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The effect of Customer Relationship Management systems on firm performance☆,☆☆

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1. Introduction

The extant literature does not thoroughly investigate the benefits of Customer Relationship Management (CRM) systems. CRM systems are different from enterprise resource planning (ERP) and supply chain management (SCM) systems in that they focus on relationships with customers. Therefore, it could be argued that CRM systems can have the greatest effect on firm performance. Thus far, the research finds evidence that CRM systems do improve customer satisfaction (Mithas et al., 2005), but implementing CRM systems does not improve stock returns or profitability (Hendricks et al., 2007). This raises the question: If there are no measurable benefits achieved while implementing CRM systems, then why do companies continue to invest heavily in them?

CRM is a strategic approach to marketing that focuses on developing and maintaining appropriate relationships with customers often with the aid of information technology (IT), or CRM systems (Payne and Frow, 2005). In their attempts to define what CRM is, Payne and Frow (2005) state that, "CRM provides enhanced opportunities to use data and information to both understand customers and cocreate value with them. This requires a cross-functional integration of processes, people, operations, and marketing capabilities that is enabled through information, technology, and applications." Simply put, the purpose of CRM is to develop and maintain relationships with customers. This notion is supported by Coltman et al. (2011) and Krasnikov et al. (2009), as these papers show that implementing CRM management philosophies positively affects performance. However, the literature looking specifically at CRM systems is lacking in conclusive results.

Vendors that sell CRM systems boast of the numerous benefits that these systems provide such as improving profitability, customer satisfaction, sales productivity, and sales predictability (Taber, 2013). Given these benefits, it is not surprising that companies were forecasted to spend $23.9 billion on CRM systems in 2014 (Gartner, 2014). However, it is surprising that the academic literature identifies few tangible benefits of CRM systems given the large investments and capabilities of the systems. It is possible that many companies overestimated the benefits of CRM systems, underutilized their CRM systems, inadequately trained their company staff to use CRM systems, or simply received too much information from their CRM systems (Taber, 2014).

☆ Data availability: The data used are publicly available from the sources cited in the text.

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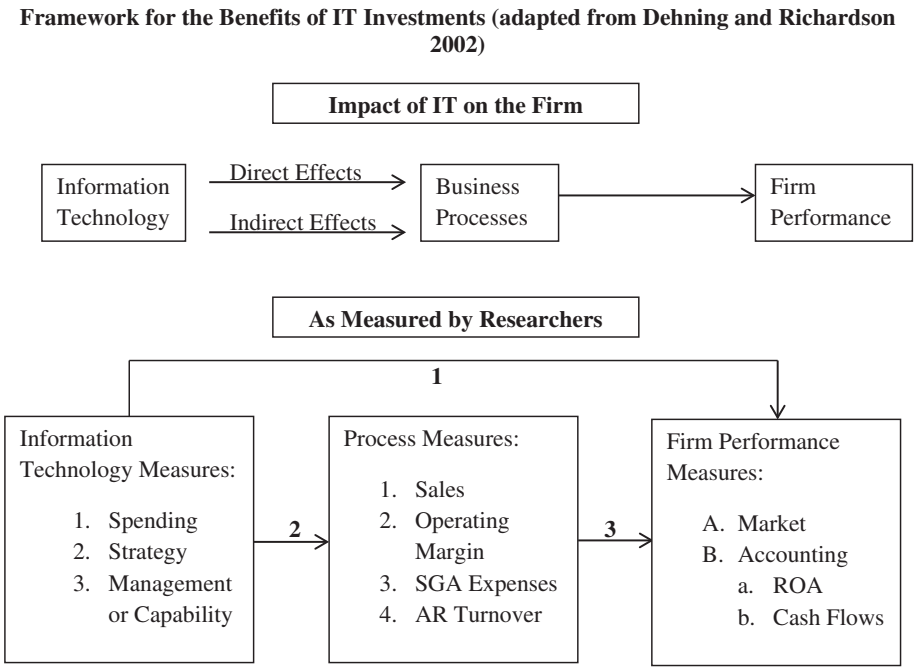

Fig. 1. Framework for the Benefits of IT Investments.
(adapted from Dehning and Richardson, 2002)

Mithas et al. (2005) find that customer knowledge increases following CRM system implementation. Similarly, other studies find that following CRM system implementation, customer satisfaction and retention improves (Boulding et al., 2005; Sutton and Klein, 2003). Conversely, other studies argue that not all customers value a relationship with firms; therefore, improving customer satisfaction does not necessarily lead to better firm performance (Danaher et al., 2008; Dowling, 2002). This notion is supported by Hendricks et al. (2007) who find no association between CRM system implementation and stock returns or firm profitability. However, given the numerous features of CRM systems, continuous, material investments by CRM adopters and the benefits for customers, we predict that there must be some measurable benefits for the firms that choose to implement them.

In examining the potential advantages of CRM system implementation, we utilize Fig. 1, adapted from Dehning and Richardson (2002) that highlights the path from IT investment to financial performance. Prior literature focuses on path number 1, or the direct effect that IT has on firm performance measures. Further, while prior literature utilizes market measures to examine firm performance, our study focuses on accounting measures of firms' performance as it is not clear that the market will respond directly to CRM system implementation, but rather to the improvements to accounting performance. While we expect that CRM system implementation will ultimately improve firm performance, we argue that one way to assess its impact is to examine whether CRM systems improve business process measures (path number 2 in Fig. 1). We argue that CRM implementation represents changes to all three IT Measures (spending, strategy, and management or capability) though the most obvious is IT spending. We also argue that a sole focus on direct performance measure improvement may be the reason why prior literature finds mixed results regarding the benefits of CRM system implementation (Hendricks et al., 2007). Therefore we first examine the effects that CRM systems have on all of the business process measures included in Fig. 1.

Based on the benefits mentioned by Taber (2013), we first examine whether CRM system implementation improves sales, sales efficiency (operating margin and selling, general, and administrative (SGA) expenses), and the ability to collect accounts receivable. Given that a primary objective of CRM system implementation is to gain new customers (Payne and Frow, 2005), CRM system implementers should be associated with an increase in sales. In addition to operational performance, we consider efficiency in supporting customer sales by examining how CRM system implementations affect selling, general, and administrative (SGA) expenses. CRM systems may allow firms to spend less in expenses for each sale made.

Prior literature finds a positive relationship between CRM system implementation and customer satisfaction (Boulding et al., 2005; Sutton and Klein, 2003). We test this from a different perspective by examining the effect of CRM system implementation on accounts receivable. If customers are more satisfied with the firm, and if communication is improved between the firm and customers due to better tracked information regarding outstanding bills, then the firms implementing CRM should be more effective at collecting accounts receivable. Therefore, we expect that accounts receivable collectability will improve following CRM system implementation.

Finally, we examine whether CRM system implementation improves overall firm performance measures (path 1 of Fig. 1), specifically return on assets (ROA) and cash flows from operations. In addition, to test if CRM systems actually help facilitate forecasting of future sales and by extension the forecasting of earnings, we examine whether the accuracy of management earnings forecasts

improves following CRM system implementation.

To perform these tests, we identify a sample of 95 CRM system implementations using press releases from both CRM system vendors and firms implementing the systems. We identify CRM system implementations that occurred between 2001 and 2011. The sample begins in 2001 because many firms before this point were also implementing enterprise systems alongside CRM systems, and we are focused on firms that are only implementing CRM systems. The sample ends in 2011, as the implementation of CRM systems in large public firms begins to decrease around this time. Compared to a control sample, identified using a similar method to Hendricks et al. (2007), we find that firms that implement CRM systems experience significant improvements in all of the areas suggested by Taber (2013).

First, we find that CRM system implementation improves business processes. Compared to the control group, firms that implement CRM systems experience greater improvements in sales. This finding is consistent with the expectation that CRM systems assist in both developing and maintaining relationships with customers (Payne and Frow, 2005). Next, we also find that firms that implement CRM systems improve their sales efficiency. We specifically find that firms that implement CRM systems improve their operating margins. We also find that these firms reduce SGA expenses as a percentage of both sales and assets. Therefore it appears that firms that implement CRM systems spend less per dollar of sales, thus improving operating efficiency. We also find that receivables collectability improves following CRM system implementation. We find that following CRM system implementation, firms report a reduction in the allowance for doubtful accounts. This may be a less direct measure of customer satisfaction than the measures used in the extant literature (Mithas et al., 2005), but it does provide evidence of another operational component that CRM systems improve. This finding suggests that CRM systems either improve customer satisfaction sufficiently enough that customers are more likely to pay on their accounts or improve the firm's ability to collect receivables. Overall, we find evidence to support path 2 in Fig. 1.

We next examine whether CRM system implementations impact firm performance measures.[1] Similar to our findings related to sales we find that following CRM system implementations firms report better operational performance, measured by ROA and cash flows from operations. Finally, while not within the framework of Fig. 1, we do find evidence that following CRM system implementation, firms issue more accurate earnings forecasts. This result suggests the CRM systems improve sales predictability.[2]

This study specifically contribute to the literature that investigates the benefits of CRM. Thus far, the extant literature finds that firms that implement CRM systems experience improved customer satisfaction and retention (Boulding et al., 2005; Sutton and Klein, 2003). Additionally, Mithas et al. (2005) find that CRM systems can improve customer knowledge. We contribute to this stream of literature, because thus far there is no empirical evidence supporting the notion that CRM systems actually improve operational performance.

This study should be of particular interest to firms interested in implementing CRM systems and the vendors that sell them. As far as we are aware, this study is the first to document empirical evidence of the operational benefits firms enjoy following the implementation of CRM systems. We document the specific areas where firms see improvement following implementation of CRM systems. This study should assist firms in deciding whether a CRM system will be a good fit for their needs. We also provide support for the various features that CRM system vendors tout about their products, suggesting that these claims may be accurate.

We organize the remainder of the paper as follows. First, we develop our hypothesis, which includes a review of relevant literature. Second, we describe our sample and research design. Finally, we discuss the results and provide a conclusion to the study.

2. Background and hypothesis development

Payne and Frow (2005, 168) define CRM as follows:

> "CRM is a strategic approach that is concerned with creating improved shareholder value through the development of appropriate relationships with key customers and customer segments. CRM unites the potential of relationship marketing strategies and IT to create profitable, long-term relationships with customers and other key stakeholders. CRM provides enhanced opportunities to use data and information to both understand customers and cocreate value with them. This requires a cross-functional integration of processes, people, operations, and marketing capabilities that is enabled through information, technology, and applications."

CRM itself is a strategy firms use to develop and improve relationships with customers. This strategy is most often associated with the implementation of a CRM system. Overall, customers and managers appear to be happy with CRM systems, as the extant literature, using information gathered from surveys, documents that CRM systems improve customer knowledge, satisfaction, and retention (Boulding et al., 2005; Mithas et al., 2005; Sutton and Klein, 2003). However, other papers argue that these improvements may not lead to benefits for a firm because customers do not necessarily desire or value strong relationships (Danaher et al., 2008; Dowling, 2002). Therefore, it is not that surprising that the extant literature fails to empirically document any operational benefits of CRM system implementation (Hendricks et al., 2007). However, we predict that there are specific business process areas that are positively impacted by CRM system implementation.

The primary focus of most of the ES literature is on how IT can improve profitability (Dehning et al., 2007; Dehning and

[1] For the tests of firm performance measures, we do not differentiate if the improvements are a result of path 1 or path 3 in Fig. 1.

[2] We recognize that our sample period includes a time in which firms were making many IT improvements such as ERP implementations. Therefore, in untabulated analysis we add an additional control variable for IT spending for those observations that we have available data from Information Week. We do not find this variable to be associated with our dependent variables in our models.

Richardson, 2002; Hendricks et al., 2007; Hitt et al., 2002; Kallunki et al., 2011; Nicolaou and Bhattacharya, 2006). This study is similar in that we also investigate how IT can improve profitability for firms. However, this study differs in that it focuses specifically on CRM systems, as opposed to ERP or SCM systems. If CRM systems aid firms in developing and maintaining relationships with customers, then these firms should experience increases in profitability. It is unclear, however, if the increase in profitability should be due to an increase in revenue (from making cross sales to current customers or finding new customers), a reduction of expenses, or a combination of both. In behavioral studies, researchers find that CRM systems improve customer happiness, leading to greater customer knowledge, satisfaction, and retention (Boulding et al., 2005; Mithas et al., 2005; Sutton and Klein, 2003). We predict that it requires less effort to make sales to a customer who is already happy with your firm. In their definition of CRM, Payne and Frow (2005, p. 168) state that "CRM provides enhanced opportunities to use data and information to both understand customers and cocreate value with them." This ability to better understand customers should allow firms with CRM systems to utilize more efficient credit terms, and better identify customers that will be able to pay their accounts. This should improve the overall accounts receivable process and reduce non-payment instances. We therefore first focus on the potential of CRM systems to directly improve business process measures (path 2 in Fig. 1). Therefore, we predict that CRM system implementation will directly improve sales, sales efficiency, and accounts receivable collectability. Specifically, our first hypothesis is as follows:

Hypothesis 1. Firms that implement CRM systems improve their business process measures to a greater degree than firms that do not implement CRM systems.

We next examine whether CRM system implementations improve operational performance measures, either directly or indirectly. Vendors of CRM systems specifically list increasing profitability as a primary benefit of implementing CRM systems (Taber, 2013); however, thus far the extant literature fails to document any empirical evidence supporting this claim (Hendricks et al., 2007). We argue that regardless of which business processes are improved by CRM system implementation (increases in sales or decreases in SGA expenses, for example), there should be some improvement in operational performance (path 1 in Fig. 1). Specifically, our second hypothesis is as follows:

Hypothesis 2. Firms that implement CRM systems improve operational performance to a greater degree than firms that do not implement CRM systems.

The final potential benefit that Taber (2013) identifies regarding CRM system implementation is sales predictability. This particular test is outside the scope of the framework in Fig. 1, but we argue that it is another process suggested by Taber (2013) that is worth exploring. Prior literature suggests that effective IT improves information flows to management (Haislip and Richardson, 2016). Haislip and Richardson (2016) also show that improvements to the information environment through better IT leads to more accurate earnings forecasts. Further, as mentioned earlier, CRM systems provide better information for management regarding their customers (e.g., what they have bought, what they have ordered, what they have paid for, etc.). Therefore, CRM systems should be the IT that most improves earnings forecast accuracy as they should improve the quality of information directly related to sales, arguably the foundation for any earnings forecast model. Similar to the evidence that ES provide critical information to assist managers in forecasting earnings (Dorantes et al., 2013), we predict that firms are able to better predict future sales following CRM implementation, as evidenced by their earnings forecasts. Specifically, our third hypothesis is as follows:

Hypothesis 3. Firms that implement CRM systems improve their sales predictability (as evidenced by management earnings forecasts) to a greater degree than firms that do not implement CRM systems.

3. Research design

To collect our sample we use Lexis-Nexis to search for press releases announcing the implementation of CRM systems. These announcements are usually either made by the CRM system vendor or the firm implementing the system. To identify the CRM system implementations, we search for the terms "CRM" or "Customer Relationship Management" and then read through each press release individually to ensure that it does indeed represent a new CRM system implementation, and not simply the adoption of a CRM management philosophy. We then identify the firm that is implementing the CRM system. Through this process we are able to identify 138 public firms that adopt a CRM system sometime during the years of 2001–2011. We then eliminate 51 of these observations because they either do not have the necessary data available to compute our financial variables in Compustat, or because we are unable to find an appropriate matching control firm. Therefore, we end with 87 CRM system implementers with the appropriate data available.

We follow Hendricks et al. (2007) in identifying our control sample. For each treatment firm we identify all firms that are within the same industry using the two-digit SIC code. We then identify all potential control firms with ROA within 90–110% the treatment firm in the year of the CRM system implementation announcement.[3] We develop these guidelines following Hendricks et al. (2007) and Barber and Lyon (1996), who emphasize the benefits of matching with a portfolio of firms. The authors of these papers document the importance of using a portfolio of firms for the comparison group, and that utilizing this method allows for well-specified and powerful test statistics. Using this method we end with a final sample of 1256 observations, 87 treatment observations and 1169

[3] We verify that ROA is not statistically significantly different between our treatment and control firms in year t-1, or the year prior to CRM system implementation for our treatment firms.

Table 1
Sample statistics.

Panel A: year distributions				
Year		CRM implementations	Control firms	All firms
2001		13	108	121
2002		22	304	326
2003		11	152	163
2004		13	288	301
2005		10	174	184
2006		11	89	100
2007		3	12	15
2008		1	13	14
2009		2	15	17
2010		0	0	0
2011		1	14	15
Total		87	1169	1256
Panel B: industry distributions				
Industry	2-digit SIC code	CRM implementations	Control firms	All firms
Chemicals	28–29	6	101	107
Electrical	36, 38	13	178	191
Equipment	35	5	39	44
Retail sales	50–59	9	37	46
Services	70–79	16	375	391
All others	All others	38	439	477
Total		87	1169	1256

control observations.[4] Panel A of Table 1 provides the distribution of the sample across time. It appears that CRM system implementations were more frequent in the early 2000s and taper off over time.[5] We assume that adoptions taper off because firms only adopt a CRM system once, and then make upgrades as needed. At this point in time most large public firms already use a CRM system, however in our data collection procedures we noted that many private firms continue to implement CRM systems. Therefore, while we are only able to investigate the changes that public firms experience following CRM system implementation, these results should be of interest to private firms that are still deciding whether they should implement CRM systems. Panel B of Table 1 provides an industry distribution of our sample. It appears that firms in service industries are the most common adopter of CRM systems, but the sample appears to be somewhat evenly distributed among all industries. Table 2 provides definitions for the variables used throughout the paper. Finally, Table 3 provides descriptive statistics for all of the observations in the pre-implementation period.[6] Table 3 shows that the observations in the treatment group are larger (based on assets) than the control group. For this reason, we do additional analysis in which we match our treatment observations with a control group based on size. See the Additional analysis section for further details.

We use a difference in differences approach to examine changes in performance measures over a four year period.[7] We essentially examine the change in our measures from year $t - 1$ (the year before the implementation announcement) to year $t + 2$ (the second year following the implementation announcement). We choose this time frame because prior literature suggests that CRM systems take approximately one year to fully implement (Hendricks et al., 2007). Therefore, year $t - 1$ is the last year before CRM system implementation begins, and year $t + 2$ is the first full year of operations with the CRM system implemented. This allows us to examine actual performance without the effects of any costs directly related to the CRM system implementation. Since our sample includes two years for each firm (the pre and post years), our final sample consists of 2512 observations, 174 treatment observations and 2338 control observations.

To examine how CRM systems potentially benefit firms, we investigate whether CRM system implementations affect a selection of performance variables. We therefore use the following OLS regression model to test our Hypotheses 1 and 2 (see Table 2 for variable definitions):

[4] Due to data restrictions, our sample is reduced to 342 for our tests of management earnings forecasts.

[5] Our number of control firms does not matchup 1 to 1 with our treatment firms, because as discussed we retain all possible control observations that meet the matching criteria. This is the preferred method used by Hendricks et al. (2007). Please see the Additional analysis section for alternative matching methodologies.

[6] Given the small sample size a number of the variables appear slightly skewed. For this reason we run a few alternative models to alleviate any concerns this creates. These variations include limiting the sample to firms that did not report a loss, winsorizing continuous variables, and finally running a generalized linear model as opposed to an ordinary least squares model. We arrive at similar results as those presented for these alternative models.

[7] We use a difference in differences approach because as discussed in Chabe-Ferret (2014) as long as the pre and post time periods are equal for both the treatment and control groups, there should be no concerns of selection bias. Further, it is possible that firms in the control group previously implemented CRM systems. Using a difference in differences approach allows us to focus on the improvements these firms make compared to firms not currently facing the implementation phase. Please see the Additional analysis section for further discussion.

Table 2
Variable definitions.

Panel A: dependent variable definitions

Variable	Definition
ROA	The return on assets calculated as net income before extraordinary items divided by total assets in year t.
Sales	The raw amount of sales in year t.
Sales Scaled	Sales scaled by total assets in year t.
CFO	Total cash flows from operations in year t.
CFO Scaled	Total cash flows from operations scaled by total assets in year t.
Oper Margin	The operating margin calculated as total operating income divided by sales in year t.
SGA	Total selling, general, and administrative expenses scaled by total sales in year t.
SGA Scaled	Total selling, general, and administrative expenses scaled by total assets in year t.
ARTurn	Accounts receivable turnover calculated as net sales divided by average accounts receivable in year t.
Doubtful	The allowance for doubtful accounts in year t.
Doubtful Scaled	The allowance for doubtful accounts scaled by sales in year t.
Abs_Error	The absolute value of the management forecast error (realized earnings less the management forecast) / lagged stock price.

Panel B: independent variable definitions

Variable	Definition
CRM	An indicator variable coded as one if the company is a CRM implementer and zero otherwise.
After	An indicator variable coded as one for observations that occur after the CRM implementation or the control year match and zero otherwise.
Size	The natural log of total assets in year t.
MTB	The market to book ratio calculated as the market value of equity divided by the book value in year t.
RD	Total research and development expenses scaled by sales in year t.
ADV	Total advertising expenses scaled by sales in year t.
CapInt	Capital intensity calculated as total assets divided by total sales in year t.
Loss	An indicator variable coded one if the firm reports a net loss in year t, and zero otherwise.
Leverage	Total liabilities divided by total assets in year t.
EarnVol	The standard deviation of ROA over the prior 10 years.
CFOVol	The standard deviation of operating cash flows over the prior 10 years.
Growth	Percentage of sales growth from year t − 1 to year t.
IndCon	The Herfindahl index in year t, measured as the sum of the squares of the market shares of all firms within the same three-digit SIC industry.
Big4	An indicator variable coded one if the firm engages a Big 4 auditor in year t, and zero otherwise.
LnAnalysts	The natural log of the number of analysts following the firm at the end of year t.
Std_AF	The standard deviation of the individual analyst forecasts for year t, immediately prior to the management forecast for year t.
News	The management forecast value less the pre-existing median analyst forecast scaled by lagged stock price.
Horizon	The number of days between the date of issuance for the management forecast and the fiscal year end date.
Litigation	An indicator variable coded one if the firm operates in an industry that is associated with increased litigation (SIC codes 2833–2836, 3570–3577, 7370–7374, and 3600–3674 following Francis et al., 1994) and zero otherwise.
High Tech	An indicator variable coded one if the firm operates in a high tech industry (as identified by Francis and Schipper, 1999), and zero otherwise.
Weak	An indicator variable coded one if the firm reports any material weaknesses in internal controls in year t, and zero otherwise.

Table 3
Descriptive statistics.

Variable	Treatment firms			Control firms		
	Mean	Standard deviation	Median	Mean	Standard deviation	Median
ROA	− 0.310	0.243	0.025	− 0.940	0.504	0.012
Sales	10,492.810	23,508.280	1382.202	1787.851	6538.702	103.209
CFO	1565.625	3809.304	144.521	358.033	1715.164	10.571
Oper Margin	− 0.084	1.651	0.135	− 0.572	8.666	0.170
SGA	0.319	0.396	0.267	0.524	1.723	0.300
ARTurn	11.428	17.783	5.956	13.791	42.847	6.053
Doubtful	129.121	310.342	8.630	19.013	96.354	1.114
Size	7.693	2.315	7.327	5.933	2.338	6.006
AT	21,300.360	46,372.800	1989.742	9670.119	76,847.300	502.915
MTB	3.393	7.688	2.559	1.880	45.684	2.003
RD	0.221	1.388	0.014	0.473	6.597	0.000
ADV	0.016	0.031	0.000	0.017	0.084	0.000
CapInt	2.781	5.654	1.250	9.191	76.227	1.731

$$[\text{Performance Measures}]_{i,t} = \lambda_0 + \lambda_1 CRM_{i,t} + \lambda_2 After_{i,t} + \lambda_3 CRM^{*}After_{i,t} + \lambda_4 Size_{i,t} + \lambda_5 MTB_{i,t} + \lambda_6 RD_{i,t-1} + \lambda_7 ADV_{i,t-1} + \lambda_8 ROA_{i,t-1} + \lambda_8 CapInt_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

For all of the models, we include year and industry fixed effects, and estimate robust standard errors clustered by firm following Petersen (2009).

Our variable of interest is the interaction of *CRM* and *After*. This coefficient (λ_3) should measure the effect of CRM system implementations during the post implementation year. We run the model numerous times using different Performance Measures as the dependent variable. For our first hypothesis, we are interested in direct measures of business process improvement. Therefore, we use *Sales*, *Sales Scaled*, *Oper Margin*, *SGA*, *SGA Scaled*, *ARTurn*, *Doubtful*, and *Doubtful Scaled* as our dependent variables for testing Hypothesis 1.[8] We expect λ_3 to be positive and significant for *Sales*,[9] *Sales Scaled*, *Oper Margin*, and *ARTurn*. We expect λ_3 to be positively related to *Oper Margin* because a larger operating margin indicates better operational efficiency. Essentially, the operating margin is a measure of what percentage of each dollar of sales becomes profit. We expect λ_3 to be positively associated with *ARTurn* because we expect firms to be able to more effectively and efficiently collect on their accounts receivable. We expect λ_3 to be negative and significant for *SGA*, *SGA Scaled*, *Doubtful*, and *Doubtful Scaled*.[10] We predict that CRM systems reduce the amount the companies will need to spend on SGA expenses to make sales. We expect λ_3 to be negatively associated with both of our allowance for doubtful accounts variables. These results would suggest that CRM systems positively impact our business process measures of sales, sales efficiency, and accounts receivable collectability.

For our second hypothesis, we are interested in measuring the effect of CRM systems on operational performance. We use *ROA*, *CFO*, and *CFO Scaled* as our dependent variables to test Hypothesis 2. We expect λ_3 to be positively associated with all of these dependent variables, indicating that CRM system implementations positively improve operational performance, either directly or indirectly (paths 1 and 3 in Fig. 1).

We include control variables based on prior literature that investigates firm performance (Campbell, 2015; Hendricks et al., 2007). We control for size (*Size*) and growth (*MTB*) factors that prior literature finds are associated with performance. Additionally, prior literature finds that prior performance is one of the greatest determinants of future performance, and therefore we include lagged values of *RD*, *ADV*, *ROA*, and *CapInt* (Baik et al., 2012; Demerjian et al., 2012; Masli et al., 2011). Finally, as suggested by Hendricks et al. (2007), it is important to control for industry and time effects, and thus we include year and industry fixed effects.

For our third hypothesis, we are interested in the effect that CRM systems have on earnings predictability, and therefore we are interested in management earnings forecasts. We use the following OLS regression model to test Hypothesis 3 (see Table 2 for variable definitions):

$$AbsError_{i,t} = \beta_0 + \beta_1 CRM_{i,t} + \beta_2 After_{i,t} + \beta_3 CRM^{*}After_{i,t} + \beta_4 Size_{i,t} + \beta_5 ROA_{i,t} + \beta_6 Loss_{i,t} + \beta_7 Leverage_{i,t} + \beta_8 EarnVol_{i,t} + \beta_9 CFOVol_{i,t} + \beta_{10} Growth_{i,t} + \beta_{11} IndCon_{i,t} + \beta_{12} Big4_{i,t} + \beta_{13} LnAnalysts_{i,t} + \beta_{14} StdAF_{i,t} + \beta_{15} Surprise_{i,t} + \beta_{16} Horizon_{j,i,t} + \beta_{17} Litigation_{i,t} + \beta_{18} High\ Tech_{i,t} + \beta_{19} Weak_{i,t+} \varepsilon_{i,t} \quad (2)$$

For this model we include year fixed effects and estimate robust standard errors clustered by firm. *Abs_Error* is the absolute value of management forecast error, measured as realized earnings less the management forecast, scaled by the closing stock price on the last day of the previous fiscal year. Therefore, a larger number is an indicator of greater error and less accurate forecasts. Our variable of interest is again the interaction of *CRM* and *After*. We predict that CRM systems make it easier for firms to predict earnings. Following CRM system implementation management earnings forecasts should be more accurate. Therefore, we predict β_3 to be negative, indicating more accurate forecasts.

We include additional independent variables to control for other factors that can possibly affect management forecast quality based on prior literatures. Because larger firms tend to have more experienced and knowledgeable staff, we expect firm size (*Size*) to be positively associated with management forecast accuracy (Kasznik and Lev, 1995). Prior literature also finds that more profitable firms tend to make more accurate forecasts and therefore we include *ROA* (Baik et al., 2011). Based on Hayn's (1995) findings that earnings of loss firms are less informative than profitable firms, other papers find a negative relationship between *Loss* and the accuracy of earnings forecasts. Feng et al. (2009) similarly find financially challenged firms issue less accurate forecasts, which is why we include both *Loss* and *Leverage*. We include *EarnVol* and *CFOVol* because other papers find that firms with highly volatile earnings face greater difficulty in issuing accurate forecasts (Dorantes et al., 2013; Feng et al., 2009). Feng et al. (2009) also find that firms with greater sales *Growth* tend to issue less accurate forecasts. Bamber and Cheon (1998) find that industry competitive pressures can influence disclosures, and we thus include *IndCon*, which is a measure of the concentration in a given firm's industry. The extant literature shows that clients of *Big4* auditors tend to issue more accurate earnings forecasts (Ajinkya et al., 2005; Feng et al., 2009). The prior literature also finds relationships between analyst behavior and management forecast accuracy. Specifically, this research finds that greater analyst following creates pressure for higher quality disclosure, while more analyst dispersion signifies greater forecasting difficulty, and therefore we include both *LnAnalysts* and *Std_AF* (Ajinkya and Gift, 1984; Ajinkya et al., 2005; Lang and Lundholm, 1996; Swaminathan, 1991). The management forecast literature shows that it is more difficult to forecast earnings further

[8] When examining a dependent variable that has a lagged version in the model, the lagged control variable is removed from the model.

[9] We include raw sales because the implementation of a CRM system may inflate assets for the first few years of implementation and therefore scaling may not give a fully clear picture of the positive effects.

[10] In our tests of *SGA* and *SGA Scaled* we do not include *RD, ADV,* or *CAPINT* in the model due to the mechanical relationship of those variables.

Table 4
Univariate analysis.

	CRM-before	Control-before	CRM & control before		CRM-after	CRM before and after		Control-after	CRM & control after	
	N = 87	N = 1169	Difference	p-Value	N = 87	Difference	p-Value	N = 1169	Difference	p-Value
Abs_Error	0.021	0.009	− 0.012	< 0.001***	0.006	− 0.015	< 0.001***	0.014	0.008	0.002***
ADV	0.016	0.017	0.000	0.995	0.015	− 0.001	0.765	0.013	− 0.002	0.502
ARTurn	11.428	13.791	2.363	0.623	15.995	4.567	0.386	11.195	− 4.799	0.196
CapInt	2.781	9.191	6.411	0.439	4.628	1.848	0.472	6.224	1.596	0.294
CFO	1565.625	358.033	− 1207.592	< 0.001***	1985.184	419.559	0.503	469.150	− 1516.034	< 0.001***
Doubtful	129.121	19.013	− 110.107	< 0.001***	83.18	− 45.941	0.255	25.833	− 57.347	0.002***
MTB	3.393	1.880	− 1.512	0.761	1.910	− 1.483	0.292	1.072	− 0.838	0.776
Oper Margin	− 0.084	− 0.572	− 0.488	0.604	− 1.224	− 1.140	0.431	− 0.380	0.844	0.309
RD	0.221	0.473	0.252	0.753	1.198	0.977	0.412	0.248	− 0.950	0.017**
ROA	− 0.310	− 0.940	− 0.630	0.254	0.020	0.331	0.075*	− 0.057	− 0.077	0.135
Sales	10,492.81	1787.851	− 8704.959	< 0.001***	12,494.68	2001.87	0.610	2433.191	− 10,061.489	< 0.001***
SGA	0.319	0.524	0.205	0.275	0.294	− 0.025	0.595	0.757	0.463	0.531
Size	7.693	5.933	− 1.760	< 0.001***	7.896	0.203	0.567	6.226	− 1.67	0.002***

All p-values are two-tailed. *, **, and *** represent significance levels of 0.10, 0.05, and 0.01 respectively.

from the period end, which we control for using *Horizon* (Ajinkya et al., 2005; Baginski and Hassell, 1997). We include *Litigation* and *High Tech*, to control for the fact that firms that operate in more litigious and high tech industries face different disclosure pressures (Francis et al., 1994). Finally, recent literature finds that firms with poor internal controls release earnings forecasts that are less accurate, which we control for by including *Weak*, which indicates if the firm reports any material weaknesses in internal controls (Feng et al., 2009; Li et al., 2012).

4. Results

4.1. Univariate results

Table 4 presents univariate results of comparisons between CRM implementation firms and our control firms. We compare CRM firms to control firms both before and after the CRM implementation. In addition, we compare CRM to themselves from before the implementation to after the CRM system implementation. It is not surprising that due to our matching criteria, in the before implementation period, the treatment and control firms are quite similar to each other. The only significant differences are in *Sales* (unscaled), *CFO* (unscaled), *Doubtful*, *Abs_Error*, and *Size*. We next compare CRM implementation firms to themselves from before implementation to after. With the exception of *ROA* and *Abs_Error*, none of these differences are statistically different. However, most of the variables change in the direction that we expect. For example, in the after implementation period, our treatment firms appear to report higher *ROA*, *Sales*, and *Cash Flows* from operations. They also report lower *SGA* expense, greater *ARTURN*, and a lower balance in the allowance for doubtful accounts. While most of these differences are not statistically significant it does suggest that when we control for market changes utilizing our difference in differences multivariate approach we may see significant results. Finally, we compare our treatment and control firms in the period after implementation. The only significant differences are the same as the pre-implementation period, but the difference is in the opposite direction for *Abs_Error* suggesting CRM system implementers improve their management earnings forecast accuracy.

4.2. Multivariate results

Tables 5, 6, and 7 present the regression results for our tests of Hypothesis 1, regarding the direct effects of CRM system implementations on business process measures. In Table 5, we specifically examine the effect of CRM systems implementations on sales. We again focus on the coefficient on the interaction of *CRM* and *After*. This coefficient should represent how the CRM implementers improved their performance over the four year period from one year before implementation to two years after implementation compared to control observations over the same four-year period. The positive and significant coefficient in both Columns 1 and 2

Table 5
Business process improvements – sales.

Variables	Column 1	Column 2
	Sales	Sales scaled
Intercept	−9471.530**	0.867***
	(0.037)	(0.000)
CRM	2808.67	0.138**
	(0.128)	(0.041)
After	−992.544**	0.100***
	(0.019)	(0.005)
*CRM*After*	2103.457***	0.062*
	(0.008)	(0.078)
Size	2335.784***	−0.070***
	(0.000)	(0.000)
MTB	−6.688***	0.000
	(0.003)	(0.126)
RD	−25.273**	−0.001
	(0.015)	(0.774)
ADV	2716.150***	−0.243**
	(0.005)	(0.017)
ROA	−227.034**	0.013***
	(0.018)	(0.001)
CapInt	−1.122	−0.002**
	(0.678)	(0.034)
Year and industry indicators	Included	Included
Number of observations	2512	2512
Adjusted R2	0.338	0.357
F-statistic	24.130***	140.590***

The dependent variables are business process measures as defined in the text. ***p < 0.01, **p < 0.05, *p < 0.10. The p-values are two-tailed except for the interaction variable, and are listed in parentheses under the coefficient. The models are estimated using ordinary least squares regressions with robust standard errors clustered by firm.

Table 6
Business process improvements – sales efficiency.

Variables	Column 1	Column 2	Column 3
	Oper Margin	SGA	SGA scaled
Intercept	−2.602***	2.723**	0.336***
	(0.007)	(0.023)	(0.000)
CRM	−0.378**	0.199	0.108***
	(0.039)	(0.140)	(0.000)
After	0.209	0.012	0.063***
	(0.414)	(0.879)	(0.001)
*CRM*After*	0.443**	−0.273*	−0.025*
	(0.049)	(0.069)	(0.090)
Size	0.232***	−0.197**	−0.070***
	(0.000)	(0.027)	(0.000)
MTB	0.009	−0.008	−0.000
	(0.337)	(0.387)	(0.133)
RD	−0.411***		
	(0.000)		
ADV	−1.458		
	(0.231)		
ROA	0.294***	−0.366***	−0.066***
	(0.000)	(0.000)	(0.000)
CapInt	−0.107***		
	(0.000)		
Year and industry indicators	Included	Included	Included
Number of observations	2512	2512	2512
Adjusted R2	0.647	0.040	0.419
F-statistic	25.360***	20.460***	80.550***

The dependent variables are business process measures as defined in the text. ***p < 0.01, **p < 0.05, *p < 0.10. The p-values are two-tailed except for the interaction variable, and are listed in parentheses under the coefficient. The models are estimated using ordinary least squares regressions with robust standard errors clustered by firm.

Table 7
Business process improvements – receivables collectability.

Variables	Column 1	Column 2	Column 3
	ARTurn	Doubtful	Doubtful scaled
Intercept	20.110***	−121.082**	0.003
	(0.003)	(0.041)	(0.655)
CRM	−2.176	66.951***	0.010*
	(0.372)	(0.000)	(0.067)
After	−4.718*	0.357	0.006**
	(0.098)	(0.969)	(0.035)
*CRM*After*	0.971	−50.857***	−0.010**
	(0.279)	(0.010)	(0.041)
Size	−1.217***	19.636***	−0.003***
	(0.003)	(0.000)	(0.002)
MTB	0.005	−0.052	−0.000
	(0.654)	(0.469)	(0.266)
RD	1.544***	0.057	−0.003***
	(0.000)	(0.917)	(0.004)
ADV	16.364	35.218	0.056
	(0.220)	(0.352)	(0.322)
ROA	0.502***	−1.651	−0.000
	(0.000)	(0.215)	(0.274)
CapInt	0.019	−0.047	0.001***
	(0.788)	(0.719)	(0.004)
Year and industry indicators	Included	Included	Included
Number of observations	1558	1558	1558
Adjusted R2	0.121	0.202	0.176
F-statistic	3.690***	15.070***	5.560***

The dependent variables are business process measures as defined in the text. ***p < 0.01, **p < 0.05, *p < 0.10. The p-values are two-tailed except for the interaction variable, and are listed in parentheses under the coefficient. The models are estimated using ordinary least squares regressions with robust standard errors clustered by firm.

suggests that CRM systems allow companies to improve their sales as raw sales and total sales scaled by total assets increased at a greater rate than for control firms. This suggests the firms that implement CRM systems are able to improve their sales business process, allowing them to attract new customers and make more sales to existing customers. Specifically the results suggest that as a percentage of assets, firms that implement CRM systems experience a 6.2% greater increase in sales compared to other firms. Overall, the evidence supports our first hypothesis suggesting that CRM systems do positively affect business processes.

Table 6 presents the regression results for our tests of sales efficiency. For all three columns, our coefficient of interest is in the predicted direction and is significant ($p < 0.10$). The positive and significant coefficient in Column 1 suggests that CRM systems improve the operating margin for firms that choose to implement them. This suggests that firms are making more profit off of each dollar of sales following CRM system implementation. The negative and significant coefficients in both Columns 2 and 3 suggest that these firms are spending less on SGA expenses as scaled by both sales and total assets. Essentially, firms are spending less on SGA expenses following CRM implementation without sacrificing sales. Specifically firms that implement CRM systems reduce the amount spent to make sales by 24% of sales more than other firms. These results further support our first hypothesis, because they show that CRM systems improve business processes that affect sales efficiency. This is important for firms because it allows them to do more with less money.

Table 7 presents the regression results for our tests of effect of CRM systems implementations on firms' ability to collect accounts receivable. Our coefficient of interest is in the predicted direction for all three columns, but it is only statistically significant ($p < 0.10$) in Columns 2 and 3. The positive coefficient in Column 1 suggests improvements to the accounts receivable turnover ratio; however, the result is not statistically significant so we do not draw any conclusions from this result. The negative and significant coefficients in Columns 2 and 3 show that firms that implement CRM systems reduce their allowance for doubtful accounts to a greater degree than control firms. This suggests that firms are more confident in their ability to collect accounts receivable following CRM system implementation, further supporting our first hypothesis.

Table 8 presents the results of our second hypothesis regarding CRM systems and operation performance. We predict that firms that implement CRM systems should experience improved operational performance, either directly through the CRM implementation or indirectly due to the business process improvements examined in Hypothesis 1. In Column 1, we find that our coefficient of interest is significant ($p = 0.047$). This indicates that CRM system implementation does improve overall profitability. Specifically, for the CRM implementers, ROA increases by 6.5% more than other firms. Additionally, the coefficient is positive and significant in both of the remaining columns ($p < 0.10$). The positive and significant coefficient in both Columns 2 and 3 show that CRM system firms experienced a greater increase in operational cash flows than control firms. Overall, we find evidence supporting our second hypothesis.

Finally, Table 9 presents the results of our third hypothesis regarding CRM systems and earnings predictability. In this test we examine whether CRM systems affect management earnings forecasts. Our coefficient of interest is negative and significant

Table 8
Operational performance.

Variables	Column 1	Column 2	Column 3
	ROA	CFO	CFO scaled
Intercept	−0.124*	2682.82	−0.128**
	(0.073)	(0.138)	(0.016)
CRM	−0.076**	297.755	−0.023
	(0.016)	(0.385)	(0.198)
After	−0.046**	−227.699*	−0.031**
	(0.017)	(0.061)	(0.011)
*CRM*After*	0.065**	320.988**	0.035**
	(0.047)	(0.019)	(0.018)
Size	0.063***	450.203***	0.036***
	(0.000)	(0.000)	(0.000)
MTB	0.001*	−1.173**	0.001
	(0.063)	(0.032)	(0.127)
RD	−0.007	−3.261	−0.003*
	(0.158)	(0.199)	(0.104)
ADV	−0.327**	599.311***	−0.056
	(0.023)	(0.005)	(0.544)
ROA		−37.324**	0.038***
		(0.044)	(0.000)
CapInt	0.001	−0.634	0.000
	(0.289)	(0.319)	(0.547)
Year and industry indicators	Included	Included	Included
Number of observations	2512	2512	2512
Adjusted R2	0.151	0.169	0.293
F-statistic	16.120***	42.020***	14.430***

The dependent variables are operational performance measures as defined in the text. ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$. The p-values are two-tailed except for the interaction variable, and are listed in parentheses under the coefficient. The models are estimated using ordinary least squares regressions with robust standard errors clustered by firm.

Table 9
Management earnings forecast error.

Variables	Absolute forecast error
Intercept	0.030***
	(0.000)
CRM	0.005
	(0.243)
After	− 0.004
	(0.136)
*CRM*After*	− 0.008**
	(0.012)
Size	− 0.000
	(0.865)
ROA	− 0.136***
	(0.000)
Loss	0.034***
	(0.000)
Leverage	− 0.002
	(0.678)
EarnVol	− 0.098
	(0.103)
CFOVol	0.052
	(0.150)
Growth	− 0.011
	(0.111)
Big4	0.002
	(0.575)
LnAnalysts	− 0.003
	(0.191)
Std_AF	0.014
	(0.250)
News	0.296**
	(0.027)
Horizon	0.000***
	(0.000)
Weak	− 0.004
	(0.176)
Year indicators	Included
Industry controls	Included
Number of observations	342
Adjusted R2	0.560
F-statistic	14.330***

The dependent variable is forecast error measured as the absolute value of management forecast error, (realized earnings less the management forecast amount)/lagged stock price. ***p < 0.01, **p < 0.05, *p < 0.10. The p-values are two-tailed except for the interaction variable, and are listed in parentheses under the coefficient. The models are estimated using ordinary least squares regressions with robust standard errors clustered by company.

(p = 0.012), indicating a lower forecast error and more accurate management earnings forecasts. As we predicted, firms that implement CRM systems are able to forecast future earnings more accurately than control firms following the implementation of the system. This supports our fourth hypothesis because this suggests that CRM systems aid firms in earnings predictability. Overall, the results support all of our hypotheses.

4.3. Additional analysis

As mentioned in the research design section, we match each treatment firm with a portfolio control firms. We also ensure that none of the control firms announce the implementation of a CRM system during the examination period. While there are many benefits to this matching methodology there are two potential issues. First, we use ROA as our primary matching criteria, but as can be seen in the univariate analysis, the treatment firms are significantly larger than the control firms. Second, while we ensure that none of the control firms implement a CRM system during the sample time frame, it is possible that these firms implemented a CRM system prior to the time period. The difference-in-differences approach used for the analysis focuses on changes that occur due to the implementation. Because we are focused on the immediate benefits of implementing a CRM system, this comparison to firms that previously implemented systems should be adequate. However, there are still potential issues with using firms with CRM systems in the control group.

We address these potential issues with our sample by running our models using two alternative samples. First, we do a one-to-one

Table 10
Alternative samples.

Dependent variables	Pred	Column 1	Column 2
		One-to-one match	CRM match
Sales Scaled	+	0.123**	0.034
		(0.014)	(0.357)
Oper Margin	+	0.188*	0.096*
		(0.090)	(0.082)
SGA	−	− 0.057*	− 0.088*
		(0.100)	(0.092)
Doubtful	−	− 36.734*	− 34.331*
		(0.082)	(0.091)
Doubtful Scaled	−	− 0.007	− 0.007
		(0.119)	(0.191)
ROA	+	0.054**	0.068*
		(0.027)	(0.097)
CFO Scaled	+	0.022*	0.056**
		(0.100)	(0.022)
Year indicators and control variables		Included	Included
Number of observations		308	160

This table presents summarized results using the different samples discussed in the Additional analysis section of the text. Each presented coefficient is the coefficient on the interaction of *CRM*After* with the variable listed used as the dependent variable. *** p < 0.01, ** p < 0.05, * p < 0.10. The p-values are listed in parentheses under the coefficient. The models are estimated using ordinary least squares regressions with robust standard errors clustered by firm.

match where each treatment firm is matched with the control firm in the same year and industry that is closest in size. This sample should alleviate concerns that the control group is too different from the treatment group. Second, we match the treatment firms that implement a CRM system earlier in the time frame with firms that implement CRM systems later in the time frame. For example, we identify a firm that implements a CRM system in 2002 with a firm that implements a CRM system in 2008, and then look at performance changes for both from 2001 to 2004. This method allows us to include firms in the control group that we are certain do not use a CRM system.

The results using the alternative samples are presented in Table 10. We do not include full models to conserve space. In this table, the more vital dependent variables are presented. The coefficients presented are the coefficients for the interaction of *CRM* and *After*, which is our coefficient of interest in our main analysis. Every coefficient in Column 1, except for the one related to *Doubtful Scaled*, is significant ($p < 0.10$) and in the direction predicted. Therefore, our results hold using the one-to-one matching method. Next, with the exception of *Sales Scaled* and *Doubtful Scaled*, we find significant coefficients ($p < 0.10$) in the predicted direction for all variables in Column 2. Overall, this table suggests that our results for our primary dependent variables are robust to the use of alternative samples.

5. Conclusion

The extant literature documents numerous benefits firms received from implementing new IT, especially ERP systems. However, despite vendor claims of how CRM systems can improve numerous facets of companies that adopt them, thus far the extant literature fails to empirically document any operational benefits of CRM systems. Using a sample of firms that implement CRM systems, we examine a collection of possible benefits for firms that choose to adopt these systems.

Our analysis provides evidence of numerous operational benefits these systems provide for firms. Specifically, we find that following CRM system implementation firms show improvements in operational performance, operational efficiency, accounts receivable collectability, and earnings predictability. These results are evidenced through increases in sales and operational cash flows, a reduction to the operating margin, a reduction of the allowance for doubtful accounts, more accurate management earnings forecasts, and improvements to other similar performance measures.

We extend the literature that examines the benefits of ES, by examining a specific type of system that has thus far not been fully investigated. Our study should be of interest to vendors of CRM systems and firms interested in implementing them as we show numerous benefits these firms can receive if they choose to invest in CRM systems. Subsequent research could consider what complementary resources should be in place around a CRM investment to ensure the maximum possible payoff of CRM investments (Brynjolfsson and Hitt, 2000). Overall, we find support for the positive implications of CRM system implementation.

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