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M&A and R&D: Asymmetric Effects on acquirers and targets?

Florian Szücs*

DIW Berlin, Mohrenstr. 58, 10117 Berlin, Germany

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ABSTRACT

We evaluate the impact of M&A activity on the growth of R&D spending and R&D intensity of 265 acquiring firms and 133 merger targets between 1990 and 2009. We use different matching techniques to construct separate control groups for acquirers and targets and use appropriate difference-in-difference estimation methods to single out the causal effect of mergers on R&D growth and intensity. We find that target firms substantially decrease their R&D efforts after a merger, while the R&D intensity of acquirers drops due to a sharp increase in sales.

1. Introduction

This article contributes to the growing empirical literature on the nexus between mergers and acquisitions (M&A) and the incentive of firms to allocate resources to research and development (R&D) and hopes to overcome some of the shortcomings of previous efforts on the same issue. An important improvement over the existing literature is the explicit differentiation of effects on acquiring and target firms. Previous studies either focus on only one group (Bertrand, 2009; Desyllas and Hughes, 2010) or include both acquiring firms and merger targets in a pooled estimation setting (Cassiman et al., 2005; Ornaghi, 2009), due to either small sample sizes or the inability to differentiate the correct roles. However, this means that either only half of the affected firms are examined or that it is assumed that acquirer and target are symmetrically affected in the aftermath of the merger. This, however, seems to be a strong and unjustified assumption: acquiring and target firms usually differ substantially with respect to their size and success (Gugler et al., 2003), but also with respect to their goals and bargaining power in managing post-merger business affairs. Thus, neglecting this distinction is likely to conceal an important source of heterogeneity in the impact of mergers on firm-level innovation activities.

Furthermore, earlier studies on the subject matter were usually either of limited geographical scope (Bertrand, 2009; Stiebale and Reize, 2011) or restricted to certain industries (Hagedoorn and Duysters, 2002; Ornaghi, 2009). The database utilized in this study contains firms from most major industrialized nations, active in numerous different industries. Thus we hope to overcome any industry or country-specific effects and provide a general overview of the phenomena in question.

Restructuring R&D activities is a protracted affair that can take a number of years to complete. Therefore the explanatory power of short-term studies on the topic is limited. To account for the relevant time horizon, we use balance sheet data from up to 6 periods after the acquisition year. Time windows of $[t+1, t+6]$ years after the acquisition year t allow us to check for drawn-out restructuring efforts after the combination. While we use pre-merger data (period $t-1$) in the estimation of the *ex-ante* probability to merge, data from the merger period t is excluded from the analysis to avoid the measurement of consolidation effects of the merger.

The goal of this article is to contribute to the empirical discussion on the relationship between mergers and the *incentive* to conduct innovative efforts. We therefore analyze the effect of mergers on two measures of R&D inputs: the growth of R&D expenditures and R&D intensity, defined as the ratio of R&D expenditures over sales. By making R&D inputs instead of R&D outputs (patents, new products) the focus of the analysis, we examine the firms' willingness to invest in innovation instead of their success in attaining it. Thus, questions about synergies and changes in the efficiency of research are not addressed by this article. However, Hagedoorn and Cloodt (2003) show that measures of R&D inputs and outputs are highly correlated and conclude that there is no major systemic disparity between them.

In terms of methodology, we follow the suggestion of Blundell and Costa Dias (2000) and combine matching techniques with

* Tel.: +49 30 89789 552
E-mail addresses: fszuecs@diw.de, florian.szuecs@gmail.com

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difference-in-difference (DiD) estimation. In the baseline specification we first use propensity-score matching (PSM) to define a measure of similarity and then employ a nearest-neighbor (NN) matching algorithm to construct control groups. We corroborate the robustness of the matching procedure in both stages by creating alternative control groups using (i) PSM but a caliper matching algorithm and (ii) a measure of similarity based on vector-distances (instead of PSM) and NN matching. In each case, the heterogeneity of acquiring firms and targets is accounted for by constructing separate control groups from a very rich pool of potential control observations. The effects on R&D growth and intensity are then evaluated using DiD estimation in the three samples thus obtained.

Our findings are consistent with the interpretation that acquisition targets are chosen because they have an attractive technological portfolio, which the acquirers start to exploit in the post-merger period. The acquirers continue to pursue their own research agenda – their R&D growth is only slightly and mostly insignificantly lower than that of the control group – but experience a sizeable reduction in R&D intensity, caused by a vast increase in sales. For the targets, both R&D growth and R&D intensity decline substantially in the post-acquisition period.

The article proceeds by reviewing the theoretical and empirical literature on the relationship of M&A and R&D in Section 2. The data sources and the empirical strategy are discussed in Section 3, while Section 4 presents the findings. Section 5 concludes.

2. Theory & literature

The literature on the effects of mergers on innovation is a large and fast-growing field, since it receives attention from both economics and management scholars. Therefore this section does not aim to offer a comprehensive overview, but rather to first summarize the theory arguments on the relationship between M&A and R&D that have been brought forward and then present a selection of thematically and methodologically related empirical articles.

From a theory perspective, the relationship between mergers and innovation is quite ambivalent. Arguments from the literature of industrial organization tell us that mergers can entail economies of scale and scope, that they make possible the elimination of duplicate efforts in similar research projects or that they may increase the appropriability of inventions by reducing technological spillovers to competitors. Additionally, an increase in market power due to a merger could also feed back onto the innovation strategy of the merging firms. Thus while there exists a multitude of potential effects, their direction is not always clear. Economies of scale or scope could actually be diseconomies due to an increase in organizational requirements; elimination of duplicate efforts should reduce R&D inputs, but not outputs; if the appropriability of inventions is low due to technology spillovers, mergers could lead to increases in R&D, but if it is high the reverse would typically be the case. Finally, the relationship of competition and innovation is not conclusively settled from either a theoretical or an empirical point of view (Aghion et al., 2005).

Possible explanations from the corporate governance literature assert that mergers require an effort from the firms' managers and thereby reduce the attention they pay to R&D projects, that the financial expenditures caused by acquisitions will typically reduce the resources available for research in subsequent years, that managers become more risk averse after mergers or that increased debt will make it less attractive to conduct R&D for tax advantage reasons. All of these lines of reasoning would typically point to a decrease in R&D efforts after a merger.

Due to this multitude of explanatory approaches offered from theory (a more comprehensive overview is presented in Veugelers (2006)), many empirical studies assume an agnostic stance with respect to their expectations. Similar to the theoretical literature, there is a wide range of approaches and findings, some of which are discussed below.

An article closely related to this one is the study by Ornaghi (2009), which analyzes the effect of 27 mergers in the pharmaceutical industry on various measures of R&D inputs and outputs. A combination of PSM and DiD estimation and, alternatively, a measure of technological relatedness is used to address issues of endogeneity. When estimating the effects on acquirers and targets in a pooled setting, Ornaghi finds a decrease in innovative efforts after mergers. Stiebale and Reize (2011) report similar findings from a sample of 304 German merger targets and explicitly control for structural zeros in reported R&D values (see Section 3.4 and Kleinknecht (1987)). The relationship between R&D intensity and acquisition activity in the electronic and electrical equipment industries is investigated in Blonigen and Taylor (2000). They find a strong negative correlation between the two and cautiously conclude that firms in their sample specialize in either 'making' or 'buying' technology. Hitt et al. (1991) report that acquisitive growth has a negative impact on firm innovation in terms of both inputs (R&D intensity) and outputs (patent intensity). They conclude that their findings are not compatible with research synergies, but could be caused by an increase in managers' risk aversion after mergers which lowers their commitment to innovation.

Studies that find increases in R&D activity after mergers include Bertrand (2009) and Stiebale (2013). Using a sample of 123 French acquisition targets in cross-border mergers and a combination of PSM and DiD methods, Bertrand (2009) finds that R&D budgets increased significantly three years after acquisition. Stiebale (2013) focuses on acquirers (324 firms) and finds that their R&D intensity significantly increases after mergers. Looking at firms in research alliances instead of mergers, Cefis et al. (2009) find that members of an alliance have higher aggregate R&D spending, but lower R&D efficiency than independently researching firms.

Ahuja and Katila (2001) distinguish technological acquisitions (i.e., acquisitions whose primary aim is technology transfer) from nontechnological acquisitions. Their sample consists of 72 large chemical companies, engaging in 534 acquisitions. Their analysis reveals that nontechnological acquisitions do not significantly influence innovative output. While technological acquisitions generally improve innovative output, the extent of the improvement depends on the technological relatedness of the two firms in a nonlinear fashion. Cloodt et al. (2006) extend this approach to four high-tech industries. While their findings with respect to technological acquisitions are largely compatible with those of (Ahuja and Katila, 2001), they find that nontechnological acquisitions have a negative impact on innovative performance after the merger.

Desyllas and Hughes (2010) analyze a sample of 2624 acquirers in high-tech industries using a similar empirical strategy. They find that the R&D intensity of an acquiring firm decreases in the period after a merger ($t+1$) but increases again in the $t+3$-period. R&D productivity is not significantly affected. They also find evidence in favour of the view that mergers between technologically related firms perform better than mergers between firms that differ greatly with respect to their knowledge bases. This argument is also advanced by Cassiman et al. (2005), who distinguish between technological and market-relatedness and use a detailed sample of 31 mergers. In contrast to Desyllas and Hughes (2010), they find that technologically complementary (substitutive) firms increase (decrease) their R&D level after the acquisition. Moreover, effects on R&D efficiency are more advantageous in complementary mergers.

Bertrand and Zuniga (2006) examine the influence of mergers on R&D spending in manufacturing on the industry level and differentiate between domestic and cross-border mergers. They find no significant relationship on an aggregate level, but show that

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