



# A Lag Effect of IT Investment on Firm Performance

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## ABSTRACT

*This article discusses the positive effects of IT investment on firm financial performance when a distinct range of characteristics is examined. The relationship between IT investment and firm performance considering the information intensity of the industry is explored using a distributed lag model. Findings indicate both a positive effect and a positive lag effect of IT investment. The effects of IT investment in the high information-intensive industry are significantly larger than in the low information-intensive industry. Furthermore, a lagged effect of IT investment is larger than an immediate effect, regardless of the information intensity of the industry. We conclude that firms in the high information-intensive industry need to be more cognizant of performance factors when investing in IT investment than in the low information-intensive industry. Moreover, it is necessary to consider the time lag between IT investment and firm performance.*

*Keywords:* information intensity; IS investment; IS value; organizational impacts; time lag

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## INTRODUCTION

Improved application of information technology (IT) may be the key factor in an organization gaining competitive advantage (Kohli & Devaraj, 2004; Porter & Millar, 1985). The greater attention executives give to the tangible benefits of IT investment, the more researchers become interested in the benefits of IT investment. However, while a number of studies have focused on the effects of IT investment, there

has been a long-running debate on the relationship between IT investment and firm performance. Research about the relationship between IT investment and firm performance can be classified into three categories. First, several researchers have asserted that there is no relationship between IT investment and organizational performance (Brynjolfsson, 1993; Gordon, 2000; Quinn & Baily, 1994; Roach, 1991; Strassmann, 1997). Rather, they argue that IT

investment could have a negative impact (Menon & Lee, 2000) on the productivity of an organization because of inefficient allocation of management resources. The elasticities of other management activities (e.g., marketing, research and development, advertising) and similar capital targeting on improving firm performance are greater than the elasticity of IT capital (Brynjolfsson & Hitt, 1996; Lee & Menon, 2000). In the worst case, as firms invest more in IT, there is a greater need for coordination between different activities and information systems across all functional areas of the organization (Dasgupta, Sarkis, & Talluri, 1999).

The second research group has asserted that there is a significant positive relationship between IT investment and organizational performance. If firms invest more in IT, their performances correspondingly increase (Bharadwaj, 2000; Bharadwaj, Bharadwaj, & Konsynski, 1999; Brynjolfsson & Hitt, 2003; Li & Ye, 1999; McGuckin & Stiroh, 1998; Rai, Patnayakuni, & Patnayakuni, 1996). Suggesting that further discussions are needed on the limitations of the studies, they have used various techniques and data to explain a positive relationship between IT investment and organizational performance.

The third research group has reported partial or mixed results, and explained possible reasons for the results (Chircu & Kauffman, 2000; Devaraj & Kohli, 2000; Francalanci & Galal, 1998; Hu & Plant, 2001; Lee & Menon, 2000; Mahmood & Mann, 1993; Prattipati & Mensah, 1997; Stiroh, 1998; Tam, 1998; Zhu & Kraemer, 2002). They report that there is a positive relationship between IT investment and a range of firm performance variables; while in some performance variables, there is a negative relationship or effect.

More in-depth discussion is needed on the three viewpoints to explain the resultant effects of IT investment on firm performance. The reasons may be variances in the sample period, the industry investigated, the level of analyses (e.g., firm, sector, country), and the methodology used (see Appendix, which de-

scribes the summary of previous firm-level studies that used IT investment as one of the IT measures). It is also likely that no consideration was given to the critical factors in the research framework regarding IT amortization (Brynjolfsson, 1993; Quinn & Baily, 1994). In addition, the issue of the time lag has been identified as an important factor in the relationship between IT investment and firm performance (David, 1990; Devaraj & Kohli, 2000, 2002; Jurison, 1996b). The investigation of the time lag has been acknowledged by researchers as being one of the limitations to their studies and an aspect for future research (Peffer & Dos Santos, 1996; Pinsonneault & Rivard, 1998; Rai et al., 1996). Implementing IT projects is invariably a lengthy process, and employees need sufficient time to learn new information systems and to become reskilled. Furthermore, sensitivity to customers' needs and responsiveness to market dynamics are considerations that also need recognition when ultimately determining firm performance (Hu & Plant, 2001). Therefore, consideration of the time lag is paramount if a comprehensive exploration of the effects of IT investment is to be conducted with an appropriate level of rigor.

Another cause of empirically inconsistent results may be a lack of consideration for the characteristics of the industry sector. Melville, Kraemer, and Gurbaxani (2004) proposed an IT business value model that included industry characteristics, such as competitiveness, regulation, technical changes, clock-speed, and other aspects that shape the way in which the focal firm generated business value. In an organizational context, the role of IT should be a decisive factor for influencing performance. Consequently, while recognizing that the role of IT in each industry is different, one also should be aware that the relationship between IT investment and the final size of the effect from IT investment might differ in and between sectors (McGuckin & Stiroh, 1998). Simultaneously, the size of the time lag for IT investment and its payoffs can vary according to the information intensity of the particular industry.

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