

The impact of technological proximity and M&A on rival firms

Impact de la Proximité technologique et des Fusac sur les entreprises rivales

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Date de soumission : 17/03/2025

Date d'acceptation : 10/05/2025

Pour citer cet article :

DIFADI. M. (2025) « The impact of technological proximity and M&A on rival firms », Revue Française d'Économie et de Gestion « Volume 6 : Numéro 5 » pp : 236- 264.

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Abstract

With a view to advancing arguments for what could influence the market reaction to merger and acquisition (M&A), we analysed the closeness of two innovative firms, using patent counts in different technology classes, and its impact on market sentiment measured by cumulative abnormal returns. Examining the consequences on competitors when patents of acquirers & targets are « related » or « unrelated » (conglomerate view), we found a correlation between merging firms and acquirers' rivals regarding the impact of technological proximity. First, the higher technological proximity within one specific industry between the merging firms, the more positive will be market reaction to merging firms, but also to acquirers' rivals. This suggests an « in-play » effect created in the competitors' abnormal returns in response to M&A involving technological proximity. Second, the technological proximity across different industries between the merging firms has a negative influence on market response to merging firms, but also to acquirers' rivals. This suggests that technological proximity beyond firms' frontiers leading to a conglomerate process is perceived by the market as being detrimental to both the acquirer and its identified rivals.

Keywords: Merger & Acquisition; Technological Proximity; Market reaction; Rival firms.

Résumé

Dans le but d'approfondir la réaction du marché aux fusions et acquisitions (Fusac), nous avons étudié la proximité technologique de deux entreprises innovantes à deux niveaux, mesurée par le nombre de brevets répartis par industrie et par segment industriel, et son impact sur le sentiment du marché mesuré par les rendements anormaux cumulés.

Concernant l'impact de la proximité technologique, nos résultats montrent une corrélation entre les entreprises fusionnantes et les concurrents des acquéreurs. Premièrement, plus la proximité technologique entre brevets d'une même industrie est élevée, et plus la réaction du marché sera positive et significative pour les sociétés fusionnantes, mais également pour les concurrents de l'acquéreur. Cela suggère un effet « in-play » créé dans les rendements anormaux des concurrents en réponse aux Fusac impliquant une proximité technologique. Deuxièmement, la proximité technologique entre différents secteurs a une influence négative sur la réaction du marché aux entreprises qui fusionnent, mais également à leurs rivaux. Ainsi, le marché considère que la proximité technologique au-delà des frontières des entreprises menant à un processus de conglomérat est préjudiciable à l'ensemble de l'industrie.

Mots clés : Fusions/Acquisitions ; Proximité Technologique ; Réaction du Marché ; Rivaux.

Introduction

The twenty-first century definitely marks the transition to a new era: that of knowledge economy. This is evidenced by the exponential growth in the number of patents from \$50 billion in 1994 to \$200 billion in 2008¹. If in a material economy, the protection of your property can be done in a bunker, a safe or under your mattress ; in the knowledge economy, only secrecy or intellectual property is a real shield for your immaterial goods. At a time when knowledge doubles every 9 years in quantity since the 1980s, and when the volume of M&A reached \$4,55 trillion in 2007 and the all-time record of \$5,8 trillion in 2021², we realize that mergers have become a formidable weapon to gain innovation and develop a competitive advantage. That said, the biggest deals are mainly in the US and in the technological fields. Among them we can mention Accenture, Google, Pfizer, Facebook ... All of them are intensive R&D companies in search of new patents and new technologies.

To amplify and/or maintain this market power, the company can use various means, including the creation of an agreement, the differentiation of products or the process of merger and acquisition called M&A (Cho & Chung (2022), Eckbo et al (2024)).

From the theoretical industrial organisation (Maksimovic & Phillips (2001), Harford (2005)) to the strategic management (Lubatkin (1983), Balakrishnan (1988), Fee & Thomas (2004), Shahrur (2005)) passing by the corporate control studies (Jensen & Ruback (1983), Roll (1986)) and the corporate and market finance papers (Rhodes-Kropf & Robinson (2008), Shleifer & Vishny (2003), Rhodes-Kropf (2003), Rhodes-Kropf & Viswanathan (2004)), regarding the craze and the abundant literature on M&A activity, it implies the importance of this phenomenon for academics and the economic world as well. It is all the more rewarding as literature from various areas put forward explanations to justify corporate takeovers.

Finally, the innovation literature implies and proves that an important motive for undertaking M&A is acquiring innovation so as to enhance firm's technological investments, and above all, to grow its knowledge bases through « grafting » new technological skills and know-how, new scope in research, new patents, and so on (Ahuja & Katila (2001), Sevilir & Tian (2011), Huang et al (2023), Mao et al (2024)). Notwithstanding, as Lubatkin (1983) emphasized, the fact that an acquirer (target) gains or losses from M&A is depending on three conditions : competitive strenghts (1), the growth rate of its markets (2), the fitting of (1) and (2) of the target (acquirer).

¹ World Intellectual Property Office.

² Reuters - Global M&A volumes hit record high in 2021, breach \$5 trillion for first time (December 31, 2021)

Accordingly, the better is the strategic fit between the acquiring firm and the acquired firm, the greater should be the subsequent output of the merger. It would seem, therefore, that mergers and acquisitions have undergone a remarkable boom with the advent of new technologies and the need to remain in the race for innovation.

That said, any merger does not go hand in hand with success or strategic efficiency. The principle of sub-additivity perfectly illustrates this idea that a merger is only successful if the productive performance of the merging companies is greater than the sum of their individual productive performance taken independently. Investing within nearest technological fields is usually prone to stronger internal selection due to duplicate opportunities (Vassolo³ et al (2004), Mazza & Shuwaikh (2022) ; however, one must keep in mind the true distinction between technologies and final products since the latter could require several and different technologies belonging to the same industry and sometimes the same industry segment.

In this perspective, we raised the question of the interaction between the merging firms' knowledge bases and the impact on market reaction measured by cumulative abnormal returns. As things stand right now, innovations, technologies, and the patents race arouse a tremendous craze among firms of every technological industry (Bena & Li (2014), Difadi (2019), Mao et al, (2024)). Our analysis of technological proximity complements the existing literature about M&A effects on rival firms since most of studies showed the relationship between abnormal returns and the merger proposal is inconsistent with the collusive hypothesis but consistent with the productive efficiency theory (Eckbo (1983), Fee & Thomas (2004), Becher et al (2008), Bena & Li (2014)).

In a willingness to advance other arguments for what could influence the market reaction to technological M&A, we wondered to **what extent does technological proximity influence abnormal returns of merging firms and of acquirers' rival firms**. Concretely, the object of this study is to examine the consequences on competitors when patents of acquirers & targets are « related » (non-conglomerate merger) or « unrelated » (conglomerate merger). Thus, we analyze the closeness of two innovative firms using patent counts in different technology classes and its impact on market sentiment measured by predicted abnormal returns for merging firms (Synergy_CAR) and rival firms (Rivals_CAR). This paper aims to show that patents' proximity between acquirers and targets could reverse the trend ; and the higher is patent

³ Taking the context of alliance portfolios, Vassolo et al (2004) showed that when a firm invests in several new ventures within a proximate defined industrial segment, the aggregate growth value of its investments is inferior to the sum of each venture's individual growth value (sub-additivity effect).

portfolios' proximity between merging firms, the higher is the noxious impact on acquirers' competitors.

Our basic intuition comes from Bena & Li (2014) and particularly from Hart (1990, 1995) who introduced a notion of complementarity more commonly known as "Synergy" in industrial economics. His works indicate that a merger between companies having complementary technologies is value-enhancing, while a merger including companies having independent technologies is value-reducing. Thereby, the synergies generated by the mergers give birth to a new and more powerful entity, able to lower its prices, to offer more efficient products and especially to position itself as a major competitor.

Following Hall et al (2001, 2005) classification of each patent by categories and subcategories based on International Patent Classification (IPC), we carried out a cross-sectional study using the Jaffe's measure (1986) to account for technological proximity between merging firms at two different levels : non-conglomerate mergers (across 37 subcategories) versus conglomerate mergers (across 6 categories). Studying 428 deals where both acquirer and target have at least one patent from 1990 to 2006, our paper's main contributions are threefold. First, we help to better understand M&A impact on competitors through the market response to a merger announcement involving technological interaction between acquirers and targets. Second, we focus on innovation output not through patent counts or citations but through technological proximity when it comes to industry-related M&A but also to non-related industries. Third, we help to know whether there is a difference in the impact on rivals, depending on the nature of the merger and the industrial proximity among merging firms.

The rest of the paper proceeds as follows. We review the literature in section 1. We develop our sample, variables and hypotheses in Section 2. We display descriptive statistics and report our empirical results regarding linear and fixed effects regressions in Section 3. Finally, the paper ends with the conclusion.

1. Literature review

1.1. Corporate takeovers : a strategic weapon in the race for innovation

1.1.1. Corporate takeovers and industries wealth.

In the corporations context, a firm can either develop technologies internally or catch it through an external way. Thereby, a merger or an acquisition is a resources redeployment so as to improve the productivity of assets. Not only will the acquiror benefit from internal and external target's environment, but also from a decrease of duplication in research and a cost reduction

(Mazza & Shuwaikh (2022)). That said, the long-standing debate around technological M&A boils down to complementarity versus independency among technological assets.

Hart (1995) starts from the basic idea that firms arise in situations where writing good contracts is complicated, making the allocation of power or control something tremendous. He defined ownership as having residual rights of control or power over « the machine » ; this suggests that buying the machine is more profitable than just rent it. Furthermore, the boundaries of firms are drawn so as to obtain power optimally amid the parties to a transaction. From that, the property rights approach underlines that « a party is more likely to own an asset if she has an important investment decision ». Typically, highly complementary assets should be under common ownership while independent assets should be separately owned. Basically, a moderate degree of overlap in the acquirer and target knowledge bases are likely to create synergies and a positive impact on the acquiring firm's subsequent innovation output. Moreover, integration should be urged when the industry contains a small number of firms due to the fact that complementarities between the bidder and the target are significant.

Following the same spirit, Hoberg & Phillips (2010) examined the impact of product market relatedness on merger-pairing and ex-post performance. Starting from the companies' product description in 10K reports from the SEC Edgar website, they introduced a variable called « product market relatedness » and implemented it to 49 908 firm-observations over the period 1997-2006. They found that bidders purchase targets that are more broadly similar⁴ to all firms in the economy rather than those that are more similar to their local rivals. Also, long-term real outcomes are better when the merging firms are similar ; the latter are even more significant when the merger allows the acquirer to stand out from its rivals. Definitely, product market relatedness plays a crucial role ex-ante and ex-post the transaction.

Fundamentally, product differentiation and the M&A process refer more to the theory of productive efficiency whereby reduction of costs and optimization of undervalued resources have a positive impact on merging firms but mixed on competing companies. This theory predicts a two-sided industry wealth effect of a merger announcement.

On one hand, the announcement of a merger may convey a positive information about the resources' value of the industry and those controlled by rival firms. Arguably, two merging firms with complementary assets will gain more efficient production, resulting in higher infra-

⁴ In their paper, Hoberg & Phillips (2010) defined « similar » as close to each other in distance in this product location space.

marginal rents and positive impact on the expected total synergy gain to both acquirer and target shareholders [Ahuja & Katila (2001), Sevilir & Tian (2011), Ang & Wu (2011), Bena & Li (2014)]. However, the increased volume of M&A within an industry may reveal a high synergistic industry but also a high demand for resources owned by other companies, leading to a positive re-evaluation of these rival firms. Actually, acquiring another firm could easily be considered as a call for help, and a disability to keep up to date with the industrial speed ; this may suggest that competition is strong and that rival firms are too competitive. Basically, the increased demand may result in expectations of future merger activity, giving birth to a positive « in-play » effect on rival firms from the announcement of a merger, for all that matters [Eckbo (1983), Schumann (1993), Fee & Thomas (2004)].

1.1.2. Corporate takeovers and negative impact on rival firms

On the other hand, productive efficiency theory predicts that rival firms may suffer from more competition in the industry due to a new more-efficient combined firm [Eckbo (1985)]. Actually, a scale-increasing efficient mergers have a tendency to negatively impact the industry's equilibrium product price, which harms competitors and by itself causes a negative industry wealth effect. Moreover, a conglomerate or an acquisition of a firm belonging to another industry may strengthen the new firm through an increase of its skills' diversification and knowledge bases' richness. This possible technological competitive advantage could definitely harm rival firms' performance and result in negative abnormal returns for competitors [Aktas et al (2006), Grimpe & Hussinger (2008), Akdogu (2009), Stahl (2010), Chung et al (2014)].

Competition within Telecommunications Industry has also been addressed by M&A studies. Akdogu (2009) worked on the announcement effects of all acquisitions through the telecom wave on both the acquirers and their industry rivals. His findings are threefold. First, there is a negative impact on the industry competitors by focusing on non-horizontal acquisitions. Higher market power prevents rivals from experiencing positive returns. Second, competitors that are closest to the acquirer in the realms of size and services suffer from a worse impact than the average rivals. Third, this negative impact is moderated for competitors that made prior acquisitions.

Focusing on It innovations, Chung et al (2014) studied the impact of a company's software patents on rivals' market value. They put forward two countervailing forces, namely market-stealing and spillover effects. The former effect makes software patents generating property

rights that give a competitive advantage over rivals, increasing efficiency for the focal firm. The latter one states that software patent may result in a greater technological opportunity for competitors, enhancing the rivals firm's market value. Their results show that an increase of 1% in a focal firm's software patent stock is tantamount to a decrease of 0.03% in competitors' market value, which means that market-stealing effect dominates spillover effect. Also, they showed a negative interaction between software and hardware, which implies that hardware patents play a role of complementary assets to software patents, beefing up market-stealing effect rather than spillover effect. Basically, in case of IT innovations, firms are more likely to benefit from a stronger competitive advantage from IT-based innovations including both hardware and software patents, compared to those concentrating solely on either hardware or software components.

Beyond USA frontiers, Eckbo (1992) and Aktas et al (2006) report that same negative industry wealth effect in response to the merger announcement, respectively in Canada and European Union.

1.2. Patent quality as a relevant indicator of innovation

1.2.1. Number of patents : a misleading tool

Intuitively, to assess the pace of an inventive step, researchers and analysts tend to refer to the number of patents filed for a company in a given period (Grilliches, 1990). However, Hirschey & Richardson (2004) point out that the number of patents is an imperfect indicator of innovative activities since it does not capture the true economic value of innovation. In fact, innovation varies considerably depending on the technological and/or economic value, and the distribution of this value is therefore "distorted". Thus, the measurement of the number of patents is by nature limited since it can not erase this heterogeneity. In addition, reluctance has been brought about the informational relevance of patents, thus giving a perception of the patent as a deceptive tool. In his study of 173 biotechnology companies, Lerner (1994) emphasized that not all patents are perceived in the same way by investors ; it depends on the field based on the patent classification plan. Lerner (1994) insists on the assessment of the patent, which must go through economic indicators that better reflect the quality of the patent.

Studies on the value of patents took as a starting point that, for investors, patent quality indicators were more useful than purely accounting information. Thus, patent data are relevant insofar as they convey useful information to investors and predict share prices. Most of the work on patent quality considers the latter to be a non-financial indicator that compensate for

the lack of information from the financial statements. This means that investors, in the case of companies with intensive patents, will have to supplement the available accounting information with extra-accounting data. They will thus be able to better anticipate the future benefits that would flow from the scientific research of companies.

1.2.2. Patent quality : several relevant measures

Several academic works have focused on this notion of patent quality and have attempted to create or improve statistical variables that reflect more a qualitative aspect of patents [Hirschey et al (2001), Chen & Chang (2010), Difadi (2019), Mao et al (2024)]. These empirical studies clearly highlight the presence of a patent, which goes hand in hand with a rich and exhaustive documentation that financial markets can imbibe to evaluate the quality of companies' scientific and technological activities. Thus, before exposing our patent quality variables, a non-exhaustive review of the various measures developed and their use in the literature would help to better understand the notion of quality and to see a little more clearly.

Science and technology as "predictors" of stock market performance, is what Deng et al (1999) pointed out. The latter insist on the quotations in the deposition, which refer to previous inventions ("backward citations") ; but also and especially on the citations of this same patent by entities wanting to use this invention ("forward citations"). In addition, Deng et al (1999) specify that citations in a patent application also allow analysis of the scientific link that derives from patents. For this purpose, they analyze the references to scientific works/papers, conferences, and other studies (but in no case to patents), which the company used to build its patent. Finally, these authors highlight the Rapidity of innovation through the time elapsed between two generations of patents. These references or quotations therefore allow the investor to appreciate the novelty of the invention. Basically, citing a patent indicates the quality of the patent and its ability to bring new technological improvements. Thus, companies with frequently cited patents have a greater probability of success, both in the sustainability of the product and in the financial markets [compared to companies whose patents are not mentioned, or not at all].

Hirschey et al (2001) wanted to show that, even beyond the relationship between the market value and the number of patents filed, there was also a significant association with the quality of patents. In the course of the work of Deng et al (1999), they then introduced a quantity indicator and three quality indicators, respectively as follows: PATENTS which reports on the number of patents filed; the Current Impact Index, which measures the quality of patents

through the number of patent citations of the last 5 years compared to all patents in the US system; Science Linkage which indicates the link with the scientific world; the Technology Cycle Time which measures the time between two generations of patents. On the one hand, the authors show that the quality of patents, related to R&D investments, positively influences the stock market valuation of the company. On the other hand, they stress that the quality of patents is of great value to investors. This allows them to conceive of a positive association between scientific efforts and the added value of R&D expenditures. Nevertheless, there is a negative correlation between speed of innovation and market value.

In this sense, Chen & Chang (2010) are also interested in the relationship between patent quality and market value. In a study of 37 US pharmaceutical companies, they then adopted four original patent quality measures, each as interesting as the next. The first variable is the Relative Patent Position (RPP) which defines the leader in a technological field as being the company with the highest number of patents in this field. The second variable is the Revealed Technology Advantage (RTA) which represents an advantage developed by the company in a particular technological field. Mathematically, it is the ratio between the proportion of patents in a particular field and the total number of patents in all areas of the firm. The third variable is the Herfindahl-Hirschman Index of Patents (HHI) which measures the degree of concentration of patents and technological fields. As the fourth and last quality variable, Chen & Chang (2010) use Patent Citations that measure both the quality of patents and the knowledge flows generated by the company. In parallel with previous studies, the authors emphasize the positive correlation and the significantly different coefficient of 0 (1%) between patent citations and market value.

2. Methodology : sample, variables, hypotheses and econometric model

2.1. Sample, data collection and rivals identification

In order to form our sample, we start with all announced & completed US M&A with announcement dates from January 1st, 1990 to December 31st, 2006 covered by the Mergers and Acquisitions database of the Thomson Financial's SDC database. We analyse all deals coded as a merger, an acquisition of majority interest, or an acquisition of assets. Thereby, we only keep an acquisition if the acquirer controls (if any) less than 50 % of the target's shares before the announcement, obtains at least 51% after the deal, and controls greater than 90% of the target after the deal completion. We require that :

1) transaction value be greater than \$1 million and at least 1% of the acquirer's market capitalization 11 days before the announcement ;

- 2) neither the acquirer nor the target be from the financial sector (SIC 6000 – 6999) ;
- 3) both the acquirer and the target be public firms and covered by Compustat and CRSP for financial information along with firm characteristics. Collecting 7556 deals from SDC and tallying them with Compustat and CRSP for financial informations, we generate 1493⁵ deals where all informations for acquirers and targets are covered by WRDS⁶.

Studying the Cumulative Abnormal Returns (CARs), we carried out the standard event study methodology to compute the CARs of the sample over the event window (-2 ; +2) around the announcement date. Following Golubov et al (2015), we measured our CARs as the return in excess of those predicted by the market model with a benchmark being the CRSP value-weighted index and parameters estimated over a period from 300 to 91 days prior the announcement.

When it comes to rivals identification, several researchers tackled this issue and most of them selected the competitor following SIC codes [Excko (1983), Fee & Thomas (2004), Shahrur (2005), Akdogu (2009), Ang & Wu (2011)]. For each merger, a horizontal competitor of the acquirer around the merger proposal announcement is identified from a list of all firms on the CRSP file associated with the same SIC code assigned to the acquirer. Therefore, in line with previous papers, the rivals are defined based on overlapping 5-digit SIC code.

As for patents, we use the NBER Patent Data Project that provides data about all utility patents⁷ awarded by the US Patent and Trademark Office over the period 1976 – 2006⁸. Using papers from Hall et al (2001) and Bessen (2009), we make dataset of summary statistics⁹ in order to summarize the number of patents per technology class corresponding to each gvkey and obtain 308 066 observations. Finally, we matched these summary statistics to our deal and firms characteristics so that we compute our innovation variables regarding our sample's requirements. We define a technological acquirer or target as a firm having at least one granted patent in their portfolio. On one hand, over 1493 mergers, we have 704 technological acquirers

⁵ We removed firms with missing abnormal returns, firms with missing accounting data, firms in extreme distress, and dropping some Penny stock deals leaving us with 1493 deals.

⁶ To merge SDC with WRDS, we use cusip and DataYearFiscal corresponding to the acquirer and the target

⁷ In our analysis we dropped firms that does not have utility patents (firms whose Pdpass is negative) because utility is a necessary requirement for patentability (US Patent Law).

⁸ The NBER is a database of 3 279 509 observations/patents and contains for each patent, an application year, a grant year, a unique patent number, a patent assignee number, and a patent's technology class (according to IPC system) ; among others.

⁹ We used the command collapse (sum) on Stata

versus 787 non-technological acquirers ; and on the other hand, we have 486 technological targets versus 1007 non-technological targets.

Since we are focusing on technological proximity between two technological firms, namely acquirers and targets, we must work exclusively on deals involving firms with at least one patent in their portfolio. Accordingly, looking for deals where both acquirer and target possess patents, we found 428 deals corresponding to our requirements and allowing us to compute a technological proximity between the technological merging firms. On that perspective, we identified and selected 428 rivals of the acquiring firms.

Table 1 : Construction of the 1990-2006 sample of technological M&A

<u>Databases</u>	Acquirers	Targets
<i>SDC</i>	7556 deals	
<i>SDC + Compustat + CRSP</i>	1493 deals	
<i>NBER</i>		
<i>Technological</i>	704 firms	486 firms
<i>Non-Technological</i>	787 firms	1007 firms
Final Sample	428 technological acquirers & targets deals	

Source : The author (from SDC, Compustat, CRSP using Stata)

2.2. Variables' description

2.2.1. Technological Proximity and other technological characteristics.

✓ Variable of interest : Technological diversification

Originally, technological proximity was introduced by Jaffe (1986) in order to measure the closeness of two innovative firms using patent counts in different technology classes. Through 49 technological fields, technological proximity is computed as the angular separation between two vectors of technological position. The measure ranges between 0 and 1 ; 1 means identical technological patterns of innovative activity, and 0 means no potential to benefit from each other's research activities. The angular separation between acquirer (acq) and target (targ) is calculated as follows :

(1)

$$\text{Tech prox} = \frac{\mathbf{F}_{\text{acq}} * \mathbf{F}'_{\text{targ}}}{(\mathbf{F}_{\text{acq}} * \mathbf{F}'_{\text{acq}})^{\frac{1}{2}} (\mathbf{F}_{\text{targ}} * \mathbf{F}'_{\text{targ}})^{\frac{1}{2}}}$$

(1.1) Where

$$\mathbf{F}_{acq} = (\mathbf{F}_{acq,1}; \dots ; \mathbf{F}_{acq,k}) \quad ; \text{ where } k \in (1, k) \text{ is the technology}$$

(1.2) Where

$$\mathbf{F}_{acq,k} = \frac{\text{Nb of awarded patents in tech class } k \text{ with application year } -4 \text{ to } -1}{\text{Total nb of awarded patents in all tech classes applied over the same 4-years}}$$

There are several ways to determine technological classes, and then the two technological vectors (Jaffe (1986), Grimpe & Hussinger (2008), Aldieri (2012), Bena & Li (2014), Stellner (2014)) ... A patent is assigned to at least one classification by the patent examiner but usually a patent is assigned to more than one patent class.

For our part, this uncentered correlation will be computed at two different levels of patent classification following NBER working papers from Hall et al (2001, 2005). The latter put forward different levels of patent classification: 6 main Categories, 37 Subcategories, 400 main (3-digit) patent classes, 120 000 patent subclasses. We consider a technological firm as a company possessing at least one patent in its portfolio or immaterial capital. In contrast, a non-technological firm has no the least patent in its portfolio. We determined the technological aspect according to NBER database.

From there, using « foreach » and « forvalues » commands on Stata, we created several loops to account for the proximity between merging firms within each industry (Categories) and each industry segment (Subcategories) in which the latter were reported to have at least one patent application during the period 1990-2006 (see Appendix 1). Therefore, we generated two different variables based on Jaffe's measure (1986) and accounting for technological proximity within two different levels of classification as follows:

Tech_Prox_S = Proximity between merging firms within each of 37 subcategories.

- ↳ It will account for the number of patents belonging to each target and located in an industry segment shared by the acquirer.
- ↳ This is the technological proximity between acquirer and the target inside one specific industry – non-conglomerate view –.

Tech_Prox_C = proximity between merging firms within each of 6 Categories.

- ↳ It will account for the number of patents belonging to each target and located in an industry shared by the acquirer.
- ↳ This is the technological proximity between acquirer and the target across several industries – conglomerate view –.

Appendix 1 : CATEGORIES level and SUBCATEGORIES level from NBER

CATEGORIES / industries		SUBCATEGORIES / industry segments / Tech fields	
1	<u>Chemical</u>	11	<i>Agriculture, Food, Textiles</i>
		12	<i>Coating</i>
		13	<i>Gas</i>
		14	<i>Organic Compounds</i>
		15	<i>Resins</i>
		19	<i>Miscellaneous</i>
2	<u>Computers & Communication</u>	21	<i>Communications</i>
		22	<i>Computer Hardware & Software</i>
		23	<i>Computer Peripherals</i>
		24 / 25	<i>Information Storage</i>
3	<u>Drugs & Medicals</u>	31	<i>Drugs</i>
		32	<i>Surgery & Medical Instruments</i>
		33	<i>Genetics</i>
		39	<i>Miscellaneous</i>
4	<u>Electrical</u>	41	<i>Electrical Devices</i>
		42	<i>Electrical Lighting</i>
		43	<i>Measuring & Testing</i>
		44	<i>Nuclear & X-rays</i>
		45	<i>Power Systems</i>
		46	<i>Semiconductor Devices</i>
		49	<i>Miscellaneous</i>
5	<u>Mechanicals</u>	51	<i>Mat Proc & Handling</i>
		52	<i>Metal Working</i>
		53	<i>Motors & Engines</i>
		54	<i>Optics</i>
		55	<i>Transportation</i>
		59	<i>Miscellaneous</i>
6	<u>Others</u>	61	<i>Agriculture, Husbandry</i>
		62	<i>Amusement Devices</i>
		63	<i>Apparel & Textile</i>
		64	<i>Earth Working</i>
		65 / 66	<i>Furniture, House Fixtures / Heating</i>
		67	<i>Pipes & Joints</i>
		68 / 69	<i>Receptacles / Miscellaneous</i>

Source : The author (from National Bureau of Economic Research (USA))

✓ Number of patents

Aside from deal and financial characteristics of a firm, one must not overlook a firm's technological characteristics. So as to better know whether the premiums and market reaction are impacted by the technological diversification or merely the number of patents possessed by the target – and also by the acquirer –. All papers dealing with patents topics used this variable in their models ((Griliches (1990), Lerner (1994), Deng et al (1999), Hirschey et al (2001), Chen et al (2010), among others).

$NP_Targ_{i,t}$ & $NP_Acq_{i,t}$ = Total number of patent applications held by firm i within year t , from 1990 to 2006, it ranges from 1 to 36778.

2.2.2. Deal and firms control variables

Following the literature, we control for deal characteristics using six dummies, namely, Status, Number of Bidders, Attitude, Tender offer, Allcash, and Poison pill. As for firm characteristics, we control through R&D¹⁰ intensity, Market value or Relative size (measured by firm's capitalization), performance (measured by market-to-book ratio), profitability (measured by ROA), Leverage, and Run-up.

2.3. Econometric model : Technological Proximity and market response

Starting from the crescent impact of technologies on cumulative abnormal returns, it might be interesting to go deeper in the concept of technology and examine whether the technological proximity between the acquirer and the target influence the Cumulative Abnormal Returns (CARs) of the merging firms, on one hand, and of the rival firms, on the other hand. Table 2 tackles this issue and concentrates on the 428 deals involving both acquirer and target as technological firms and allowing us to compute the technological proximity between those latter.

With a view to examining to what extent does technological proximity between merging firms influences predicted abnormal returns of the latter and those of their rivals, we estimate the following empirical model in our baseline OLS regressions:

¹⁰ We must keep in mind that firms are not forced to report R&D expenditures which results in a considerable number of missing values in this variable. Since we lose a high percentage of observations due to missing values within control variables, we create a dummy variable equals to one if the R&D information is reported and zero otherwise. Based on this standard practise¹⁰, we then replace missing values in R&D expenditures with 0 so as to obtain an homogeneous sample with the same number of observations in our regressions that makes them comparable. [Fernández-Kranz, D., & Santaló, J. (2010)]

$$\mathbf{Synergy_CARs}_{i,t} = \alpha_0 + \alpha_1 \text{Tech_Prox_S}_{i,t} + \alpha_2 \text{Tech_Prox_C}_{i,t} + \alpha_3 \text{Targ_Size_Pat}_{i,t} + \alpha_4 \text{Acq_Size_Pat}_{i,t} + \alpha_5 X_{i,t} + \alpha_6 Z_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$\mathbf{Rivals_CARs}_{i,t} = \beta_0 + \beta_1 \text{Tech_Prox_S}_{i,t} + \beta_2 \text{Tech_Prox_C}_{i,t} + \beta_3 \text{Targ_Size_Pat}_{i,t} + \beta_4 \text{Acq_Size_Pat}_{i,t} + \beta_5 X_{i,t} + \beta_6 Z_{i,t} + \varepsilon_{i,t} \quad (2)$$

Where i indexes deal number and t indexes the year. *Synergy_CARs* _{i,t} term is the dependent variable accounting for combined abnormal returns and is measured by taking the product of Acquirers CARs and Targets CARs. Actually, it represents the market sentiment towards potential technological synergy gains. *Rivals_CARs* _{i,t} is the second dependent variable dealing with identified rivals of each acquirer and their predicted abnormal returns. At the right side, the $\text{Tech_Prox_S}_{i,t}$ is the technological proximity computing the closeness of two innovative merging firms using patent counts over 37 subcategories as defined by Hall et al (2001). The $\text{Tech_Prox_C}_{i,t}$ refers to the technological proximity measuring the closeness of two innovative merging firms using patent counts over 6 main categories as defined by Hall et al (2001). The $\text{NP_Targ}_{i,t}$ and $\text{NP_Acq}_{i,t}$ are technological variables controlling, respectively, for the target's number of patents and acquirer's number of patents. As for $X_{i,t}$, it refers to deal characteristics and $Z_{i,t}$ represents acquirer's and target's firm characteristics as enounced in Section 2. Working on technological proximity within industries and industry segments, we ran a fixed effects model controlling for industries characteristics by including acquirer's 4-SIC digit code along with year fixed effects (see Table 4).

2.4. Hypotheses development

The literature has always been emphasizing innovation as a sharing process in the sens that new innovative outputs come in the aftermaths of existing elements of knowledge recombined into new products (Schumpeter (1934)).

The Competitive Advantage hypothesis states that the combined resources of the merging firms generate a fiercer and more powerful adversary unless rivals can replicate the investment, for all that matters. This suggests that the new merged firm creates value for the acquirer and the target while hurting their competitors ; and then predicts positive abnormal returns for the acquirer and negative abnormal returns for rivals (Eckbo (1983)). Thereby, acquiring a target whose innovation is a land of plenty could give the acquiring firm more potential advantages (Mazza & Shuwaikh (2022), Huang et al (2024)). We then put forward the two following hypothesis :

H1 a : *The higher subcategories technological proximity between the merging firms, the more positive will be market reaction to acquirers.*

H1 b : *The higher subcategories technological proximity between the merging firms, the more negative will be market reaction to rival firms.*

According to the property rights theory of Hart (1995) and empirical studies [(Huang et al (2024), Mao et al (2024)], a merger between companies having complementary technologies is value-enhancing, while a merger including companies having independent technologies is value-reducing. A moderate degree of overlap in the acquirer and target knowledge bases are likely to create synergies and a positive impact on the acquiring firm's subsequent innovation output. We predict that the market would depreciate the acquisition of a target that ventures into several industries since conglomerates tend to reduce the risk of managerial human capital and to create « business empires » perhaps valued excessively by CEOs [Roll (1986)]. Conglomerate may also reflect an agency problem by the fact that executive compensation showed little sensitivity to firm performance at the time [Jensen & Murphy (1990)]. We then hypothesize that :

H2 a : *The higher Categories technological proximity between the merging firms, the more negative will be market reaction to acquirers and rival firms.*

H2 b : *The higher Categories technological proximity between the merging firms, the more positive will be market reaction to rival firms.*

3. Descriptive statistics and empirical results

3.1. Descriptive statistics and linear regressions

3.1.1. Summary statistics : Technological Proximity and market response

Table 2 shows descriptive statistics for our technological sample of 428 observations from 1990 to 2006, where both acquirer and target have at least one patent.

Studying the impact of technological proximity on merging firms and rivals abnormal returns, we put forward different cumulative abnormal returns (CARs), namely, Synergy_CAR (combined abnormal returns) and Rivals_CAR. Looking at the mean (median), we observe that the market response is positively pronounced when it comes to merging firms and negative for rival firms. Concretely, Synergy_CAR has a mean of 0.020 (0.018) versus -0.018 (-0.012) for Rival_CAR.

Technological acquirers appear in a « better health » and much larger firm than technological targets, regarding firms' characteristics. Indeed, technological targets have a median market value (358 533) while acquirers have a median that is almost tenfold (3 578 995). Looking at

variables' median, technological acquirers have also higher ROA, MTB, and FCF in comparison with technological targets. However, we can note that targets have more R&D intensity (0.080) than acquirers (0.058), and that the former have twice as much cash as the latter. This indicate that beyond making higher investments in R&D, the average technological targets have a tendency to be a much larger firm with higher earnings and cash-flow. This is consistent with Phillips and Zhdanov (2013) who found that large firms prefer not to vie or compete with small firms in an R&D rate race, letting small companies innovate more.

As for the technological proximity between merging firms, Table 2 displays the variable Tech_Prox_S has a mean of 0.30 and a median of 0.22 showing that proximity among technological segments is well pronounced and that merging firms have a minimum of closeness regarding their patents clasified by subcategories. On the other hand, the variable Tech_Prox_C has a mean of 0.11 and a median of 0.04 suggesting that proximity is slighly present among merging firms belonging to different industries. These descriptive statistics do not sound spooky since it is easier to find more technological proximity between firms belonging to the same industry or between two large firms each of both having a true range of patents across several industries.

Table 2 : Summary statistics – Variables of interest and firms' characteristics

	N	Mean	p50	p25	p99	sd	min.	max.
Rivals_CAR	428	-0.018	-0.012	-0.054	0.175	0.081	-0.377	0.382
Synergy_CAR	428	0.020	0.018	-0.018	0.242	0.081	-0.294	0.309
Tech_Prox_S	428	0.296	0.224	0.043	0.911	0.273	0	0.973
Tech_Prox_C	428	0.106	0.043	0.000	0.537	0.137	0	0.635
Targ_mv	428	2308504	358533.3	110247.5	5.06e+07	7548555	2905.15	7.72e+07
Targ_roa	428	0.042	0.114	-0.006	0.375	0.252	-1.956	0.478
Targ_mtb	428	2.691	1.871	1.297	14.846	2.559	0.534	23.477
Targ_rd	428	0.119	0.080	0.022	0.785	0.164	0	1.502
Targ_fcf	428	-0.031	0.018	-0.169	0.197	0.209	-2.160	0.303
Targ_run_up	428	1.051	0.900	0.671	3.802	0.850	0.123	13.657
Acq_mv	428	2.67e+07	3578995	896409.8	2.13e+08	5.40e+07	23456	4.93e+08
Acq_roa	428	0.143	0.153	0.094	0.418	0.131	-0.598	0.492
Acq_mtb	428	3.045	2.220	1.583	13.934	3.219	0.330	47.686
Acq_cash	428	0.212	0.135	0.037	0.808	0.216	0.000	0.932
Acq_rd	428	0.082	0.058	0.019	0.469	0.105	0	1.098
Acq_lev	428	0.084	0.057	0.010	0.375	0.094	0	0.616
Acq_fcf	428	0.042	0.053	0.010	0.206	0.098	-0.624	0.251
Acq_run_up	428	1.125	1.034	0.839	2.996	0.531	0.200	7.102

Source : The author (using Stata)

3.1.2. Linear regressions – Technological proximity influence on merging firms and rivals

Table 3 portrays linear regressions over our sample of 428 technological deals during the period 1990 – 2006 and the wealth effect of technological proximity on market sentiment measured by Synergy_CAR and Rivals_CAR. We run new pooled regressions taking into account as variables of interest, the technological proximity within the two levels in columns (1) to (4). On one hand, we regress the two Technological proximity variables on Synergy_CAR in columns (1) and (2) ; and on the other hand, we regress these two variables on Rivals_CAR in columns (3) and (4). The univariate regression in column (1) shows a highly significant impact with opposite sign depending on whether the proximity is within one specific industry or across several ones. Thereby, Tech_Prox_S has a positive and significant coefficient ($\alpha_1 = 0.04$) at 1% level in column (1), Tech_Prox_C shows a negative and significant coefficient ($\alpha_2 = - 0.03$) at 1% level in this very univariate regression. Moreover, once we introduce firms and deal characteristics in column (2), the former stays positive ($\alpha_1 = 0.06$) but less significant at 10% while the latter remains negative ($\alpha_2 = - 0.02$) but less significant at 5% in column (2). As for Rivals_CAR, technological proximity keeps the same signs but definitely loses in significativity. The univariate regression in column (3) reports the same signs as column (1). However, it shows a nil and nonsignificant coefficient β_1 of Tech_Prox_S, while Tech_Prox_C

Table 3 : Technological proximity influence on merging firms and rivals CAR -

Linear regression

<i>Variable</i>	(1) Tech Prox	(2) Synergy CAR	(3) Tech Prox	(4) Rival CAR
Tech_Prox_S	0.04*** (2.80)	0.06* (1.88)	0.00 (0.15)	0.01 (0.18)
Tech_Prox_C	-0.03*** (-2.94)	-0.02** (-2.20)	-0.02** (-2.36)	-0.01 (-1.57)
NP_Acq		-0.00*** (-3.12)		-0.00* (-1.87)
NP_Targ		-0.00 (-0.32)		-0.00 (-1.15)
Status_Dummy		-0.01 (-0.78)		-0.00 (-0.31)
TendOff_Dummy		0.01 (0.87)		0.01 (0.89)
Attitude_Dummy		-0.03 (-1.50)		0.00 (0.15)
AllCash_Dummy		0.01* (1.65)		0.02* (1.69)
NboB_Dummy		0.01 (0.75)		0.01 (0.43)
Acq_MV		-0.00 (-0.30)		0.00** (2.21)
Acq_Runup		-0.01 (-0.50)		-0.00 (-0.13)
Acq_ROA		-0.07 (-1.08)		-0.03 (-0.43)
Acq_Lev		0.10* (1.96)		-0.01 (-0.25)
Acq_RD		-0.09 (-1.26)		-0.16** (-2.54)
Acq_FCF		-0.00 (-0.02)		-0.00 (-0.04)
Targ_MV		-0.00 (-0.31)		-0.00* (-1.93)
Targ_Runup		-0.00 (-0.27)		0.01* (1.87)
Targ_ROA		0.00 (0.55)		0.00 (0.40)
Targ_Lev		-0.05 (-1.49)		-0.05 (-1.40)
Targ_RD		0.02 (0.68)		0.01 (0.19)
Targ_FCF		-0.04 (-1.39)		-0.02 (-0.77)
Relatedness_SIC_2		0.00 (0.13)		-0.01 (-0.81)
Number of cases	428	428	428	428
R ² -Squared	0.04	0.13	0.02	0.18

Significance levels are reported in parentheses, *, **, *** and denote 10%, 5%, 1% level, respectively

Source : The author (using Stata)

has a negative and significant coefficient at 10% level ($\beta_2 = -0.02$) suggesting that the Rivals' abnormal returns are correlated to merging firms abnormal returns but significance is almost inexistent. Furthermore, once we introduce firms and deal characteristics in column (4), both variables keep the same opposite signs and lose any significance.

Looking at control variables, we can observe that an all cash transaction has a positive significant (10%) impact once on Synergy_CAR and Rivals_CAR. If an acquirer does not feel self-assured about the target's real value, it would be more cautious to pay with equity so as to share potential negative returns and thus minimizing the problem of adverse selection [Sudarsanam & Mahate (2003)]. On the flip side, a cash payment gives the acquirers' shareholders an opportunity to reap future gains from the merge. Following Jensen (1986), acquiring a target through a cash offer mitigates likely agency problems by releasing excess free cash flows. Moreover, we can note that acquirers R&D intensity has a negative and significant (5%) impact on Rivals_CAR meaning that technological acquirers with high R&D have a potential to harm competitors through a merger or an acquisition of another technological target firm.

Finally, we observed that the impact of technological proximity on Synergy_CAR is correlated to the one on Rivals_CAR, but the nonsignificant coefficients in columns (3) and (4) do not allow us to validate these results. Therefore, we must wonder whether the market is sensitive to mergers' impact on rivals or not and whether the market may react differently depending on each industry characteristics.

3.2. Fixed Effects regressions : Technological Proximity's influence on market response

3.2.1. Empirical results display and analysis – Acquirers' 4-digit SIC

Arguably, the market could react differently depending on the target's line of business purchased by acquirers. With a view to add more accuracy about the acquirer's line of business and since we are using the international patent classification for our technological proximity measure, we introduced fixed effects controlling for acquirer's 4-digit code and year effects. Table 4 shows a fixed effects model over our sample of 428 technological deals. For the sake of comparability, columns (1) to (3) still show regressions over Synergy_CAR as a dependent variable ; while columns (4) and (5) show regressions where the dependent variable is Rivals_CAR. Starting from the impact of technological proximity on merging firms' abnormal returns, we can see that Tech_Prox_S is positive and highly significant at 1% level both in the univariate column (1) and firm & deal controls in column (2). This very coefficient α_1 remains positive but lost in significance (10%) once we introduced year effects in column (3). On the

other hand, Tech_Prox_C is still negative and significant at 5 % except in column (3). These empirical results indicate that the more we go deep in SIC code classification better is the impact of technological proximity within different industry segments belonging to one specific industry. Looking at Rivals_CAR as a dependent variable in columns (4) and (5), our results show significant coefficient for our variables of interest in column (4). The closeness of two innovative firms sharing patents belonging to the same industry has a positive and significant impact on rivals abnormal returns at 10% (Tech_Prox_S : $\beta_1 = 0.04$). Nevertheless, the closeness of two innovative firms sharing patents belonging to the different industries has a negative and significant impact on rivals abnormal returns at 10% (Tech_Prox_C : $\beta_2 = -0.02$). That said, we must note that targets and acquirers number of patents are significant but at an unstable way and with a nil coefficient when it comes to Rivals_CAR in columns (4) and (5). Also, attitude and payment method characteristics seem to play some significant role respectively in column (2) and column (4) at 10% level. The choice of the method depends on whether the acquirer discerns valuation risk or not and may be partially guided by agency cost consideration. Basically, stock offers are widely perceived as a negative information signal while cash offers are believed to convey positive information. Intuitively, an equity offer is tantamount to a risk-distribution since the stock-offered value is closely linked to the ex-post performance of the joint entity. As for firms characteristics, target_lev is negatively significant at 5% in columns (2) and (3), and at 10% level in columns (4) and (5). It seems that the market does not perceive target_leverage in the same way as premiums. In addition, acq_RD has a highly significant and negative coefficient (-0.14) in columns (4) and (5), meaning that acquirers' R&D intensity could harm rivals abnormal returns in a context of a technological merger proposal announcement.

Table 4 : Technological proximity influence on merging firms and rivals CAR – fixed and year effects, 4-digit SIC code

	(1) Tech_Prox	(2) Acquirer CAR	(3) Year effects	(4) Rivals CAR	(5) Year effects
Tech_Prox_S	0.04*** (4.75)	0.07*** (2.83)	0.06* (1.95)	0.04* (1.70)	0.02 (0.79)
Tech_Prox_C	-0.02** (-2.52)	-0.02** (-2.28)	-0.02* (-2.03)	-0.02* (-1.73)	-0.01 (-1.59)
NP_Acq		-0.00*** (-2.99)	-0.00*** (-3.43)	-0.00 (-1.33)	-0.00 (-1.58)
NP_Targ		-0.00 (-0.05)	0.00 (0.26)	-0.00* (-1.85)	-0.00 (-1.47)
Status_Dummy		-0.02 (-1.08)	-0.02 (-1.42)	-0.01 (-0.85)	-0.01 (-1.01)
TendOff_Dummy		0.01 (0.68)	0.02 (1.30)	0.00 (0.30)	0.01 (1.06)
Attitude_Dummy		-0.03* (-1.93)	-0.02 (-1.29)	-0.00 (-0.10)	0.00 (0.21)
AllCash_Dummy		0.01 (1.52)	0.01 (0.69)	0.02* (1.86)	0.01 (1.18)
NboB_Dummy		0.01 (0.87)	0.02 (1.47)	0.01 (0.42)	0.01 (0.85)
Acq_MV		0.00* (0.01)	0.00 (0.81)	0.00*** (3.63)	0.00*** (4.80)
Acq_Runup		-0.01* (-1.95)	-0.01* (-1.86)	-0.01 (-1.34)	-0.00 (-0.91)
Acq_ROA		-0.10* (-1.83)	-0.10 (-1.22)	0.02 (0.32)	-0.00 (-0.01)
Acq_Lev		0.05 (1.23)	0.05 (1.21)	-0.03 (-0.69)	-0.04 (-0.70)
Acq_RD		-0.09 (-1.36)	-0.09 (-1.28)	-0.14** (-2.65)	-0.14** (-2.36)
Acq_FCF		0.02 (0.24)	-0.00 (-0.04)	-0.04 (-0.61)	-0.05 (-0.57)
Targ_MV		-0.00 (-0.78)	-0.00 (-0.72)	-0.00** (-2.25)	-0.00* (-1.87)
Targ_Runup		-0.00 (-0.83)	-0.00 (-0.15)	0.00 (0.41)	0.00* (1.99)
Targ_ROA		0.00 (0.48)	0.01 (1.22)	0.00 (0.10)	0.01 (0.76)
Targ_Lev		-0.08** (-2.09)	-0.07** (-2.55)	-0.07* (-1.78)	-0.07* (-2.04)
Targ_RD		0.03 (1.02)	0.02 (0.68)	0.03 (1.39)	0.02 (0.87)
Targ_FCF		-0.04** (-2.12)	-0.03 (-1.27)	-0.03 (-1.62)	-0.02 (-0.95)
Relatedness_SIC_2		0.01 (0.89)	0.01 (0.81)	-0.00 (-0.50)	-0.01 (-0.66)
Number of Cases	428	428	428	428	428
R ² -within	0.04	0.12	0.17	0.12	0.18
R ² -between	0.35	0.05	0.10	0.00	0.21

Significance levels are reported in parentheses, *, **, *** and denote 10%, 5%, 1% level, respectively

Source : The author (using Stata)

Therefore, our empirical evidence can be displayed in three points. First, our empirical results indicate a correlation between merging firms and acquirers' rivals regarding the impact of technological proximity on predicted abnormal returns since this impact on acquirers' competitors goes hand in hand with the one on merging firms. On one hand, the higher Subcategories technological proximity (Tech_Prox_S) between the acquirer and the target, the more positive will be market reaction to merging firms, but also to acquirers' rivals. On the other hand, the higher Categories technological proximity between the acquirer and the target, the more negative will be market response to merging firms, but also to acquirers' rivals.

This lead to our second result showing that the closeness of two innovative firms, using patent counts in different industry segments inside one specific industry (Tech_Prox_S), has a positive impact on predicted abnormal returns albeit it is highly significant at 5% or 1% for merging firms and at 10% level or even nonsignificant for rival firms. This suggests that the increased demand may result in expectations of future merger activity, giving birth to a positive « in-play » effect created in the competitors' abnormal returns in response to a merger involving technological proximity between targets and acquirers.

Third, the closeness of two innovative firms, using patent counts across several industries (Tech_Prox_C), has a negative impact on predicted abnormal returns albeit it is highly significant at 5% for merging firms but slightly significant at 10% for rival firms. This suggests that technological proximity beyond firms' frontiers leading to a conglomerate process is perceived by the market as being detrimental to merging firms but also to rival firms. Basically, a conglomerate takeover may put forward an underperformance of a specific industry since acquirers merge with targets from another industry. This could lead to a negative wealth effect on that specific industry and other stakeholders belonging to.

All in all, our results are inconsistent with the collusion predicted by the market power theory but consistent with the property rights theory and the positive information effect predicted by the productive efficiency theory.

3.2.2. Discussing our empirical results

Basically, our empirical results validate Hypothesis H1.a since the higher Subcategories technological proximity (Tech_Prox_S) between the acquirer and the target, the more positive will be market reaction to merging firms. This is in line with Hart (1995), Mazza & Shuwaikh (2022), Huang et al (2024), Mao et al (2024)] arguing that a merger between companies having complementary technologies is value-enhancing, while a merger including companies having independent technologies is value-reducing. A moderate degree of overlap in the acquirer and

target knowledge bases are likely to create synergies and a positive impact on the acquiring firm's subsequent innovation output. Our results also validate Hypothesis H2.a since the higher Categories technological proximity between the acquirer and the target, the more negative will be market response to merging firms. Granted, two different technologies inside the same industry might easily impel two firms to merge, still, two different technologies each of which belongs to different industries might dampen the two firms to merge. Assimilation, managerial, and communication costs are some good reasons that might make the market reacts negatively to such acquisition and illustrate the latter argument. Our results are therefore consistent with previous researchers analyzing the value of diversification when many corporation started to diversify and finding no striking evidence about the value of diversified companies [Servaes (1996), Ravenscraft & Scherer (1987), Lang & Stulz (1994)].

Notwithstanding, our empirical evidences do not validate hypotheses H1.b and H2.b predicting an opposite impact on rival firms. Actually, Table 4 show a correlation between merging firms and acquirers' rivals regarding the impact of technological proximity on predicted abnormal returns – albeit coefficients in Rival_CAR regressions are weakly significant or even nonsignificant under year effects. First, the higher subcategories technological proximity between the merging firms, the more positive will be market reaction to rival firms. The announcement of a merger may convey a positive information about the resources' value of the industry and those controlled by rival firms. Arguably, two technological merging firms with complementary assets will gain more efficient production, resulting in higher infra-marginal rents to these very firms. Nonetheless, the increased volume of M&A within an industry may reveal a high synergistic industry but also a high demand for resources owned by other companies, leading to a positive re-evaluation of these rival firms. Basically, the increased demand may result in expectations of future merger activity, giving birth to a positive « in-play » effect on rival firms from the announcement of a merger, for all that matters.

Second, the technological proximity across several categories/industries between the merging firms results in a negative market reaction to rival firms. The innovation literature showed that technological overlaps between merging firms play a tremendous role in post-acquisition innovation [Hart (1995), Breschi et al (2003), Leten et al (2007), Hoberg & Phillips (2010), Bena & Li (2014), Mao et al (2024)]. The Competitive Advantage hypothesis is broken into two versions : Efficient through competitor, and Rational Overpayment. The latter suggests that acquirers would rationally overpay for the target so as to shy away from a negative payoff externality which they would suffer from if another rival takes over the target firm. « Rational

Overpayment » version predicts negative abnormal returns for rivals when acquirers experience negative abnormal returns. Thus, independent technologies within a merger would negatively impact the acquirer even if rivals rely on target's technologies. In addition, Productive efficiency theory predicts that rival firms may suffer from more competition in the industry due to a new more-efficient combined firm [Eckbo (1983), Eckbo et al (2024)]. Actually, a scale-increasing efficient mergers have a tendency to negatively impact the industry's equilibrium product price, which harms competitors and by itself causes a negative industry wealth effect. Moreover, a conglomerate or an acquisition of a firm belonging to another industry may strengthen the new firm through an increase of its skills' diversification and knowledge bases' richness. This possible technological competitive advantage could definitely harm rival firms' performance and result in negative abnormal returns for competitors.

Conclusion

Technological interdependence has become ubiquitous within the corporate world, and it is no accident that large firms expand their technological competencies over many technological fields. In this paper, focusing on patents, we studied the impact of technological proximity between merging firms on abnormal returns of that very firms and of acquirers' rivals.

Carrying out a cross-sectional study that analyses 428 deals and technological proximity across 37 industry-segments (industry related M&A) and 6 different industries (conglomerate M&A), our empirical evidence indicates a correlation between merging firms and acquirers' rivals regarding the impact of technological proximity on predicted abnormal returns. The closeness of two innovative firms inside one specific industry (Tech_Prox_S), has a positive and significant impact on predicted abnormal returns for merging firms and, to a lesser extent, for rival firms. This suggests that the increased demand may result in expectations of future merger activity, giving birth to a positive « in-play » effect created in the competitors' abnormal returns in response to a merger involving technological proximity between targets and acquirers.

Moreover, M&A across several industries (Tech_Prox_C), has a negative impact on predicted abnormal returns albeit it is highly significant at 5% for merging firms but slightly significant at 10% for rival firms. This suggests that technological proximity beyond firms' frontiers leading to a conglomerate process is perceived by the market as being detrimental to merging firms but also to rival firms.

All in all, M&A involving industry-related technological firms positively influence the market reaction to merging firms, but also to rival firms. However, a conglomerate takeover may put forward an underperformance of a specific industry since acquirers merge with targets from

another industry. This could lead to a negative wealth effect on that specific industry and other stakeholders belonging to.

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