STOCK MARKET REACTIONS TO ANNOUNCEMENTS OF ERP SYSTEM IMPLEMENTATION IN THE US

by

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ABSTRACT

Research on the impact of announcements of investments in enterprise resource planning (ERP) systems has so far yielded divergent results. The present study, using data on ERP system implementation announcements of 112 predominantly Fortune 350 firms during 1990-2010, examines the impact of ERP implementation announcements on stock returns in the United States. The empirical result shows that abnormal returns of the US firms for the event window (-1, +1) on ERP system implementation announcements are positive and statistically significant. Our empirical results reveal that publicly traded companies in the US generate significant reactions in the positive direction in the stock market. The reason of this positive announcement effect is that the market stays hopeful of larger returns for the years to come with the streamlining of business processes in line with the industry's best practices. The capital market anticipates positive net future cash flows from the use of ERP systems. ERP systems enhance the efficiency and effectiveness of the firms through increasing their production flexibility and streamlining critical business processes such as sales and inventory management. Accordingly, stock market participants react positively to the announcements of ERP system implementations as is proven in this study.

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ABBREVIATIONS

AAR	Average Abnormal Return
AR	Abnormal Return
CAAR	Cumulative Average Abnormal Return
CASAR	Cumulative Average Standardized Abnormal Return
CRSP	Center for Research in Security Prices
EGARCH	Exponential Generalized Autoregressive Conditional Heteroskedasticity
ERP	Enterprise Resource Planning
FF	Fama-French Three-Factor Model
GARCH	Generalized Autoregressive Conditional Heteroskedasticity
ICT	Information and Communications Technologies
MAM	Market-Adjusted Model
MM	Market Model
MTB	Market-to-Book Ratio
NFPI	Non-Financial Performance Incentives
OLS	Ordinary Least Squares
ROA	Return on Assets
SCAR	Standardized Cumulative Abnormal Returns
SR	Stock Returns

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Chapter 1

INTRODUCTION

Investment in information and communications technologies (ICT) has expanded significantly recording a growth rate of 25 per cent in the last few decades (Ranganathan and Brown, 2006; Benco and Prather, 2008). A substantial component of this investment has been in the enterprise resource planning (ERP) systems (Davenport, 1998; McAlary, 1999). The global market for ERP systems is estimated at $65 billion in 2010 (D'Aquila et al., 2009). Investments in ERP systems are motivated by evidence which indicate substantial improvements in operational, financial performance, and enhancement of business value in the firms adopting ERP systems (Cottelleer and Bendoly, 2006; Mabert et al., 2003; McAfee, 2002; Madapusi and D'Souza, 2011).

An ERP system is one of the efficient ways to use ICT by business and incorporate best business practices into one integrated software application package that can affect every function within a business like human resources, logistics, finance, and marketing etc. An ERP package can affect every aspect of the business but it also can reduce data redundancy and data errors, thereby enhancing the data integrity and reliability so as to facilitate better management information system and decision making. The implementation of an ERP system is capital

intensive and costly to start with. It also involves substantial time and changes to the business processes. According to a study by Umble and Umble (2002) of 63 firms, the average ERP system implementation costs $11 million and takes 23 months to complete. An ERP implementation is mostly found in highly capitalized Fortune 500 firms, but its modular implementation is now common in medium and small capitalization firms as well. ERP system implementation has not proven to be universally successful with reports of failed projects (Barker and Frolick, 2003; Davenport, 1998; Gargeya and Bradley, 2005).

There are many studies which have attempted to assess the contribution of ERP systems to firm performance. Prior studies examining implementation of ERP systems can be primarily classified into three lines of research. The first line of studies attempt to identify key factors that impact ERP system implementations and are mostly in the form of survey or case study methods (Themistocleous et al., 2001; Umble et al., 2003; Al-Mashari et al., 2003; Duplaga and Astani, 2003; Sarker and Allen, 2003; Barker and Frolick, 2003; Paper et al., 2003; Kumar et al., 2003; Bradford and Florin, 2003). The second line of research addresses the impact of ERP systems implementation on firm performance (Poston and Grabski, 2001; Hitt et al., 2002; Hunton et al., 2003; Nicolaou, 2004).

The third line of research examines the stock market's and financial analysts' reactions to the announcements of ERP system implementations (Hayes et al., 2001; Hunton et al., 2002; Ho et al., 2008). Most of these studies adopt the event study methodology to assess the impact of ERP investment announcements by looking at stock market's or analysts' reactions. The fundamental idea behind the event study methodology is the premise of the stock market efficiency. In an efficient market, stock price reflects all available information (past and present). When the unexpected but relevant news reaches the financial markets, there is a positive or negative impact on the stock market depending upon whether the news is perceived by investors as good or bad. Despite numerous studies on the announcement effects of ERP implementations, the results are mixed - some show statistically significant event period positive returns (Benco and Prather, 2008), some show no or negative returns (Roztocki and Weistroffer, 2008). These results have added less clarity to the research in this area.

The main aim of our present study is to examine the stock market impacts of ERP implementation announcements of 112 firms in the United States (U.S.) over a time span of two decades ranging from 1990 to 2010. These companies predominantly come under the Fortune 350 category and represent top firms in various sectors of economy. Our research adopts robust models and statistical procedures. The study is organized as

follows: chapter II presents survey of literature, chapter III discusses data source and methodology, chapter IV demonstrates the results of the empirical exercise, and chapter V offers the conclusions.

Chapter II

SURVEY OF LITERATURE

This chapter is an overview of the literature on the subject. This chapter is divided into two sections. Section 1 presents an overview of prior research in this area. Section 2 reports the literature on impact of ERP system implementation announcements on stock returns.

2.1 Prior Research

Earlier studies investigating implementation of ERP systems can be classified into three primary lines of research.

The first line of research endeavors to establish key factors that influence implementation of ERP systems. Majority of these studies use survey or case study methods to recognize factors that lead to the success or failure of implementations (for example, Themistocleous et al., 2001; Umble et al., 2003; Al-Mashari et al., 2003; Duplaga and Astani, 2003; Sarker and Allen 2003; Barker and Frolick, 2003; Paper et al., 2003; Kumar et al., 2003; Bradford and Florin, 2003).

The second line of research focuses on the impact of implementation of ERP systems on enterprise performance. Some of these

studies use accounting-based performance measures to compare firm performance before and after ERP implementation (Poston and Grabski, 2001; Hunton et al., 2003; Hitt et al., 2002; Nicolaou, 2004).

The third line of research comprises of studies, which examine the reactions of the stock market and financial analysts to the announcements of ERP system implementations (Hayes et al., 2001; Ranganathan et al., 2006; Benco and Prather, 2008). The empirical evidence in this regard is ambiguous with evidence of positive, negative, and no impact on stock returns. In the following paragraph, we review the literature in this area.

2.2 Literature Review

Gaver and Gaver (1993) suggest that using matched samples may alleviate industry and macroeconomic forces. The matched sample (control group) is chosen by finding observations in the same population from which the sample of interest (treatment group) is extracted such that these observations are as similar to the sample firms as practicable.

Poston and Grabski (2001) study on financial impacts of ERP implementations finds, after considering in-firm variances, that no considerable improvement is associated with residual income or the ratio of general, selling, and administrative expenses in each of the three years after the ERP system implementation. However, a substantial

improvement in firm performance consequential from a decrease in the ratio of cost of goods sold to revenues is observed three years after the ERP system implementation (but not in the first or second year after implementation). In addition, there is a considerable reduction in the ratio of employees to revenues for each of the three years examined following the implementation of the ERP system.

Hayes et al. (2001) study the market reaction to ERP implementation announcements via cumulative abnormal returns surrounding announcement dates. They report an overall positive reaction to the initial ERP announcements, which is most positive for small/healthy firms and more positive for larger ERP vendors than for smaller ERP vendors. On the whole, they conclude that the market reacts favorably to ERP announcements, as cumulative abnormal returns surrounding the announcement date are considerably positive. Their hypothesis is also that market reactions to small/healthy and large/unhealthy firms would be more positive than the reactions to small/unhealthy firms. But, this effect is realized only for the small/healthy firms. They advocate that the non-significant effect for large/unhealthy firms might have been due to low power, as the mean reaction was in the anticipated direction, but sample sizes are small.

Hayes et al. (2001) attribute positive, cumulative, and significant abnormal returns to ERP announcements, but they want others to be cautious about drawing causal inferences from event studies of this nature. Another limitation of the Hayes et al. (2001) study is that one of their hypotheses does not obtain statistical significance (large/unhealthy firms > small/unhealthy firms). Even as they attribute the lack of significance to low power, it can also be possible that the underlying theory leading to their hypothesis requires to be improved further.

Hayes et al. (2001) argue that as firm managers announce their ERP implementation plans, they are indicating to the market that the firm intends to incur the heavy implementation costs. Simultaneously, owing to the strategic benefits that result from ERP system implementations such as curtailed internal and external transaction costs, reduced information asymmetry among information consumers, and lower capital cost, managers are also pointing out the anticipated improvements in productivity and profitability that should positively influence future discounted cash flows. As the market recognizes these contradictory signals, if it determines that the long-term benefits exceed the short-term costs, then the overall market reaction should be positive.

Hayes et al. (2001) also recognize that the market reaction could be negative, as ERP implementations are infamous for being risky and

costly. Hence the reaction to ERP implementation plans can be cynical if investors believe that the discounted value of long term benefits emanating from the implementation will not balance the short term costs. Based on these arguments, Hayes et al. (2001) offer a non-directional hypothesis concerning the overall effect of ERP implementation plans on the market value of the announcing firms.

While the Hayes et al. (2001) study uses standardized cumulative abnormal returns (SCAR) as a dependent variable, Hunton et al. (2002) implore analysts' earnings forecasts as their criteria variables. Hayes et al. (2001) also indicate that the market reactions to ERP implementation plans can vary depending upon the interaction of a firm's financial health and its size. They envisage a combined effect of both the financial health and size of the firm. In particular, they expect the market to react most positively to small/healthy and large/unhealthy firm announcements as the investors can perceive that (1) both firm categories can endure the financial strain of ERP implementations, (2) small/healthy firms might emerge larger and stronger via ERP systems, and (3) large/unhealthy firms can turn out to be more competitive, thus healthier by adopting ERP systems. Their forecast is that the market would respond least favorably to small/unhealthy firm announcements, as their ability to withstand the financial strain of the implementation period would be in question. Lastly, Hayes et al. (2001) explore no prophecy as regards the large/healthy firms,

as they are uncertain about how ERP systems would improve the effectiveness or efficiency of firms that are already considered to be strong and healthy.

Hunton et al. (2002) analyze the financial analysts' reaction to ERP implementation plans and investigate the degree to which investors believe that ERP systems increase the value of a firm by probing into changes in analysts' earnings predictions before and after the announcement of its plan to invest in an ERP system. In total, 63 analysts participated in a two (firm size: small and large) by two (firm health: unhealthy and healthy) randomized between-subjects design. The ERP announcement represented a within-subjects manipulation. In general, the financial analysts' overall reaction to ERP implementation plans was positive, as mean post-announcement earnings forecasts were considerably higher than mean pre-announcement forecasts. As expected, mean earnings forecast revisions in the small/healthy and large/unhealthy firm conditions were significantly higher than mean forecast revisions in the small/unhealthy firm condition. Experimental results from this study support previous findings of Hayes et al. (2001), who explored the same research questions, along with others, by examining cumulative abnormal returns surrounding ERP announcements. Triangulation studies of this type using multi-methods (e.g., behavioral vs. archival) and complementary criterion variables (e.g., earnings forecasts vs. cumulative

abnormal returns) are significantly valuable to social scientists, as they provide insight into the consistency, reliability, and validity (both internal and ecological) of proposed theoretical relationships (Boyd et al., 1993; Flick, 1992; Libby et al., 2002).

Hunton et al. (2002) also examine changes in financial analysts' earnings predictions after they receive an announcement of a firm's plan to implement an ERP system. They conclude that the overall reaction to the announcement is positive, with the mean post-announcement earnings forecasts significantly surpassing the mean pre-announcement earnings forecasts.

Both Hunton et al. (2002) and Hayes et al. (2001) examine the impact of an ERP implementation on the firm value. But the Hayes et al. (2001) investigation focuses on standardized cumulative abnormal returns (an objective measure), whereas Hunton et al. (2002) study examines financial analysts' earnings forecasts (a perceptual measure).

Elayan et al. (2005) use a matched sample event study analysis to establish whether one firm's announcement to take action has unfavorably influenced a matched sample firm that decided not to act.

Wier et al. (2005) assert that the joint adoption of ERP and use of non-financial performance incentives (NFPI) yield greater corporate performance than either ERP or NFPI alone. In their research, performance is mirrored by return on assets (ROA) and stock returns (SR). Study results endorse their hypothesis that firms with both NFPI and ERP obtain appreciably higher short-term and long-term ROA and SR as compared to either ERP-only or NFPI-only firms. These research findings provide valuable insight into the theoretical and practical repercussions of adopting both ERP and NFPI strategies together.

Ranganathan and Brown (2006) in their research on "ERP investments and the market value of firms: toward an understanding of influential ERP project variables" present that all ERP purchases do not have the same potential impact at the firm level owing to ERP project decisions made at the time of purchase. Working on a sample of 116 investment announcements in US–based firms between 1997 and 2001, they find support for their hypotheses that ERP projects with bigger functional scope (two or more value-chain modules) or greater physical scope (multiple geographical sites) result in positive and higher shareholder returns. Additionally, the highest increases in returns (3.29%) are found for ERP purchases with larger functional and physical scopes, whereas negative returns are found for projects with smaller functional and physical scopes. These conclusions empirically support the earlier

theory on the organizational integration benefits of ERP systems, the contribution of complementary resource investments to the business value of ICT investments, and the growth options associated with ICT platform investments. In summary, in their study on ERP implementation announcements, they focus on differences in the announcement effects due to project-specific variables such as functional scope, physical scope, and vendor status.

Botta-Genoulaz and Millet ((2006) while investigating the use of ERP systems in the service sector, get an in-depth view into how services approach ERP implementation. A review of ERP projects, especially in services, done by six case studies has been carried out. They identify and discuss some characteristics of services, which are distinct as compared to manufacturing. Primary characteristics that are identified, deal with complete or partial integration, customer or product orientation, importance of labor that is the human factor. They conclude that trends to standardization and integration as seen in the industries are also growing in the service sector, but in different ways.

Benco and Prather (2008) investigate the market reaction of 111 firms that announce investments in ERP systems. They use equally weighted and value weighted indices, estimate event study betas with ordinary least square (OLS) and Scholes-Williams techniques, and use

Generalized Autoregressive Conditional Heteroskedasticity (GARCH) and Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) methods to scrutinize how differences in assumptions concerning event period return variance influence the results. They perform matched-pair analysis to study whether a firm's ERP project announcement affects non-announcing firms. Their conclusion is that only healthy firms that declare ERP investments experience statistically significant event period returns.

Brazel and Dang (2008) study the effect of ERP system implementations on the management of earnings and earnings release dates. They examine whether ERP system implementations have influenced the degree to which firms manage earnings amounts and release dates. They conclude from a sample of ERP adopters that implementations result in boosting the absolute value of discretionary accruals (i.e. greater earnings management). They also find a positive relationship between the extent of ERP module adoption and the extent of earnings management. With respect to earnings release dates, firms with incentives to enhance the timeliness of their release dates experienced a decrease in reporting lag subsequent to ERP system implementations. These results matter to financial statement preparers implementing new ERP applications, auditors serving clients with ERP systems, and

regulators overseeing the financial markets and consolidation in the ERP industry.

Morris and Laksmana (2010) research the impact of ERP systems on earnings management. They utilize the absolute value of discretionary accruals as a proxy for earnings management, comparing levels for 143 firms in 32 industry groups that had ERP system implementations between 1994 and 2003 to levels for a control group. They come out with the fact that over a span of ten years around the implementation date, firms that implemented ERP systems show a significant decrease in the absolute value of total discretionary accruals, while the control group does not. Also, they state that short-term discretionary accruals are driving the results, whereas the long-term discretionary accruals display no substantial change for either group.

Chapter III

DATA SOURCE AND METHODOLOGY

This chapter presents the data source and methodology used in the empirical investigation. Section 1 discusses the data source and section 2 explains the methodology used in our empirical research.

3.1 Data

Data on the ERP system implementation announcements of 112 US firms for the 1990-2010 period were collected utilizing LexisNexis Academics searching the quarterly earnings call transcripts of the companies, articles in various industry and professional association journals, disclosures by the companies, and announcements by large ERP vendors like SAP, Oracle, and Microsoft. The keywords used for search were "ERP" and "ERP implementation". This data gathering process garnered a sample of 112 US firms announcing implementation of ERP systems. The event date (t = 0) was the announcement date from the data source.

3.2 Methodology

We used standard event study methodology, Brown and Warner (1985) expansion of market model, to analyze the effect of ERP

implementation announcement on market and risk-adjustment daily returns. The stock price data, adjusted for dividends and splits, was compiled from CRSP (Center for Research in Security Prices) database. The amassed stock price data was automated employing Eventus software and the standardized abnormal returns were computed exercising Eventus software. The Standard and Poor's S&P 500 Index (value-weighted) was chosen as the proxy for the market return. The collection of stock price data was automated through use of Eventus software, and the abnormal returns were calculated through Eventus software (Cowan, 2009). The estimation period to figure the alpha and beta was from day (t) -30 to +30. The pre-estimation period for the event study was 240 days prior to the event date, equivalent to approximately one year of trading.

Based on the framework of Brown and Warner (1985) and Campbell et al. (1997), let t represent the time period relative to the ERP implementation announcement event. Actual return is estimated as follows:

$$R_{jt} = K_{jt} + e_{jt} \qquad (3.1)$$

where:

R_{jt} is the observed stock return for company j in day t,

K_{jt} is the "normal" (i.e. expected or predicted return of a particular model),

e_{jt} is the part of the return which is abnormal or unexpected.

Abnormal return (AR) is the difference between the observed actual return and the predicted normal return. This is the component of the observed return that cannot be justified by market movements and captures the effect of the ERP implementation announcement event. Abnormal return is estimated as follows:

$$e_{jt} = R_{jt} - K_{jt} \tag{3.2}$$

In the econometric investigation, we need to specify a model of normal returns (i.e. expected returns unconditional on the event but conditional on other information). We use the market model (MM), market-adjusted model (MAM), and Fama-French three-factor model (FF) for this purpose as given in equations (3.3), (3.4), and (3.5).

Market model:

$$AR_{jt} = R_{jt} - (\hat{\alpha}_j + \hat{\beta}_j R_{mt}) \tag{3.3}$$

Market-adjusted model:

$$AR_{jt} = R_{jt} - R_{mt} \tag{3.4}$$

Fama-French three-factor model:

$$\begin{aligned} R_{jt} &= \alpha_j + \beta_j R_{mt} + s_j SMB_t + h_j HML_t + e_{jt} \\ AR_{jt} &= R_{jt} - (\hat{\alpha}_j + \hat{\beta}_j R_{mt} + \hat{s}_j SMB_t + \hat{h}_j HML_t) \end{aligned} \tag{3.5}$$

where:

t is the day relative to the event day 0,

AR_{jt} is the abnormal return for the common stock of the firm j on day t,

R_{jt} is the observed stock return for the firm j on day t,

α_j and β_j are the estimates for regression coming from OLS regression procedures over the period t = -30 to +30 relative to the event day 0,

R_{mt} is the return of a market index on day t,

$(\hat{\alpha}_j + \hat{\beta}_j R_{mt})$ denotes the normal return for the firm j due to the market-wide movement,

SMB_t is the average return on small market-capitalization portfolios minus the average return on three large market-capitalization portfolios, and

HML_t is the average return on two high book-to-market equity portfolios minus the average return on two low book-to-market equity portfolios.

We computed the abnormal returns for market model, market-adjusted model, and Fama-French three-factor model. We have also worked out the standardized abnormal returns for market and market-adjusted models. Our empirical analysis is based on all these three models. We do not see any significant differences in the empirical results in the choice of models. To detect statistically significant effects from ERP implementation announcements, various event windows are examined and t-statistics tests are compiled on the average abnormal returns (AAR) and cumulative average abnormal returns (CAAR).

Chapter IV

EMPIRICAL RESULTS

This chapter presents empirical results of the estimate of abnormal returns outlined in Chapter III and is organized as follows. Section 1 provides an overview of descriptive statistics of the sample. Section 2 presents the results of our empirical investigation.

4.1 Descriptive Statistics

Table 4.1 reports the descriptive statistics of the sample of 112 US firms included in this study. As revealed, the average total assets come to $21 billion and the average market capitalization comes to $19 billion. The lowest asset size in terms of total assets and market capitalization comes to $76 million and $53 million respectively. The standard deviations of these variables are relatively high. Most of the firms in the sample have high profitability (as revealed by return on assets) and low leverage.

Table 4.1: Descriptive Statistics of the 112 US Firms Announcing ERP System Implementation

Variables	Mean	Median	Standard Deviation	Minimum	Maximum
			(in million $)		
Total Assets	20574	10317	33432	76	276543
Market Capitalization	18840	10162	28141	53	203428
Cash Flow	1516	750	2262	-784	15876
EBIT	1499	897	2418	-5952	18713
EBITDA	2146	1340	2940	-2	23358
Long Term Debt	5171	1673	16340	0	167173
			(in %)		
Leverage	0.22	0.20	0.24	0.00	2.21
Return on Assets	0.10	0.09	0.08	-0.04	0.54

4.2 Empirical Results

Tables 4.2 (a to c) report the results of CAARs for US ERP implementing firms using (a) Market Model, (b) Market-Adjusted Model, and (c) Fama-French Three-Factor Model as outlined in chapter 3 in equations 3.3 to 3.5. These estimates of CAARS in the immediate event window (-1, +1) show a positive impact in the range of 1.15 per cent (for Fama-French three-factor model) to 1.46 per cent (for market-adjusted model).

Table 4.2 (a to c): Cumulative Average Abnormal Returns (CAAR) for ERP Implementation Announcing Firms

(a) Market Model - Abnormal Returns

Event Window	CAAR (%)	t-statistic	p-value	Standard Deviation
(-30, +30)	-0.85	-0.64	0.53	14.17
(-1, +1)	1.39	2.83	0.01**	5.20
(-5, +5)	1.19	1.84	0.07*	6.82

***, **, * indicate statistical significance at 1%, 5%, and 10% level respectively.

(b) Market-Adjusted Model - Abnormal Returns

Event Window	CAAR (%)	t-statistic	p-value	Standard Deviation
(-30, +30)	2.26	1.78	0.08*	13.39
(-1, +1)	1.46	2.99	0.00***	5.16
(-5, +5)	1.61	2.50	0.01**	6.81

***, **, * indicate statistical significance at 1%, 5%, and 10% level respectively.

(c) Fama-French Three-Factor Model - Abnormal Returns

Event Window	CAAR (%)	t-statistic	p-value	Standard Deviation
(-30, +30)	-1.01	-0.76	0.45	14.09
(-1, +1)	1.15	2.69	0.01**	4.53
(-5, +5)	0.64	1.19	0.24	5.68

***, **, * indicate statistical significance at 1%, 5%, and 10% level respectively.

Charts 4.1 (a to c) report the box plots of estimates of CARs for different models. As is evident from the box plots, the variation of CARs is higher for longer event window (-30, +30).

Chart 4.1 (a): Box Plot of CARs for Different Event Windows in Market Model

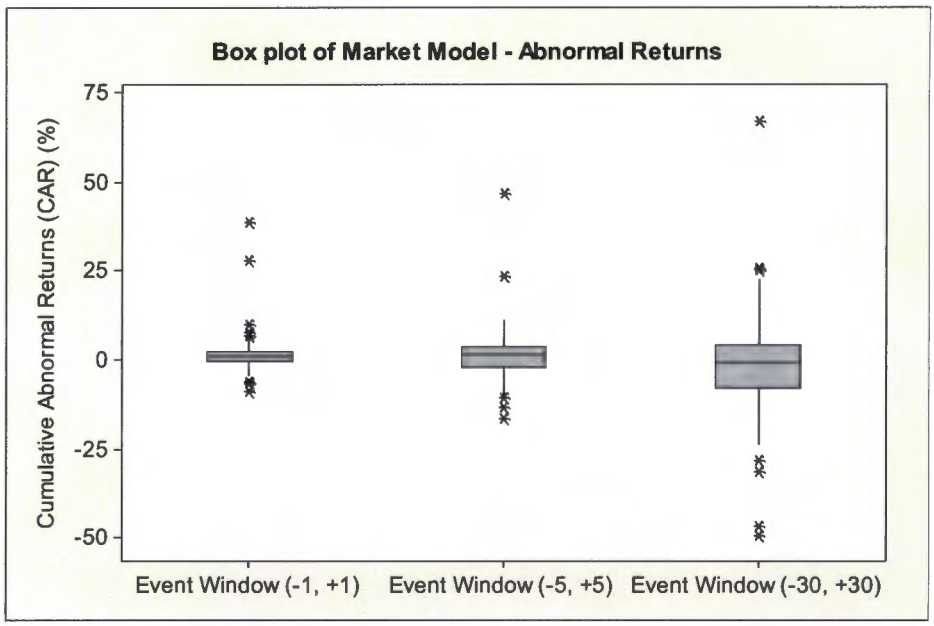


Chart 4.1 (b): Box Plot of CARs for Different Event Windows in Market-Adjusted Model

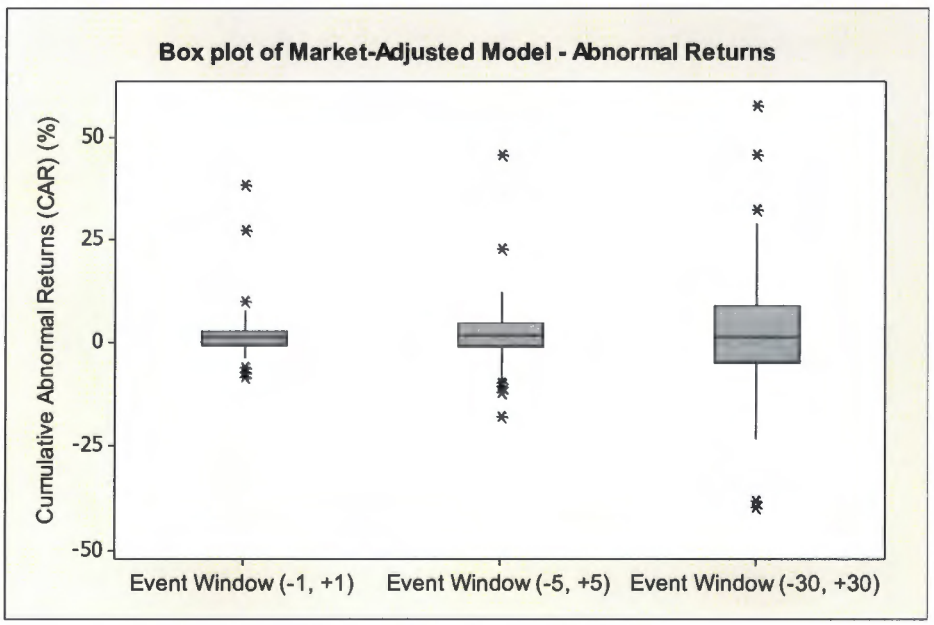
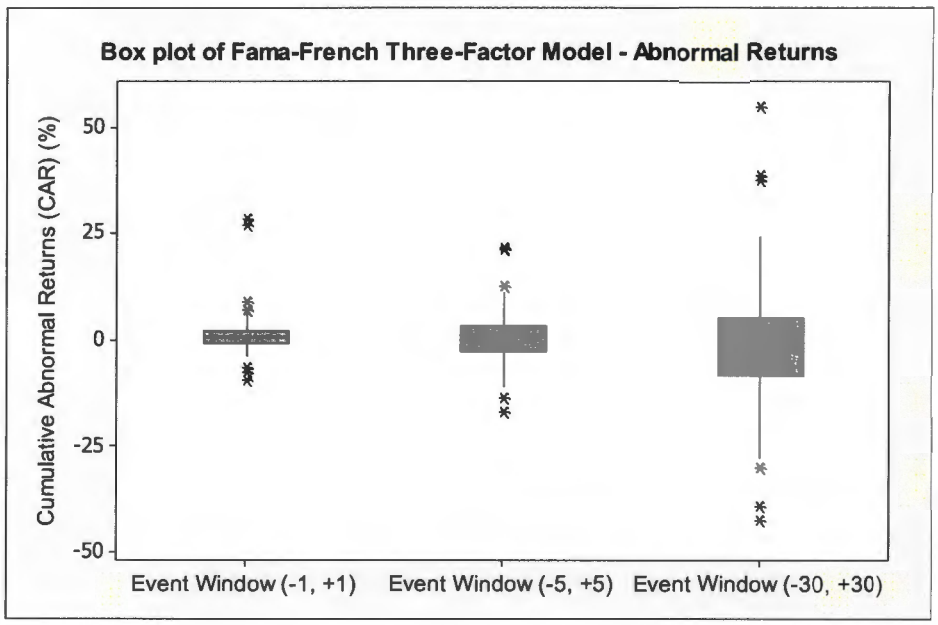


Chart 4.1 (c): Box Plot of CARs for Different Event Windows in Fama-French Three-Factor Model



Charts 4.2 (a to c) report the relationship between CARs, the risk of the firm and size (market capitalization). These results show higher the risks (beta), higher are the CARs, thereby confirming the positive risk-reward relationships.

Chart 4.2 (a): Relationship between CAR, Risk (Beta) and Market Capitalization - Market Model

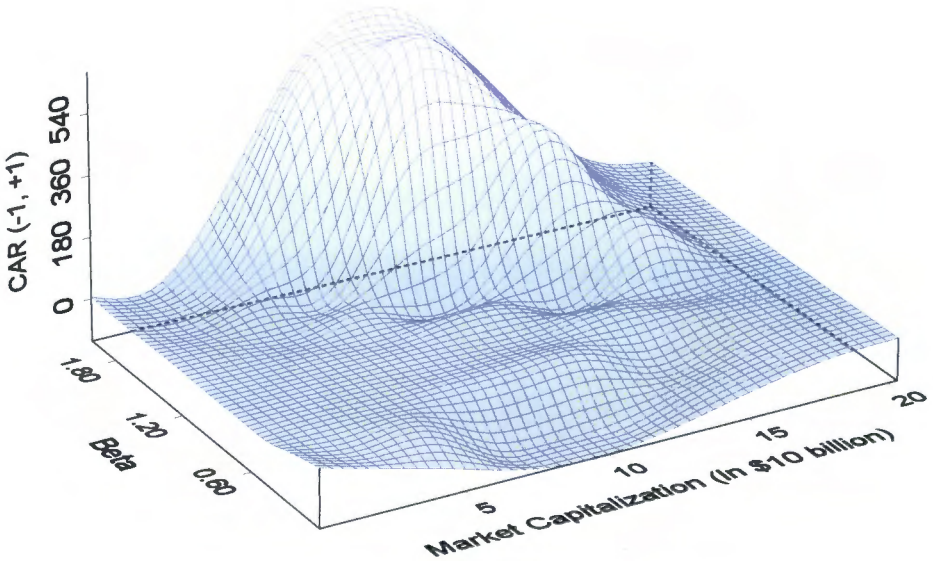


Chart 4.2 (b): Relationship between CAR, Risk (Beta) and Market Capitalization - Market Adjusted Model

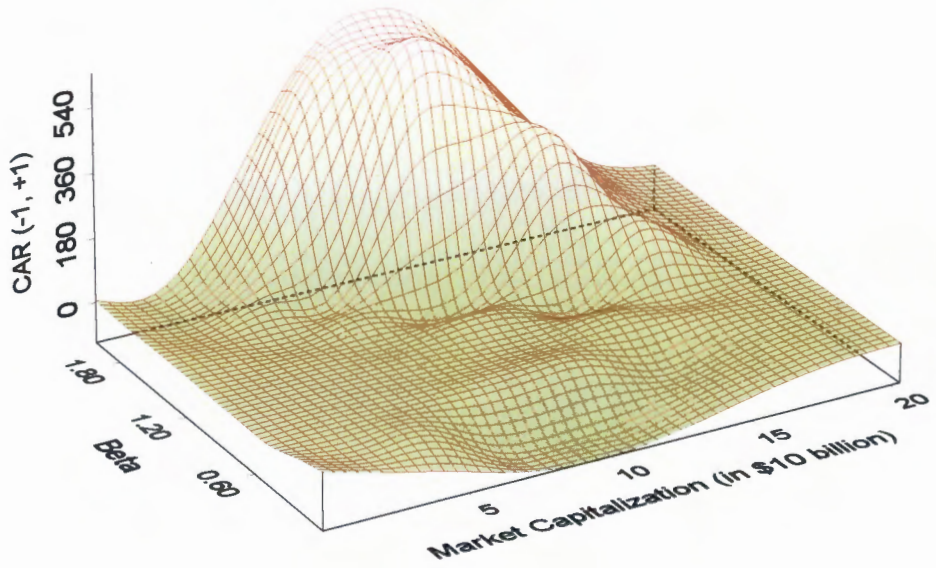
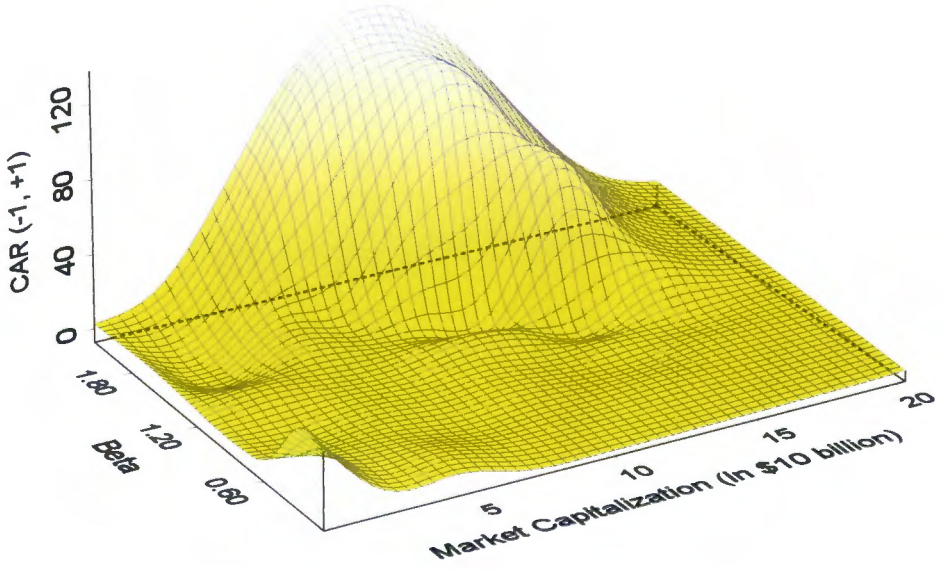


Chart 4.2 (c): Relationship between CAR, Risk (Beta) and Market Capitalization - Fama-French Three-Factor Model



Tables 4.3 (a to b) report standardized CAARs for (a) Market Model and (b) Market-Adjusted Model and the standardized abnormal returns are marginally lower than the non-standardized results presented in Tables 4.2 (a to c). These results are similar to the earlier results (Hayes et al., 2001; Poston and Grabski, 2001; Hunton et al., 2002; Ranganathan and Brown, 2006; Benco et al., 2008).

Table 4.3 (a to b): Cumulative Average Standardized Abnormal Returns (CASAR) for ERP Implementation Announcing Firms

(a) Market Model - Standardized Abnormal Returns

Event Window	CASAR (%)	t-statistic	p-value	Standard Deviation
(-30, +30)	-0.73	-1.05	0.30	7.42
(-1, +1)	0.62	3.11	0.00***	2.13
(-5, + 5)	0.53	1.71	0.09*	3.25

***, **, * indicate statistical significance at 1%, 5%, and 10% level respectively.

(b) Market-Adjusted Model - Standardized Abnormal Returns

Event Window	CASAR (%)	t-statistic	p-value	Standard Deviation
(-30, +30)	1.11	1.81	0.07*	6.51
(-1, +1)	0.65	3.32	0.00***	2.08
(-5, +5)	0.81	2.63	0.01**	3.25

***, **, * indicate statistical significance at 1%, 5%, and 10% level respectively.

Table 4.4: Determinants and Cumulative Abnormal Returns of ERP System Implementation Announcements (1990-2010)

This table reports OLS estimates of the following multivariate regression model:

$$CAR\,[-1,+1] = \alpha_0 + \beta_1 SIZE + \beta_2 ROA + \beta_3 LEV + \beta_4 MTB + \varepsilon,$$

where CAR is the cumulative abnormal returns estimated from one trading day before the ERP implementation announcement through one trading day after the announcement using the market model, market-adjusted model, and Fama-French three-factor model. The variable SIZE is defined as the natural logarithm of the firm's total assets. The variable Return on Assets (ROA) is defined as net income over the book value of total assets. The variable Leverage (LEV) is defined as total debt divided by the book value of total assets. The Market-to-Book ratio (MTB) is defined as the market value of the ordinary (common) equity divided by the balance sheet value of the ordinary (common) equity in the company.

Variables	**Exp. Sign**	**OLS (Market Model)**	**OLS (Market-Adjusted Model)**	**OLS (Fama-French Model)**
Intercept	+/-	0.05	0.20	-0.20
		(3.88)	(3.85)	(3.37)
LogSize *(SIZE)*	+	0.06	0.05	0.06
		(0.37)	(0.37)	(0.32)
Return on Assets *(ROA)*	+	0.96	0.93	0.81
		(8.21)	(8.15)	(7.15)
Leverage *(LEV)*	(-)	-0.53	-0.51	-0.39
		(2.09)	(2.07)	(1.82)
Market to Book Ratio *(MTB)*	+	0.57	0.57	0.56
		(0.63)	(0.62)	(0.55)
R^2		*0.02*	*0.02*	*0.02*
F- statistic		*0.45*	*0.46*	*0.54*
Observations		*112*	*112*	*112*

Notes: Figures in brackets are standard error (HAC standard errors using Newey-West procedure).
***, **, * indicate statistical significance at 1%, 5%, and 10% level respectively.
Exp. sign is the expected sign of the coefficient as hypothesized.

These results confirm that if the ERP system implementation announcements convey information about the positive earnings prospects of adopting firms, then the positive news is immediately reflected in the stock returns of the firms surrounding the ERP project announcement date. Subsequently, when the market digests the positive news, the stock market prices come back to their normal behavioral pattern.

Chapter V

CONCLUSIONS

Studies on the after-effects of announcements of investments in ERP system implementations have so far delivered divergent results. The current study, using market data on ERP system implementation announcements of 112 predominantly Fortune 350 firms during 1990-2010, analyzes the impact of ERP project announcements on stock returns in the US. The empirical result establishes that abnormal returns (-1, +1) of US firms on ERP system implementation announcements are positive and statistically significant. Our empirical research also proves that publicly traded companies in the US create significant reactions in the positive direction in the stock market when they announce implementation of ERP systems signifying that investors view this decision positively and that it could contribute to enhanced business value in the future.

The reason for this positive effect of the ERP announcement is that the market stays optimistic on larger returns for future years with the streamlining of business processes in alignment with the industry's best practices. The capital market looks forward to positive net future cash flows from the use of ERP systems. Accordingly, stock market

participants react positively to the announcements of ERP system implementations as is proven in this study.

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APPENDIX

Table 4.1 (a to c): Daily Average Abnormal Returns (AAR) for ERP Implementation Announcing Firms (N=112)

(a) Market Model - Abnormal Returns

Day	Average Abnormal Return (AAR) (%)	t-statistic	p-value	Standard Deviation
-30	-0.09	-0.56	0.58	1.65
-29	0.15	0.62	0.54	2.50
-28	-0.20	-1.24	0.21	1.73
-27	0.51	1.65	0.10*	3.26
-26	0.38	2.33	0.02**	1.73
-25	-0.19	-1.32	0.19	1.54
-24	0.28	1.91	0.06*	1.53
-23	0.17	0.97	0.34	1.82
-22	-0.19	-1.18	0.24	1.74
-21	-0.02	-0.08	0.94	2.01
-20	0.07	0.34	0.74	2.01
-19	0.03	0.18	0.86	1.60
-18	-0.06	-0.46	0.65	1.48
-17	-0.06	-0.32	0.75	2.12
-16	0.29	1.37	0.17	2.23
-15	0.04	0.22	0.83	1.88
-14	0.00	0.01	0.99	2.45
-13	-0.02	-0.11	0.91	1.65
-12	-0.01	-0.06	0.95	1.47
-11	0.19	1.13	0.26	1.76
-10	0.14	0.73	0.47	2.01
-9	-0.09	-0.42	0.68	2.31
-8	0.09	0.59	0.55	1.66
-7	0.24	1.66	0.10*	1.54
-6	0.12	0.86	0.39	1.48
-5	0.21	1.25	0.21	1.73
-4	0.14	0.87	0.39	1.72
-3	0.35	2.03	0.05**	1.83
-2	0.34	2.09	0.04**	1.73
-1	0.55	3.39	0.00***	1.72
0	0.96	2.58	0.01**	3.92
+1	-0.11	-0.57	0.57	2.07
+2	-0.39	-2.18	0.03**	1.88
+3	-0.12	-0.65	0.52	2.03
+4	-0.37	-1.78	0.08*	2.20

Day	Average Abnormal Return (AAR) (%)	t-statistic	p-value	Standard Deviation
+5	-0.36	-2.23	0.03**	1.72
+6	-0.38	-1.54	0.13	2.63
+7	-0.41	-2.54	0.01**	1.74
+8	-0.06	-0.31	0.76	1.93
+9	-0.41	-1.91	0.06*	2.26
+10	0.21	2.74	0.80	0.43
+11	-0.25	-1.15	0.25	2.28
+12	0.00	-0.01	1.00	2.27
+13	-0.29	-1.93	0.06*	1.61
+14	0.04	0.23	0.82	1.87
+15	-0.23	-1.34	0.18	1.85
+16	0.28	1.46	0.15	2.01
+17	-0.32	-1.75	0.08*	1.91
+18	-0.23	-1.37	0.17	1.73
+19	-0.08	-0.48	0.63	1.77
+20	-0.29	-1.81	0.07*	1.72
+21	0.08	0.42	0.68	1.95
+22	0.19	0.90	0.37	2.17
+23	-0.25	-1.12	0.27	2.36
+24	0.05	0.25	0.80	1.89
+25	-0.15	-0.94	0.35	1.69
+26	-0.33	-2.10	0.03**	1.68
+27	-0.47	-2.39	0.02**	2.06
+28	0.03	0.16	0.87	1.66
+29	-0.12	-0.62	0.53	2.08
+30	-0.36	-1.71	0.09*	2.23

(***, **, * indicate statistical significance at 1%, 5%, and 10% level respectively.)

(b) Market-Adjusted Model - Abnormal Returns

Day	Average Abnormal Return (AAR) (%)	t-statistic	p-value	Standard Deviation
-30	-0.06	-0.40	0.69	1.66
-29	0.13	0.58	0.57	2.41
-28	-0.12	-0.70	0.49	1.83
-27	0.61	2.01	0.05**	3.23
-26	0.43	2.65	0.01**	1.71
-25	-0.23	-1.55	0.12	1.59
-24	0.30	1.99	0.05**	1.59
-23	0.15	0.87	0.39	1.88
-22	-0.14	-0.85	0.40	1.75
-21	0.08	0.42	0.67	2.02
-20	0.03	0.16	0.87	2.00
-19	0.13	0.88	0.38	1.62
-18	-0.02	-0.13	0.89	1.61
-17	0.04	0.18	0.86	2.16
-16	0.34	1.60	0.11	2.27
-15	0.12	0.68	0.50	1.87
-14	0.10	0.41	0.68	2.47
-13	0.04	0.22	0.82	1.66
-12	0.02	0.14	0.89	1.48
-11	0.21	1.21	0.23	1.80
-10	0.20	1.05	0.30	1.97
-9	-0.03	-0.13	0.90	2.35
-8	0.17	1.10	0.27	1.64
-7	0.30	2.04	0.04**	1.55
-6	0.13	0.92	0.36	1.55
-5	0.30	1.78	0.08*	1.76
-4	0.18	1.09	0.28	1.75
-3	0.40	2.25	0.03**	1.86
-2	0.37	2.24	0.03**	1.73
-1	0.56	3.39	0.00***	1.75
0	0.95	2.57	0.01**	3.90
+1	-0.05	-0.23	0.82	2.16
+2	-0.37	-1.97	0.05**	1.99
+3	-0.10	-0.55	0.59	2.00
+4	-0.27	-1.25	0.21	2.27
+5	-0.35	-2.03	0.05**	1.81
+6	-0.34	-1.36	0.18	2.65
+7	-0.30	-1.86	0.07*	1.73
+8	0.03	-0.15	0.88	1.89
+9	-0.35	-1.60	0.11	2.30

Day	Average Abnormal Return (AAR) (%)	t-statistic	p-value	Standard Deviation
+10	0.37	1.39	0.17	2.81
+11	-0.18	-0.82	0.41	2.35
+12	0.02	0.08	0.94	2.33
+13	-0.21	-1.29	0.20	1.70
+14	0.15	0.88	0.38	1.84
+15	-0.20	-1.05	0.30	1.96
+16	0.29	1.40	0.16	2.16
+17	-0.22	-1.25	0.22	1.86
+18	-0.16	-0.95	0.34	1.79
+19	-0.03	-0.19	0.85	1.78
+20	-0.25	-1.35	0.18	1.92
+21	0.15	0.77	0.44	2.10
+22	0.25	1.18	0.24	2.26
+23	-0.15	-0.66	0.51	2.41
+24	0.11	0.60	0.55	1.96
+25	-0.11	-0.68	0.50	1.70
+26	-0.26	-1.61	0.11	1.71
+27	-0.41	-2.02	0.05**	2.17
+28	0.05	0.30	0.76	1.71
+29	-0.15	-0.74	0.46	2.14
+30	-0.32	-1.56	0.12	2.15

(***, **, * indicate statistical significance at 1%, 5%, and 10% level respectively.)

(c) Fama-French Three-Factor Model - Abnormal Returns

Day	Average Abnormal Return (AAR) (%)	t-statistic	p-value	Standard Deviation
-30	-0.09	-0.58	0.56	1.71
-29	0.28	1.22	0.22	2.45
-28	-0.23	-1.38	0.17	1.79
-27	0.39	1.33	0.19	3.11
-26	0.28	1.76	0.08*	1.71
-25	-0.22	-1.52	0.13	1.51
-24	0.24	1.63	0.11	1.54
-23	0.09	0.54	0.59	1.82
-22	-0.08	-0.48	0.63	1.72
-21	-0.01	-0.07	0.95	2.06
-20	0.09	0.45	0.66	2.01
-19	0.08	0.50	0.62	1.58
-18	0.02	0.13	0.90	1.49
-17	-0.10	-0.55	0.58	1.97
-16	0.25	1.25	0.21	2.12
-15	0.00	0.01	0.99	1.81
-14	0.02	0.09	0.93	2.33
-13	0.05	0.33	0.74	1.60
-12	-0.04	-0.30	0.77	1.44
-11	0.16	0.95	0.34	1.79
-10	0.20	1.07	0.29	1.96
-9	-0.10	2.03	-0.52	0.61
-8	0.00	1.55	0.01**	0.99
-7	0.12	0.83	0.41	1.57
-6	0.10	0.75	0.46	1.38
-5	0.20	1.17	0.25	1.76
-4	0.14	0.87	0.39	1.74
-3	0.18	1.09	0.28	1.79
-2	0.20	1.15	0.25	1.80
-1	0.43	2.82	0.01**	1.62
0	0.86	2.40	0.02**	3.78
+1	0.14	-0.77	0.44	1.87
+2	-0.43	-2.38	0.02**	1.90
+3	-0.16	-0.85	0.40	1.95
+4	-0.32	-1.58	0.12	2.14
+5	-0.33	-2.10	0.04**	1.66
+6	-0.36	-1.49	0.14	2.58
+7	-0.36	-2.21	0.03**	1.70
+8	-0.12	-0.75	0.45	1.74
+9	-0.42	-2.06	0.04**	2.18

Day	Average Abnormal Return (AAR) (%)	t-statistic	p-value	Standard Deviation
+10	0.19	0.74	0.46	2.67
+11	-0.20	-0.98	0.33	2.20
+12	-0.02	-0.08	0.94	2.26
+13	-0.34	-2.24	0.03**	1.58
+14	0.05	0.29	0.77	1.78
+15	-0.18	-0.97	0.34	1.93
+16	0.16	0.92	0.36	1.87
+17	-0.31	-1.76	0.08*	1.85
+18	-0.19	-1.26	0.21	1.61
+19	-0.04	-0.25	0.80	1.73
+20	-0.17	-1.00	0.32	1.75
+21	0.14	0.75	0.45	1.97
+22	0.22	1.14	0.26	2.08
+23	-0.15	-0.72	0.48	2.22
+24	0.03	0.18	0.86	1.84
+25	-0.11	-0.72	0.48	1.63
+26	-0.28	-1.70	0.09*	1.74
+27	-0.41	-2.01	0.05**	2.13
+28	0.06	0.37	0.71	1.59
+29	-0.03	-0.16	0.87	2.09
+30	-0.30	-1.48	0.14	2.17

(***, **, * indicate statistical significance at 1%, 5%, and 10% level respectively.)

Table 4.2 (a to b): Daily Average Standardized Abnormal Returns (ASAR) for ERP Implementation Announcing Firms (N=112)

(a) Market Model – Standardized Abnormal Returns

Day	Average Standardized Abnormal Return (ASAR) (%)	t-statistic	p-value	Standard Deviation
-30	-0.05	-0.55	0.58	0.97
-29	0.07	0.69	0.50	1.13
-28	-0.08	-0.86	0.39	1.02
-27	0.11	1.06	0.29	1.12
-26	0.22	2.41	0.02**	0.96
-25	-0.12	-1.45	0.15	0.86
-24	0.12	1.39	0.17	0.92
-23	0.06	0.56	0.58	1.14
-22	-0.05	-0.60	0.55	0.95
-21	-0.02	-0.17	0.86	1.25
-20	0.03	0.36	0.72	0.99
-19	0.00	0.03	0.97	0.91
-18	-0.04	-0.45	0.65	0.94
-17	-0.11	-0.93	0.35	1.20
-16	0.19	1.74	0.08*	1.15
-15	0.08	0.79	0.43	1.05
-14	-0.01	-0.10	0.92	1.12
-13	0.05	0.60	0.55	0.87
-12	-0.02	-0.22	0.83	0.81
-11	0.19	1.87	0.06*	1.08
-10	0.11	1.05	0.30	1.13
-9	-0.01	-0.11	0.91	1.08
-8	0.05	0.61	0.54	0.85
-7	0.09	1.18	0.23	0.81
-6	0.07	0.91	0.37	0.86
-5	0.10	1.09	0.28	0.99
-4	0.04	0.47	0.64	0.92
-3	0.18	2.08	0.04**	0.91
-2	0.17	1.93	0.06*	0.95
-1	0.34	4.02	0.00***	0.88
0	0.41	2.54	0.01**	1.71
+1	-0.12	-1.21	0.23	1.08
+2	-0.21	-2.24	0.03**	0.99
+3	-0.11	-1.03	0.31	1.09
+4	0.12	-1.08	0.28	1.17
+5	-0.16	-2.01	0.05**	0.83
+6	-0.16	-1.34	0.18	1.26

Day	Average Standardized Abnormal Return (ASAR) (%)	t-statistic	p-value	Standard Deviation
+7	-0.20	-1.93	0.06*	1.08
+8	-0.03	-0.32	0.75	0.96
+9	-0.26	-2.72	0.01**	1.02
+10	-0.06	-0.60	0.55	1.02
+11	-0.12	-1.12	0.27	1.16
+12	-0.06	-0.40	0.69	1.70
+13	-0.16	-1.99	0.05**	0.85
+14	0.03	0.35	0.72	0.96
+15	-0.15	-1.54	0.13	1.03
+16	0.15	1.47	0.14	1.06
+17	-0.20	-1.88	0.06*	1.18
+18	-0.07	-0.69	0.49	1.04
+19	-0.05	-0.54	0.59	0.91
+20	-0.15	-1.65	0.10*	0.94
+21	0.10	0.92	0.36	1.19
+22	0.09	0.76	0.45	1.18
+23	-0.12	-1.09	0.28	1.13
+24	0.03	0.26	0.80	1.09
+25	-0.12	-1.10	0.27	1.19
+26	-0.19	-2.19	0.03**	0.91
+27	-0.34	-2.30	0.02**	1.55
+28	0.06	0.63	0.53	0.97
+29	-0.03	-0.31	0.76	1.04
+30	-0.19	-1.77	0.08*	1.15

(***, **, * indicate statistical significance at 1%, 5%, and 10% level respectively.)

(b) Market-Adjusted Model – Standardized Abnormal Returns

Day	Average Standardized Abnormal Return (ASAR) (%)	t-statistic	p-value	Standard Deviation
-30	-0.02	-0.23	0.82	0.95
-29	0.08	0.79	0.43	1.11
-28	-0.05	-0.46	0.65	1.08
-27	0.18	1.76	0.08*	1.08
-26	0.25	2.89	0.01**	0.92
-25	-0.15	-1.78	0.08*	0.88
-24	0.13	1.56	0.12	0.91
-23	0.06	0.55	0.58	1.07
-22	-0.02	-0.17	0.87	0.96
-21	0.04	0.30	0.77	1.22
-20	0.00	0.02	0.99	0.96
-19	0.07	0.77	0.45	0.90
-18	-0.02	-0.21	0.83	0.98
-17	-0.03	-0.28	0.78	1.15
-16	0.20	1.80	0.07*	1.16
-15	0.12	1.24	0.22	1.05
-14	0.05	0.50	0.62	1.10
-13	0.08	0.94	0.35	0.85
-12	0.02	0.30	0.77	0.77
-11	0.20	1.91	0.06*	1.08
-10	0.12	1.24	0.22	1.05
-9	0.02	0.22	0.83	1.05
-8	0.08	1.06	0.29	0.82
-7	0.14	1.78	0.08*	0.80
-6	0.07	0.88	0.38	0.85
-5	0.16	1.68	0.10*	1.00
-4	0.06	0.69	0.50	0.93
-3	0.19	2.24	0.03**	0.91
-2	0.20	2.21	0.03**	0.94
-1	0.32	3.75	0.00***	0.90
0	0.39	2.53	0.01**	1.64
+1	-0.06	-0.56	0.58	1.08
+2	-0.18	-1.81	0.07*	1.05
+3	-0.09	-0.92	0.36	1.07
+4	-0.05	-0.44	0.66	1.16
+5	-0.13	-1.54	0.13	0.91
+6	-0.15	-1.29	0.20	1.23
+7	-0.13	-1.30	0.20	1.03
+8	-0.04	-0.40	0.69	0.94

Day	Average Standardized Abnormal Return (ASAR) (%)	t-statistic	p-value	Standard Deviation
+9	-0.23	-2.27	0.03**	1.05
+10	0.04	0.37	0.71	1.04
+11	-0.08	-0.70	0.49	1.18
+12	-0.04	-0.28	0.78	1.70
+13	-0.11	-1.31	0.19	0.89
+14	0.12	1.34	0.18	0.91
+15	-0.11	-1.09	0.27	1.09
+16	0.12	1.18	0.24	1.08
+17	-0.14	-1.31	0.19	1.11
+18	-0.02	-0.20	0.84	1.06
+19	-0.03	-0.32	0.75	0.91
+20	-0.13	-1.36	0.17	0.99
+21	0.15	1.32	0.19	1.21
+22	0.12	1.02	0.31	1.19
+23	-0.06	-0.57	0.57	1.10
+24	0.06	0.59	0.56	1.05
+25	-0.10	-0.93	0.36	1.15
+26	-0.14	-1.74	0.08*	0.87
+27	-0.28	-1.91	0.06*	1.57
+28	0.07	0.71	0.48	1.00
+29	-0.03	-0.32	0.75	1.03
+30	-0.17	-1.60	0.11	1.11

(***, **, * indicate statistical significance at 1%, 5%, and 10% level respectively.)