

THE EFFECT OF INFORMATION TECHNOLOGY INVESTMENT ANNOUNCEMENTS ON THE MARKET VALUE OF SPANISH BANKS¹

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Abstract

One of the most popular topics in the Information Systems (IS) field has been the impact of the Information Technology (IT) investments on the business value. In the last years, several papers have dealt with this elusive relation, using different approaches to resolve it. In this work, we review the contributions that have made use of the event-study methodology and carry out a critical exposition of the advantages and disadvantages of it. Starting with these considerations, we develop an analysis of the effect of IT-related announcements on the market value of Spanish banks. In this study, the news articles have been classified in different categories to determine whether the nature of the IT action influences in the effect on the market value of the firm. The results of our tests show that the IT investments produced significant and positive abnormal returns, and these impacts are different depending on the characteristics of the announcement. However, the further discussion lead us to adopt a cautious vision with regard to conclusions that are based on the use of this methodology in the IT business value field, due to the inconsistency of the results.

Keywords: IT Investments, Event Study Methodology, Business Performance.

1 INTRODUCTION

Determining whether investment in information technology (IT) has an impact on firm performance has been and continues to be one of the key questions in the information systems (IS) field (Dickson and Nechis, 1984; Hartog and Herbert, 1986; Brancheau *et al.*, 1996; Lee *et al.*, 1999; Barney *et al.*, 2001). Over the last few years, a huge number of studies have tried to solve this problem in one way or another (Turner, 1982; Bender, 1986; Harris and Katz, 1991; Weill, 1992; Rai *et al.*, 1996; Bharadwaj *et al.*, 1999; Bharadwaj, 2000; Sircar *et al.*, 2000; among others).

This interest is due to two fundamental reasons: First, the evolution of this technology in the business field itself. There appears to be little doubt that today, IT are extremely important in most industries, thanks to their growing application possibilities. This fact has resulted in a situation of constant increase of investments in this technology. Second, the way studies have evolved in this field. In the early years, the conclusions about the impact of IT on performance were contradictory. However, a change has taken place. Nowadays, a large number of works have suggested that, in general, IT investments have significant positive effects on business performance measures (Weill, 1992; Rai *et*

¹ This paper has been supported by Project SEJ2005-08805 of Spanish Ministry of Education and Science, Project V069 of Madrid Regional Government and University Rey Juan Carlos and Catedra Iberdrola for Research in Business Management and Organization.

al., 1996; Bharadwaj *et al.*, 1999; Bharadwaj, 2000; Sircar *et al.*, 2000; among others). Nonetheless, other questions continue unsolved, keeping the relevance of this research subject.

Determining whether IT can improve firm competitiveness poses many problems that are widely discussed in previous works: the difficulties of IT and firm results measurement (Weill and Olson, 1989; Brynjolfsson, 1993), the existence of adjustment periods in the organization to exploit these technologies (Brynjolfsson, 1993), the appropriation of returns on the part of other agents (Brynjolfsson and Hitt, 1996), the difficulty about separating IT effects from others elements that determine firm results (Weill and Olson, 1989), the bad management of IT resources (Weill and Olson, 1989) and the need to have other tangible and intangible resources in order to make the most of IT investments (Clemons and Row, 1991; Brynjolfsson *et al.*, 1998; Powell and Dent-Micallef, 1997) or the IT capabilities creation (Bharadwaj *et al.*, 1999; Bharadwaj, 2000), are some of the key aspects at stake.

Due to all these considerations, the studies in this field have evolved through different ways. Some of them have directed their efforts to the sophistication of the proposed relation (Bhatt and Grover, 2005; Bharadwaj, 2000; Broadbent, *et al.*, 1999; Ravichandran and Lertwongsatien, 2005; Ray *et al.*, 2005; Santhanam and Hartono, 2003; among others), including additional factors to complete the explanation of the impact of IT. This approach allows outlining the nature of the proposed relationship with greater precision. However, it shows a very outstanding problem and, sometimes, hard to avoid: the need for higher levels of information demands a close contact with the firms themselves to obtain the data.

Other researches have tried to avoid the difficulties using methodologies that, to a certain extent, allow separating the IT effects on firm results. Particularly, we must emphasize the extensive studies that have used the event-study methodology with this purpose (Dos Santos *et al.*, 1993; Hayes *et al.*, 2000; Chatterjee *et al.*, 2001; Hayes *et al.*, 2001; Im *et al.*, 2001; Oh and Kim, 2001; Subramani and Walden, 2001; Chatterjee *et al.*, 2002; Dehning *et al.*, 2003; Sabherwal and Sabherwal, 2005; Hunter, 2003; Dehning *et al.*, 2004). Contrary to the previous case, this methodology does not require that researchers ask company for information while, in the light of the results of the previous studies, it seems to evaluate the impact of IT on the market value of the firm precisely.

Many analyses that use this methodology have appeared thanks to the incentive of these advantages that we have mentioned above. Nonetheless, from our point of view, this approach has also serious disadvantages that must be taken into account in the research design. Therefore, this study has a double goal. First, we want to answer the question whether IT investments affect the market value of the firm, using the event-study methodology. More precisely, we try to evaluate whether this effect exists and if there are differences according to the kind of investment that considered firms do. Second, we will analyse the disadvantages of the event methodology, in the light of our analysis and the previous contributions.

Assuming these considerations, the remainder of the paper is organized as follows. The next section outlines a brief review of the event-study methodology and some of the main papers that have used it to study the relationship between IT and competitiveness, analysing the characteristics and conclusions of each study. In section three we suggest the use of this methodology to the Spanish banking firms, considering other additional factors that can influence the proposed relationship. This section also outlines the methodology of the study and describes the main conditions the research design must observe. The results are presented in section four and the last section provides conclusions of the analysis as well as the use of the methodology.

2 THE EVENT-STUDY METHODOLOGY IN IT-BUSINESS VALUE FIELD

Over the last few years, the amount of studies that analyse the relationship between IT and firm results using the event methodology have increased. Dos Santos *et al.* (1993) were pioneers in the application of this methodology to the study of the proposed relationship. With a sample of 97 IT investments

news they observed the market value of the firm reaction due to their publication. These authors emphasized the advantages the market had to value the effects instead of internal measures, since these ones show important limitations to capture the impact of the technology. Specifically, if the firm's securities are traded in an efficient market (Fama, 1970), the event-study methodology will take into account immediately the benefits that certain application can have in the value creation capability of the firm, considering all the factors that take part in the relationship.

The basic advantage of this approach lies in its simplicity. However, this simplicity also means a problem and it is the lack of information it provides about how the process to create value from IT works. In fact, according to this situation, Dos Santos *et al.* (1993) suggest IT investment announcements affect firm value differently, depending on whether they are innovative or follow-up investments. This study also examines whether firm values in two major industry groups (financial services and manufacturing) were affected differently by IT investments. Indeed, they conclude IT investments result in positive changes in firm value only when investments are classified as innovative.

Starting from this contribution, many studies have tried to analyse the relationship according to this methodology. Im *et al.* (2001) extend the news sample used by Dos Santos *et al.* (1993) and consider additional firm variables (like size and industry in which firm operates) to evaluate their effects. They also take into account the publication date of the announcements and distinguish two categories: those ones of the original sample (published between 1981 and 1990) and the added ones (between 1991 and 1996). This distinction reveals the importance IT productivity paradox had on market reaction and the conclusions of the study confirm this aspect. From our perspective, this conclusion is especially relevant since it casts doubt on the market efficiency and, therefore, the technique validity.

Oh and Kim (2001) go more deeply into the use of the methodology. They include a correlations analysis to prove the firm financial situation may have moderating effects on the impact of IT investments on firm market value. This study proves again the growing interest to delimit the additional factors that can influence the proposed relationship.

Chatterjee *et al.* (2002) consider not only the firm characteristics (like size, growth, industry and level of diversification) but also the type of announcement, and distinguish two categories: infrastructure investments and applications investments. The authors show a significant difference in the effects of one kind and the other, although both categories result in positive changes in firm market value.

Lastly, Dehning *et al.* (2003) carry out a study in which they bring together the samples used by Dos Santos *et al.* (1993), Im *et al.* (2001) and Chatterjee *et al.* (2002) and they combine the event methodology and the regression analysis. These authors classify news articles according to the purpose of the investment and the innovation degree it means for the industry. They conclude that investments with a strategic purpose and those that represent a greatest innovation for the industry are expected to provide superior positive returns for firms.

Besides these studies, in the IS field, the event methodology has been used to analyse the outsourcing effect (Hayes *et al.*, 2000), the initiatives related to *e-commerce* (Subramani and Walden, 2002; Dehning *et al.*, 2004), the implementation of ERP systems (Hayes *et al.*, 2001), and the creation of CIO position (Chatterjee *et al.*, 2001). Undoubtedly, the publication of these more specific studies lies in the purpose to avoid the limitation we mentioned above: the lack of explanations that this methodology offers.

As it can be observed in the studies evolution, this limitation has also produced a progressive sophistication of the analysis, either by using complementary methodologies or by using subsamples that are generated according to different criterions (related to the kind of announcement as well as to the firm that invests).

Starting from these considerations, the objective of this study is to analyse the stock price behaviour of Spanish banking firms announcing plans to invest in IT. We describe our analysis model in the next section.

3 THE EFFECT OF IT INVESTMENT ON THE SPANISH BANKING FIRMS

The objective of this study is, indeed, to determine whether IT investments have affected market value of Spanish banking firms, using the event methodology. The choice of only one industry is in line with the conclusions generated by previous studies in which the industry is always taken into account, due to the application and the effects of these technologies have not been uniform in different industries (see, for example, Kettinger *et al.*, 1994). So, according to the line proposed by previous studies, our first hypothesis can be enunciated as follows:

Hypothesis 1: The publication of IT investment announcements generates the reaction of the stock market and produces abnormal positive returns.

Nevertheless, we consider the kind of investment affects stock market reaction to the announcement differently, as some of the analysed studies show (Dos Santos *et al.*, 1993; Chatterjee *et al.*, 2002). This way, we categorized each announcement of our sample based on the following criteria:²

- Innovative for the firm – The investment represented the first use of a technology by the firm.
- Cooperation – The investment implied the cooperation between the investor and other firms (operating or not in the same industry) to develop or implement technologies or innovations existing in this field (outsourcing contracts included).
- Related to Internet – The investment represented the use of this technology by the firm.
- Internal nature – The investment would result in the implementation or maintenance of IT related to the internal operations of firm.

Thus, according to the line proposed by previous studies, the second hypothesis could be enunciated as follows:

Hypothesis 2: The stock market reaction to IT investment announcements is different, depending on the nature of the investment.

Finally, we proposed what it is commonly called ‘new economy crisis’ had affected the market value of firms, following other previous contributions again (Dehning *et al.*, 2004). Since the effects of this crisis appeared harder in Spain from the beginning of 2001, we included the next hypothesis in our model:

Hypothesis 3: The stock market reaction to IT investment announcements is different before the beginning of 2001.

To our perspective, the existence of this effect will invalidate this methodology since we would have to accept the market sometimes valued these investments erroneously.

3.1 Sample selection procedure and data description

To start with the study, we searched BARATZ³ database over the period from 1996 to 2001. As a result of the search criteria⁴, the full text of 817 titles was examined. These articles had appeared in daily newspapers focusing on business news (Expansión, Cinco Días and Gaceta de los Negocios) and they were related to firms that traded on the Madrid Stock Market. The sample was reduced to 202 articles. The titles were reviewed to determine whether they were likely to represent news stories or news releases about specific IT investments. For the remaining announcements, the Registro de

² “Innovative category” was also considered at first, as Dos Santos *et al.* (1993) did. However, it was not finally included due to the lack of announcements that met this requirement.

³ This database collects the news published by the Spanish newspapers focused on business affairs.

⁴ The announcements were selected whether firm name appeared and also if the abstract included some of the following words: technology, hardware, software, Internet, computer, ATM, ERP, CRM and network.

Hechos Relevantes de la Comisión Nacional del Mercado de Valores (CNMV)⁵ was checked for news that might contaminate the price data (e.g., dividends, earnings, mergers, increases of capital or other types of announcements) on the days around the investment announcement date. After these data screens, the remaining sample included 193 announcements.

Two researchers independently categorized each investment based on the proposed criteria. The two independent categorizations were then compared and there were only five conflicting categorizations in the sample. In each of these five cases, another researcher with experience in this field was consulted in order to solve the conflict.

Table 1 presents a breakdown of the announcements by category and the year in which the announcement appeared. The largest number of IT investment announcements was concentrated around the latest years of the considered period. The fall in the number of announcements related to this kind of investments during 2001 could be influenced by what it is commonly called 'new economy crisis' and it reached its maximum degree at the end of the first trimester of that year.

Year	Cooperation	Internet	Innovation	Internal nature	Announcements
1996	7	11	7	7	19
1997	9	13	12	10	24
1998	6	9	8	10	20
1999	7	17	14	9	26
2000	31	65	30	6	74
2001	16	27	20	2	30
Total	76	142	91	44	193

Table 1. *Distribution and categorization of announcements over time*

4 RESULTS

Once the sample was refined, we used the method proposed by Dood and Warner (1983), one of the most popular approaches in this literature, to determine whether IT investment announcements really generate abnormal returns. Besides, we proposed several tests in order to show whether different reactions took place depending on the characteristics of the announcements. In view of the characteristics of the Spanish Stock Market and according to McWilliams and Siegel (1997) suggestions, we have selected two event windows: from the day of the announcement to two days after it and two days after the event. Table 2 reports the results for the full sample and for each subsample.

	RAC _{0,+2}		RAC _{+1,+2}	
	Cumulative Abnormal Returns	Test Z	Cumulative Abnormal Returns	Test Z
TOTAL	0,26%	1,592	0,21%	1,872*
COOPERATION	0,30%	0,862	0,23%	1,372
INTERNET	0,26%	1,351	0,24%	1,664*
INNOVATION	0,08%	0,751	0,05%	0,777
INTERNAL	0,18%	0,539	0,08%	0,584
* Significance at 90% **Significance at 95% ***Significance at 99%				

Table 2. *Cumulative abnormal returns*

⁵ The Comisión Nacional del Mercado de Valores (CNMV) is the agency in charge of supervising and inspecting the Spanish Stock Markets and the activities of all the participants in those markets.

The results indicate that neither the announcements of the full sample nor the ones of the subsamples have significant effects on the market value of Spanish banking firms when we consider the first event window. We obtain similar results with the other event window, although in that case there are weak effects for the full sample as well as for the Internet subsample. This way, we conclude hypothesis 1 can be only partially accepted.

Regarding the existence of different effects depending on the kind of announcement, the second event window we have considered seems to show more clearly how different actions affected companies in different ways. So, hypothesis 2 cannot be rejected.

In order to contrast the existence of effects derived from the technological bubble, we divided the sample so as we repeated the tests only with the announcements published between 1996 and 2000. Table 3 summarizes the main results for this new sample.

	RAC _{0,+2}		RAC _{+1,+2}	
	Cumulative Abnormal Returns	Test Z	Cumulative Abnormal Returns	Test Z
TOTAL	0,50%	2,504**	0,38%	2,682***
COOPERATION	1,37%	1,231	1,02%	2,017**
INTERNET	0,55%	2,302**	0,44%	2,497**
INNOVATION	0,36%	1,454	0,21%	1,350
INTERNAL	0,27%	0,685	0,16%	0,736
* Significance at 90% **Significance at 95% ***Significance at 99%				

Table 3. Cumulative abnormal returns (sample 1996-2000)

When both tables are compared, an obvious difference appears that confirms hypothesis 3. The full sample of announcements as well as the Internet subsample had undoubtedly a positive impact on firm results. The announcements that mean cooperation among firms even had significant effects when we considered the (+1,+2) event window. From our point of view, these results reveal a clear weakness of this methodology that must be taken into account for further applications.

5 CONCLUSIONS

Regarding the possibilities the event-study method offers, the only thing we can offer as a result of our study is that the IT investment has effects on the firm competitiveness, assuming that the market value is a faithful indicator of the creation of value of the company. We can even be certain that the investments in Internet-related activities produce the largest effects on this value.

However, there are two fundamental limitations in this study. The first one, which is shared with the rest of works that adopt this perspective, lies in the lack of an explanation about the origin of that value; in addition to this, it is unknown whether there is any difference among the yields obtained by the companies that the announcements referred to. This methodology ignores completely the rest of circumstances, at least when it is considered in an isolated way.

Second, and in response to the question about the precision of the market, it is interesting to observe the existent significant difference between the results obtained when the full sample of announcements is considered, on the one hand, and the results when we exclude those news appeared in 2001, on the other. Do the companies no longer know how to exploit the new technologies? Were the cooperation agreements for the development or installation of these technologies less valuable in 2001? Did the market fail in 2001? Or did it fail before? Is the technological bubble maybe falsifying our analysis? From our point of view, and keeping in mind the results obtained in our analysis, we should meditate on the suitability of considering the use of this methodology to analyse the IT impact.

Undoubtedly, the value that the market grants to the investments adapts to the circumstances of each company, every time that new information becomes public. However, the event-study methodology only uses the punctual information that the market offers when these news are known, without taking into account the possible future adaptations. The consideration of wider analysis event windows does not seem the most appropriate solution, according to the recommendations to apply this methodology. In this sense, we consider that this methodology presents some problems that make its application in this study field more difficult.

Finally, we are fully aware off the partiality of our analysis. Such as we expressed in the introduction, the studies that pretend to determine the impact of IT should not only try to demonstrate that this effect exists but also to explain it. In this sense, even assuming that this methodology was valid, it would be necessary a deeper analysis of the results, in which those firm characteristics that can determine the competitive impact of the IT are considered.

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