THE EFFECT OF ENTERPRISE RESOURCE PLANNING SYSTEM (ERP) IMPLEMENTATIONS ON THE PROPERTIES OF ANALYST FORECASTS

Debjeet Pradhan, Tarleton State University
pradhan@tarleton.edu

Joseph F. Brazel, North Carolina State University
jfbrazel@ncsu.edu

ABSTRACT

We know from earlier studies that the implementation of Enterprise Resource Planning (ERP) systems has allowed companies to process, prepare, and disseminate accounting information more quickly and accurately than the legacy accounting systems that they replaced. However, ERP systems also provide a greater opportunity for companies to manage earnings. In this study, we examine if ERP implementations have improved the information environment for equity analysts. Using implementation data from a major ERP software provider, we find that the magnitude of analyst forecast accuracy decreased and its standard deviation increased soon after ERP implementations. These results hold even when we control for discretionary accruals.

INTRODUCTION

Enterprise Resource Planning (ERP) systems are "information system packages that integrate information and information-based processes within and across functional areas in an organization" (Kumar & Hillegersberg, 2002). Frequently, ERP systems replaced ageing legacy systems, which were patchworks of disparate information technology (IT) systems with different operating systems and database architectures. Sharing of data between the IT systems was difficult, often requiring costly custom programming or middleware implementations. Functional departments acted like information "silos," resulting in excessive politicking and operational inefficiencies. The implementation of ERP systems helped alleviate some of these problems by integrating information across an entire organization through the use of a single authoritative database and automated workflows.

ERP systems gather information in a timely manner, help process accounting information efficiently (Davenport, 1998; Hitt et al., 2002) and provide a unified enterprise view of a firm's financial condition (Dillon, 1999). They also help eliminate information silos and allow managers unprecedented access to accounting information (O'Leary, 2000). Brazel and Dang (2008) show that ERP system implementations shorten reporting lags, between quarter-end and earnings release dates, for "good news" firms. Hayes et al. (2001) compare ERP adopters with ERP non-adopters

and illustrate that ERP adopters exhibit improved operational performance. ERP systems also enable managers to provide more accurate management forecasts.

The above evidence points to an improved internal information environment for firms with ERP systems which likely creates expectations among external users of accounting information of improved operational and financial performance. Such expectations could raise the optimism among equity analysts regarding earnings forecasts. Consistent with this expectation, the market reacts positively to ERP implementation announcements (Hunton et al., 2003).

Analyst forecasts

Equity analysts play an important role in capital markets by providing earnings forecasts and buy or sell recommendations about the firms that they cover. They gather, analyze and release information, obtained from various sources, in the form of research reports or notes. Such reports or notes are frequently used by investors to make investment decisions. Prior studies have shown that the stock market does react to the information contained in analyst reports (e.g., Park & Stice, 2000).

A primary source of information for equity analyst is the firms themselves. Publicly traded U.S. firms are required to make certain disclosures about their business to the Securities and Exchange Commission, but they also voluntarily provide other information to capital market participants (e.g., analysts). A company with a better internal information environment (ERP adopters) can provide more accurate and useful information, relative to ERP non-adopters, thereby enabling analysts to make better earnings forecasts and stock recommendations.

However, ERP systems also provide managers with powerful tools to test out the effect of different discretionary accrual scenarios and thereby manage earnings (Brazel & Dang, 2008). In addition, there is evidence to suggest that there is a reduction in internal control effectiveness and audit quality subsequent to ERP implementations (Wright & Wright, 2002; Brazel & Agoglia, 2007), which may lead managers to engage in opportunistic behavior to, for example, issue bad news management earnings forecasts around stock option award periods to temporarily depress stock prices (Aboody & Kasznik, 2000), or issue overly optimistic forecasts around secondary equity offerings to ensure higher prices for new shares (Rogers & Stocken, 2005). Such opportunistic behavior by managers may not be entirely transparent to external observers. To the extent that analysts cannot entirely unravel manipulations in reported earnings, earnings management can make it more difficult for analysts to issue accurate forecasts.

This study examines whether the implementation of ERP systems by firms helps them improve the information environment for equity analysts, such that earnings forecasts for firms became more accurate after ERP implementation, relative to prior periods. The information environment consists of publicly available information, including quarterly and annual financial statements, regulatory filings with the Securities and Exchange Commission, macroeconomic reports, and others, which generally tend to be based on historical data. It also includes privately generated information from interviews, surveys, macroeconomic forecasts, and other research conducted by

the analysts themselves. Firms can greatly enhance this environment by voluntarily releasing firm- and industry-specific information that is more up to date. To the extent that ERP tools help firms gather and process information efficiently, firms should be able to provide better guidance to financial analysts after ERP implementation, relative to prior periods.

RESEARCH DESIGN

Our research design relies on a time-series regression analysis using a dummy variable to distinguish time periods before and after ERP implementations. We employ this design in preference over cross-sectional matched sample tests to reduce the effect of measurement errors arising from a lack of ERP implementation data for firms outside our sample. Text based keyword searches are not a reliable method of identifying firms that do not have ERP systems in a given year. As more and more firms implement ERP systems over time, as the majority of firms did for competitive reasons, measurement error was expected to grow rapidly during the 1990s. To illustrate, by 1999, 70% of Fortune 1000 firms (most firms in our sample are large firms) had either adopted or were in the process of implementing ERP systems. As such, there would be a low likelihood of finding appropriate matched firms without ERP systems in the latter part of our sample period. For this reason, we avoid cross-sectional designs for our tests and instead rely on ordinary least square regression with a time-based dummy variable. The dummy variable equals 0 in time periods preceding ERP implementation, and 1 otherwise. The main advantage of this design is that firms in the sample serve as their own control groups.

Our main dependent variables are forecast accuracy and the standard deviation of analyst forecasts. Forecast accuracy is defined as the negative of the absolute value of analyst forecast error, deflated by beginning of period stock price.

$$\text{Forecast accuracy} = -(|EPS_t - AF_t|) / P_t$$

Where, EPS_t = Earnings per share in quarter t
AF_t = median analyst forecast of EPS_t for quarter t
P_t = Price per share in the beginning of quarter t

We define standard deviation of analyst forecasts as the inter-analyst standard deviation of EPS forecasts, deflated by stock price at the beginning of the quarter.

Our control variables are consistent with Lang and Lundholm (1996). Prior studies noted below have shown that these variables are associated with analyst following and firm disclosure policy, which in turn are associated with forecast accuracy and standard deviation of analyst forecasts.

Market Value	= the market value, in $ billions, of the firm's equity at the beginning of the quarter.
Std. Dev. Of ROE	= the historical standard deviation of return on equity (ROE) computed over the preceding ten quarters.
Return-Earnings Correlation	= the historical correlation between quarterly returns and earnings computed over the preceding ten quarters.

Earnings Surprise = the absolute value of the difference between the current quarter's earnings per share and last year's same quarter earnings per share, divided by the price at the beginning of the fiscal quarter.

Market value is a proxy for firm size. Larger firms have been shown to have larger analyst following (Bhushan, 1989; Brennan & Hughes, 1991), more extensive media coverage, and better disclosure policies (Waymire, 1986; Lang & Lundholm, 1993). Analyst forecast accuracy will be positively correlated with market value (Lang & Lundholm, 1996).

The standard deviation of ROE is a proxy for performance variability. There is weak evidence that analysts are more likely to follow firms with low performance variability (Lang & Lundholm, 1996), suggesting that firms with high performance variability have inferior disclosure environments. Analyst forecast accuracy will be weakly associated with performance variability (Lang & Lundholm, 1996).

The incentives for private information acquisition will be greater when the returns-earnings correlation is high because it is easier to forecast future stock price based on earnings forecasts (King, et al., 1990). However, counter to this intuition, Lang and Lundholm (1996) find a weak, negative association between analyst forecast accuracy and returns-earnings correlations.

Earnings surprise is included as a control variable because analyst forecast accuracy is likely to be affected by the magnitude of earnings information (Lang & Lundholm, 1996). For example, if a firm introduces a new product, then realized earnings are likely to deviate substantially from expected earnings. Earnings surprise will be negatively associated with analyst forecast accuracy.

SAMPLE SELECTION

We obtain our sample of ERP system implementations from a proprietary database supplied by a leading international provider of ERP systems. The database contains the names of firms that implemented the ERP system and the dates on which the system went live. We start with 315 unique firms with ticker symbols, CUSIP, and PERMNO in the database that implemented ERP systems between 1994 and 1999.

From Compustat we get 377,341 firm-quarter observations for the period 1991 through 2004. We chose this period because we needed at least 12 quarters of data before the first ERP implementation date and 12 quarters of data beyond the last ERP implementation date. We merged this data with returns data from CRSP and dropped observations with missing values. We were left with 252,866 firm-quarter observations. Then we combined this data with our ERP implementation data and dropped observations with missing values. That left us with 21,229 firm-quarter observations. Finally, we merged analyst forecast data from IBES and limited the observations to plus or minus 3 years from the ERP implementation dates. That left us with 1885 firm-quarter observations to estimate our regressions.

RESULTS

Table 1 shows descriptive statistics for the variables used in our regressions for the periods both before and after the completion of ERP implementation. Variable definitions are provided in Appendix 1. Forecast accuracy has been defined as the negative of the absolute forecast error, deflated by stock price, in order to ensure that a higher value indicates a more accurate forecast. A forecast accuracy of zero is the most accurate. A univariate comparison of mean forecast accuracy (Table 1, Panel A versus Panel B) demonstrates that analyst forecasts become less accurate in the period immediately following ERP implementations. However, a univariate analysis does not reliably explain the change in forecast accuracy because it may be driven by other variables, creating a correlated, omitted variable problem. Therefore, we carry out multivariate regressions to study the relation between our dependent and independent variables.

TABLE 1. DESCRIPTIVE STATISTICS

Panel A. After completion of ERP Implementation:

Variable	N	Mean	Std. Dev.	Median	Min.	Max.
Forecast accuracy	932	-0.3746	0.8333	-0.1023	-9.0275	0
Std. dev. fcast acc	883	0.0021	0.0039	0.0008	0	0.06161
Market value	929	18.911	55.901	16.160	-33.152	600.627
Std. dev. ROE	932	-0.4817	1.6680	-0.0786	-10.1727	0.5123
Ret-earn corr	932	-0.0313	0.2824	0.0058	-0.8828	0.7649
Earn surprise	932	-0.0183	0.0600	-0.0175	-0.5172	0.8921
Disc accrual	743	0.0021	0.0388	0.0012	-0.1713	0.3616

Panel B: Before completion of ERP Implementation:

Variable	N	Mean	Std. Dev.	Median	Min.	Max.
Forecast Accuracy	966	-0.2770	0.6171	-0.0821	-7.4189	0
Std. dev. fcast acc	915	0.0019	0.0071	0.0008	0	0.1959
Market Value	958	9.4897	22.5030	1.6288	-17.8490	166.0252
Std. dev. ROE	966	-0.1317	0.2640	-0.0887	-2.4199	0.3983
Ret-earn corr	966	-0.0349	0.2806	-0.0073	-0.8359	0.7280
Earn surprise	964	-0.0151	0.0372	-0.0122	-0.2837	0.4447
Disc accrual	691	-0.0028	0.0441	-0.0016	-0.5473	0.2413

Table 2 shows correlations between the dependent and independent variables used in this study. In our sample, forecast accuracy is positively correlated with firm size and the standard deviation of return on equity, but negatively correlated with the return-earnings correlation and earnings surprise in the period following ERP implementation. These results are generally consistent with those of Lang & Lundholm, (1996).

TABLE 2. PEARSON (ABOVE)/SPEARMAN (BELOW) CORRELATIONS

Panel A. After completion of ERP Implementation:

Variable	Forecast Accuracy	Std. dev. fcast acc	Market Value	Std. dev. ROE	Ret-earn corr	Earn surprise	Disc accrual
Forecast Accuracy	1	**-0.6229**	**0.1353**	**0.1498**	**-0.0685**	**-0.2752**	0.0551
Std. dev. fcast acc	**-0.5904**	1	**-0.1460**	-0.0498	**0.0935**	**0.1403**	-0.0553
Market Value	**0.3871**	**-0.3811**	1	**-0.2349**	-0.0089	**-0.0799**	0.0008
Std. dev. ROE	**-0.0929**	**0.1009**	**-0.1062**	1	**0.0976**	-0.0126	-0.0120
Ret-earn corr	-0.0531	**0.1045**	-0.0357	0.0248	1	**0.0605**	0.0219
Earn surprise	**-0.2077**	**0.1660**	**-0.2071**	**0.1263**	**0.1008**	1	-0.0097
Disc accrual	**0.0915**	**-0.0751**	0.0387	0.0182	0.0564	-0.0521	1

Panel B: Before completion of ERP Implementation:

Variable	Forecast Accuracy	Std. dev. fcast acc	Market Value	Std. dev. ROE	Ret-earn corr	Earn surprise	Disc accrual
Forecast Accuracy	1	**-0.3134**	**0.1145**	-0.0358	**-0.0995**	**-0.2371**	**0.1102**
Std. dev. fcast acc	**-0.5726**	1	**-0.0625**	0.0475	**0.0299**	**0.3230**	-0.0797
Market Value	**0.3136**	**-0.2760**	1	-0.0112	**-0.0884**	-0.0438	0.0108
Std. dev. ROE	-0.0353	0.0309	**-0.0913**	1	0.0497	0.0364	-0.0291
Ret-earn corr	**-0.1026**	**0.1589**	**-0.1475**	-0.0082	1	0.0506	-0.0192
Earn surprise	**-0.0996**	**0.1551**	**-0.1174**	**0.0865**	0.0523	1	-0.0423
Disc accrual	**0.0681**	-0.0517	0.0226	-0.0052	-0.0287	**-0.0893**	1

Bold: Significant at the 10% level or better

Our main results are shown in Table 3, where we present the results of a regression of analyst forecast accuracy on the ERP dummy and control variables.

$$\text{Forecast accuracy} = b_0 + b_1\,(\text{ERP dummy}) + b_2\,\text{Lagged market value} + b_3\,\text{Standard deviation of ROE} + b_4\,\text{Return-earnings correlation} + b_5\,\text{Earnings surprise} + e \quad (1)$$

A negative sign on the ERP dummy coefficient indicates that analyst forecast accuracy decreased after ERP implementation compared to periods immediately preceding the implementation. These results hold even when we control for discretionary accruals. Discretionary accruals are estimated as the absolute value of the residual from the modified Jones model (Dechow et al., 1995). We report t-statistics and p-values based on robust standard errors to control for firm clustering effects (Petersen, 2009).

TABLE 3. REGRESSION OF ANALYST FORECAST ACCURACY

	Panel 1			Panel 2		
Variable	Coefficient	t-stat	p-value	Coefficient	t-stat	p-value
Intercept	**-0.3476**	-6.78	<.0001	**-0.3518**	-6.48	<.0001
ERP	**-0.1008**	-2.26	0.0266	**-0.0953**	-1.86	0.0665
Market Value	**0.0024**	3.27	0.0016	**0.0024**	3.24	0.0018
Std. dev. ROE	**0.0914**	1.91	0.0592	**0.0982**	1.77	0.0805
Ret-earn corr	**-0.1928**	-2.26	0.0265	**-0.2656**	-2.58	0.0117
Earn surprise	**-3.6434**	-3.16	0.0022	**-3.0660**	-3.6	0.0006
Disc. Accrual				**1.3762**	3.2	0.002
No. of observations	1885			1425		
R-sqr	0.1098			0.1034		

Standard errors are clustered by firm

Bold: Significant at the 10% level or better

Forecast accuracy is positively correlated with market value. This was to be expected because larger companies have better information environments, larger analyst following, and more accurate analyst forecasts. Analyst forecast accuracy is positively correlated with the standard deviation of ROE, contrary to the findings of Lang & Lundholm (1996) who found only a weak, negative relation between forecast accuracy performance variability.

Forecast accuracy is negatively correlated with the return-earnings correlation, consistent with Lang and Lundholm (1996), and suggesting that earnings do a relatively poor job of capturing value relevant information about the stock. Similarly, forecast accuracy is negatively correlated with earnings surprise, indicating that analysts find it harder to make accurate forecasts when the level of earnings is significantly different from the previous period. These results are consistent with Lang and Lundholm (1996).

In Panel 2 of Table 3, we control for the ability of companies to manage earnings by including a variable for discretionary accruals. Earnings management can help make analyst forecasts more accurate if it is used as a mechanism to smooth earnings and provide better management guidance. On the other hand, opportunistic behavior by management can make it more difficult for analysts to make accurate forecasts. In our sample, analyst forecast accuracy is positively correlated with discretionary accruals.

We also test the effect of ERP implementation on the standard deviation of analyst forecasts. In Table 4, we present the results of a regression of the standard deviation of analyst forecasts on the ERP dummy and control variables. The ERP dummy variable is positive and significant only when we control for discretionary accruals. The results suggest that the standard deviation of analyst forecasts increases in the period following ERP implementations. This result is consistent with the results in Table 3, as the standard deviation of analyst forecasts is expected to be negatively correlated with analyst forecast accuracy (see Table 2). As such, all coefficients in Table 4, Panel 2 have the opposite sign when compared to Table 3.

TABLE 4. REGRESSION OF STANDARD DEVIATION OF ANALYST FORECASTS

	Panel 1			Panel 2		
Variable	Coefficient	t-stat	p-value	Coefficient	t-stat	p-value
Intercept	**0.0025**	4.72	<.0001	**0.0019**	7.84	<.0001
ERP	0.0004	1.58	0.1180	**0.0007**	2.25	0.0275
Market Value	**-0.00001**	-2.62	0.0104	**-0.00001**	-3.13	0.0025
Std. dev. ROE	-0.0002	-1.1	0.2746	-0.0003	-1.49	0.1407
Ret-earn corr	0.0008	1.13	0.2612	**0.0014**	2.26	0.0265
Earn surprise	**0.0335**	1.86	0.0671	**0.0132**	2.19	0.0315
Disc. Accrual				**-0.0051**	-3.23	0.0018
No. of observations	1785			1359		
R-sqr	0.06516			0.0770		

Standard errors are clusted by firm

Bold: Significant at the 10% level

ROBUSTNESS TESTS

We test the robustness of our results by arbitrarily shifting the pre-/post- ERP implementation (pseudo-event) window both backward by one year, and forward by one and two years. We expect to see no effect of ERP adoption across the pseudo-events. The results are shown in Tables 5 and 6. When the pre-/post- event window is shifted backward by one year, when ERP was yet to be implemented, the dummy variable is not statistically significant, as expected. However, when we shift the pre-/post- event window forward by one year, the dummy variable is negative and significant, suggesting that the effects of ERP adoption persist for a period of time after ERP implementation as firms transition to a new accounting environment. When we shift the pre-/post- event window forward by two years, the effects of ERP implementation go away. Collectively, these results suggest that the observed changes in analyst forecast accuracy is related to ERP implementation rather than some other uncontrolled events.

TABLE 5. ROBUSTNESS TEST: REGRESSION OF ANALYST FORECAST ACCURACY

	Pseudo event = 1 year earlier than actual ERP implementation			Pseudo event = 1 year later than actual ERP implementation			Pseudo event = 2 years later than actual ERP implementation		
Variable	Coefficient	t-stat	p-value	Coefficient	t-stat	p-value	Coefficient	t-stat	p-value
Intercept	**-0.405**	-7.2	<.0001	**-0.350**	-5.92	<.0001	**-0.4052**	-6.14	<.0001
ERP	0.003	0.07	0.9478	**-0.126**	-1.88	0.0644	-0.0401	-0.45	0.6554
Market Value	**0.002**	2.63	0.0102	**0.003**	2.89	0.005	**0.0023**	2.69	0.0087
Std. dev. ROE	0.142	1.43	0.158	0.080	1.49	0.1392	0.0676	1.4	0.1643
Ret-earn corr	-0.278	-3.37	0.0012	**-0.217**	-1.76	0.0824	-0.1843	-1.46	0.1486
Earn surprise	-4.304	-3.96	0.0002	**-2.525**	-2.85	0.0056	**-3.1193**	-2.26	0.0267
Disc. Accrual	0.221	0.59	0.5589	0.632	1.24	0.2203	-0.1161	-0.25	0.8028
No. of observations	1499			1398			1493		
R-sqr	0.09975			0.0741			0.08006		

Standard errors are clustered by firm

Bold: Significant at the 10% level or better

TABLE 6. REGRESSION OF STANDARD DEVIATION OF ANALYST FORECASTS

	Pseudo event = 1 year earlier than actual ERP implementation			Pseudo event = 1 year later than actual ERP implementation			Pseudo event = 2 years later than actual ERP implementation		
Variable	Coefficient	t-stat	p-value	Coefficient	t-stat	p-value	Coefficient	t-stat	p-value
Intercept	**0.0024**	6.52	<.0001	**0.0021**	6.97	<.0001	**0.0024**	6.52	<.0001
ERP	0.0008	1.42	0.1584	**0.0008**	1.81	0.0737	0.0008	1.42	0.1584
Market Value	**-0.00001**	-2.47	0.0154	**-0.00001**	-2.7	0.0084	**-0.00001**	-2.47	0.0154
Std. dev. ROE	-0.0002	-0.81	0.4221	-0.0002	-1.14	0.2591	-0.0002	-0.81	0.4221
Ret-earn corr	**0.0017**	1.69	0.0952	**0.0014**	1.75	0.0843	**0.0017**	1.69	0.0952
Earn surprise	**0.0182**	1.79	0.0773	0.0102	1.61	0.1121	**0.0182**	1.79	0.0773
Disc. Accrual	0.0004	0.11	0.9095	-0.0018	-0.65	0.5157	0.0004	0.11	0.9095
No. of observations	1408			1328			1408		
R-sqr	0.0572			0.04844			0.0572		

Standard errors are clustered by firm

Bold: Significant at the 10% level or better

CONCLUSION

Previous studies have shown that ERP systems gather and process information more efficiently and accurately, resulting in an improved internal information environment for firms that implement ERP systems. This enables management at these firms to provide guidance that is more accurate to security analysts. However, there is evidence to suggest that ERP systems enable firms to engage in greater earnings management (Brazel & Dang, 2008). Hence, whether or not ERP systems result in a better external information environment is an empirical question.

The results of this study show that analyst forecast accuracy decreased and the standard deviation of analyst forecasts increased in the years following ERP implementation. These results hold even after we control for discretionary accruals. It appears that the information environment for equity analysts has worsened after ERP implementations, even as management forecasts have become more accurate over the same period.

REFERENCES

Aboody, D. & Kasznik, R. (2000). CEO stock option awards and the timing of corporate voluntary disclosures. *Journal of Accounting and Economics*, *29*(1), 73 – 100.

Bhushan, R. (1989). Firm characteristics and analyst following. *Journal of Accounting and Economics, 11*(July), 255–274.

Brazel, J. F., & Agoglia, C. P. (2007). An examination of auditor planning judgements in a complex accounting information system environment. *Contemporary Accounting Research 24*(4), 1059–1083.

Brazel, J. F., & Dang, L. (2008). The effect of ERP System implementations on the management of earnings and earnings release dates. *Journal of Information Systems*, *22*(2), 1–21.

Brennan, M., & Hughes, P. (1991). Stock prices and the supply of information. *Journal of Finance 46*(December), 1665–1691.

Davenport, T. (1998). Putting the enterprise into the enterprise system. *Harvard Business Review 76*, 121–131.

Dechow, P. M., Sloan, R. G., & Sweeney, A. P. (1995). Detecting earnings management. *The Accounting Review 70*(April): 193–225.

Dillon, C. 1999. Stretching towards enterprise flexibility with ERP. *APICS – The Performance Advantage* (October), 38–43.

Hayes, D. C., Hunton, J. E., & Reck, J. L. (2001). Market reaction to ERP implementation announcements. *Journal of Information Systems, 15*(1), 3–18.

Hitt, L. M., Wu, D. J., & Zhou, X. (2002). Investment in enterprise resource planning: Business impact and productivity measures. *Journal of Management Information Systems, 19*(1), 71–98.

Hunton, J. E., Lippincott, B., & Reck, J. L. (2003). Enterprise resource planning systems: Comparing firm performance of adopters and nonadopters. *International Journal of Accounting Information Systems, 4*(3): 165–184.

King, R., Pownall, G. & Waymire, G. (1990). Expectations adjustments via timely management forecasts: Review, synthesis and suggestions for future research. *Journal of Accounting Literature 9*, 113–144.

Kumar, K., & Hillegersberg, J. V. (2000). ERP experiences and evolution. *Communications of the ACM, 43*(4), 22-26.

Lang, M. H. & Lundholm, R. J. (1993). Cross-sectional determinants of analyst ratings of corporate disclosures. *Journal of Accounting Research, 31*(Autumn), 246–271.

Lang, M. H. & Lundholm, R. J. (1996). Corporate disclosure policy and analyst behavior. *The Accounting Review, 71*(4), 467–492.

O'Leary, D. E. (2000). *Enterprise resource planning systems: Systems, life cycle, electronic commerce, and risk.* Cambridge University Press.

Park, C. W. & Stice, E. K. (2000). Analyst forecasting ability and the stock price reaction to forecast revisions. *Review of Accounting Studies, 5*(2000), 259–272.

Petersen, M. (2009). Estimating standard errors in finance panel data sets: Comparing approaches. *Review of Financial Studies, 22*(1), 435–480.

Rogers, J. L., & Stocken, P. C. (2005). Credibility of management forecasts. *The Accounting Review, 80*(4), 1233–1260.

Waymire, G. (1996). Additional evidence on the accuracy of analyst forecasts before and after voluntary management earnings forecasts. *The Accounting Review,* 59(January), 129–142.

Wright, S. & Wright, A. M. (2002). Information system assurance for Enterprise Resource Planning systems: Unique risk considerations. *Journal of Information Systems, 16*(s-1), 99–113.

APPENDIX 1

Variable definitions:

ERP:	An indicator variable that is equal to one for years following ERP implementation, and zero otherwise.
Forecast Accuracy:	The negative of the absolute value of the analyst forecast error deflated by stock price, multiplied by 100 (to convert to %).
Market Value:	Market value of outstanding equity at the beginning of the quarter in billions of dollars.
Std. dev. ROE:	Standard deviation of return on equity (ROE) over prior 10 quarters
Ret-earn corr:	Market adjusted return-earnings per share correlation over prior 10 quarters.
Earn surprise:	The absolute value of the difference between the current quarter's earnings per share and last quarter's earnings for share, divided by the price at the beginning of the quarter.
Disc. Accrual:	Discretionary accruals in the prior quarter, estimated as the residual of the Modified Jones model.
Std. dev. fcast acc:	Standard deviation of accuracy of analyst forecasts.

THE UNIVERSITY OF TENNESSEE MARTIN
COLLEGE OF BUSINESS AND GLOBAL AFFAIRS

JOURNAL OF INTERNATIONAL BUSINESS DISCIPLINES
www.jibd.org

The International Academy of Business Disciplines

Volume 16, Number 2 November 2021

Published By:
University of Tennessee at Martin and the International Academy of Business Disciplines

ISSN 1934-1822 WWW.JIBD.ORG