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

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Abstract

We examine the impact of acquiring public versus private targets on acquirers' long-run innovation outcomes. Our analysis shows that acquisitions of private targets are associated with an increase in innovation outcomes and innovation efficiency. We do not find an impact on innovation for public targets. These differences in innovation effects between private versus public targets is also reflected in announcement returns. Our results highlight the importance of private targets for innovation in the M&A market and the fact that the announcement market reaction accounts for this difference.

Keywords: M&As; private target acquisitions; public target acquisitions; innovation; patent.
JEL classification: G34, O31, O32, O34.

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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, Henderson, and Stern, 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 anti-takeover 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, Sarin, and Shapiro, 2000; Maksimovic, Phillips, and Yang, 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, Hsu, and Li, 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, Manso, and Silva, 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. Post-acquisition, acquirers and targets combine their complementary knowledge to improve innovation outcomes and efficiency (Rhodes-Kropf and Robinson, 2008).

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

[1]The KPSS patent data library is described in Kogan, Papanikolaou, Seru, and Stoffman (2017).

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, Chen, Wang, Zhang, and Zhang, 2019; Brav, Jiang, Ma, and Tian, 2018; Hirshleifer, Hsu, and Li, 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.

We show 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 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 an increase in innovation within existing expertise. It seems that acquiring firms chose the particular target because the target existing expertise exhibits high technological overlap with the acquirer. The acquisition then aims to exploit deeper the existing area (Mei, 2019). 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-acquisition even for targets with existing patents.

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 are significantly higher than for public target acquirers, our final test focuses on acquirer announcement abnormal returns. Complementing results in the literature (Faccio, McConnell, and Stolin, 2006; Jaffe, Jindra, Pedersen, and Voetmann, 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, Servaes, and Zingales, 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, Netter, and Stegemoller, 2002; Moeller, Schlingemann, and Stulz, 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 2 describes the data and statistics. Section 3 presents and discusses our results. Section 4 discusses endogeneity issues. Section 5 analyzes announcement abnormal returns and section 6 concludes.

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 SDC Platinum 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[2] 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 innovation, 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:

$$(1) \quad Prob(Public_{i,t}) = \alpha_1 + X_{i,t-1}\beta_1 + \gamma_1 Size_{i,t-1} + \delta_1 RD_{i,t-1} + a_{1,i} + d_{1,t} + \varepsilon_{1,i,t},$$

$$(2) \quad Prob(Private_{i,t}) = \alpha_2 + X_{i,t-1}\beta_2 + \gamma_2 Size_{i,t-1} + \delta_2 RD_{i,t-1} + a_{2,i} + d_{2,t} + \varepsilon_{2,i,t},$$

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. $a_{1,i}$ ($a_{2,i}$) and $d_{1,t}$ ($d_{2,t}$) are industry and year fixed effects, respectively. Table 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 private targets is 23.2 percent.

Insert Table 1 about here.

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

[2]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.

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 A. Panel B in Table 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 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 markedly different. This justifies our research question and construction of two treatment groups – public versus private target acquirers – and their separate matched groups.

Insert Table 2 about here.

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 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 1 and 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}.[3] 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.

Insert Figures 1 and 2 about here.

Table 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.[4] 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.

Insert Table 3 about here.

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

[4] Our main specifications use the natural logarithm of one plus the innovation level. Table **??** in the Internet Appendix shows the univariate differences for innovation levels instead of the logarithmic transformation.

3 Results

Our research question aims to test the impact of public versus private target acquisitions on innovation outcomes of acquirers while controlling for innovation activity of similar firms that do not engage in acquisitions. 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:

$$\begin{aligned} Innovation_{i,t} = {} & \alpha_1 Post\,public_{i,t} + \beta_1(Public_i \times Post\,public_{i,t}) + \alpha_2 Post\,private_{i,t} \\ & + \beta_2(Private_i \times Post\,private_{i,t}) + Y_{i,t}\gamma + a_i + d_t + \varepsilon_{i,t}, \end{aligned} \tag{3}$$

where $Innovation_{i,t}$ is the innovation outcome for firm i in year t – we use 9 innovation outcome measures in logarithmic transformations; $Post\,public_{i,t}$ ($Post\,private_{i,t}$) 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 calendar 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 the regression because they perfectly correlate with the firm

fixed effects.

Panel A in Table 4 shows coefficient estimates for equation (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.[5] 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 variable, only a 1 percent increase. 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 coefficients show that exploratory innovation tends to decrease, while exploitative innovation tends to increase over event time for public target acquirers and their matches.

Insert Table 4 about here.

Panels B and C in Table 4 show DiD effects based on equation (3) separately for the sample of public target acquirers and private target acquirers with their 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

[5] 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-acquisition (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 $0.071 \times (1 + 72.08) \times 1 = 5.19$.

private target acquisitions have a slightly larger magnitudes relative to the effects shown in Panel A.[6]

Overall, results in Table 4 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 5 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) as follows:

$$Innovation_{i,t} = \sum_{j=0}^{5} \beta_{1,j} Public\, deal_{i,j} + a_{1,i} + d_{1,i} + \varepsilon_{1,i,t}, \tag{4}$$

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

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 acquirer of public (private) target and the year is j event years away from the year of acquisition, and zero otherwise.[7] 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 $Public_i$ ($Private_i$)

[6]Table I.1 in the Internet Appendix shows that the results are very similar when not including any control variables in the DiD regression (3). Table I.2 covers a shorter event window including 3 instead of 5 years before and after acquisition announcement year. The results are somewhat weaker for exploitative patent variables and depth for private targets. Also, only 3 out of 9 $\beta_2 - \beta_1$ coefficient differences are significant. We conclude that the innovation outcome effects are stronger with a longer time horizon.

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

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.

Insert Table 5 about here.

Table 5 shows regression results for public and private target acquisitions in Panel A and B, respectively. Panel A confirms our conclusions from Table 4: 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 6 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 innovation output per unit of input only for private target acquisitions. Majority of the DiD coefficients for private targets are positive and statistically significant,[8] 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.

Insert Table 6 about here.

[8]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.

Our next test focuses on checking whether it matters that a target has a proven ability to innovate prior to its acquisition.[9] 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 7 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 7 suggests that acquiring a target with our without existing patents matters only for exploitative innovation after acquisitions of private targets.[10]

Insert Table 7 about here.

The results in Table 7 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

[9]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.

[10]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 for public target and private target subsamples in Table I.3 in the Internet Appendix.

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.[11] In contrast, acquired innovative ideas that are not yet formalized into patents seen to encourage somewhat more exploration into new areas.

Table I.4 in the Internet Appendix, 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.

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 4 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

[11] 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.

withdrawn groups is random.

We start with all withdrawn deals due to exogenous reasons and classify them into public versus private target acquisitions.[12] 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 4. 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.[13]

Panel A in Table 8 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 I.5 in the Internet Appendix shows persistency of innovation improvements up to 5 years after private target acquisitions.

Insert Table 8 about here.

Panel B in Table 8 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. 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.

[12] 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 I.7 in the Internet Appendix lists all withdrawal reasons for the 30 random deals.

[13] 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.

5 Acquirer announcement abnormal returns

Our final step is to examine whether the innovation outcome effects documented in section 3 can contribute in explaining differences in acquirer announcement abnormal returns between private versus public targets. Table 9 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). 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.

Insert Table 9 about here.

6 Conclusions

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.

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.

We conclude our analysis by investigating acquirers' 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.

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Appendix A Variable definitions

The table uses the following abbreviations: KPSS for Kogan, Papanikolaou, Seru, and Stoffman patent data library (https://iu.app.box.com/v/patents). NBER for National Bureau of Economic Research (https://www.nber.org/patents/).

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, Fleming, and Manso, 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
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

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Variable	Definition	Source
Same SIC	A dummy variable indicating whether the acquirer and target are from the same 3-digit SIC codes.	SDC

Table 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, 25^{th}, 50^{th} and 75^{th} percentiles for deal frequencies, innovation measures, and control variables for all technological firms between 1995 and 2005. All variables are defined in Appendix A and winsorized at the 1^{st} and 99^{th} 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.**	**25^{th} perc.**	**Median**	**75^{th} perc.**
Deal frequencies						
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 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 A and winsorized at the 1^{th} and 99^{th} 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. 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 A and winsorized at the 1^{th} and 99^{th} 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 4. 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 industry fixed effects and the following control variables: acquirer size, R&D expenditures, leverage, net income and HH index. Standard errors at firm level are reported in parentheses. All variables are defined in Appendix A and winsorized at the 1$^{\text{th}}$ and 99$^{\text{th}}$ 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)
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

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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
	(0.023)	(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)
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 5. 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 industry fixed effects and the following control variables: acquirer size, R&D expenditures, leverage, net income and HH index. Standard errors at firm level are reported in parentheses. All variables are defined in Appendix A and winsorized at the 1$^{\text{th}}$ and 99$^{\text{th}}$ 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
	(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)

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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 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**
	(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 6. 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 industry fixed effects and the following control variables: acquirer size, R&D expenditures, leverage, net income and HH index. Standard errors at firm level are reported in parentheses. All variables are defined in Appendix A and winsorized at the 1^{th} and 99^{th} 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 7. 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 industry fixed effects and the following control variables: acquirer size, R&D expenditures, leverage, net income and HH index. Standard errors at firm level are reported in parentheses. All variables are defined in Appendix A and winsorized at the 1^{th} and 99^{th} 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)
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 8. 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 industry fixed effects and the following control variables: acquirer size, R&D expenditures, leverage, net income and HH index. Standard errors at firm level are reported in parentheses. All variables are defined in Appendix A and winsorized at the 1$^{\text{th}}$ and 99$^{\text{th}}$ 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*
	(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)

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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	0.030	-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***
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

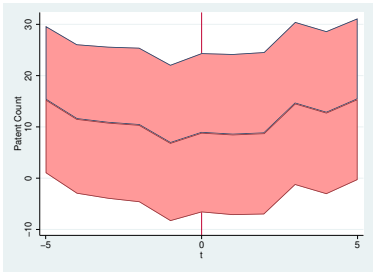
Table 9. Announcement abnormal returns

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. Standard errors at firm level are reported in parentheses. All variables are defined in Appendix A and winsorized at the 1^{th} and 99^{th} percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

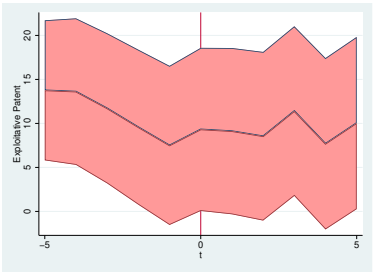
	(1)	(2)	(3)	(4)
Constant	0.028**	0.035***	0.036***	0.035***
	(0.013)	(0.013)	(0.014)	(0.013)
Private	0.017***	0.008	0.008	0.008
	(0.003)	(0.006)	(0.006)	(0.006)
ΔPatent count Q_2	-0.004	-0.011	-0.011	-0.011
	(0.003)	(0.007)	(0.008)	(0.008)
ΔPatent count Q_3	-0.003	-0.005	-0.005	-0.006
	(0.003)	(0.008)	(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
	(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 1. Evolution of coefficients from cross-sectional regressions for public target acquirers and their matched firms

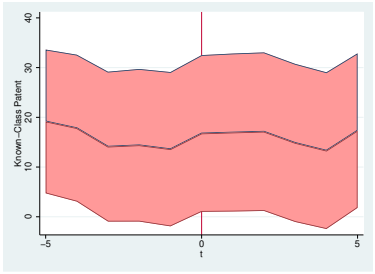
This figure plots the evolution of coefficients from yearly cross-sectional regressions of Ln(1+innovation) on a dummy that indicates public target acquirers over the period from t_{-5} to t_{+5}. It plots the estimated dummy coefficients with 95% confidence intervals based on heteroscedasticity-robust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



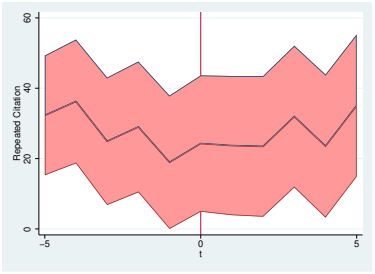
Patent Count



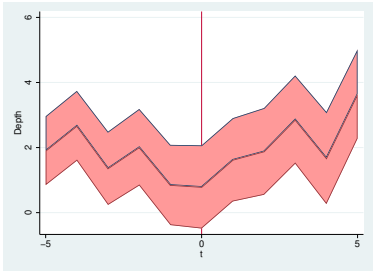
Exploitative Patent



Known-Class Patent



Repeated Citation



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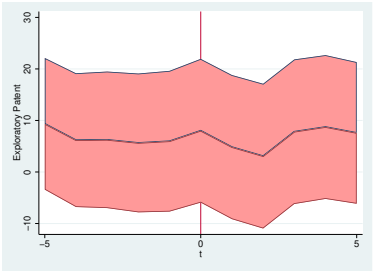
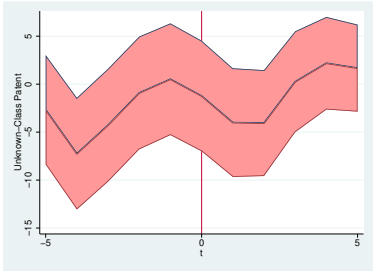
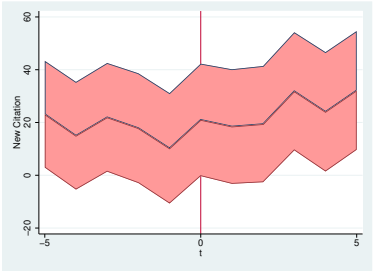


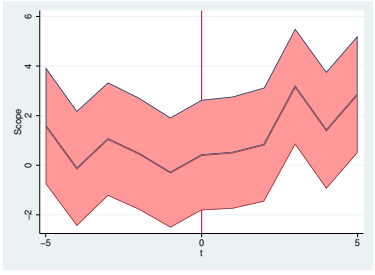
Exploratory Patent



Unknown-Class Patent



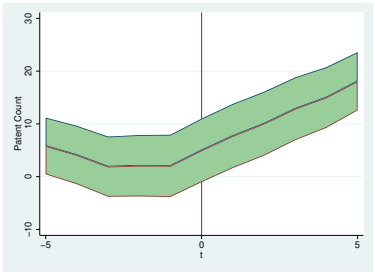
New Citation



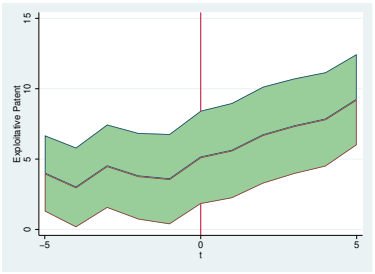
Scope

Figure 2. Evolution of coefficients from cross-sectional regressions for private target acquirers and their matched firms

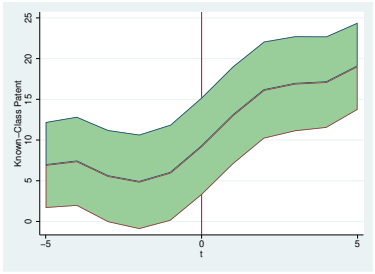
This figure plots the evolution of coefficients from yearly cross-sectional regressions of Ln(1+innovation) on a dummy that indicates private target acquirers over the period from t_{-5} to t_{+5}. It plots the estimated dummy coefficients with 95% confidence intervals based on heteroscedasticity-robust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



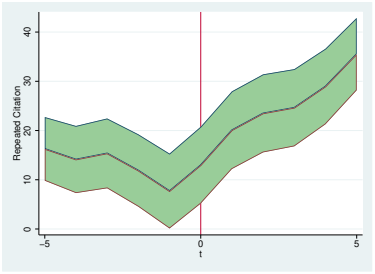
Patent Count



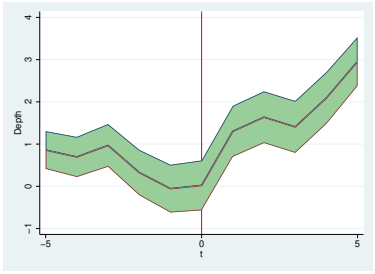
Exploitative Patent



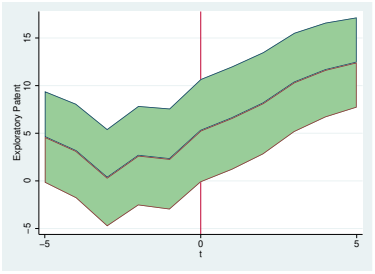
Known-Class Patent



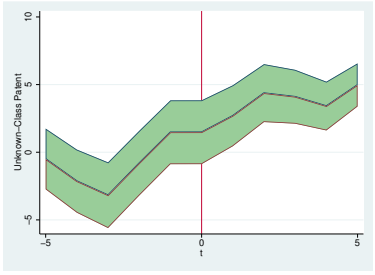
Repeated Citation



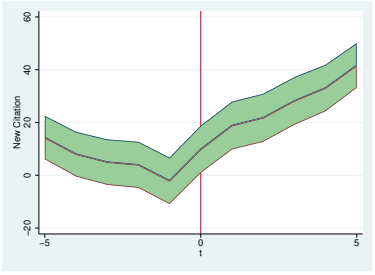
Depth



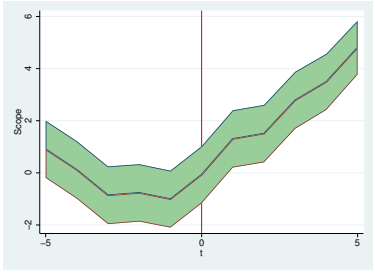
Exploratory Patent



Unknown-Class Patent



New Citation



Scope

Internet appendix to

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

(not for publication)

This appendix presents supplementary results not included in the main body of the paper.

Table I.1. Baseline DiD without control variables

This table replicates Table 4 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 firm and year fixed effects. Standard errors at firm level are reported in parentheses. All variables are defined in Appendix A and winsorized at the 1^{th} and 99^{th} 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
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

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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
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***
	(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 I.2. DiD with a shorter event window

This table replicates results in Table 4 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 firm and year fixed effects and control variables. Standard errors at firm level are reported in parentheses. All variables are defined in Appendix A and winsorized at the 1^{th} and 99^{th} 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
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

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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
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
	(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 I.3. Interaction with patent target: the two sub-samples

This table replicates Table 7 but separately for the two sub-samples with public and private target acquisitions. All regressions include firm and year fixed effect and control variables. Standard errors at firm level are reported in parentheses. All variables are defined in Appendix A and winsorized at the 1^{th} and 99^{th} 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
	(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 I.4. Interaction with patent target: shorter event window

This table replicates Table 7 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 firm and year fixed effects and control variables. Standard errors at firm level are reported in parentheses. All variables are defined in Appendix A and winsorized at the 1^{th} and 99^{th} 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)
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

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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
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)
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 I.5. 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 industry fixed effects and the following control variables: acquirer size, R&D expenditures, leverage, net income and HH index. Standard errors at firm level are reported in parentheses. All variables are defined in Appendix A and winsorized at the 1^{th} and 99^{th} 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$3	0.075	0.089	0.036	0.172	0.035	-0.004	0.008	-0.012	-0.003
	(0.058)	(0.052)	(0.031)	(0.110)	(0.021)	(0.027)	(0.060)	(0.089)	(0.009)
Public deal$_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)

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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 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$3	0.113***	0.098**	0.031	0.364***	0.066***	0.027	0.073*	0.103	0.007
	(0.035)	(0.037)	(0.018)	(0.084)	(0.019)	(0.031)	(0.035)	(0.069)	(0.008)
Private deal$_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 I.6. Announcement abnormal returns - interaction with the improvement in innovation

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. ΔInnovation represents the change in each of the average innovation measure for post- versus pre-acquisitions. We split all firms into 4 quartiles. Q_1 is the reference category. Standard errors at firm level are reported in parentheses. All variables are defined in Appendix A and winsorized at the 1^{th} and 99^{th} percentiles. ***, ** and * indicate significance at the one-, five- and ten-percent levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
Constant	0.035***	0.031**	0.022	0.022	0.029**	0.033**	0.023*	0.026*
	(0.014)	(0.014)	(0.013)	(0.013)	(0.014)	(0.013)	(0.013)	(0.013)
Private	0.010*	0.010*	0.014**	0.014**	0.015***	0.009	0.012**	0.014**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.006)	(0.006)
ΔInnovation Q_2	-0.007	-0.015**	0.004	0.004		-0.008	0.003	-0.003
	(0.008)	(0.007)	(0.007)	(0.007)		(0.009)	(0.008)	(0.008)
ΔInnovation Q_3	-0.007	-0.003	-0.002	-0.002	-0.003	-0.006	-0.002	0.003
	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
ΔInnovation Q_4	-0.011	-0.006	-0.003	-0.003	-0.001	-0.011*	-0.005	-0.006
	(0.007)	(0.007)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)
Private x ΔInnovation Q_2	0.005	0.014*	-0.005	-0.005		0.008	0.002	0.004
	(0.008)	(0.008)	(0.008)	(0.008)		(0.010)	(0.009)	(0.009)
Private x ΔInnovation Q_3	0.001	0.005	0.004	0.004	0.002	0.007	-0.000	-0.003
	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)
Private x ΔInnovation Q_4	0.020***	0.008	0.012	0.012	0.004	0.018**	0.014*	0.009
	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)
Ln (market value)	-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)
Cash only	0.008***	0.008***	0.008***	0.008***	0.008***	0.008***	0.008***	0.008***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Hostile deal	0.004	0.004	0.003	0.003	0.004	0.005	0.003	0.003
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Exploratory patent	Unknown-class patent	New citation	Scope	Exploitative patent	Known-class patent	Repeated citation	Depth
Same SIC	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Ln (R&D expenditures)	-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)
Ln (sales)	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Leverage	-0.001	-0.003	-0.003	-0.003	-0.003	-0.002	-0.002	-0.002
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Net income	-0.020***	-0.021***	-0.021***	-0.021***	-0.020***	-0.021***	-0.021***	-0.020***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
HH Index	-0.002	-0.004	-0.002	-0.002	-0.003	-0.003	-0.003	-0.003
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
#Obs	7,029	7,029	7,029	7,029	7,029	7,029	7,029	7,029
R^2	0.024	0.021	0.022	0.022	0.021	0.022	0.022	0.021

Table I.7. 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.
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.

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Date announcement	Target's name	Acquirer's name	Reason for withdrawn
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
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.
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."

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Date announcement	Target's name	Acquirer's name	Reason for withdrawn
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.
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.