Reviewing Event Studies in MIS: An Application of the Firm Value Framework

Bruce Dehning  
*Chapman University*  
bdehning@chapman.edu

Vernon J. Richardson  
*University of Kansas*  
vrichardson@ku.edu

Theophanis Stratopoulos  
*University of New Hampshire*  
theos@unh.edu

Abstract

Our objective in this paper is to show how the firm value framework can be used to examine IT investments and research on IT investment decisions. The firm value approach adds to the process-oriented approach through simultaneous evaluation of all of the factors that affect firm value. We demonstrate how to use the firm value framework in evaluating two streams of research in MIS, event studies of IT investment announcements and e-commerce initiatives.

1. Introduction

Dehning and Stratopoulos [7] show how a variant of the dividend discount model (DDM) can be used to demonstrate the effect of IT investments on firm value. Their model is a function of four variables, the average or normal level of profits in an industry (I), firm-level variations in profitability (F), the duration of F (n), and the riskiness of the company (k). Combining these into one model results in equation (1).

\[
V = \frac{1}{k} \left[ I + F - F(1+k)^{-n} \right]
\]

Where:
- \( V \) = Firm value.
- \( I \) = The normal level of profits in the industry.
- \( F \) = Firm specific deviation in earnings.
- \( n \) = The duration of the deviation in earnings.
- \( k \) = The required rate of return for this particular firm based on the opportunity cost of comparable risk alternative investments

As described in [15] an investment in IT is bound to lead to one of the following scenarios: competitive disadvantage, competitive parity, temporary or sustained competitive advantage. The model presented in equation (1) is versatile enough to allow for all three possible outcomes. When either \( F=0 \) and/or \( n=0 \) there is no change in earnings, firm value is given by equation (1) and the company maintains competitive parity. A positive value of \( F \) implies a company with a competitive advantage, while a negative value of \( F \) implies a company at a competitive disadvantage. A combination between a positive \( F \), and a small or large \( n \), can be used to describe a company enjoying a temporary or sustained competitive advantage, respectively. Figure (1) illustrates the fact that future dividends are impounded into current value at a discounted amount (dependent upon \( k \)). Firm value can be thought of as the area under the downward sloping line. This demonstrates that firm value, the area under the dashed line, decreases as \( k \) increases.

![Figure 1](image)

**Figure 1**  
The firm value framework.

2. IT investments and the firm value framework

The model developed above shown in equation (1) will serve as the framework for analyzing the effect of IT investments on firm value. Firm value in this framework is a function of four variables \( I, F, n, \) and \( k \). A review of how IT investments translate into firm value will help clarify the difficulty in measuring the impact of IT on firm value. IT has direct and indirect effects on business processes. These business processes together determine the profitability of the company, which determines firm value. Current stock price may or may not reflect the value of the firm depending on the level of market efficiency, and how well management has communicated with market participants. Management has some control over this relation by their ability to disclose relevant information to market participants. This can be direct in
the form of a conference call or press release, or indirectly through dividend announcements, stock repurchases, insider buying and selling of company shares, etc.

To measure the impact of IT with the least amount of noise, direct measures of business processes should be used. However, these are the most difficult measurements to make. Firms are not required to report most direct measures of business processes. There are some proxies available from the financial statements at the aggregate level, such as inventory turnover, profit margin, asset turnover, and market share. However, changes in these variables might lag IT implementation by several years, [2], [3], and are short-term measures that ignore the long-term benefits of IT.

The second option that researchers have is to try and measure the variables \( I \), \( F \), \( n \), and \( k \) directly. Similar to direct measures of business processes, measures of \( I \) and \( F \) such as ROE, ROA, and ROS might lag IT implementation by several years [2], [3], and are short-term measures that ignore the long-term benefits of IT.

Measuring the duration of an increase in profits due to an IT investment \( (n) \) implies a longitudinal study comparing IT implementing firms to industry average profits or the profitability of a direct competitor. The firm itself may also be used as a control, examining the duration of the change in profits before and after IT implementation.

Most of the risk factors that determine \( k \) are impossible to measure directly, but several proxies are readily available. The variability of earnings, cash flows, and market returns remain the best proxies for market participant’s judgment of the riskiness of the company. Other risk measures such as downside risk [16] and capital structure (e.g. debt-to-equity ratio) can also be used.

The advantage of using firm value to evaluate the benefits of IT investments is that firm value considers all future benefits to the firm, both short-term and long-term. This eliminates the problem of estimating the time lag between implementation and increased profitability or productivity. A problem with firm value is that it is not directly observable, but there are numerous proxies, all based on stock price. Although there appears to be some mispricing in the market, stock price is still the best measure of firm value. Stock price can be measured in levels (Market Capitalization, Tobin’s q, Ohlson Model) or in changes (Event Studies, Long-Window Returns, Association Studies).

An advantage and a disadvantage of stock price is that it captures the effect of all four variables in the firm value model, \( I \), \( F \), \( n \), and \( k \). The advantage is that there are no missing variables; all factors that affect firm value are considered. Dos Santos et al. [10] recognized this as a reason that event studies are better than accounting performance measures, because event studies capture both risk and return. The disadvantage is that any significant relation between an IT investment and stock price cannot be attributed to any one of the four variables without further investigation. In the following section we review two streams of research in MIS that have used an event study methodology. Event studies are interesting in the context of the firm value framework because they measure changes in firm value directly. The two research streams we chose to evaluate in the context of the firm value framework are interesting because while the papers often found conflicting results, the results can be reconciled in light of the firm value framework.

3. Examining IT event studies using the firm value framework

In Table 1, we summarize the variables used in previous event studies in MIS to see how they fit into the firm value framework. Although you could argue that each variable used in these studies measures some aspect of \( I \), \( F \), \( n \), and \( k \), we focus on the main effects of each variable.

3.1. IT investment announcements

Dos Santos et al. [10] examine the stock price reaction to IT investment announcements in the context of two explanatory variables, industry and innovation. Contrary to the variable name, the industry variable (financial firms versus manufacturing firms) captures a firm-specific effect \( (F) \). An announcement of an IT investment by a firm would not be a signal of a change in \( I \), the industry level of profitability, but a change in \( F \), a firm level change in profits. The reason this variable is expected to have a significant effect is that financial firms are more likely to have a change in \( F \) that is larger than the change in \( F \) for non-financial firms due to the information intensity of the industry. In essence, then, this “industry” variable serves as a surrogate for a firm’s degree of information intensity. The innovation variable measures both \( F \) and \( n \). By being the first to use a new technology or to introduce a new technology-enabled product or service, a firm is more likely to have an increase in \( F \) that is difficult for competitors to duplicate (a longer duration, \( n \)).

Im, et al. [14] examine the stock price reaction to IT investment announcements in the context of three explanatory variables: industry, size, and time period. As in [10], the industry variable measures expected changes in \( F \). Firm size most likely reflects aspects of competitive advantage \( (F) \), the duration of competitive advantage \( (n) \), risk \( (k) \), and the information set available to market participants. Smaller firms are more likely to have certain advantages when information is considered an asset and complete contracting is not possible [4]. The duration of
competitive advantage is longer for small firms because they are less likely to undergo scrutiny, and viewed as less of a threat to larger firms in the industry. Small firms are also generally more risky, so this variable also captures some of the differences in k between firms. Firm size also measures the information set available to investors prior to the IT investment announcement, and the announcements for small firms contain more news than those for large firms [1]. Due to the numerous possible effects of size on firm value, interpreting results of firm size variables is problematic.

The third variable, time period, does not actually measure what Im et al. [14] theorize that it measures. A problem with using accounting measures of performance is that there is a time lag between when IT investments are made and when the benefits show up in the financial statements. While Im et al. [14] state that including a time period variable controls for this problem, this is not a problem with market measures but rather for accounting performance measures. Time period likely captures firm-specific effects, F and n. As IT investments become more integrated into business activities, not only does the likelihood of firm performance gains increase but it is increasingly difficult for competitors to figure out the exact nature of the competitive advantage granted by IT. Thus, in the latter time period (one of increased integration), an increase in firm profitability is more likely to have a longer duration, and therefore a larger impact on firm value.

Dehning, Richardson, and Zmud [9] examine the stock price reaction to IT investment announcements in the context of four explanatory variables: industry, size, time period, and industry IT strategic role. Industry, size, and time period are virtually the same variables as in [14]. They add industry IT strategic role [5], [19], [22] as an overarching industry-level construct to explain the IT-firm value relation.

Industry IT strategic role as conceptualized by Schein [19] consists of four states, automate, informate up, informate down, and transform. These have implications for I, F, and n in the firm value framework. Companies adopting IT to automate human labor generally invest in IT in order to improve the efficiency of existing business processes. Informate up and informate down involve the use of IT to induce decision-making and decision-taking at, respectively, higher and lower organizational levels. When implemented well, these IT investments possess the potential to enhance competitiveness through improvements in the effectiveness of existing business processes. IT meant to both automate and informate will affect F and n in the firm value framework. Although there might be an increase in profits (F) from the new IT, it is likely to be short-lived (n) as competitors copy and even improve the IT used. Thus the IT investments become a strategic necessity within the industry and not a source of competitive advantage.

Companies that use IT in a transform role introduce radical business models that disrupt industry practices and market structures as a means to position themselves more favorably within an industry. The intended market changes are disruptive rather than incremental, and hence promise high, sustainable returns if successful. Companies able to do this successfully form a new, more profitable (I), sub-industry. Companies announcing IT investments when an industry is in transform mode are in essence announcing their intention to join the new, more profitable sub-industry. The market will react to the company’s announcement based on the probability the company will successfully join the new sub-industry and the increased profits of the new sub-industry over the existing industry level of profits (ΔI).

Dos Santos et al. [10] find that for the overall sample and the finance or manufacturing sub-groups there is not a significant market reaction to IT investment announcements. However there is a significant reaction for firms that made innovative IT investment announcements. Im et al. [14] also find no overall or industry effects, but find that firm size and time period are significantly related to the market reaction to IT investment announcements. Specifically they find that small firms experience a significantly positive reaction and larger firms a negative but insignificant reaction. Overall they find a significant negative correlation between firm size and the market reaction to IT investment announcements.

The two time periods examined by Im et al. [14] were 1981 to 1990 and 1991 to 1996. They find a significantly positive reaction to announcements in the later period, and a negative but insignificant reaction in the earlier period. In the later period they also find significant industry and size effects. The financial firms in the later period have a significant positive reaction to IT investment announcements, whereas the non-financial firms have a negative and insignificant reaction to their IT investment announcements. The size effect was the same as in tests of the overall sample, small firms experience a significantly positive reaction, and larger firms a negative but insignificant reaction, and a significant negative correlation between firm size and the market reaction to IT investment announcements.

Dehning, Richardson, and Zmud [9] find similar results as [14] in Univariate tests, but in Multivariate tests find that a single construct, industry IT strategic role, is the only significant predictor of the market reaction to IT investment announcements. They find that companies making an IT investment announcement when their industry is in automate mode experience a significant negative reaction, whereas companies that make an announcement when their industry is in informate or
transform modes experience a significant positive reaction.

The findings that a single industry variable, industry IT strategic role [9], explains the previous findings of [10] and [14] requires further analysis. It is most likely due to the fact that other variables such as industry, innovation, and time period are actually measuring the same underlying construct as industry IT strategic role.

It is easy to see how time is one dimension of industry IT strategic role, as industries move over time through the automate, informate, and transform modes. The innovation measure of Dos Santos et al. [10] also contains information about industry IT strategic role. The first company or two announcing IT initiatives at a higher level IT strategic role could signal the change in industry IT strategic role from automate to informate or from informate to transform. The financial vs. non-financial industry variable also contains information about industry IT strategic role. The incentive in information intensive industries to move to higher levels of IT use would be elevated due to increased payoffs from IT relative to industries that are not as information or IT intense. Thus the time variable, innovation variable, and industry variables are proxying for the underlying construct industry IT strategic role. Thus in multivariate tests where only the orthogonal portions of each variable are used to estimate the influence independent variables have on the dependent variable, the other variables are not significant.

### 3.2. E-commerce initiative announcements

In the following section we will examine two event studies that examine similar events but find conflicting results and show how the firm value framework can be used to reconcile these results. In the first study, Subramani and Walden [21] use the event study methodology to assess the value implications of e-commerce initiatives announced by firms. Drawing on the Resource Based View of the firm (RBV), they examined if the economic value of e-commerce initiatives is linked to the nature of firm’s resources (brick-and-mortar vs. net firms). In addition they also considered the nature of the e-commerce initiative (B2B vs. B2C), and the nature of the product, digital vs. tangible, on the firm’s cumulative abnormal returns.

Subramani and Walden [21] claim that e-commerce initiatives undertaken by firms reflect their commitment to build resources and capabilities necessary for competing in emerging markets. The move places them in a position to exploit the potential of expected growth in online commerce. To the extent that this expectation materializes, these companies will participate in a new industry with higher level of profits. The industry level of profits (I) captures this effect in the firm value framework.

Within in this new industry, firms may have a differential performance advantage or disadvantage, captured by F and n in the firm value framework. The authors use RBV in order to argue that because brick-and-mortar firms have operated in their markets for many years, they have accumulated valuable experience and understanding of their markets and customers. This knowledge can be leveraged when they expand their operations in the e-commerce market. Net firms have significant capabilities related to Internet technology, but they “are likely to confront a steeper curve with respect to the business context than non-net firms face with respect to the technology component.” The authors claim that since the resources and capabilities of brick-and-mortar firms are path dependent and relatively difficult to imitate, they have a competitive advantage when compared to net firms. Obviously, this translates into a positive F for the brick-and-mortar firms that can be sustained for a number of years (large n). Therefore in the context of firm value framework, an e-commerce announcement when coming from a brick-and-mortar signals the possibility of a sustainable competitive advantage. If the announcement comes from a net-firm it signals a temporary competitive advantage.

The authors also point out a contrary argument to the above in that the source of the advantage for brick-and-mortar firms, years of experience in a conventional market, may be a handicap when they operate in a dynamic environment such as that of e-commerce that is characterized by rapid changes. Net firms have the entrepreneurial culture and ability to make rapid changes in their strategy in order to “leverage and align with changes in the fluid technological and market environments.” This implies a change in the expected results in the context of the firm value framework. An e-commerce announcement when coming from a brick-and-mortar company signals the possibility of a temporary competitive advantage (small n) or even a competitive disadvantage (negative F). An announcement coming from a net-firm signals a sustained competitive advantage (large n).

The authors then build their argument on projections for growth in two markets, Business-to-Business (B2B) and Business-to-Consumer (B2C) e-commerce. Given the larger current and projected size of B2B commerce, they argue that the profit potential in the B2B market is much stronger than in the B2C market. Considering that the e-commerce announcement is a signal that the company will participate in the B2B or B2C market we can say that this is two separate industries, and captured by I, the normal level of profits within each industry.

The effect of joining the B2B or B2C market on the company’s expected profits is mitigated by the idiosyncrasies of these markets. In B2C the company’s ability to reap the benefits will be hindered by its ability...
to establish and manage processes for efficient delivery of goods to customers.

Benefits from B2B e-commerce are expected to be derived from scale economies from accessing a wider customer base and from greater efficiency through the streaming of supply chain using Internet technologies. As firms can potentially establish multiple B2B relationships, firms currently initiating B2B initiatives will have the opportunity to transfer the learning from initial B2B initiatives to become more efficient in subsequent relationships through the development of alliances and capabilities.

Companies who have invested and mastered the process of fostering such alliances over the years will enjoy an increase in their profitability. Offsetting these advantages are “uncertainties arising from the increased ability of large buyers to appropriate benefits from suppliers in procuring through online auctions and the possibility of supplier firms engaging in dynamic pricing, raising the overall costs of items to buyers.” These firm-specific factors are captured by \( F \) in the firm value framework.

The authors argue that although e-commerce is used to sell of both tangible and digital products, it offers a significant advantage to firms selling digital products. This is because the Internet can be used for the delivery of the product itself. The authors argue in terms of a differential profitability in the markets of these two types of products based on the fact that the marginal cost of producing digital goods is very small [20]. Considering that the e-commerce announcement as a signal that the company will sell digital or tangible goods, we expect that this impact will be captured in the firm value framework by \( F \).

Although not explicitly introduced as a hypothesis, the authors discuss the role of size in the discussion of the results.

As per the previous discussion of firm size variables, size is probably captured in the firm value framework by \( F, n, \) and \( k \).

The second paper that examines the market reaction to e-commerce initiative announcements is [8]. The authors attempt to replicate the findings of [21] but use a different time period of announcements. Whereas Subramani and Walden [21] used announcements in the fourth quarter of 1998, Dehning, Richardson, Urbaczewski, and Wells [8] use announcements in the fourth quarter of 2000. The difference in the results of the two papers is striking. Subramani and Walden [21] find abnormal stock market return of 4.2% in the -1/+1 window (no significance level stated), 7.5% during the -5/+5 window (significant at \( p<.001 \)), and 16.7% during the -10/+10 window (\( p<.001 \)). Dehning, Richardson, Urbaczewski, and Wells [8] find abnormal stock market return of -1.9% in the -1/+1 window (\( p<.001 \)), -6.4% during the -5/+5 window (\( p<.001 \)), and -10.1% during the -10/+10 window (\( p<.001 \)).

The firm value framework can be used to examine how investors behaving rationally in each time period could have had such different reactions in the two periods. Remember that announcing an e-commerce initiative is a signal that part of your firm is joining a new industry with a different level of profits, \( I \). The market should react based on the difference in industry level profits (\( \Delta I \)), the size of the firm relative to the e-commerce initiative, and the probability of successfully joining the new industry. In 1998 \( \Delta I \) was believed to be large, and the probability of joining the industry was not believed to be low for most firms. In 2000 investors had a much clearer view of both of these factors. It was clear in 2000 that the differential level of profits in e-commerce was very small, if not negative for most companies, and that successful e-commerce ventures were very difficult to obtain (low probability of joining the new industry). With the additional knowledge of two years of experience, the same rational investors that increased the market value of firms making e-commerce initiative announcements in 1998 were penalizing companies for the same behavior in 2000.

4. Conclusions

We have shown how the value of firms is dependent upon only four factors, and how analyzing research using the firm value framework can help clarify how the market will react to IT investments and initiatives. We hope that this framework will be used in future research to understand the nature of IT investment decisions and what variable in the firm value framework is expected to change due to the investment or initiative.
REFERENCES


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