Exiting the market by mergers and acquisitions. Does the crisis matter?

Exiting the Market by Mergers and Acquisitions. Does the Crisis Matter?

Riccardo Cappelli (PhD)
Department of Economics and Social Sciences, Marche Polytechnic University, Ancona, Italy
Piazzale Martelli 8 60100 Ancona
E-mail: r.cappelli@univpm.it

Marco Cucculelli (PhD)
Department of Economics and Social Sciences, Marche Polytechnic University, Ancona, Italy
Piazzale Martelli 8 60100 Ancona
E-mail: m.cucculelli@univpm.it

Abstract

Mergers and Acquisitions (M&A) have been extensively and thoroughly studied as a result of a decision on exiting the market. Most attention has been directed to M&A occurring during business booms when numerous deals take place and prices are high. Conversely, least attention has been devoted to M&A during a crisis or just after recessionary periods.

Using a sample of 358 mergers that occurred in Europe before (145) and after (213) the financial crisis, this paper explores if and to what extent the innovation profile of incumbents affects the exit decisions through M&A before and after the crisis.

Internal R&D and product innovations are major drivers of deals in young industries, whereas process innovation plays a crucial role in mature industries. Patents are the only key innovation drivers of M&A after the crisis, both in young and mature industries. We furnish here some explanations of the mechanisms behind these emergent behaviours.

JEL Code: G34; L10; C1

Keywords: mergers and acquisitions; firm exit; financial crisis; R&D; product innovation; process innovation; patent; economic cycle; industry life-cycle; uncertainty

1. Introduction

The exit strategy of a firm can be seen as part of its overall strategy (Cefis and Marsili 2012), and is performed in various ways (Balcacen et al. 2012). This paper deals with M&A, and explores whether M&A exit decisions respond differently before and after a crisis, thus making M&A an exit route dependent on the economic scenario in which they occur.

Many interdisciplinary studies of the 2007–2008 global financial crisis examine the causes of a crisis, corporate governance and firm value, stock market efficiency, new firm registration, macroeconomic performance, and compare the present crisis to previous crises (Reddy et al. 2014; Rao and Reddy 2017). However, there is very limited evidence on M&A with respect to the financial crisis.

In the ’70s and ’80s, M&A dominated the headlines, with spectacular and often hostile deals one after another. They emerged as a powerful engine of restructuring, and was a way out for the corporate sector viewed as sclerotic and too dense with conglomerates. After the ’80s ended in recession, M&A staggered, only to bounce back a few years later and stop again in the dot-com bust of the ’90s. By the 2000s, M&A revived following the business cycles, and a record in transactions in global M&A volume was generated in 2007. Then came 2008, and M&A came to a halt again (Teitelman 2014).

In all these events, a common feature was the difference between the types and the nature of transactions during the different phases of the business cycle: large versus small deals, domestic versus cross-border deals, related versus unrelated conglomerate deals, cash-financed (or external finance) versus share-backed deals, and so on (Blonigen and Pierce 2016). This evidence made mergers – as a way of exiting the market for incumbents – dependent on the characteristics and the intensity of the economic climate in which transactions occurred.

The literature on market entry has already addressed this topic by showing how external business and economic conditions shape the profile and intensity of the process of entry and innovation (Santarelli and Vivarelli 2007; Caballero Hammour 1994). According to this literature, market entry occurs as conditional on some characteristics of the potential entrants and on their fit with existing market conditions. Studies on post-entry survival confirmed this approach (Santarelli and Vivarelli 2004; Mata and Portugal 2007).

This paper strives to highlight a similar point by studying whether exit conditions related to the merger activity are different when the business cycle is taken into account. The existing literature shows that firms may adopt an M&A strategy to exploit the economic benefits emanating from their innovations (Cefis and Marsili 2011 and 2012; Cotei and Farhat 2018). Moreover, Cefis and Marsili (2012) demonstrate that such exit strategies are closely related to the nature and synergies of innovative efforts. The authors find that product innovations are more conducive to exiting by M&A than process innovations. Cefis and Marsili (2011) find a positive association between patent and M&A, and explain this result arguing that patenting firms are a more attractive target for an M&A. However, little is known on whether the impact of innovation on M&A deals changed after a major economic downturn, i.e., the crisis of 2008. The recent crisis is likely

to reduce the demand for innovative goods which are often more expensive, and increase the positive conditions for process innovations that reduce costs/prices (OECD, 2009). In general, the demand-side effects of a crisis may affect the firms M&A exit strategies.

Using data from BvD-Zephyr, this paper compares the probability of being a target of an M&A transaction before the crisis period (2004–2007) and after the crisis period (2011–2014) by using the company's innovation profile as a main determinant. As we consider three different types of innovations: innovation input (internal R&D); intermediate output (patents); and outcomes (product, process and organisational innovations); we control for the industry maturity to avoid the confounding effects of the industry life-cycle (ILC) stage on innovation and, in turn, on M&A decisions.

The results of probit estimates show significant differences in the way the innovation variables affect the probability for a firm to be acquired before and after the crisis. Before the crisis period, one can observe that all types of a firm's innovation measures are positively associated with the probability of observing an M&A deal. By contrast, none of these innovation measures have a significant effect on the probability of being an M&A target after the crisis, except patents, whose specific characteristics help in mitigating the risky return streams in unstable periods following the crisis.

In general, this paper provides a first (at least to our knowledge) empirical evidence to the fact that the nature of innovation behind the exit decisions through M&A are very different before and after the crisis, thus making M&A an exit strategy dependent on the business cycle in which they occur.

The remainder of this paper is organised as follows. The next section provides a brief discussion of the role of economic recessions in affecting innovation variables behind the M&A process. Section 3 introduces data and methods, while Section 4 presents the empirical analysis and results. Section 5 provides a conclusion and a discussion of our findings.

2. Economic crisis and the decision to exit

M&As have been extensively studied as a result of a decision on market exit. These studies highlight the situation that firms which undertake innovations may consider an M&A exit as a viable strategy to appropriate the economic value of these innovations (Cefis and Marsili, 2011; Gans and Stern, 2003). However, these studies consider periods characterised by economic stability or economic growth. Conversely, less attention has been devoted to M&A during a crisis or just after recessionary periods. This paper aims at exploring this specific issue.

Some stylised facts about recession show that economic uncertainty tends to increase during downturns, and falls during boom times. The comparison between corporate activity during the '2000s and after the financial crisis (from 2009 onwards) suggests significant differences in the role of uncertainty in driving the company's decisions about staying or exiting the market. This makes the company's decision endogenous to the business cycle, with lower economic growth resulting in greater uncertainty.

The crisis has affected M&A processes in different fields and from different aspects. The crisis has driven down the volume of transactions and hindered the ability of many companies to pull off deals. Lower profits, a large gap between buyers and sellers when assessing a company's value, greater difficulty in obtaining financing, and the lender's demands for more equity up front are the main factors contributing to this decline. "The expectation value gap" (between what a buyer is willing to pay and what a seller is willing to accept) has widened because of the economic-financial crisis. As a result, the number of completed M&A transactions has fallen sharply. This has led to changes in the structure of transactions owing to the changes in the value of the deals.

There have been extensive discussions relating to the notion that "recessions are times when productivity improving activities are undertaken because of their temporarily low opportunity costs" (Caballero and Hammour 1994), or because the increase in the probability of bankruptcy because of the bad times raises the pressure of managers to initiate organisational changes (Nickell et al. 2001). In such adverse periods, the likelihood of a firm being forced out of business looms large, challenging employment stability (Nickell et al. 2001), accelerating the job turnover (Davis and Haltiwanger 1992) and the firm's turnover (Oulton 1987), or the firm's survival and M&A (Nishimura et al. 2005; Alvarez and Georg 2009).

Uncertainty appears to rise during recessions. The growth rates of both industries and firms, accentuate dispersion; also, variance in productivity is largely affected (Bloom 2014). During recessions, the flow of innovations and new information between firms slows down, thereby giving rise to uncertainty. Individuals are less confident about the future, and forecasting proves to be much harder. When business is slack, the opportunity cost of reorganisation is lower, and firms will find it more economical to try out new ideas and to invest in research and capital. However, innovation is more likely to be exploited during boom-time markets (Caballero and Hammour 1994), when the probability of expanding the business potential of a new product is maximised by a more receptive consumer demand. Uncertainty fostered by recession can make firms cautious about investment and acquisitions, the costs of which adjustment can prove to be expensive to reverse. Additionally, more cautiousness also means more selective investments, i.e., a change in the investment profile of similar firms before and after the event that affected the perceived level of uncertainty. In 2009, the Chief Economist of the International Monetary Fund, Olivier Blanchard, wrote in *The Economist*: "uncertainty is largely behind the dramatic collapse in demand. Given the uncertainty, why build a new plant, or introduce a new product? Better to pause until the smoke clears" (*The Economist*, 2009). Finally, financial resources and investment opportunities are better when the economy is in good shape, thus making company decisions about the future depend on the actual and forecasted status of the economy.

All these aspects suggest that innovation-driven M&A are more likely to occur before the crisis than after a major crisis. Recession generates higher risk that, in turn, increases risk premia and raises the cost of finance. It also increases the probability of bankruptcy, which means higher borrowing costs, more selective credit conditions, even in financing deals outside the sectoral affiliation of the company. Therefore, deals outside

the sector of affiliation can require higher financing costs that make them less likely to occur, and are therefore preferred by those closely focussed on bidder sectors.

As a general consideration, uncertainty fostered by crisis is expected to introduce significant changes in the scenario that modifies the process of exit by mergers, and makes it different from the process as it existed before the crisis. In detail, we expect that innovation and technological resources are more relevant before the crisis when favourable economic conditions can facilitate the management of risks involved in business transactions. Hence, we derive the following hypothesis.

Hypothesis: firms performing innovation activities are more likely to be a target of M&A transactions before the crisis period than after the crisis period.

We also explore whether some innovation input and/or output are more relevant for M&A deals[1], and how that differs between young and the mature industries. In this regard, innovation synergies (Ahuja and Katila 2001; Larson and Finkelstein 1999) can take on different forms, like the realisation of economies of scale and scope in innovation activities, or skill and technology transfers, and it is reasonable to assume that these synergies are heterogeneously affected by innovation input and output. For example, an acquiring firm may choose a target firm to realise R&D synergies, i.e., acquiring of firms with similar R&D, or to realise product synergies, i.e., acquiring firms with complementary products (Yu et al. 2016; Bhattacharyya and Naser 2020). On the other hand, M&A may be driven by strategic technological acquisition motives. In that case, patents are more relevant than R&D and other types of innovation outputs because of the legal protection afforded to the patent owner. For example, an acquirer firm may be interested in acquiring the patent portfolio of other firms to resolve an IP dispute or to break down existing patent fences, or to create barriers for other firms (Gansand Stern 2000; Grimpeand Hussinger 2008; Stellner 2015). Moreover, there are a few studies which show that different degrees of information asymmetries are associated with different types of innovation inputs and outputs. For example, it would be easier to detect and valuate a product innovation than a process innovation (Cefis and Marsili 2007 and 2012). Again, to a potential acquirer, patents act as quality signals for innovation capabilities of the target firm (Cotei and Farhat 2018; Hsu and Ziedonis 2008). Thus, in line with the existing literature (see e.g., Cefis and Marsili 2011 and 2012), we take into account the fact that innovation input (R&D) and innovation output activities (e.g., patents) performed by target firms are heterogeneous incentives for M&A investments.

However, we argue that this depends on the stage of the ILC. The ILC literature provides a stylised description of the evolution of an industry emphasising that product characteristics, innovation sources, and competitive forces differ over the industry stages of the ILC (Abernathy and Clark 1985; Gort and Klepper 1982; Klepper 1997). According to this literature, we expect, for example, that process innovations are more

[1] In a related strand of the literature, several studies emphasise the positive effect of innovation on firm's performance or survival (Griliches, 1979; Audretsch, 1991; Crepon et al., 1998). However, these studies do not examine the relationship between innovation and firm exit strategies. Exit through M&A can be regarded as successful exit (Cotei and Farhat 2018). On the other side, i.e. from the bidding company's point of view, the acquisition of innovative firms can be an integral part of a firm's innovation strategy (King et al., 2003).

important in mature industries than in young industries, because the focus of innovation activities shifts from product to process innovation as the industry matures.

The above argumentations highlight mainly the driver of M&A transactions from the acquiring firm's point of view. On the other hand, we expect that M&A exit strategies are influenced by the characteristics of the target firm's innovation and by the ILC stage. As recently shown by Cefis and Marsili (2011), the distinction between product and process innovation helps in explaining the firm's strategic choices related to an exit, and how these choices respond to the environmental (industry) conditions in which firms operate. In line with this, we also test our hypothesis which distinguishes between different types of innovation activities, i.e., innovation input activities (R&D), and innovation output activities (in the form of patents and in the form of product, process, and organisational innovations), and the ILC stage, i.e., young and mature industries.

3. Data and Methods

3.1 Sample

To test the study's hypothesis, we built a dataset by drawing information from three main sources: (i) the EU-EFIGE Bruegel-UniCredit survey on "European Firms in a Global Economy"; (ii) the BvD-Zephyr database; (iii) the BvD-Amadeus database. The EU-EFIGE survey collects detailed qualitative and quantitative information about a firm's characteristics like the firm's size, its age, the group of appurtenance, the sector in which the firm operates and, above all, the firm's innovative activities and performances.[2] The dataset covers a representative sample (at the country and industry level) of 14759 manufacturing firms with more than ten employees from seven European countries: Austria, France, Germany, Hungary, Italy, Spain and the UK. As the survey was run in early 2010, information is mostly collected as a cross-section for the years 2009–2010, although some questions cover the period 2007–2009. The BvD-Zephyr and BvD-Amadeus provide, respectively, information on a company's M&A deals for the period 2001–2014, and information on the company's legal status in 2014.[3]

Through the matching of these three databases, we have composed a database with information on M&A transactions, legal status, and innovation characteristics for a sample of 13212 companies.[4]

---

[2]The sample is mainly composed of small and medium-sized enterprises and established companies: the average firm's size is small to medium, with a mean of 70 employees and a median of 27; the firms surveyed have been in business for 24 years on average. The majority of the firms are located in Germany, Italy, and Spain (more than 80% of the total), while 12% of the companies operate in the UK, 3.5% in Hungary, and 2.8% in Austria. For additional information about the EU-EFIGE survey, see Altomonte and Aquilante (2012).

[3] We also have data on the company's legal status in 2017 (Bvd-Amadeus) and the data on M&A deals for the period 2015–2017 (Bvd-Zephyr). However, we limit our data to 2014 so as to have similar time spans for the pre- and post-crisis periods, and to avoid an excessive temporal gap with the EUFIGE data.

[4]For 1367 firms (9.3% of the total), we do not have information about the legal status or innovation activities. Considering the 13212 firms (14579−1367) for which we have information on M&A transactions, legal status, and innovation characteristics, the sample estimates are comprised of firms that exit the market by M&A or by failure (bankruptcy or liquidation).

To construct our sample of the analysis, we identify the firms that exit the market. In line with the existing literature (Cefis and Marsili, 2011 and 2012; Balcaen et al. 2011 and 2012), we first distinguish distress-related exits in two subgroups, i.e., court-driven exit (bankruptcy) and out-of-court exit. For the latter, we distinguish voluntary liquidations from M&A exits. Using the BvD-Zephyr information, we identify the firms that are involved in M&A deals during the observed period (2001–2014). On the other hand, using the BvD-Amadeus information, we identify the 582 firms that were inactive in 2014[5] because of market failure (bankruptcy or liquidation).

Finally, to identify the stages of evolution for each industry, we use the EUROSTAT time-series data (period 1995–2013) on overall industry production values.

3.2 Dependent variable

From a methodological point of view, we construct a dependent variable that indicates whether a firm is a target of an M&A deal before or after the crisis period. Figure 1 shows the number of firms which perform M&A deals by year. In line with what is reported by other studies (see e.g., Teitelman, 2014), we observe that the number of M&A deals decreases after the year 2007 because of the crisis. However, the number of M&A deals has risen after the year 2010. Hence, we consider the years 2008–2010 as the crisis period (not covered by our empirical analysis), and post-2010 (i.e. 2011–2014) as the post-crisis period. Assuming an equal time span between the two analysed periods, we consider the years 2004–2007 as the pre-crisis period.[6]

- Figure 1 about here –

The dependent variable is a dummy variable that is set equal to 1 if the company has been acquired by another bidding company (included or not in the EFIGE dataset) during the analysed periods. On the other hand, the dependent variable is zero when the company exited the market owing to bankruptcy or liquidation.[7]

3.3 Independent variables

To measure the firm's degree of innovation, we use several variables. First, we construct a dummy variable (R&D) measuring whether a firm performs internal R&D activities or not. In particular, R&D is set equal to

[5] Differently from Bvd-Zephyr data on M&A, we do not have BvD-Amadeus information on the firm's legal status before the year 2014.

[6] As a check for robustness, we perform additional analyses considering different periods of interval for the pre-crisis period, i.e., also including the year 2003 and/or the year 2008. The results (available from the authors upon request) are similar.

[7] Note that the number of M&A firms varies between the pre- and post-crisis period, while the number of failed firms is constant because of missing information on the exit date. It follows that the number of observations differs between the two analysed periods because the number of M&A firms varies between the two periods.

1 for firms that had declared in the EFIGE survey to have one or more employees involved in R&D activities.[8] As additional measures of innovation, we construct three dummies which are set equal to 1 if a firm had declared in the EFIGE survey that during the period 2007–2009, has carried out a product innovation (PRODinnov), a process innovation (PROCinnov) and an organisational innovation (ORGANinnov). Finally, as additional measure of innovation output, we consider the logarithm of the number of patents held by a firm.[9]

To determine whether the relationship between a firm's innovation and M&A exit is shaped by the development phase of the industry, another set of innovation variables is constructed integrating the previous innovation variables with information about the stage of the ILC in which the M&A target firm is active. In particular, for each of the five types of innovation measures, we make a distinction on whether the M&A target firm is operating in a young or in a mature industry. The distinction between young and mature industries is made using yearly data (period 1995–2013) on aggregate production value changes by industry, and adopting a statistical approach widely used to model business cycles, i.e., the Hamilton's latent state regime-switching method. The explanation of this technique is out of the scope of this paper, and so, for more details, we refer you to Cucculelli and Peruzzi (2019). From this disaggregation, we obtain a set of ten variables (i.e., five innovation variables for firms in young industries and five innovation variables for firms in mature industries). Table 1 gives the full list of innovation variables used in the estimates.

- Table 1 about here -

In order to account for potential sources of a firm's heterogeneity, we also include a set of control variables that are traditionally used in empirical studies on M&A exit. To control for the age of firms, we include a dummy (AGE) that is set equal to 1 if the firm is more than 10 years old.[10] We also control for the firm's size through three dummies: one dummy is set equal to 1 if the firm's number of employees is lower than 50 (SIZE SMALL); a second one (SIZE MEDIUM) is set equal to 1 if the firm's number of employees is between 50 and 249; and a third one (SIZE LARGE) is set equal to 1 if the firm's number of employees is equal to or greater than 250. Moreover, the number of subsidiaries within the firm's group (SUBSIDIARIES) controls both for the firm's group membership and for the dimension of the group. Finally, we include a set of dummies for the firm's country of domicile, and a set of dummies for the firm's industry (NACE Rev.2 3-digit level).

4 Results

Table 2 shows the descriptive statistics and matrix of correlations of the variables used in the estimates.

[8] We refer to the following EFIGE question: "In 2008 what percentage/number of employees have been involved in R&D activities?"

[9] As mentioned above, information on a firm's innovations are provided by the EUFIGE survey. However, since EUFIGE lacks the data on patent stock, the number of a firm's patents is provided by BvD-Amadeus.

[10] With this variable, we control for the fact that the mortality rates of firms are age-dependent (Coad 2018). We choose a cut-off value of 10 years because after 10 years a firm can be reasonably considered as a successfully established firm.

- Table 2 about here -

Table 3 reports the average marginal effects (AMEs) of the variables used in the probit estimations. For each set of innovation variables, we perform two probit regressions, i.e., one for the pre-crisis period (models with the suffix 'a') and one for the post-crisis period (models with the suffix 'b'). Models 1a, 1b, 3a, 3b, 5a, and 5b show the AMEs of probit regression obtained using the firm's innovation variables, while Models 2a, 2b, 4a, 4b, 6a, and 6b show the AMEs of probit regression obtained using the firm's innovation variables interacted with the industry stage of the M&A target firms. Models 1a and 2b present the effects of internal R&D activities. Models 3a and 4b present the effects of the firm's innovation outputs, i.e., product, process and organisational innovations. Finally, Models 5a and 6b present the results of the effects on M&A of patents.

We find that R&D internal activities have a positive and significant effect on M&A during the pre-crisis period (Model 1a). Moreover, when we distinguish between young and the mature industries, we observe that R&D internal activities are significant for M&A only in young industries (Model 1b). On the other hand, in line with our hypothesis, we observe that R&D activities are not significant in the post-crisis period (Model 2b). In general, the not significant role of technological and innovation resources in the M&A deals that occurred after recession can be considered as a signal of the substantial change in the external conditions that altered the M&A strategies before and after the crisis.[11]

- Table 3 about here -

Looking at the variables when measuring a firm's innovation outputs, we find a significant and positive effect of product and process innovations during the pre-crisis period (see Model 2a). As expected, we find that product innovations are important in young industries, while process innovations are relevant in mature industries (see Model 3a). These results are in line with the ILC theory (Gort and Klepper 1982; Ter Wal and Boschma 2011; Utterback and Suarez 1993) which emphasises that competition shifts from product characteristics to price, and focus shifts from product to process innovation as the industry matures. Again, we observe that a firm's innovation outputs are not significant in the post-crisis period (see Model 3b).

Considering the effects of patents, we observe that the patent portfolio exerts a positive and significant effect on the probability of a firm to be a target of an M&A during the crisis period (see Model 5a), and that patents are relevant both in young and mature industries (see Model 6a). Interestingly, we find that patents are significant indicators for M&A also during the post-crisis period (see Model 6b).[12] These results are in contrast with our hypothesis. We interpret these results using the following argumentations. First, patents act

[11]A firm's exit strategy might be influenced by financial constraint (Ponikvar et al. 2018). As a check for robustness, we perform additional estimates including the liquidity ratio (expressed in %) as proxy for a firm's financial constraint. The results of these estimates are similar. Moreover, the AMEs associated with liquidity ratio is statistically non-significant.

[12] As a check for robustness, we perform additional estimates including the whole set of innovation variables. The results (see Table A1 in the appendix) are similar.

as a quality signal for innovation capabilities of the target firm.[13] As argued by Hsu and Ziedonis (2008), patents have properties that are coherent with the definition of quality signals provided by Spence (1973), i.e., they can be observed by third parties,[14] and are costly to obtain.[15] The information disclosed in patents allows a potential acquirer to know and evaluate aspects of the target firm's inventions that would remain unknown (Long 2002). Moreover, patents signal other characteristics of internal innovative activities like the quality of R&D staff (Hottenrott et al. 2016). Patent information is particularly relevant when an investor tries to select the most promising startup firms which, by nature, are characterised by greater technicality and demand uncertainty (Conti et al. 2013). However, as argued by Ransbotham and Mitra (2010), patents are also important for evaluating unexplored growth options of established companies. Unexplored growth options refer to potentially profitable technologies that are not yet exploited by the target firm because they lack in complementary capabilities. To sum up, patents can be considered as an effective mechanism in reducing information asymmetries between the patenting firm and outside investors (Long 2002).

Second, patents provide to the owners a legal monopoly position on inventions for a relevant period of time (usually 20 years). Patents protect inventions from imitation by competitors and, thus, can be considered as an effective tool for the appropriation of the economic returns from these inventions. This reduces the perceived level of market uncertainty of patenting firms (Czarnitzki and Toole 2011; Ayob and Senik, 2015). In addition, patents increase the opportunities to generate revenues from inventions. Specifically, patents facilitate the selling and licensing of technologies and, thus, provide additional forms of economic returns than the (traditional) commercialisation of products (Chen et al. 2011). Given the increasing relevance of the market for technologies (Moreira et al. 2019), we might suspect that M&A-acquiring firms consider patents more valuable than other types of innovation.

Third, innovation activities are subject to technological risk. However, when a firm obtains a patent, the technological risk is overcome. As patent offices in most countries grant patents for inventions that are new, industrially applicable, and involve an inventive step, patents indicate successful R&D and innovation activities. Moreover, we can safely assume that patenting firms are working at the knowledge frontier, and thus are more attractive to M&A acquirer firms. In this regard, the acquisition of firms can be considered also as a strategy to enter emerging technologies (Chaudhuri and Tabrizi 1999; Warner et al. 2006).

And finally, the fourth; other than for the purpose of acquiring valuable technological assets of the target firm, M&A acquisitions may also be driven by the willingness of the acquirer firm to strengthen its position within the arena of technological competition (Cassiman et al. 2005; Grimpe and Hussinger, 2008). Firms may strategically use patents to preempt rivals from patenting substitute inventions (fencing patents), or as bargaining chips in cross-licensing negotiations and IP litigations (block to play) (Cappelli et al. 2018;

[13] The literature on patents as a yardstick of quality for outsider investors, mainly considers equity investments as those made by venture capitalists. However, we can safely assume that the same argumentations are valid in the case of M&A.

[14] Patent documents are easily available from the open access online database of the patent office of the country in which the patent is registered (see, for example, the European Patent Register for European Patent Applications).

[15] For example, the cost of obtaining a standard direct EPO patent is about 31000 Euro (OECD, 2009).

Cohen et al. 2000). In the former, the acquisition of patents represents a way to erect barriers to entry (Grimpe and Hussinger, 2008), while in the latter, the acquisition of patents represents a way to gain the freedom to operate (Blind et al. 2006; Somaya 2012). In general, M&A may be driven by strategic technology acquisition motives.

From the target firm's point of view, patents are the only innovation type which allow firms to prevent an exit from the market by bankruptcy or liquidation after the crisis period. It might be the case that economic turbulence following the crisis has decreased the likelihood of survival among the innovative firms, but patenting firms are a more attractive target for an M&A.

To sum up, the above argumentations support the idea that some characteristics specific of patents mitigate the uncertainty associated with innovation-driven M&A investments. This "moderating" role of patents might be particularly relevant in unstable periods as in the analysed after-crisis period.

5. Conclusions

This study investigates the determinants of M&A in a representative sample of European firms to understand whether the role of innovation efforts of M&A target firms changes during the recent crisis. Our analysis allows to grasp some interesting issues not fully developed in the M&A literature.

By using different measures of innovation and performing probit estimates on a sample of firms that exited the market by M&A in a period before the crisis (2004–2007), and a period after the crisis (2011–2014), this paper shows significant differences in the relative importance of innovation variables in affecting the probability for a firm to be acquired. These evidences corroborate the intuition that recession changes the drivers behind the M&A process, thus making the process of exit strongly dependent on how recession modifies the intensity of uncertainty in the economy.

We show that several indicators of a firm’s innovation activities are associated with M&A transactions before the crisis. Both innovation input and output measures of innovation affect M&A, and the relevance of the different measures of innovation depends on the industry life-cycle stage of the target firm’s industry. Specifically, we show that internal R&D, product innovations, and patents are the drivers of M&A in young industries, while process innovations and patents are the drivers of M&A in mature industries. On the other hand, we find that only patents matter for M&A transactions after the crisis for a firm operating in both types of industries.

It is well known that the business cycle affects the investment decisions of firms. The uncertainty fostered by the recent crisis might be at the base of the change in the relationship between a target firm’s innovation and M&A acquisitions. Patents have several characteristics which may mitigate the risks of M&A investments during the unstable period following the recent crisis. First, as a litmus test of quality, patents are an effective tool in reducing information asymmetries between the patenting firm and outside investors. This can be considered particularly relevant in periods of recession where the flow of information between

buyers and sellers contracts because of reduced economic activities (Fajgelbaum et al. 2017; Saijo 2017). Second, patents protect firms from competitors, and allow firms to appropriate a greater share of value from the innovation (Teece 1986; Cohen et al. 2000; Hsu and Ziedonis 2011). This reduces the perceived level of market uncertainty of the target patenting firms. In the same vein, patents facilitate the market of technology and, thus, provide additional forms of return to M&A-acquired firms. Third, differently from innovation activities like R&D, patents are, by nature, not subject to technological risks. Taken in conjunction with the consideration that patenting firms are working at the knowledge frontier, it is clear that patenting firms are more attractive to potential acquirer firms both to strengthen the existing technological core competencies or as a strategy to enter emerging technologies (Chaudhuri and Tabrizi, 1999; Warner et al. 2006). Finally, M&A may be driven by the acquisition of patents for strategic purposes; for example, to erect barriers to entry (Grimpe and Hussinger, 2008), or to gain the freedom to operate (Blind et al. 2006; Somaya 2012).

From the target firm's point of view, only patents represent an important innovative tool to avoid market exit by bankruptcy or liquidation after the crisis period. Recent studies show that innovation activities in target firms are the "ticket" for survival in a stable environment (Cefis and Marsili 2011). Considering the post-crisis period as a turbulent environment, the empirical results of this paper partially support the existing literature and highlight the importance of accounting for the heterogeneity in innovation activities/measures. Having said that, we also call for careful interpretation of our findings. Since we use data for the period 2007–2009 to measure internal R&D activities and product, process and organisational innovations, we are considering ex-ante information to explain post-crisis M&A, and ex-post information to explain pre-crisis M&A. We argue that innovation activities like internal R&D activities may be considered quite stable over a few years because of the specificity of the R&D investments which make these investments irreversible (Dixit and Pindyck 1994). However, we acknowledge that a potential measurement bias might exist. In addition, although we are aware of the problem of selection bias (i.e., firms may not be interested in M&A transactions, and an exit by bankruptcy or liquidation is measured at the last considered year of analysis), it could not be directly addressed because of data constraints. Finally, since we control for country and industry characteristics, and for the standard firm's characteristics used in the M&A exit literature, we are aware that we cannot rule out the potential omitted bias problem in the performed cross-section analysis. We acknowledge that our analysis only measures association rather than causal links between the target firm's innovation efforts and M&A transactions.

References

Abernathy, W.J. and Clark, K.B. (1985) 'Innovation: Mapping the winds of creative destruction', *Research Policy*, 14, 3–22.

Ahuja, G. and Katila, R. (2001), 'Technological acquisitions and the innovation performance of acquiring firms: A longitudinal study', *Strategic Management Journal*, 22(3), 197-220.

Altomonte, C. and Aquilante, T. (2012), 'The EU-EFIGE/Bruegel-Unicredit dataset', Working Papers, Bruegel.

Alvarez, R., Benavente, J.M. and Crespi, G. (2006), 'Does economic crisis spur organizational change? Evidence from Chilean manufacturing plants', manuscript available at: http://ssrn.com/abstract¼940400.

Audretsch, D.B. (1991), 'New-firm survival and the technological regime', *Review of Economics and Statistic*s, 73, 441-450.

Crepon, B., Duguet, E., and Mairesse, J. (1998), 'Research, innovation, and productivity: an econometric analysis at the firm level', *The Economics of Innovation and New Technology*, 7, 115–158.

Audretsch, D.B. (1995), 'The Propensity to Exit and Innovation', *Review of Industrial Organization,* 10(5), 589-605

Ayob,. A.H. and Senik, Z.C. (2015), 'The role of competitive strategies on export market selection by SMEs in an emerging economy', *International Journal of Business and Globalisation*, 14(2), 208-225.

Balcaen, S., Manigart, S., Buyze, J. and Ooghe, H. (2012), 'Firm exit after distress: differentiating between bankruptcy, voluntary liquidation and M&A', *Small Business Economics*, 39(4), 949-975.

Bhattacharyya, S.S. and Naser, S. (2020) 'Comparative analysis of mergers and acquisitions in Indian and international pharmaceutical industry with unique case-lets', International Journal of Business and Globalisation, 25(1), 112-136

Blind, K., Edler, J., Frietsch, R. and Schmoch, U. (2006), 'Motives to patent: Empirical evidence from Germany', *Research Policy*, 35(5), 655-672.

Blonigen, B.A. and Pierce, J.R. (2016), 'Evidence for the Effects of Mergers on Market Power and Efficiency', Finance and Economics Discussion Series 2016-082, Washington: Board of Governors of the Federal Reserve System.

Bloom, N. (2014), 'Fluctuations in uncertainty', *Journal of Economic Perspectives*, 28(2), 153-176

Burgelman, R.A. (1994), 'Fading memories: A process theory of strategic business exit in dynamic environments', *Administrative Science Quarterly*, 24-56.

Caballero, R., Hammour, M. (1994), 'The cleansing effect of recessions', *American Economic Review*, 84 (5), 1350–1368.

Cappelli, R., Corsino, M., Torrisi, S. and Laursen, K. (2018), 'Technological Competition and Patent Strategy: Protecting Innovation, Preempting Rivals and Defending the Freedom to Operate', *Academy of Management Proceedings*, DOI: 10.5465/AMBPP.2018.18067abstract.

Cassiman, B., Colombo, M.G., Garrone, P. and Veugelers, R. (2005), 'The impact of M&A on the R&D process. An empirical analysis of the role of technological- and market-relatedness', *Research Policy*, 34, 195-220.

Cefis, E. and Marsili, O. (2007), 'Going, going, gone. Innovation and exit in manufacturing firms', ERIM Report Series, Reference No. ERS-2007-015-ORG.

Cefis, E. and Marsili, O. (2011), 'Born to flip. Exit decisions of entrepreneurial firms in high-tech and low-tech industries', *Journal of Evolutionary Economics*, 21(3), 473-498.

Cefis, E. and Marsili, O. (2012), 'Going, going, gone. Exit forms and the innovative capabilities of firms'. *Research Policy, 41*(5), 795-807.

Chaudhuri, S. and Tabrizi, B. (1999), 'Capturing the real value in high-tech acquisitions', *Harvard Business Review*, 77(5), 123-130.

Chang, S. J. (1996), 'An evolutionary perspective on diversification and corporate restructuring: Entry, exit, and economic performance during 1981-89', *Strategic Management Journal*, 587-611.

Chen, Y., Dowling, M. and Helm, R. (2011), 'Licencing as a commercialisation strategy under different institutional contexts: a comparative empirical analysis of German and Chinese biotechnology firms, *International Journal of Business and Globalisation*, 7(2), 131-151.

Coad, A. (2018), 'Firm age: a survey', *Journal of Evolutionary Economics*, 28(1), 13-43.

Cohen, W.M., Nelson, R.R. and Walsh, J.P. (2000), 'Protecting their intellectual assets: appropriability conditions and why firms patent or not?', NBERWorking Paper No. 7552, Cambridge, MA.

Conti, A., Thursby, J. and Thursby, M. (2013), 'Patents as Signals for Startup Financing', *Journal of Industrial Economics*, 61(3), 592-622.

Cotei, C. and Farhat, J. (2018), 'The M&A exit outcomes of new, young firms', *Small Business Economics*, 50(3), 545-567.

Cucculelli, M. and Peruzzi, V. (2019), 'Innovation over the industry life cycle. Does ownership matter?', *Research Policy*, DOI: https://doi.org/10.1016/j.respol.2019.103878.

Czarnitzki, D. and Toole, A.A. (2011), 'Patent Protection, Market Uncertainty, and R&D Investment', *The Review of Economics and Statistics*, 93(1), 147-159.

Davis S., and Haltiwanger J.C. (1992), 'Gross job creation, gross job destruction, and employment reallocation', *The Quarterly Journal of Economics*, 107(3), 819–863.

de Figueiredo, J. M. and Silverman, B.S. (2012), 'Firm survival and industry evolution in vertically related populations', *Management Science, 58*(9), 1632-1650.

Dixit, A.K. and Pindyck, R.S. (1994), *Investment under Uncertainty*, Princeton, Princeton University Press.

Dunne, T., Roberts, M.J. and Samuelson, L. (1988), 'Patterns of Firm Entry and Exit in U.S. Manufacturing Industries', *The RAND Journal of Economics,* 19(4), 495-515.

Fajgelbaum, P.D., Schaal, E. and Taschereau-Dumouchel, M. (2017), 'Uncertainty Traps*', *The Quarterly Journal of Economics*, 132(4), 1641-1692.

Fortune, A. and Mitchell, W. (2012), 'Unpacking firm exit at the firm and industry levels: The adaptation and selection of firm capabilities', *Strategic Management Journal, 33*(7), 794-819.

Gans, J.S. and Stern, S. (2010), 'Is there a market for ideas?', *Industrial and Corporate Change*, 19(3), 805–837.

Gort, M. and Klepper, S. (1982), 'Time paths in the diffusion of product innovations', *Economic Journal* 92(367), 630–653.

Griliches, Z. (1979), 'Issues in assessing the contribution of research and development to productivity growth', *Bell Journal of Economics*, 10, 92–116.

Grimpe, C. and Hussinger, K. (2008), 'Building and blocking: the two faces of technology acquisitions', Discussion Paper No. 08-042, ZEW – Centre for European Economic Research, Manheim.

King, D., Dalton, D., Daily, C. and Covin, J. (2004), 'Meta-analyses of post-acquisition performance: indications of unidentified moderators', Str*ategic Management Journal*, 25, 187-200.

Hall, B.H. and Ziedonis, R.H. (2001), 'The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semiconductor Industry, 1979-1995', *The RAND Journal of Economics*, 32(1), 101-128.

Hottenrott, H., Hall, B.H. and Czarnitzki, D. (2017), 'Patents as Quality Signals? The Implications for Financing Constraints on R&D', *Economics of Innovation and New Technology*, 25(3), 197–217.

Hsu, D. and Ziedonis, R. (2011), 'Strategic factor markets and the financing of technology startups: When do patents matter more as signalling devices?', Unpublished Working Paper.

Hsu, D.H. and Ziedonis, R.H. (2013), 'Resources as dual sources of advantage: implications for valuing entrepreneurial-firm patents', *Strategic Management Journal*, 34(7), 761–781.

Klepper, S. (1997), 'Industry life cycles', *Industrial and Corporate Change*, 6(1), 145–181.

Larsson, R. and Finkelstein, S. (1999), 'Integrating strategic, organizational, and human resources perspectives on mergers and acquisitions: a case survey of synergy realization', *Organization Science*, 10(1), 1-26.

Long, C. (2002), 'Patent signals', *University of Chicago Law Review*, 69, 625–679.

Mata, J. and Portugal, P. (2004), 'Patterns of Entry, Post-Entry Growth and Survival: A Comparison Between Domestic and Foreign Owned Firms', *Small Business Economics*, 22, 283–298.

Moreira, S., Cabaleiro, G. and Reichstein, T. (2019), 'Licensing decision: a rent dissipation lens applied to product market competition, openness to external knowledge and exogenous sunk costs', *Industrial and Corporate Change*, 28(4), 773-792.

Nickell, S., Nicolitsas, D. and Patterson, M. (2001), 'Does doing badly encourage management innovation?', *Oxford Bulletin of Economics and Statistics*, Department of Economics, University of Oxford, 63(1), 5–28.

Nishimura, K., Nakajima, T. and Kiyota, K. (2005), Does the natural selection mechanism still work in severe recessions? Examination of the Japanese economy in the 1990s, *The Journal of Economic Behavior and Organization,* 58(1), 53–78.

Organisation for Economic Co-operation and Development (OECD) (2009), *OECD Patent Statistics Manual*, Paris.

Oulton, N. (1987), 'Plant Closure and the Productivity Miracle in Manufacturing', *National Institute Economic Review*, 53–59, August

Ransbotham, S. and Mitra, S. (2010, 'Target Age and the Acquisition of Innovation in High-Technology Industries', *Management Science*, 56(11), 2076-2093.

Ponikvar, N., Zajc Kejžar, K. and Peljhan, D. (2017), 'The role of financial constraints for alternative firm exit modes', *Small Business Economics*, 51(1), 85-103.

Rao, N.V. and Reddy, K.S. (2017), 'Editorial: Institutional role, the Market for corporate control and Firm performance', International Journal of Business and Globalisation, 19(1), 1-5.

Reddy, K.S., Nangia, V.K. and Agrawal, R. (2014), 'The 2007–2008 Global Financial Crisis, and Cross-border Mergers and Acquisitions: A 26-nation Exploratory Study', *Global Journal of Emerging Market Economies*, 6 (3), 257-281.

Saijo, H. (2017), 'The Uncertainty Multiplier and Business Cycles', *Journal of Economic Dynamics & Control*, DOI: 10.1016/j.jedc.2017.02.008.

Santarelli, E., Vivarelli, M. (2007), 'Entrepreneurship and the process of firms' entry, survival and growth' *Industrial and Corporate Change,* 16(3), 455-488.

Spence, M. (1973), 'Job market signalling', *Quarterly Journal of Economics*, 87, 355–374.

Somaya, D. (2012), 'Patent Strategy and Management', *Journal of Management*, 38(4), 1084-1114.

Stellner, F. (2015). *The impact of technological distance on M&A target choice and transaction value*. In F. Stellner (Ed.), Technological distance: Theoretical foundations, statistical analysis and application to mergers and acquisitions (pp. 91–139). Norderstedt: Books on Demand.

Teece, D, (1986), 'Profitting from technological innovation: Implications for integration collaboration, licencing and public policy', *Research Policy*, 15(6), 285-305.

Teitelman R. (2014), 'Merge or Die: Slow Economy Sheds New Light on M&A', *Istitutional Investors*, January 2, 2014

Ter Wal, A.L.J. and Boschma, R. (2011), 'Co-evolution of firms, industries and networks in space', *Regional Studies*, 45(7), 919–933.

Utterback, J.M. and Suarez, F.F. (1993), 'Innovation, competition, and industry structure', *Research Policy*, 22, 1–21.

Yu, Y., Umashankar, N. and Rao, V.R. (2016), 'Choosing the Right Target: Relative Preferences for Resource Similarity and Complementarity in Acquisition Choice', *Strategic Management Journal*, 37, 1808–1825.

Warner, A.G., Fairbank, J. F. and Steensma, H. K. (2006), 'Managing uncertainty in a formal standards-based industry: A real options perspective on acquisition timing', *Journal of Management*, 32, 279-298.

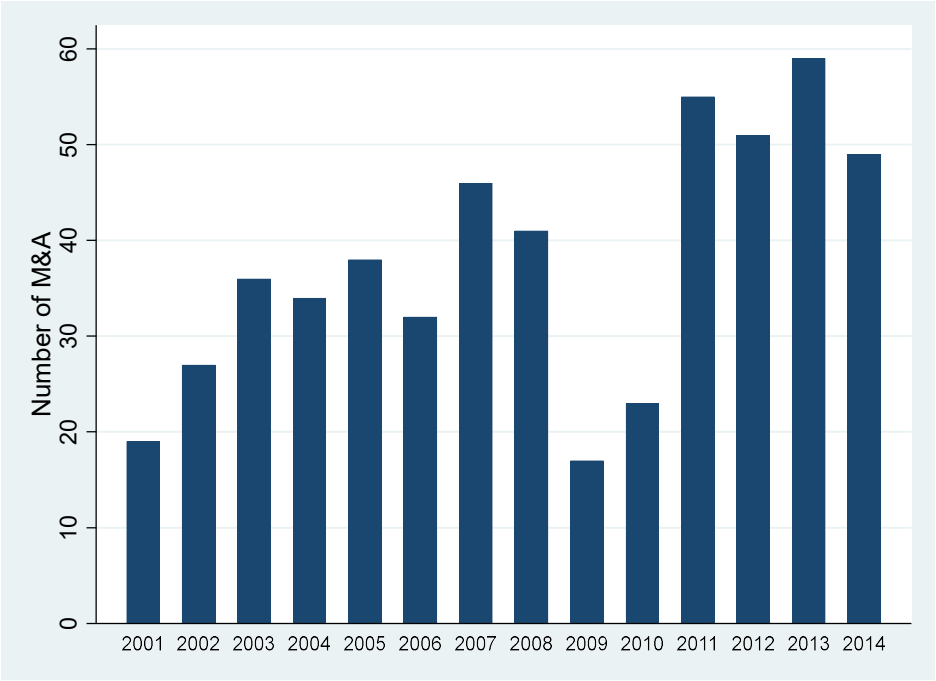

Figure 1. Number of M&A deals by year - period 2001-2014

Table 1. List of innovation variables

Type of innovation	Type of innovation and ILC
R&D	R&D * Young industries
	R&D * Mature industries
Patent	Patent * Young industries
	Patent * Mature industries
PRODinnov	PRODinnov * Young industries
	PRODinnov * Mature industries
PROCinnov	PROCinnov * Young industries
	PROCinnov * Mature industries
ORGANinnov	ORGANinnov * Young industries
	ORGANinnov * Mature industries

Notes: the label 'R&D' refers to a dummy for internal R&D activities; 'Patent' refers to the number of patents; 'PRODinnov', 'PROCinnov' and 'ORGANinnov' refers, respectively, to a dummy for product, pocess and organisational innovations; 'Young industries' and 'Mature industries' refers, respectively, to industry in the young and mature stages.

Table 2. Descriptive statistics and matrix of correlations

	Variable	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
(1)	M&A	0.23	0.42	1.00																				
(2)	PRODinnov	0.50	0.50	0.16	1.00																			
(3)	PRODinnov * Young industries	0.34	0.47	0.18	0.72	1.00																		
(4)	PRODinnov * Mature industries	0.16	0.37	-0.01	0.43	-0.31	1.00																	
(5)	PROCinnov	0.42	0.49	0.17	0.28	0.19	0.14	1.00																
(6)	PROCinnov * Young industries	0.27	0.45	0.19	0.23	0.45	-0.27	0.72	1.00															
(7)	PROCinnov * Mature industries	0.15	0.35	0.00	0.11	-0.30	0.53	0.49	-0.25	1.00														
(8)	ORGANinnov	0.30	0.46	0.07	0.29	0.16	0.19	0.51	0.33	0.30	1.00													
(9)	ORGANinnov * Young industries	0.19	0.39	0.11	0.22	0.39	-0.21	0.36	0.56	-0.20	0.74	1.00												
(10)	ORGANinnov * Mature industries	0.11	0.31	-0.03	0.16	-0.25	0.54	0.30	-0.21	0.69	0.54	-0.17	1.00											
(11)	R&D	0.65	0.48	0.22	0.34	0.26	0.14	0.21	0.15	0.10	0.18	0.10	0.14	1.00										
(12)	R&D * Young industries	0.42	0.49	0.24	0.28	0.58	-0.37	0.13	0.43	-0.35	0.06	0.31	-0.30	0.63	1.00									
(13)	R&D * Mature industries	0.23	0.42	-0.03	0.07	-0.39	0.60	0.08	-0.33	0.53	0.13	-0.26	0.52	0.40	-0.46	1.00								
(14)	Patent	0.64	1.19	0.37	0.14	0.10	0.06	0.09	0.07	0.04	0.08	0.07	0.03	0.16	0.11	0.05	1.00							
(15)	Patent * Young industries	0.44	1.01	0.29	0.12	0.20	-0.09	0.07	0.15	-0.09	0.07	0.13	-0.07	0.12	0.21	-0.11	0.81	1.00						
(16)	Patent * Mature industries	0.21	0.75	0.22	0.07	-0.10	0.23	0.05	-0.08	0.18	0.05	-0.07	0.16	0.09	-0.12	0.24	0.57	-0.03	1.00					
(17)	AGE	0.91	0.29	0.04	0.03	0.05	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	-0.02	0.00	-0.02	0.04	0.04	0.01	1.00				
(18)	SIZE SMALL	0.31	0.46	-0.18	-0.05	-0.05	-0.01	-0.07	-0.08	0.00	-0.05	-0.07	0.01	-0.09	-0.09	0.00	-0.09	-0.08	-0.04	0.01	1.00			
(19)	SIZE MEDIUM	0.11	0.31	0.25	0.08	0.08	0.00	0.08	0.08	0.02	0.02	0.04	-0.03	0.09	0.08	0.01	0.16	0.16	0.05	0.02	-0.23	1.00		
(20)	SIZE LARGE	0.58	0.49	0.01	0.00	0.00	0.00	0.02	0.03	-0.01	0.04	0.03	0.01	0.02	0.03	-0.01	-0.02	-0.02	0.01	-0.02	-0.79	-0.42	1.00	
(21)	SUBSIDIARIES	0.20	0.50	0.28	0.05	0.07	-0.02	0.12	0.12	0.02	0.06	0.05	0.02	0.15	0.13	0.01	0.43	0.37	0.21	0.07	-0.10	0.14	0.00	1.00

Table 3. Determinants of M&A - Probit estimates

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
VARIABLES	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis
R&D	0.079***	0.034										
	(0.025)	(0.026)										
R&D * Young industries			0.117***	0.036								
			(0.032)	(0.032)								
R&D * Mature industries			0.043	0.048								
			(0.039)	(0.037)								
PRODinnov					0.070**	0.038						
					(0.029)	(0.029)						
PROCinnov					0.077**	0.020						
					(0.031)	(0.033)						
ORGANinnov					-0.043	0.002						
					(0.029)	(0.035)						
PRODinnov * Young industries							0.111***	0.032				
							(0.036)	(0.034)				
PROCinnov * Young industries							0.036	-0.016				
							(0.035)	(0.037)				
ORGANinnov * Young industries							-0.022	0.059				
							(0.032)	(0.045)				
PRODinnov * Mature industries							0.021	0.056				
							(0.046)	(0.045)				
PROCinnov * Mature industries							0.110*	0.076				
							(0.057)	(0.059)				
ORGANinnov *Mature industries							-0.030	-0.067				
							(0.050)	(0.051)				
Patent									0.061***	0.074***		
									(0.018)	(0.028)		
Patent * Young industries											0.060***	0.092*
											(0.021)	(0.054)
Patent * Mature industries											0.067**	0.062**
											(0.032)	(0.027)

(continues)

Table 3. Determinants of M&A - Probit estimates *(continued)*

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
VARIABLES	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis
Age	0.070**	0.013	0.059	0.031	0.055	0.036	0.051	0.034	0.065*	0.020	0.065*	0.018
	(0.031)	(0.045)	(0.043)	(0.045)	(0.041)	(0.046)	(0.040)	(0.046)	(0.039)	(0.044)	(0.039)	(0.044)
Size_2	0.117***	0.263**	0.140***	0.308**	0.136***	0.291**	0.127***	0.301**	0.103***	0.265**	0.103***	0.268**
	(0.030)	(0.123)	(0.035)	(0.122)	(0.038)	(0.119)	(0.036)	(0.118)	(0.030)	(0.127)	(0.030)	(0.126)
Size-3	0.022	-0.100**	0.032	-0.258***	0.029	-0.280***	0.028	-0.263***	0.026	-0.102**	0.026	-0.097**
	(0.022)	(0.045)	(0.026)	(0.060)	(0.027)	(0.061)	(0.026)	(0.060)	(0.024)	(0.046)	(0.024)	(0.047)
SUBSIDIARIES	0.135***	0.060***	0.197***	0.120***	0.193***	0.128***	0.181***	0.126***	0.129***	0.049**	0.129***	0.049**
	(0.022)	(0.018)	(0.028)	(0.020)	(0.026)	(0.021)	(0.025)	(0.021)	(0.022)	(0.023)	(0.022)	(0.023)
Observations	727	795	727	795	727	795	727	795	727	795	727	795
Log Pseudolikelihood	-73.350	-138.517	-107.538	-170.696	-113.356	-174.004	-105.298	-168.141	-79.283	-135.858	-79.276	-135.733

Notes: standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Appendix

Table A1. Determinants of M&A - Probit estimates

	Model 7		Model 8	
VARIABLES	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis
R&D	0.059**	0.026		
	(0.024)	(0.027)		
R&D * Young industries			0.068**	0.014
			(0.032)	(0.030)
R&D * Mature industries			0.039	0.058
			(0.029)	(0.042)
PRODinnov	0.007	0.009		
	(0.021)	(0.024)		
PROCinnov	0.044*	-0.002		
	(0.024)	(0.029)		
ORGANinnov	-0.034	-0.002		
	(0.022)	(0.030)		
PRODinnov * Young industries			0.021	0.028
			(0.025)	(0.031)
PROCinnov * Young industries			0.056**	-0.047
			(0.028)	(0.031)
ORGANinnov * Young industries			-0.040	0.045
			(0.028)	(0.037)
PRODinnov * Mature industries			-0.009	-0.002
			(0.033)	(0.038)
PROCinnov * Mature industries			0.027	0.077
			(0.039)	(0.053)
ORGANinnov *Mature industries			-0.046	-0.083*
			(0.035)	(0.048)
Patent	0.063***	0.074***		
	(0.017)	(0.027)		
Patent * Young industries			0.108***	0.084*
			(0.036)	(0.050)
Patent * Mature industries			0.051**	0.064**
			(0.021)	(0.026)
Age	0.086***	0.018	0.085***	0.010
	(0.030)	(0.044)	(0.030)	(0.044)
SIZE MEDIUM	0.117***	0.254**	0.133***	0.248**
	(0.029)	(0.125)	(0.028)	(0.117)
SIZE LARGE	0.023	-0.091**	0.025	-0.085*
	(0.021)	(0.044)	(0.021)	(0.046)
SUBSIDIARIES	0.121***	0.045**	0.116***	0.056***
	(0.020)	(0.022)	(0.020)	(0.021)
Observations	727	795	727	795
Log Pseudolikelihood	-67.8304	-134.762	-65.5814	-131.505

Notes: standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1