

The Business Value of CRM Systems: Productivity, Profitability, and Time Lag

Shutao Dong

PhD Candidate

The Paul Merage School of Business
University of California, Irvine
sdong01@merage.uci.edu

Kevin Zhu

Associate Professor

The Rady School of Management
University of California, San Diego
kxzhou@ucsd.edu

Introduction

Firms are increasingly adopting *customer relationship management* (CRM) systems to improve their interactions with customers (Rigby et al. 2002). CRM systems are enterprise applications that manage business interactions with customers through integrating customer-oriented business processes, including marketing, sales, and customer services (Gefen and Ridings 2002, Karimi et al. 2001). Firms use CRM systems not only to automate customer-oriented business processes to reduce costs, but also to collect and analyze customer data to better fulfill customer needs and improve customer satisfaction (Karimi et al. 2001). Meanwhile, it remains unclear whether such investments can generate significant business payoffs in terms of productivity and profitability (Aral et al. 2005, Rigby et al. 2002). In fact, firms have seen vastly different outcomes of CRM investments. Firms such as First American Corporation and Harrah's Entertainment have been successful in leveraging CRM systems to improve their customer understanding, product/service quality, cost efficiency, and thus profitability (Goodhue et al. 2002). Some other firms, however, have failed to derive business value from their CRM investment (Rigby et al. 2002). Large-sample data on CRM impact are difficult to get, but some evidence shows that 41% of the firms with CRM projects were either experiencing significant difficulties or close to failure (TDWI, 2000). The mixed evidence on the business value of CRM calls for more research in this important area. In light of this, we propose to investigate whether CRM systems generate productivity and profitability gains for firms, and how long it would take for such gains to materialize, i.e. the lag pattern of CRM value.

Measures of CRM and Its Business Impact

According to the CRM literature (Gefen and Ridings 2002), a CRM system consists of multiple modules including: *operational* CRM, which supports a variety of customer-oriented business processes in marketing, sales and service operations; and *analytic* CRM, which analyzes customer data and transaction patterns to improve customer relationships. Operational and analytic CRM modules provide the major functions of a CRM system. In addition to leveraging CRM functions, firms use CRM systems to realize collaborative interactions with customers and business partners through system integration. *System integration* links CRM systems with back-office enterprise systems (such as enterprise resource planning (ERP) and legacy systems) and web-based e-business applications via Internet-based communication protocols, and connects these systems with those of suppliers' and customers' based on common data standards. Further, leveraging CRM systems requires both IT and business managers to have sufficient technical and business *skills* for carrying out CRM-enhanced operations (Goodhue et al. 2002). More importantly, successful CRM implementation often entails significant organizational transformation due to the complexity of multiple operations involved in managing customer relationships (Karimi et al. 2001). Implementing a CRM system is only part of the needed change. To embrace the new ways of interacting with customers, firms need to align various organizational aspects with their CRM systems, e.g. business processes, strategies, top management support, and employee training (Goodhue et

al. 2002). These organizational efforts are termed as organizational capital and must take place in conjunction with technology investments (Brynjolfsson et al. 2002).

Based on the above discussion, we measure the main variables of CRM and its business impact using the following items:

CRM Adoption (or Adoption): We asked firms in which year they began using CRM. CRM adoption=1 in and after that year; CRM adoption=0 before that year.

Marketing Functionality: The number of marketing activities that the firms' CRM system supports: customer targeting, pricing, marketing campaign management.

Sales Functionality: The number of sales activities that the firms' CRM system supports: account management, sales lead management, sales recommendations.

Service Functionality: The number of service activities that the firms' CRM system supports: service knowledge database management, customer data management, call center operations, teller service management.

Analytic Functionality: The number of analytic activities that the firms' CRM system supports: customer value analysis, customer retention rate analysis, sales forecasting.

System Integration (or Integration): Extent CRM system integrated with internal enterprise systems and databases using common standards; extent CRM system integrated with front-end web systems using common standards (5-point scale).

Skills: Business staff (e.g. in marketing/sales/service) has the technical skills to use CRM system; business staff knows how to use CRM system to improve business operations; IT staff has the technical know-how to manage CRM system; IT staff understand customer-oriented business operations (5-point scale).

Organizational Capital: Extent the firm has communicated CRM's strategic vision to employees; extent top management supports the use of CRM; extent the firm has reengineered business processes to use CRM; extent the firm has provided training for employees to use CRM; extent the firm has provided incentives to motivate employees to use CRM (5-point scale).

Productivity: Value Added, i.e. output (sales) minus COGS, for regressions on K (ordinary capital), L (labor expense) and CRM variables to conduct productivity analysis.

Profitability Ratios: Return on Assets (ROA) and Profit Margin (i.e. net income/sales).

Market Value: Tobin's q , that is, market value (i.e. stock price*outstanding shares)/total assets.

For the multi-item variables (integration, skills and org. capital), we conducted confirmatory factor analysis (CFA) in PLS for validation and calculated their factor scores for use in OLS regression.

Empirical Models

We use the OLS model specifications below to analyze the impacts of CRM, following the literature on IT productivity (Brynjolfsson et al. 2002, Hitt et al. 2002, Anderson et al. 2003, Aral et al. 2005):

Productivity Analysis: We use the traditional Cobb-Douglas specification to test the productivity effects of CRM at the aggregate adoption level and the multiple-variable level, as shown below:

$$\text{Log (Value Added)} = \alpha + \beta_1 \text{Log } K + \beta_2 \text{Log } L + \beta_3 \text{Adoption} + \text{Year} + \varepsilon \quad (1)$$

$$\text{Log (Value Added)} = \alpha + \beta_1 \text{Log } K + \beta_2 \text{Log } L + \beta_3 \text{Marketing Func.} + \beta_4 \text{Sales Func.} + \beta_5 \text{Service Func.} + \beta_6 \text{Analytic Func.} + \beta_7 \text{Integration} + \beta_8 \text{Skills} + \beta_9 \text{Org. Capital} + \text{Year} + \varepsilon \quad (2)$$

Profitability & Market Value Analysis: We examine the profitability and market value effects of CRM at the aggregate adoption level (and at the multiple-variable level, which is ongoing):

$$\text{Log (Performance Ratio Numerator)} = \alpha + \beta_1 \text{Log (Performance Ratio Denominator)} + \beta_2 \text{Adoption} + \text{Year} + \varepsilon \quad (3)$$

Productivity Lag Effects: As we have time-series financial performance data and invariant CRM variables after the year of adoption for each firm, we analyze the lag effects using cross-sectional data for each post-adoption year, based on the following model:

$$\text{Log (Value Added}_t) = \alpha + \beta_1 \text{Log } K_t + \beta_2 \text{Log } L_t + \beta_3 \text{Marketing Func.} + \beta_4 \text{Sales Func.} + \beta_5 \text{Service Func.} + \beta_6 \text{Analytic Func.} + \beta_7 \text{Integration} + \beta_8 \text{Skills} + \beta_9 \text{Org. Capital} + \varepsilon \quad (4)$$

($t > 0$: number of years since adoption)

In our ongoing work, we will also examine the lag effects of profitability and market value.

Data and Results

We conducted a survey on CRM functionality, systems integration, skills, and organizational capital of 150 U.S. public banking firms (SIC 60), all of which are CRM adopters. We then collected the annual financial data of these firms from Compustat. These two datasets are matched for examining the impact of CRM on productivity, profitability and market value, resulting in a total dataset of 1285 observations.

Table 1. Productivity Regressions (Pooled Data)

DV	ln (value added)	ln (value added)
CRM Adoption (1/0)	0.094***	
ln (ordinary capital)	0.330***	0.352***
ln (labor expense)	0.669***	0.637***
Marketing Func.		0.052**
Sales Func.		-0.015
Service Func.		0.054***
Analytic Func.		0.062***
Integration		0.057**
Skills		0.001
Org. Capital		0.104***
Controls	Year	Year
R ²	90.2%	90.3%

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Productivity Effects:

Our results of productivity analysis are presented in Table 1. As shown in column 1 (corresponding to equation 1), CRM adoption has a significant impact on productivity. Results in column 2 (corresponding to equation 2) suggest that marketing, service and analytic functionality, together with integration and organizational capital, serve as the major sources of productivity gains from CRM. Among them, organizational capital tends to be the strongest factor, indicating the importance of complementary organizational alignments (in business processes, strategies, top management support, training, etc) that are required by CRM implementation. On the other hand, Sales Functionality is statistically non-significant, which seems to suggest that sales-force automation does not generate productivity gains.

Profitability & Market Value Effects:

Results of equation 3 are shown in Table 2. We find that CRM adoption has a significant impact on profit margin, and a weaker impact on ROA and Tobin's q . Generally speaking, the profitability and market value effects of CRM tend to be weaker than the productivity effects.

Table 2. Profitability and Market Value Regressions (Pooled Data)

DV	ROA	Profit Margin	Tobin's q
	ln (net income)	ln (net income)	ln (market value)
CRM Adoption (1/0)	0.080*	0.078**	0.097*
ln (assets)	0.942***		0.865***
ln (sales)		0.922***	
Controls	Year	Year	Year
R ²	72.7%	85.9%	73.7%

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

The Lag Effects:

Table 3 shows the preliminary results of our efforts to test the lag effects (equation 4). We find that there is a significant time lag in terms of productivity gains from CRM adoption. Marketing, service and analytic functionality have a significant effect on productivity in one to two years right after CRM adoption, possibly because CRM functionality can be learned by employees quickly, therefore generating instant productivity gains in customer-oriented operations. After that, it is until the fifth year that CRM variables (org. capital, integration, and marketing functionality) appear to have a significant effect on productivity. This seems to suggest that, it generally takes significant time for firms to adjust various organizational aspects to fully take advantage of CRM. Such complementary organizational transformation might further catalyze deeper productivity gains from CRM functionality and integration. Moreover, accumulating customer data and learning customer behavior pattern takes time, which may also lead to the relatively long time lag of CRM productivity effects (hence, the second jump in productivity gains). We realize that the lag effects are complex; what we have are still quite preliminary. We are continuing our analysis in this area.

Table 3. Productivity Regressions—Lag Effects (Post-Adoption Data Only)

DV	ln (value added)				
	Year 1	2	3	4	5
ln (ordinary capital)	0.394***	0.259***	0.231***	0.312***	0.315***
ln (labor expense)	0.563***	0.680***	0.746***	0.636***	0.564***
Marketing Func.	0.131**	0.031	0.074	0.090	0.117*
Sales Func.	-0.027	-0.021	-0.008	-0.020	-0.039
Service Func.	-0.058	0.048*	-0.062	-0.078	-0.028
Analytic Func.	0.074*	0.083***	-0.041	0.001	-0.027
Integration	-0.001	0.018	0.040	0.088	0.170***
Skills	0.080	0.024	0.024	0.076	0.014
Org. Capital	0.069	-0.008	-0.040	-0.114	0.196**
R ²	90.56%	96.56%	95.31%	93.38%	93.70%

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Cells in grey contain significant coefficients of CRM variables.

Ongoing Work

Our ongoing work mainly focuses on three directions.

First, we will analyze the profitability and market value effects of CRM at the multiple-variable level, using the following model:

$$\text{Log (Performance Ratio Numerator)} = \alpha + \beta_1 \text{Log (Performance Ratio Denominator)} + \beta_2 \text{Marketing Func.} + \beta_3 \text{Sales Func.} + \beta_4 \text{Service Func.} + \beta_5 \text{Analytic Func.} + \beta_6 \text{Integration} + \beta_7 \text{Skills} + \beta_8 \text{Org. Capital} + \text{Year} + \varepsilon \quad (5)$$

Second, we will examine the lag effects of profitability and market value using the following model and an alternative specification (7).

$$\text{Log (Performance Ratio Numerator}_t) = \alpha + \beta_1 \text{Log (Performance Ratio Denominator}_t) + \beta_2 \text{Marketing Func.} + \beta_3 \text{Sales Func.} + \beta_4 \text{Service Func.} + \beta_5 \text{Analytic Func.} + \beta_6 \text{Integration} + \beta_7 \text{Skills} + \beta_8 \text{Org. Capital} + \varepsilon \quad (6)$$

($t > 0$: number of years since adoption)

$$\text{Performance Ratio}_{t+T} = \alpha + \beta_1 \text{Performance Ratio}_T + \beta_2 \text{Performance Ratio}_{T-1} + \beta_3 \text{Marketing Func.} + \beta_4 \text{Sales Func.} + \beta_5 \text{Service Func.} + \beta_6 \text{Analytic Func.} + \beta_7 \text{Integration} + \beta_8 \text{Skills} + \beta_9 \text{Org. Capital} + \varepsilon \quad (7)$$

($t > 0$: number of years since adoption in year $T+1$ for a specific firm)

Third, we will investigate other firm performance measures such as asset utilization and labor productivity. In addition, we are also seeking other potential model specifications that may provide further insights. We hope to be able to present the above results to the workshop in December.

References

- Anderson, M., R.D. Banker, and N. Hu. 2003. The impact of information technology spending on future performance. *Proceedings of the International Conference on Information Systems*, Seattle, WA.
- Aral, S., E. Brynjolfsson, and D.J. Wu. 2005. Does process enabling IT matter? Measuring the business value of extended enterprise systems. Workshop on Information Systems and Economics. Irvine, CA.
- Brynjolfsson, E. L.M. Hitt, and S. Yang. 2002. Intangible assets: Computers and organizational capital. *Brookings Papers on Economic Activity*. **2002**(1): 137-198.
- Gefen, D., and C.M. Ridings. 2002. Implementation team responsiveness and user evaluation of customer relationship management: A quasi-experimental design study of social exchange theory. *Journal of Management Information Systems* **19**(1): 47-69.
- Goodhue, D.L., B.H. Wixom, and H.J. Watson. 2002. Realizing business benefits through CRM: Hitting the right target in the right way. *MIS Quarterly Executive* **1**(2): 79-94.
- Hitt, L.M., D.J. Wu, and X.G. Zhou. 2002. Investment in enterprise resource planning: Business impact and productivity measures. *Journal of Management Information Systems* **19**(1): 71-98.
- Karimi, J., T.M. Somers, and Y.P. Gupta. 2001. Impact of information technology management practices on customer service. *Journal of Management Information Systems* **17**(4): 125-158.
- Rigby, D.K., F.F. Reichheld, and P. Schefter. 2002. Avoid the four perils of CRM. *Harvard Business Review* **80**(2): 101-109.
- TDWI. 2000. Harnessing customer information for strategic advantage: Technical challenges and business solutions. *TDWI industry Study 2000*. The Data Warehousing Institute.