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Disruptive information technology innovations and the cost of equity capital: The moderating effect of CEO incentives and institutional pressures

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ABSTRACT

Disruptive information technology (IT) innovations not only present opportunities, but also cause uncertain impacts on firm risk that affects the equity financing cost of a firm. This paper used longitudinal data from 146 U.S. listed firms that adopted radio frequency identification (RFID), a disruptive technology that enables supply chain process innovation. Results show that firms that adopted RFID significantly reduced their cost of equity capital, and the reduction was stronger for firms with greater CEO incentive-based compensation and coercive pressure. The findings help managers make strategies that maximize the benefits of disruptive IT innovations.

1. Introduction

Disruptive information technology (IT) innovation is defined as an architectural innovation originating in the IT based that has subsequent pervasive and radical impacts on development processes and their outcome [1]. Disruptive IT innovation revolutionizes operation processes that provides firms with major new growth in business, dramatic improvements, and more efficient on unit performance [1–3]. Engaging in innovation activities also help firms to be aware of the latest development, absorb new and related knowledge, and develop dynamic capabilities that equip firms with abilities to handle dynamic market changes [4–6]. However, disruptive IT innovation also has drawbacks that investors may perceive it negatively. The adoption of disruptive IT innovations is risky and expensive, and their benefits are uncertain in the long term. The adoption often leads to disruptions in operations of the adopting firms because its measures may not compatible with the existing systems. The innovation also dramatically modifies a firm's division of labor and requires new skills and behavior to sustain competitive advantage. Firms have to adjust their thinking and operation processes to meet significant changes caused by the innovation [1,2]. Any change would encounter resistance from people, who believe that their interests would be compromised following the adoption of those innovations [7]. Moreover, the adoption of disruptive IT innovations requires certain capabilities and resources, firms that do not possess sufficient resources or capabilities for the adoption are likely to fail the adoption and suffer financial losses from the adoption. In addition, it can take firms years to receive the full benefit of these innovations.

Researchers have been interested in understanding the relationship between IT innovations and economic performance. Early research has examined how IT innovations impact financial performance using accounting-based measure [e.g., 8–10] and market-based measures [e.g., 11–13], and how the impact varies with contextual factors such as firm and technology characteristics. Mithas et al. [8] examined more than 400 global firms. They found that IT had a positive impact on profitability, and firms had greater success in achieving higher profitability through IT-enabled revenue growth than through IT-enabled cost reduction. Zhu [10] examined the main effects and the interaction effects of e-commerce and IT on firm performance. They found a positive interaction effect between IT infrastructure and e-commerce capability, suggesting that the complementarity positively contributes to sales per employee, inventory turnover, and cost reduction. Li and Ye [9] found that the impact of IT investments on financial performance was positively associated with greater environmental changes, more proactive company strategy, and

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closer CEO/CIO ties. As for those short-term event studies, Dos Santos and colleagues [12] discovered that innovative IT investments increased market returns, while noninnovative investments did not. Dardan et al. [11] found that e-commerce initiatives increased stock return and volume, and the returns were different in good and bad markets. Hayes and coworkers [13] found that the market reacted positively to initial enterprise resource planning (ERP) announcements and more positively toward ERP investment news from small and financially healthy firms. More recently, empirical studies also have started to examine the impact of IT investments on risk. Dewan and Ren [14] found that IT investment increases both profitability and risk (i.e., variability of profitability), and that suitable firm boundary strategies of diversification and vertical integration in supply chain can moderate the effects of IT on firm performance in a manner that increases profitability and decreases risk, at the margins.

This study examines the same substantive issues, but takes a long-term event study approach [15] to jointly examine the response of the capital market to disruptive IT innovations and the factors that affect this response. Studying the effect of disruptive IT innovations on the cost of equity capital is important. First, the cost of equity capital is the internal rate of return that the market applies to the future cash flows of a firm to determine its current market value. If the capital market perceives that a disruptive IT innovation improves the risk portfolio of the firm, then the capital market will lower the cost of capital, which will increase the overall economic performance of the firm. Second, the cost of equity capital is a key input in the long-term investment decisions of a firm because it reflects the required rate of return on firm investments of investors [16]. Third, previous studies have suggested that agency cost and institutional pressures could influence the cost of equity capital [17–20]. However, empirical evidence is limited to support such a claim in the context of disruptive IT innovations. Overall, a deeper understanding of the effect of disruptive IT innovation on financing costs and the conditions that reduce this cost has significant competitive implications for a firm.

The present study estimates the impact of disruptive IT innovations on the cost of equity capital and the moderating effect of CEO incentives and institutional pressures on the impact based on longitudinal objective data. Using radio frequency identification (RFID) as the example of disruptive technology for supply chain process innovation [21–26], we apply long-term event study analysis to estimate abnormal change in the cost of equity capital between the adopters and non-adopters. We then conduct hierarchical regression analysis to examine how CEO incentives and institutional pressures affect the magnitude and direction of the abnormal cost of equity capital.

1.1. RFID as supply chain process innovation

Due to the disruptive nature of RFID, it is not commonly adopted in manufacturing industries until Walmart launched a mandate requiring its top 100 suppliers to used RFID tags on the cases or pallets of shipments in 2003. An RFID system includes tags and readers, application software, computing hardware, and middleware [27]. RFID allows the automated identification of products by embedding chips with wireless antennas into objects [28] and offers numerous advantages relative to barcodes. Among the advantages are the simultaneous reading of goods, absence of the constraint of line-of-sight tracking, storage of relevant information, and reusability [29]. RFID also dramatically changes the structure of work processes, such as order tracking and fulfillment as well as inventory control [28]. In particular, the tags can store and share relevant information over the Internet in real-time. Therefore, RFID adoption provides firms complete visibility of inventory movement along the supply chain leading to operational and strategic benefits [30]. Moreover, RFID provides real-time intelligence to organizations [31] and enables new business model (e.g., B-to-B e-commerce applications) [32].

RFID is widely viewed as a disruptive technology [21–24] that revolutionizes supply chain processes and practices [25,26]. For example, Bose et al. [21] discussed that RFID met the two criteria of being a disruptive IT innovation. First, the adoption of RFID incorporated different architectural principles that substitute the existing bar code systemand fundamentally change the supply chain operations of adopting firms. Second, RFID could create several radical services and process innovations during the implementation stage. Krotov and Junglas [24] suggested that RFID introduced a new value proposition that had the potential to become a disruptive technology with a profound impact on business and society. For example, it changes management style from passive to proactive and enables an efficient fight against counterfeit products [33]. Moreover, Sheffi [34] identified RFID as a disruptive technology similar to personal computers, which showed six stages in its evolution, namely, (1) fog of innovation, (2) life support for existing technologies, (3) stamp of approval, (4) transition from the old, (5) ubiquity, and (6) the big bang. Sheffi defined RFID development between the first and third stages of the innovation cycle because of its unclear benefits and several unsolved problems such as security and privacy.

Since RFID is a disruptive technology, firms need to overcome several challenges to realize the full potential of RFID adoption [35–38]. For example, firms face high cost of establishing an RFID infrastructure throughout the supply chain because the adoption involves investment in tags, readers and related equipment, network and communication systems, data maintenance and process including changes to existing enterprise resource planning and other related systems [35]. Moreover, the integration of RFID into the supply chain processes of a firm is complex, the adoption destroys a firm's existing competences when using barcode system, thus requiring to the reinvention of its key processes in the business network [40]. RFID adoption also requires warehouse activities in the supply chain to be completely re-engineered [32]. However, firms are often lack of expertise such as RFID data analysts, RFID systems technicians, and RFID maintenance officers in the business network to implement that adoption [39]. In addition, firms adopting RFID may not instantly experience its benefits [42], and it may take as long as two to three years for returns on investment to begin to appear [43].

RFID has received increasing attention from academics and practitioners since Walmart launched a mandate requiring its top 100 suppliers to use RFID tags on the cases or pallets of shipments in 2003. Previous studies focus on examining the business value of RFID using accounting-based measures, such as operational performance and profitability [e.g., 36, 39, 44, 45], and market-based measures such as stock price [e.g., 21, 46]. For instance, a case study of five Hong Kong fashion retailers by Moon and Ngai [36] indicated improved operational efficiency and effectiveness and increased sales and profits as major benefits of RFID adoption. Jeong and Lu [46] found an overall positive abnormal stock return on RFID investment announcements over a three-day event window based on 128 RFID investments. However, the impact of RFID on the cost of equity capital and the effect of CEO incentives and institutional pressures on that impact remain uncertain.

2. Theoretical development and hypotheses

2.1. The impact of disruptive IT innovations on the cost of equity capital

Firms can be financed through equity. The cost of equity is the expected return from the investment of firm equity, such as stock. In