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NETWORK EFFECTS AND THE CREATION OF SHAREHOLDERS' WEALTH IN THE CONTEXT OF SOFTWARE FIRM MERGERS AND ACQUISITIONS

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Abstract

This paper investigates the reaction of financial markets to the announcement of a business combination between software firms. Based on the theory of economic networks, this article argues that mergers of software firms should lead to greater wealth creation because of the network effect theoretically linked to the combination of software products. This hypothesis is partially supported, as only the targets in software/software outperform those in the other categories, yielding abnormal returns of great magnitude. In addition, we could not conclude that controlling position in the target enabled bidders to make the appropriate technological decisions to ensure the emergence of network effects in the portfolio of the new entity and create additional wealth for the shareholders of both the bidder and the target. Future research is needed to better understand the effect of the different properties of the software pooled inside the product portfolio of the new entity.

Keywords : Merger and acquisition, network effects, software industry.

1 INTRODUCTION

With the acquisition of J.D. Edwards by Peoplesoft and the subsequent hostile bid by Oracle on the new entity, a wave of consolidation seems to be emerging in the software industry. In the wake of the post dot.com bust, many specialists of the sector have argued that the software industry is entering a more mature stage in which fewer large firms will dominate. Recent declarations by Larry Elison, CEO of Oracle, clearly illustrate the state of mind of some software firms' executives regarding this industrial consolidation: "1000 tech firms must die!"

In this context, it is the right time to investigate the potential of shareholder's wealth creation associated with the business combination of software firms. Based on the theory of economic networks, this article argues that mergers of software firms should lead to greater wealth creation because of the network effect theoretically linked to the combination of software products. In addition, we put forward the hypothesis that the degree of ownership should influence the capacity of the bidder to make the appropriate technological decision to ensure the emergence of network effects in the portfolio of the new entity (and thus additional wealth for the shareholders of both the bidder and the target).

2. THEORETICAL CONTEXT

2.1 Measuring the wealth creation in merger and acquisition: the event study approach

Over the last decades, shareholders' wealth creation in mergers and acquisitions (M&A) has been a matter of great interest in the financial literature. Different methodologies have been employed to investigate this phenomenon, but the most widely used is certainly the event study methodology.

This methodology is grounded in the efficient market hypothesis stating that capital markets immediately account, in an unbiased way, for new publicly available information. When a significant economic event comes up, it is possible to assess its financial impact on a company by measuring the market performance of its common stock within a relatively short period surrounding the event. Performance is measured by the abnormal return of the asset price. This abnormal return corresponds to the actual return that the stock price achieved during the event window, minus the normal return of this asset. This normal return is estimated through a model calculating the return the stock should have had if the event had not occurred. For further details on the theoretical and empirical issues of the event study methodology, readers should refer to (MacKinlay 1997) and (McWilliams et al. 1997).

In the case of mergers and acquisitions, the event study approach has been widely used because it is the most objective way to assess the a priori anticipation of the potential of an M&A. At the moment of the announcement, market participants estimate the current value of the incremental cash flow expected from the combination of the parties into the new entity. Based on this appreciation, trading decisions are made and the assets price of both the bidder and the target are readjusted. By measuring the abnormal returns, the event methodology aims at isolating the potential of the announced business combination, as perceived by the financial markets.

Based on this methodology, a vast body of knowledge on mergers and acquisitions has been developed over the years. Despite some contradicting results reported in the 1970s and 1980s (mainly related to limited sample sizes), the following evidence has been substantiated by several authors (Agrawal et al. 1992; Fuller et al. 2002; Jensen et al. 1983; Loughran et al. 1997):

- The abnormal returns of the bidding firm are, on average, either slightly positive or nil.
- The shareholders of the target firm benefit from large abnormal returns within a short event window surrounding the public announcement of the acquisition. However, large variations are reported in the returns, ranging from +10 to +30 depending on the sampled sector and the period under investigation (Jensen et al. 1983).

In other words, market reactions to M&A announcements are generally favorable for the targets and, at best, slightly positive for the bidders. Yet, different empirical results have brought further explanation to the observed variance in the results. For example, gains are more important in tender offers than in mergers where cash (instead of share transfer) is used for payment (Loughran et al. 1997; Dodd and Ruback, 1977; Datta et al. 1992). Bidders benefit from buying privately owned targets or subsidiaries, but underperform when acquiring public targets or when a multiple-bid situation occurs (Fuller et al. 2002; Loughran et al. 1997; Dodd et al 1977; Datta et al. 1992). Madhavan et al. (1995) denote an industry effect with regards to the information-processing load associated with analyzing events.

To our knowledge, no study has specifically targeted the market reaction to the business combination of software firms. Nevertheless, related research on joint ventures and alliances in the information technology indicate patterns relevant to this study. Koh et Venkatraman (1991) conclude that markets react favorably to announcements of joint ventures in the information technology sector. Results from Das et al. (1998) indicate that technology-based alliances lead to higher abnormal profit than marketing-based alliances. From these results, markets seem to react favorably to the coming together of information technology firms.

2.2 Network effects and wealth creation in mergers and acquisitions of software firms

The main argument of this article is that the business combination of software firms should theoretically create wealth for shareholders for both the bidder and the target because of the potential network effect that arises from the combination of software products in one unified portfolio.

An industry exhibits a network effect when "the value of a unit of the good increases with the [expected] number of units [to be] sold" (Farrell et Saloner, 1985; Economides, 1996). This paradoxical economic phenomenon emerges when the value of goods is directly linked to the installed base of the product. The greater the critical mass of users of a certain network of goods, the more value this product will have for the customers.

The telecommunication industry is a classic example of a sector where network effects are determinant to the success of innovation. A phone has no value unless a telecommunications network exists, and other people own phones. In such a bidirectional network, the value of the network is equal to n * (n - 1), where n represents the total number of phones in circulation. Any new phone subscriber will add 2n to value of the network.

In addition to traditional networks, Economides (1996, 2001) introduce the notion of virtual networks. A virtual network corresponds to a "collection of compatible components that share a common technical platform" (Economides, 2001). The DVD standard set up a virtual network for all DVD related products, i.e. DVD players and DVD disks. In a virtual network, network effect arises from the auto-reinforcing phenomenon that emerges within the complementary components. The larger the installed base of a certain component gets, the more value it represents to the complementary goods coevolving in the same virtual networks. This supplementary value will contribute to the larger diffusion of these complementary goods, which in turn will draw positive feedback to the other parties of the network.

Software products exhibit properties that make them natural candidates for virtual networks. Two complementary and compatible software products can easily build upon each other to create an auto-reinforcing context that would promote the diffusion of both products. Economics (2001) makes the case of Microsoft's Operating System and the Office Application Suite that have clearly benefited and continue to profit from a significant network effect.

The business combination of software firms has the potential of inducing new virtual networks or expanding existing ones. Take for example the acquisition of Great Plains (an enterprise software system provider) by Microsoft in 2001. After further development, the combined entity offers an ERP that is very well integrated with the MS Office suite (e.g., a manager using MS Project can easily export an updated budget into Great Plains' accounting module). The complementarity and the

compatibility within the extended Microsoft Portfolio contribute to the sales expansion of both the enterprise application system and project management software.

Several authors have already covered the topic of relatedness and synergetic gains in mergers and acquisitions. According to Seth (1990), related mergers should benefit from one or more of these inductors of shareholders' wealth: higher market power, greater economies of scale and/or scope, better coinsurance and enhanced risk diversification. Yet, conflicting results prevail regarding relatedness in mergers and acquisitions. Elger and Clack (1980) and Lubatkin (1987) find that conglomerate mergers create more abnormal returns for both the bidder and the target. Chatterjee (1992) reveals that market reaction is more important for unrelated targets than for related targets. On the other hand, Shelton (1988) brings to light the fact that supplementary mergers create more wealth than unrelated acquisitions. Singh and Montgomery (1987) report higher abnormal returns for related targets. Finally, Seth (1990) finds that both unrelated and related acquisitions create shareholders' wealth.

3. RESEARCH QUESTION AND HYPOTHESIS

In the light of the theory of economic networks, the large percentage of unexplained variances in the abnormal returns of both parties involved in a business combination and the conflicting results of the relatedness literature, this article aims at answering the following research question:

Does the business combination of two software firms create more wealth for shareholders than mergers with non-software firms?

To answer this question, we propose the following framework of business combinations (See Table 1). In this framework, bidders and targets are respectively represented in vertical and horizontal axes. The framework is composed of 4 types of business combinations: A software firms acquiring a software target (1st Category), a software firms acquiring a non-software target (2nd Category), a non-software bidder acquiring a software target (3rd Category) and all other non-software business combinations (4th Category).

	Targets					
Bidders	❸ **Non-software Bidder**	vs	**Software target**	❹ **Non-software Bidder**	vs	**Non-software Target**
	❶ **Software Bidder**	vs	**Software target**	❷ **Software bidder**	vs	**Non-software Target**

Table 1. Framework of business combinations in the software sector

The main argument of this paper is that, based on the theory of economic networks, the business combination of the software firms should lead to the creation of a virtual network and the emergence of network effects. This auto-reinforcing effect should translate to greater wealth creation for the shareholders of both the bidders' and targets' firms. Therefore, we pose the following hypothesis.

*H1: The shareholders of both the bidder and the target of a business combination involving two software firms (1st category) will benefit from more important wealth creation than is the case for business combination involving non-software firms.*Furthermore, the degree of ownership should influence the capacity of generating network effects. By acquiring a controlling position in a target, the bidder should be able to make the necessary technological decisions to ensure the complementary and compatibility of the new entity's software portfolio. Therefore, the following hypothesis is put forward.

H2: In the case of the business combination of software firms (1st category), higher controlling position should lead to greater wealth creation than that generated by the merger of non-software firms.

4. METHODS

Data on mergers and acquisitions were obtained through Thomson Financial's SDC Platinum Database. This database records worldwide mergers and tender offers. For the purpose of this article, we selected the successful mergers and tender offers that occurred from 1980 to 2002. Acquisitions for which information had been leaked into the public domain before the official announcement (and therefore had lost the effect of surprise) were also discarded from the dataset.

Mergers were classified according to the proposed framework. Bidders and targets were classified as software firms when their primary SIC code was 7371 (Computer Programming Services) or 7372 (Prepackaged Software). Table 2 presents the total number of mergers and acquisitions per category. The fourth category obviously accounts for the greater number of M&A, while the second category (involving software firms acquiring non-software firms) is the smallest of all. From this selection, only the bidders and targets included in the Center for Research in Security Prices (CRSP) database were retained for the analysis.

		Targets	
		Software Targets	**Non-software Targets**
Bidders	**Non-software bidder**	❸ 9203 M&A CRSP Bidders : 1440 CRSP Targets : 280	❹ 357565 M&A CRSP Bidders : 39780 CRSP Targets : 12213
	Software bidders	❶ 5243 M&A CRSP Bidders : 1181 CRSP Targets : 174	❷ 4690 M&A CRSP Bidders : 812 CRSP Targets : 91

Table 2. Number of mergers and acquisitions from 1980 to 2002 per category (all degrees of ownership)

Degree of ownership	**Bidders**	**Targets**
< 20%	1953	5234
20 - 50%	1586	1369
> 50 %	39674	6155
Overall	43213	12758

Table 3. Number of bidders and targets per degree of ownership

		Software		**Non-software**	
		Bidders	**Targets**	**Bidders**	**Targets**
Non-software		❸		❹	
	< 20%	88	129	1800	5063
	20 - 50%	47	22	1520	1339
	> 50 %	1305	129	36460	5811
	Sub-Total	1440	280	39780	12213
Softwarejb		❶		❷	
	< 20%	26	17	39	25
	20 - 50%	12	4	7	4
	> 50 %	1143	153	766	62
	Sub-Total	1181	174	812	91

Table 4. Number of bidders and targets per category and degree of ownership

Tables 3 and 4 present the distribution of the selected cases according to the degree of ownership of the bidder in the target firm after the acquisition. Stake position between 20 and 50 % appears to be the smallest of all three categories, while controlling position (> 50 %) is by far the most important. When looking at the distribution of M&A, important variances are observed in terms of the number of

firms in each subcategory. On the one hand, the number of targets and bidders is unsurprisingly very high. On the other hand, equity position in categories 1 and 2 (software firms acquiring software firms or non-software firms), stake position between 20 and 50 % appears to be quite infrequent. This variance will require that particular attention be paid to the statistical power of the test realized in the next section. Statistical power, i.e., 1 minus the probability to reject the nil hypothesis when it this true (1- β) will thus be reported for every result. Cohen (1988) states that for a mature topic, statistical power should be greater than 80%.

Event studies were carried out with Eventus software. A CRSP value weighted index was used for the market model estimation. Model estimation was made from 245 to 45 before the acquisition announcement. M&A with fewer than 145 days of data before the announcement were excluded from the analysis. Normal return of each firm was estimated with the standard approach:

$$E(R_{jt}) = \alpha_j + \beta_j R_{mt} + \varepsilon_{jt};$$

where $E(R_{jt})$ is the rate of return expectancy of firm *j* on day *t*, α is the intercept, β is the systematic risk of stock of firm *j* and R_{mt} the rate of return of the CRSP value weighted index. Through the transformation of the previous equation, a firm's daily abnormal return is calculated by subtracting the normal expected return from the actual observed return on the market:

$$A_{jt} = R_{jt} - E(R_{jt}) = R_{jt} - (\alpha_j + \beta_j R_{mt});$$

where A_{jt} is the abnormal return of firm *j* on day *t*. If *t*=0 stands for the merger announcement day, the average abnormal return (AAR) of a group of *n* firms for each trading day within the window of analysis is computed as per the following:

$$AAR_t = \frac{\sum_{j=1}^{n} A_{jt}}{N}$$

The cumulative average abnormal return (CAAR) adds up the total returns within the window of analysis (e.g. from 2 days before the event announcement up to 2 days after the event):

$$CAAR_{T1,T2} = \frac{\sum_{j=1}^{N} \sum_{T1}^{T2} A_{jt}}{N};$$

where T1 and T2 are respectively the starting day before the event and the ending day of the window of analysis.

Following the recommendation of McWilliams and Siegel (1997), short analytical windows were selected to limit interference from other events: -1 day to initial announcement (-1,0), -2 days to +2 days (2,2) and -5 days to +5 days (-5,5). Considering a few days before the announcement helps to take into account the links that can be made before the acquisition is officially announced.

5. RESULTS

5.1 Overall results

Table 5 presents the overall market reaction to M&A announcements. Cumulative abnormal returns (CAAR) are tested against the null hypothesis that the event has not yielded a profit different from what the common stock would have generated if the event had not occurred, i.e., a 0 % CAAR.

Our results are consistent with previous articles on the matter (Agrawal et al. 1992; Fuller et al. 2002; Jensen et al. 1983; Loughran et al. 1997): within a short analytical window, CAAR of the bidder stock is around 1%, while the target stock range is from 9 % to 13 % depending on the window analyzed.

	-1,0			-2,2			-5,5		
	CAAR	sig	1- β[1]	CAAR	Sig	1- β	CAAR	sig	1- β
Bidders	0.76%	***	1.00	1.12%	***	1.00	1.01%	***	1.00
Targets	8.46%	***	1.00	11.83%	***	1.00	13.06%	***	1.00

*** p<0.001 ** p<0.01 * p<0.05 t p<0.01

[1] Statistical power of the test (α = 0.05)

Table 5. Cumulative abnormal returns: Overall results

5.2 Merger and acquisition categories

This first hypothesis states that, because of the network effect potential, software/software M&As (1st category) should benefit from abnormal profit of greater magnitude than other types of mergers (table 6). To verify this hypothesis, this section compares (on a two by two basis) the CAAR of the first categories (software/software) to the CAAR of the three others (table 7).

Contrary to expectations, bidders' CAAR in a software/software M&A is not significantly different from zero. In other terms, the market appears to be indifferent to the announcement with regard to the bidders' stock price. In addition, the bidders in the three other categories of M&A yield higher CAAR than the bidders in the first category. It should be noted that statistical power is lightly under .80 when comparing 1 vs 3 and 1 vs 4 in the [-1,0] window. On the targets' side, the situation is completely different. Software targets involved in a software/software M&A benefit from the most important abnormal returns of all four categories with abnormal returns of up to 28.40 % in a period of -5 to 5 days surrounding the event. With such a considerable yield, the target's abnormal returns significantly differ from those of the three other categories.

In the light of these results, H1 cannot be rejected on the targets' side, while no empirical evidence has been found to support H1 on the bidders' side.

Moreover, it is also worthy to highlight the market reaction to the announcement of software/non-software mergers (2nd category) and non-software/software (3rd category). On the bidders' side, 2nd and 3rd categories present the highest abnormal returns, ranking respectively first and second within the four groups. As for the targets, these two categories yield comparable CAAR, ranking between the 1st and the 4th categories.

5.3 Degree of ownership

The second hypothesis concerns the impact of ownership on the capacity to capture the network effect's potential. H2 states that software bidders acquiring a controlling position in a software target should benefit from larger abnormal profit than would be the case for mergers with non-software firms.To validate this hypothesis, we first need to look at the overall impact of the degree of ownership on abnormal returns. The following table aggregates the cumulative abnormal returns with regards to bidder's ownership in the target after the announced transaction. Analysis of variance reveals that the market reaction differs significantly between the three categories of ownership. As a matter of fact, for both bidders and targets, CAAR increases with ownership, reflecting the potential synergy that the new controlling owner can induce in the unified entity.

Table 8 breaks down these ownership-based results into the four M&A categories. The first finding pertains to the fact that, on the bidders' side, ownership does not impact the market reaction to software/software M&A: at every level of ownership, CAAR is not significantly different from zero. In addition, when comparing the CAAR results of the controlling bidders from the 1st category to its peers in the three other categories (see table 8), our findings clearly highlight that the latter benefits from much larger CAAR than the formers. However, for the categories <20 % and 20-50 %, statistical power is too low to formulate a definitive conclusion on this matter.

			Targets																	
			Software targets									Non-software targets								
			-1,0			-2,2			-5,5			-1,0			-2,2			-5,5		
			CAAR	Sig	1 - β[1]	CAAR	sig	1 - β	CAAR	sig	1 - β	CAAR	sig	1 - β	CAAR	sig	1 - β	CAAR	sig	1 - β
Bidders	**Non -software bidder**					❸									❹					
		Bidder CAAR	1.10%	***	0.992	1.56%	***	0.986	1.10%	*	0.627	0.73%	***	1.000	1.11%	***	1.000	1.05%	***	1.000
		Target CAAR	11.14%	***	1.000	13.65%	***	1.000	14.78%	***	1.000	8.23%	***	1.000	11.59%	***	1.000	12.81%	***	1.000
	Software bidders					❶									❷					
		Bidder CAAR	0.18%		0.111	0.01%		0.050	-1.40%		0.839	2.34%	***	0.999	2.26%	***	0.987	2.04%	***	0.861
		Target CAAR	19.07%	***	1.000	26.55%	***	1.000	28.40%	***	1.000	13.76%	***	1.000	15.61%	***	1.000	17.08%	***	1.000

*** p<0.001 ** p<0.01 * p<0.05 t p<0.01

1 Statistical power of the test (α = 0.05)

Table 6. Cumulative abnormal returns per category

	❶ vs ❷						❶ vs ❸						❶ vs ❹					
	-1,0		-2,2		-5,5		-1,0		-2,2		-5,5		-1,0		-2,2		-5,5	
	sig	1- β[1]	sig	1- β	sig	1- β	sig	1- β	sig	1- β	sig	1- β	sig	1- β	sig	1- β	sig	1- β
Bidders	***	.986	***	.925	***	.987	*	.744	**	.827	***	.948	*	.604	***	.981	***	.999
Targets	**	.389	**	.829	*	.746	***	.843	***	.992	***	.985	***	.895	***	.999	***	.999

*** p<0.001 ** p<0.01 * p<0.05 *t* p<0.01

[1] Statistical power of the test (α = 0.05)

Table 7. Inter-category comparisons

		-1,0			-2,2			-5,5		
		CAAR	sig	1 – β[1]	CAAR	sig	1 - β	CAAR	sig	1 - β
Bidders	< 20%	0.07%		0.09	0.21%		0.22	-0.15%		0.09
	20 - 50%	0.40%		0.37	0.81%	***	0.80	0.83%	**	0.64
	> 50 %	0.66%	***	1.00	1.04%	***	1.00	0.91%	***	1.00
	Anova		***			**			**	
Targets	< 20%	4.21%	***	1.00	6.22%	***	1.00	7.27%	***	1.00
	20 - 50%	5.61%	***	1.00	7.62%	***	1.00	9.66%	***	1.00
	> 50 %	14.11%	***	1.00	19.44%	***	1.00	21.08%	***	1.00
	Anova		***			***			***	

*** p<0.001 ** p<0.01 * p<0.05 *t* p<0.01

[1] Statistical power of the test (α = 0.05)

Table 8. Cumulative abnormal returns per degree of ownership

As for the targets in software/software M&A, the ownership breakdown illustrates the important variability of the results. The announcement of a controlling stake clearly leads to the most important CAAR presented in table 9 (with an increase of 31% in the [-5, +5] window). However, large increases in CAAR are also observed in the three other categories, leading to less difference in the two by two comparisons (table 10). Consequently, when taking only the transaction in which a controlling stake was acquired, comparisons between the 1st and 2nd categories as well as between the 1st and 3rd categories do not appear to reveal significant differences with regards to abnormal profit. It should however be noted that statistical power is not sufficient to conclude with 95% confidence that the difference is not significant. Yet, differences between the 1st and 4th categories still remain and show that mergers involving a software party do differ from the rest of business combinations. Based on these findings, H2 cannot be supported.

6. DISCUSSION

This paper put forward two main results. Only the target in a software/software M&A benefits from positive market reaction, and these abnormal returns are significantly higher than what targets earn in any other category of business combinations. Controlling position does lead to higher abnormal profit, but software/software M&As do not seem to take greater advantage than other categories of business combinations. The following paragraphs discuss these two results.

6.1 Network effect of the target and the bidder

High abnormal returns for the shareholders of the targets are not surprising. What is of interest in our results is mainly the fact that our findings help to explain a portion of the observed variance in the target's abnormal returns. This paper has proposed the theory of network effect to explain the higher yield generated by the targets involved in software/software M&A. The market appears to recognize the potential for wealth creation associated with the introduction of the target software product into the portfolio of the bidders.

The unexpected result is the finding that bidders in software/software mergers clearly underperform compared to bidders in the other categories. Not only is the additional value associated with network effect not taken into account, but the market appears to be on average indifferent to the business combination. One explanation for this phenomenon can lie in the expectation of the financial market. Because building a virtual network is the clear determinant of success in this industry, it is possible that the markets expect software firms to develop portfolios of complementary products. If so, the business combination is not a surprise event anymore, the incremental wealth already taken into account in the price of the asset. In this case, future research should try to assess whether the market penalizes firms that do not follow the path of mergers (e.g., reaction to unsuccessful merger attempts).

				Targets																
				Software targets									Non-software targets							
				-1,0			-2,2			-5,5			-1,0			-2,2			-5,5		
				CAAR	sig	1 - β	CAAR	sig	1 - β	CAAR	sig	1 - β	CAAR	sig	1 - β	CAAR	sig	1 - β	CAAR	sig	1 - β
Bidders	**Non-software bidders**			❸									❹							
		Bidders CAAR	< 20%	-0.23%		0.067	0.10%		0.052	-1.42%		0.266	0.10%		0.140	0.25%		0.290	-0.06%		0.060
			20 - 50%	3.21%		0.347	5.37%	*t*	0.378	5.70%	*	0.487	0.35%		0.300	0.71%	**	0.710	0.79%	*	0.600
			> 50 %	0.80%	***	0.902	1.18%	***	0.818	0.87%	*t*	0.387	0.65%	***	1.000	1.07%	***	1.000	0.99%	***	1.000
		Targets CAAR	< 20%	6.64%	***	1.000	6.85%	***	1.000	8.46%	***	0.996	4.11%	***	1.000	6.15%	***	1.000	7.19%	***	1.000
			20 - 50%	7.75%	***	0.829	13.72%	***	0.773	14.04%	*	0.505	5.52%	***	1.000	7.44%	***	1.000	9.50%	***	1.000
			> 50 %	18.82%	***	1.000	24.67%	***	1.000	26.31%	***	1.000	13.79%	***	1.000	19.10%	***	1.000	20.69%	***	1.000
	Software bidders			❶									❷							
		Bidders CAAR	< 20%	-0.67%		0.087	-0.05%		0.050	-1.48%		0.094	-0.26%		0.060	-1.50%		0.270	-0.48%		0.060
			20 - 50%	-1.32%		0.159	-2.34%		0.184	-4.84%		0.245	-5.45%		0.080	-3.71%		0.110	-13.38%		0.160
			> 50 %	0.06%		0.055	-0.45%		0.189	-1.78%		0.929	1.65%	***	0.980	1.75%	***	0.900	1.25%	*t*	0.430
		Targets CAAR	< 20%	6.93%	**	0.601	10.20%	*	0.550	9.39%		0.269	10.25%	**	0.690	14.02%	*	0.580	15.92%	*t*	0.450
			20 - 50%	12.49%	***	0.374	27.01%	*	0.186	25.88%	***	0.317	17.34%	t	0.160	15.18%	***	0.460	22.91%	t	0.140
			> 50 %	20.84%	***	1.000	28.16%	***	1.000	30.96%	***	1.000	18.09%	***	1.000	19.69%	***	0.990	22.59%	***	0.99

*** p<0.001 ** p<0.01 * p<0.05 t p<0.01 $_1$ Statistical power of the test (α = 0.05)

Table 9. Cumulative abnormal returns per category and degree of ownership

❶ vs ❷						❶ vs ❸						❶ vs ❹					
-1,0		-2,2		-5,5		-1,0		-2,2		-5,5		-1,0		-2,2		-5,5	
sig	1- β	sig	1- β	sig	1- β	sig	1- β	sig	1- β	sig	1- β	sig	1- β	sig	1- β	sig	1- β
**	.882	**	.898	***	.935	*	.503	**	.794	***	.950	**	.539	***	.950	***	.999
NS	.112	NS	.331	NS	.251	NS	.106	NS	.130	NS	.146	NS	.998	***	.774	***	.796

*** p<0.001 ** p<0.01 * p<0.05 *t* p<0.01 $_1$ Statistical power of the test (α = 0.05)

Table 10. Inter-category comparisons – Degree of ownership > 50 %

6.2 Ownership and network effect

Unexpectedly, results indicate that controlling position doesn't seem to greatly affect the creation of wealth in software/software mergers. On the bidders' side, financial markets are indifferent to M&A announcements whatever the level of ownership. It is possible that the same expectation phenomenon explains this indifference. Markets would anticipate the fact that only an M&A strategy that would lead to a controlling position in the target ensures the success of the operation (the other degree of ownership being penalized).

As for the targets, their performance is not different from those in other mergers involving software (categories 2 and 3). However, the fact that all the targets in software-based mergers (categories 1, 2 and 3) outperform significantly the targets in all the other mergers (category 4) is an indication of the importance of ownership in software mergers. Therefore, markets recognize that a controlling position is necessary to develop coherence and compatibility within the software-oriented product portfolio (whether only software or mixed with non-software product) of the new combined entity.

7. CONCLUSION

The objective of this paper was to investigate the reaction of financial markets to the announcement of a business combination between software firms. Based on the theory of network economics, we have tested the hypothesis that mergers between software companies should theoretically generate network effects that should translate into the creation of wealth for the shareholders of both the bidder and the target. This hypothesis was partially supported, as only the targets in software/software outperform those in the other categories, yielding abnormal returns of great magnitude. The second hypothesis related to the degree of ownership was not supported. Nevertheless, the targets in all the mergers involving software and for which a controlling position was acquired by the bidder outperformed the rest of the targets. This result appears to be an indication of the influence of the degree of ownership in mergers involving software.

There are limitations to the above analysis. Because of the important number of mergers taken into account in this paper, it was not possible to control for confounding events that might have occurred on the same day of the events studied. CRSP database is also limited in terms of coverage outside the United States. Nevertheless, most of our tests exhibit high statistical power which brings support to the generalization of our results.

Future research is needed to better understand the role of network effects in the creation of wealth for the shareholders of software firms involved in business combinations. One research direction that is actually under investigation looks at the different properties of the software pooled inside the product portfolio of the new entity. These properties might help to further our understanding of the network effects in the software industry.

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