.047)	(0.097)	(0.048)	(0.097)	(0.049)	(0.096)	(0.048)
Pub. M&A activity	1.438***	0.154	1.405***	0.155	1.422***	0.143	1.431***	0.144	1.473***	0.146
	(0.209)	(0.139)	(0.209)	(0.139)	(0.209)	(0.138)	(0.209)	(0.138)	(0.209)	(0.138)

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	(1)		(2)		(3)		(4)		(5)	
	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private
Priv. M&A activity	0.760***	1.849***	0.679***	1.866***	0.679***	1.872***	0.661***	1.861***	0.702***	1.872***
	(0.131)	(0.071)	(0.130)	(0.071)	(0.130)	(0.071)	(0.130)	(0.071)	(0.131)	(0.071)
Capital expenditures	-0.913**	-0.679***	-0.905**	-0.685***	-0.939**	-0.694***	-0.902**	-0.687***	-0.908**	-0.690***
	(0.386)	(0.198)	(0.386)	(0.198)	(0.386)	(0.197)	(0.386)	(0.197)	(0.386)	(0.197)
R&D expenditures	-0.633**	-1.896***	-0.470*	-1.963***	-0.478*	-2.035***	-0.372	-2.001***	-0.470*	-2.028***
	(0.263)	(0.157)	(0.259)	(0.157)	(0.258)	(0.158)	(0.256)	(0.157)	(0.258)	(0.158)
Log sales	0.372***	0.152***	0.358***	0.154***	0.359***	0.153***	0.357***	0.150***	0.362***	0.153***
	(0.014)	(0.008)	(0.014)	(0.008)	(0.014)	(0.008)	(0.014)	(0.008)	(0.014)	(0.008)
Net income over sales	-0.013***	0.004	-0.013***	0.003	-0.013***	0.003	-0.013***	0.002	-0.013***	0.003
	(0.005)	(0.004)	(0.005)	(0.003)	(0.005)	(0.003)	(0.005)	(0.003)	(0.005)	(0.003)
Leverage	-0.012	-0.013***	-0.013	-0.013***	-0.013	-0.013***	-0.013	-0.013***	-0.014	-0.013***
	(0.009)	(0.005)	(0.009)	(0.005)	(0.009)	(0.005)	(0.009)	(0.005)	(0.009)	(0.005)
Cash holding	0.135	0.047	0.076	0.054	0.068	0.047	0.101	0.060	0.088	0.049
	(0.160)	(0.078)	(0.160)	(0.078)	(0.160)	(0.078)	(0.160)	(0.078)	(0.160)	(0.078)
Capital intensity	0.048	-0.320***	0.057	-0.333***	0.068	-0.340***	0.058	-0.343***	0.059	-0.340***
	(0.153)	(0.078)	(0.152)	(0.078)	(0.152)	(0.078)	(0.151)	(0.078)	(0.151)	(0.078)
Q firm	0.068***	0.066***	0.067***	0.066***	0.067***	0.067***	0.066***	0.067***	0.066***	0.067***
	(0.010)	(0.006)	(0.010)	(0.006)	(0.010)	(0.006)	(0.010)	(0.006)	(0.010)	(0.006)
Q industry	0.030*	0.029***	0.032**	0.028***	0.031**	0.026***	0.035**	0.028***	0.032**	0.027***
	(0.016)	(0.008)	(0.015)	(0.008)	(0.015)	(0.008)	(0.015)	(0.008)	(0.015)	(0.008)
Sales growth	0.100***	0.110***	0.104***	0.108***	0.104***	0.107***	0.106***	0.108***	0.101***	0.107***

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	(1)		(2)		(3)		(4)		(5)	
	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private
	(0.019)	(0.010)	(0.019)	(0.010)	(0.019)	(0.010)	(0.019)	(0.010)	(0.019)	(0.010)
Ind. Sales growth	-0.001	-0.002	-0.001	-0.002	-0.001	-0.002	-0.001	-0.002	-0.002	-0.002
	(0.004)	(0.002)	(0.004)	(0.002)	(0.004)	(0.002)	(0.004)	(0.002)	(0.004)	(0.002)
Constant	-10.171***	-4.607***	-9.584***	-4.783***	-9.627***	-4.718***	-9.639***	-4.659***	-9.859***	-4.732***
	(0.416)	(0.222)	(0.411)	(0.222)	(0.410)	(0.221)	(0.409)	(0.224)	(0.412)	(0.224)
#Obs	102,364	102,364	102,397	102,397	102,516	102,516	102,500	102,500	102,516	102,516
Panel B: average and deviation for product market conditions										
Average close similarity	2.997***	-1.069***								
	(0.310)	(0.205)								
Deviation close similarity	0.710	-0.919**								
	(0.616)	(0.414)								
Average HH Index			-0.722***	0.080						
			(0.131)	(0.061)						
Deviation HH Index			0.241*	0.196***						
			(0.145)	(0.069)						
Average product market IQR					-1.155***	0.007				
					(0.223)	(0.098)				
Deviation product market IQR					-0.120	-0.075				
					(0.171)	(0.076)				
Average Lerner Index							-0.017	0.030***		

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	(1)		(2)		(3)		(4)		(5)	
	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private
							(0.015)	(0.009)		
Deviation Lerner Index							0.041**	0.006		
							(0.016)	(0.010)		
Average fluidity									0.044***	0.002
									(0.007)	(0.004)
Deviation fluidity									-0.013	-0.003
									(0.009)	(0.006)
Product market rank	-0.778***	-0.281***	-0.802***	-0.261***	-0.789***	-0.252***	-0.839***	-0.289***	-0.787***	-0.251***
	(0.098)	(0.047)	(0.098)	(0.047)	(0.098)	(0.048)	(0.097)	(0.049)	(0.096)	(0.048)
Pub. M&A activity	1.440***	0.156	1.374***	0.153	1.404***	0.145	1.424***	0.147	1.500***	0.148
	(0.209)	(0.139)	(0.209)	(0.139)	(0.209)	(0.138)	(0.209)	(0.138)	(0.209)	(0.138)
Priv. M&A activity	0.773***	1.848***	0.695***	1.869***	0.686***	1.872***	0.670***	1.854***	0.735***	1.874***
	(0.131)	(0.071)	(0.130)	(0.071)	(0.130)	(0.071)	(0.131)	(0.071)	(0.131)	(0.071)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-10.286***	-4.599***	-9.445***	-4.762***	-9.615***	-4.724***	-9.689***	-4.605***	-10.136***	-4.751***
	(0.417)	(0.222)	(0.413)	(0.223)	(0.411)	(0.222)	(0.410)	(0.224)	(0.416)	(0.226)
#Obs	102,364	102,364	102,397	102,397	102,516	102,516	102,500	102,500	102,516	102,516

Table 2.5 Predicting public and private target acquisitions: average marginal effects

This table reports average marginal effects from multinomial logistic regressions. The dependent variable is set to zero for all non-deal firm-year observations, to one for all public target acquisitions, and two for all private target acquisitions. No deals is the reference category. Panel A focuses on effects of product market conditions and Panel B decomposes the effects of product market conditions into their effects due to overall average across all years in the data set and the deviation in each year from the average. The reported coefficients on product market conditions and M&A activity are standardized. All specifications include industry and year fixed effects. Standard errors at firm level are reported in parentheses. All variables are defined in Appendix 2.5.1 and winsorized at the 1st and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)		(2)		(3)		(4)		(5)	
	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private
Panel A: product market conditions										
Close similarity	0.008***	-0.011***								
	(0.001)	(0.002)								
HH Index			-0.003***	0.004***						
			(0.001)	(0.001)						
Product market IQR					-0.003***	0.000				
					(0.001)	(0.001)				
Lerner Index							0.001	0.005**		
							(0.001)	(0.002)		
Fluidity									0.002***	0.000
									(0.001)	(0.001)
Product market rank	-0.008***	-0.008***	-0.009***	-0.007***	-0.009***	-0.007***	-0.009***	-0.007***	-0.009***	-0.007***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
Pub. M&A activity	0.004***	0.000	0.003***	0.000	0.004***	0.000	0.004***	0.000	0.004***	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

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	(1)		(2)		(3)		(4)		(5)	
	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private
Priv. M&A activity	0.002***	0.028***	0.002***	0.028***	0.002***	0.028***	0.002***	0.028***	0.002***	0.028***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
#Obs	102,364	102,364	102,397	102,397	102,516	102,516	102,500	102,500	102,516	102,516
Panel B: average and deviation for product market conditions										
Average close similarity	0.010***	-0.012***								
	(0.001)	(0.002)								
Deviation close similarity	0.001	-0.003**								
	(0.001)	(0.001)								
Average HH Index			-0.006***	0.003						
			(0.001)	(0.002)						
Deviation HH Index			0.001*	0.003***						
			(0.001)	(0.001)						
Average product market IQR					-0.005***	0.001				
					(0.001)	(0.001)				
Deviation product market IQR					-0.001	-0.001				
					(0.001)	(0.001)				
Average lerner Index							-0.002	0.010***		
							(0.002)	(0.003)		
Deviation lerner Index							0.002**	0.000		

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	(1)		(2)		(3)		(4)		(5)	
	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private
							(0.001)	(0.001)		
Average fluidity									0.005***	0.000
									(0.001)	(0.002)
Deviation fluidity									-0.001	0.000
									(0.001)	(0.001)
Product market rank	0.000***	-0.008***	-0.008***	-0.007***	-0.008***	-0.007***	-0.009***	-0.008***	-0.008***	-0.007***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
Pub. M&A activity	0.004***	0.000	0.003***	0.000	0.003***	0.000	0.004***	0.000	0.004***	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Priv. M&A activity	0.002***	0.028***	0.002***	0.028***	0.002***	0.028***	0.002***	0.028***	0.002***	0.028***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
#Obs	102,364	102,364	102,397	102,397	102,516	102,516	102,500	102,500	102,516	102,516

Table 2.6 Predicting no and public target acquisitions: multinomial logistic regressions

This table reports coefficient estimates for multinomial logistic regressions. The dependent variable is set to zero for private target acquisitions, one for all non-deal firm-year observations, and two for all public target acquisitions. Private target acquisition is the reference category. Panel A focuses on effects of product market conditions and Panel B decomposes the effects of product market conditions into their effects due to overall average across all years in the data set and the deviation in each year from the average. Due to high correlations among product market conditions, we run five specifications for each measure separately. All specifications include industry and year fixed effects. Standard errors at firm level are reported in parentheses. Standard errors are reported in parentheses. All variables are defined in Appendix 2.5.1 and winsorized at the 1st and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)		(2)		(3)		(4)		(5)	
	No deal	Public	No deal	Public	No deal	Public	No deal	Public	No deal	Public
Panel A: product market conditions										
Close similarity	0.992***	3.382***								
	(0.183)	(0.312)								
HH Index			-0.127***	-0.415***						
			(0.047)	(0.107)						
Product market IQR					0.042	-0.452***				
					(0.055)	(0.136)				
Lerner Index							-0.014**	-0.005		
							(0.006)	(0.011)		
Fluidity									-0.001	0.016***
									(0.003)	(0.006)
Product market rank	0.279***	-0.504***	0.264***	-0.561***	0.250***	-0.569***	0.276***	-0.576***	0.252***	-0.561***
	(0.047)	(0.105)	(0.047)	(0.104)	(0.048)	(0.104)	(0.049)	(0.104)	(0.048)	(0.103)
Pub. M&A activity	-0.154	1.284***	-0.155	1.250***	-0.143	1.279***	-0.144	1.287***	-0.146	1.327***
	(0.139)	(0.235)	(0.139)	(0.235)	(0.138)	(0.235)	(0.138)	(0.235)	(0.138)	(0.235)

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	(1)		(2)		(3)		(4)		(5)	
	No deal	Public	No deal	Public	No deal	Public	No deal	Public	No deal	Public
Priv. M&A activity	-1.849***	-1.089***	-1.866***	-1.187***	-1.872***	-1.193***	-1.861***	-1.199***	-1.872***	-1.170***
	(0.071)	(0.141)	(0.071)	(0.140)	(0.071)	(0.140)	(0.071)	(0.140)	(0.071)	(0.141)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	4.607***	-5.564***	4.783***	-4.802***	4.718***	-4.908***	4.659***	-4.980***	4.732***	-5.127***
	(0.222)	(0.450)	(0.222)	(0.446)	(0.221)	(0.445)	(0.224)	(0.445)	(0.224)	(0.448)
#Obs	102,364	102,364	102,397	102,397	102,516	102,516	102,500	102,500	102,516	102,516
Panel B: average and deviation for product market conditions										
Average close similarity	1.069***	4.066***								
	(0.205)	(0.355)								
Deviation close similarity	0.919**	1.629**								
	(0.414)	(0.702)								
Average HH Index			-0.080	-0.802***						
			(0.061)	(0.140)						
Deviation HH Index			-0.196***	0.044						
			(0.069)	(0.154)						
Average product market IQR					-0.007	-1.162***				
					(0.098)	(0.236)				
Deviation product market IQR					0.075	-0.045				
					(0.076)	(0.181)				
Average lerner Index							-0.030***	-0.047***		

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	(1)		(2)		(3)		(4)		(5)	
	No deal	Public	No deal	Public	No deal	Public	No deal	Public	No deal	Public
							(0.009)	(0.016)		
Deviation lerner Index							-0.006	0.035*		
							(0.010)	(0.018)		
Average fluidity									-0.002	0.041***
									(0.004)	(0.008)
Deviation fluidity									0.003	-0.010
									(0.006)	(0.010)
Product market rank	0.281***	-0.497***	0.261***	-0.540***	0.252***	-0.536***	0.289***	-0.550***	0.251***	-0.537***
	(0.047)	(0.105)	(0.047)	(0.105)	(0.048)	(0.105)	(0.049)	(0.104)	(0.048)	(0.104)
Pub. M&A activity	-0.156	1.284***	-0.153	1.221***	-0.145	1.260***	-0.147	1.278***	-0.148	1.353***
	(0.139)	(0.235)	(0.139)	(0.235)	(0.138)	(0.235)	(0.138)	(0.235)	(0.138)	(0.235)
Priv. M&A activity	-1.848***	-1.075***	-1.869***	-1.174***	-1.872***	-1.186***	-1.854***	-1.184***	-1.874***	-1.139***
	(0.071)	(0.141)	(0.071)	(0.140)	(0.071)	(0.140)	(0.071)	(0.141)	(0.071)	(0.141)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	4.599***	-5.686***	4.762***	-4.683***	4.724***	-4.891***	4.605***	-5.083***	4.751***	-5.385***
	(0.222)	(0.452)	(0.223)	(0.449)	(0.222)	(0.446)	(0.224)	(0.446)	(0.226)	(0.452)
#Obs	102,364	102,364	102,397	102,397	102,516	102,516	102,500	102,500	102,516	102,516

Table 2.7 Acquisition outcomes

This table reports coefficient estimates when regressing the changes in outcome variables from one year before the current year to one, two and three years later on the public and private target acquisition dummies and a set of control variables. We also include time and firm fixed effects. The panel covers all publicly listed US firms in HPDL over the period from 1994 to 2018. All regressions include year and firm fixed effects. Standard errors at firm level are reported in parentheses. All variables are defined in Appendix 2.5.1 and winsorized at the 1st and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)	(5)	(6)
	$[-1,1]$	$[-1,2]$	$[-1,3]$	$[-1,1]$	$[-1,2]$	$[-1,3]$
	Product distance			Market shares		
Public target	0.167***	0.141***	0.162***	1.054***	1.100***	0.955***
	(0.044)	(0.051)	(0.058)	(0.057)	(0.081)	(0.106)
Private target	-0.038	-0.041	-0.015	0.356***	0.397***	0.411***
	(0.026)	(0.030)	(0.035)	(0.033)	(0.048)	(0.062)
Fluidity	0.250***	0.306***	0.353***	-0.008	-0.004	-0.014
	(0.005)	(0.005)	(0.006)	(0.006)	(0.008)	(0.011)
HH Index	-2.681***	-3.340***	-3.885***	-0.112	-0.157	-0.199
	(0.056)	(0.066)	(0.075)	(0.071)	(0.102)	(0.134)
Pub. M&A activity	0.199	0.204	0.326*	-0.893***	-1.293***	-1.426***
	(0.131)	(0.153)	(0.175)	(0.167)	(0.239)	(0.313)
Priv. M&A activity	-0.047	-0.174**	-0.278***	0.167*	-0.350***	-0.884***
	(0.074)	(0.086)	(0.098)	(0.094)	(0.134)	(0.176)
Log sales	-0.010	0.001	0.007	-0.750***	-1.085***	-1.414***
	(0.013)	(0.015)	(0.018)	(0.016)	(0.024)	(0.031)
Net income over sales	0.002	0.000	0.002	-0.006***	0.003	0.016***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)
Leverage	0.001	0.006	-0.006	-0.016**	-0.015	-0.034***
	(0.005)	(0.006)	(0.007)	(0.006)	(0.009)	(0.013)
Cash holdings	-0.240***	-0.234**	-0.032	-0.104	0.289*	0.304
	(0.086)	(0.102)	(0.118)	(0.109)	(0.157)	(0.207)
Capital intensity	0.160	0.208*	0.396***	0.114	-0.105	-0.237
	(0.106)	(0.125)	(0.145)	(0.134)	(0.193)	(0.255)
Q firm	-0.054***	-0.053***	-0.056***	0.194***	0.207***	0.233***
	(0.006)	(0.008)	(0.009)	(0.008)	(0.012)	(0.015)
Q industry	-0.015	-0.007	-0.011	-0.168***	-0.192***	-0.254***
	(0.009)	(0.011)	(0.013)	(0.012)	(0.017)	(0.022)
Ind. Sales growth	-0.001**	-0.001	-0.002**	-0.001	-0.001	-0.001

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	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	-1.016***	-2.019***	-2.351***	14.059***	20.932***	28.168***
	(0.267)	(0.314)	(0.363)	(0.340)	(0.485)	(0.638)
Public-private target	0.205***	0.182***	0.177***	0.698***	0.703***	0.544***
#Obs	95,586	84,277	74,491	97,964	87,917	78,854
R^2	0.095	0.109	0.120	0.049	0.051	0.055
	Operating expenses			Net working capital		
Public target	-5.657***	-7.048***	-10.314***	-0.069*	-0.090*	-0.085*
	(0.990)	(1.082)	(1.717)	(0.041)	(0.046)	(0.050)
Private target	-1.090*	-2.044***	-4.155***	-0.019	0.000	0.013
	(0.571)	(0.628)	(1.004)	(0.022)	(0.025)	(0.028)
Fluidity	0.380***	0.005	-0.266	-0.000	-0.009*	-0.010*
	(0.106)	(0.117)	(0.187)	(0.004)	(0.005)	(0.005)
HH Index	-4.133***	-2.424*	-6.483***	-0.072	-0.087*	-0.089
	(1.216)	(1.332)	(2.121)	(0.046)	(0.052)	(0.057)
Pub. M&A activity	1.486	-2.650	-7.452	0.027	0.017	0.010
	(2.910)	(3.199)	(5.101)	(0.117)	(0.133)	(0.146)
Priv. M&A activity	2.835*	1.436	2.468	0.092	0.093	0.080
	(1.620)	(1.777)	(2.829)	(0.062)	(0.070)	(0.077)
Log sales	-4.462***	-14.914***	-28.799***	0.117***	0.101***	0.127***
	(0.352)	(0.390)	(0.626)	(0.011)	(0.012)	(0.014)
Net income over sales	0.539***	1.474***	2.304***	-0.009***	-0.008***	-0.008***
	(0.080)	(0.094)	(0.146)	(0.001)	(0.002)	(0.002)
Leverage	0.679***	0.564***	0.505**	0.004	0.009*	0.003
	(0.115)	(0.128)	(0.211)	(0.004)	(0.005)	(0.006)
Cash holdings	19.963***	23.700***	19.714***	0.341***	0.328***	0.375***
	(2.086)	(2.306)	(3.694)	(0.069)	(0.080)	(0.088)
Capital intensity	-0.322	5.649**	7.782*	0.119	0.033	0.189*
	(2.352)	(2.594)	(4.183)	(0.086)	(0.099)	(0.109)
Q firm	-3.340***	-3.434***	-3.793***	0.038***	0.040***	0.046***
	(0.151)	(0.165)	(0.257)	(0.005)	(0.006)	(0.006)
Q industry	2.615***	1.966***	0.943***	0.001	0.005	0.001
	(0.209)	(0.230)	(0.364)	(0.008)	(0.009)	(0.009)
Ind. Sales growth	-0.009	-0.036*	0.025	0.001**	0.002***	0.002***
	(0.017)	(0.018)	(0.029)	(0.001)	(0.001)	(0.001)
Constant	84.840***	299.511***	588.689***	-2.223***	-1.743***	-2.406***
	(7.016)	(7.766)	(12.437)	(0.225)	(0.256)	(0.282)

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Public-private target	-4.567***	-5.004***	-6.159***	-0.050	-0.090*	-0.098*
#Obs	81,248	72,566	64,853	82,590	73,919	66,125
R^2	0.021	0.042	0.063	0.007	0.006	0.007
	Sales over assets			EBIT over assets		
Public target	-0.058***	-0.044***	-0.033***	-0.009*	-0.008	-0.011
	(0.006)	(0.007)	(0.008)	(0.006)	(0.005)	(0.007)
Private target	-0.024***	-0.023***	-0.014***	-0.017***	-0.019***	-0.019***
	(0.004)	(0.004)	(0.005)	(0.003)	(0.003)	(0.004)
Fluidity	0.006***	0.007***	0.010***	0.003***	0.004***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
HH Index	-0.012	-0.016*	-0.001	0.019***	0.010	0.025***
	(0.008)	(0.009)	(0.010)	(0.007)	(0.007)	(0.009)
Pub. M&A activity	0.015	-0.005	0.016	0.015	0.019	0.025
	(0.019)	(0.022)	(0.024)	(0.017)	(0.016)	(0.021)
Priv. M&A activity	-0.021**	-0.003	0.007	-0.039***	-0.027***	-0.033***
	(0.011)	(0.012)	(0.014)	(0.009)	(0.009)	(0.012)
Log sales	-0.067***	-0.082***	-0.093***	-0.047***	-0.055***	-0.061***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Leverage	0.006***	0.008***	0.009***	-0.000	0.000	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Cash holdings	0.020	0.055***	0.067***	-0.196***	-0.177***	-0.202***
	(0.012)	(0.014)	(0.016)	(0.012)	(0.012)	(0.015)
Capital intensity	0.015	0.034*	0.028	0.023*	0.011	-0.015
	(0.015)	(0.018)	(0.020)	(0.013)	(0.013)	(0.017)
Q firm	-0.029***	-0.029***	-0.031***	0.001	0.002**	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Q industry	0.011***	0.012***	0.009***	-0.015***	-0.009***	-0.003**
	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Ind. Sales growth	-0.000	-0.000	0.000*	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.263***	1.509***	1.647***	0.881***	1.034***	1.150***
	(0.035)	(0.041)	(0.046)	(0.037)	(0.036)	(0.049)
Public-private target	-0.034***	-0.021**	-0.019*	0.008	0.011*	0.008
#Obs	97,987	87,942	78,876	81,259	72,577	64,860

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R^2	0.038	0.039	0.043	0.024	0.027	0.021
	R&D expenditures			Capital expenditures		
Public target	-0.067	-0.085	0.127	-0.262***	-0.253***	-0.194*
	(0.146)	(0.157)	(0.191)	(0.090)	(0.097)	(0.101)
Private target	0.184**	0.295***	0.441***	0.199***	0.040	-0.055
	(0.085)	(0.092)	(0.113)	(0.052)	(0.057)	(0.060)
Fluidity	-0.009	-0.015	0.026	-0.027***	-0.037***	-0.064***
	(0.015)	(0.016)	(0.020)	(0.009)	(0.010)	(0.011)
HH Index	0.138	0.115	0.024	0.276**	0.229*	0.078
	(0.183)	(0.198)	(0.242)	(0.113)	(0.122)	(0.127)
Pub. M&A activity	-0.690	-0.320	-0.241	-0.323	0.132	-0.073
	(0.429)	(0.464)	(0.568)	(0.264)	(0.286)	(0.299)
Priv. M&A activity	0.365	-0.029	-0.267	-0.611***	-0.911***	-0.382**
	(0.241)	(0.261)	(0.319)	(0.149)	(0.161)	(0.168)
Log sales	0.177***	0.177***	0.303***	-0.178***	-0.219***	-0.224***
	(0.042)	(0.046)	(0.056)	(0.026)	(0.028)	(0.029)
Net income over sales	0.080***	0.077***	0.037***	0.019***	0.016***	0.020***
	(0.006)	(0.006)	(0.008)	(0.003)	(0.004)	(0.004)
Leverage	0.009	0.016	0.035	-0.004	-0.002	-0.010
	(0.017)	(0.018)	(0.023)	(0.010)	(0.011)	(0.012)
Cash holdings	3.883***	2.341***	1.208***	3.770***	3.161***	2.925***
	(0.280)	(0.305)	(0.376)	(0.173)	(0.188)	(0.198)
Capital intensity	-1.012***	-0.125	0.233	-1.208***	-1.275***	-1.739***
	(0.345)	(0.374)	(0.463)	(0.213)	(0.231)	(0.243)
Q firm	-0.568***	-0.446***	-0.492***	-0.075***	-0.160***	-0.216***
	(0.021)	(0.022)	(0.027)	(0.013)	(0.014)	(0.014)
Q industry	0.519***	0.436***	0.394***	0.088***	0.039*	0.047**
	(0.030)	(0.033)	(0.040)	(0.019)	(0.020)	(0.021)
Ind. Sales growth	0.000	0.001	0.000	-0.000	0.000	0.001
	(0.002)	(0.002)	(0.003)	(0.001)	(0.001)	(0.001)
Constant	-2.854***	-3.223***	-5.937***	3.274***	4.199***	4.740***
	(0.871)	(0.939)	(1.152)	(0.537)	(0.579)	(0.606)
Public-private target	-0.251	-0.380**	-0.314	-0.461***	-0.293**	-0.139
#Obs	98,069	88,028	78,961	98,069	88,028	78,961
R^2	0.021	0.014	0.011	0.026	0.030	0.033
	PPE			Tax paid		

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Public target	-0.766***	-0.714***	-0.445**	-0.311***	-0.237***	-0.234***
	(0.131)	(0.155)	(0.174)	(0.046)	(0.052)	(0.057)
Private target	-0.028	0.124	0.122	-0.143***	-0.263***	-0.322***
	(0.077)	(0.091)	(0.103)	(0.026)	(0.030)	(0.033)
Fluidity	-0.014	-0.050***	-0.098***	0.012**	0.024***	0.034***
	(0.014)	(0.016)	(0.018)	(0.005)	(0.006)	(0.006)
HH Index	0.239	0.524***	0.541**	0.303***	0.294***	0.304***
	(0.165)	(0.195)	(0.220)	(0.056)	(0.064)	(0.070)
Pub. M&A activity	0.015	-0.127	-0.221	-0.183	-0.343**	-0.492***
	(0.386)	(0.458)	(0.516)	(0.136)	(0.155)	(0.170)
Priv. M&A activity	0.966***	0.522**	0.910***	-0.450***	-0.437***	-0.399***
	(0.217)	(0.257)	(0.290)	(0.074)	(0.085)	(0.093)
Log sales	0.448***	0.464***	0.406***	-0.325***	-0.421***	-0.494***
	(0.038)	(0.045)	(0.051)	(0.015)	(0.017)	(0.019)
Net income over sales	-0.020***	-0.023***	-0.017**	0.009***	0.014***	0.017***
	(0.005)	(0.006)	(0.007)	(0.003)	(0.004)	(0.004)
Leverage	-0.029**	-0.033*	-0.038*	0.028***	0.043***	0.049***
	(0.015)	(0.018)	(0.021)	(0.005)	(0.006)	(0.007)
Cash holdings	11.537***	13.255***	14.170***	-0.669***	-1.062***	-1.434***
	(0.253)	(0.301)	(0.341)	(0.101)	(0.117)	(0.129)
Capital intensity	-3.270***	-5.243***	-7.273***	-0.127	0.061	0.175
	(0.311)	(0.370)	(0.420)	(0.107)	(0.123)	(0.136)
Q firm	-0.033*	0.021	-0.001	-0.114***	-0.189***	-0.248***
	(0.019)	(0.022)	(0.025)	(0.008)	(0.009)	(0.010)
Q industry	0.206***	0.136***	0.110***	0.021**	0.006	0.010
	(0.027)	(0.033)	(0.036)	(0.011)	(0.012)	(0.013)
Ind. Sales growth	-0.008***	-0.007***	-0.006**	0.001	0.001	0.000
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Constant	-7.784***	-7.792***	-6.430***	6.197***	7.890***	9.448***
	(0.786)	(0.933)	(1.053)	(0.305)	(0.346)	(0.381)
Public-private target	-0.738***	-0.838***	-0.567***	-0.168***	0.026	0.088
#Obs	97,789	87,683	78,592	80,287	71,648	64,085
R^2	0.041	0.043	0.045	0.040	0.061	0.076

Table 2.8 Propensity score matching

This table reports coefficient estimates obtained from logit models predicting the probability of acquiring public (column 1) and private target (column 4) used in the propensity score matching procedure. The table also reports the mean values for all regressors for all firm-years with public target acquisitions in column 2, the corresponding matched firms in column 3, all firm-years with private target acquisitions in column 5 and their corresponding matched firms in column 6. In column 1 (column 4), the dependent variable is set equal to one if a firm acquirers a public (private) target and zero otherwise. The two logistic regressions include industry and year fixed effects. Standard errors at firm level are reported in parentheses. All variables are defined in Appendix 2.5.1 and winsorized at the 1st and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)	(5)	(6)
	Public target acquirer			Private target acquirer		
	Coefficient	Mean public	Mean match	Coefficient	Mean private	Mean match
Close similarity	3.412***	0.149	0.149	-1.660***	0.112	0.111*
	(0.339)			(0.230)		
HH Index	0.809***	0.163	0.167	0.101	0.216	0.218
	(0.147)			(0.071)		
Product market IQR	-0.007	0.051	0.049	-0.143**	0.082	0.084
	(0.151)			(0.068)		
Lerner Index	0.025***	-0.538	-0.506	0.033***	-0.459	-0.420*
	(0.009)			(0.006)		
Fluidity	-0.029***	8.257	8.266	0.014***	7.292	7.265
	(0.006)			(0.004)		
Product market rank	-1.097***	0.303	0.309	-0.311***	0.427	0.432
	(0.096)			(0.046)		
Log number of peers	0.124***	4.399	4.388	0.005	3.684	3.652*
	(0.025)			(0.013)		
Pub. M&A activity	2.150***	0.073	0.075	0.335***	0.051	0.052
	(0.195)			(0.124)		
Priv. M&A activity	0.856***	0.166	0.172*	2.569***	0.204	0.205
	(0.118)			(0.061)		
Log sales	0.303***	20.377	20.334	0.161***	19.766	19.729
	(0.013)			(0.007)		
Net income over sales	-0.012***	-0.204	-0.223	0.008**	-0.197	-0.207

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	(0.004)			(0.003)		
Leverage	-0.003	0.755	0.762	-0.009**	0.646	0.652
	(0.008)			(0.005)		
Q firm	0.066***	2.031	2.002	0.070***	2.199	2.195
	(0.008)			(0.004)		
Constant	-9.995***			-5.315***		
	(0.430)			(0.220)		
#Obs	93,921			105,978		
Pseudo R^2	0.1215			0.0703		
Propensity score		0.114	0.112		0.212	0.211

Table 2.9 Acquisition outcomes with the matched sample

This table reports coefficient estimates when regressing the changes in outcome variables (from one year before the current year to one, two and three years later) on the public and private target acquisition dummies and a set of control variables using the sample of acquirers and matched firms over the period from 1994 to 2018. All regressions include the following control variables: fluidity, HH Index, pub. M&A activity, priv. M&A activity, log sales, net income over sales, leverage, cash holdings, capital intensity, Q firm, Q industry, and ind. sales growth. All regressions include year and firm fixed effects. Standard errors at firm level are reported in parentheses. All variables are defined in Appendix 2.5.1 and winsorized at the 1st and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)	(5)	(6)
	$[-1,1]$	$[-1,2]$	$[-1,3]$	$[-1,1]$	$[-1,2]$	$[-1,3]$
	Product distance			Market shares		
Public target	0.079*	0.136**	0.164***	1.339***	1.650***	1.816***
	(0.045)	(0.053)	(0.062)	(0.063)	(0.093)	(0.125)
Private target	-0.084***	-0.066*	-0.077*	0.520***	0.699***	0.866***
	(0.028)	(0.034)	(0.040)	(0.040)	(0.059)	(0.080)
Constant	0.088	-0.652**	-0.225	0.108	-0.640	-1.002
	(0.242)	(0.287)	(0.336)	(0.356)	(0.518)	(0.696)
Public-private target	0.163***	0.202***	0.241***	0.819***	0.951***	0.950***
#Obs	34,174	30,279	26,934	34,670	31,056	27,924
R^2	0.028	0.026	0.023	0.040	0.041	0.044
	Operating expenses			Net working capital		
Public target	-4.800***	-4.688***	-6.055***	-0.082**	-0.103***	-0.089**
	(0.880)	(0.981)	(1.503)	(0.034)	(0.039)	(0.043)
Private target	-0.959*	1.405**	2.200**	-0.003	-0.001	-0.004
	(0.553)	(0.620)	(0.952)	(0.020)	(0.023)	(0.026)
Constant	30.128***	37.033***	88.801***	-0.491***	-0.324	-0.469**
	(4.885)	(5.417)	(8.230)	(0.172)	(0.198)	(0.219)
Public-private target	-3.841***	-6.093***	-8.255***	-0.079**	-0.102**	-0.085*
#Obs	29,548	26,405	23,627	29,404	26,306	23,612
R^2	0.031	0.030	0.048	0.007	0.005	0.007
	Sales over assets			EBIT over assets		
Public target	-0.043***	-0.023***	-0.014	-0.001	0.000	-0.005
	(0.006)	(0.007)	(0.008)	(0.004)	(0.004)	(0.005)

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Private target	-0.011***	-0.004	0.002	-0.008***	-0.010***	-0.009***
	(0.004)	(0.005)	(0.005)	(0.003)	(0.003)	(0.003)
Constant	0.251***	0.322***	0.362***	-0.009	0.087***	0.081***
	(0.034)	(0.040)	(0.046)	(0.025)	(0.022)	(0.027)
Public-private target	-0.032***	-0.019**	-0.016	0.007	0.010**	0.004
#Obs	34,671	31,058	27,926	29,548	26,405	23,627
R^2	0.025	0.026	0.032	0.027	0.019	0.020
	R&D expenditures			Capital expenditures		
Public target	-0.150	-0.206*	-0.088	-0.207***	-0.175**	-0.149
	(0.097)	(0.110)	(0.140)	(0.079)	(0.086)	(0.091)
Private target	0.164***	0.145**	0.147	0.197***	0.062	-0.001
	(0.062)	(0.070)	(0.090)	(0.050)	(0.055)	(0.059)
Constant	-1.067**	-0.475	1.073	-1.707***	-0.825*	-0.382
	(0.544)	(0.614)	(0.778)	(0.442)	(0.477)	(0.507)
Public-private target	-0.314***	-0.351***	-0.235	-0.404***	-0.237**	-0.148
#Obs	34,694	31,087	27,949	34,694	31,087	27,949
R^2	0.024	0.014	0.011	0.024	0.040	0.052
	PPE			Tax paid		
Public target	-0.587***	-0.520***	-0.257	-0.221***	-0.135***	-0.134**
	(0.119)	(0.142)	(0.166)	(0.042)	(0.048)	(0.055)
Private target	0.116	0.151*	0.164	-0.103***	-0.195***	-0.248***
	(0.076)	(0.091)	(0.106)	(0.026)	(0.030)	(0.034)
Constant	-0.681	1.191	2.136**	-0.070	-0.157	0.228
	(0.665)	(0.791)	(0.919)	(0.237)	(0.271)	(0.303)
Public-private target	-0.703***	-0.671***	-0.421**	-0.118**	0.060	0.114*
#Obs	34,588	30,961	27,819	29,711	26,557	23,812
R^2	0.031	0.034	0.035	0.032	0.054	0.072

Table 2.10 Announcement abnormal returns: interaction with product market conditions

This table reports OLS estimates for acquirers 7-day cummulative abnormal returns around the announcement dates of public and private target acquisitions. *Public* is equal to 1 is the target is a public firm and 0 if the target is a private firm. Product market condition represents each of the five measures of product market conditions 1 year prior to announcement year. We split all firms into 4 quartiles. $Q1$ is the reference category. All regressions include year and firm fixed effects. Standard errors at firm level are reported in parentheses. All variables are defined in Appendix 2.5.1 and winsorized at the 1th and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Close similarity		HH Index		Product market IQR		Lerner Index		Fluidity	
Public	-0.021***	-0.016***	-0.022***	-0.016***	-0.022***	-0.016***	-0.022***	-0.020***	-0.022***	-0.017***
	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.002)	(0.001)	(0.003)
Product market condition	-0.031***		0.011***		0.010***		-0.000		-0.000*	
	(0.007)		(0.002)		(0.003)		(0.000)		(0.000)	
Product market condition Q_2		-0.001		-0.005***		-0.004***		0.006***		-0.002
		(0.002)		(0.002)		(0.001)		(0.002)		(0.002)
Product market condition Q_3		-0.001		-0.004***		0.000		0.008***		-0.003*
		(0.002)		(0.002)		(0.002)		(0.002)		(0.002)
Product market condition Q_4		-0.004**		-0.007***		-0.005***		0.009***		-0.001
		(0.002)		(0.002)		(0.002)		(0.002)		(0.002)
Public*product market condition Q_2		0.001		-0.003		0.001		0.005		-0.004
		(0.005)		(0.004)		(0.004)		(0.004)		(0.004)
Public*product market condition Q_3		-0.007		-0.010**		-0.007*		-0.003		-0.006
		(0.004)		(0.004)		(0.004)		(0.004)		(0.004)
Public*product market condition Q_4		-0.010**		-0.005		-0.011***		-0.007**		-0.009**
		(0.004)		(0.004)		(0.004)		(0.004)		(0.004)

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Hostile deal	0.011	0.010	0.012	0.011	0.011	0.008	0.011	0.010	0.016*	0.015
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Same industry	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Ln MV prior	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Product market rank	0.005**	0.005**	0.006**	0.005**	0.006***	0.005**	0.009***	0.008***	0.007***	0.006***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Pub. M&A activity	-0.002	-0.002	-0.004	-0.003	-0.005	-0.002	-0.006	-0.001	-0.005	-0.005
	(0.007)	(0.007)	(0.006)	(0.007)	(0.006)	(0.007)	(0.006)	(0.006)	(0.007)	(0.007)
Priv. M&A activity	-0.011***	-0.011***	-0.010***	-0.011***	-0.010***	-0.012***	-0.010***	-0.012***	-0.011***	-0.010***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Capital expenditures	0.010	0.010	0.011	0.011	0.012	0.005	0.012	0.004	0.013	0.013
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
R&D expenditures	0.009	0.009	0.011	0.011	0.012	0.013	0.009	0.004	0.011	0.011
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Log sales	-0.002***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001**	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Net income over sales	0.000	0.000	0.000	0.000	-0.000	-0.000	-0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Leverage	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Cash holding	-0.005	-0.005	-0.003	-0.003	-0.003	-0.005	-0.003	-0.007*	-0.003	-0.002
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)

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Q firm	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Sales growth	-0.001***	-0.001***	-0.001***	-0.001***	-0.001**	-0.001**	-0.001***	-0.002***	-0.001***	-0.001***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.055***	0.052***	0.044***	0.052***	0.045***	0.053***	0.040***	0.040***	0.048***	0.048***
	(0.011)	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)
#Obs	31,133	31,133	31,145	31,145	31,853	31,853	31,805	31,805	30,875	30,875
R^2	0.018	0.018	0.019	0.019	0.018	0.019	0.018	0.019	0.018	0.018

Table 2.11 Announcement abnormal returns - correction for endogeneity bias

This table reports the two-step estimation procedure to correct for endogeneity bias. In the 1st step, we model the acquirer's selection between public and private targets as a function of product market conditions and other firm characteristics. In the 2nd step, we estimate a model of acquirer announcement abnormal return. Column 1 presents coefficient estimates from the selection model. *Public* is equal to 1 is the target is a public firm and 0 if the target is a private firm. Columns 2 to 4 summarize the regression results for the acquirer 7-day cumulative abnormal returns. *Lambda* is the correction for endogeneity bias obtained from the 1st step. *Fit* is the probability p of choosing public target if the target firm is a public firm or $1-p$ if the target is a private firm. All regressions include year and firm fixed effects. Standard errors at firm level are reported in parentheses. All variables are defined in Appendix 2.5.1 and winsorized at the 1th and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)
	Public	CARs (-3,3)	CARs (-3,3)	CARs (-3,3)
Panel A: Selection model includes all measures of product market conditions				
Public		-0.021***	-0.020***	0.009
		(0.001)	(0.003)	(0.011)
Hostile deal		0.013	0.013	0.013
		(0.010)	(0.010)	(0.010)
Same industry		0.001	0.001	0.001
		(0.001)	(0.001)	(0.001)
Ln MV prior		-0.000**	-0.000	-0.000*
		(0.000)	(0.000)	(0.000)
λ (Correction for endogeneity for target choice)		0.017***		
		(0.004)		
Fit ("aligned" choice of target)			0.004	0.031***
			(0.005)	(0.011)
Public deal x fit				-0.058***
				(0.021)
Close similarity	3.209***	0.034**	-0.014	0.015
	(0.230)	(0.015)	(0.011)	(0.015)
HHI	0.424***	0.016***	0.013***	0.015***
	(0.083)	(0.004)	(0.004)	(0.004)
Product market IQR	-0.010	-0.003	-0.002	-0.002
	(0.084)	(0.004)	(0.004)	(0.004)
Lerner Index	-0.004	-0.001**	-0.001**	-0.001**
	(0.006)	(0.000)	(0.000)	(0.000)
Fluidity	-0.017***	0.000	0.000	0.000
	(0.004)	(0.000)	(0.000)	(0.000)
Product market rank	-0.371***	0.004	0.011***	0.009***

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	(1) Public	(2) CARs (-3,3)	(3) CARs (-3,3)	(4) CARs (-3,3)
	(0.054)	(0.003)	(0.003)	(0.003)
Log number of peers	0.049***			
	(0.015)			
Pub. M&A activity	1.158***	0.014*	-0.005	0.006
	(0.117)	(0.008)	(0.007)	(0.008)
Priv. M&A activity	-1.341***	-0.028***	-0.010***	-0.017***
	(0.065)	(0.005)	(0.003)	(0.004)
Capital expenditures	0.074	0.004	0.002	0.002
	(0.199)	(0.009)	(0.009)	(0.009)
R&D expenditures	0.847***	0.026***	0.015*	0.020**
	(0.161)	(0.009)	(0.008)	(0.009)
Log sales	0.087***	0.000	-0.001	-0.000
	(0.008)	(0.000)	(0.000)	(0.000)
Net income over sales	-0.017***	0.000	0.000	0.000
	(0.004)	(0.000)	(0.000)	(0.000)
Leverage	0.001	0.000	0.000	0.000
	(0.005)	(0.000)	(0.000)	(0.000)
Cash holding	0.126	-0.003	-0.003	-0.003
	(0.090)	(0.004)	(0.004)	(0.004)
Q firm	-0.013***	-0.001***	-0.001**	-0.001**
	(0.005)	(0.000)	(0.000)	(0.000)
Sales growth	-0.048***	-0.002***	-0.002***	-0.002***
	(0.012)	(0.001)	(0.001)	(0.001)
Constant	-2.994***	-0.017	0.019*	-0.012
	(0.221)	(0.012)	(0.010)	(0.015)
#Obs	30,227	30,227	30,227	30,227
LR $chi^2(52)$	2979.12			
Prob > chi^2	0.0000			
Pseudo R^2	0.1125	0.016	0.015	0.015
Panel B: Selection model includes the first principle component of all product market conditions				
Public		-0.021***	-0.018***	0.003
		(0.001)	(0.004)	(0.010)
Hostile deal		0.013	0.013	0.013
		(0.010)	(0.010)	(0.010)
Same industry		0.001	0.001	0.001

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	(1) Public	(2) CARs (-3,3)	(3) CARs (-3,3)	(4) CARs (-3,3)
		(0.001)	(0.001)	(0.001)
Ln MV prior		-0.000*	-0.000	-0.000
		(0.000)	(0.000)	(0.000)
λ (Correction for endogeneity for target choice)		0.019***		
		(0.004)		
Fit ("aligned" choice of target)			0.007	0.026**
			(0.006)	(0.011)
Public deal x fit				-0.042**
				(0.020)
1st Principal component	0.094***	0.001	-0.001***	-0.001
	(0.007)	(0.000)	(0.000)	(0.000)
Controls	Yes	Yes	Yes	Yes
Constant	-2.128***	-0.003	0.024**	0.005
	(0.205)	(0.010)	(0.009)	(0.013)
#Obs	30,227	30,227	30,227	30,227
LR $chi^2(52)$	2737.09			
Prob > chi^2	0.0000			
Pseudo R^2	0.1034	0.015	0.015	0.015

Table 2.12 Product market condition correlations

This table reports Pearson correlation coefficients for our measures of competitive pressures and threats (close similarity, HHI, product market IQR, Lerner Index, and fluidity), market power rank, log number of peers, and M&A activity (public M&A activity, and private M&A activity). All variables are defined in Appendix 2.5.1 and winsorized at the 1st and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

Variable	Close similarity	HH Index	Product market IQR	Lerner Index	Fluidity	Product market rank	Log number of peers	Pub. M&A activity
HH Index	-0.588***							
Product market IQR	-0.439***	0.643***						
Lerner Index	-0.104***	0.088***	0.110***					
Fluidity	0.667***	-0.462***	-0.361***	-0.288***				
Product market rank	-0.075***	0.167***	0.162***	0.103***	-0.090***			
Log number of peers	0.812***	-0.764***	-0.619***	-0.218***	0.679***	-0.147***		
Pub. M&A activity	0.098***	-0.071***	-0.058***	0.099***	0.038***	-0.079***	0.113***	
Priv. M&A activity	-0.197***	0.097***	0.059***	0.164***	-0.152***	-0.023***	-0.151***	0.175***

Table 2.13 Statistics for the average and deviation of product market conditions

This table reports the statistics for average product market conditions across all years and deviation in each year from the average. Panel A shows the mean, standard deviation, 25th, 50th and 75th percentiles of the average and deviations of product market conditions. Panel B reports means of the average and deviations of product market conditions for three different groups of firm-year observations: public target acquirers in column 2, private target acquirers in column 3, and the remaining firm-year observations without acquisitions in column 4. All variables are defined in Appendix 2.5.1 and winsorized at the 1th and 99th percentiles.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Summary statistics							
	# Obs.	Mean	St.dev.	25th perc.	Median	75th perc.	
Average-close similarity	102,514	0.120	0.081	0.061	0.101	0.156	
Average-HH Index	102,514	0.238	0.196	0.086	0.170	0.335	
Average-product market IQR	102,516	0.082	0.118	0.004	0.024	0.118	
Average-fluidity	102,516	-0.851	2.583	-0.346	0.047	0.137	
Average-Lerner Index	102,516	7.544	3.150	5.195	7.056	9.411	
Average-product market rank	102,516	0.512	0.262	0.302	0.516	0.727	
Deviation-close similarity	102,364	0.001	0.025	-0.011	0.000	0.012	
Deviation-HH Index	102,397	-0.008	0.134	-0.060	-0.009	0.025	
Deviation-product market IQR	102,516	0.010	0.125	-0.017	0.000	0.002	
Deviation-Lerner Index	102,500	0.001	1.144	-0.036	0.022	0.151	
Deviation-fluidity	102,516	-0.012	1.872	-1.095	-0.132	0.918	

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Deviation-product market rank	102,516	-0.006	0.147	-0.076	-0.006	0.064

Panel B: Group comparison

	#Obs	Public deals	Private deals	No deals	Public vs. no deals	Private vs. no deals	Public vs. private
Average-number of peers	102,486	235.161	115.176	147.798	87.362***	-32.623***	119.985***
Average-close similarity	102,514	0.155	0.106	0.122	0.034***	-0.016***	0.049***
Average-HH Index	102,514	0.172	0.252	0.238	-0.066***	0.014***	-0.080***
Average-product market IQR	102,516	0.051	0.088	0.083	-0.032***	0.005***	-0.037***
Average-Lerner Index	102,516	-0.640	-0.469	-0.927	0.287***	0.458***	-0.170***
Average-fluidity	102,516	8.441	7.177	7.568	0.873***	-0.391***	1.264***
Average-product market rank	102,516	0.344	0.451	0.532	-0.188***	-0.080***	-0.107***
Deviation-log number of peers	100,422	5.099	0.628	0.381	4.718***	0.247	4.471***
Deviation-close similarity	102,364	0.003	0.001	0.001	0.002***	0.000	0.002***
Deviation-HH Index	102,397	-0.006	-0.008	-0.008	0.002**	0.000	0.002**
Deviation-product market IQR	102,516	0.002	0.007	0.010	-0.009**	-0.003***	-0.006
Deviation-Lerner Index	102,500	0.037	-0.001	0.001	0.036	-0.002	0.039*
Deviation-fluidity	102,516	-0.050	-0.010	-0.011	-0.039	0.001	-0.040
Deviation-product market rank	102,516	-0.010	-0.009	-0.006	-0.004	-0.003**	0.000

Chapter 3

M&As and Innovation: Empirical Evidence from Acquiring Public versus Private Targets

3.1 Introduction

Innovation reflects companies' efforts to develop and accumulate knowledge, and it has long been recognized as a key factor of firm growth in today's knowledge economy (Hall, 1993; Cockburn et al., 2000). While existing literature establishes that innovation is an important factor in generating growth and value, we need to ask where does innovation come from. It has been argued that merger and acquisition (M&A) activity is an important channel for firms to enhance their innovation output (Bena and Li, 2014). Empirical evidence shows that M&As are associated with contemporaneous and future innovation outcomes (Sevilir and Tian, 2012), especially when there are more antitakeover provisions (Carline and Gogineni, 2021). Phillips

and Zhdanov (2013) argue that, instead of pursuing in-house R&D development, large firms obtain access to innovation by acquiring small firms. In this paper, we investigate whether innovation outcomes differ when firms acquire public versus private targets. In addition, we link differences in announcement abnormal returns for public versus private target acquirers to improvements in innovation outcomes.

We argue that differences in acquiring a public versus private target are closely associated with an acquiring firm looking for specific attributes in a target firm that fit acquirer's strategic choice for the acquisition. Different acquirers from different environments pursue different goals for their deals and these motivations align with attributes of public versus private targets. Also, public versus private targets differ concerning their attitudes to innovation activities. Publicly listed firms are large and established entities (Koeplin et al., 2000; Maksimovic et al., 2013). An easy access to public equity markets relaxes their financial constraints and potentially allows public firms to get involved in risky investments and long-term innovation. However, public firms are often pressured to deliver near-term results (Gao et al., 2018). They may sacrifice long-term risky investments and innovation in order to meet short-term earnings targets. Private firms, in contrast, are smaller, younger, riskier, and less transparent (Koeplin et al., 2000; Ferreira et al., 2014). Private firms lack financial slack due to their weaker access to public equity markets. But because private firms face less short-term pressures from financial markets, they may be more willing to pursue a long investment horizon and engage in risky innovation (Ferreira et al., 2014). We conjecture that these differences in attitudes towards innovation in private versus public firms impact on the choice to acquire public versus private targets, which then impacts innovation outcomes of the two types of acquisitions.

We use a sample of 171,758 firm-year observations which consists of acquirers of private and public targets and their corresponding matched firms between 1990 and 2010. We combine a sample of all US publicly listed firms that are available on

KPSS patent data library[1] with a sample of acquirers on SDC, financial data from Compustat and stock prices from CRSP. We use the propensity score procedure to find matched firms with similar pre-acquisition innovation.

Relying on the difference-in-differences (DiD) methodology, we compare innovation outcomes when acquiring public and private targets with their respective matched firms from 5 years prior to 5 years after acquisition announcements. Our results show that innovation outcomes increase significantly more post-acquisition of private targets than in matched firms. This increase is also larger than for acquisitions of public targets. Private target acquisitions are associated with a significant increase in the number of new patents as well as exploratory innovation, which requires new knowledge or a departure from existing knowledge, and exploitative innovation, which builds only on existing knowledge. These results suggest that firms are more likely to acquire private targets when they search for innovation. In contrast, we find insignificant innovation changes post-acquisition of public targets relative to control firms. This suggests that firms acquire public targets for other strategic purposes that are, on average, unrelated to innovation. Altogether, we find significant and meaningful differences in innovation outcomes between public versus private target acquisitions. We also show that these innovation effects are persistent over at least 5 years after acquisition announcements.

Existing literature argues that an increase in innovation output is due to an equally large increase in innovation input – R&D investment (Chang et al., 2019; Brav et al., 2018; Hirshleifer et al., 2013). Intuitively, one expects that an increase in R&D spending helps firms produce more patents and generate more citations. However, the key questions is whether firms are able increase innovation output per unit of R&D input, i.e. increase innovation efficiency. Our results show that relative to matched firms, private target acquirers are indeed able to increase their innovation efficiency significantly. In contrast, innovation efficiency does not change

[1]The KPSS patent data library is described in Kogan et al. (2017).

after acquisitions of public targets. Acquiring private targets enhances innovation outputs both on extensive and intensive margin.

As a next step, we test whether innovation outcomes increase more when firms acquire targets with a proven ability to innovate. Aghion and Tirole (1994) suggest that established firms that are not very good at innovating themselves can obtain innovation by acquiring targets which are more efficient at innovation. Moreover, Sevilir and Tian (2012) find that a positive relationship between M&A activity and innovation is primarily driven by deals involving firms that own patents before becoming a target. Hence, we expect that acquisitions involving targets with existing patents result in a greater improvement in acquirers' innovation outcomes.

Our results suggest that acquiring targets with existing patents brings no additional increase for the patent count, neither for public nor for private target acquirers. Interestingly, acquiring private targets with existing patents is associated with a larger increase in exploitative innovation outcomes, while exploratory innovation outcomes do not change. These results are somewhat surprising as a combination of acquirers and targets with patents generates a larger increase in innovation within existing expertise. It seems that acquired private targets own innovative ideas regardless whether they do or do not file them as patents. It is likely that acquiring firms chose the particular target that already owns patent because the target existing expertise exhibits high technological overlap with the acquirer. The acquisition then aims to exploit deeper the existing area (Mei, 2019). Therefore, we observe that acquiring private target with existing patent is associated with a larger increase in exploitative innovation. In contrast, acquired innovative ideas that are not yet formalized into patents seen to encourage somewhat more exploration into new areas. It is important to note, however, that acquiring private targets without any existing patents is still associated with an increase in patent count and exploratory innovation - in addition to exploitative innovation. We next show that innovative outcomes of public target acquisitions do not increase post-acquisition

even for targets with existing patents. This further supports our argument that firms acquire public targets for innovation unrelated reasons.

Overall, our evidence shows that acquisitions of private targets are associated with an increase in innovation outcomes. We also show that the reason why we observe an increase in innovation outcomes at private target acquirers is due to an increase in innovation efficiency. We propose two explanations for why we see an increase in innovation outcomes at private target acquirers. First, from the acquiring firms point of view, our results seem to suggest that firms are likely to acquire private targets when they search for innovation. This is due to the innovative nature of private firms as they are on average younger, smaller, and face less pressures from their shareholders to deliver short term results (Koeplin et al., 2000; Ferreira et al., 2014). Private target acquisitions facilitate the combined firms to use their complementary assets and knowledge to improve innovation outcomes. We find some evidence that both acquirers and private targets exhibit some degree of technological similarity in their patents. Second, we also find that acquiring private targets without existing patents are still associated with an increase in acquirers' innovation outcomes. This further suggests that even when private targets' innovative ideas are not formalized into a patent, the combination between the two firms generates synergies from asset complementarities that allow acquirers to improve their innovation.

We observe anecdotal evidence that the two types of acquisitions are associated with different outcomes. In 2015, H.J. Heinz Co. announced their intention to merge with the Kraft Foods Group with an estimated deal value of $45 billion.[2] The combined firm was expected to generate synergies through international growth and economies of scale. Heinz derives 60% of its sales from regions other than North America with emerging economies contribute 25% of its sales. In contrast, Kraft derives 98% of its sales from North America. The merger provides scope for the

[2]https://www.forbes.com/sites/greatspeculations/2015/03/30/analysis-of-the-kraft-heinz-merger/?sh=16daf0ebc9a8

combined firms to sell Kraft's brands in international markets. In addition, the two companies have also announced that they expect to realize $1.5 billion in annual cost savings which mostly comes from higher economies of scale in the North American market. Our second example, the acquisition of Visualase Inc. by Medtronic Inc. in 2014,[3] illustrates an acquisition driven by complementary technology and experimental product expansion. Medtronic, the acquirer, is a medical device company focusing on manufacturing and selling device-based medical therapy. The main reason for the acquisition of Visualase, a privately held company developing a MRI-guided laser and image-guided systems, was its alignment with Medtronic's ongoing investment in technology and expansion in its neurosurgical portfolio. The two examples illustrate our main point that goals and outcomes of public versus private target acquisitions may be systematically different. Firms tend to choose private targets when they search for innovation. The increase in innovation is achieved through asset or technological complementarities between acquirers and private targets.

Even though we carefully select the control group of firms such that they have similar innovation to the treatment group of acquiring firms just before their acquisitions, our results could still be driven by innovation inertia of firms that decide to acquire. The argument is that these firms have high innovation drive and aspirations and they would increase innovation relative to the control group even without the acquisitions. We check this bias comparing successful acquisitions to exogenously withdrawn ones (Savor and Lu, 2009; Seru, 2014). Because both types aim to acquire, the withdrawn counterfactual should control for innovation inertia of acquirers. Our results show that relative to withdrawn private target acquisitions, innovation outcomes are higher for successful private target acquisitions. In contrast, successful public target acquisitions have no significant effect on acquirers' innovative outcomes.

As our results suggest that innovation outcomes for private target acquirers

[3] http://newsroom.medtronic.com/phoenix.zhtml?c=251324&p=irol-newsArticle&ID=1951904.

are significantly higher than for public target acquirers, our final test focuses on acquirer announcement abnormal returns. Complementing results in the literature (Faccio et al., 2006; Jaffe et al., 2015), we show that the 5-day announcement abnormal returns are significantly higher for private target acquirers with the largest increase in new patents. Our results suggest that higher announcement returns when firms acquire private targets can be explained by a higher expectation of improvement in innovation.

Our paper contributes to two streams in finance literature. First, we contribute to the literature on the relationship between M&As and subsequent innovation (Rajan et al., 2000; Scharfstein and Stein, 2000; Sevilir and Tian, 2012; Phillips and Zhdanov, 2013; Bena and Li, 2014; Mei, 2019). Sevilir and Tian (2012) show that M&As are positively associated with contemporaneous and future innovative outcomes, measured by the number of patents and citations obtained by the acquirers. In contrast, Rajan et al. (2000) and Scharfstein and Stein (2000) argue that M&As are associated with lower innovation because post-acquisition employees tend to have less incentive to generate valuable ideas. We add to this literature by showing a sharp difference in innovation outcomes when acquiring public versus private targets. Our finding that acquiring private target with patents is associated with a larger increase in exploitative innovation is in line with Mei (2019).

Second, we contribute to literature on differences in acquiring public versus private targets (Chang, 1998; Fuller et al., 2002; Moeller et al., 2004; Faccio et al., 2006; Jaffe et al., 2015). This literature has so far focussed on explaining differences in the market reaction to acquisitions of public versus private targets, but has not reached a consensus yet. Our evidence suggests that acquiring firms tend to choose private targets when they search for innovation, while they acquire public targets for innovation unrelated reasons. In line with these findings, we further show that the market reacts more positively to acquisitions of private targets with the highest increase in new patents. Taken together, our paper contributes to explaining value

differences when firms acquire public versus private targets.

The remainder of the paper is organized as follows. Section 3.2 describes the data and statistics. Section 3.3 presents and discusses our results. Section 3.4 discusses endogeneity issues. Section 3.5 analyzes announcement abnormal returns and section 3.6 concludes.

3.2 Data

To measure innovation output, we rely on patent and citation data that are available in KPSS database covering the period between 1926 and 2010 (Kogan et al., 2017). The M&A data come from the SDC database and meet the following requirements: (i) the acquirer is a publicly listed US firm; (ii) the target is a US stand-alone public or private firm; (iii) the deal is not a leveraged buyout, spinoff, recapitalization, exchange offer, self-tender, repurchase acquisition, or privatization; and (iv) the deal is completed. Finally, financial information comes from Compustat with relatively poor coverage before 1990. Constraints of these three data sets define our time frame: our data start in 1990 (Compustat restriction) and extend to 2010 (KPSS restriction). Note that because we are comparing innovation before versus after acquisitions, we cover all acquisitions between 1995 and 2005 to allow for five years of innovation data at both ends.

We require that all firms in our main sample file at least one patent over the period between 1985 and 2010[4] because the fraction of listed firms with a patent is relatively small and we do not want to mix innovative with uninnovative firms. Our research question in essence concerns only innovative firms because firms without any patents would by definition have a zero change in innovation variables from before to after acquisitions.

Because determinants of becoming an acquirer may correlate with innova-

[4]This gives us a five year lag before the main sample beginning. Note that our main findings hold also when we check patents filed over the period from 1990 until 2010.

tion, we build a sample of control firms such that they have similar innovation characteristics with acquirers. We also require that they do not make any acquisitions during the sample period. We use propensity score matching. As a first step in the procedure, we model the probability of acquiring public and private targets using all firms with at least one filed patent as follows:

$$\begin{aligned} Prob(Public_{i,t}) &= \alpha_1 + X_{i,t-1}\beta_1 + \gamma_1 Size_{i,t-1} + \delta_1 RD_{i,t-1} + a_{1,i} + \\ &\quad d_{1,t} + \varepsilon_{1,i,t}, \qquad (3.1) \\ Prob(Private_{i,t}) &= \alpha_2 + X_{i,t-1}\beta_2 + \gamma_2 Size_{i,t-1} + \delta_2 RD_{i,t-1} + a_{2,i} + \\ &\quad d_{2,t} + \varepsilon_{2,i,t}, \qquad (3.2) \end{aligned}$$

where $Public_{i,t}$ ($Private_{i,t}$) is equal to 1 if a firm i is an acquirer of public (private) target in year t and zero otherwise; $X_{i,t-1}$ is a matrix of five innovation measures (patent count, exploratory patent, unknown-class patent, new citation, and scope); $Size_{i,t-1}$ is the natural logarithm of fixed assets; and $RD_{i,t-1}$ is the natural logarithm of R&D expenditure. $a_{1,i}$ ($a_{1,i}$) and $d_{1,t}$ ($d_{2,t}$) are industry and year fixed effects, respectively. Table 3.1 tabulates estimated coefficients for the two logit regressions in Panel A and summary statistics for the corresponding variables in Panel B. Note that public target acquisitions happen in 6.4 percent of firm-year observations in the sample, while the frequency for public targets is 23.2 percent.

In line with the previous literature (Sevilir and Tian, 2012; Bena and Li, 2014), our first measure of innovation outcome is patent count which represents total number of new patents that a firm applies for in a given year. In addition, we use eight other innovation measures to classify innovation into two types: exploratory innovation, which extends beyond a firm's existing expertise, and exploitative innovation, which exploits existing expertise and does not tap into new territories. We use four alternative measures for each type. All definitions are provided in Appendix 3.7.1. Panel B in Table 3.1 shows summary statistics for all innovation

variables for the population of firms with at least one patent.

As the second step in the propensity score matching procedure, we use the coefficient estimates of the two logit models to calculate the predicted probability of becoming public (private) target acquirer, the propensity score. For each public (private) target acquirer, we find a matched firm that has the closest propensity score and is from the same industry and the acquisition announcement year. Table 3.2 compares acquirers and their matched non-acquiring firms one year prior to the acquisition. Columns 1 to 3 focus on the public target acquirers, while columns 4 to 6 on the private target acquirers. Panel A shows the fit of the matching procedure. One year before the acquisition, none of the innovation variables of public (private) target acquirers are statistically different from their matched firms. Importantly, the propensity score differences for public (private) target acquirers in column 3 (6) are not significant. Also note that innovation between public versus private target acquirers is different. This justifies our research question and construction of two treatment groups – public versus private target acquirers – and two separate matched groups.

Using the acquirers and their matches, we construct a panel centered on the deal announcement year (t_0) and spreading 5 years back (t_{-5}) and 5 years forward (t_{+5}). Panel B in Table 3.2 shows growth rates in the innovation variables from 5 years before the acquisition to 1 year before the acquisition for public (private) target acquirers in column 1 (4) and their matched firms in column 2 (5). We can see that, except one, the mean differences in columns 3 and 6 are not statistically different. This confirms the main assumption of the difference-in-differences approach that absent acquisitions the average change in the treated versus matched groups would have been the same. In other words, absent acquisitions, the two groups would have continued to experience parallel trends. Figures 3.1 and 3.2 lead to the same conclusion. They plot differences in average innovation, and their 95% confidence intervals, between public (private) acquirers and their corresponding matched firms

over the event time from t_{-5} to t_{+5}.[5] We can see that, except the case when innovation is measured using depth, differences in innovation between acquirers and their matched firms do not increase before acquisitions for both public and private target acquirers.

Table 3.3 shows univariate differences in innovation between acquirers versus their corresponding matched firms over the event window. Panel A focusses on public target acquirers, while Panel B on private target acquirers.[6] The pre-acquisition figures correspond to the average over t_{-5} to t_{-1}, and the post-acquisition figures to the average over t_0 to t_{+5}. Columns 5 and 6 show the difference between acquirers versus matched firms pre- and post-acquisition, respectively. Columns 7 and 8 show differences between post- versus pre-acquisitions for acquirers and matched firms, respectively. Finally, column 9 shows the difference in differences.

Panel A shows that despite many significant differences between public target acquirers and their matched firms in columns 5 to 8, the double differences in column 9 are not significant for any of the innovation measures. In contrast, Panel B shows that acquirers of private targets increase their innovation significantly from 5 years before to 5 years after the acquisitions relatively to their matched firms. All the double differences in column 9 are statistically significant. These statistics suggest that acquiring private targets is associated with an improvement in acquirers' innovation outcomes, while acquiring public targets is not.

3.3 Results

Our research question aims to test the impact of public and private target acquisitions ('events or treatments') on innovation outcomes of acquirers ('treatment groups') versus group of matched firms that do not engage in acquisitions ('control

[5] We run yearly cross-sectional regressions of Ln(1+innovation) on a dummy that indicates public/private acquirers.

[6] Our main specifications use the natural logarithm of one plus the innovation level. Table 3.4 shows the univariate differences for innovation levels instead of the logarithmic transformation.

groups'). The acquisition announcements are staggered over the period from 1995 to 2005 and we normalize them as event years t_0. We use a panel consisting of both public and private target acquirers and their corresponding matched firms with data on patents and citations over the years t_{-5} to t_{+5}. If we considered only changes in acquirers' innovative outcomes pre- versus post- acquisitions, the comparison may be biased because the observed effect could be due to a time trend. Similarly, if we compared acquirers and matched firms post-acquisitions, the resulting difference may also be biased since the the observed effects could pertain due to permanent differences between the two groups. Instead, we use the difference-in-differences approach.

Because we are interested in comparing innovation outcomes separately for public and private target acquirers, we use two distinct treatment groups and their corresponding two matched groups. We estimate the following regression equation:

$$\begin{aligned} Innovation_{i,t} &= \alpha_1 Post\,public_{i,t} + \beta_1(Public_i \times Post\,public_{i,t}) + \alpha_2 Post\,private_{i,t} \\ &\quad + \beta_2(Private_i \times Post\,private_{i,t}) + Y_{i,t}\gamma + a_i + d_t + \varepsilon_{i,t}, \end{aligned} \tag{3.3}$$

where $Innovation_{i,t}$ is the innovation outcome for firm i in year t – we use 9 innovation outcome measures in logarithmic transformations; $Postpublic_{i,t}$ ($Postprivate_{i,t}$) is equal to 1 in the post-deal period for public (private) targets and their matched firms including the deal announcement year and zero otherwise; $Public_i$ ($Private_i$) is a dummy variable equal to 1 in all event years for a public (private) target acquisition and zero otherwise; $Y_{i,t}$ is a matrix of control variables that contains acquirer size, R&D expenditure, leverage, net income and HH index; a_i is the firm fixed effect; d_t the year fixed effect; and $\varepsilon_{i,t}$ is the error term. Coefficients β_1 and β_2 for the interaction terms $Public_i$ x $Post\ public_{i,t}$ and $Private_i$ x $Post\ private_{i,t}$, respectively, are the DiD coefficients of interests. We drop $Public_i$ and $Private_i$ from from the regression because they perfectly correlate with the firm fixed effects.

Panel A in Table 3.5 shows coefficient estimates for equation 3.3 for all 9 measures of innovation outcomes. The DiD coefficients across all innovation measures show that private target acquisitions increase innovation post-deal more than their corresponding matched firms. In contrast, public target acquisitions do not exhibit any significant effect on acquirers' innovative outcomes. The last row in Panel A tests for the difference between the two DiD coefficients ($\beta_2 - \beta_1$). We can see that the differences are significantly positive for 7 out of the 9 innovation measures.

In economic terms, private target acquirers file 5.19 patents more than their matched firms after acquisitions.[7] Given that the mean patent count for private target acquirers is 47.75 before acquisitions, this effect is economically significant. The highest economic effect is for 'new citations' with private target acquirers having 96.85 more new citations post acquisition than their matched firms. This represents an increase of 23 percent from the mean value for private targets before acquisitions. The lowest economic effect is for the depth, only a 1 percent increase. Following acquisition, private target acquirers increase 0.01 more depth relative to their corresponding matched firms. Still, this effect is economically significant considering that the mean of depth for private target acquirers is 0.116 prior to acquisition. The coefficient for *Post private* reflects the pure effect of passage of time in the absence of acquisitions and suggests that innovation decreases from before to after acquisitions for both exploratory and exploitative innovation groups for private target acquisitions and their matches. Interestingly, the post public variable shows that exploratory innovation tends to decrease, while exploitative innovation tends to increase over event time for public target acquirers and their matches.

Panels B and C in Table 3.5 show DiD effects based on equation 3.3 separately for the sample of public target acquirers and private target acquirers with their

[7]Specifically, because $\frac{d[Ln(1+y)]}{dx} = \frac{\frac{1}{1+y}dy}{dx}$ we have that $dy = \frac{d[Ln(1+y)]}{dx} \times (1+y)dx$. For instance, when quantifying the effect of a private target acquisition post-acquistion (dx) on the patent count change (dy), we change x from zero to one, so $dx = 1$. The change in the patent count (dy) from its mean value (72.08) with $\beta_2 = 0.071$ is equal to $0.071 \times (1 + 72.08) \times 1 = 5.19$.

corresponding matched firms, respectively. We can see that our conclusions hold. The DiD coefficients for public target deals are statistically insignificant, while the DiD coefficients for private target acquisitions are significant at the 1- or 5-percent level. The DiD coefficients for private target acquisitions have a slightly larger magnitudes relative to the effects shown in Panel A.[8]

Overall, results in Table 3.5 suggest that acquisitions of private targets are associated with a significant increase in innovation, both exploitative and explorative. However, this is not the case for acquisitions of public targets. These results suggest that firms are more likely to acquire a private target when they have an increase in innovation in mind. While the insignificant effects on the innovative outcomes for public targets indicate that firms acquire a public target for innovation unrelated reasons. Our results are also in line with findings that private targets are more innovative (Ferreira et al., 2014) and that a combination with a private target allows for a combination of complementary assets (Rhodes-Kropf and Robinson, 2008).

Table 3.8 investigates how long the change in the innovative outcomes persists. We estimate regressions separately for public and private targets, as they are easier to read, and introduce leads into the baseline DiD regression 3.3 as follows:

$$Innovation_{i,t} = \sum_{j=0}^{5} \beta_{1,j} Public\, deal_{i,j} + a_{1,i} + d_{1,i} + \varepsilon_{1,i,t}, \tag{3.4}$$

$$Innovation_{i,t} = \sum_{j=0}^{5} \beta_{2,j} Private\, deal_{i,j} + a_{2,i} + d_{2,i} + \varepsilon_{2,i,t}, \tag{3.5}$$

where $Innovation_{i,t}$ is one of the 9 innovation measures for firm i in year t and $Public\ deal_{i,j}$ ($Private\ deal_{i,j}$) is a dummy variable that equals 1 if firm i is an

[8]Table 3.6 shows that the results are very similar when not including any control variables in DiD regression (3.3). Table 3.7 covers a shorter event window including 3 instead of 5 years before and after acquisition announcement year. The results are somewhat weaker for the exploitative patent and depth for private targets. Also, only 3 out of 9 $\beta_2 - \beta_1$ coefficient differences are significant, which shows that the innovation outcome effects show more with a longer time horizon.

acquirer of public (private) target and the year is j event years away from the year of acquisition, and zero otherwise.[9] Thus, $Public\ deal_{i,j}$ and $Private\ deal_{i,j}$ are like typical DiD interaction terms. As the regressions include all leads starting at $j = 0$, the reference category includes all lags from -5 to -1. $a_{p,i}$, $d_{p,i}$, and $\varepsilon_{p,i,t}$, where $p = 1, 2$, are firm fixed effects, year fixed effects, and error terms, respectively. We do not introduce a separate $Public_i$ ($Private_i$) dummy, because it is perfectly collinear with firm fixed effects since it does not vary across time for a given firm. Similarly, the event-time dummies, i.e. the number of years after acquisition, perfectly correlate with year fixed effects because they do not vary across firms.

Table 3.8 shows regression results for public and private target acquisitions in Panel A and B, respectively. Panel A confirms our conclusions from Table 3.5: relative to the average innovation pre-acquisitions, innovation outcomes at public target acquirers do not change significantly differently than in matched firms in any of the lead years. Panel B shows that the lead DiD coefficients for private target acquisitions are positive and majority of them are statistically significant. We conclude that the innovation outcome effects for private target acquisitions are persistent for at least 5 years after acquisitions.

Table 3.9 explores whether our baseline results hold also when considering efficiency of innovation outcomes per unit of input – i.e. innovation outcomes per dollar of R&D expenditure (Chang et al., 2019; Hirshleifer et al., 2013). We construct innovation efficiency measures as natural logarithm of one plus each measure of innovation over the average R&D expenditure in the past three years. First, column 1 shows effects of acquisitions on the R&D expenditure. Following Brav et al. (2018), we use a logarithmic transformation. We can see that both public and private target acquirers increase their R&D spending post-acquisition more than the matched firms. However, this increase in innovation input is translated into higher

[9] Note that $Public\ deal_{i,j}$ ($Private\ deal_{i,j}$) is zero for all matched firms in all years.

innovation output per unit of input only for private target acquisitions. Majority of the DiD coefficients for private targets are positive and statistically significant,[10] while the corresponding DiD coefficients for public acquirers are, except one, statistically insignificant. Overall, these results suggest that acquiring private target enhances innovation outputs by allowing acquirers to deploy their R&D investments more efficiently. They increase innovation both the intensive and extensive margin.

Our next test focuses on checking whether it matters that a target has a proven ability to innovate prior to its acquisition.[11] Our prior is that acquiring targets with filed patents is associated with higher increase in post acquisition innovation outcomes (Bena and Li, 2014). Also, we expect that this effect is stronger for exploratory than for exploitative innovation because more established innovation with filed patents should reflect more ingenious and original thinking. Table 3.10 shows results for DiD regressions with two extra triple interaction terms to capture the additional effect of acquisitions of public/private targets with existing patents. In our sample, 43% (18%) of total public (private) targets own patent by the time they are acquired. We can see that acquiring targets with existing patents at the time of acquisition has no additional effect on patent count in column 1, both for public and private target acquirers. For the exploratory innovation outcomes in columns 2 to 5, most of the triple interaction terms are negative and statistically insignificant. In contrast, 3 out of 4 exploitative innovation variables in columns 6 to 9 have significant triple interaction terms for private targets. The triple interaction terms for public targets remain insignificant. Overall, Table 3.10 suggests that acquiring a target with our without existing patents matters only for exploitative innovation after acquisitions of private targets.[12]

[10]Note that we lose about a third of observations due to missing R&D expenditure data. Replacing missing R&D data with zeros does not help because the average R&D expenditure is in the denominator.

[11]To identify patents owned by private targets, we also use NBER patent-citation database in addition to KPSS. The NBER database provides information on patent and citation data between 1976 and 2006. We match by company name and state of incorporation and perform a fuzzy match.

[12]The economic magnitudes of the 3 significant DiD effects are between 13 and 14.2 percent of the mean value pre-acquisition. These results are again confirmed when we run regressions separately

The results in Table 3.10 are surprising in two ways. First, our prior was that existing patents on target level was associated with an increase in innovation across all targets, regardless whether they are private or public, and that acquisitions of targets without patents would exhibit weaker effects. Second, we also expected that targets with existing patents would help to increase exploratory innovation more than exploitative innovation. Our results show that having previous patents matters only for private targets and the effect is present only for exploitative innovation. Moreover, acquisitions of private targets without existing patents are still associated with a significant increase across all measures of innovation. It seems that acquired private targets own innovative ideas regardless whether they do or do not file them as patents. Moreover, existing patents seem to provide hints about current expertise and then encourage their exploitation post-acquisition.[13] In contrast, acquired innovative ideas that are not yet formalized into patents seen to encourage somewhat more exploration into new areas.

Table 3.12 , however, shows a significant increase in exploitative innovation for targets with patents relative to pre-acquisition, matched firms, and non-patent targets also for public targets. Indeed, 3 out of 4 exploitative innovation measures have positive triple interaction terms, which are significant at the 10-percent level. This suggests that the extra effect of acquiring a target with existing patents is shorter lived for public target acquisitions. Still, the overall effect of acquiring public targets with patents, $\beta_1 + \gamma_1$ is not statistically significant for neither of the exploitative innovation variables.

To study asset or technological complementarity between acquirers and targets, we investigate a pairwise technological similarity. Note that not all targets have owned patents by the time they are acquired. Therefore, the pairwise similarity is computed for the sub sample of acquisitions of targets with existing patents.

for public target and private target subsamples in Table 3.11.

[13] Mei (2019) argues that a high technological overlap between acquirers and targets is associated with increases in innovation within existing fields and decreases in innovation in new areas.

Following existing literature (Bena and Li, 2014; Jaffe, 1986), we compute pairwise cosine similarity. The pairwise cosine similarity is computed based on the similarity in technological class patents owned by the combined firms. In Table 3.13, we compare the pairwise cosine similarity for public and private deal. The results suggest that the similarity is, on average, higher for public deal than private deal. This does not necessarily contradict our previous explanations due to two reasons. First, public targets have filed more patents compare to private targets in pre acquisition period. Hence, the likelihood that both acquirers and public targets own patent in the same technological class is higher than for private target acquirer and their targets. Second, we argue that innovative ideas of target firms are not necessarily formalized into a patent. In particular, this will likely be the case for private targets as they are in general smaller, younger, and less profitable compare to public targets (Koeplin et al., 2000; Ferreira et al., 2014). Filing a patent could potentially be costly for private targets. Therefore, even if the pairwise cosine similarity between acquirers and private targets is smaller than acquirers and public targets, it does not necessarily mean that private targets have less innovative ideas to combine with the acquirers.

To sum up, our results show that acquisitions of private targets are associated with an increase in innovation outcomes, while acquisitions of public targets do not have significant impacts on acquirers' innovation. We further show that the reason why we observe an increase in innovation outcomes at private target acquirers is due to an increase in innovation efficiency. Post-acquisitions, private target acquirers are able to deploy their R&D more efficiently to generate innovation outcomes. Our proposed explanation for why private target acquirers are able to improve their innovation efficiency is due to the synergies from asset and/or technological complementarity between acquirers and private targets. The existing literature suggests that M&As foster innovation by bringing together firms with their complementary assets and technologies and allowing firms to combine their capabilities to innovate

new products and technologies (Rhodes-Kropf and Robinson, 2008; Makri et al., 2010; Bena and Li, 2014). Rhodes-Kropf and Robinson (2008) develop a theoretical model which suggests that acquirer and target firms combine their complementary assets to create synergies and mergers will generate greater surplus when the the combined firms are more compatible in terms of production and technology. Bena and Li (2014) show that acquirers with prior technological linkage to their targets generate more patents. Further evidence from Makri et al. (2010) shows that both complementary scientific knowledge and complementary technological knowledge contribute to post-merger invention performance by stimulating higher quality and more novel inventions. Indeed, we also find some evidence on technological similarity between acquirers and private targets which could suggest that both firms might be able to use their complementary knowledge. While we also find that the both acquirers and public targets have some degree of technological similarity, the acquisition of public targets is not associated with an increase in innovation outcomes. Our explanation for these results is because firms acquire public targets for innovation unrelated reasons.

3.4 Endogeneity tests

Even though we carefully select the control group of firms such that they have similar innovation to the treatment group of acquiring firms just before their acquisitions, our results could still be driven by innovation inertia of firms that decide to acquire. The argument is that these firms have high innovation drive and aspirations and they would increase innovation relative to the control group even without the acquisitions. In other words, the effects we see in Table 3.5 are not due to combining acquirers with targets, but rather due to internal drive for innovation inherent within the firms that chose to acquire. To test for this possibility, we follow Seru (2014) and Bena and Li (2014), and form a new control group with firms that attempted acquisitions, but

these acquisitions were unsuccessful due to exogenous reasons. As this control group includes firms that intend to acquire but are eventually not successful, we have a suitable counterfactual with similar inertia to innovate. Moreover, Seru (2014) argue that selection into the successful versus withdrawn groups is random.

We start with all withdrawn deals due to exogenous reasons and classify them into public versus private target acquisitions.[14] Frequency of withdrawing is relatively low, so this group is significantly smaller than the group of successful deals we use in the baseline DiD regressions in Table 3.5. As we still want to keep innovation pre-acquisition similar across the treatment and control groups, we match each withdrawn acquisition with a successful acquisition based on innovation and firm characteristics using propensity score matching.[15]

Panel A in Table 3.14 shows results for DiD regressions now comparing a subset of successful deals with matched withdrawn deals. We can see that the effect for private target acquisitions pertains: all DiD coefficients β_2 are positive and significant. In the absence of private target innovative ideas to combine with, the post-acquisition innovation outcomes are significantly smaller. It is not the inertia to innovate that drives our results. Table 3.15 shows persistency of innovation improvements up to 5 years after private target acquisitions.

Panel B in Table 3.14 explores the effect of acquiring targets with existing patents in the context of successful versus withdrawn deals. Coefficients γ_1 for the triple interaction terms for public targets are again, except one, not statistically significant. For private targets, coefficients γ_2 for the triple interaction terms in columns 6 to 9 with exploitative innovation are all positive as statistically significant.

[14] Savor and Lu (2009) document that the main reasons for deal failures are targets' rejection of the offer, failure in negotiations, objection by regulatory bodies, competing offer, and general market conditions. We choose 30 random deals and investigate reasons for their withdrawal in news articles. We do not find these reasons related to innovation at all. Table 3.16 lists all withdrawal reasons for the 30 random deals.

[15] We estimate 2 logit models, separately for public and private targets, using all withdrawn and successful deals in our sample. We end up with 498 and 469 withdrawn public and private target acquisitions, respectively, and 325 and 539 successful public and private target acquisitions, respectively

Also, the plain DiD coefficients β_2, except 2, remain statistically significant. We can conclude that our baseline results seem not to be driven by acquirers drive to innovate. Combining acquirers with targets is essential for increased innovation outcomes after acquisitions.

3.5 Acquirer announcement abnormal returns

Our final step is to examine whether the innovation outcome effects documented in section 3.3 can contribute in explaining differences in acquirer announcement abnormal returns between private versus public targets. Table 3.17 regresses the acquirer 5-day cumulative abnormal return around deal announcements, adjusted by the value-weighted market index return, on a dummy for private target and a set of control variables following M&A literature (Faccio et al., 2006; Fuller et al., 2002; Brown and Warner, 1985). All specifications include year and firm fixed effects. In column 1, we add a set of dummy variables indicating quartiles by the relative change in patent count from before to after acquisitions. The first quartile with the lowest improvement in patent count is dropped and constitutes the reference category. Using the set of dummy variables, we assume that the market is able to sort out acquirers into those that are going to improve innovation the most versus those that do not do it at all. We can see that in line with previous literature the private target dummy is significantly positive, indicating that acquisitions of private targets create more value for the acquiring firm shareholders. The 3 quartile dummies are not significant: we do not have any overall valuation effect according to innovation improvement.

In column 2, we add interaction terms between the quartiles for patent count change and the private target dummy to separate the valuation effect of innovation improvements between public versus private firms. We can see that inclusion of the interaction terms is important. The highest quartile dummy is statistically

significant both for public and private targets but with opposite signs. The market reaction is significantly lower for public acquisitions with the highest than in the lowest improvement in patent count. In contrast, for private targets with the highest improvement in patent count enjoy the highest market reaction. Moreover, the plain private target dummy halfs in size and becomes insignificant. The value differences between private and public firms are explained by the differences in innovation improvement. Columns 3 and 4 further control for the change in profitability and industry competition from before to after acquisitions, but the coefficients for quartile 4 do not change.

3.6 Conclusion

This paper studies different innovation outcomes when firms acquire public versus private targets. Using deal-level panel data of the U.S. firms from 1990 until 2010, we show that innovation outcomes increase significantly post-acquisition for private targets relative to matched firms and public targets. Private target acquisitions are associated with a significant increase in the number of new patents as well as exploratory and exploitative innovation. Exploratory innovation requires new knowledge or a departure from existing knowledge, whereas exploitative innovation builds only on existing knowledge. Our results suggest that firms are more likely to acquire private targets when they search for innovation. Following acquisition, the two firms combine their complementary knowledge to improve innovation outcomes and efficiency (Rhodes-Kropf and Robinson, 2008). Also, our results support the idea that private firms are more willing to pursue a long investment horizon and are more motivated to engage in risky innovation (Ferreira et al., 2014). In contrast, we find insignificant innovation effects for public target acquisitions relative to control firms. This suggests that firms acquire public targets for other strategic purposes that are, on average, not associated with innovation. We also show that these

innovation effects are persistent over at least 5 years after acquisition announcement.

Our next analysis focuses on investigating whether acquiring firms are able to attain innovation outputs at a reasonable cost. We therefore study whether acquirers are more efficient at generating innovation output for every dollar spent on the input. Our results show that relative to matched firms, private target acquirers are able to significantly increase their innovation efficiency. In contrast, effects of public target acquisitions on acquirers' innovation efficiency are insignificant. Acquiring private targets enhances innovation outputs by allowing acquirers to deploy their R&D investments more efficiently.

As a next step, we study whether innovation outcomes differ when firms acquire targets with a proven ability to innovate. We expect that acquisitions involving targets with existing patents result in a greater improvement in acquirers' innovation outcomes (Sevilir and Tian, 2012; Aghion and Tirole, 1994). We find that acquiring targets with existing patents brings no additional effects for the patent count, neither for public nor for private target acquirers. Interestingly, acquiring private targets with existing patent is associated with a larger increase in exploitative innovation outcomes, while exploratory innovation outcomes do not change. These results are somewhat surprising because the combination of acquirers and targets with patents generates an increase in innovation within existing expertise. One possible explanation is that when firms acquire targets with existing patents, acquiring firms target the existing expertise due to high technological overlap between the two firms. The acquisition is then to exploit deeper the existing area (Mei, 2019). It is important to note, however, that acquiring private targets without any existing patents is still associated with an increase in both exploratory and exploitative innovation. Innovative outcomes of public target acquisitions do not increase post-acquisitions even for targets with existing patents.

Overall, our results show that acquisitions of private targets are associated with an increase in innovation outcomes, while acquisitions of public targets do not

have significant impacts on acquirers' innovation. We argue that firms are likely to acquire private targets as they search for innovation. Next, we find that the reason why we observe an increase in innovation outcomes at private target acquirers is due to an increase in innovation efficiency. Post-acquisitions, private target acquirers are able to deploy their R&D more efficiently to generate innovation outcomes. Our proposed explanation for why private target acquirers are able to improve their innovation efficiency is due to the synergies from asset and/or technological complementarity between acquirers and private targets.

Even though we carefully select the control group of firms such that they have similar innovation to the treatment group of acquiring firms just before their acquisitions, our results could still be driven by innovation inertia of firms that decide to acquire. We check this bias comparing successful acquisitions to exogenously withdrawn ones. Both types aim to acquire, the withdrawn counterfactual should control for innovation inertia of acquirers. Following Savor and Lu (2009) and Seru (2014), we compare future innovation outcomes of successful versus withdrawn acquirers. Our results show that relative to withdrawn private target acquisitions, innovation outcomes are higher for successful private target acquisitions. In contrast, successful public target acquisitions have no significant effect on acquirers' innovative outcomes.

3.7 Appendix

3.7.1 Variable Definition

Variable	Definition	Source
Public deal	A dummy variable equal to 1 if firms acquire public target in a given year and 0 for firms that acquire private target and matched firms.	SDC
Private deal	A dummy variable equal to 1 if firms acquire private target in a given year and 0 for firms that acquire public target and matched firms.	SDC
Pub. target with patent	A dummy variable equal to 1 if firms acquire public target that own patent in a given year and 0 for the rest.	SDC, KPSS
Priv. target with patent	A dummy variable equal to 1 if firms acquire private target that own patent in a given year and 0 for the rest.	SDC, NBER
CARs(-2,2)	The 5-day cummulative abnormal returns $(-2, +2)$ around the announcement dates for the acquirers.	SDC, Compustat
Patent count	Total number of new patents that a firm applies for in year t.	KPSS, NBER
Exploratory patent	A patent that a firm applies for in year t makes at least 80% of its citations based on the knowledge outside firms' existing expertise (Gao et al., 2018).	KPSS, NBER
Unknown-class patent	Total number of patents that a firm applies for in year t within technological classes previously unknown to the firm (Balsmeier et al., 2017).	KPSS, NBER
New citation	A citation that a firm makes in year t that has never been made by the firm in the previous 5 years (Gao et al., 2018).	KPSS, NBER
Scope	Total number of new citations made by patents that a firm applies for in year t divided by total number of citations made by all patents applied for in the same period (Katila and Ahuja, 2002).	KPSS, NBER
Exploitative patent	A patent that a firm applies for in year t makes at least 80% of its citations based on firms' existing expertise (Gao et al., 2018).	KPSS, NBER
Known-class patent	Total number of patents that a firm applies for in year t within technological classes previously known to the firm (Balsmeier et al., 2017) (Balsmeier et al., 2017).	KPSS, NBER
Repeated citation	A citation that a firm makes in year t that has been made by the firm in the previous 5 years (Gao et al., 2018).	KPSS, NBER
Depth	Total number of repeated citations made by patents that a firm applies for in year t divided by total number of citations made by all patents applied for in the same period (Katila and Ahuja, 2002).	KPSS, NBER

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Variable	Definition	Source
ΔPatent count	Natural logarithm of the ratio between the average total patent counts in the post-deal relative to the average total patent counts in the pre-deal period	KPSS, NBER
ΔROA	The ratio between the average returns on assets (ROA) in the post-deal relative to the average ROA in the pre-deal period.	Compustat
ΔHH Index	The ratio between the average HH Index in the post-deal relative to the average HH Index in the pre-deal period.	Compustat
Ln (sales)	Natural logarithm of total revenues.	Compustat
Ln (R&D expenditures)	Natural logarithm of total R&D expenditures.	Compustat
Leverage	Long-term debt divided by shareholder equity.	Compustat
HH Index	The sum of squared market shares in the net sales of a firm's three-digit SIC industry.	Compustat
Ln(market value)	Natural logarithm of market value two days prior to the annoucement dates	SDC, Compustat
Cash only	A dummy variable indicating whether the method of payment for the acquisition is cash only.	SDC
Hostile deal	A dummy variable indicating whether the deal attitude is classified as a hostile deal.	SDC
Same SIC	A dummy variable indicating whether the acquirer and target are from the same 3-digit SIC codes.	SDC
Cosine similarity	$$\frac{\Sigma_{k=1}^{K} P_{i,k} P_{j,k}}{\sqrt{\Sigma_{k=1}^{K} P_{i,k}^2}\sqrt{\Sigma_{k=1}^{K} P_{j,k}^2}}$$ Where the vector $P_i = (P_{i,1}, \ldots, P_{i,K})$ consists of ratios of the number of awarded patents applied for by the acquirer i in each technological class $k \epsilon$ (1, K) during the period [-3,-1] or [-5,-1] to the total number of awarded patents to the acquirer applied for over the same period, and a vector of $P_j = (P_{j,1}, \ldots, P_{j,K})$ consists of ratios of the number of awarded patents applied for by the target j in each technological class k during the period [-3,-1] or [-5,-1] to the total number of awarded patents to the target applied for over the same period.	KPSS, NBER

Table 3.1 Likelihood of acquisitions

This table reports in Panel A coefficient estimates obtained from estimating logit models predicting the probability of acquiring public and private targets over the period between 1995 and 2005. The dependent variable, public (private) target equals to one if a firm acquires a public (private) target in the given year. All explanatory variables are lagged one year. All specifications include Fama-French 12-sector and year fixed effects. Standard errors are reported in parentheses. Panel B shows the mean, standard deviation, 25th, 50th and 75th percentiles for deal frequencies, innovation measures, and control variables for all technological firms between 1995 and 2005. All variables are defined in Appendix 3.7.1 and winsorized at the 1st and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels, respectively.

Panel A: Probability of acquiring

	Public target	**Private target**
Constant	-9.791***	-3.703***
	(0.366)	(0.166)
Ln(1+patent count)	0.130	-0.306***
	(0.120)	(0.073)
Ln(1+exploratory patent)	-0.247**	0.107*
	(0.103)	(0.064)
Ln(1+unknown-class patent)	-0.239***	-0.173***
	(0.060)	(0.041)
Ln(1+new citation)	0.269***	0.304***
	(0.058)	(0.034)
Ln(1+scope)	-0.815***	-0.569***
	(0.223)	(0.123)
Size	0.352***	0.135***
	(0.016)	(0.007)
R&D	-0.015***	-0.027***
	(0.005)	(0.003)
Number of observations	19,158	19,158
Pesudo R^2	0.143	0.0769

Panel B: Summary statistics for all technological firms

	# obs.	**Mean**	**St.dev.**	**25th perc.**	**Median**	**75th perc.**
Deal frequencies						

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Public deal	20,823	0.064	0.245	0.000	0.000	0.000
Private deal	20,823	0.232	0.422	0.000	0.000	0.000
Innovation variables included						
Ln(1+patent count)	20,823	1.016	1.426	0.000	0.693	1.609
Ln(1+exploratory patent)	20,823	0.798	1.264	0.000	0.000	1.099
Ln(1+unknown-class patent)	20,823	0.342	0.615	0.000	0.000	0.693
Ln(1+new citation)	20,823	2.099	2.389	0.000	1.099	3.951
Ln(1+scope)	20,823	0.353	0.345	0.000	0.656	0.693
Remaining innovation variables						
Ln(1+exploitative patent)	20,823	0.274	0.682	0.000	0.000	0.000
Ln(1+known-class patent)	20,823	0.776	1.373	0.000	0.000	1.099
Ln(1+repeated citation)	20,823	1.249	1.978	0.000	0.000	2.398
Ln(1+depth)	20,823	0.113	0.190	0.000	0.000	0.185
Control variables						
R&D	20,823	11.399	7.596	0.000	15.047	16.795
Size	20,100	18.137	4.392	16.602	18.581	20.756

Table 3.2 Propensity score matching

This table shows means for acquirers and their corresponding matched firms across all innovation and control variables in Panel A and innovation variable growth rates from 5 years to 1 year before the acquisition in Panel B. Column 1 to 3 cover public target subsample, while Column 4 to 6 cover private target subsample. All variables are defined in Appendix 3.7.1 and winsorized at the 1th and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Public target			Private target		
	Acquirer	Match	Mean diff.	Acquirer	Match	Mean diff.
Panel A: Matching summary statistics						
Ln (1+patent count)	1.950	1.895	0.054	1.313	1.358	-0.045
Ln (1+exploratory patent)	1.627	1.584	0.043	1.083	1.125	-0.041
Ln (1+unknown-class patent)	0.587	0.592	0.005	0.452	0.475	-0.023
Ln (1+new citation)	3.429	3.354	0.075	2.613	2.673	-0.060
Ln (1+scope)	0.456	0.456	0.000	0.403	0.407	-0.004
Ln (1+exploitative patent)	0.716	0.649	0.067	0.392	0.394	-0.002
Ln (1+known-class patent)	1.748	1.632	0.116	1.080	1.102	-0.022
Ln (1+repeated citation)	2.362	2.221	0.141	1.603	1.597	0.006
Ln (1+depth)	0.151	0.145	0.007	0.119	0.119	0.000
Size	20.805	20.792	0.013	19.433	19.387	0.046
R&D	12.348	11.988	0.360	11.371	11.364	0.008
Propensity score	0.158	0.155	0.003	0.313	0.312	0.001
Number of observations	1,327	1,327		4,808	4,808	
Panel B: Parallel trend univariate tests						
Ln (1+patent count)	0.043	0.053	-0.010	0.012	0.013	-0.001
Ln (1+exploratory patent)	0.042	0.046	-0.004	0.008	0.007	0.001
Ln (1+unknown-class patent)	0.016	0.012	0.004	-0.008	-0.014	0.006
Ln (1+new citation)	0.045	0.050	-0.005	0.014	0.020	-0.006
Ln (1+scope)	0.029	0.035	-0.007	0.010	0.017	-0.008
Ln (1+exploitative patent)	0.062	0.087	-0.025*	0.028	0.021	0.007
Ln (1+known-class patent)	0.047	0.056	-0.009	0.007	0.000	0.007
Ln (1+repeated citation)	0.064	0.082	-0.018	0.028	0.035	-0.007
Ln (1+depth)	0.075	0.105	-0.029	0.045	0.061	-0.016

Table 3.3 Acquirers versus matched firms: univariate differences

This table reports summary statistics on all innovation measures for acquirers of public target, acquirers of private targets, and their corresponding matched firms, both pre- and post-activism. Panel A shows the comparison in the average *Ln(1+innovation)* between public target acquirers and their matched firms; while Panel B shows the comparison in the average *Ln(1+innovation)* between private target acquirers and their matched firms. Column 5 reports the difference in innovation measures for acquirers and matched firms, pre-acquisitions; Column 6 reports the difference in innovation measures for acquirers and matched firms, post-acquisitions; Column 7 reports the difference in innovation measures for acquirers, post and pre-acquisitions; Column 8 reports the difference in innovation measures for matched firms, post and pre-acquisitions, Column 9 shows difference-in-difference in innovation measures. To test differences in the mean, we use a simple OLS regression of our innovation measures. All variables are defined in Appendix 3.7.1 and winsorized at the 1th and 99th percentiles.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Pre-acquisition		Post-acquisition		Differences				
	Acquirer	Match	Acquirer	Match	(1) - (2)	(3) - (4)	(3) - (1)	(4) - (2)	(7) - (8)
Panel A: Average innovation for public target acquirer versus matched firm									
Ln(1+patent count)	2.152	2.094	2.245	2.161	0.058	0.084**	0.093***	0.067 *	0.025
Ln(1+exploratory patent)	1.816	1.792	1.842	1.807	0.024	0.035	0.026	0.015	0.011
Ln(1+unknown-class patent)	0.668	0.707	0.547	0.573	-0.039***	-0.025**	-0.120***	-0.134***	0.014
Ln(1+new citation)	3.616	3.504	3.767	3.563	0.112**	0.205***	0.151***	0.058	0.093
Ln(1+scope)	0.464	0.464	0.453	0.443	0.000	0.010*	-0.011**	-0.021***	0.010
Ln(1+exploitative patent)	0.858	0.769	1.026	0.942	0.090***	0.085***	0.168***	0.173***	-0.005
Ln(known+class patent)	1.955	1.853	2.060	1.933	0.102***	0.127***	0.105***	0.080**	0.025
Ln(1+repeated citation)	2.523	2.306	2.895	2.645	0.216***	0.250***	0.372***	0.338***	0.034
Ln(1+depth)	0.147	0.133	0.186	0.165	0.014***	0.021***	0.039***	0.032***	0.007
Number of observations	7,405	7,052	8,733	8,486					
Panel B: Average innovation for private target acquirer versus matched firm									
Ln(1+patent count)	1.417	1.389	1.452	1.362	0.028*	0.090***	0.035 **	-0.027*	0.062***
Ln(1+exploratory patent)	1.196	1.168	1.173	1.102	0.029**	0.071***	-0.023*	-0.066***	0.042**
Ln(1+unknown-class patent)	0.497	0.498	0.397	0.373	-0.002	0.024***	-0.099***	-0.125***	0.026***
Ln(1+new citation)	2.633	2.566	2.694	2.477	0.067***	0.216***	0.060 ***	-0.089***	0.149***
Ln(1+scope)	0.381	0.383	0.370	0.356	-0.001	0.015***	-0.011***	-0.027***	0.016***
Ln(1+exploitative patent)	0.467	0.440	0.576	0.512	0.027***	0.064***	0.109 ***	0.072 ***	0.037***
Ln(1+known-class patent)	1.223	1.174	1.269	1.139	0.049***	0.130***	0.046 ***	-0.035**	0.081***
Ln(1+repeated citation)	1.672	1.563	1.922	1.693	0.109***	0.229***	0.250 ***	0.130 ***	0.120***
Ln(1+depth)	0.109	0.107	0.140	0.126	0.003**	0.014***	0.031 ***	0.020 ***	0.011***
Number of observations	32,278	30,799	39,353	37,652					

Table 3.4 Acquirers versus matched firms: plain innovation measures

This table replicates Table 3.3 where we use logarithmic transformations ln(1+innovation), but now without the transformation. Panel A (Panel B) compares innovation between public (private) target acquirers and their matched firms. For testing differences in the mean, we use a simple OLS regressions. All variables are defined in Appendix 3.7.1 and winsorized at the 1th and 99th percentiles.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Pre-Acquisition		Post-Acquisition		Difference		
	Acquirer	Control	Acquirer	Control	(3) - (1)	(4) - (2)	(5) - (6)
Panel A: Average innovation for public target acquirer vs. matched firm							
Patent count	89.448	88.171	124.987	120.302	35.539 ***	32.131 ***	3.408
Exploratory patent	44.761	45.664	56.307	59.151	11.546 ***	13.487 ***	-1.941
Unknown-class patent	1.917	2.145	1.444	1.554	-0.473 ***	-0.591 ***	0.118
New citation	753.256	663.979	1171.520	943.365	418.264***	279.386***	138.878**
Scope	0.636	0.628	0.595	0.573	-0.041 ***	-0.055 ***	0.014
Exploitative patent	6.713	6.241	10.556	9.810	3.842 ***	3.569 ***	0.273
Known-class patent	85.377	83.217	119.293	112.321	33.916 ***	29.104 ***	4.812
Repeated citation	252.931	194.638	503.100	331.736	250.169***	137.098***	113.071***
Depth	0.163	0.142	0.211	0.184	0.047 ***	0.042 ***	0.006
#obs	8,090	8,090	9,708	9,708			

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Pre-Acquisition		Post-Acquisition		Difference		
	Acquirer	Control	Acquirer	Control	(3) - (1)	(4) - (2)	(5) - (6)
Panel B: Average innovation for private target acquirer vs. matched firm							
Patent count	47.750	45.980	59.879	54.768	12.129 ***	8.788 ***	3.342
Exploratory patent	24.928	25.098	27.542	27.350	2.615 ***	2.252 ***	0.363
Unknown-class patent	1.311	1.386	0.943	0.918	-0.368 ***	-0.469 ***	0.101 ***
New citation	420.352	346.191	566.493	409.209	146.141***	63.018 ***	83.123***
Scope	0.503	0.507	0.476	0.443	-0.027 ***	-0.064 ***	0.038 ***
Exploitative patent	3.231	3.138	5.306	4.545	2.076 ***	1.406 ***	0.669 ***
Known-class patent	45.477	42.866	57.418	49.210	11.941 ***	6.343 ***	5.598 **
Repeated citation	142.840	96.020	248.627	144.826	105.788***	48.806 ***	56.982***
Depth	0.116	0.110	0.157	0.138	0.041 ***	0.028 ***	0.013 ***
#obs	37,595	37,595	45,114	45,114			

Table 3.5 Baseline difference-in-differences regressions

This table shows estimation results from DiD regressions for acquirers of public and private targets and their corresponding matched firms from years t_{-5} to t_{+5} around the acquisition announcement year (t_0) with 9 measures of innovation outcomes as alternative dependent variables. Panel A includes both public and private target acquisitions and their mathces with 171,758 firm-year observations, Panel B restricts to public target acquisitions with 31,676 observations and Panel C focusses on private target acquisitions with 140,082 observations. *Public deal* is a dummy variable indicating a public target, *Private deal* is a dummy variable indicating a private target. *Post public (Post private)* is a dummy variable indicating the period after public (private) target acquisitions including the year of the acquisition announcement. All regressions include year and firm fixed effects and the following control variables: acquirer size, R&D expenditures, leverage, net income and HH index. Standard errors are clustered by firm and year and reported in parentheses. All variables are defined in Appendix 3.7.1 and winsorized at the 1th and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
	Panel A: Full sample with public and private target acquisitions								
Constant	0.412**	0.394***	0.246***	1.108***	0.205***	-0.025	0.268*	0.227	0.003
	(0.154)	(0.137)	(0.068)	(0.295)	(0.046)	(0.057)	(0.130)	(0.199)	(0.020)
Post public	0.021	0.011	-0.063***	-0.039	-0.011*	0.071***	0.013	0.108**	0.010**
	(0.026)	(0.024)	(0.017)	(0.039)	(0.006)	(0.017)	(0.030)	(0.039)	(0.004)
Public x post public (β_1)	-0.010	-0.009	0.033	0.045	0.003	-0.035	-0.000	-0.024	0.001
	(0.034)	(0.031)	(0.025)	(0.049)	(0.007)	(0.025)	(0.038)	(0.056)	(0.005)
Post private	-0.060***	-0.049***	-0.037***	-0.150***	-0.017***	-0.030***	-0.079***	-0.067**	-0.003
	(0.017)	(0.014)	(0.012)	(0.028)	(0.004)	(0.008)	(0.020)	(0.029)	(0.002)

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
Private x post private (β_2)	0.071***	0.053***	0.046***	0.160***	0.018***	0.030***	0.087***	0.107***	0.009***
	(0.017)	(0.015)	(0.013)	(0.034)	(0.006)	(0.010)	(0.019)	(0.029)	(0.003)
R^2	0.913	0.893	0.617	0.842	0.610	0.884	0.911	0.855	0.561
$\beta_2 - \beta_1$	0.081**	0.062*	0.013	0.115*	0.015*	0.065**	0.087**	0.131**	0.008
Panel B: Sub-sample with public target acquisitions									
Constant	0.035	0.108	0.090	0.572	0.158*	-0.193	-0.072	-0.351	-0.047
	(0.368)	(0.310)	(0.150)	(0.643)	(0.091)	(0.163)	(0.350)	(0.527)	(0.042)
Post public	-0.020	-0.020	-0.034	-0.095**	-0.008	0.021	-0.039	0.008	0.004
	(0.023)	(0.022)	(0.021)	(0.033)	(0.005)	(0.016)	(0.030)	(0.030)	(0.003)
Public x post public	-0.026	-0.023	0.029	0.023	0.001	-0.042	-0.016	-0.047	-0.000
	(0.033)	(0.030)	(0.025)	(0.048)	(0.006)	(0.025)	(0.037)	(0.056)	(0.005)
R^2	0.926	0.908	0.627	0.873	0.645	0.900	0.920	0.878	0.594
Panel C: Sub-sample with private target acquisitions									
Constant	0.405***	0.382***	0.255***	1.109***	0.207***	-0.037	0.255**	0.238	0.008
	(0.142)	(0.129)	(0.068)	(0.269)	(0.043)	(0.053)	(0.118)	(0.185)	(0.019)

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
Post private	-0.051***	-0.042***	-0.044***	-0.137***	-0.017***	-0.019**	-0.068***	-0.045	-0.001
	(0.016)	(0.013)	(0.012)	(0.027)	(0.003)	(0.007)	(0.019)	(0.029)	(0.003)
Private x post private	0.074***	0.055***	0.046***	0.164***	0.018***	0.031***	0.090***	0.111***	0.010***
	(0.017)	(0.015)	(0.013)	(0.034)	(0.006)	(0.010)	(0.019)	(0.029)	(0.003)
R^2	0.906	0.886	0.610	0.830	0.599	0.875	0.905	0.845	0.550

Table 3.6 Baseline DiD without control variables

This table replicates Table 3.5 but we do not include control variables. The data set contains 201,014 firm-year observations in Panel A, 35,596 observations in Panel B and 165,418 observations in Panel C. All regressions include year and firm fixed effects. Standard errors are clustered by firm and year and reported in parentheses. All variables are defined in Appendix 3.7.1 and winsorized at the 1th and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
Panel A: Full sample with public and private target acquisitions									
Constant	1.341***	1.119***	0.439***	2.442***	0.344***	0.484***	1.156***	1.585***	0.106***
	(0.021)	(0.017)	(0.009)	(0.042)	(0.007)	(0.006)	(0.017)	(0.029)	(0.003)
Post public	0.048	0.024	-0.071***	0.037	-0.001	0.086***	0.020	0.190***	0.018***
	(0.046)	(0.039)	(0.023)	(0.086)	(0.014)	(0.018)	(0.039)	(0.058)	(0.005)
Public x post public (β_1)	0.005	-0.000	0.021	0.068	0.010	-0.019	0.002	-0.013	0.003
	(0.034)	(0.030)	(0.022)	(0.053)	(0.008)	(0.023)	(0.038)	(0.051)	(0.005)
Post private	0.001	-0.010	-0.046**	-0.040	-0.002	0.004	-0.038	0.048	0.008
	(0.041)	(0.033)	(0.018)	(0.080)	(0.012)	(0.014)	(0.034)	(0.059)	(0.005)
Private x post private (β_2)	0.083***	0.065***	0.045***	0.197***	0.026***	0.032***	0.091***	0.112***	0.010***
	(0.017)	(0.015)	(0.010)	(0.035)	(0.006)	(0.010)	(0.017)	(0.026)	(0.003)
$\beta_2 - \beta_1$	0.078**	0.065*	0.024	0.129*	0.016*	0.051**	0.089**	0.125**	0.007

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
R^2	0.876	0.861	0.591	0.792	0.552	0.862	0.880	0.814	0.514
Panel B: Sub-sample with public target acquisitions									
Constant	1.949***	1.640***	0.581***	3.282***	0.415***	0.793***	1.751***	2.301***	0.137***
	(0.023)	(0.020)	(0.011)	(0.043)	(0.006)	(0.007)	(0.021)	(0.025)	(0.002)
Post public	0.044	0.026	-0.031	0.022	0.006	0.051**	0.009	0.116**	0.013***
	(0.047)	(0.041)	(0.024)	(0.084)	(0.011)	(0.019)	(0.044)	(0.051)	(0.004)
Public x post public	0.005	-0.000	0.021	0.068	0.010	-0.019	0.002	-0.013	0.003
	(0.034)	(0.030)	(0.022)	(0.053)	(0.008)	(0.023)	(0.038)	(0.051)	(0.005)
R^2	0.894	0.881	0.612	0.831	0.594	0.879	0.891	0.845	0.557
Panel C: Sub-sample with private target acquisitions									
Constant	1.210***	1.006***	0.408***	2.261***	0.328***	0.417***	1.028***	1.431***	0.099***
	(0.021)	(0.016)	(0.010)	(0.042)	(0.007)	(0.006)	(0.016)	(0.030)	(0.003)
Post private	0.002	-0.010	-0.054***	-0.035	-0.004	0.012	-0.036	0.064	0.009
	(0.040)	(0.032)	(0.018)	(0.081)	(0.013)	(0.014)	(0.032)	(0.060)	(0.006)
Private x post private	0.083***	0.065***	0.045***	0.197***	0.026***	0.032***	0.091***	0.112***	0.010***

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
	(0.017)	(0.015)	(0.010)	(0.035)	(0.006)	(0.010)	(0.017)	(0.026)	(0.003)
R^2	0.867	0.850	0.580	0.777	0.538	0.853	0.873	0.801	0.501

Table 3.7 DiD with a shorter event window

This table replicates results in Table 3.5 but with an event window from t_{-3} to t_{+3}. Panel A with both public and private target acquisitions includes 129,458 firm-year observations. Panel B (Panel C) focusses on the public (private) target acquisitions and their matches only and includes 23,665 (105,793) observations. All regressions include year and firm fixed effects and control variables. Standard errors are clustered by firm and year and reported in parentheses. All variables are defined in Appendix 3.7.1 and winsorized at the 1th and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
Panel A: Full sample with public and private target acquisitions									
Constant	0.770***	0.684***	0.400***	1.616***	0.246***	0.218***	0.669***	0.784***	0.056**
	(0.082)	(0.073)	(0.041)	(0.169)	(0.030)	(0.040)	(0.090)	(0.138)	(0.021)
Post public	-0.020	-0.014	-0.017	-0.094**	-0.011*	0.033**	-0.040	0.001	0.000
	(0.021)	(0.019)	(0.017)	(0.037)	(0.006)	(0.014)	(0.024)	(0.031)	(0.003)
Public x post public (β_1)	0.023	0.013	-0.002	0.060	0.003	0.009	0.038	0.042	0.007
	(0.026)	(0.025)	(0.022)	(0.045)	(0.008)	(0.019)	(0.027)	(0.041)	(0.005)
Post private	-0.056***	-0.048***	-0.030***	-0.154***	-0.019***	-0.010	-0.074***	-0.063**	-0.001
	(0.014)	(0.013)	(0.009)	(0.022)	(0.005)	(0.007)	(0.016)	(0.026)	(0.003)
Private x post private (β_2)	0.066***	0.063***	0.046***	0.158***	0.019***	0.012	0.081***	0.076***	0.003
	(0.012)	(0.013)	(0.013)	(0.026)	(0.006)	(0.008)	(0.015)	(0.022)	(0.003)
$\beta_2 - \beta_1$	0.043	0.05*	0.048*	0.098*	0.016	0.003	0.043	0.034	-0.004

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
R^2	0.939	0.922	0.674	0.870	0.651	0.919	0.941	0.889	0.608
Panel B: Sub-sample with public target acquisitions									
Constant	0.995***	0.994***	0.520***	1.938***	0.237***	0.257**	0.902***	0.978***	0.033
	(0.181)	(0.162)	(0.102)	(0.347)	(0.069)	(0.094)	(0.198)	(0.276)	(0.025)
Post public	-0.030	-0.014	-0.009	-0.091**	-0.008	0.001	-0.056**	-0.034	-0.004
	(0.022)	(0.023)	(0.020)	(0.039)	(0.007)	(0.017)	(0.025)	(0.031)	(0.004)
Public x post public	0.019	0.011	-0.003	0.057	0.003	0.006	0.035	0.037	0.006
	(0.026)	(0.024)	(0.021)	(0.045)	(0.008)	(0.018)	(0.026)	(0.040)	(0.005)
R^2	0.949	0.934	0.687	0.899	0.695	0.929	0.947	0.911	0.656
Panel C: Sub-sample with private target acquisitions									
Constant	0.688***	0.599***	0.374***	1.504***	0.243***	0.182***	0.584***	0.694***	0.056**
	(0.082)	(0.074)	(0.043)	(0.172)	(0.029)	(0.041)	(0.089)	(0.144)	(0.022)
Post private	-0.054***	-0.048***	-0.031***	-0.156***	-0.019***	-0.003	-0.070***	-0.055*	-0.000
	(0.014)	(0.014)	(0.009)	(0.022)	(0.004)	(0.007)	(0.016)	(0.027)	(0.003)
Private x post private	0.066***	0.063***	0.046***	0.159***	0.020***	0.013	0.082***	0.077***	0.003

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
	(0.012)	(0.013)	(0.013)	(0.026)	(0.006)	(0.008)	(0.015)	(0.023)	(0.003)
R^2	0.935	0.916	0.667	0.859	0.640	0.914	0.938	0.880	0.595

Table 3.8 Persistency of changes in innovation outcomes

This table shows estimation results from DiD regressions for acquirers of public and private targets and their corresponding matched firms from years t_{-5} to t_{+5} around the acquisition announcement year (t_0) with 9 measures of innovation outcomes as alternative dependent variables. Panel A with 31,676 observations includes only public target acquisitions and their matches and Panel B focusses on private target acquisitions with their matches and contains 140,082 observations. *Public deal*$_j$ (*Private deal*$_j$) is a dummy variable that takes a value of 1 if firm i is an acquirer of public (private) target and the observation is j years away from the acquisition announcement year, and zero otherwise. All regressions include year and firm fixed effects and the following control variables: acquirer size, R&D expenditures, leverage, net income and HH index. Standard errors are clustered by firm and year and reported in parentheses. All variables are defined in Appendix 3.7.1 and winsorized at the 1th and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
				Panel A: Sub sample for public target acquisitions					
Constant	0.016	0.087	0.067	0.517	0.154	-0.186	-0.098	-0.357	-0.046
	(0.370)	(0.310)	(0.151)	(0.649)	(0.092)	(0.165)	(0.353)	(0.528)	(0.043)
Public deal$_0$	0.010	0.023	0.026	0.043	0.004	-0.015	0.020	0.016	0.001
	(0.021)	(0.020)	(0.020)	(0.036)	(0.006)	(0.013)	(0.024)	(0.034)	(0.003)
Public deal$_1$	-0.040	-0.034	-0.006	-0.030	-0.005	-0.029	-0.024	-0.049	-0.000
	(0.028)	(0.024)	(0.021)	(0.047)	(0.007)	(0.018)	(0.032)	(0.046)	(0.004)
Public deal$_2$	-0.060*	-0.067*	-0.010	-0.042	-0.003	-0.039*	-0.056	-0.066	0.004
	(0.032)	(0.033)	(0.030)	(0.049)	(0.007)	(0.021)	(0.036)	(0.045)	(0.005)
Public deal$_3$	-0.071	-0.081*	0.028	-0.063	-0.004	-0.052	-0.092*	-0.083	0.003

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
	(0.043)	(0.041)	(0.028)	(0.060)	(0.008)	(0.030)	(0.047)	(0.064)	(0.005)
Public deal$_4$	-0.078	-0.066	0.040	-0.096	-0.017*	-0.065*	-0.091	-0.126	-0.003
	(0.053)	(0.046)	(0.029)	(0.075)	(0.009)	(0.037)	(0.061)	(0.085)	(0.007)
Public deal$_5$	-0.022	-0.029	0.055	0.027	0.001	-0.047	-0.049	-0.044	0.006
	(0.052)	(0.050)	(0.037)	(0.074)	(0.011)	(0.035)	(0.064)	(0.087)	(0.007)
R^2	0.926	0.909	0.627	0.873	0.646	0.900	0.920	0.878	0.594
Panel B: Sub sample for private target acquisitions									
Constant	0.377**	0.356**	0.233***	1.038***	0.198***	-0.046	0.222*	0.217	0.008
	(0.143)	(0.129)	(0.068)	(0.270)	(0.043)	(0.053)	(0.121)	(0.187)	(0.019)
Private deal$_0$	0.062***	0.058***	0.030**	0.114***	0.013**	0.022**	0.058***	0.083***	0.005*
	(0.011)	(0.012)	(0.013)	(0.025)	(0.005)	(0.008)	(0.011)	(0.019)	(0.003)
Private deal$_1$	0.053***	0.037***	0.020*	0.104***	0.011	0.020**	0.061***	0.105***	0.011***
	(0.014)	(0.012)	(0.011)	(0.031)	(0.006)	(0.008)	(0.015)	(0.023)	(0.003)
Private deal$_2$	0.034**	0.015	0.023	0.072*	0.004	0.027***	0.061***	0.098***	0.012***
	(0.016)	(0.015)	(0.014)	(0.037)	(0.007)	(0.009)	(0.016)	(0.024)	(0.003)
Private deal$_3$	0.040*	0.021	0.026	0.096**	0.008	0.020	0.061**	0.084**	0.009**

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
	(0.020)	(0.019)	(0.016)	(0.037)	(0.006)	(0.011)	(0.023)	(0.033)	(0.004)
Private deal$_4$	0.052**	0.028	0.036*	0.127**	0.016*	0.030*	0.060*	0.090*	0.012**
	(0.024)	(0.020)	(0.018)	(0.046)	(0.008)	(0.016)	(0.029)	(0.044)	(0.005)
Private deal$_5$	0.058**	0.036	0.050**	0.155***	0.020**	0.019	0.068**	0.070*	0.009*
	(0.026)	(0.022)	(0.019)	(0.048)	(0.007)	(0.017)	(0.030)	(0.038)	(0.004)
R^2	0.906	0.886	0.610	0.830	0.598	0.875	0.905	0.845	0.550

Table 3.9 Innovation efficiency

This table shows estimation results from DiD regressions for acquirers of public and private targets and their corresponding matched firms from years t_{-5} to t_{+5} around the acquisition announcement year (t_0) with 10 measures of innovation outcomes that reflect innovation efficiency. The sample includes both public and private target acquisitions and their mathces with 114,887 firm-year observations. *Public deal* is a dummy variable indicating a public target, *Private deal* is a dummy variable indicating a private target. *Post public (Post private)* is a dummy variable indicating the period after public (private) target acquisitions including the year of the acquisition announcement. All regressions include year and firm fixed effects and the following control variables: acquirer size, R&D expenditures, leverage, net income and HH index. Standard errors are clustered by firm and year and reported in parentheses. All variables are defined in Appendix 3.7.1 and winsorized at the 1th and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	R&D	Patent count/ R&D	Exploratory patent/ R&D	Unknown-class patent/ R&D	New citation/ R&D	Scope/ R&D	Exploitative patent/ R&D	Known-class patent/ R&D	Repeated citation/ R&D	Depth/ R&D
Constant	10.670***	2.634***	2.039***	1.717***	22.426***	1.520***	1.024***	1.564***	4.237***	1.061***
	(0.285)	(0.115)	(0.071)	(0.061)	(1.423)	(0.036)	(0.006)	(0.044)	(0.356)	(0.007)
Post public	0.156***	0.003	0.005	0.017**	-0.364	0.014**	-0.000	-0.039**	-0.189*	0.000
	(0.054)	(0.025)	(0.015)	(0.007)	(0.291)	(0.006)	(0.002)	(0.019)	(0.103)	(0.001)
Public x post public (β_1)	0.201***	0.037	0.026	0.011	0.555	0.005	-0.003	0.029	0.257*	0.000
	(0.061)	(0.033)	(0.018)	(0.008)	(0.383)	(0.007)	(0.003)	(0.028)	(0.133)	(0.002)
Post private	-0.043	-0.090***	-0.063***	-0.029***	-1.341***	-0.016***	-0.005***	-0.071***	-0.291***	-0.001
	(0.033)	(0.014)	(0.010)	(0.006)	(0.183)	(0.005)	(0.001)	(0.010)	(0.063)	(0.001)
Private x post private (β_2)	0.212***	0.053***	0.027**	0.002	0.698***	-0.003	0.003	0.067***	0.282***	-0.001
	(0.037)	(0.019)	(0.013)	(0.007)	(0.231)	(0.006)	(0.002)	(0.013)	(0.079)	(0.001)
R^2	0.679	0.580	0.461	0.299	0.548	0.453	0.460	0.712	0.607	0.422

Table 3.10 Acquiring targets with existing patents

This table shows estimation results from DiD regressions for acquirers of public and private targets and their corresponding matched firms from years t_{-5} to t_{+5} around the acquisition announcement year (t_0) with 9 measures of innovation outcomes as alternative dependent variables. The data set includes both public and private target acquisitions and their matches and contains 171,758 firm-year observations. *Public deal* is a dummy variable indicating a public target, *Private deal* is a dummy variable indicating a private target. *Post public (Post private)* is a dummy variable indicating the period after public (private) target acquisitions including the year of the acquisition announcement. *Public (Private) with patent* is a dummy variable equal to 1 for acquisitions of public (private) targets with existing patents. All regressions include year and firm fixed effects and the following control variables: acquirer size, R&D expenditures, leverage, net income and HH index. Standard errors are clustered by firm and year and reported in parentheses. All variables are defined in Appendix 3.7.1 and winsorized at the 1th and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
Constant	0.412**	0.396***	0.248***	1.108***	0.205***	-0.028	0.268*	0.223	0.003
	(0.154)	(0.137)	(0.069)	(0.295)	(0.046)	(0.058)	(0.131)	(0.200)	(0.020)
Post public	0.021	0.011	-0.063***	-0.039	-0.011*	0.071***	0.013	0.108**	0.010**
	(0.026)	(0.024)	(0.017)	(0.039)	(0.006)	(0.017)	(0.030)	(0.039)	(0.004)
Public x post public (β_1)	-0.003	-0.000	0.067**	0.037	0.003	-0.044	0.016	-0.045	-0.003
	(0.038)	(0.036)	(0.027)	(0.057)	(0.008)	(0.026)	(0.043)	(0.056)	(0.005)
Public x post public x	-0.014	-0.020	-0.076***	0.018	-0.001	0.021	-0.035	0.046	0.010
public with patent (γ_1)	(0.051)	(0.049)	(0.026)	(0.080)	(0.011)	(0.035)	(0.052)	(0.073)	(0.006)
Post private	-0.060***	-0.049***	-0.037***	-0.150***	-0.017***	-0.030***	-0.079***	-0.067**	-0.003
	(0.017)	(0.014)	(0.012)	(0.028)	(0.004)	(0.008)	(0.020)	(0.029)	(0.002)

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
Private x post private (β_2)	0.072***	0.059***	0.054***	0.160***	0.018**	0.016*	0.087***	0.091***	0.007*
	(0.017)	(0.015)	(0.014)	(0.037)	(0.007)	(0.009)	(0.019)	(0.029)	(0.004)
Private x post private x	-0.006	-0.029	-0.041*	0.004	-0.005	0.069***	0.003	0.086*	0.013***
private with patent (γ_2)	(0.038)	(0.038)	(0.020)	(0.057)	(0.008)	(0.022)	(0.038)	(0.047)	(0.004)
R^2	0.913	0.893	0.617	0.842	0.610	0.884	0.911	0.855	0.561
$\beta_1 + \gamma_1$	-0.017	-0.02	-0.010**	0.055	0.002	-0.023	-0.019	0.001	0.007
$\beta_2 + \gamma_2$	0.066***	0.030***	0.013***	0.164***	0.013**	0.085*	0.090***	0.177***	0.02*
$(\beta_2 + \gamma_2) - (\beta_1 + \gamma_1)$	0.083*	0.05	0.022	0.109*	0.011	0.108**	0.109	0.176**	0.013
$\beta_2 - \beta_1$	0.075*	0.059	-0.013	0.123*	0.015	0.06**	0.071	0.136**	0.01

Table 3.11 Interaction with patent target: the two sub-samples

This table replicates Table 3.10 but separately for the two sub-samples with public and private target acquisitions. All regressions include year and firm fixed effect and control variables. Standard errors are clustered by firm and year and reported in parentheses. All variables are defined in Appendix 3.7.1 and winsorized at the 1th and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
				Panel A: Sub-sample with public target acquisitions					
Constant	0.035	0.108	0.092	0.571	0.158*	-0.194	-0.072	-0.353	-0.048
	(0.369)	(0.310)	(0.148)	(0.644)	(0.091)	(0.164)	(0.350)	(0.530)	(0.043)
Post public	-0.020	-0.020	-0.033	-0.095**	-0.008	0.021	-0.039	0.008	0.004
	(0.023)	(0.022)	(0.021)	(0.033)	(0.005)	(0.017)	(0.030)	(0.030)	(0.003)
Public x post public	-0.027	-0.022	0.061**	0.009	0.002	-0.057**	-0.009	-0.078	-0.004
	(0.037)	(0.035)	(0.027)	(0.055)	(0.008)	(0.025)	(0.042)	(0.056)	(0.005)
Public x post public x	0.002	-0.003	-0.072**	0.031	-0.002	0.032	-0.016	0.069	0.010
public with patent	(0.048)	(0.046)	(0.026)	(0.077)	(0.011)	(0.035)	(0.049)	(0.070)	(0.006)
R^2	0.926	0.908	0.628	0.873	0.645	0.900	0.920	0.878	0.594
				Panel B: Sub-sample with private target acquisitions					
Constant	0.406***	0.384***	0.258***	1.109***	0.207***	-0.041	0.255**	0.234	0.007

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
	(0.142)	(0.129)	(0.068)	(0.269)	(0.043)	(0.053)	(0.119)	(0.185)	(0.019)
Post private	-0.051***	-0.042***	-0.044***	-0.137***	-0.017***	-0.019**	-0.068***	-0.045	-0.001
	(0.016)	(0.013)	(0.012)	(0.027)	(0.003)	(0.007)	(0.019)	(0.029)	(0.003)
Private x post private	0.075***	0.062***	0.054***	0.164***	0.019**	0.018*	0.090***	0.096***	0.007*
	(0.017)	(0.015)	(0.014)	(0.037)	(0.007)	(0.009)	(0.019)	(0.029)	(0.004)
Private x post private x	-0.009	-0.033	-0.042*	0.001	-0.004	0.068***	-0.001	0.081	0.013***
private with patent	(0.039)	(0.038)	(0.020)	(0.058)	(0.008)	(0.023)	(0.039)	(0.047)	(0.004)
R^2	0.906	0.886	0.610	0.830	0.599	0.876	0.905	0.845	0.550

Table 3.12 Interaction with patent target: shorter event window

This table replicates Table 3.10 but for a shorter event window starting at t_{-3} and ending at t_{+3}. Panel A with both public and private target acquisitions includes 129,458 firm-year observations. Panel B (Panel C) focusses on the public (private) target acquisitions and their matches only and includes 23,665 (105,793) observations. All regressions include year and firm fixed effects and control variables. Standard errors are clustered by firm and year and reported in parentheses. All variables are defined in Appendix 3.7.1 and winsorized at the 1th and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
	Panel A: Full sample with public and private target acquisitions								
Constant	0.769***	0.684***	0.400***	1.613***	0.246***	0.216***	0.668***	0.780***	0.055**
	(0.082)	(0.073)	(0.041)	(0.169)	(0.030)	(0.040)	(0.090)	(0.138)	(0.021)
Post public	-0.020	-0.014	-0.017	-0.095**	-0.011*	0.032**	-0.040	0.001	0.000
	(0.021)	(0.019)	(0.017)	(0.037)	(0.006)	(0.014)	(0.024)	(0.031)	(0.003)
Public x post public (β_1)	0.000	-0.006	0.015	0.007	-0.003	-0.011	0.026	-0.000	0.003
	(0.029)	(0.026)	(0.021)	(0.057)	(0.010)	(0.018)	(0.030)	(0.040)	(0.004)
Public x post public x	0.053	0.045	-0.041*	0.124**	0.013	0.046*	0.028	0.099*	0.010*
public with patent (γ_1)	(0.033)	(0.033)	(0.023)	(0.058)	(0.011)	(0.026)	(0.035)	(0.050)	(0.005)
Post private	-0.056***	-0.048***	-0.030***	-0.154***	-0.019***	-0.010	-0.074***	-0.062**	-0.001
	(0.014)	(0.013)	(0.009)	(0.021)	(0.005)	(0.007)	(0.016)	(0.026)	(0.003)

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
Private x post private (β_2)	0.061***	0.061***	0.047***	0.147***	0.019***	0.001	0.075***	0.056**	0.001
	(0.013)	(0.014)	(0.013)	(0.026)	(0.006)	(0.008)	(0.016)	(0.025)	(0.003)
Private x post private x	0.028	0.008	-0.009	0.057	0.003	0.061***	0.032	0.106***	0.012***
private with patent (γ_2)	(0.023)	(0.025)	(0.016)	(0.039)	(0.007)	(0.016)	(0.022)	(0.033)	(0.004)
R^2	0.939	0.922	0.674	0.870	0.651	0.919	0.941	0.889	0.608
$\beta_1 + \gamma_1$	0.053	0.039	-0.026	0.131	0.01	0.035	0.054	0.099	0.013
$\beta_2 + \gamma_2$	0.089***	0.069***	0.038***	0.204***	0.022***	0.062	0.107***	0.162**	0.013
$(\beta_2 + \gamma_2) - (\beta_1 + \gamma_1)$	0.036*	0.030**	0.064	0.073**	0.012*	0.027	0.053	0.063	0
$\beta_2 - \beta_1$	0.061*	0.067**	0.032	0.140**	0.022*	0.012	0.049	0.056	-0.002
Panel B: Sub-sample with public target acquisitions									
Constant	0.994***	0.993***	0.520***	1.936***	0.237***	0.256**	0.901***	0.977***	0.033
	(0.181)	(0.162)	(0.102)	(0.346)	(0.069)	(0.095)	(0.199)	(0.278)	(0.025)
Post public	-0.030	-0.015	-0.009	-0.091**	-0.008	0.001	-0.056**	-0.034	-0.004
	(0.022)	(0.023)	(0.020)	(0.039)	(0.007)	(0.017)	(0.025)	(0.031)	(0.004)
Public x post public	-0.007	-0.012	0.014	0.003	-0.002	-0.016	0.019	-0.011	0.002
	(0.028)	(0.025)	(0.021)	(0.056)	(0.010)	(0.018)	(0.029)	(0.039)	(0.004)

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
Public x post public x	0.061*	0.053	-0.040	0.128**	0.012	0.051*	0.037	0.113**	0.010*
public with patent	(0.032)	(0.032)	(0.023)	(0.058)	(0.011)	(0.025)	(0.033)	(0.048)	(0.005)
R^2	0.949	0.934	0.687	0.899	0.695	0.929	0.947	0.911	0.656
Panel C: Sub-sample with private target acquisitions									
Constant	0.686***	0.599***	0.374***	1.502***	0.242***	0.179***	0.583***	0.689***	0.055**
	(0.082)	(0.074)	(0.043)	(0.172)	(0.029)	(0.041)	(0.089)	(0.145)	(0.022)
Post private	-0.054***	-0.048***	-0.031***	-0.156***	-0.019***	-0.003	-0.070***	-0.055*	-0.000
	(0.014)	(0.014)	(0.010)	(0.022)	(0.004)	(0.007)	(0.016)	(0.026)	(0.003)
Private x post private	0.061***	0.062***	0.047***	0.148***	0.019***	0.002	0.076***	0.057**	0.001
	(0.013)	(0.014)	(0.013)	(0.026)	(0.006)	(0.008)	(0.016)	(0.025)	(0.003)
Private x post private x	0.027	0.007	-0.008	0.056	0.003	0.060***	0.031	0.105***	0.012***
private with patent	(0.023)	(0.025)	(0.016)	(0.039)	(0.007)	(0.016)	(0.022)	(0.032)	(0.004)
R^2	0.935	0.916	0.667	0.859	0.640	0.914	0.938	0.880	0.595

Table 3.13 Pairwise cosine similarity

This table reports the mean of pairwise cosine similarity between public and private target acquirers and their corresponding targets in column 2 and 3, respectively. Note that not all target firms own patents by the time the are acquired. Therefore, the reported observations are sub sample of acquisitions of targets with existing patents. We measure pairwise cosine similarity from $_{t-3}$ to $_{t-1}$ and from $_{t-5}$ and $_{t-1}$. All variables are defined in Appendix 3.7.1 and winsorized at the 1th and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels, respectively.

	(1)	(2)	(3)	(4)
	#Obs	Public deal	Private deal	Mean diff.
Cosine similarity $_{t-3}$ to $_{t-1}$	954	0.302	0.183	-0.118***
Cosine similarity $_{t-5}$ to $_{t-1}$	1,059	0.300	0.197	-0.104***

Table 3.14 Successful versus withdrawn deals

This table shows estimation results from DiD regressions for withdrawn public and private target acquisitions and their corresponding matched successful acquisitions from years t_{-5} to t_{+5} around the acquisition announcement year (t_0) with 9 measures of innovation outcomes as alternative dependent variables. The data set includes 17,283 firm-year observations. *Public deal* (*Private deal*) is a dummy variable indicating a successful public (private) target. *Post public* (*Post private*) is a dummy variable indicating the period after public (private) target acquisitions including the year of the acquisition announcement. All regressions include year and firm fixed effects and the following control variables: acquirer size, R&D expenditures, leverage, net income and HH index. Standard errors are clustered by firm and year and reported in parentheses. All variables are defined in Appendix 3.7.1 and winsorized at the 1th and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
				Panel A: Baseline DiD					
Constant	0.192**	0.158**	0.137***	0.624***	0.127***	-0.057	0.079	0.209	0.021
	(0.075)	(0.066)	(0.034)	(0.143)	(0.024)	(0.045)	(0.078)	(0.126)	(0.014)
Post public	-0.041	-0.051**	-0.024	-0.068	-0.002	-0.001	-0.039	-0.006	0.007
	(0.027)	(0.024)	(0.014)	(0.056)	(0.011)	(0.014)	(0.025)	(0.038)	(0.005)
Public x post public (β_1)	0.059	0.080*	0.050*	0.126	0.025	-0.015	-0.000	-0.027	-0.006
	(0.041)	(0.039)	(0.024)	(0.084)	(0.015)	(0.022)	(0.038)	(0.061)	(0.007)
Post private	-0.047	-0.036	0.007	-0.100	-0.007	-0.029**	-0.048	-0.087*	-0.004
	(0.033)	(0.031)	(0.017)	(0.071)	(0.013)	(0.011)	(0.029)	(0.044)	(0.004)
Private x post private (β_2)	0.141***	0.115***	0.051***	0.362***	0.070***	0.045*	0.096**	0.154**	0.013*

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
	(0.039)	(0.035)	(0.017)	(0.089)	(0.019)	(0.023)	(0.037)	(0.066)	(0.007)
R^2	0.878	0.851	0.585	0.793	0.603	0.794	0.882	0.823	0.564
Panel B: Interactions with patent target									
Constant	0.194**	0.159**	0.136***	0.627***	0.127***	-0.054	0.081	0.215	0.022
	(0.075)	(0.066)	(0.034)	(0.143)	(0.024)	(0.045)	(0.078)	(0.125)	(0.014)
Post public	-0.041	-0.051**	-0.024	-0.068	-0.002	-0.001	-0.039	-0.006	0.007
	(0.027)	(0.024)	(0.014)	(0.056)	(0.011)	(0.014)	(0.025)	(0.038)	(0.005)
Public x post public	0.050	0.081*	0.071**	0.126	0.031	-0.047**	-0.002	-0.078	-0.011
	(0.044)	(0.040)	(0.026)	(0.098)	(0.019)	(0.021)	(0.041)	(0.061)	(0.006)
Public x post public x	0.030	-0.004	-0.067	0.000	-0.020	0.101**	0.007	0.158	0.016
public with patent	(0.089)	(0.079)	(0.052)	(0.173)	(0.028)	(0.048)	(0.086)	(0.135)	(0.015)
Post private	-0.047	-0.036	0.007	-0.100	-0.007	-0.029**	-0.048	-0.087*	-0.004
	(0.033)	(0.031)	(0.017)	(0.072)	(0.013)	(0.011)	(0.029)	(0.044)	(0.004)
Private x post private	0.126***	0.106***	0.045**	0.333***	0.069***	0.030	0.077*	0.118*	0.009
	(0.040)	(0.036)	(0.018)	(0.092)	(0.019)	(0.022)	(0.038)	(0.066)	(0.007)
Private deal x post private x	0.179	0.097	0.077*	0.341*	0.009	0.170**	0.222*	0.421**	0.042***

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
private with patent	(0.106)	(0.099)	(0.043)	(0.171)	(0.033)	(0.072)	(0.114)	(0.153)	(0.011)
R^2	0.878	0.851	0.585	0.793	0.603	0.795	0.882	0.824	0.565

Table 3.15 Persistency of changes in innovation outcomes: successful versus withdrawn deals

This table shows estimation results from DiD regressions for withdrawn public and private target acquisitions and their corresponding matched successful acquisitions from years t_{-5} to t_{+5} around the acquisition announcement year (t_0) with 9 measures of innovation outcomes as alternative dependent variables. Panel A with 7,391 observations includes only public target acquisitions and their matches and Panel B focusses on private target acquisitions with their matches and contains 8,603 observations. *Public deal*$_j$ (*Private deal*$_j$) is a dummy variable that takes a value of 1 if firm i is an acquirer of public (private) target and the observation is j years away from the acquisition announcement year, and zero otherwise. All regressions include year and firm fixed effects and the following control variables: acquirer size, R&D expenditures, leverage, net income and HH index. Standard errors are clustered by firm and year and reported in parentheses. All variables are defined in Appendix 3.7.1 and winsorized at the 1th and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
				Panel A: Sub-sample for public target acquisitions					
Constant	0.244*	0.226**	0.139	0.563*	0.082	0.006	0.228**	0.298	0.010
	(0.126)	(0.105)	(0.082)	(0.319)	(0.057)	(0.049)	(0.089)	(0.184)	(0.023)
Public deal$_t$0	0.037	0.057*	0.039	0.096	0.018	0.009	-0.012	-0.006	-0.002
	(0.031)	(0.030)	(0.029)	(0.072)	(0.020)	(0.021)	(0.031)	(0.059)	(0.006)
Public deal$_t$1	0.031	0.046	0.040	0.061	0.009	-0.005	-0.009	-0.015	0.002
	(0.038)	(0.037)	(0.034)	(0.088)	(0.017)	(0.022)	(0.030)	(0.064)	(0.009)
Public deal$_t$2	0.074	0.079*	0.041	0.165	0.047**	0.002	0.005	0.008	0.003
	(0.044)	(0.042)	(0.027)	(0.097)	(0.018)	(0.021)	(0.041)	(0.063)	(0.007)
Public deal$_t$3	0.075	0.089	0.036	0.172	0.035	-0.004	0.008	-0.012	-0.003

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
	(0.058)	(0.052)	(0.031)	(0.110)	(0.021)	(0.027)	(0.060)	(0.089)	(0.009)
Public deal$_t$4	0.054	0.078	0.030	0.065	-0.000	-0.011	0.024	0.024	-0.004
	(0.056)	(0.053)	(0.030)	(0.107)	(0.020)	(0.030)	(0.057)	(0.083)	(0.008)
Public deal$_t$5	0.065	0.053	0.025	0.156	0.021	0.022	0.002	0.101	0.011
	(0.061)	(0.057)	(0.041)	(0.150)	(0.028)	(0.032)	(0.053)	(0.090)	(0.010)
R^2	0.895	0.868	0.585	0.816	0.635	0.842	0.901	0.848	0.586
Panel B: Sub-sample for private target acquisitions									
Constant	-0.013	-0.025	0.116**	0.321*	0.108***	-0.159*	-0.152	-0.047	0.015
	(0.117)	(0.102)	(0.048)	(0.179)	(0.027)	(0.079)	(0.126)	(0.186)	(0.016)
Private deal$_t$0	0.095***	0.069***	0.030	0.218***	0.048***	0.020	0.068***	0.099**	0.012*
	(0.023)	(0.023)	(0.021)	(0.054)	(0.012)	(0.028)	(0.023)	(0.046)	(0.007)
Private deal$_t$1	0.131***	0.109***	0.070**	0.334***	0.074***	0.023	0.057*	0.096*	0.005
	(0.030)	(0.031)	(0.025)	(0.054)	(0.015)	(0.016)	(0.033)	(0.054)	(0.006)
Private deal$_t$2	0.112**	0.083**	0.049**	0.332***	0.074***	0.055**	0.067	0.169**	0.021**
	(0.043)	(0.037)	(0.021)	(0.110)	(0.020)	(0.020)	(0.039)	(0.070)	(0.008)
Private deal$_t$3	0.113***	0.098**	0.031	0.364***	0.066***	0.027	0.073*	0.103	0.007

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Patent count	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
	(0.035)	(0.037)	(0.018)	(0.084)	(0.019)	(0.031)	(0.035)	(0.069)	(0.008)
Private deal$_t$4	0.197***	0.126**	0.079***	0.624***	0.125***	0.078**	0.109**	0.313***	0.037***
	(0.047)	(0.045)	(0.026)	(0.103)	(0.018)	(0.036)	(0.042)	(0.071)	(0.009)
Private deal$_t$5	0.216***	0.169**	0.081***	0.659***	0.131***	0.074*	0.117*	0.234*	0.024*
	(0.075)	(0.063)	(0.023)	(0.203)	(0.032)	(0.042)	(0.067)	(0.116)	(0.012)
R^2	0.818	0.787	0.552	0.725	0.532	0.634	0.824	0.755	0.519

Table 3.16 Withdrawn acquisitions

Date announcement	Target's name	Acquirers's name	Reason for withdrawn
07/02/2000	Amazescape.com Inc	Premier Concepts Inc	Target firm committed a material and substantial breach of the Merger Agreement. Target's progress to date on its business plan has been modest at best and are led to conclude that target is not currently even prosecuting its business plan in a meaningful way. Certain ongoing problems, such as AmazeScape's failure to satisfy its obligations to major suppliers.
06/06/2000	Impac Medical Systems Inc	Varian Medical Systems Inc	Department's Antitrust Division announced its intent to block the transaction, saying it would reduce competition significantly in the sale of radiation oncology management systems software and medical devices known as linear accelerators sold in the United States
08/02/2001	Adexa Inc	Freemarkets Inc	Both companies attributed the failed merger to the slowing economy, sour market conditions and delays in winning regulatory approval from the Securities and Exchange Commission. Instead, FreeMarkets and Adexa have both agreed to enter a nonexclusive partnership that calls for selling each other's software and services to joint clients.
28/03/2001	MAYAN Networks Corp	Ariel Corp	MAYAN Networks notice to Ariel cited the failure of the Merger to close on or before August 31, 2001 as the primary reason for the unilateral termination of the merger agreement. Nasdaq cited their opinion that the combination of Ariel and MAYAN Networks would not meet the initial listing standards for the Nasdaq National Market, and that Ariel failed to meet the continued listing standards for the Nasdaq National Market
22/08/2001	Eos Biotechnology	Pharmacopeia Inc	The merger has faced public opposition from at least one of Pharmacopeia's stockholders, OrbiMed Advisors LLC, which owns about 10 percent of Pharmacopeia's stock.
24/10/2001	Graphco Technologies Inc	PerfectData Corp	N/A
30/04/2002	Cogentrix Energy Inc	Aquila Inc	Both companies agreed that the current uncertainty of the electric power market made proceeding with the transaction impractical and not in either company's best interest.

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Date announcement	Target's name	Acquirer's name	Reason for withdrawn
14/11/2001	Pegasus Pharmacy Inc	Restaurant Teams International Inc	As a result of various irreconcilable circumstances between the Company and management of the two subsidiaries, the Company signed a Settlement and Separation Agreement (the "Separation Agreement") in which ownership of MedEx and Pegasus was returned to the original owners and the Company received a perpetual, paid-up license to utilize, improve, resell, and distribute the technology within a protected territory in the United States consisting of 158 CMSA's in the United States and all international rights.
14/11/2001	MedEx Systems Inc	Restaurant Teams International Inc	As a result of various irreconcilable circumstances between the Company and management of the two subsidiaries, the Company signed a Settlement and Separation Agreement (the "Separation Agreement") in which ownership of MedEx and Pegasus was returned to the original owners and the Company received a perpetual, paid-up license to utilize, improve, resell, and distribute the technology within a protected territory in the United States consisting of 158 CMSA's in the United States and all international rights.
08/02/2002	Aspect SemiQuip International	Patriot Scientific Corp	That such an acquisition would not meet the business objectives of either company. With present market conditions and the present strategic direction of PTSC, it was decided the acquisition would not have been productive.
19/02/2002	Incubation Park Business Development Inc	TeleServices Internet Group Inc	The company announced that it had signed a letter of intent to acquire Incubation Park Business Development Inc. ("Incubation Park"), subject to certain terms and conditions (the "Letter of Intent"). The Company has had no success to date in raising the capital needed to fulfill the various terms of the Letter of Intent. On April 3, 2002, Incubation Park notified the Company that they had received an offer of financing from another party. Since the Company has not been able to raise the necessary capital to fulfill the terms of the Letter of Intent, nor is there any prospect it will be able to do so, by mutual agreement between the Company and Incubation Park the Letter of Intent has been cancelled.
27/02/2002	Southwick Management Inc	VPN Communications Corp	All parties decided it was in the best interest of the shareholders of both entities for the companies to pursue separate paths

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Date announcement	Target's name	Acquirer's name	Reason for withdrawn
15/03/2002	BaySpec Inc	Finisar Corp	Current market conditions as well as the outlook for capex spending within the telecommunications industry, make it difficult to complete the BaySpec acquisition as planned," said Jerry Rawls, Finisar's President and CEO
18/03/2002	Screenphone.net Inc	Telco-Technology Inc	During the quarter ended March 31, 2002, the Company obtained loans from certain private parties in the aggregate amount of $85,000. All of such loans bear interest at 6.75% and mature in six months. During the quarter ended March 31, 2002, the Company loaned $35,000 to ScreenPhone in connection with the transaction contemplated by the Letter of Intent. As a result of the decision to not proceed with the proposed business combination
21/03/2002	Reliant Pharmaceuticals Inc	Alkermes Inc	The companies agreed to terminate the merger agreement due to general market conditions.
16/05/2002	Franklin Bank of California	Wal-Mart Stores Inc	A coalition of consumer groups, unions, independent banks, credit unions, and realtors managed a legislative feat in California last month when they pushed through an 11th hour bill to block Wal-Mart's attempt to acquire a small bank. Wal-Mart filed an application with state regulators in April to buy Franklin Bank of California, an industrial bank with $2.5 million in assets and three employees in Orange County. The new law prohibits non-financial firms from buying state-chartered banks.
11/07/2002	IDS Software Systems Inc	HPL Technologies Inc	HPL Technologies, Inc. today reported that the audit committee of the Company has initiated an investigation into financial and accounting irregularities involving revenue reported during prior periods. HPL also announced that, in light of the recent developments, it is unlikely that the Company will be able to complete the pending acquisition of IDS Software Systems.

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Date announcement	Target's name	Acquirer's name	Reason for withdrawn
29/08/2002	Bob Baker Auto Group	Asbury Automotive Group Inc	Asbury Automotive Group (NYSE: ABG), one of the largest automotive retailers and service companies in the U.S., today announced that it expects to restructure its previously announced acquisition of the Bob Baker Auto Group. Following Asbury's recently announced agreement to acquire the Bob Baker Auto Group, Asbury requested franchise purchase approval from each relevant manufacturer. Ford Motor Company recently informed Asbury that it does not intend to approve Asbury's pending acquisition of the Bob Baker Ford franchise, contending that Asbury has not complied with its contractual agreement with Ford Motor Company.
12/11/2002	DxCG Inc	I-trax Inc	DxCG terminated the merger agreement because the Company failed to satisfy certain conditions to closing, including third party financing for the cash portion of the purchase price.
07/05/2003	Donobi Inc	Reality Wireless Networks Inc	Reality Wireless Networks, Inc., has failed, inter alia, to satisfy the conditions precedent to the obligations set forth in the proposed definitive agreement and has not cured these breaches. Therefore, Donobi, Inc., has decided to terminate the agreement for Reality Networks, Inc.'s, failure to satisfy the conditions.
26/06/2003	Kiboga Systems Inc	DataLogic International Inc	The Company had attempted to expand via merger and acquisition but was not able to achieve the desired results. The Company had incurred sizable expenses, as paid in capital, for the M&A effort without adding any significant net gain to the bottom line in fiscal 2003. The majority of the expenses were in consulting and legal fees for market research, due diligence and legal representation.
06/02/2004	SunWest Communications Inc	USURF America Inc	Reogranization between USURF and SunWest.
16/03/2004	Argent LLC	MaxxZone.com Inc	As a result of due diligence concerns, MaxxZone has terminated its Letter of Intent to acquire Argent, LLC, enabling MaxxZone to enter into this Letter of Intent with the Target. Established more than 20 years ago, the Target is an international forwarding and logistic company based in Hong Kong and specializing in Sea and Air Freight.

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Date announcement	Target's name	Acquirer's name	Reason for withdrawn
19/04/2004	Apex Sight LLC	VoIP Inc	After extensive time delays and due diligence, Apex Sight LLC is withdrawing from the proposed merger. Henry Cooper, CEO, Apex Sight LLC stated, "After spending considerable time and expense, it was determined that the long term value for the shareholders of Apex Sight LLC would not recognize the potential returns on their investment by completing the merger.
18/05/2004	BioHorizons Implant Systems Inc	Encore Medical Corp	The two parties agreed to end the merger when the deadline passed late last week. Davis Henley, vice president of business development for Encore Medical says the deal was quashed, in part, because the Securities and Exchange Commission did not complete its evaluation of the deal by the beginning of September. Additionally, between the time Encore Medical entered into the agreement with BioHorizons, the Austin company acquired St. Paul, Minn.-based medical device company Empi Inc for $360 million, an acquisition that Henley calls an order of magnitude bigger than the BioHorizons deal. Both we and BioHorizons had some concerns about how that acquisition would impact our transaction with BioHorizons," Henley says. "The BioHorizons acquisition became less significant and less important for us."
10/01/2005	Aptus Corp	InsynQ Inc	In April 2005, this deal was rescinded by mutual agreement, and the 40 million shares of common stock were returned to us and we returned the 1,500 "MyBooks" licenses to Aptus Corp. This was done in anticipation of an asset purchase agreement to be executed on April 30, 2005, in which we purchased all the intellectual property rights and applications codes from Aptus Corp, which included the source code of MyBooks.
19/01/2005	Brazos Resources Inc	Opus Communities Inc	Further due diligence on the acquisition showed the cost for the property was higher than expected.

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Date announcement	Target's name	Acquirer's name	Reason for withdrawn
31/01/2005	Omni Oil	Gas Inc	Empiric Energy Inc & Empiric Energy Inc., Dallas, (Pink Sheets: EPRC) has terminated its letter of intent with Dallas-based independent Omni Oil & Gas Inc. Though an acquisition may still occur in the future, the companies have agreed it would not be beneficial for either company at this time.
18/05/2005	South Seas Data Inc	Nayna Networks Inc	Acquisitions may disrupt or otherwise have a negative impact on our business. We plan to use this as a strategy to grow our business. If we buy a company, then we could have difficulty in integrating that company's personnel and operations. In addition, the key personnel of the acquired company may decide not to work for us. An acquisition could also distract our key management and employees and increase our operating and other expenses. Furthermore, we may have to incur debt or issue equity securities to pay for any such future acquisitions, the issuance of which could be dilutive to our existing stockholders. Our common stock price is highly volatile and the current market for our common stock is limited.
06/07/2005	Hands On	GoAmerica Inc	The mergers will occur only if stated conditions are met, including the approval of the merger agreement and the mergers by the stockholders of VRS and SLS and the approval of the issuance of the GoAmerica shares to be issued in the mergers by the GoAmerica stockholders, and the absence of any material adverse effect in the businesses of GoAmerica or Hands On. Many of these conditions are outside the control of Hands On and GoAmerica. In addition, both parties also have the right to terminate the merger agreement in certain circumstances. Accordingly, there may be uncertainty regarding the completion of the mergers. This uncertainty may cause customers and suppliers to delay or defer decisions concerning Hands On or GoAmerica, which could negatively affect their respective businesses. Customers and suppliers who dealt with either GoAmerica or Hands On in the past may choose not to continue to do business with the combined company. Any delay or deferral of those decisions or changes in existing relationships could have a material adverse effect on the respective businesses of Hands On and GoAmerica, regardless of whether the mergers are ultimately completed.

Table 3.17 Announcement abnormal returns

This table reports OLS estimates for acquirers' 5-day cumulative abnormal returns around announcement dates of public and private target acquisitions. *Private* is equal to 1 if the target is a private firm and 0 if the target is a public firm. ΔPatent count represents the change in average new patents that an acquirer applies for post- versus pre-acquisitions. We split all firms into 4 quartiles. Q_1 is the reference category. All regressions include year and firm fixed effects. Standard errors at firm level are reported in parentheses. All variables are defined in Appendix 3.7.1 and winsorized at the 1th and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)
Constant	0.028**	0.035***	0.036***	0.035***
	(0.013)	(0.013)	(0.014)	(0.013)
Private	0.017***	0.008	0.008	0.008
	(0.003)	(0.006)	(0.006)	(0.006)
ΔPatent count Q_2	-0.004	-0.011	-0.011	-0.011
	(0.003)	(0.007)	(0.008)	(0.008)
ΔPatent count Q_3	-0.003	-0.005	-0.005	-0.006
	(0.003)	(0.008)	(0.008)	(0.008)
ΔPatent count Q_4	0.003	-0.015**	-0.015**	-0.015**
	(0.003)	(0.007)	(0.007)	(0.007)
Private x ΔPatent count Q_2		0.009	0.009	0.009
		(0.008)	(0.008)	(0.008)
Private x ΔPatent count Q_3		0.003	0.003	0.003
		(0.008)	(0.008)	(0.008)
Private x ΔPatent count Q_4		0.022***	0.022***	0.022***
		(0.008)	(0.008)	(0.008)
ΔROA			-0.004	
			(0.008)	
ΔHH Index				0.004
				(0.009)
Ln (market value)	-0.001**	-0.001**	-0.001**	-0.001**
	(0.000)	(0.000)	(0.000)	(0.000)
Cash only	0.008***	0.008***	0.008***	0.008***
	(0.003)	(0.003)	(0.003)	(0.003)
Hostile deal	0.005	0.004	0.003	0.004

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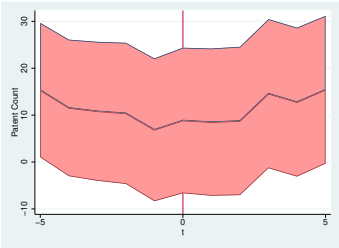
	(1)	(2)	(3)	(4)
	(0.022)	(0.022)	(0.022)	(0.022)
Horizontal deal	0.002	0.002	0.002	0.002
	(0.003)	(0.003)	(0.003)	(0.003)
Ln (R&D expenditure)	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Size	-0.002***	-0.002***	-0.002***	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
Leverage	-0.002	-0.002	-0.002	-0.002
	(0.007)	(0.007)	(0.007)	(0.007)
Net income	-0.020***	-0.020***	-0.021***	-0.020***
	(0.005)	(0.005)	(0.005)	(0.005)
HH Index	-0.003	-0.002	-0.002	
	(0.007)	(0.007)	(0.007)	
R^2	0.021	0.023	0.023	0.023

Figure 3.1 Evolution of coefficients from cross-sectional regressions for public target acquirers and their matched firms

This figure plots the evolution of coefficients from yearly cross-sectional regressions of Ln(1+innovation) on a dummy that indicates public target acquirers over the period from t_{-5} to t_{+5}. It plots the estimated dummy coefficients with 95% confidence intervals based on heteroscedasticity-robust standard error.



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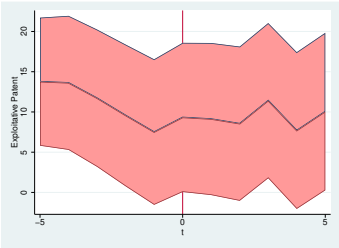

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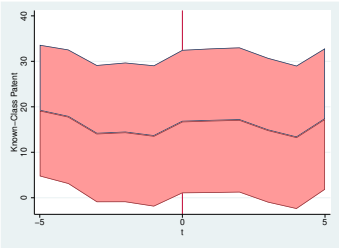

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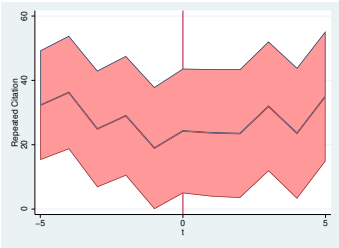

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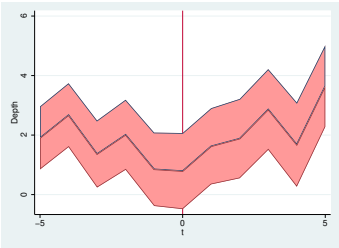

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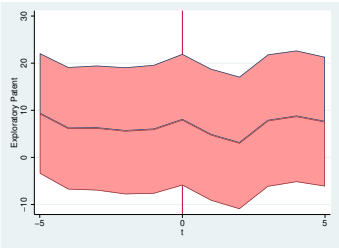

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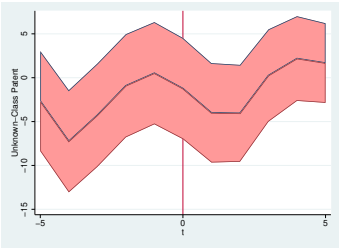

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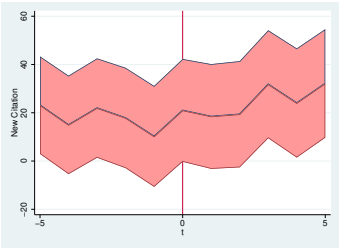

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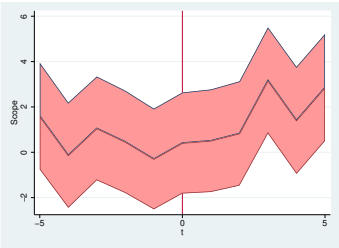
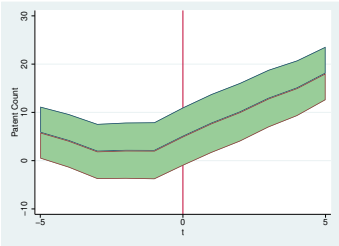


(i) Scope

Figure 3.2 Evolution of coefficients from cross-sectional regressions for private target acquirers and their matched firms

This figure plots the evolution of coefficients from yearly cross-sectional regressions of Ln(1+innovation) on a dummy that indicates private target acquirers over the period from t_{-5} to t_{+5}. It plots the estimated dummy coefficients with 95% confidence intervals based on heteroscedasticity-robust standard error.



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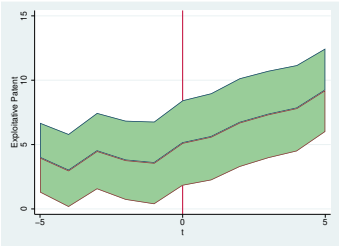

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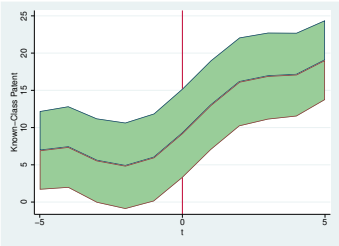

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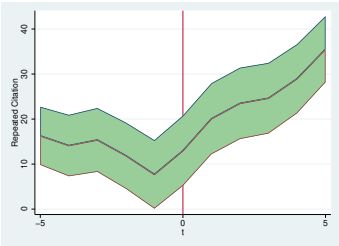

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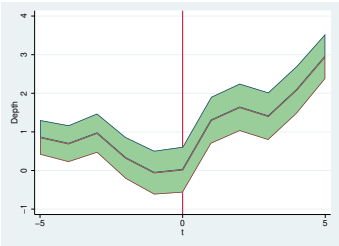

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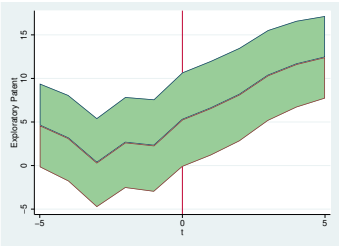

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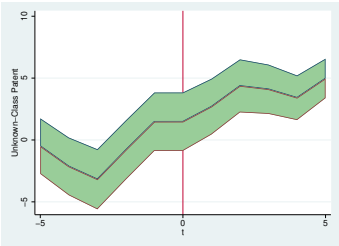

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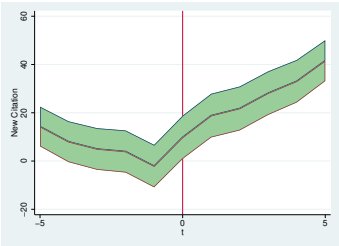

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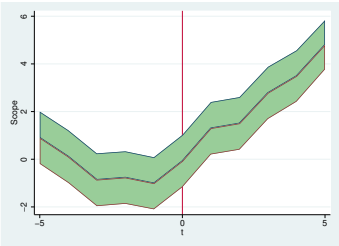

(i) Scope

Chapter 4

Leveraged Buyouts and Peers' Reaction: Empirical Evidence from Public-to-Private and Private-to-Private LBOs

4.1 Introduction

The rapid growth of private equity (PE) firms and buyout markets has attracted a considerable attention from researchers, policymakers, and the media. Indeed, the literature shows evidence on the improvement of outcomes at target firms following LBOs (Acharya et al., 2013; Gong and Wu, 2011; Lerner et al., 2011; Jensen, 1989).[1] Despite the existing evidence on post-deal improvements at target firms, little is known about how LBOs impact individual peers within the same industries.

[1] Jensen (1989) explains that the extensive use of leverage in LBO transactions tends to create high pressures on managers to not waste firms' money. Such pressures are likely to reduce firms' free cash flow problem. Acharya et al. (2013) show positive abnormal performance from transaction initiated by large private equity firms that is associated with improvement in sales and operating margin during private phase. Lerner et al. (2011) find that firms pursue more influential innovations in the years following private equity investments.

Bernstein et al. (2016) show that industries with at least one PE transaction in the past five years grow faster in terms of total production and employment and are less exposed to aggregate shocks. However, the focus on Bernstein et al. (2016) is on the aggregate industry performance rather than individual peers. Therefore, it is unclear if the effects are driven by the improvement at LBO targets or individual peers. Aldatmaz and Brown (2020) document that an increase in PE investment is associated with higher labor productivity, employment, profitability, and capital expenditures for publicly-listed peers. The analysis in Aldatmaz and Brown (2020), however, does not take into account private-to-private LBOs that occur within an industry. Private-to-private LBOs account for more than 80% of the total buyout transactions. Excluding private-to-private LBOs does not give an accurate representation of buyout activity in a given industry.

In this paper, I investigate to what extent public-to-private and private-to-private LBOs contribute in explaining spillover effects for individual peers. My analysis builds on the industrial organization and competitive strategy literature which predicts that the improvement in cost efficiency and product differentiation at target firms is likely to impact oligopolistic industry equilibrium through various channels. First, explore how public-to-private and private-to-private LBOs in a given industry impact individual peer's outcomes. Spillovers are likely to exist as firms compete and interact with each other and as knowledge is transferred trough employees or technologies (Blomström and Kokko, 1998). The existing evidence from the industrial organization literature shows that cost efficiencies, technological advancements, and productivity gains at some firms are likely to spill over other firms within the same industries.[2] Harford et al. (2016) study three plausible explanations on how LBOs impact the target's industry: (1) PE firms select into industries where real changes will occur regardless of whether LBOs take place; (2) LBOs tend to

[2]Smarzynska Javorcik (2004); Blomström and Kokko (1998); Bernstein and Nadiri (1989); Blomström (1986) are among the studies on the spillover effects from foreign multinational firms to domestic companies.

signal private industry-wide information about the target's industry; and (3) LBOs impact the competitive pressures of the target's industry, causing individual peers to undergo operational, governance, or strategic changes. Second, I investigate what are major channels to explain spillover effects. A related literature in Hedge Fund Activism (HFA) suggests three possible channels for product market spillovers, i.e, the nature of intervention, peer firms' response, and the type of the industry (Aslan and Kumar, 2016).

I use a sample of 294,483 firm-year observations which consists of 59,612 U.S. public and private firms that are available in S&P Capital IQ (CIQ) over the period between 1996 and 2017. To examine spillover effects of LBOs on peer firms, I combine public and private firms with a sample of public-to-private and private-to-private LBOs on CIQ from 1996 to 2017. Because my LBO sample includes private-to-private LBOs, incorporating private firms is important to have a better representation of an industry. A firm is classified as a peer (non-peer) if its industry is (not) targeted by by public-to-private and/or private-to-private LBOs in a given year.

Using difference-in-differences (DiD) methodology, I compare outcomes of individual peers versus non peers. I summarize the results in three following ways. First, the DiD coefficients show that, post-LBOs, peer firms experience lower profitability and market shares compare to non-LBO peers. These findings seem to suggest that LBOs create pressures within the industry which subsequently associated with adverse outcomes for individual peers. One plausible explanation is that target firms may be able to expand their scales and operate more efficiently post-LBOs. Indeed, Boucly et al. (2011) show that private-to-private LBOs are associated with a significant expansion of target firms. Such expansion by LBO targets could result in an increase in target's market shares which subsequently corresponds to a deterioration in profitability and market shares at peer firms. Second, I find that peer firms decrease their inventory turnover and increase operating expenses

post-LBOs, suggesting that peers operate less efficiently. Notably, an increase in operating expenses is not reflected in an increase in R&D expenditures or advertising expenses. This indicates that, post-LBOs, peer firms do not attempt to improve their innovation or product differentiation. Third, I document that peer firms have less savings in net working capital relative to non peer firms. The results give us an indication that peer firms do not invest their excess cash optimally in favor of maintaining liquidity, potentially due to higher pressures within their industry. To a large extent, my overall results tend to support competitive effect hypothesis (Harford et al., 2016). Due to professional expertise and skill of PE firms, LBOs have shown to impact target's operating performance, which subsequently increase competitive pressures for individual peers.

Overall, my findings contradict with the existing evidence in Bernstein et al. (2016) and Aldatmaz and Brown (2020), but consistent with Harford et al. (2016). Bernstein et al. (2016) study the relationship between PE investments and the growth rates of total production, employment, and capital formation across 20 countries in 26 countries. The focus in Bernstein et al. (2016) is in country-industry-year, whereas my study focuses on firm-year. Hence, the effects we observe in Bernstein et al. (2016) may be driven by the performance of LBO targets as they focus in the aggregate industry performance rather than in individual peers. Aldatmaz and Brown (2020) study the impact of public-to-private LBOs on labor productivity, employment, profitability, and capital expenditures at publicly listed peers in 19 industries across 52 countries. One reason for why my results are different from Aldatmaz and Brown (2020) is because their study focuses on worldwide PE buyouts which include developed and developing nations. In addition, they use different industry classifications, i.e., Industry Classification Benchmark (ICB) which has different level of aggregation with the four-digit Standard Industry Classification (SIC).[3] My results are consistent with Harford et al. (2016) where they use a sam-

[3]In the Table 4.12, I replicate Aslan and Kumar (2016) study by focusing on the impact of

ple of US public-to-private LBOs over the period 1991-2012 and they find evidence consistent with LBOs shocking the competitive environment of the target's industry and associated with a decrease in peer's profitability.

My next analysis attempts to shed lights on the channels for spillovers. How large the spillover effects of LBOs within an industry will depend on the nature of intervention, peer firms' response, and the type of the industry. Following Aslan and Kumar (2016), I investigate target specific, peer specific, and industry specific channels. The existing literature has shown that LBOs are associated with the improvement in target firm's operation, financial, and governance (Bernstein and Sheen, 2016; Acharya et al., 2013; Gong and Wu, 2011; Lerner et al., 2011). The improvement at target firm is likely to represent a significant competitive pressures on its industry. Target specific channel links post-LBO improvement at target firms to individual peers' outcomes. Next, Aslan and Kumar (2016) argue that when HFA peers compete on the basis of strategic complement against target improvements, negative spillover effects tend to be weaker if peers respond by improving their operating efficiency and product differentiation and they refer that as peer specific channel. I conjecture that when individual peers can improve their profitability margin, increase investment in capex, or improve their product differentiation, peers are able to mitigate the worst outcomes from post-LBO pressures. Lastly, the existing literature suggests that how much the spillover effects are realized by individual peers is likely depend on the characteristics of the industry (Aldatmaz and Brown, 2020). Industry specific channel addresses to what extent industry characteristics have an impact on how much spillovers are absorbed by peer firms.

I show that post-LBO improvement at target firms is associated with more adverse outcomes for peers. The results suggest that post-LBO increase in asset turnover at target firms is associated with a decrease in peers' profitability. I also find that the improvement in market shares at target firms corresponds to a larger

public-to-private LBOs on publicly listed peers. My results stand ground.

decrease in peers' market shares. To a large extent, these results are expected. As target firms are able to capture larger market shares post-LBOs, individual peers significantly lose their own market shares. The increase of asset turnover and market shares at targets do not have significant effects on peers' operating efficiency and net working capital.

Next, I find that individual peers that have initiated improvement in a similar way as target firms are able to mitigate the worse outcomes post-LBOs. As peer firms respond to LBO pressures by improving their profitability margin, capex, or product differentiation, the overall negative spillover effects disappear. In particular, I show that individual peers that are able to improve their operating and/or EBITDA margins post-LBOs can increase their overall profitability and market shares. Notably, the improvement in EBITDA margin is most beneficial to peer firms in protecting their market shares. My findings are, to some extent, consistent with Aslan and Kumar (2016).[4]

I then document that industry characteristics play a significant role in explaining spillover effects within individual peers. I use industry concentration and capital intensity to study industry specific channels. I show that the adverse spillover effects of industry LBO are stronger in more concentrated industries. A higher industry concentration is associated with a further decrease in peers' profitability and market shares. The results are somewhat surprising as more concentrated industries experience more adverse outcomes. The existing literature suggests that managerial slack is a major issue in concentrated industries (Giroud and Mueller, 2010), therefore, the present of LBOs is likely to increase competitions and subsequently mitigates managerial slacks. One plausible explanation for my results could be that in more concentrated industries, firms face issue of managerial entrenchment or private benefit of controls. The decrease in managerial slacks may not be able to curb

[4]Their study shows that peers that are able to achieve above average improvement in their own productivity, cost and capital allocation efficiency, and product differentiation suffer lower reductions in markup and market shares.

problems that arise from entrench managers. Hence, I find that negative spillover effects are more severe in highly concentrated industries. I further find that, on average, a higher industry capital intensity is associated with a smaller decrease in profitability and market shares. A highly capital intensive industry requires a large investment in capital expenditures which reflects a high entry barrier. On the one hand, targets may increase their investment in capital expenditures following LBOs which subsequently brings pressures for individual peers. But on the other hand, a higher industry entry barrier may protect peers from a threat of new entrants. As a result, peer firms in highly capital intensive industries suffer less deterioration in their profitability and operating efficiency.

So far, the results show significant negative spillover effects of industry LBOs. This analysis does not establish causality, however, because it could be the case that the selection of targets by PE firms is not random. I cannot address this concern in a definite manner in the absence of instrumental variables. Following procedures in Aslan and Kumar (2016), I run purged residuals regressions to address the possibility of spurious correlations in my results. The purged residuals regressions are done by a two-stage regression. In the 1st stage, I obtained residuals of peers' outcomes that are purged of the effects of firm's sales growth and time-varying industry shocks.[5] I use sales growth because PE may target firms whose sales are either in a growing or declining phase. Hence, the residuals from the 1st stage will capture portion of outcome variables that is orthogonal to firm's sales growth and industry effects. In the 2nd stage, I regress the purged residuals on a time dummy for post-LBOs and a set of control variables. Using purged residuals regressions, I show that, overall, the results stand ground. Post-LBOs, peer firms experience lower profitability, decrease in market shares, and lower operating efficiency. The effects on net working capital are slightly weaker.

[5]Aslan and Kumar (2016) use Tobin's-Q to control for time-varying investment opportunities for peer firms. I do not use Tobin-s-Q in this analysis because the firm sample includes private firms. Therefore, I employ an alternative proxy using firm's sales growth.

I conclude the analysis by investigating cumulative abnormal returns (CARs) for the peer and non-peer firms around the announcement of public-to-private LBOs within their industries. I exclude the announcement of private-to-private LBOs because stock market data is available only for public firms. I show that public-to-private LBOs are positively associated with CARs which suggests that, on average, shareholders of peer firms react positively to the LBO news. When I take into account industry competitions, however, I find that peer firms that operate in less competitive industries experience significantly lower returns. The results seem to indicate that market is able to sort out peers to those that operate in less competitive industries that potentially face managerial entrenchment. This finding also supports the main finding in the DiD specification. Finally, I document that CARs are significantly lower for peers with lower entry barriers.

This paper contributes to two streams in the literature. First, this study adds to the literature that examines how peers' outcomes change following LBO deals. The existing literature on the relationship between LBO deals and post-LBO outcomes mostly focuses on targets' outcomes (Acharya et al., 2013; Lerner et al., 2011; Gong and Wu, 2011; Jensen, 1989). This paper aims to extend the analysis by examining externalities from LBO transactions in the individual peers. Bernstein et al. (2016) conclude that private equity investments are associated with aggregate growth on total production and employment in the industries. Instead of studying outcomes on the aggregate industry level, this paper focuses on the firm level outcomes. Aldatmaz and Brown (2020) show significant link between private equity investment and employment growth, productivity growth, and labor productivity growth within the industry of public firms across different countries. However, study by Aldatmaz and Brown (2020) ignores the present of private-to-private LBOs in a given industry. Harford et al. (2016) study three hypothesis to explain the impact of LBOs in target's industry and conclude that LBOs impact the competitive nature of target's industry and associated with a decrease in peers'

profitability. I contribute by explaining that the present of public-to-private and/or private-to-private LBOs within an industry is associated with adverse outcomes for individual peers. My findings contradict with the findings in Aldatmaz and Brown (2020) and Bernstein et al. (2016), but consistent with Harford et al. (2016).

Second, this paper explains the main channels for spillover effects in LBO industry. The industrial organization literature suggests three possible channels for product market spillovers post-activisim, i.e., the nature of intervention, peer firms' response, and the type of industry. Aslan and Kumar (2016) document that the spillover effects on peers' product market performance is commensurate with post-activism improvement in targets' productivity, cost and capital efficiency, and product differentiation. In this study, I show that the improvement in targets' profitability and market shares post-LBOs are associated with more adverse outcomes at peer firms. However, as peers are able to respond to LBO pressures by improving their operating and EBITDA margins and product differentiation, negative spillover effects disappear. Lastly, I document that industry characteristics play an important role in explaining spillover effects for individual peers. The findings suggest that the spillover effects on industry dynamics are most pronounced in industries with specific characteristics. The negative spillover effects are more severe in more concentrated industries, supporting the idea that concentrated industries may face issues of managerial entrenchment. In addition, I show that a higher industry capital intensity is associated with less severe outcomes for individual peers, supporting the idea a higher industry entry barrier may protect peers from a threat of new entrants post LBOs.

The remainder of the paper is organized as follows. Section 4.2 describes the data and descriptive statistics. Section 4.3 presents and discusses the results. Section 4.4 discusses the endogeneity test. Section 4.5 examines announcement effects of LBOs. Section 4.6 concludes.

4.2 Data and statistics

4.2.1 Data

I use Capital IQ database to construct a base sample of LBO targets. Bernstein et al. (2016) argue that the Capital IQ provides the most comprehensive database of worldwide PE transactions. The base sample contains all merger and acquisition (M&A) transactions that meet the following requirements: (a) the target firm is a U.S. stand-alone public or private firm; (b) the transaction is classified as a leveraged buyout, management buyout, or going private; (c) the deal is completed; and (d) the deal was announced between 1996 and 2017. Following the literature on the competitive effects of financial events (Lang and Stulz, 1992), I identify peer firms as all other firms in the same primary four-digit Standard Industry Classification (SIC) codes on Compustat. To avoid any selection bias, I follow Aslan and Kumar (2016) by including those firms that are future LBO targets. I then use two filters to allow meaningful analysis. First, I retain firm-years with positive revenues and total assets and those with available information on industry classifications (four-digit SIC Codes). Second, I require firms in my sample to have a complete data on revenues and total assets for at least 3 consecutive years.[6]

I include both public and private firms as my sample to have a better representation of an industry. Incorporating both public and private firms is also important because my base sample for LBO deals also includes private-to-private LBOs. Therefore, incorporating private firms in my analysis would give a better representation of an industry. I obtain financial and accounting data on public and private peers from Capital IQ over the period between 1996 and 2017. Capital IQ provides financial and accounting data on US private firms because of two reasons. First, a private firm must file an Exchange Act registration statement if it has more than $10 million of total assets and if the firm has a class of equity securities, for instance

[6]In unreported results, I perform an analysis without restricting the sample to have a complete data on revenues and total assets for at least 3 consecutive years and the results remain consistent.

common stocks, that is owned by 500 or more shareholders.[7] Such private firm is required to report the annual and quarterly reports as well as proxy statements. Second, if a private firm decides to list the securities on a U.S. exchange, the Securities Act of 1933 requires the firm to file a registration statement i.e., Form S-1 that contains basic financial information (Gao et al., 2018).

4.2.2 Variables

I investigate spillover effects of industry LBO on peer firms by focusing on profitability, market shares, operating efficiency, and savings net working capital. I use three proxies to measure profitability: operating income over total assets, return on assets (ROA), and cash flow from operations (CFO) over total assets. Operating efficiency is measured by inventory turnover and operating expenses over total assets. Savings in net working capital is measured by the ratio between total current assets over current liabilities (NWC), current assets over total assets, cash over total assets, and current liabilities over total assets.

In order to study how spillover effects are absorbed by individual peers, I explore three major channels of product market spillovers, i.e., target specific channel, peer specific channel, and industry specific channel. I argue that improvements in targets' profitability and market shares are likely to give high pressures for peers and subsequently associated with more adverse outcomes. Measuring targets' improvement post-LBOs proves to be challenging due to limited availability of targets' financial data. Therefore, I rely on the very basic information in targets' financial data, i.e., total revenues and total assets. The easiest way to measure target specific channel in this study is by using changes in total asset turnover and market shares. Next, I explore peers' specific channel by incorporating targets' improvements in operating margin, EBITDA margin, capital expenditures, and advertising expenses post-LBOs. Aslan and Kumar (2016) show that negative spillover effects

[7] Gao et al. (2018) use Capital IQ in their study and argue that they are able to cover 93% of private firms in their sample meet this first criterion.

of hedge fund activism (HFA) are likely to be weaker (less negative) if peers' respond is by competing on the basis of strategic complements, i.e., by improving their own productivity, cost and capital allocation efficiency, and product differentiation. Finally, I investigate to what extent industry characteristics play significant roles in explaining spillover effects within LBO industry. Aldatmaz and Brown (2020) argue that how large these spillover effects are absorbed by the peer firms should depend on the characteristics of the industry. I use industry concentration and industry capital intensity to study industry specific channel. Industry concentration is likely to play a key role in explaining spillover effects. Indeed, the existing literature argues that managerial slack is the most important issue for concentrated industries (Giroud and Mueller, 2010). Managers in concentrated industries are less pressured to improve company's performances. Giroud and Mueller (2010) explain that policy efforts aiming to improve corporate governance are more beneficial for less competitive industries. I use industry operating margin, Lerner Index, and HH Index as proxies for industry concentration. Industry operating margin is computed as median value of operating income over total sales in a given industry. Lerner Index is computed as median value of the ratio of EBITDA over total sales within an industry.[8] The higher the value of the Lerner Index, the more likely that firms operate in less competitive environment. HHI is calculated as the sum of squared market shares of firms within a given industry. A high industry capital intensity may explain a high entry barrier as firms, on average, put a significant amount of investment in capital expenditures which could potentially hinder new entrants to the industry. Industry capital intensity is measured by average capital expenditures for a given four-digit SIC codes in a given year.

[8]Lerner Index measures the extent to which firms can set prices over marginal cost (Giroud and Mueller, 2010).

4.2.3 Statistics

Table 4.1 presents total number of industries and the division of private-to-private and public-to-private LBOs, aggregated within two-digit SIC bracket over the sample period. An industry is defined by the four-digit SIC codes. Column 1 shows total number of industries; while columns 5, 7, and 9 show total number of industries for any LBOs, private-to-private LBOs, and public-to-private LBOs, respectively. The preponderant majority of the industries - nearly 88% - are in manufacturing, services, wholesale and retail trade, and financial sectors. The representation of the other sector, except transportation, is at least 2%. Over the sample period, nearly 78% of total industries experience an LBO, in particular, private-to-private LBOs. By contrast, public-to-private LBOs take place only in 20% of the total industries. Some industries experience both private-to-private and public-to-private LBOs in a given year.[9] Most of private-to-private and public-to-private LBOs dominate manufacturing, wholesale and retail trade, and service sectors. Either public-to-private or private-to-private LBOs rarely happen in public administration sector. For around 1.5 to 3.5% of private-to-private LBOs take place within all other sectors. A slightly large percentage of public-to-private LBOs, nearly 18%, happen in financial sector. The other sectors, other than agriculture and public administration, experience public-to-private LBOs for at least 2.3%.

To complement the figure shown in Table 4.1, Table 4.2 shows the distribution of LBO deals across industries. Columns 3, 5, and 7 present the distribution of any LBOs, private-to-private LBOs, and public-to-private LBOs across industries, respectively. Consistent with the results shown in Table 4.1, the majority of private-to-private LBOs take place within manufacturing, wholesale and retail trades, and and service sectors. In particular, 36% of total private-to-private LBOs are happening in the manufacturing sector, nearly 30% in service sector, 8.4% in retail trade, and 10.7% in wholesale trade. Less than 1% of total private-to-private

[9] In unreported results, I find that 12.5% of the total industries experienced both types of LBOs

LBOs take place in agriculture and public administration sector. A similar trend emerges for public-to-private LBOs. The present of public-to-private LBOs in manufacturing sector is the largest - nearly 34%. 26% of total public-to-private LBOs are happening in service sector, followed by financial, retail trade, and mining sectors for around 8%. Lastly, only 0.34% of total public-to-private LBOs target the agriculture sector.

Table 4.3 shows the distribution of LBO deals across years. Columns 3, 5, and 7 show total number of any LBOs, private-to-private LBOs, and public-to-private LBOs, respectively. The acceleration of private-to-private LBO activities starts from the beginning of the sample period with a slight drop in 2001 and reaching a peak around 8% between 2006 and 2007. Private-to-private LBOs decline in 2009 and start to increase in 2010. In 2012, the number of private-to-private LBOs climb to 5.5% and decrease from 2015 onwards. In a similar vein, total number of public-to-private LBOs are relatively high in the late 1990s and start to decrease in the early 2000s. The number of public to private LBOs also reach a peak between 2006 and 2007. Public-to-private LBOs start to decline from 2008 and climb to 5.7% in 2013. From 2014 onwards, total number of public-to-private LBOs are relatively moderate, ranging between 1.7% and 3.8%.[10] The decline in the number of private-to-private and public-to-private appears to happen during economic downturn.

Table 4.4 shows number of peers within the industries. For each LBO and non-LBO industries, I show yearly total and average peers across four-digit SIC codes. Total and average number of LBO peers are shown in columns 2 and 3, respectively. Total and average number of non-LBO peers are shown in columns 4 and 5, respectively. Over the sample period, total and average number of LBO peers exceed that of non-LBO peers. Particularly, the average number of LBO peers is more than twice of the average number of non-LBO peers. As there are more

[10]The pattern is consistent with Strömberg (2008) who shows that the majority of LBO deals take place between 2004 and 2005 with private to private LBOs represent the largest number of LBO transactions.

industries experiencing LBOs, as shown in Table 4.2 and Table 4.3, the number of LBO peers should be larger than non-LBO peers.

Table 2.2 shows mean, standard deviation, median and first and second quartile for all LBO peers, outcome variables, spillover channels, and control variables. 61% of firms-years in my sample are LBO peers which supports the figure shown in Table 4.4. More than 80% of total LBO peers are peers of private-to-private LBOs. Due to a significant number of peers of private-to-private LBOs, I argue that it is appropriate to include private-to-private LBOs in this study. Note that these are overall averages for the full (unbalanced) panel. I use firm size, leverage, cash holdings, ROA, industry sales growth, and HH Index as control variables.

4.3 Spillover effects of LBOs

4.3.1 Baseline results

To test the impact of LBOs (public-to-private and/or private-to-private LBOs) on individual peers, I use the following baseline regression model. For each LBO firm k in industry m (at the four digit level), let i be a peer firm (i.e., firms in the same industry as LBO targets). I denote $y_{i,k,t}$ as the outcomes for firm i in year t. I estimate the following regression equation:

$$y_{i,k,t} = \alpha + \beta PostLBO_{k,t} + \delta X_{i,k,t-1} + \psi_m + \xi_t + \eta_{i,k,t} \tag{4.1}$$

Where $X_{i,k,t-1}$ is vector of lagged control variables for firm outcomes. $PostLBO$ is a dummy variable for post-LBO periods. $PostLBO$ is equal to 1 if the firm-year $_{i,t}$ is within [t+1, t+3] years of an LBO event for target k - which is a *pseudo-event* year for peer firm i. ψ_m and ξ_t are industry and year fixed effects, respectively. Following Aslan and Kumar (2016), the inclusion of these fixed effects ensures that my DiD estimates are robust to industry-and time-specific unobservable variables

that might otherwise confound my analysis. The coefficient β is a measure of the average spillover effects of LBO events on individual peers in the three years following the LBOs, after controlling for the observable firm characteristics and unobservable industry- and time effects.

Table 4.6 shows the results for the equation 4.1 for all 12 measures of firm outcomes. I present the results for profitability in columns 1 until 3, market shares in column 4, operating efficiency in columns 5 until 8, and savings in net working capital in columns 9 until 12. The DiD coefficients show that LBOs are associate with a decrease in profitability, market shares, operating efficiency, and savings in net working capital.

I document that peer firms suffer from a decrease of 0.005 and 0.003 in operating income and ROA relative to non-peer firms post LBO deals. The decrease in operating income and ROA is mostly due to decreases in operating margin and asset turnover. This finding indicates that, post-LBOs, peer firms experience lower operating profits and, at the same time, lower efficiency in generating revenues. Given that the unconditional mean level of operating income and ROA are equal to 0.125 and 0.118, respectively, these effects are also significant in terms of economic magnitude. The results appear to suggest that industries where LBOs happen are likely to create more pressures for peer firms. Consistent with the results on operating income and ROA, I also find that, post LBO, peer firms suffer from a decrease in cash flows from operation. The result on market shares shows that peer firms experience a decrease of 0.004 in their market shares compare to non-peers after LBOs. The economic significant for this DID effects is 8% of the unconditional mean value of firms' market shares.

Turning to the other outcomes, on average, LBOs pressure peer firms to increase their operating expenses. Notably, an increase in operating expenses is not reflected in an increase in R&D expenditures or advertising expenses. This suggests that, post-LBOs, peer firms do not seem to improve their innovation and product

differentiation.[11] In terms of net working capital, I find that, post LBOs, peer firms have less savings in net working capital relative to no peer firms as they increase their cash holdings and decrease their current liabilities. To some extent, the results give us an indication that peer firms do not invest their excess cash optimally in favor of maintaining their liquidity.

Overall, my results tend to support competitive effect hypothesis (Harford et al., 2016). Due to professional expertise and skill of PE firms, LBOs have shown to improve target's operating and financial performance, which increase competitive pressures within the industries and subsequently associated with adverse outcomes among individual peers.

4.3.2 Target-specific channels

Table 4.7 analyzes the role of target-specific factors on post-LBO effects on peer firms for all measures of outcomes. I argue that the improvement at target firm is likely to represent significant competitive pressures on its industry. In other words, post-LBO improvement at target firms is positively associated with a further deterioration in peers' outcomes. I measure the improvement at target firms by changes in asset turnover (i.e., revenues over total assets) and market shares.[12]. The results show that an increase in asset turnover at target firms has significant effects on peers' operating income and ROA. Increasing asset turnover by 1 standard deviation lowers peers' operating income and ROA by 0.7% and 0.6%, respectively, holding everything else constant. As shown in Table 4.4, the average number of LBO peers in LBO industries is 29.14. Therefore, the average effects of targets' asset turnover for industry peers is 0.20 and 0.17 for the operating income and ROA, respectively. The effect of target's improvement in asset turnover on peers' operating cash flow is weaker. Next, I find that improvement in targets' market

[11] Note that the existing literature uses advertising expense as a proxy for product differentiation (Bagwell, 2007; Haan and Moraga-González, 2011).

[12] A comprehensive financial data for target firms after LBOs are not widely available. As a result, I measure the improvement of target firm post-LBOs by using revenue and market share

shares has a negative impact on targets' own market shares. To a large extent, this result is expected. As target firms are able to capture larger market shares post-LBOs, peer firms significantly lose their market shares. Increasing market share of target firms by one standard deviation, ceteris paribus, lower peers' market share by 0.2%. More importantly, the average effect of the improvement in targets' market shares on industry peers' market shares is 0.06. This suggests that an increase in target's market shares by one standard deviation is associated with a reduction of 0.06 in market shares for industry peers. The overall effects seem to be consistent with the decrease in peers' operating income and ROA. As industry peers suffer from a decrease of 0.20 and 0.17 in operating income and ROA, respectively, their overall market shares are lower by 0.06. I further find that the improvement in asset turnover and market share at target firms is associated with a weaker effect on peers' operating expense and net working capital. Lastly, I show that the improvement at target firms do not have any significant effects on peers' operating expense and NWC. This could, in part, be because of no direct correlation between targets' improvement and peers' operating costs and net working capital. Overall, the results give us a strong indication that, post-LBO, target firms are be able to improve their profitability and market shares which associated with more adverse outcomes at peer firms.

4.3.3 Peer-specific channels

This analysis aims to study whether negative spillover effects are weaker when individual peers initiate improvement in profitability margin, capital expenditures, and product differentiation. In Table 4.8, I find that as peer firms respond to LBO pressures by initiating improvement in operating and EBITDA margins, capital expenditures, and advertising expense, they are able to overcome the adverse effects of industry LBOs. I document that peer firms that raise their post-LBO operating margin by one standard deviation increase their operating income and ROA by

1.5% and 1.3%, respectively. I also find significant effects of EBITDA margin on peers' operating income, ROA, CFO, and market shares. Most importantly, the improvement in EBITDA margin is most beneficial to peer firms in protecting their market shares. Note that peer firms in these regressions are all peers within industry LBOs. The results seem to indicate that some peers that are able to improve their efficiency, as reflected by operating and EBITDA margin, appear to increase their overall profitability. While the results are somewhat contradictive from Table 4.7, my propose explanation is that for peers that have the capacity to generate revenue or operating profit more efficiently, they are able to overcome LBO pressures and improve their profitability and market shares.

In addition to operating and EBITDA margins, I find that an increase in capital expenditures and advertising expenses at peer firms are associated with an improvement in peers' profitability. An increase in capital expenditures reflects an increase investment in fixed assets, which could subsequently result in an increase total revenues. Similarly, an increase in advertising expenses suggests that peer firms improve their product differentiation. As peers are able to improve their product differentiation, they may be able to increase their revenues which subsequently increase their overall profitability. Turning to the other outcomes, an increase in capital expenditures is associated with a higher saving in net working capital and a decrease in cash holdings. Overall, the results support the view that peer firms that have initiated improvements, in a similar way as target firms, tend to be able to able to mount more timely and do not actually suffer from negative spillover effects post LBOs.

4.3.4 Industry-specific channels

My evidence so far suggests that LBOs are associated with negative spillover effects for individual peers. How much these spillover effects are absorbed by the peer firms is likely depend on the characteristics of the industry Aldatmaz and Brown

(2020). In this section, I exploit the cross-section of industries to investigate where the spillovers from PE-backed companies are most pronounced.

First, I study the level of competition or concentration within an industry. Giroud and Mueller (2010) document that firms in less competitive industries experience a significant drop in operating performance after the passage of business combination law. Business combination law is introduced to reduce the threat of hostile takeovers. Reducing the threat from hostile takeovers is likely to weaken firms' corporate governance and increase the opportunity for managerial slacks (Giroud and Mueller, 2010). The existing literature suggests that managerial slack is an important issue in less competitive industries. As described in Giroud and Mueller (2010), managers in less competitive industries tend to enjoy a quiet life. In contrast, managers in more competitive industries have to work under constant pressures to improve firms' performances. To the extent that LBOs are likely to create higher pressures and increase competitions for individual peers, I expect that the deterioration in outcomes is less severe in less competitive industries. I measure industry competition by using industry operating margin, Lerner Index, and HH Index [13]. I show that the adverse spillover effects of industry LBO are stronger in more concentrated industries. The economic significant is that the increase in one standard deviation in Lerner Index is associated with a decrease of 1.5% and 1.2% in operating income and ROA, respectively. I also find that the effect of HH Index is particularly significant on market shares. An increase in 1 standard deviation in HH index is associated with a further decrease of 1.1% in peers' market shares. The results are somewhat surprising. One potential explanation for my results could be that, in more concentrated industries, firms face issues of managerial entrenchment or private benefit of control. The decrease in managerial slacks may not be able to curb problems that arise from entrench managers. Therefore, I see that negative

[13]The firms in my sample consist of both public and private firms whose financial data are available in CIQ. As the coverage of private firms are not very high, using HH Index to measure industry competition may not be an ideal approach. Therefore, I incorporate industry operating margin and Lerner Index as additional measure for industry competition

spillover effects are more severe in highly concentrated industries. The effects of these industry specific measures are slightly weaker on the operating expenses and net working capital.

Second, I explore whether industry capital intensity has an impact on peers' outcomes post-LBOs. A highly capital intensive industry is characterized by high investments in capital expenditures. I show that, on average, peer firms in highly capital intensive industries have much lower reduction in profitability and market shares. For instance, an increase in 1 standard deviation in industry capital intensity is associated with an increase of 0.4% and 0.3% in peers' operating income and ROA, respectively. A higher industry capital intensity reflects higher industry entry barrier. On the one hand, targets may increase their investment in capital expenditures following LBOs which subsequently brings pressures for individual peers. But on the other hand, a higher industry entry barrier may protect peers from a threat of new entrants. As a results, peer firms in highly capital intensive industries suffer less reduction in their profitability and operating efficiency.

Overall, the findings in this section indicate that the spillover effects on industry dynamics are most pronounced in industries with specific characteristics. The negative spillover effects on profitability, operating efficiency, and market shares are more severe in less competitive industry, which potentially explain the issues of managerial entrenchment or private benefit of control. In addition, the adverse impacts of industry LBO are lower in highly capital intensive industries. To a large extent, the results suggest that peer firms in highly capital intensive industries have weaker pressures as they are protected by the threats of new entrants.

4.4 Endogeneity tests

So far, I document significant negative spillover effects of individual peers. However, my analysis may not establish causality because the selection of LBO targets by PE

firms is not random. It could also be the case that these results are driven by reverse causality, i.e., PE firms may select to invest in industries that are worse performing. Indeed, Aslan and Kumar (2016) highlight that the most important skill of hedge funds is identifying future targets that potentially have higher likelihood of superior competitive performance in response to underlying industry shocks within their industries. In a similar vein, it may be the case that PE firms have strong skills to identify targets that are likely to perform better relative to their peers within an industry that is declining. For instance, some firms in the industries where sales growth is in decline may have already initiated improvement in their cost efficiency or product differentiation. Even in the absence of LBOs, these firms are likely to give higher pressures for individual peers. Hence, instead of identifying causative spillover effects of LBOs, it is possible that my results reflect a differential sensitivity to underlying common industry shocks by target and peer firms that are observed through strategic target selection by PE firms.

It is challenging to address this concern in a definite manner in the absence of instrumental variables. Following procedures in Aslan and Kumar (2016), I run purged residuals regressions to address the possibility of spurious correlations in my results. The purged residuals regressions are done by a two stage regression. In the 1st stage, I obtained residuals of peers' outcomes that are purged of the effects of firm's sales growth and time-varying industry shocks. Note that Aslan and Kumar (2016) use Tobin's-Q to control for time-varying investment opportunities for HFA peers. I do not use Tobin-s-Q in this analysis because the firm sample includes private firms. I use an alternative proxy using firm's sales growth because PE may target firms whose sales are either in a growing or declining phase. In addition, existing literature uses sales growth as a measure of investment opportunity especially when we cannot observe market value of private firms (Asker et al., 2015). In the 2nd stage, I regress the purged residuals on a time dummy for post-LBOs and a set of control variables. I further include industry-by-year fixed effects to control for

industry-and time-specific unobservable variables. For each LBO target k in industry m (at the four-digit SIC codes), I first run a regression on outcome of peer firms i using industry by-year-fixed effects and a vector of control variables.

$$y_{i,k,t} = \alpha + \delta X_{i,k,t-1} + \psi_m + \xi_t + \eta_{i,k,t} \tag{4.2}$$

I use the same control variables as in the previous specifications (Ln(Total Assets), Leverage, Cash Holding, ROA, Ind. Sales Growth, and HH Index) and I add sales growth at time t for firm i. The residuals $\eta_{i,k,t}$ captures the portion of outcome variable that is orthogonal to firm's sales growth and industry effects (Aslan and Kumar, 2016). In the 2nd stage, I then estimate the following equation:

$$\eta_{i,k,t} = \alpha + \beta PostLBO_{k,t} + \upsilon_{i,k,t}, \tag{4.3}$$

where $PostLBO_{k,t}$ is equal to 1 if the firm-year $_{i,t}$ is within [t+1, t+3] years of the LBO event for target k.

The two-stage regression is designed to set a performance benchmark for peer firms, i.e., their performance in response to firm's sales growth and industry trends, in order to evaluate spillover effects of LBOs on target firms. Using purge residuals regressions, most of my results are consistent with my main DiD specifications. I show, in Table 4.10, that industry LBOs are associated with significant adverse effects on peers' profitability, market shares, and operational efficiency. The effects on net working capital are generally insignificant except for cash holding. Ceteris paribus, peer firms experience a decrease of 0.003 and 0.005 in ROA and market shares 3 years after the event compare to non-peer firms.

4.5 Announcement effects of LBOs

A direct measure of the expected wealth effects of LBOs is stock price reaction of peer firms around LBO announcements. I conduct an event study to investigate CARs for the peer and non-peer firms around the announcement of public-to-private LBOs. I exclude the announcement of private-to-private LBOs because stock market data is available only for public firms. Including private-to-private LBOs is slightly less relevant. I choose a short [-2,+2] announcement window to avoid the noise in longer windows. Table 4.11 regresses firm 5-day cumulative abnormal return around announcement of public-to-private LBOs, adjusted by value-weighted market index return, on a dummy of peer firm, industry characteristics, and a set of control variables following LBO literature.[14]

In columns 1 & 2, I show that public-to-private LBOs are positively associated with CARs which suggests that, on average, shareholders of peer firms react positively to the LBO news. Economically, the announcement of public-to-private LBOs is associated to an increase of around 0.1-0.2% of abnormal returns over the period between two days prior to and two days after the announcement date. The results are somewhat surprising, but one possible explanation could be because of the exclusion of private-to-private LBOs in CAR's analysis. Columns 3 to 5 show the regression results when I take into account industry concentrations that are measured by industry operating margin, Lerner Index, and HH Index, respectively. I add interaction terms between LBO peers and high industry concentration dummies. The results suggest that peer firms that operate in less competitive industries experience significantly lower returns. By adding interaction terms between LBO peers and high industry concentration dummies, I assume that market is able to sort out peers to those that operate in less competitive industries that potentially face managerial entrenchment. The results, supporting the findings from DiD regres-

[14] As robustness checks, I perform an analysis using a longer term window, i.e., [-5,+5] and the results remain consistent.

sions, show that industry with lower competitions are associated with significantly lower returns. It may also be the case that in less competitive industries, the improvement of LBO targets will have detrimental impact on peer firms. For instance, LBO targets may be able to capture more market shares post-deal and, hence, peer firms suffer from a reduction in their market shares. Hence, peers in less competitive industries are less likely able to cope with the pressures from LBO targets and, therefore, markets react more negatively. The last column adds an analysis on the industry entry barrier as measured by industry capital intensity. I find that a lower entry barrier is associated with lower abnormal returns for the shareholders of LBO peers. Lower entry barriers strengthen pressures from LBOs as well as increase threats from new entrants and, as a result, market react more unfavorably.

4.6 Conclusion

This paper studies how LBOs impact individual peers within an industry. The existing literature finds some evidence on the improvement in the peers' outcomes following LBOs. However, the literature does not explore the extent to which LBOs can be attributed to the improvement in individual peer's outcomes. In addition, the literature tends to exclude the present of private-to-private LBOs in the analysis. In this paper, I study whether public-to-private and/or private-to-private LBOs contribute in explaining spillover effects within individual peers and what are the major channels to explain these spillover effects. Using deal-level panel data of the U.S. firms from 1996 until 2017, I show a significant association between LBOs and the changes in outcomes of individual peers. The DiD coefficients show that, post-LBOs, peer firms experience lower profitability, market shares, and operating efficiency suggesting that industry LBOs are likely to create more pressures for peer firms and subsequently associated with adverse peers' outcomes. I also find that peer firms have less savings in net working capital relative to no peer firms, post-

LBOs. To a large extent, the results give us an indication that peer firms do not invest their excess cash optimally in favor of maintaining their liquidity. My overall results tend to support competitive effect hypothesis (Harford et al., 2016). Due to professional expertise and skill of PE firms, LBOs have shown to impact target's operating performance, which subsequently increase competitive pressures within individual peers.

My next analysis attempts to shed lights on the channels for spillovers. I study three major channels to explain these spillover effects namely target specific, peer specific, and industry specific channels. I show that post-LBO improvement at target firms are positively associated with further deteriorations in peers' outcomes. The results suggest that post-LBO increase on asset turnover at target firms has significant negative effects on peers' profitability. In addition, I also find that the improvement in targets' market shares has a negative impact on the peers' market shares. As target firms are able to capture larger market shares post-LBOs, peer firms significantly lose their market shares. Next, I show that when peer firms respond to LBO pressures by improving their profitability margin, increase investments in capex, or improving their product differentiation, the adverse effects of industry LBOs disappear. In particular, I find that individual peers that have initiated an improvement in operating and/or EBITDA margins post-LBOs increase their overall profitability and market shares.

Further analysis shows that industry characteristics play significant role in explaining spillover effects within individual peers. I show that, on average, the adverse spillover effects of industry LBO are stronger in more concentrated industries. Peers in more concentrated industries suffer from further deterioration in profitability and market shares. One possible explanation is because more concentrated industries are associated with more entrench managers. The decrease in managerial slacks may not be able to curb problems that arise from entrench managers. I then document that, on average, peer firms in industries with higher capital intensity

have lower reduction profitability and operating efficiency. A highly capital intensive industry requirers a large investment in capital expenditures which reflects a high entry barrier. On the one hand, targets may increase their investment in capital expenditures following LBOs which subsequently brings pressures for individual peers. But on the other hand, a higher industry entry barrier may protect peers from a threat of new entrants. As a results, peer firms in highly capital intensive industries suffer less reduction in their profitability and operating efficiency.

Finally, I conclude my analysis by studying market reactions to the announcement of public-to-private LBOs. I show that public-to-private LBOs are positively associated with higher CARs which suggests that, on average, shareholders react positively to the announcement of LBOs within the industries. However, when I take into account industry competitions, the results suggest that peer firms that operate in less competitive industries experience significantly lower returns. To a large extent, the results suggest that market is able to sort out peers to those that operate in less competitive industries that potentially face managerial entrenchment. Also, I document that the CARs are significantly lower for peers that operate in industries with lower entry barriers, suggesting that lower entry barrier strengthens competitive pressures from LBOs on peer firms. As a result, market react more unfavorably.

4.7 Appendix

4.7.1 Variable Definition

Variable	Definition	Source
Main variables:		
LBO	A dummy variable equal to one if a public-to-private or private-to-private LBO takes place in a given industry and zero otherwise.	Capital IQ
Priv-to-Priv LBO	A dummy variable equal to one if a private-to-private LBO takes place in a given industry and zero otherwise.	Capital IQ
Pub-to-Priv LBO	A dummy variable equal to one if a public-to-private LBO takes place in a given industry and zero otherwise.	Capital IQ
Operating Income	Operating income scaled by total assets.	Capital IQ
ROA	EBITDA income scaled by total assets.	Capital IQ
CFO	Cash flow from operations scaled by total assets.	Capital IQ
Inventory Turnover	COGS scaled by inventories.	Capital IQ
Market Shares	A firm's sales over total sales in the same four-digit SIC industry.	
Operating Expenses	Operating expenses scaled by total assets.	Capital IQ
R&D Expenditures	R&D expenditures scaled by total assets.	Capital IQ
Advertising Expenses	Advertising expenses scaled by total assets.	Capital IQ
Net Working Capital	Current assets over current liabilities.	Capital IQ
Current Assets	Current assets over total assets.	Capital IQ
Current Liabilities	Current liabilities over total assets.	Capital IQ
ΔAsset Turnover^{T}	The change in revenue over assets for target firms between the year before LBO announcement (LBO-1) and time t	Capital IQ
ΔMarket Shares^{T}	The change in market shares for target firms between the year before LBO announcement (LBO-1) and time t	Capital IQ
ΔOperating Margin^{P}	The change in operating margin for peer firms between the year before LBO announcement (LBO-1) and time t	Capital IQ
ΔEBITDA Margin^{P}	The change in EBITDA margin for peer firms between the year before LBO announcement (LBO-1) and time t	Capital IQ
ΔCapex^{P}	The change in capital expenditures for peer firms between the year before LBO announcement (LBO-1) and time t	Capital IQ
ΔAdvertising Expenses^{P}	The change in advertising expenses for peer firms between the year before LBO announcement (LBO-1) and time t	Capital IQ

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Variable	Definition	Source
Ind. Operating Margin	Median operating margin over sales in a given four-digit SIC industry	Capital IQ
Lerner Index	Median EBITDA over sales in a given four-digit SIC industry	Capital IQ
HH Index	A measure of industry concentration that calculated as a sum of squared market shares based on sales for all firms in the 4-digit SIC.	Capital IQ
Ind.Capital Intensity	Median capital expenditures over total assets in a given four-digit SIC industry	Capital IQ
Ln(Total Assets)	Natural logarithm of firm's total assets.	Capital IQ
Leverage	Total debt scaled by total assets.	Capital IQ
Cash Holdings	Total cash scaled by total assets.	Capital IQ
Ind. Sales Growth	The average sales growth in a given four-digit SIC industry	Capital IQ

Table 4.1 Total industries

This table presents total industries and the division between industries of private-to-private and public-to-private LBOs between 1996 and 2017. An industry is defined by the four-digit SIC codes. Columns 3 and 4 report total number of industries within the two-digit SIC bracket, columns 5 and 6 report total number of industries for any types of LBOs, columns 7 and 8 report total number of industries for private-to-private LBOs, columns 9 and 10 report total number of industries for public-to-private LBOs.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2-Digit SIC	Sector	#Industries		#LBO Industries		#Industry for Priv-to-Priv LBO		#Industry for Pub-to-Priv LB0	
01-09	Agriculture	49	4.50%	18	2.13%	18	2.15%	1	0.46%
10-14	Mining	25	2.30%	14	1.66%	13	1.55%	8	3.70%
15-17	Construction	30	2.76%	29	3.43%	29	3.46%	5	2.31%
20-39	Manufacturing	556	51.10%	428	50.65%	426	50.90%	97	44.91%
40-49	Transportation	13	1.19%	13	1.54%	13	1.55%	5	2.31%
50-51	Wholesale Trade	86	7.90%	80	9.47%	78	9.32%	16	7.41%
52-59	Retail Trade	76	6.99%	66	7.81%	65	7.77%	18	8.33%
60-67	Finance, Insurance, & Real Estate	60	5.51%	49	5.80%	47	5.62%	27	12.50%
70-89	Services	171	15.72%	146	17.28%	146	17.44%	38	17.59%
91-99	Public Administration & Others	22	2.02%	2	0.24%	2	0.24%	1	0.46%
		1,088	100%	845	100%	837	100%	216	100%

Table 4.2 Distribution of LBOs deals by industry

This table presents the distribution of LBO deals across industries over the period from 1996 to 2017. Columns 3 and 4 report total number of any LBOs, columns 5 and 6 report total number of private-to-private LBOs, and columns 7 and 8 report total number of public-to-private LBOs.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2-Digit SIC	Sector	#LBOs		#Priv-to-Priv LBOs		#Pub-to-Priv LBOs	
01-09	Agriculture	70	0.48%	68	0.48%	2	0.34%
10-14	Mining	218	1.48%	173	1.22%	45	7.73%
15-17	Construction	361	2.45%	351	2.48%	10	1.72%
20-39	Manufacturing	5,283	35.86%	5,087	35.95%	196	33.68%
40-49	Transportation	891	6.05%	856	6.05%	35	6.01%
50-51	Wholesale Trade	1,546	10.49%	1,518	10.73%	28	4.81%
52-59	Retail Trade	1,241	8.42%	1,192	8.42%	49	8.42%
60-67	Finance, Insurance, & Real Estate	839	5.70%	788	5.57%	51	8.76%
70-89	Services	4,246	28.82%	4,094	28.93%	152	26.12%
91-99	Public Administration & Others	37	0.25%	23	0.16%	14	2.41%
		14,732	100%	14,150	100%	582	100%

Table 4.3 Distribution of LBO deals by year

This table presents the distribution of LBO deals across years. Columns 1 and 2 report total number of any LBOs, columns 3 and 4 report total number of private-to-private LBOs, and columns 5 and 6 report total number of public-to-private LBOs.

	(1)	(2)	(3)	(4)	(5)	(6)
	#LBOs		#Priv-to-Priv LBOs		#Pub-to-Priv LBOs	
1996	235	1.50%	221	1.56%	14	2.41%
1997	349	2.19%	323	2.28%	26	4.47%
1998	482	3.07%	453	3.20%	29	4.98%
1999	526	3.33%	491	3.47%	35	6.01%
2000	466	3.05%	450	3.18%	16	2.75%
2001	445	2.88%	425	3.00%	20	3.44%
2002	563	3.71%	546	3.86%	17	2.92%
2003	638	4.19%	617	4.36%	21	3.61%
2004	805	5.29%	779	5.51%	26	4.47%
2005	866	5.64%	831	5.87%	35	6.01%
2006	1093	7.09%	1044	7.38%	49	8.42%
2007	1188	7.73%	1139	8.05%	49	8.42%
2008	856	5.57%	820	5.80%	36	6.19%
2009	596	3.84%	566	4.00%	30	5.15%
2010	742	4.83%	711	5.02%	31	5.33%
2011	743	4.90%	722	5.10%	21	3.61%
2012	806	5.29%	780	5.51%	26	4.47%
2013	695	4.49%	662	4.68%	33	5.67%
2014	732	4.82%	710	5.02%	22	3.78%
2015	705	4.72%	695	4.91%	10	1.72%
2016	608	3.98%	587	4.15%	21	3.61%
2017	593	3.92%	578	4.08%	15	2.58%
Total	14732	100.00%	14150	100.00%	582	100.00%
Mean	669.64		643.18		26.45	
Median	666.50		639.50		26.00	

Table 4.4 Number of peers by industry

This table presents yearly total and average number of peers within four-digit SIC codes between 1997 and 2018. Columns 3 and 4 show total and average number of any LBO peers, respectively. Columns 5 and 6 show total and average number of non-LBO peers, respectively.

(1)	(2)	(3)	(4)	(5)
Year	LBO Peers		Non-LBO Peers	
	Total	Mean	Total	Mean
1997	5,052	31.19	3,711	10.76
1998	5,305	28.83	3,888	12.83
1999	5,385	28.49	4,094	12.71
2000	4,832	25.43	4,468	12.73
2001	4,772	25.52	4,314	12.08
2002	5,647	23.33	3,869	11.21
2003	7,116	27.16	3,560	8.36
2004	8,351	26.60	3,690	8.27
2005	10,656	32.49	4,825	10.49
2006	12,863	29.64	3,656	7.31
2007	11,821	26.99	3,663	7.96
2008	9,785	27.72	4,330	8.30
2009	8,425	32.28	4,743	8.11
2010	8,671	27.61	4,280	8.12
2011	7,321	24.24	5,904	10.95
2012	7,846	23.35	5,357	10.52
2013	8,521	27.31	5,539	10.18
2014	11,153	35.98	7,954	14.10
2015	13,798	48.08	9,770	16.28
2016	11,179	38.7	10,989	18.82
2017	7,653	32.99	7,301	13.45
2018	3,637	17.24	4,789	10.37
	179,789	29.14	114,694	11.09

Table 4.5 Summary statistics

This table reports the mean, standard deviation, 25th, 50th and 75th percentiles for LBO peers, outcome variables, spillover channels, and control variables between 1996 and 2017. All variables are defined in Appendix 4.7.1 and winsorized at the 1th and 99th percentiles.

Variable	# obs.	Mean	St.dev.	25th perc.	Median	75th perc.
LBO Peers						
LBOs	294,483	0.611	0.488	0.000	1.000	1.000
Priv-to-Priv LBO	294,483	0.556	0.497	0.000	1.000	1.000
Pub-to-Priv LBO	294,483	0.054	0.226	0.000	0.000	0.000
Outcome Variables						
Operating Income	294,483	0.125	0.382	0.000	0.009	0.088
ROA	294,481	0.118	0.334	0.000	0.000	0.115
CFO	155,899	0.188	0.370	0.031	0.085	0.169
Inventory Turnover	175,549	9.466	25.871	0.000	1.086	6.520
Market Shares	294,483	0.051	0.153	0.000	0.002	0.019
Operating Expenses	292,232	0.553	0.967	0.000	0.027	0.800
R&D Expenditures	294,483	0.021	0.078	0.000	0.000	0.000
Advertising Expenses	294,483	0.005	0.021	0.000	0.000	0.000
Net Working Capital	279,624	5.089	16.648	1.000	1.760	3.455
Current Assets	294,483	0.516	0.320	0.210	0.521	0.815
Current Liabilities	294,483	0.384	0.597	0.101	0.231	0.492
Spillover Channels						
ΔAsset Turnover^{T}	294,483	-0.032	0.269	0.000	0.000	0.000
ΔMarket Share^{T}	294,483	0.000	0.016	0.000	0.000	0.000
ΔOperating Margin^{P}	294,483	0.049	0.497	0.000	0.000	0.000
ΔEBITDA Margin^{P}	294,483	0.018	0.314	0.000	0.000	0.000
ΔCapex^{P}	294,483	0.018	0.455	0.000	0.000	0.000
ΔAdv. Expenses^{P}	294,483	-0.014	0.102	0.000	0.000	0.000
Ind. R&D Intensity	294,483	0.021	0.047	0.000	0.000	0.008
Lerner Index	294,483	0.109	0.297	0.000	0.000	0.147
HH Index	294,483	0.225	0.203	0.085	0.160	0.291

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Variable	# obs.	Mean	St.dev.	25th perc.	Median	75th perc.
Control Variables						
Ln (Total Assets)	294,483	17.213	3.122	14.904	16.811	19.584
Leverage	294,483	0.105	0.213	0.000	0.000	0.114
Cash Holdings	294,483	0.179	0.231	0.025	0.084	0.237
Ind. Sales Growth	293,938	0.561	1.194	0.091	0.241	0.615

Table 4.6 Peers outcomes

This table presents the results of regressions examining the effects of LBOs on profitability, market shares, operating efficiency, and net working capital for individual peers. Post LBO is a dummy variable that takes value of one if peer firms is within [t+1, t+3] years after the LBO event year. I include years fixed effect to account for time trends in the value of the dependent variables and industry fixed effects to incorporate the adjustment in industry performance. I also include pre-event dummies up to three years. All variables are defined in Appendix 4.7.1 and winsorized at the 1th and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1) Operating Income	(2) Return on Asset	(3) CFO	(4) Market Shares	(5) Inventory Turnover	(6) Operating Expenses	(7) R&D Expenditures	(8) Advertising Expenses	(9) NWC	(10) Current Assets	(11) Cash Holdings	(12) Current Liabilities
Post LBO	-0.005***	-0.003**	-0.005*	-0.004**	-0.545*	0.024***	0.001	0.000	0.654***	-0.001	0.003***	-0.013***
	(0.002)	(0.001)	(0.003)	(0.002)	(0.292)	(0.007)	(0.001)	(0.000)	(0.153)	(0.002)	(0.001)	(0.004)
Ln (Total Assets)	-0.017***	-0.007***	-0.026***	0.022***	1.090***	-0.016*	0.000	0.000***	-0.320***	-0.016***	-0.006***	-0.046***
	(0.002)	(0.001)	(0.003)	(0.001)	(0.199)	(0.009)	(0.000)	(0.000)	(0.036)	(0.001)	(0.000)	(0.004)
Leverage	0.049***	0.047***	0.054***	0.011**	9.902***	0.355***	-0.010***	0.002	0.108	-0.118***	-0.008***	0.138***
	(0.008)	(0.005)	(0.009)	(0.005)	(1.616)	(0.035)	(0.002)	(0.001)	(0.358)	(0.009)	(0.002)	(0.029)
Cash Holding	0.005	0.007*	0.204***	0.034***	1.102	-0.166***	0.026***	0.002***	14.245***	0.448***	0.733***	-0.350***
	(0.011)	(0.004)	(0.017)	(0.005)	(0.912)	(0.033)	(0.005)	(0.001)	(0.971)	(0.014)	(0.009)	(0.021)
ROA	0.687***	0.632***	0.410***	0.022***	4.011***	1.011***	0.045***	0.006***	-1.826***	-0.016***	0.006***	0.722***
	(0.010)	(0.008)	(0.009)	(0.002)	(0.856)	(0.031)	(0.004)	(0.001)	(0.164)	(0.003)	(0.001)	(0.015)
Ind. Sales Growth	0.001***	0.000**	0.001	-0.002***	-0.068*	-0.002	0.000	-0.000*	-0.083**	0.002***	-0.001***	0.003***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.036)	(0.001)	(0.000)	(0.000)	(0.034)	(0.001)	(0.000)	(0.001)
HH Index	0.012**	0.010***	0.005	0.188***	2.258***	0.060*	-0.004	-0.001	-1.157*	-0.030***	0.006*	-0.008
	(0.005)	(0.003)	(0.014)	(0.015)	(0.863)	(0.035)	(0.004)	(0.001)	(0.595)	(0.010)	(0.003)	(0.020)
Constant	0.306***	0.162***	0.519***	-0.375***	-10.271***	0.901***	0.019***	-0.001	8.018***	0.744***	0.136***	1.062***
	(0.033)	(0.020)	(0.049)	(0.027)	(3.362)	(0.148)	(0.004)	(0.001)	(0.586)	(0.022)	(0.006)	(0.064)
#Obs	294,483	294,481	155,899	294,484	175,549	292,232	294,484	294,484	279,625	294,484	294,484	294,484
R^2	0.598	0.634	680	0.208	1,052	1,085	0.079	0.022	0.046	0.225	0.586	0.317

Table 4.7 Target specific

This table presents the results of regressions examining the effects of LBOs on profitability, market shares, operating efficiency, and net working capital for individual peers. For brevity, I only present the estimation results for the variables of interest. Post LBO is a dummy variable that takes value of one if peer firms is within [t+1, t+3] years after the LBO event year. ΔX^T is the change in X for target firms between the year before LBO announcement (H-1) and time *t*. Unreported controls are Ln(Total Assets), Leverage, Cash Holdings, ROA, Ind. Sales Growth, and HH Index. I include years and industry fixed effects and pre-event dummies up to three years. All variables are defined in Appendix 4.7.1 and winsorized at the 1st and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Operating Income		ROA		CFO		Market Shares		Inventory Turnover	
Post LBO	-0.005***	-0.005***	-0.003**	-0.003***	-0.004*	-0.005*	-0.003*	-0.003	-0.530*	-0.531*
	(0.002)	(0.002)	(0.001)	(0.001)	(0.003)	(0.003)	(0.002)	(0.002)	(0.291)	(0.290)
ΔAsset Turnover^T	0.005**		0.005**		0.002		-0.001		-0.019	
	(0.002)		(0.002)		(0.003)		(0.001)		(0.226)	
Post LBO x ΔAsset Turnover^T	-0.007***		-0.006***		-0.005		0.001		-0.053	
	(0.003)		(0.002)		(0.004)		(0.001)		(0.227)	
ΔMarket Share^T		0.001		0.001		0.001		0.002**		0.012
		(0.001)		(0.001)		(0.002)		(0.001)		(0.201)
Post LBO x ΔMarket Share^T		-0.002		-0.001		-0.003*		-0.002*		-0.204
		(0.001)		(0.001)		(0.002)		(0.001)		(0.216)
Constant	0.117***	0.117***	0.128***	0.128***	0.170***	0.170***	0.055***	0.055***	10.715***	10.699***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.492)	(0.494)
#Obs	293,938	293,938	293,936	293,936	155,826	155,826	293,939	293,939	175,190	175,190
R^2	0.598	0.598	0.634	0.634	0.488	0.488	0.208	0.208	0.028	0.028

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	Operating Expenses		R&D Expenditures		Advertising Expenses		NWC		Current Assets	
Post LBO	0.024***	0.025***	0.001	0.001	0.000	0.000	0.641***	0.648***	-0.001	-0.001
	(0.007)	(0.007)	(0.001)	(0.001)	(0.000)	(0.000)	(0.149)	(0.150)	(0.002)	(0.002)
ΔAsset Turnover^{T}	-0.010		0.000		0.000		-0.049		0.003	
	(0.017)		(0.001)		(0.000)		(0.075)		(0.002)	
Post LBO x ΔAsset Turnover^{T}	0.009		0.001		-0.000		0.088		-0.001	
	(0.018)		(0.001)		(0.000)		(0.078)		(0.002)	
Market Share_T		-0.001		0.000		0.000		0.015		-0.002
		(0.007)		(0.000)		(0.000)		(0.042)		(0.002)
Post LBO x Market Share_T		0.003		-0.000		-0.000		0.078*		0.002
		(0.007)		(0.000)		(0.000)		(0.045)		(0.002)
Constant	0.775***	0.775***	0.030***	0.030***	0.004***	0.004***	4.452***	4.456***	0.533***	0.533***
	(0.029)	(0.029)	(0.003)	(0.003)	(0.000)	(0.000)	(0.139)	(0.139)	(0.004)	(0.004)
#Obs	291,692	291,692	293,939	293,939	293,939	293,939	279,128	279,128	293,939	293,939
R^2	0.278	0.278	0.080	0.079	0.022	0.022	0.046	0.046	0.225	0.225

	Cash Holdings		Current Liabilities	
Post LBO	0.004***	0.003***	-0.012***	-0.013***
	(0.001)	(0.001)	(0.004)	(0.004)
ΔAsset Turnover^{T}	0.000		0.005	
	(0.001)		(0.004)	

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Post LBO x ΔAsset Turnover^{T}	-0.000		-0.004	
	(0.001)		(0.005)	
Market Share_T		-0.001		-0.004
		(0.001)		(0.003)
Post LBO x Market Share_T		0.001		0.000
		(0.001)		(0.003)
Constant	0.166***	0.166***	0.317***	0.317***
	(0.002)	(0.002)	(0.010)	(0.010)
#Obs	293,939	293,939	293,939	293,939
R^2	0.586	0.586	0.317	0.317

Table 4.8 Peer specific

This table presents the results of regressions examining the effects of LBOs on profitability, market shares, operating efficiency, and net working capital for individual peers. For brevity, I only present the estimation results for the variables of interest. Post LBO is a dummy variable that takes value of one if peer firms is within [t+1, t+3] years after the LBO event year. ΔX^P is the change in X for peer firms between the year before LBO announcement (H-1) and time *t*. Unreported controls are Ln(Total Assets), Leverage, Cash Holdings, ROA, Ind. Sales Growth, and HH Index. I include years and industry fixed effects and pre-event dummies up to three years. All variables are defined in Appendix 4.7.1 and winsorized at the 1st and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Operating Income				ROA				CFO			
Post LBO	-0.010***	-0.009***	-0.007***	-0.005***	-0.007***	-0.008***	-0.005***	-0.003**	-0.008***	-0.008***	-0.006**	-0.004
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)	(0.003)
ΔOperating Margin^P	0.009***				0.006***				0.003**			
	(0.002)				(0.002)				(0.001)			
Post LBO x ΔOperating Margin^P	0.015***				0.013***				0.005***			
	(0.002)				(0.002)				(0.001)			
ΔEBITDA Margin^P		0.013***				0.015***				0.006***		
		(0.003)				(0.003)				(0.002)		
Post LBO x ΔEBITDA Margin^P		0.014***				0.012***				0.004*		
		(0.003)				(0.003)				(0.002)		
ΔCapex^P			0.002				0.002				0.001	
			(0.002)				(0.002)				(0.002)	
Post LBO x ΔCapex^P			0.008***				0.008***				0.004**	
			(0.002)				(0.002)				(0.002)	
ΔAdv. Expense^P				0.002				0.002				0.002

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				(0.001)				(0.001)				(0.002)
Post LBO x ΔAdv. Expense^{P}				0.006***				0.005***				0.003
				(0.002)				(0.001)				(0.002)
Constant	0.119***	0.118***	0.116***	0.116***	0.129***	0.129***	0.127***	0.127***	0.169***	0.169***	0.169***	0.169***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
#Obs	293,938	293,938	293,938	293,938	293,936	293,936	293,936	293,936	155,826	155,826	155,826	155,826
R^2	0.606	0.608	0.599	0.599	0.641	0.648	0.636	0.635	0.490	0.491	0.489	0.489

	Market Shares				Inventory Turnover				Operating Expense			
Post LBO	-0.002	-0.002	-0.002	-0.003*	-0.613**	-0.631**	-0.615**	-0.524*	0.016**	0.017**	0.018***	0.025***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.287)	(0.289)	(0.293)	(0.290)	(0.007)	(0.007)	(0.007)	(0.007)
ΔOperating Margin^{P}	-0.002**				0.255				0.031***			
	(0.001)				(0.270)				(0.008)			
Post LBO x ΔOperating Margin^{P}	0.002*				0.096				0.007			
	(0.001)				(0.278)				(0.008)			
ΔEBITDA Margin^{P}		-0.004***				0.860***				0.042***		
		(0.001)				(0.300)				(0.012)		
Post LBO x ΔEBITDA Margin^{P}		0.003***				-0.535*				-0.001		
		(0.001)				(0.302)				(0.012)		
ΔCapex^{P}			-0.002*				0.407				0.022**	
			(0.001)				(0.263)				(0.010)	
Post LBO x ΔCapex^{P}			0.001				-0.048				0.009	

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			(0.001)				(0.252)				(0.008)	
ΔAdv. Expense^{P}				-0.001				0.279				0.021*
				(0.001)				(0.180)				(0.013)
Post LBO x ΔAdv. Expense^{P}				0.000				-0.252				-0.013
				(0.001)				(0.185)				(0.013)
Constant	0.054***	0.054***	0.055***	0.055***	10.756***	10.783***	10.713***	10.704***	0.780***	0.779***	0.774***	0.774***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.499)	(0.497)	(0.493)	(0.495)	(0.029)	(0.029)	(0.028)	(0.029)
#Obs	293,939	293,939	293,939	293,939	175,190	175,190	175,190	175,190	291,692	291,692	291,692	291,692
R^2	0.208	0.208	0.208	0.208	0.028	0.028	0.028	0.028	0.283	0.284	0.281	0.279

	R&D Expenditure				Advertising Expense				NWC			
Post LBO	0.001	0.001	0.000	0.001	0.000	0.000	0.000	0.000*	0.653***	0.657***	0.668***	0.645***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.150)	(0.150)	(0.150)	(0.151)
ΔOperating Margin^{P}	0.001**				0.000				-0.037			
	(0.000)				(0.000)				(0.035)			
Post LBO x ΔOperating Margin^{P}	-0.000				0.000				0.012			
	(0.000)				(0.000)				(0.035)			
ΔEBITDA Margin^{P}		0.001				0.000				-0.094**		
		(0.001)				(0.000)				(0.042)		
Post LBO x ΔEBITDA Margin^{P}		0.000				0.000				0.058		
		(0.001)				(0.000)				(0.044)		
ΔCapex^{P}			0.002**				0.000				-0.036	

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			(0.001)				(0.000)				(0.034)	
Post LBO x ΔCapex^{P}			-0.000				0.000				-0.077**	
			(0.001)				(0.000)				(0.033)	
ΔAdv. Expense^{P}				0.000				0.001***				0.004
				(0.000)				(0.000)				(0.055)
Post LBO x ΔAdv. Expense^{P}				0.001**				0.001***				-0.040
				(0.000)				(0.000)				(0.055)
Constant	0.030***	0.030***	0.030***	0.029***	0.004***	0.004***	0.004***	0.004***	4.445***	4.442***	4.456***	4.454***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.139)	(0.139)	(0.137)	(0.139)
#Obs	293,939	293,939	293,939	293,939	293,939	293,939	293,939	293,939	279,128	279,128	279,128	279,128
R^2	0.080	0.080	0.082	0.080	0.022	0.022	0.023	0.045	0.046	0.046	0.046	0.046

	Current Assets				Cash Holdings				Current Liabilities			
Post LBO	-0.001	-0.001	-0.001	-0.001	0.003***	0.003***	0.004***	0.003***	-0.016***	-0.016***	-0.013***	-0.012***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.004)	(0.004)	(0.004)	(0.004)
ΔOperating Margin^{P}	0.000				0.001**				0.009**			
	(0.001)				(0.001)				(0.004)			
Post LBO x ΔOperating Margin^{P}	0.001				-0.001				0.005			
	(0.001)				(0.001)				(0.004)			
ΔEBITDA Margin^{P}		0.000				0.001				0.014**		
		(0.002)				(0.002)				(0.007)		
Post LBO x ΔEBITDA Margin^{P}		0.001				-0.000				0.003		

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		(0.002)				(0.002)				(0.007)		
ΔCapex^{P}			0.001				-0.002**				0.001	
			(0.001)				(0.001)				(0.004)	
Post LBO x ΔCapex^{P}			-0.004**				-0.002*				0.005	
			(0.002)				(0.001)				(0.005)	
ΔAdv. Expense^{P}				0.002				-0.000				-0.001
				(0.002)				(0.001)				(0.004)
Post LBO x ΔAdv. Expense^{P}				-0.002				-0.002				0.008**
				(0.002)				(0.001)				(0.004)
Constant	0.533***	0.533***	0.533***	0.533***	0.166***	0.166***	0.166***	0.166***	0.318***	0.318***	0.316***	0.316***
	(0.004)	(0.004)	(0.005)	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)	(0.010)	(0.010)	(0.010)	(0.010)
#Obs	293,939	293,939	293,939	293,939	293,939	293,939	293,939	293,939	293,939	293,939	293,939	293,939
R^2	0.225	0.225	0.225	0.225	0.586	0.586	0.586	0.586	0.318	0.319	0.317	0.317

Table 4.9 Industry specific

This table presents the results of regressions examining the effects of LBOs on profitability, market shares, operating efficiency, and net working capital for individual peers. For brevity, I only present the estimation results for the variables of interest. Post LBO is a dummy variable that takes value of one if peer firms is within [t+1, t+3] years after the LBO event year. Unreported controls are Ln(Total Assets), Leverage, Cash Holdings, ROA, Ind. Sales Growth, and HH Index. I include years and industry fixed effects and pre-event dummies up to three years. All variables are defined in Appendix 4.7.1 and winsorized at the 1st and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Operating Income				ROA				CFO			
Post LBO	-0.005***	-0.006***	-0.005***	-0.005***	-0.003**	-0.004***	-0.003**	-0.004***	-0.002	-0.003	-0.005*	-0.006**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)	(0.003)
Ind. Operating Margin	0.027***				0.021***				0.016***			
	(0.005)				(0.003)				(0.005)			
Post LBO x Ind. Operating Margin	-0.011**				-0.009**				-0.008***			
	(0.006)				(0.004)				(0.003)			
Lerner Index		0.028***				0.026***				0.013**		
		(0.006)				(0.005)				(0.005)		
Post LBO x Lerner Index		-0.015***				-0.012***				-0.006**		
		(0.005)				(0.004)				(0.003)		
Post LBO x HH Index			-0.001				-0.000				0.002	
			(0.001)				(0.001)				(0.003)	
Ind. Capital Intensity				0.014***				0.018***				0.004
				(0.003)				(0.002)				(0.003)
Post LBO x Ind. Capital Intensity				0.004***				0.003**				0.003**
				(0.001)				(0.001)				(0.001)

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Constant	0.114***	0.115***	0.117***	0.102***	0.126***	0.126***	0.128***	0.110***	0.164***	0.166***	0.170***	0.163***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)
#Obs	293,938	293,938	293,938	293,938	293,936	293,936	293,936	293,936	155,826	155,826	155,826	155,826
R^2	0.598	0.598	0.598	0.598	0.634	0.634	0.634	0.634	0.489	0.489	0.488	0.488
	Market Shares				Inventory Turnover				Operating Expenses			
Post LBO	-0.003	-0.003	-0.001	-0.003*	-0.523*	-0.515*	-0.570*	-0.562**	0.024***	0.026***	0.026***	0.021***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.282)	(0.282)	(0.325)	(0.274)	(0.007)	(0.007)	(0.007)	(0.007)
Ind. Operating Margin	0.001				0.065				-0.022			
	(0.002)				(0.210)				(0.013)			
Post LBO x Ind. Operating Margin	-0.002				0.348				0.018			
	(0.002)				(0.231)				(0.013)			
Lerner Index		-0.003				0.989*				-0.005		
		(0.003)				(0.542)				(0.012)		
Post LBO x Lerner Index		0.001				-0.119				0.015		
		(0.002)				(0.348)				(0.017)		
Post LBO x HH Index			-0.011***				0.311				0.022***	
			(0.003)				(0.214)				(0.008)	
Ind. Capital Intensity				-0.004				2.536***				0.112***
				(0.003)				(0.599)				(0.021)
Post LBO x Ind. Capital Intensity				0.002				-0.048				0.025***
				(0.002)				(0.437)				(0.010)

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Constant	0.054***	0.055***	0.056***	0.058***	10.737***	10.622***	10.747***	8.182***	0.778***	0.775***	0.776***	0.659***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.492)	(0.490)	(0.501)	(0.635)	(0.028)	(0.029)	(0.028)	(0.027)
#Obs	293,939	293,939	293,939	293,939	175,190	175,190	175,190	175,190	291,692	291,692	291,692	291,692
R^2	0.208	0.208	0.208	0.208	0.028	0.028	0.028	0.030	0.278	0.278	0.278	0.282
	R&D Expenditures				Advertising Expenses				NWC			
Post LBO	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.648***	0.640***	0.642***	0.655***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.151)	(0.148)	(0.155)	(0.150)
Ind. Operating Margin	0.002				0.000				0.059			
	(0.002)				(0.000)				(0.135)			
Post LBO x Ind. Operating Margin	-0.004**				0.000				-0.033			
	(0.002)				(0.000)				(0.122)			
Lerner Index		0.004**				0.000				0.229		
		(0.002)				(0.000)				(0.158)		
Post LBO x Lerner Index		-0.005***				0.000				-0.218*		
		(0.002)				(0.000)				(0.127)		
Post LBO x HH Index			0.000				-0.000				-0.020	
			(0.001)				(0.000)				(0.122)	
Ind. Capital Intensity				0.000				0.001***				0.138
				(0.001)				(0.000)				(0.127)
Post LBO x Ind. Capital Intensity				0.001				0.000				-0.150
				(0.001)				(0.000)				(0.108)

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Constant	0.029***	0.029***	0.030***	0.029***	0.004***	0.004***	0.004***	0.003***	4.443***	4.431***	4.483***	4.383***
	(0.003)	(0.002)	(0.003)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.136)	(0.136)	(0.143)	(0.184)
#Obs	293,939	293,939	293,939	293,939	293,939	293,939	293,939	293,939	279,128	279,128	279,128	279,128
R^2	0.080	0.080	0.079	0.079	0.022	0.022	0.022	0.022	0.046	0.046	0.045	0.046
	Current Assets				Cash Holdings				Current Liabilities			
Post LBO	-0.001	-0.001	-0.001	-0.001	0.004***	0.003***	0.003***	0.004***	-0.013***	-0.012***	-0.012***	-0.012***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.004)	(0.004)	(0.004)	(0.004)
Ind. Operating Margin	-0.005**				0.002**				-0.005			
	(0.003)				(0.001)				(0.008)			
Post LBO x Ind. Operating Margin	0.005**				-0.001				-0.004			
	(0.002)				(0.001)				(0.006)			
Lerner Index		-0.007**				0.002**				-0.026***		
		(0.003)				(0.001)				(0.005)		
Post LBO x Lerner Index		0.006**				-0.001				0.014**		
		(0.002)				(0.001)				(0.005)		
Post LBO x HH Index			-0.000				0.001*				-0.001	
			(0.002)				(0.001)				(0.003)	
Ind. Capital Intensity				-0.017***				-0.003**				-0.037***
				(0.003)				(0.001)				(0.006)
Post LBO x Ind. Capital Intensity				0.002				-0.001*				0.005
				(0.002)				(0.001)				(0.005)

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Constant	0.534***	0.534***	0.533***	0.548***	0.166***	0.166***	0.166***	0.169***	0.317***	0.319***	0.316***	0.349***
	(0.004)	(0.005)	(0.004)	(0.006)	(0.002)	(0.002)	(0.002)	(0.002)	(0.010)	(0.010)	(0.010)	(0.010)
#Obs	293,939	293,939	293,939	293,939	293,939	293,939	293,939	293,939	293,939	293,939	293,939	293,939
R^2	0.225	0.225	0.225	0.225	0.586	0.586	0.586	0.586	0.317	0.317	0.317	0.318

Table 4.10 Purge residuals

This table reports the estimates from purged residuals regressions for the effects of LBOs on peers' outcomes. The purged residuals regressions are done by a two stage regression. In the 1st stage, I obtain residuals of peers' outcomes that are purged of the effects of firm's sales growth and time-varying industry shocks. In the 2nd stage, I regress the purged residuals on a time dummy for post-LBOs and a set of control variables. I include industry-by-year fixed effects to control for industry-and time-specific unobservable variables. Reported coefficients are from the 2nd stage of the regression. All variables are defined in Appendix 4.7.1 and winsorized at the 1th and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1) Operating Income	(2) Return on Asset	(3) CFO	(4) Market Shares	(5) Inventory Turnover	(6) Operating Expenses	(7) R&D Expenditure	(8) Advertising Expenses	(9) NWC	(10) Current Assets	(11) Cash Holdings	(12) Current Liabilities
Post LBO	-0.001	-0.003***	0.003*	-0.005***	-1.042***	-0.029***	-0.001***	0.000	-0.004	0.000	0.005***	0.005
	(0.001)	(0.001)	(0.002)	(0.001)	(0.186)	(0.005)	(0.000)	(0.000)	(0.003)	(0.001)	(0.001)	(0.003)
Ln (Total Assets)	0.000	-0.000	0.001*	-0.000	-0.003	0.004***	0.000	-0.000	0.003***	0.002***	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.029)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Leverage	0.045***	0.045***	0.049***	0.009***	9.751***	0.341***	-0.007***	0.002***	-0.251***	-0.115***	-0.013***	0.134***
	(0.002)	(0.002)	(0.003)	(0.001)	(0.319)	(0.007)	(0.001)	(0.000)	(0.005)	(0.002)	(0.001)	(0.005)
Cash Holding	0.002	0.001	0.028***	-0.001	0.549	-0.016**	-0.004***	-0.000*	-0.027***	-0.041***	0.005***	-0.014***
	(0.002)	(0.002)	(0.004)	(0.001)	(0.416)	(0.007)	(0.001)	(0.000)	(0.005)	(0.002)	(0.001)	(0.005)
ROA	-0.001	-0.002**	-0.005***	-0.002**	0.075	0.014***	0.000	0.000*	0.017***	0.013***	0.000	-0.004
	(0.001)	(0.001)	(0.001)	(0.001)	(0.195)	(0.004)	(0.000)	(0.000)	(0.003)	(0.001)	(0.001)	(0.003)
Ind. Sales Growth	0.000	0.000	0.004***	-0.000	0.055	-0.004***	-0.000*	0.000	0.004***	-0.003***	-0.000	-0.006***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.058)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
HH Index	0.022***	0.009***	0.064***	0.202***	0.692	-0.028**	-0.009***	-0.003***	-0.078***	-0.045***	0.016***	0.031***
	(0.004)	(0.003)	(0.007)	(0.002)	(0.537)	(0.012)	(0.001)	(0.000)	(0.009)	(0.004)	(0.002)	(0.009)
Constant	-0.015***	-0.002	-0.042***	-0.042***	-0.728	-0.070***	0.004***	0.001	0.005	-0.009**	-0.009***	-0.014
	(0.004)	(0.003)	(0.006)	(0.002)	(0.577)	(0.013)	(0.001)	(0.000)	(0.009)	(0.004)	(0.003)	(0.009)
#Obs	243,280	243,279	145,258	243,281	149,548	241,537	243,281	243,281	243,281	243,281	243,281	243,281
R^2	0.002	0.002	0.003	0.041	0.007	0.011	0.001	0.001	0.009	0.011	0.001	0.003

Table 4.11 Announcement abnormal returns - interaction with industry characteristics

This table reports OLS estimates for firms' 5-day cumulative abnormal returns around announcement dates of public-to-private LBOs. *Peers* is equal to 1 if the firm is an individual peer of public-to-private LBOs and 0 if the firm is a non LBO peer. Robust standard errors at firm level are reported in parentheses. All variables are defined in Appendix 4.7.1 and winsorized at the 1th and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)	(5)	(6)
	CAR	CAR	CAR	CAR	CAR	CAR
	(-2,2)	(-2,2)	(-2,2)	(-2,2)	(-2,2)	(-2,2)
Peers	0.002**	0.002***	0.003***	0.003***	0.004***	0.009***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
High Ind. Operating			-0.001***			
Margin			(0.000)			
Peers x High Ind.			-0.004***			
Operating Margin			(0.001)			
High Lerner Index				-0.000**		
				(0.000)		
Peers x High Lerner Index				-0.003**		
				(0.001)		
High HH Index					-0.000	
					(0.000)	
Peers x HH Index					-0.007***	
					(0.002)	
Low Ind. Capital Intensity						0.001***
						(0.000)
Peers x Low Ind.						-0.018***
Capital Intensity						(0.001)
Ln (Total Assets)		-0.002***	-0.002***	-0.002***	-0.002***	-0.002***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R&D Expenditures		-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Net Income		-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Leverage		0.003***	0.003***	0.003***	0.003***	0.003***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Cash Holding		-0.007***	-0.007***	-0.007***	-0.007***	-0.007***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HH Index		0.000	0.000	0.000		0.000

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	(1)	(2)	(3)	(4)	(5)	(6)
	CAR	CAR	CAR	CAR	CAR	CAR
	(-2,2)	(-2,2)	(-2,2)	(-2,2)	(-2,2)	(-2,2)
		(0.000)	(0.000)	(0.000)		(0.000)
Constant	0.010***	0.047***	0.047***	0.047***	0.047***	0.047***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
#Obs	4,216,074	3,218,293	3,218,247	3,218,247	3,218,293	3,218,167
R^2	0.000	0.004	0.004	0.004	0.004	0.004

Table 4.12 Peers outcomes - excluding private-to-private LBOs

This table presents the results of regressions examining the effects of public-to-private LBOs on profitability, market shares, operating efficiency, and net working capital for publicly listed peers. Post LBO is a dummy variable that takes value of one if peer firms is within [t+1, t+3] years after the LBO event year. I include years fixed effect to account for time trends in the value of the dependent variables and industry fixed effects to incorporate the adjustment in industry performance. I also include pre-event dummies up to three years. All variables are defined in Appendix **??** and winsorized at the 1th and 99th percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1) Operating Income	(2) Return on Asset	(3) CFO	(4) Market Shares	(5) Inventory Turnover	(6) Operating Expenses	(7) R&D Expenditures	(8) Advertising Expenses	(9) NWC	(10) Current Assets	(11) Cash Holdings	(12) Current Liabilities
Post LBO	-0.006	-0.008**	-0.002	-0.005***	-0.096	-0.002	-0.004	-0.000	0.088	0.007**	0.003*	0.011
	(0.004)	(0.004)	(0.004)	(0.001)	(0.409)	(0.010)	(0.004)	(0.000)	(0.080)	(0.003)	(0.002)	(0.011)
Ln (Total Assets)	-0.040***	-0.021***	-0.029***	0.027***	-0.290	-0.136***	-0.001	-0.000	-0.017	-0.016***	-0.005***	-0.084***
	(0.004)	(0.002)	(0.003)	(0.003)	(0.176)	(0.012)	(0.000)	(0.000)	(0.033)	(0.002)	(0.000)	(0.006)
Leverage	0.064***	0.038***	0.086***	-0.000	1.046	0.071*	-0.000	-0.000	-0.774	-0.084***	-0.017***	0.208***
	(0.011)	(0.008)	(0.014)	(0.006)	(1.181)	(0.040)	(0.003)	(0.001)	(0.502)	(0.012)	(0.003)	(0.037)
Cash Holding	0.179***	0.091***	0.227***	0.006	2.419	-0.347***	0.080***	0.004**	5.503***	0.431***	0.623***	-0.477***
	(0.045)	(0.013)	(0.026)	(0.006)	(2.562)	(0.053)	(0.011)	(0.002)	(0.721)	(0.019)	(0.012)	(0.036)
ROA	0.608***	0.578***	0.399***	0.032***	-0.823	0.651***	0.039***	0.004***	-0.968***	-0.012**	0.011***	0.667***
	(0.012)	(0.009)	(0.012)	(0.005)	(0.622)	(0.026)	(0.004)	(0.001)	(0.137)	(0.005)	(0.002)	(0.022)
Ind. Sales Growth	0.000	0.002	-0.000	-0.003**	0.273	0.008	0.000	-0.000	-0.005	-0.000	-0.001	-0.005
	(0.002)	(0.001)	(0.002)	(0.001)	(0.182)	(0.009)	(0.000)	(0.000)	(0.024)	(0.002)	(0.001)	(0.003)
HH Index	0.004	-0.003	0.017	0.210***	-0.210	-0.052	-0.008	-0.004	0.117	0.004	0.005	-0.002
	(0.015)	(0.011)	(0.021)	(0.025)	(2.197)	(0.053)	(0.011)	(0.003)	(0.392)	(0.014)	(0.006)	(0.044)
Constant	0.789***	0.455***	0.580***	-0.505***	17.916***	3.454***	0.041***	0.010***	2.598***	0.713***	0.138***	1.870***

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	(1) Operating Income	(2) Return on Asset	(3) CFO	(4) Market Shares	(5) Inventory Turnover	(6) Operating Expenses	(7) R&D Expenditures	(8) Advertising Expenses	(9) NWC	(10) Current Assets	(11) Cash Holdings	(12) Current Liabilities
	(0.072)	(0.041)	(0.061)	(0.058)	(3.543)	(0.231)	(0.009)	(0.003)	(0.614)	(0.036)	(0.007)	(0.105)
#Obs	87,375	87,375	86,258	87,375	59,342	87,362	87,375	87,375	87,189	87,375	87,375	87,375
R^2	0.583	0.609	0.457	0.263	0.002	0.357	0.085	0.017	0.032	0.191	0.440	0.367

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