Technological Acquisitions: The Impact of Innovation on Stock Performance

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This paper investigates technological acquisitions and innovation's impact on US acquiring firms' stock performance between 2012 and 2016. Firms pursue technological acquisitions with the rationale of creating value, improving market share, and achieving economies of scale. Acquisitions have not always yielded the desired results. Overall, acquirers' long-run abnormal returns tend to be negative. This study suggests that innovation positively impacts stock performance around the announcement date and one year after the acquisition. The 3-year post-acquisition analysis finds that technological acquisitions do not affect acquiring companies' stock performance. A bump in the one-year post-acquisition performance dissipates over the three-year horizon.

Keywords: technological acquisitions, US acquiring firms, stock performance, innovation

INTRODUCTION

Acquisitions are significant strategic investment events that entail vast utilization of resources. Over the years, there has been an increase in acquisition activities both domestically and internationally. The extant literature supports that corporate organizations pursue acquisition-related transactions to penetrate new markets, achieve economies of scale, gain competitive advantage, increase market share and synergy, improve financial performance, and maximize shareholder value (Jagersma, 2005). The value of global acquisitions exceeded $5 trillion in 2021, most related to technology markets, thereby making technological acquisitions the most extraordinary materialization of strategies (Statista Research Department, 2021).

Technological acquisitions are when a firm is acquired for its technological knowledge or capabilities. They are essential for the acquiring firm to gain and sustain its competitive advantage (Ahn, 2020). Theoretically, technological acquisitions provide firms with economies of scale and competitive advantage and increase the company's ability to absorb, develop, and recombine knowledge in many new ways, thereby contributing to a firm's short-term performance and long-term competitive advantage (McCarthy & Aalbers, 2016). Ahuja and Katila (2001) established that with technological acquisition, the absolute size of the acquired knowledge base positively impacts output. Technological edge is a crucial component of the target firm's assets. Due to the subsequent expansion in the acquirer's technological expertise base, the possibility of inventive recombination becomes more likely in the newly incorporated entity. Technological acquisitions allow acquiring firms to create value by realizing technological synergies and helping firms overcome the inherent dependency pathway. By absorbing target firms' technological inputs, acquiring firms can augment their technological knowledge base and enhance the possibility of innovative recombination. Although acquisitions are a growing trend and a well-researched area, critical issues remain unclear, including acquiring firms' poor long-term stock performance. Further, technological acquisitions and innovations are susceptible to post-acquisition complications (McCarthy & Aalbers, 2016); nevertheless, not much consideration has been given to studies on technological acquisitions directly connecting innovation to stock performance.

Innovation is a complex process related to production function changes and processes whereby firms seek to acquire and build upon their distinctive technological competencies, identified as the set of resources a firm possesses and how innovative capabilities transform these products. Innovation may be crucial for competing in the market because it can result in superior performance (Wang & Wang, 2012). Shouyu (2017) established that innovation had been generally regarded as a critical factor affecting firm performance. Innovation is a critical machine for firms to acclimate to and shape the environment in which they operate and serve as a mechanism that influences dynamic capabilities. Industries that work in a dynamic environment may develop new products that secure their competitive advantages. Exploiting these opportunities may require businesses to be equipped with robust dynamic capabilities and continuous innovation (Helfat & Raubitschek, 2018).

Little work in the literature focuses explicitly on technological acquisitions, stock performance, and innovation. These gaps are crucial and call for more empirical work in this area. This paper investigates technological acquisitions and innovation's impact on acquiring firms' stock performance. The study seeks to answer the puzzle about acquiring firms' post-acquisition poor long-run stock performance. The long-run stock performance of an acquisition tends to perform worse than before the acquisition. Introducing innovation as a critical factor will help establish the answer to the poor post-acquisition long-run stock performance. This research will provide a much broader insight and direction that will expand on the knowledge of past research by examining technological acquisitions, critical factors that drive stock performance, and abnormal returns after technological acquisitions. The study answers the testable research question, "Do technological acquisitions improve or diminish stock performance?"

As tangentially alluded to earlier, the most striking observations with the extant studies were the fact that there were no research papers on technological acquisitions that emphasized innovation and stock performance. This research aims to add to the empirical evidence concerning technological acquisitions. The findings will contribute in several important ways to the literature on technological acquisitions in general, particularly how innovation impacts stock performance.

The paper is organized as follows: the second section contains the background. The third section summarizes literature review and hypotheses. The fourth section describes the methodology. The fifth explains the data. The sixth section illustrates the discussion and analysis. The seventh section concludes the paper.

BACKGROUND

Technological acquisitions have played an essential role in companies' growth and competitiveness. Competitive advantages and the ability to apply innovation in products and services play a key role in obtaining higher returns and future fortitude. Most importantly, technological acquisitions improve the innovative performance of the acquiring firms. The acquiring firm's capabilities level is crucial for realizing technological synergies in technological acquisitions. Firms with dynamic competencies will better understand the critical post-merger integration process for creating technological synergies. Firms are willing to promote adequate coordination with the acquired target firm, allowing them the autonomy necessary for successful integration. Based on these conditions, shareholders may perceive that technological acquisitions by firms will be more value-creating when the acquiring firm has higher technological competencies. Therefore, the capabilities of acquiring firms will positively affect technological acquisitions and their impact on stock returns (Ahn, 2020).

Innovation is the practical application of an invention or a discovery to a process that ensures better results for the company, positively impacting its competitiveness and long-term success. In this regard, in recent years, an emerging field of research has pointed attention to the concept of innovation, illustrating a paradigm that assumes the firms may use both external and internal ideas that may lead to paths to the markets as the firms look to advance their respective technologies (Dezi et al., 2018). Highlighting innovation represents a paradigm shift from traditional sources of advantage toward a strategic orientation particularly suited to today's rapidly changing business environments. Innovation is crucial to competing in the market, resulting in superior performance. It has a solid link to newness or creativity, to quality concepts like standardization, low tolerance, and systematic procedure adherence. In general, firms with greater innovativeness will be more successful in responding to customers' needs and developing new capabilities that allow the firm to achieve better performance or superior profitability.

Consequently, researchers have increasingly paid more attention to the effects various aspects of innovation have on firm performance, just as time-based competition has become a significant concern for present-day business organizations. More and more firms have recognized that the quick response of their competitors to new product development poses a critical competitive threat and, therefore, attempt to introduce new products, services, or processes even more quickly, impacting the firm performance and market demands (Wang & Wang, 2012). As a result, innovation speed guarantees quicker responses to the environment by launching new products with lower times and costs, eventually improving firm performance. Innovation quality is an additional crucial factor affecting firm performance. High-quality innovation requires synonymously implementing several new products, processes, or practices across various organizational activities. It requires firms to collaborate among multiple activity domains; such collaborations may create inimitable ways, encourage newness, and promote competitiveness (Wang & Wang, 2012). Summing up, firms with a high level of capabilities will be in a better position to assimilate and utilize external knowledge, thus increasing the innovation process and innovative performance (Lund Vinding, 2006).

A widely held idea is that the past two decades' economic and stock market boom has been thrust primarily by science and technology. Industrial research and development, new information technology, and scientific results from firms and other sectors generate a constant stream of innovations and productivity appreciation that enhance the performance of stock prices. Some studies have established that innovation correlates strongly with subsequent improvements in a firm's productivity, returns, and stock prices (Deng et al., 1999). The typical effect of acquisition activity on firm performance does not lead to superior performance. In fact, a stronger argument can be made that acquisition activity has a modest negative effect on the long-term performance of acquiring firms (King et al., 2004). The outcomes for acquiring firms are much more ambiguous. Some studies show positive gains, others report insignificant or zero gains, but most report losses. In other cases, some extant studies have shown that acquiring firms underperform after acquisition. There is evidence of negative performance three years post-acquisition; however, particularly in the later years, the post-acquisition years do not show conclusive evidence of acquisitions or substantial evidence that contradicts market efficiency (Loderer & Martin, 1992).

LITERATURE REVIEW AND HYPOTHESES

This section discusses the literature on innovation and firm performance. In addition, hypotheses are developed focusing on how innovation influences stock performance around the technological acquisition announcement date, industry type as a moderating condition and post-acquisition abnormal returns.

Innovation and Stock Performance

Innovation is introducing something new or a new idea, method, or device representing a paradigm shift from traditional sources of advantage toward a strategic orientation suited to today's rapidly changing business environments. Innovation is crucial to compete in the market, for it can result in superior performance. Firms with greater innovativeness will be more successful in responding to customers' needs and developing new capabilities to achieve superior profitability. Consequently, firms pursuing innovation significantly improve their future profitability (Kallunki et al., 2009).

Sood and Tellis (2009) used the Fama-French 3-factor model (including Carhart's momentum factor) on 5,481 announcements from 69 firms in five markets and 19 technologies between 1977 and 2006. The authors argued that the market's true appreciation of innovation could be estimated by evaluating the total market returns to the entire innovation project. The total market returns to an innovation project were more than an average innovation event. The returns to adverse events were higher in absolute value than positive ones. Further returns to the firm announcing innovation initiatives are substantially greater than its competitors.

Hirshleifer et al. (2013) examined the effect of innovation on future profitability and stock returns. The authors argued that innovation is associated with higher and more persistent profitability suggesting that more innovative firms can maintain a competitive advantage and positive future stock returns, indicating the mispricing of innovation in current share prices.

The study by Grieco (2018), showed successful innovation tends to positively impact a firm's profits and growth, consistent with the idea that stock prices reflect expectations about future profits. Additionally, in stages distinguished by major innovation, firms seen as both probable winners and losers will experience volatility in their stock prices. Nonetheless, in instances where there is uncertainty, innovation may cause a stir-up of market shares, leading to the diminishing power of the incentive to safeguard the status quo.

Szutowski (2019) study employed the measurement of the short- and long-term effect of innovation announcements on stock returns. The study utilized the adoption and diffusion theory as its conceptual background. The research was based on an event study and buy-and-hold methods, covering 398 announcements released for 121 companies. The research shows that the innovation advancement stage complements its source by clarifying its relationship with abnormal market value changes. The analysis extends the discussion on the role of the source of innovation and its advancement stage, and the study's outcome indicates a positive market reaction to high innovation advancement stage announcements compared to low advancement stage ones. Moreover, the study recommends a positive market reaction to in-house development compared to collaborative development and copying.

Some prior studies view innovation and its effects on business performance as strategically critical considerations for modern business organizations. The study by Gök and Peker (2017) investigated how innovation affects two different facets of firm performance: market performance and financial performance. Their research results revealed a suppression effect of market performance on the innovation–financial performance relationship. Further, the authors find a negative correlation between innovation and financial performance; nevertheless, market performance reverses this adverse effect to a total positive influence through its suppression effect. This outcome suggests a critical role of market performance in converting innovation into positive financial results.

De Joode (2011) investigated the relationship between innovation and stock returns; the study explained which (risk) factors can explain stock returns by introducing a new factor to the Fama French three-factor model, i.e., the factor innovation. The study utilized a dataset from 1993 to 2010 to analyze how factor innovation could account for stock returns. The author finds a positive coefficient of the factor innovation based on raw patent counts. The positive beta indicates that stocks with many patent counts yield abnormal returns compared to those with low ones.

The evidence above suggests different views on the impact of innovation on stock performance. This paper suggests

Hypothesis 1: *Innovation positively impacts stock performance in technological acquisitions around the announcement date*.

A Moderating Condition for Hypothesis 1 is Industry Type. Because firms tend to compete within industries, the long-held belief is that industries have become constraining forces for firms to adapt or perish. The role of industry structure has been shown to affect firms in their management of licensing activities, strategic decisions made by firms in regulated and unregulated firms within the same industry, the decision to internationalize firms economizing behaviors, product versus market growth decisions, risk reduction factors organizational learning orientations and in the growth of firms in emerging economies.

Further, the resource used within a specific industry may be used to assess the success of certain competitive firm activities (Wefald, 2010). However, successfully developing and introducing innovation needs specific organizational resources and capabilities. Wolf and Terrell (2016) elucidated that high-tech industries are essential to the U.S. economy, providing about 12 percent of all jobs but producing almost 23 percent of output. Chaudhuri and Tabrizi (1999) studied the practices of 24 high-tech firms in their execution of 53 acquisitions to determine why some of the firms would succeed or not. They posit that some of these acquirers demonstrated slightly positive but disappointing returns on investments, and the successful acquirers' focus on capabilities put them ahead of the crowd. Industries configuring their resources through innovation should be associated with improved stock performance. Thus, the positive relationship between innovation and stock performance is moderated by industry type.

Acquiring Companies and Abnormal Returns

Many researchers, especially in the USA, attempt to estimate the effect of acquisitions on the share prices of the bidding companies. These studies often employ event studies. They estimate abnormal stock price changes on and around the offer-announcement date and following acquisitions. Abnormal returns are usually defined as the difference between actual stock returns and a market index to consider market-wide effects on individual securities' returns (Buckley & Casson, 1998). Harris and Ravenscraft (1991) argue that the abnormal returns of domestic acquisition targets do not differ from the abnormal returns of targets in cross-border acquisitions, provided that capital market factors are not segmented internationally.

According to Schwert (1996), on average, the abnormal returns to bidders from 1975 to 1991 were not significantly different from zero. The stock prices of acquirers that became targets declined significantly after acquisitions. The stock prices of acquiring firms that were not acquired increased significantly when they announced acquisitions. They found that those who subsequently divested had extremely negative event returns. Acquisitions that were not consequently divested had significantly positive event returns. These event returns suggest that when companies announce acquisitions, the event returns to forecast the likelihood that the assets will ultimately be divested. The authors noted that the returns to acquiring firms were approximately zero in the aggregate. When acquiring firms experienced negative event returns, they were likely to become takeover targets. Bidders who experienced positive event returns were less likely to become targets, and event returns could separate between bad and suitable bidders.

The anecdotal evidence by Jensen and Ruback (1983) on the effect of tender offers on stock prices revealed that shareholders of target companies in successful takeovers achieve significant abnormal returns. Also, it was concluded that when a merger does the takeover, the gains are 20%, and when the takeover is done by tender offer, the gains are 30%. According to the study, bidding companies' shareholders do not fare very well. Bidding firms experience abnormal returns of 4% in tender offers; the percentage is zero in acquisitions. These numbers are significantly small to leave doubt about the effect on bidders. Shareholders of firms involved in unsuccessful takeover attempts experience small negative returns in tender offers.

Capron and Pistre (2002) explored the conditions under which acquirers earn abnormal returns. They employed an empirical test of Barney and Chatterjee's arguments by examining the role of the respective resource contribution of the target and the acquirer using a sample of 101 horizontal acquisitions. They posit that acquirers do not earn abnormal returns when they only receive resources from the target. The authors argued that acquirers can expect to earn abnormal returns when they transfer their resources to the target. Overall, it was concluded that value creation does not ensure value capture for the acquirer.

Andrade et al. (2001) established that long-term stock performance exhibits several concerns. Evaluation of these outcomes varies; for instance, Fama and French assert that value firms' relatively high stock returns are due to increased risk, perhaps related to distress. On the other hand, it was maintained by other researchers that the differential stock returns of value and growth stocks are not associated with risk but arise because investors mistakenly estimate future stock performance by inferring from past performance. Even though the model of expected returns becomes increasingly essential and depending on the model, it may be very challenging to determine whether the stock return is statistically significant. The fundamental problem stems from long-term abnormal performance, for instance, the stock market efficiency and a market equilibrium model. The bottom line is that if long-term expected returns can only be roughly estimated, then estimates of long-term abnormal returns are necessarily imprecise.

Ismail et al. (2011) examined the long-run performance of acquisitions. They investigated the main determinants of post-acquisition stock performance to determine the sources of value creation or value destruction. The results have shown that acquirers significantly underperform over the three-year post-event period. After examining possible explanations for the long-run stock performance of the acquisitions, the study found that the stock-financed acquisitions under-perform. The study did not compare post-acquisition performance with a benchmark or control group of similar industries to account for industry effects, which was the main drawback. Thus, the negative abnormal returns could be due to industry conditions.

Akhtar and Nosheen (2022) used a multi-dimensional framework to assess acquisition performance. The framework incorporates both financial and non-financial factors. The financial factors consist of accounting measures, and the nonfinancial factors encompass the market-based measures. The authors used the event study to examine the abnormal returns of stocks in both the short and long term. They argued that fintech acquisitions tend to positively impact the stock returns of acquiring firms in the short run and negatively in the long run.

The effect of acquisitions on the abnormal stock returns for both the acquiring and the acquired firms is inconclusive; where some studies reported insignificant improved abnormal returns, some extant studies have reported significant positive abnormal returns. On the other hand, few studies reported positive returns in the high acquisition activity period and negative returns in the low activity period. Furthermore, results reported that acquisitions lead to a decline in abnormal returns for acquiring and target firms (Ismail et al., 2011).

In some cases, it was noted that the long-run stock performance of acquiring firms exhibited negative results. It was further pointed out that the stock performance of acquiring firms was superior before acquisitions (Chang & Tsai, 2013).

Innovation and Cumulative Abnormal Returns

Schöler et al. (2014) focused on studying the causes of the success of innovations. They used the event study and financial expert ratings and analyzed the types of payoffs to 428 innovations by 39 institutions between 2001 and 2010. The findings suggest that the average cumulative abnormal stock market returns to innovation were twice as high in the United States as in Europe. The authors discovered that the precariousness of the innovation increases abnormal returns, even though complexity diminishes cumulative abnormal stock market returns. Consequently, the market considers innovations profitable, not detrimental, despite being prone to external and unknown events. Remarkably, the cumulative abnormal stock market returns to innovations tend to be higher in recessions than expansions.

An analysis by King et al. (2004) of 93 empirical studies of acquisitions performance concluded that stock values for acquiring and targeting firms generally increase significantly on the day of the acquisition announcement. This analysis suggests that shareholders expect long-term synergy gains from acquisitions. Despite expected gains at the time of the announcement, market returns to the acquiring firm after the acquisition and performance are generally a zero-sum gain; nearly half of all acquisitions create value the other half do not (Andre et al., 2004).

Majid et al. (2021) performed a study to determine the effect of corporate innovation on abnormal stock returns. The study employed data from 2013 to 2018. Their results were consistent when investor sentiments were introduced to the analysis, and it found that in the presence of noise trading and investors' prejudice, the abnormal stock returns of innovative firms remained positive. The findings confirmed the value of significance hypothesis that corporate innovation acts as a resource to enable a firm to get positive abnormal returns in the capital market.

Hatem (2015) performed an empirical study that was similar to the study by Danbolt and Maciver (2012). They identified the components that explain cumulative abnormal returns. The author used a sample of 1,063 firms for 14 years from 1998 to 2011. The authors calculated the cumulative abnormal returns using the event study method. They chose the short event period from -1 day and one day after the event day and a long event period from -10 days to +10 days. The estimation period began from -240 days to -21 days. The authors determine that the market reacts positively after the announcement of an acquisition.

Instances of integrating firm-level risk and the returns of extremely innovative firms tend to be greater than that of non-innovative firms. To this extent, researchers such as Mazzucato, 2003 have justified a firm's innovative attitude with its dimension or the intensity of market competition. Nevertheless, participating in innovation strongly affects the organization's stock value. It is crucial to note that firms who want to boost their firm's value could augment the firms' prospects of future accomplishment, and an innovative route may be the key approach to reach such an objective.

On average, firms that engage in acquisitions significantly perform poorly in the post-acquisition period, and their long-run stock performance tends to be negative (Agrawal et al., 1992; Agrawal & Mandelker 2000; Schmidt & Fowler, 1990).

The evidence above suggests different views on innovation and cumulative abnormal returns. This paper proposes

Hypothesis 2: *Innovation improves cumulative abnormal returns post-acquisition in technological acquisitions.*

METHODOLOGY

The study investigates innovation's impact on acquiring firms' stock performance in a technological acquisition. The research techniques for the study are the event study methodology, regression analysis, and calendar time approach based on the Fama - French 3 - Factor Model. This section describes the event study methodology and examines the factors influencing cumulative abnormal returns. In addition, the dependent, independent, and control variables are discussed.

An event study is the standard means of measuring an event's security price reaction. The analysis is categorized into pre-acquisition, around the announcement date, and post-acquisition periods for the bidders in technological acquisitions. The abnormal stockholder returns measure the market's reaction to the acquisition. This assumes market efficiency, in that share prices react in an unbiased and timely manner, and the extent of the gain reflects the firm in the coming periods (Malkiel & Fama, 1970; Roberts, 1967).

An abnormal return (residual) is the actual return less the return predicted by the firm's beta, and the market return. The predicted return represents the return that would be expected if no event took place and a firm's historical performance continues in the future. The residual or abnormal return means the part of the return that is not anticipated and is, therefore, an estimate of the change in firm value on a day caused by the event (acquisition announcement and post-acquisition). In line with this, the estimation model for determining the daily abnormal return on the stock is:

$$AR_{it} = R_{it} - E(\check{R}_{it}),$$

where *t* is the day measured relative to the event, AR_{it} is the abnormal return on the stock *í* for day *t*, R_{it} is the return on stock *í* for day *t*, $E(\check{R}_{it})$ is the expected rate of return on the stock *í* for day *t*, derived from a market model (Brown & Warner, 1985). The market model is estimated over -252 to -24 trading days preceding the announcement window.

The cumulative abnormal returns for each stock *í*, $CAR_{i,k,l,}$, is the dependent variable in the regressions. It is computed by summing the abnormal returns over the event window as indicated below:

$$CAR_{i,k,l} = \sum_{i=k}^{l} AR_{i,t},$$

where $CAR_{i,k,l}$ is for the period from $t = k$ days until $t = l$ days. For example, around the announcement date, *CAR* can be calculated over 11 trading days, k = -5 to l = +5.

The paper analyzes acquirers' post-acquisition performance in technological acquisitions, which occur mainly in high-tech industries. The high-tech sector is characterized as having high concentrations of workers in Science, Technology, Engineering, and Mathematics occupations (Wolf & Terrell, 2016). The successful performance of high-tech companies depends on continuous innovation, that is why the key independent variable is innovation, which will be measured by research and development expenses (R&D) to sales. R&D is considered an engine of any economy's economic growth and a driver of innovation and sustainable development (Fernández et al., 2018). Spending on R&D increased innovation possibilities (Harris & Moffat, 2011). For the control variables, which can influence stock performance, the firm and industry characteristics such as the acquirer's size and book to market, are employed (Dutta, 2015).

Regarding the deal characteristics, the value of the acquisition deal is used (Salvi et al., 2018). Further, pertaining to macroeconomic conditions, the Gross Domestic Product (GDP) growth rate is included. It is a standard measure of an indicator of a nation's economic growth (Uddin & Boateng, 2011).

The empirical model for analyzing stock price reactions around the announcement date takes the following general form:

$$CAR_{i,k,l} = \alpha + \beta_1 RD_i + \beta_2 SACQ_i + \beta_3 BMV_i + \beta_4 VACQD_i + \beta_5 GDPGR_i + \varepsilon_i \quad (1)$$

In this equation, $CAR_{i,k,l}$ represents the cumulative abnormal return around the announcement dates for acquirer i, during the event periods k, l ($k = -1$ and $l = +1$, $k = -5$ and $l = +5$, $k = -10$ and $l = +10$), $i = 1, \ldots, N$; α is an intercept coefficient. RD_i is the value of acquirer *i's* research and development expenses/sales. The control variables include $SACQ_i$ (Size of the Acquirer), BMV_i (book to market value), $VACQD_i$ (value of the acquisition deal), and $GDPGR_i$ (Gross Domestic Product growth rate), while ε_i is an error term.

The post-acquisition performance analysis utilizes the calendar-time approach for calculating abnormal returns based on the Fama and French (1993) three-factor model. In this approach, the monthly calendar-time portfolio returns for firms, who have completed an acquisition, is calculated. Next, the monthly average abnormal return is estimated as the intercept of the Fama and French (1993) three factor model:

$$R_{pt} - R_{ft} = \alpha_{pt} + \beta_1 (R_{mt} - R_{ft}) + \beta_2 SMB_t + \beta_2 HML_t + \varepsilon_t, \quad (2)$$

where R_{pt} is the monthly return on a portfolio of firms that acquired companies within the last three years of the calendar month t, R_{ft} is the risk-free rate, SMB_t is the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks, HML_t is the difference between the return on a portfolio of high book-to-market values' stocks and a portfolio of low book-to-market values stocks. SMB_t and HML_t can be downloaded from Kenneth French's website; α_{pt} is the average monthly abnormal return.

The calendar-time approach overcomes some of the complications connected to the event-time methods (similar to Dutta & Jog, 2009; Mitchell & Stafford, 2000). Fama (1998) explicitly proposes the formation of monthly portfolios in calendar time for measuring the average abnormal long-run performance. This was due to the following reasons: monthly returns are less subject to the bad model problem; monthly portfolios permit the researcher to assess the cross-correlation between the firms in the sample; and the portfolio returns allow for a superior arithmetical inference. As a result, the calendar-time portfolio approach is favored over the event-time approach for measuring abnormal returns (Andre et al., 2004). Notwithstanding the visible desirability of the calendar-time portfolio approach, some extant studies prefer the buy-and-hold abnormal return BHAR methodology and have argued that BHAR is the proper estimator for the reason that it precisely signifies the investor encounter. Some authors have also predominantly contended that the calendar-time portfolio approach has low power to detect abnormal performance because it averages over months of event pursuit. For instance, the calendar-time portfolio approach may be unsuccessful in evaluating significant abnormal returns if abnormal performance mainly occurs in months of intense occurrence (Mitchell & Stafford, 2000).

DATA

This section discusses the sample selection criteria and data sources. The sample for the study focuses on technological acquisitions from 2012 to 2016. Acquisitions are identified as technological acquisitions if the acquirer and target have high-tech three-digit SIC codes described in the study by Kile and Phillips (2009) (see Appendix, Table A1). The data is categorized into three parts to assess innovation impacts on stock performance (the pre-acquisition, the announcement, and the post-acquisition periods).

The primary sample of firms' financial and stock price information is obtained from the Electronic Data Gathering, Analysis, and Retrieval system (EDGAR), Center for Research in Security Prices (CRSP), Compustat, via the Wharton Research Data Services (WRDS) platform for the periods 2012 through 2016. The acquisitions information, including companies' names, the announcement and completion dates, deal values, and the SIC codes, are from the Zephyr database. The following criteria for pulling the acquisition data are applied:

- For a deal to qualify for inclusion in the sample, the transaction amount must be greater than $ 1 million.
- The acquirer must be publicly traded and domiciled in the U.S.
- The target must be publicly traded and domiciled within the U.S.
- Acquiring and target companies must fall under the high-tech industries category SIC codes (refer to Table A1 in the Appendix).
- The acquirers' final stake in the target must be equal or greater than 51 percent.
- Deal must be marked completed and confirmed.
- No additional acquisitions by the same company 3 years before and 3 years after the deal.

202 acquisitions met the selection criteria. Table 1 below reports the breakdown of industries and their respective number of deals. Computer Programming had the highest number of deals, 64 per the overall sample. They were followed by Surgical, Medical, and Dental instruments with 36 deals. The Drug industry had 27 deals. Further, Electronic Components and Accessories had 23 deals. Laboratory, Optic, Measure, and Control Instruments had 17 deals. Both Computer and Office Equipment and Communication Equipment have 12 deals, respectively. Communication Services, NEC had three deals, and Research, Development, and Testing Services had eight deals.

TABLE 1
ANALYZED HIGH-TECH INDUSTRIES

SIC Code	Industry Description	Number of Deals
283	Drugs	27
357	Computer and Office Equipment	12
366	Communication Equipment	12
367	Electronic Components and Accessories	23
382	Laboratory, Optic, Measure, Control Instruments	17
384	Surgical, Medical, Dental Instruments	36
489	Communication Services, NEC	3
737	Computer Programming, Data Processing	64
873	Research, Development, Testing Services	8
		202

Table 2 shows the statistics of the explanatory variables. The deal value changes from $1 million to $26,200 million, and the acquirer size varies from $1 million to $354,392 million. The R&D expenses to sales ratio changed from 0 to 20.616. The book-to-market ratio ranges from 0.0225 to 139,191. The GDP growth rate percentage varies from 3.63% to 4.20%. The Fama and French data for the post-acquisition was downloaded from Kenneth French's website. The statistics of the explanatory variables by industry are shown in Appendix, Table A2. The deal value changes for Computer Programing from $2.8 million to $354,392 million, and the acquirer size varies from $2.5 million to $26,200 million. Followed by Surgical, Medical, and Dental Instruments, the deal value changed from $3.08 million to $169,351.3 million, and the acquirer size varied from $1.6 million to $18,044.89 million. The Drug industry with the deal value changes from $1 million to $195,965 million, and acquirer size varies from $1 million to $21,000 million. Electronic Components and Accessories had with the deal value changes from $7.15 million to $172,304.9 million, and acquirer size varies from $7.5 million to $16,700 million. Laboratory, Optic, Measure, and Control Instruments had with the deal value changes from $1.18 million to $56,799.9 million, and acquirer size varies from $1.18 million to $998 million.

TABLE 2
STATISTICS OF CONTROL VARIABLES IN MODEL (1)

Variable	Mean	Std.Dev	Min	Max
R&D Expenses to Sales Ratio	0.3885	2.0828	0	20.616
Book-to-Market Ratio	809.2254	9838.767	0.0225	139,191
GDP Growth Rate (Percent)	3.88	0.25	3.63	4.20
Acquirer Size (Millions)	$15,669.90	$43,406.80	$1.00	$354,392
Deal Value (Millions)	$1,509.55	$4,110.01	$1.00	$26,200

RESULTS AND DISCUSSION

An analysis of stock performance in the US technological acquisitions is performed for two periods: around the announcement date and in the long run. The sample includes 202 high-tech firms that engaged in technological acquisitions of high-tech targets over the 2012 – 2016. The event window length is debatable. The event windows may not capture the full impact of the transaction if there is information leakage about the bid, whereas long event windows may introduce noise into the data. This report examines the (-10, +10) trading days windows around the announcement date and up to 750 days (3 years) post-acquisition.

Short-Term Performance Analysis Around the Announcement Date

This section describes the event study output and the model regression results around the announcement date. The cumulative abnormal return (CAR) around the announcement day was calculated using the market model for three windows: (-1 to +1), (-5 to +5), and (-10 to +10). Table 3 shows derived CAR values. The t-statistics are between -0.1591 and 0.6590, indicating that CAR values for all 3 windows are statistically insignificant. It appears that the announcement of technological acquisitions by US firms does not impact its stock performance. This is consistent with a study by (Song and Walking, 2004). An acquirer had insignificant abnormal return if the acquirer bid activity is dormant for less than a year and earned 1% positive abnormal returns when the acquirer bid activity is dormant for more than a year. In their study on US acquisitions, Mulherin (2000) and Leeth and Borg (2000) achieved positive cumulative abnormal returns. In another study by Mulherin and Boone (2000) US acquisitions achieved a negative cumulative abnormal return around the announcement date.

TABLE 3
CUMULATIVE ABNORMAL RETURNS OVERALL SAMPLE

CAR	[-1,+1]	[-5,+5]	[-10,+10]
AVG, %	0.2148	-0.1023	0.4868
t-Stats	0.3978	-0.1591	0.6560

Table 4 shows the average cumulative abnormal returns (CARs) by SIC codes around the announcement. The Drugs industry has positive CARs for all three windows, whereas Computer and Office Equipment displays negative CARs. The Research, Development, and Testing Services industry shows positive CARs for the (-1, +1) and (-10, 10) windows and a negative CAR for the (-5, +5) windows. It appears that, on average, acquiring firms' stocks in the Drugs industry outperform around the announcement day, while the Computer and Office Equipment acquirers underperform. The behavior of the Research, Development, and Testing Services acquirers' stocks around the acquisition announcement is mixed.

TABLE 4
CUMULATIVE ABNORMAL RETURNS BY INDUSTRY

SIC Code	Industry	N	CAR	[-1,+1]	[-5,+5]	[-10,+10]
283	Drugs	27	AVG	1.71%	2.34%	1.52%
			t-Stats	1.2536	1.3645	0.8333
357	Computer and Office Equipment	12	AVG	-4.05%	-4.29%	-4.97%
			t-Stats	-1.9562*	-1.4775	-1.5790
873	Research, Development, Testing Services	8	AVG	3.99%	-8.90%	1.47%
			t-Stats	1.2768	-1.2671	0.2149

Hypothesis 1 proposed that innovation positively impacts stock performance around the announcement date of technological acquisitions. This study assumes that companies with higher R&D expenses are more innovative and uses R&D expenses/Sales as an indicator of innovation. An analysis of the influence of the R&D expenses and other factors on CARs around the announcement dates is based on Model regressions (1). Table 5 presents the regression results and t-statistics for the overall sample. The R-Square value in Table 6 varies from 0.0183 to 0.1086, which is low enough to cause concern regarding the goodness of fit. The R&D Expenses coefficient for CAR (-1, +1) is statistically insignificant. In other two windows, (-5, +5) and (10, +10), R&D expenses have statistically significant positive coefficients, indicating that acquirers with higher R&D expenses have higher CARs. This validates Hypothesis 1 that innovation enhances stock performance around the announcement date. The regression's mean variance inflation factor (VIF) was 1.65, below 10. Hence, the analysis has no multicollinearity problem. The White test (White, 1980) was utilized to see whether there was heteroscedasticity in the residuals. The null hypothesis is that there is no heteroskedasticity. The probability value of the chi-square statistic was 0.308 above 0.1. This means that the null hypothesis cannot be rejected.

TABLE 5
STOCK PERFORMANCE AROUND THE ANNOUNCEMENT DATE

Variable	[-1, +1]	[-5, +5]	[-10, +10]
R&D Expenses	0.0011	0.0103	0.0138
	(1.25)	(9.82)***	(3.49)***
Book-to-Market Ratio	2.13e-07	5.06e-07	7.70e-07
	(1.56)	(2.97)***	(4,07)***
LN (Acquirer Size)	-0.0024	0.0020	0.0087
	(-0.76)	(0.57)	(2.14)**
LN (Deal Value)	-0.0013	-0.0052	-0.0120
	(-0.32)	(-1.05)	(-2.29)**
GDP Growth Rate	-0.0208	-0.0065	-0.0426
	(-0.83)	(-0.25)	(-1.48)
Constant	0.1061	0.0320	0.1618
	(1.11)	(0.31)	(1.46)
R^2	0.0183	0.0631	0.1086

The t-statistics are in parentheses below the coefficients. The superscripts *, **, and *** mark statistical significance at the 10%, 5%, and 1% levels, respectively.

As part of Hypothesis 1, this study assumes that industries configuring their resources through innovation should be associated with improved stock performance. Thus, the positive relationship between innovation and stock performance is moderated by industry type. Tables 6-8 present the regression results and t-statistics by industry based on the SIC codes. The t-statistics are in parentheses below the coefficients. The superscripts *, **, and *** mark statistical significance at the 10%, 5%, and 1% levels, respectively.

TABLE 6
STOCK PERFORMANCE AROUND THE ANNOUNCEMENT DATE
BY INDUSTRY – DRUGS

Variable	[-1, +1]	[-5, +5]	[-10, +10]
R&D Expenses	- 0.0009	0.0073	0.0073
	(- 0.24)	(1.83)*	(2.91)***
Book-to-Market Ratio	- 0.0127	- 0.0164	- 0.0164
	(- 0.67)	(-0.78)	(-0.75)
LN (Acquirer Size)	- 0.0120	- 0.0104	- 0.0104
	(- 0.76)	(- 0.63)	(- 0.60)
LN (Deal Value)	- 0.0078	0.0047	0.0047
	(- 0.65)	(0.35)	(0.35)
GDP Growth Rate	- 0.0232	0.0101	0.1007
	(- 0.37)	(0.14)	(0.13)
Constant	0.1592	0.0362	0.0362
	(- 0.61)	(0.13)	(0.1)
R^2	0.0353	0.2429	0.224

Table 6 shows the results for the Drugs industry, where the R-Square value varies from 0.0353 to 0.2429, which is low enough to cause concern regarding the goodness of fit. The R&D Expenses coefficient for CAR (-1, +1) is statistically insignificant. In the other two windows (-5, +5) and (10, +10), R&D expenses have statistically significant positive coefficients. The Drugs industry's mean-variance inflation factor (VIF) for the regression was 3.78, below 10. Hence, the analysis has no multicollinearity problem. The White test (White, 1980) suggested no heteroskedasticity in residuals.

TABLE 7
STOCK PERFORMANCE AROUND THE ANNOUNCEMENT DATE BY INDUSTRY - LABORATORY, OPTIC, MEASURE, CONTROL INSTRUMENTS

Variable	[-1, +1]	[-5, +5]	[-10, +10]
R&D Expenses	- 0.8367	- 0.6856	- 0.1957
	(- 2.94)***	(- 1.58)	(- 0.31)
LN (Deal Value)	0.0001	- 0.0016	- 0.0062
	(0.13)	(- 0.16)	(- 0.42)
GDP Growth Rate	0.1512	0.1201	- 0.1086
	(2.85)***	(1.48)	(0.91)
Constant	- 0.5068	- 0.3979	- 0.3651
	(- 2.39)	(- 1.23)	(- 0.76)
R^2	0.5782	0.2822	0.0913

The t-statistics are in parentheses below the coefficients. The superscripts *, **, and *** mark statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 7 shows the Laboratory, Optic, Measure, and Control Instruments industry results. The R-Square value varies from 0.0913 to 0.5782, which is moderate enough not to cause concern regarding the goodness of fit. The R&D Expenses coefficient for CAR (-1, +1) is statistically significant. In the other two windows (-5, +5) and (10, +10), R&D expenses have statistically insignificant positive coefficients. The Laboratory, Optic, Measure, and Control Instruments industry had a mean-variance inflation factor (VIF) for the regression was 1.03, below 10. Hence, the analysis has no multicollinearity problem. The White test (White, 1980) showed no heteroskedasticity in residuals.

TABLE 8
STOCK PERFORMANCE AROUND THE ANNOUNCEMENT DATE BY INDUSTRY - SURGICAL, MEDICAL, DENTAL INSTRUMENTS

Variable	[-1, +1]	[-5, +5]	[-10, +10]
R&D Expenses	-0.0535	- 0.0170	0.0613
	(- 3.41)***	(- 0.91)	(2.2)**
GDP Growth Rate	- 0.0723	- 0.0744	- 0.1262
	(- 1.41)	(-1.71)	(- 1.39)
Constant	0.2943	0.3046	- 0.5072
	(1.48)	(-1.76)	(- 1.46)
R^2	0.0897	0.0719	0.982

The t-statistics are in parentheses below the coefficients. The superscripts *, **, and *** mark statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 8 shows the results for the Surgical, Medical, and Dental Instruments industries, where the R-Square value varies from 0.0719 to 0.982, which is low enough to cause concern regarding the goodness of fit. The R&D Expenses coefficients for CAR (-5, +5) are statistically insignificant. In the other two windows (-1, +1) and (10, +10), R&D expenses have statistically significant negative and positive coefficients, respectively. The Surgical, Medical, and Dental Instruments industry had a mean-variance inflation factor (VIF) for the regression was 1.01, below 10. Hence, the analysis has no multicollinearity problem. The White test indicated there was no heteroskedasticity in residuals.

The results in Tables 6-8 show that R&D expenses hurt the stock performance of acquirers in three industries (Drugs; Laboratory, Optic, Measure and Control Instruments; Surgical, Medical, Dental Instruments) over the short window of 3 days, whereas a positive impact is demonstrated for: (i) Drugs in the (-5, +5) and (-10, +10) windows; (ii) Surgical, Medical, Dental Instruments in the (-10, +10) window only.

Hypothesis 1 proposes that innovation positively impacts stock performance around the acquisition announcement day. That aligns with a similar theoretical rationale posited by (Hirshleifer et al., 2013; Grieco, 2018; Kallunki et al., 2009). Hirshleifer et al. (2013) examined the effect of innovation on future profitability and stock returns. They argued that innovation is associated with higher and more persistent profitability suggesting that more innovative firms can maintain a competitive advantage and positive future stock returns. The study by Grieco (2018), showed successful innovation tends to positively impact a firm's profits and growth, consistent with the idea that stock prices reflect expectations about future profits. Consequently, firms pursuing innovation significantly improve their future profitability (Kallunki et al., 2009).

Based on the SIC codes analysis results, Communication Equipment, Research, Development, Testing Services, Computer Programming, Data Processing, Electronic Components and Accessories, Computer and Office Equipment, and Communication Services, NEC industries have displayed statistically insignificant outcomes around the announcement dates. These outcomes indicate that these industries do not fully align with the study's preposition that industries configuring their resources through innovation will be associated with improved stock performance.

Nevertheless, the results for the Drugs, Laboratory, Optic, Measure, and Control Instruments, and Laboratory, Optic, Measure, and Control Instruments industries fully validate the prediction and are consistent with extant studies by Helfat and Raubitschek, 2018; Dranev et al. (2019), and Wolf and Terrell (2016). Helfat and Raubitschek (2018) argued that reconfiguring resources might lead to competitive advantage and improve stock performance (value creation). There is a direct and positive connection between innovation, value creation, and value capture. Akhtar and Nosheen (2022) argued that fintech acquisitions positively and negatively impact firms' stock returns in the short and long run.

Long-Run Post-Acquisition Performance Analysis

The paper also investigates long-run stock performance after technological acquisitions. The analysis employs the calendar time portfolio approach based on the Fama and French 3-factor model. Two post-acquisition periods are considered: one year and three-year. The regressions are run over 60 calendar months: from January 2013 to December 2017 for the one-year and from January 2015 to December 2019 for the three-year analysis. Both periods employed seven acquisition sets: overall sample, low R&D expenses, high R&D expenses, and four R&D quartiles. Table 9 shows the R&D to sales levels of partitioning. Low R&D expenses change from 0% to 8.53%. The high R&D expenses vary from 8.65 % to 2062.00%. Quartile 1 ranges from 0% to 3.57%. Quartile 2 is from 3.58% - 8.53%. Quartile 3 changes from 8.65% to 16.89%. Quartile 4 values are from 17.27% to 2062.00%. Examples of the companies which make up the respective breakdown include ANI Pharmaceuticals (Quartile 1), Honeywell International Inc. (Quartile 2), Irobot Corporation (Quartile 3), and Pfizer Inc. (Quartile 4).

TABLE 9
PARTITIONING (R&D)/SALES LEVELS

Low R&D		High R&D	
0% - 8.53%		8.65 % - 2062.00%	
QT 1	**QT 2**	**QT 3**	**QT 4**
0% - 3.57%	3.58% - 8.53%	8.65% - 16.89%	17.27% - 2062.00%

Table 10 exhibits the post-acquisition CAR regression results and t-statistics for both the one- year and 3-year analyses.

TABLE 10
LONG-RUN POST-ACQUISITION PERFORMANCE

1 - Year Analysis							
Variable	**Overall Sample**	**Low R&D**	**High R&D**	**QT 1**	**QT 2**	**QT 3**	**QT 4**
Alpha (%)	0.9195 (2.27)**	3.4078 -1.07	0.9204 (2.45)**	0.6882 -0.98	1.2508 -1.33	0.8381 (1.68)*	0.9919 (2.44)***
Market Risk Premium	0.5322 (3.95)***	1.4333 -1.36	0.4774 (3.83)***	0.7719 (3.31)***	0.5707 (1.83)*	0.4879 (2.94)***	0.4683 (3.47)***
SMB	0.4259 (2.57)***	2.7607 (2.13)**	0.3403 (2.22)**	0.4397 (1.53)***	0.4319 -1.13	0.3494 (1.71)*	0.3284 (1.98)***
HML	0.0511 -0.31	4.7673 (3.72)***	-0.0233 -0.15	0.0893 -0.31	0.1745 -0.46	-0.1855 - (0.92)	0.1316 -0.8
R-Square	0.3526	0.3217	0.317	0.2406	0.1071	0.2166	0.2892
3 – Year Analysis							
Alpha (%)	0.5926 -1.34	0.51665 -0.69	0.4808 -1.38	0.5572 -0.93	0.4951 -0.49	0.6805 -1.4	0.5193 (1.68)*
Market Risk Premium	0.9451 (7.61)***	1.1611 (5.54)***	0.6891 (7.07)***	1.035 (6.15)***	1.2065 (4.29)***	0.7532 (5.52)***	0.6098 (7.04)***
SMB	0.3919 (2.09)**	0.5479 (1.73)*	0.2171 -1.47	0.6735 (2.65)***	0.4085 -0.96	0.2263 -1.1	0.1937 (- .0687)
HML	-0.0654 (- 0.40)	-0.1334 (- 0.48)	-0.0195 (- 0.15)	-0.1715 (- 0.77)	-0.049 (- 0.13)	-0.0103 (- 0.06)	-0.0301 (- 0.26)
R-Square	0.5813	0.4328	0.5303	0.5139	0.2965	0.4058	0.5284

The t-statistics are in parentheses below the coefficients. The superscripts *, **, and *** mark statistical significance at the 10%, 5%, and 1%, respectively.

The one-year R-Square value in Table 10 varies from 0.1071 to 0.3526 which confirms the acceptable goodness of fit. The alpha coefficients estimate the average monthly abnormal returns. The Alpha for the overall sample is positive and significant for the one-year post-acquisition period, implying that, on average, technological acquisitions outperform over a one-year run.

Hypothesis 2 examines the effect of innovation on cumulative abnormal returns post-acquisition and predicts a positive relationship. This study associates innovation with higher research and development expenses. The partitioning of the sample by R&D expenses produced different average monthly abnormal returns. The low R&D, quartile 1, and quartile 2 tech acquisitions have statistically insignificant average monthly returns. The alpha coefficients for high R&D, quartile 3, and quartile 4 are positive and statistically significant, suggesting that levels of research and development expenses do positively impact one-year stock performance. The post-acquisition regressions results fully support hypothesis 2 over the 1-year horizon and validate the prediction that innovation positively impacts the long-term performance of acquiring high-tech companies.

The regression coefficient of the market risk premium is statistically significant. The SMB coefficients are positive and statistically significant. HML coefficients are statistically insignificant. A positive coefficient of SMB means that the sample's average size of acquiring firms is not quite large. A negative non-significant coefficient of HML implies that the book-to-market ratios vary across the firms in the sample and do not affect the calendar months' portfolios returns.

In the three-year analysis, the R-Square value varies from 0.2965 to 0.5813, which indicates the goodness of fit. The alpha coefficient is positive and significant in only the quartile 4, suggesting that high research and development expenses positively impact long-run stock performance. The impact of R&D expenses on the post-acquisition stock performance appears to erode between the one-year and three-year periods. The regression coefficient of the market risk premium is close to 1.0 and is statistically highly significant. The SMB coefficients are positive and statistically significant for the overall sample, low R&D, high R&D, quartile 1, quartile 2, and quartile 3; except for quartile 4. HML coefficients are statistically negative and non-significant. A positive coefficient of SMB means that the sample's average size of acquiring firms is not quite large. A negative non-significant coefficient of HML implies that the book-to-market ratios vary across the firms in the sample and do not affect the calendar months' portfolios returns.

A number of tests were employed to assess the robustness of the regression outputs, including checking for the following diagnostics - multicollinearity and heteroscedasticity. The overall sample's variance inflation factor (VIF) was 1.07, below 10. Hence, the analysis has no multicollinearity problem. The White test indicated no heteroskedasticity in the residuals.

The paper's findings are consistent with those documented in previous studies by Mager and Meyer-Fackler (2017); Zakaria and Kamaludin (2018); Kohers and Kohers (2000); Capron and Pistre (2002); Ismail et al. (2011); Agrawal et al. (2000); Schmidt and Fowler (1990). The theoretical rationale is that, on average, firms that engage in acquisitions significantly perform poorly in the post-acquisition period, and their long-run stock performance tends to be negative. This study shows that acquirers significantly outperform in the one-year but demonstrates no improvement over the three-year post-acquisition period.

Examining possible explanations for the long-run stock performance of the acquisitions, the study by Zakaria and Kamaludin (2018) found investors are likely to receive positive and significant returns after the completion of the event. This may be due to the presence of abnormal return opportunities that investors may exploit during the period following the announcement date and after the event completion period, which might provide valued insight. Further, the study by Kohers and Kohers (2000) shows that acquirers of high-tech targets experience significantly positive abnormal returns, notwithstanding whether the event is funded with cash or stock. In another episode, the abnormal stock returns of innovative firms remained positive. This finding confirmed the value of the significance hypothesis that corporate innovation acts as a resource to enable a firm to get positive abnormal returns in the capital market (Majid et al., 2021).

On the other hand, Ismail et al. (2011) found that stock-financed acquisitions underperform. It was established that long-term stock performance tends to exhibit several concerns. The fundamental problem stems from long-term abnormal performance, for instance, the stock market efficiency and a market equilibrium model. The bottom line is that if long-term expected returns can only be roughly estimated, then estimates of long-term abnormal returns are necessarily imprecise.

CONCLUSION

This article examines the short- and long-run stock price performance of 202 US-acquiring companies engaged in technological acquisitions from 2012 – 2016. The study finds that the US companies engaging in technological acquisitions experience statistically insignificant cumulative abnormal returns around the announcement date and positive cumulative abnormal returns over the one-year post-acquisition period. Thus, technological acquisitions result in an improvement in stock performance one year following the acquisitions.

An analysis of the innovation impact on the stock performance of acquiring companies in technological acquisitions suggests that innovation positively and significantly impacts stock performance around the announcement date. These findings have important implications for US managers who view the initial increase in stock price around announcement dates as a signal for a positive shareholder response. The long-run analysis supports the view that innovation improves 1-year stock performance after technological acquisitions.

The study is not without limitations. The main limitation is the small sample size (202 acquisitions), which could compromise the robustness of the results. Also, the dataset, which comprised targets from a single country, limits the generalizability of the findings. Hence, further studies could conduct several robustness checks and use data from other countries to check whether the findings from this single-country study apply to other economies as well.

The calendar time portfolio approach is unsuited for detecting abnormal performance associated with events such as acquisitions clustered across time. Also, the approach has low power to detect abnormal performance because it averages over months of events. For instance, the calendar-time portfolio approach may be unsuccessful in evaluating the significant abnormal returns in months of intense occurrence.

The empirical analysis of this paper is based on OLS regressions, an alternative statistical technique may be employed, such as weighted least squares.

Overall, the results contribute to the technological acquisition literature. This research can be expanded to discuss the influence of technological acquisitions on target firms instead of acquiring firms around the announcement date. For post-acquisition analysis, the study can be extended by using different models for estimating abnormal returns.

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APPENDIX

TABLE A1
THREE-DIGIT SIC CODES OF SAMPLE HIGH-TECHNOLOGY COMPANIES

SIC Code	Industry Name
283	Drugs
357	Computer and Office Equipment
366	Communication Equipment
367	Electronic Components and Accessories
382	Laboratory, Optic, Measure, Control Instruments
384	Surgical, Medical, Dental Instruments
481	Telephone Communications
482	Miscellaneous Communication Services C
489	Communication Services, NEC
737	Computer Programming, Data Processing
873	Research, Development, Testing Services

Source: Kile and Phillips (2009).

TABLE A2
DESCRIPTIVE STATISTICS OF EXPLANATORY VARIABLES BY INDUSTRY

Industry	Variable	N	Mean	Std.Dev	Min	Max
Drugs	R&D Expenses to Sales Ratio	27	1.6500	4.7720	0	20.6160
	Book-to-Market Ratio		0.6891	1.2746	0.0225	5.8688
	GDP Growth Rate Percent		3.94	0.26	3.63	4.20
	Acquirer Size (Millions)		$25,503	$49207.47	$1	$195,965
	Deal Value (Millions)		$3,777.68	$6,062.73	$1	$21,000
Electronic Components and Accessories	R&D Expenses	23	0.1373	0.1133	0.0055	0.3695
	Book-to-Market Ratio		573.7356	2,387.608	0.2691	11,403.23
	GDP Growth Rate Percent		4.04	0.24	3.63	4.20
	Acquirer Size (Millions)		$8,985.83	$3,5662.7	$7.15	$172,304.9
	Deal Value (Millions)		$1,177.88	$3,481.07	$7.15	$16,700
Surgical, Medical, Dental Instruments	R&D Expenses	36	0.1089	0.2320	0	1.4244
	Book-to-Market Ratio		0.4829	0.3628	0.1312	1.6210
	GDP Growth Rate Percent		3.86	0.24	3.63	4.20
	Acquirer Size (Millions)		$15,050.86	$33,366.16	$3.08	$169,351.3
	Deal Value (Millions)		$1,519.22	$4,123.57	$1.6	$18,044.89
Computer Programming, Data Processing	R&D Expenses	64	0.1123	0.0906	0	0.3299
	Book-to-Market Ratio		2,204.439	17,395.71	0.0281	139,191
	GDP Growth Rate Percent		3.86	0.25	3.63	4.20
	Acquirer Size (Millions)		$21,653.52	$60,075.84	$2.8	$354,392
	Deal Value (Millions)		$1,324.69	$4,058.79	$2.5	$26,200

Industry	Variable	N	Mean	Std.Dev	Min	Max
Laboratory, Optic, Measure, Control Instruments	R&D Expenses	17	0.0644	0.0407	0	0.1521
	Book-to-Market Ratio		3.0712	10.9578	0.1805	45.5892
	GDP Growth Rate Percent		3.82	0.22	3.63	4.20
	Acquirer Size (Millions)		$5,894.65	$14,058.61	$1.18	$56,799.9
	Deal Value (Millions)		$174.2588	$244.3615	$1.18	$998
Computer and Office Equipment	R&D Expenses	12	0.1366	0.1023	0.0179	0.3618
	Book-to-Market Ratio		0.5764	0.5675	0.2607	2.2679
	GDP Growth Rate Percent		3.84	0.27	3.63	4.20
	Acquirer Size (Millions)		$15,897.34	$24,162.71	$73.69	$81,747.03
	Deal Value (Millions)		$2,006.28	$5,389.30	$6.7	$19,000
Communication Equipment	R&D Expenses	12	0.1004	0.0597	0	0.1936
	Book-to-Market Ratio		1.9625	3.6609	0.1086	11.5753
	GDP Growth Rate Percent		3.84	0.27	3.63	4.20
	Acquirer Size (Millions)		$1,883.55	$2,127.55	$8	$5,622.38
	Deal Value (Millions)		$364.693	$974.20	$8	$3,450
Research, Development, Testing Services	R&D Expenses	8	1.9435	5.3667	0	15.2249
	Book-to-Market Ratio		24.3104	24.3104	0.2062	69.2281
	GDP Growth Rate Percent		3.74	0.19	3.63	4.20
	Acquirer Size (Millions)		$2,008.47	$2,433.67	$10.9	$7,354.11
	Deal Value (Millions)		$202.8	$298.70	$4	$850

Industry	Variable	N	Mean	Std.Dev	Min	Max
Communication Services, NEC	R&D Expenses	3	547,846	0.0949	0	0.1644
	Book-to-Market Ratio		2,997.438	5,191.446	0.1126	8,992.004
	GDP Growth Rate Percent		3.95	0.23	3.73	4.20
	Acquirer Size (Millions)		$4,250.23	$3,868.01	$1,886	$8,714
	Deal Value (Millions)		$1,111	$952.95	$47	$1,886