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Examining business value of customer relationship management systems: IT usage and two-stage model perspectives

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Highlights

- A two-stage model for CRM value: operational/strategic benefits and firm performance.
- High revenue per employee reflects the operational benefits of CRM usage.
- High level of customer satisfaction reflects the strategic benefits of CRM usage.
- Firm size and industry competition positively moderate the benefits of CRM usage.
- Operational and strategic benefits of CRM usage improve firm performance.

ABSTRACT

Empirical evidence for the business value of customer relationship management (CRM) systems remains unsolid in IS studies. This study proposes a new model for CRM value according to IT/IS usage theory and "two-stage model." Empirical tests show that operational benefits of CRM are reflected in firms' high revenue per employee, which leads to high profitability; strategic benefits of CRM are reflected in firms' high customer satisfaction, which leads to high profitability and market valuation. Firm size positively moderates the

operational and strategic benefits of CRM, while the industry's product differentiation level negatively moderates operational and strategic benefits of CRM.

Keyword: Customer relationship management systems; Information system usage; Operational benefits; Strategic benefits; Firm performance

1. Introduction

In an integrated global market, firms face strict competition in all sectors. To maintain their existing market share and to reach out to potential market demand, firms should pay close attention to their customer relationship management (CRM). The benefits of CRM systems may be great on overall customer service experience, marketing, and sales. For example, statistics from industries show that CRM gives an average return of $8.71 for every $1 spent, according to Nucleus Research; CRM can increase revenue by a whopping 41% according to Trackvia.com. Because firm executives from a wide variety of industries tout CRM's value, CRM system sales are soaring. According to Gartner, CRM software revenue reached $39.5 billion worldwide in 2017, and it will continue to be the largest and fastest growing software market.

CRM systems are among the many types of enterprise systems. Their main functions are embedded in the business processes of firms that are related to customers, such as marketing, customer service, and customer data analysis. CRM implementation is a vital step in any CRM strategy, which, if successful, results in improved performance. However, a large percentage of firms often fail to meet their expectations of CRM implementation [26]. Therefore, corporate managers should have a profound understanding of the major targets, necessary conditions, and evaluation methods of CRM implementation. In the practical sense, marketing research scholars and information systems (IS) scholars have raised a specific research question related to the business value of CRM [61,62]. This question focuses on the performance outcome of CRM implementation, as well as on the factors that influence such performance outcome.

Existing empirical studies on CRM value can be classified into two streams. The first stream explains the underlying reasons (including the influencing and moderating factors) behind CRM value creation on the basis of theories such as customer relationship strategy, organizational resources, and information technology (IT)/IS usage; however, most of the studies under this stream conduct surveys among managers using subjective performance metrics [1,4,14,16,23,24,39,60,63,75] or internal data from certain companies [35,36,47]. The aforementioned studies require further examination using objective measurements to improve

their reliability. The second stream focuses on the absolute influence of CRM on firm performance. Studies under this stream use objective data to measure the direct correlations between CRM and profitability or stock price performance. Existing evidence suggests that a firm's stock price incurs an abnormal return around CRM implementation announcements [20,47]. However, CRM lacks a significant long-term influence on profitability ratios and stock prices compared with enterprise resource planning (ERP) and supply chain management (SCM) [5,32]. To testify the contribution of CRM to a firm's performance, new empirical models and performance metrics should be introduced.

On the basis of a review of related studies on CRM business value, as well as the limitations and shortcomings of previous studies, the present study describes CRM usage further and categorizes its contributions to a comprehensive model. Such model includes the different types of performance metrics that may effectively illustrate how CRM creates business value. The proposed model attempts to answer two research questions: "What theories, performance metrics, and analytical framework should be adopted to measure the actual contribution of CRM?" and "What are the moderating factors in the value creation of CRM?"

The rest of this paper is organized as follows. We start with the theoretical background and related research on IT business value and then present our research framework and hypotheses. In the empirical study section, we discuss the data sources, regression models, and operationalization of the metrics and then report the results. We summarize our findings in the discussions and conclusion section.

2. Theoretical background and related research

2.1. Performance metrics in IT and CRM business value

The business value of CRM is among the many research topics in the area of enterprise IT and its business value. In empirical studies on the business value of enterprise IT, the performance metrics adopted by researchers include process performance and firm/organizational performance; the latter can be further classified into accounting-based firm performance and stock market performance [50,66].

Process performance metrics reflect the influence of IT on a firm's operational efficiency in a specific aspect or in a certain business process, such as inventory turnover, labor (hours) per unit of output, selling expense ratio, market share, receivable/payable turnover, and customer value-related measure [48,50,58]. In the CRM context, Krasnikov et al. [45] conducted an analysis of US commercial banks and discovered the positive and negative effects of CRM, that is, it reduces cost efficiency (for a given output, the target cost divided by the actual cost) while promoting profit efficiency (for a given input, the actual profit divided by the target profit). Customer satisfaction is another important process performance

metric in the study of CRM [34,60,71]. For example, CRM usage in the online shopping context has a positive effect on customer satisfaction [25,43]. At the firm level, studies using the American Customer Satisfaction Index (ACSI) revealed that firms that employ CRM achieve significantly high ACSI scores or experience an increase in their scores after CRM implementation [20,54]. However, the aforementioned studies did not comprehensively explain process performance in the context of CRM. First, no performance metric can be applied to all industries to measure the influence of CRM on operational efficiency. Second, studies on the connections between CRM and ACSI scores merely collected 40 to 50 observations [20,54].

Accounting-based firm performance is often represented by profit/profitability ratios [48,66], with return on assets (ROA) and return on equity (ROE) being the most widely used ratios in most studies [5,31,32,48]. However, both ratios suffer from the interfering effects of macroeconomic conditions and the competitive environment; hence, their validity in measuring the return of investments in IT is reduced [50]. In addition, existing evidence cannot reveal the relationship between CRM and ROA/ROE.

In measuring stock market performance, most researchers, excluding those conducting "event studies," use mid-term or long-term stock return or valuation levels and regard Tobin's Q (the market valuation of all assets of a firm divided by their book value) as a suitable measurement, particularly because this ratio is forward-looking, considers risk factors, and is not easily affected by changes in accounting policies [7,15,74]. Limited evidence supports the substantial influence of CRM on the long-term market valuation of firms. Liu et al. [49] suggested that the integration of CRM and ERP can significantly raise a firm's Tobin's Q. However, if the integration effect is not considered, then the direct influence of CRM on Tobin's Q is not significant.

Table 1 summarizes a few of the aforementioned empirical studies based on objective data.

2.2. Moderating factors of IT and CRM business value

Recent studies on IT business value paid close attention to the influence of moderating factors. By contrast, the studies on CRM business value rarely discussed such moderating factors. Because the factors affecting CRM value creation should be related to the nature of enterprise IT, the moderators of the IT business value of the other types of IS can provide insights into the study of CRM value moderators. For example, firm size and industry characteristics are regarded as contextual factors in IS business value research [66]; corporate governance is also a key moderator of IT business value [33,76]. In empirical studies, firm size is considered as a moderator of product innovation that results from supply chain integration [44]; hence, firms with more business lines can yield large benefits from IT investments and ERP usage [22,76]. The characteristics of industry competitive environment are also regarded as moderators of IT business value [52,74]. However, except for the study

on ERP–CRM integration [49], limited evidence relates to the moderators of CRM business value.

2.3. Theoretical background for a comprehensive CRM value model

As indicated in a review of related studies, the existing body of research does not adequately explain CRM business value. First, the empirical studies that utilize objective data sources lack a strong theoretical foundation. To improve the findings of existing studies, their theoretical foundation should be strengthened, and suitable performance metrics that correspond to CRM functions should be adopted. Second, the direct linkage between IT and firm performance is more easily discovered in studies on IT investment and ERP than in studies on CRM business value. This phenomenon indicates the need to redesign the empirical research model for the mechanisms of CRM value creation instead of merely extending prior studies. Third, studies on the moderating factors of CRM business value remain limited. The empirical studies that use objective data sources should include moderating factors in the research model to avoid the weakening effects of unsuccessful CRM implementations, as well as to increase the robustness of the results.

With the objective of addressing the limitations of existing studies, the current study establishes a suitable model for empirical analysis on the basis of a strong theoretical background related to the research question.

IT business value studies based on objective performance metrics extensively discuss the direct effects of IT on performance metrics. However, they rarely explore the indirect effects when explaining IT business value generation. IT has an effect on intermediate variables, and these variables have effects on output variables. Furthermore, different moderating factors may influence both intermediate and output variables. This type of empirical test model is referred to as a two-stage model [8,53]. By classifying performance metrics, this two-stage model provides an empirical test methodology for the mechanisms of IT business value creation. Furthermore, it can serve as a solution in the CRM context, in which the significant and direct influence of CRM on firm performance cannot be easily established. In the first stage of the two-stage model, CRM usage could improve process performance. In the second stage, process performance could result in profitability or stock price changes. This two-stage model illustrates the indirect contribution of CRM to firms.

To select the appropriate CRM value measurements, the functions of CRM in the theoretical context of IS must be summarized. IT/IS usage is an important theoretical view in IS studies because it emphasizes actual IS usage, in which the functions used are the determining factors of IS value [11]. In the categorization of IT usage, Subramani [68] proposed “exploitative use” (dealing with structured processes) and “explorative use” (dealing with unstructured processes) and classified the benefits of IT usage as operational

benefits and strategic benefits. In a succeeding empirical study, Sanders [65] determined that the exploitative use of IT mainly generates operational benefits, whereas the explorative use of IT primarily generates strategic benefits. On the basis of the aforementioned studies, Dong [23] claimed that the operational benefits of CRM include a considerably low marketing cost and an increase in the efficiency of the processes related to customer service, while the strategic benefits of CRM include a significantly high customer satisfaction and sales forecasting accuracy; the author also contended that the operational and strategic benefits of CRM will eventually improve firm performance.

By consolidating the aforementioned studies, the present study proposes a CRM business value creation model on the basis of the two-stage model and IS usage theory. In this model, the exploitative use of CRM results in operational benefits, whereas the explorative use of CRM provides strategic benefits. Therefore, the operational and strategic benefits of CRM will eventually improve firm performance. The development process of these operational and strategic benefits is affected by both internal and external moderating factors. To test this model, objective data and measurements are selected on the basis of the existing literature.

3. Research hypotheses

3.1 Operational and strategic benefits of CRM

The functional modules of CRM can be identified as front-office or back-office modules [39,45] or as "operational CRM" or "analytical CRM," respectively [23,27]. The front-office or operational CRM functions include sales support, marketing and service processes, and improved communications between a company and its customers through an efficient flow of information. The back-office or analytical CRM functions play a key role in information integration; thus, a company can analyze the basic characteristics and behavioral patterns of its customers.

According to the exploitation and exploration concepts in IS usage, the front-office CRM is close to the definition of exploitative use, which mainly contributes to efficiency improvement in existing business processes, whereas the back-office CRM can explain explorative use because it assists companies in exploring new business opportunities and gaining strategic advantages [65,68].

The major operational benefits of CRM lie in the improvement of selling efficiency. The front-office modules of CRM can support salespeople as they transact with customers and perform service tasks. These modules can even replace the roles of a few support staff members as a means to enhance the overall productivity of a sales function/department [41]. In the IT business value literature, revenue per employee (total revenue divided by the number of employees) is used as one of the process performance metrics [5,58]. It is the most suitable performance metric to measure the operational benefits resulting from CRM usage because of the following reasons. First, surveys among CRM users have reported that CRM

can raise the potential service capacity of the sales force and is thus beneficial to each salesperson's sales performance [1,36,63]. Second, in firm-level empirical studies on the business value of IT investments and enterprise systems, revenue per employee is considered as an important process performance metric that reflects productivity and selling efficiency [5,12,58].

On the basis of the preceding discussions, we propose the following hypothesis:

H1: A firm's CRM usage can provide operational benefits.

The operational benefits of CRM are eventually reflected in the improvements in firm performance. In the IT business value literature, firm performance includes financial and stock market performance [51,66]. In the current study, we select profitability (ROA) and market valuation level (Tobin's Q) as firm performance indicators, as they are the most commonly used firm performance metrics in IT business value studies.

The relationship between operational efficiency and firm performance metrics can be explained from two aspects. On the one hand, the two-stage model of IT business value reiterates that improvements in operational efficiency metrics result in enhancements in profitability and market valuation [8,53]. On the other hand, studies on organizational resources suggest that operational efficiency metrics are reflections of firms' "slack resources," which guarantee an improvement in their financial performance [19].

With regard to the operational benefits of CRM, revenue per employee embodies a firm's labor productivity [5], an increase in which should result in a considerably high valuation [51]. Therefore, the operational benefits of CRM can aid firms in obtaining a considerably high profitability and valuation.

H2: The operational benefits of CRM can improve firm performance.

On strategic level, customer satisfaction can reflect a firm's competitive advantage [70]. Through CRM, a firm can formulate a differentiation strategy to achieve a significantly high customer satisfaction [60]. Therefore, an increase in customer satisfaction is regarded as a strategic benefit of CRM systems [23].

The strategic benefit of CRM is closely attributed to the analytical functions of the back-office modules of CRM [73]. In practice, most companies that use CRM tend to accumulate a large amount of data and aspire to obtain meaningful results from data analyses

[69]. If a company can effectively use these back-office modules and perform a thorough analysis of customer profiles and sales records, then this company may acquire an improved understanding of the preferences and consumption patterns of its customers, which they can summarize as "customer knowledge." In this way, this company can improve its products and services accordingly and experience an increase in its customer satisfaction index [54].

The influence of CRM usage on customer satisfaction can also be explained from the service quality perspective [35]. First, CRM facilitates firms' understanding of customized needs. With such understanding, firms can provide additional personalized products and services and consequently make customers feel that the quality of their products and services is improving. Second, CRM can reinforce the relationship between a firm and its customers. CRM can direct firms' adequate attention to its customers, and enable them to convert new customers into loyal customers. Third, CRM enables firms to automatically respond to and deal with the orders and inquiries of customers with considerable accuracy. In this scenario, firms can complete a standardized service cycle and consequently improve their reliability as perceived by its customers. We then propose the following hypothesis:

H3: A firm's CRM usage can provide strategic benefits.

With a high customer satisfaction level, a firm's customers may exhibit a strong repurchase intention, which is an essential factor in the growth of both sales revenue and net income [30,55,56]. The customer satisfaction index is also closely related to a firm's stock market performance. Strong evidence supports the positive relationship between customer satisfaction and a company's stock market returns [29,38,57,59,70]. The customer satisfaction index is also positively related to Tobin's Q [56,72]. The positive correlation of customer satisfaction with market performance, as presented in previous studies, can be explained as follows. A considerably high customer satisfaction is a signal of market competence and potential growth; thus, owning a group of loyal customers can lock-in future revenue and profits.

In sum, a significantly high customer satisfaction level as a result of CRM can aid firms in improving their profitability and stock market performance.

H4: The strategic benefits of CRM can improve firm performance.

3.2. Moderating factors of CRM business value

We further discuss the moderating factors of the operational and strategic benefits of

CRM as well as the moderating factors of the conversion of the two types of benefits into firm performance.

Firm size and market competition are contextual factors in IT business value research [66] as well as influential factors related to the product and process innovation of firms [18]. CRM value creation through operational and strategic benefits begins with the optimization of sales and service processes. This optimization is succeeded by the appropriate use of customer information, analysis of customers' demands, and support for new product development. Firm size and market competition are related to these processes; thus, they may also be related to CRM value creation.

The operational benefits of CRM share several similarities with the benefits provided by other types of enterprise systems because it can also reduce coordination cost, particularly external coordination cost. Existing evidence suggests that large companies often incur high coordination costs because they tend to be composed of a large number of employees, departments, and customers; with the use of IT, such companies can reduce their external coordination costs, which can be reflected in a decrease in selling expense, a reduction in employee number as a result of job task replacement, and the outsourcing of support functions [37]. For CRM usage, large companies can easily establish standardized selling and service processes. These companies can also share their information with downstream distributors or service providers. In this way, they delegate to their partners the task of directly interacting with customers and consequently reduce the size of their salesforce. With such reduction, revenue per employee increases. Hence, large companies show a considerable potential to realize the operational benefits of CRM.

In empirical studies on the influence of CRM on customer satisfaction, large companies are often used as sample companies, and the results are within expectations [9,54]. Such preference for large companies is driven by the fact that the value of the back-office modules of CRM is also tied to firm size. The data mining of customer profiles and sales records is dependent on the quantity of data. Large companies feature relatively stable business processes, reasonably long duration of data accumulation, and different business lines and units, from which these companies can retrieve relevant information and categorize different types of customers [13]. By contrast, small- or medium-sized companies face difficulties in the use of CRM for data management and processing because of their weak technological capabilities [2].

On the basis of the preceding discussions, the current study measures the moderating effect of firm size on the operational and strategic benefits of CRM.

H5: Large companies can obtain high levels of operational and strategic benefits from CRM usage.

The competitive environment of an industry has substantial impacts on the returns of firms' IT investments [52,74]. Several metrics of the competitive environment of industries have been identified as relevant factors of CRM's business value [49]. Among these metrics, product differentiation is defined as the level of variation among the products of different companies within a certain sector. A low level of product differentiation indicates homogeneous competition among the companies. Under such a condition, the substitutability of products or services of different companies is strong, and the profit margins of different companies are close to each other [42]. To obtain competitive advantage and enlarge market share, high levels of operational efficiency and customer loyalty are vital for a firm. Therefore, CRM system usage should play a more important role in industries with low levels of product differentiation.

Under homogeneous competition, usage of IT can significantly improve a firm's operational efficiency [74]. If the products and services of a firm are standardized, the sales force automation function of CRM can increase the selling efficiency for the staff, which will result in high revenue per employee. On the other hand, from the sales record of the same product across a longer period, a firm can discover the patterns of customer behavior more easily. Increased customer knowledge will finally help the firm improve customer satisfaction.

Therefore, this study proposes the following hypothesis:

H6: In industries with low levels of product differentiation, companies can obtain high levels of operational and strategic benefits from CRM usage.

Fig. 1 presents all the hypotheses and corresponding performance metrics that constitute the comprehensive CRM value creation model.

1. Empirical research design

1.1. Data sources

This study utilizes the Harte–Hanks CI Technology Database, Compustat, and ACSI as data sources for the empirical analysis. The original information in the CI database is acquired from Fortune 1000 companies in the US that record site-level (subsidiaries or branches) IT applications. For the CI database, we select the data covering the fiscal years 2001 to 2008, including the records of CRM usage and other metrics for enterprise IT. We obtain the annual financial figures and stock performance of US-listed companies from Compustat and match

them with the information in the CI database. Hence, we obtain 7,915 firm–year observations as the sample for empirical analysis. We also obtain the annual customer satisfaction scores of renowned US companies from the official ACSI website and match them with the scores in the sample according to company name. A total of 387 samples can be matched with the corresponding customer satisfaction scores.

1.2. Basic regression models

To examine H1, we set up regression models (1):

$$RevenuePerEmp_{it} = u_1 CRMuse_{it} + v_1 ASuse_{it} + w_1 SCMuse_{it} + a_1 Agrowth_{it} + s_1 Rgrowth_{it} + e_1 Egrowth_{it} + \Sigma c_1 \cdot Industry\ and\ Year\ Dummies \quad (1)$$

In the above regression model, i represents the firm and t represents the year. *CRMuse* represents CRM usage, *ASuse* and *SCMuse* are the controlling variables because accounting system (AS) and SCM system usage can contribute business value to firms, the exact definition of which is provided in the following sections. In CI database, these two types of enterprise systems are treated as core modules of ERP systems, among which AS is often regarded as the key module of ERP system [28]. *RevenuePerEmp* is calculated as the total revenue (in million dollars) divided by the number of employees. The growth of firms also has a significant effect on revenue per employee [3,21]; thus, we include the controlling variable firm growth in our equations. We use the annual growth rates of total assets, revenue, and employees (*Agrowth/Rgrowth/Egrowth*) as proxies for firm growth. The controlling variables should also include the industry and year dummies [17]. For this purpose, we use the first digit of the SIC code as the industry classifier.

To examine H3, we set up regression model (2):

$$ACSI_{it} = u_2 CRMuse_{it} + v_2 ASuse_{it} + w_2 SCMuse_{it} + c_2 ITlaborcost_{it} + t_2 ITassets_{it} + m_2 Manufacturing_{it} \quad (2)$$

We set up the regression model on the basis of the work of Mithas et al. [54], in which the intensity of overall IT usage is considered as a controlling variable (the definitions are explained in the succeeding sections). We also consider the gap between the ACSI scores of manufacturing companies and those of service companies and thusseta dummy variable for

manufacturing companies [54].

To examine H2 and H4, we set up regression models (3) to (6):

$$ROA_{it} = p_3 RevenuePerEmp_{it} + q_3 Size_{it} + f_3 Leverage_{it} + \Sigma c_3 \cdot Industry\ and\ Year\ Dummies \quad (3)$$

$$ROA_{it} = d_4 ACSI_{it} + q_4 Size_{it} + f_4 Leverage_{it} + \Sigma c_4 \cdot Industry\ and\ Year\ Dummies \quad (4)$$

$$Tobin's\ Q_{it} = p_5 RevenuePerEmp_{it} + q_5 Size_{it} + f_5\ Leverage_{it} + \Sigma c_5 \cdot Industry\ and\ Year\ Dummies \quad (5)$$

$$Tobin's\ Q_{it} = d_6 ACSI_{it} + q_6 Size_{it} + f_6 Leverage_{it} + \Sigma C_6 \cdot Industry\ and\ Year\ Dummies \quad (6)$$

In the aforementioned models, we use firm size (*Size*, log of total revenue), financial leverage (*Leverage*, liability over total assets), and industry and year dummies as controlling variables. All these variables can be regarded as exogenous factors that may affect firm performance [76].

In the examination of moderators, we adopt the method of Zhang and Huang [76] and perform regressions within groups of samples. In accordance with the ranking criteria of Fortune 1000 companies, we use sales revenue to separate the sample firms into groups of large or small firms. For the proxy of product differentiation, we follow the methodology of Liu et al. [49], that is, the gross margin of all firms is first computed from Compustat, and then, all firms are classified into specific sectors according to the four-digit SIC industry codes. The product differentiation index for each sector is defined as the standard deviation of the gross margin divided by its average. Therefore, a large index equates to a high level of product differentiation.

To ensure the robustness of moderating effects, we also refer to Liu et al [49] and use regression functions that include cross terms to check the significance level of the moderators:

$$RevenuePerEmp_{it} = u_1 CRMuse_{it} + v_1 ASuse_{it} + w_1 SCMuse_{it} + a_1 Agrowth_{it} + s_1 Rgrowth_{it} + e_1 Egrowth_{it} + r_7 CRMuse_{it} * Size_{it} + d_7 CRMuse_{it} * Differentiation_{it} + \Sigma c_1 \cdot Industry\ and\ Year\ Dummies \quad (7)$$

$$ACSI_{it} = u_2 CRMuse_{it} + v_2 ASuse_{it} + w_2 SCMuse_{it} + c_2 ITlaborcost_{it} + t_2 ITassets_{it} + m_2 Manufacturing_{it} + r_7 CRMuse_{it} * Size_{it} + d_7 CRMuse_{it} * Differentiation_{it} \quad (8)$$

In models (7) and (8), *Size* is also log of total revenue, while *Differentiation* is defined as the standard deviation of the gross margin divided by the average of the sector. The significance level of the two cross terms can further testify the different impacts on performance metrics between two groups of sample firms.

1.3. Operationalization of CRM usage and other variables

According to IT usage theory, "extent of use" is one of the measurements for actual IT usage [11]. The present study follows this concept and operationalizes the metric for the CRM usage of sample firms in basic regression models.

On the basis of the original data of the CI database, we use the coverage ratio of the CRM system of a firm as the proxy of CRM usage, which can be calculated as the revenue-weighted average proportion of CRM use among all the branches (subsidiaries) of that firm; that is,

CRMuse = Σ[Branch revenue∗BranchCRMusage(using=1, not using=0)] / Total revenue

We also calculate the weighted average coverage of AS and SCM systems by the same methodology and define them as *ASuse* and *SCMuse*, respectively.

To measure the intensity of IT usage, the following variables can be calculated from the CI database:

ITassets = Total value of computer assets / Total assets

ITlabor = Number of IT staff / Number of employees

ITlaborcost = Expenditure on IT staff / Total revenue

For the performance metrics, we use Compustat to calculate *RevenuePerEmp* defined in H1. We define ROA as the net income divided by the total assets and Tobin's Q as the sum of the market value of the common stock, preferred stock, and liability divided by the total assets by the end of the fiscal year.

1.4. Regression model for endogenous factors

Apart from the aforementioned basic model settings, we also refer to Shaver [67] for the econometrics of the endogeneity issue of corporate strategy. We set up regression models that consider endogenous factors and further affirm the validity of both H1 and H3. The methodology includes two steps of regression.

In the first step, we perform a probit regression, in which the dependent variable is a dummy variable of CRM usage, and the independent variables are the potential factors that

may influence CRM usage. These variables include firm size and other metrics for enterprise IT usage (ERP, SCM, IT labor, and expenditure on IT labor). Firm growth should also be considered as a factor related to IT usage [37]. Therefore, we develop the following regression model (9):

$$P(CRM=1)=\Phi(q_7 Size_{it}+y_7 ASuse_{it}+z_7 SCMuse_{it}+ m_7 ITlaborcost_{it}+ l_7 ITlabor_{it}+ a_7 Agrowth_{it} + s_7 Rgrowth_{it} + e_7 Egrowth_{it} + \Sigma c_7 \cdot Industry\ and\ Year\ Dummies) \quad (9)$$

which can also be expressed briefly as follows:

$$P(CRM=1)=\Phi(\gamma \cdot \omega)$$

where Φ is the cumulative distribution function of the standard normal distribution, ω is the group of variables that may influence CRM usage, and γ is the corresponding vector of the regression coefficient.

For each observation, we can calculate the correction variable λ that accounts for implicit endogenous factors that may influence both CRM usage and firm performance.

If CRM=1, $\lambda=\varphi(\gamma \cdot \omega)/\Phi(\gamma \cdot \omega)$;

If CRM=0, $\lambda= -\varphi(\gamma \cdot \omega)/[1 - \Phi(\gamma \cdot \omega)]$

where φ is the probability density function of the standard normal distribution.

The second step is linear regression based on models (1) and (2), with dependent variables as operational and strategic benefits and independent variables modified as a dummy variable of CRM usage, other controlling variables, and the correction variable λ. If CRM can still explain the operational and strategic benefits and the correction variable cannot offset the effects, then we can ensure that the operational and strategic benefits are in fact brought by CRM usage.

2. Data analysis and hypothesis testing

2.1. Descriptive statistics

Tables 2 and 3 show the descriptive statistics and correlation matrix, respectively, of the variables. The results suggest that both the performance and controlling variables have suitable variations for the regression analyses. The correlations between the controlling variables are not expected to cause multicollinearity problems.

2.2. Hypothesis testing

To estimate the above panel data models' coefficients, we use the pooled regression method because of the following reasons. First, our approach is analogous to the analysis of the effects of IT capital investments on overall firm return/risk by Dewan et al. [22]. Essentially, the approach is to regress a measure of operational (strategic) benefits on CRM usage and non-CRM usage along with other controls as the independent variables. Because we focus on how the usage of CRM affects firms' benefits, we do not pay attention to the time trends of such an effect. Second, the companies in Fortune 1000 are always rotating, and sample companies covered by CI dataset vary considerably during 2001 to 2008. The vastly unbalanced characteristics of our dataset determine that it is better to adopt pooled regression models.

We use Stata 11.0 to run our regressions. The results of models (1) and (2) are shown in Tables 4 and 5.

The results shown in Tables 4 and 5 suggest that within a certain sector, companies with a high CRM coverage have high revenue per employee and high ACSI score. These results support H1 and H3. We also perform the variance inflation factor test and Breusch–Pagan test to ensure that the model does not have multicollinearity or heteroskedasticity problems. We notice that the effect of CRM usage on the performance variables is stronger than controlling variables, and the coefficients of controlling variables might be counter intuitive. Therefore, we also perform the regression with controlling variables only, and the real effects of accounting systems and SCM are shown.

Using models (3) to (6), we can examine the effects of the operational and strategic benefits of CRM on firm performance. Table 6 shows the results.

The results shown in Table 6 suggest that firms with high revenue per employee and high customer satisfaction have a significantly high ROA. Customer satisfaction also has a substantial contribution to Tobin's Q. Moreover, the explanatory power of the operational benefits of CRM in Tobin's Q is relatively smaller than that of the other three models. Therefore, H4 is supported, and H2 is partially supported. The operational benefits of CRM can promote profitability, whereas its strategic benefits can promote both profitability and market valuation. This result confirms the importance of the strategic benefits of CRM to firms.

For each year, we rank the sample companies according to their revenue and their industry's product differentiation. We group the samples into two halves and then perform regression analyses using models (1) and (2) and perform regression analyses using models (7) and (8) as robustness check. Tables 7 and 8 show the results.

Tables 7 and 8 indicate the following results: CRM usage more greatly contributes to revenue per person in large companies than in small companies. Companies in industries with low product differentiation level also yield more operational benefits from CRM usage. Similarly, large companies have significantly stronger improvements in customer satisfaction; companies in industries with low product differentiation level have relatively more improvements in their customer satisfaction. In sum, H5 and H6 are supported.

Finally, we reexamine the operational and strategic benefits of CRM by considering the endogenous factors. The first step is the probit regression of "whether to use CRM" (see Table A-1 in the Appendix), and the correction term λ can be calculated for each observation. The second step is to regress the metrics of the operational and strategic benefits on "whether to use CRM" and incorporate λ into the model. We can then obtain the regression results (see Tables A-2 and A-3). As indicated in Table A-2, the companies that use CRM have relatively higher revenue per employee than those that do not use CRM. The results are the same when the correction term is added into the model, thereby suggesting that the correlation between CRM and selling efficiency metrics in fact reflects the operational benefits of CRM. The results (Table A-3) also show that the effect of CRM on ACSI is significant when we consider the hidden factors of firm competence. This result can further support the idea that actual CRM usage decides the strategic benefits it provides to a firm.

2.3. Discussion of the results

The hypotheses in the comprehensive model for CRM value generation have been affirmed in the preceding empirical analyses. With regard to its operational benefits, CRM usage can promote selling efficiency, which is reflected by high revenue per employee. With regard to its strategic benefits, CRM usage can significantly improve the customer satisfaction index of firms.

Large companies obtain highly significant operational benefits from CRM usage, whereas small companies may also realize operational benefits to some extent. This result shows the advantage of large companies when they use CRM to standardize their selling process and promote operational efficiency. With regard to the moderating effect of firm size on the strategic benefits of CRM, the regression results also suggest that sales revenue has significant positive moderating effects. If a company generates high revenue and accumulates a large amount of data from explorative CRM usage, then it can clearly understand market structure and customer demand.

We also consider the moderating effect of industry competitive environment. In

industries with homogeneous competition, firms can benefit more from CRM usage. This result indicates that if the products and services in an industry are usually standardized, companies have to pay more attention to the quality of customer service and analytics of customer behavior.

In previous studies, researchers could not determine the direct relationship between CRM usage and profitability and market valuation. Our results show that CRM usage first generates operational and strategic benefits, which are then eventually reflected in ROA and Tobin's Q. We also find that the strategic benefits of CRM are more important than its operational benefits because ACSI scores are highly correlated with Tobin's Q, while operational efficiency has little contribution to Tobin's Q. This result may be explained from two perspectives: from the firms' perspective, operational benefits mainly contribute to a firm's productivity in the short term, while strategic benefits may contribute to the competitiveness of a firm in the long run. From investors' perspective, customer satisfaction scores can be easily disseminated as valuation signals among investors. If a company achieves a high customer satisfaction level from its successful CRM usage, then investors may be optimistic about its future performance, which is reflected in its high Tobin's Q.

3. Conclusion

In this study, we performed an empirical analysis on the generation of CRM business value from the perspective of operational benefits, strategic benefits, and firm performance. The result shows that the operational benefits of CRM are reflected in firms' high revenue per employee, whereas the strategic benefits are embodied in high customer satisfaction. Moreover, these operational and strategic benefits can promote firms' profitability and market valuation. The analysis of moderators shows that firm size and industry competition are significant moderators of the operational and strategic benefits of CRM.

The theoretical contribution of this study is the comprehensive model for CRM value creation that combines the two-stage model of IT business value with IT usage theory. On the basis of previous research, we propose performance metrics and consider internal and external moderating factors. Compared with previous studies that use archival data to examine CRM business value [5,9,20,32,49,54], the current work achieves a substantial improvement with the proposed model settings. On the one hand, we use process performance metrics, thereby solidifying the theoretical foundation of the empirical analysis of CRM business value. On the other hand, we maintain the profitability and market valuation metrics used by prior studies and explain the contribution of CRM to indirect correlations. Our conclusions are highly comprehensive compared with those of empirical studies on CRM value based on objective data sources. Our conclusions are also meaningful to the IT business value literature because we emphasize actual usage and set up an analytical framework that includes more factors and processes in IT business value generation.

From a practical perspective, this study provides several suggestions related to corporate managers' decision on CRM implementation and usage. First, managers should clarify the goal of CRM implementation and focus on selling efficiency enhancements, customer data analyses, and improvements in customer relationships. The performance outcome of CRM usage may vary significantly among different companies [27]; thus, we identify the factors that influence CRM value. The results are invaluable to practitioners. For small- or medium-sized companies, a rational goal should be set for CRM implementation because the expected return from CRM may be limited. If a company operates using a market-driven strategy with a relatively high revenue, then it should utilize CRM to improve customer satisfaction. Second, actual CRM usage decides its benefits to a company; thus, companies should ensure CRM usage in all their departments and subsidiaries. Economies of scale in CRM usage should be facilitated because data accumulation is important in conducting customer analyses. Third, if a company operates in an industry with homogeneous competition, then it can achieve significant gains by investing in CRM systems. In practice, manufacturers of consumer goods are likely to face a less product-differentiated competitive environment. Thus, these companies need to maintain an efficient sales force and an enhanced brand value. In this case, CRM systems are necessary to ensure competitive advantage.

This study also has a few limitations. The performance metrics used in this work are influenced by numerous factors, and controlling variables cannot shield the interferences completely. Although we propose multiple routes of CRM value generation, we still treat CRM as a single unit in the empirical analyses. Thus, this work lacks detailed analyses of the different types of usage and their corresponding performance effect. In future studies, researchers should attempt to retrieve additional information on the functional modules of CRM used by companies so that highly detailed analyses can be performed. The analysis of the relationship between CRM usage and customer satisfaction can also be improved if additional data on customer satisfaction can be retrieved.

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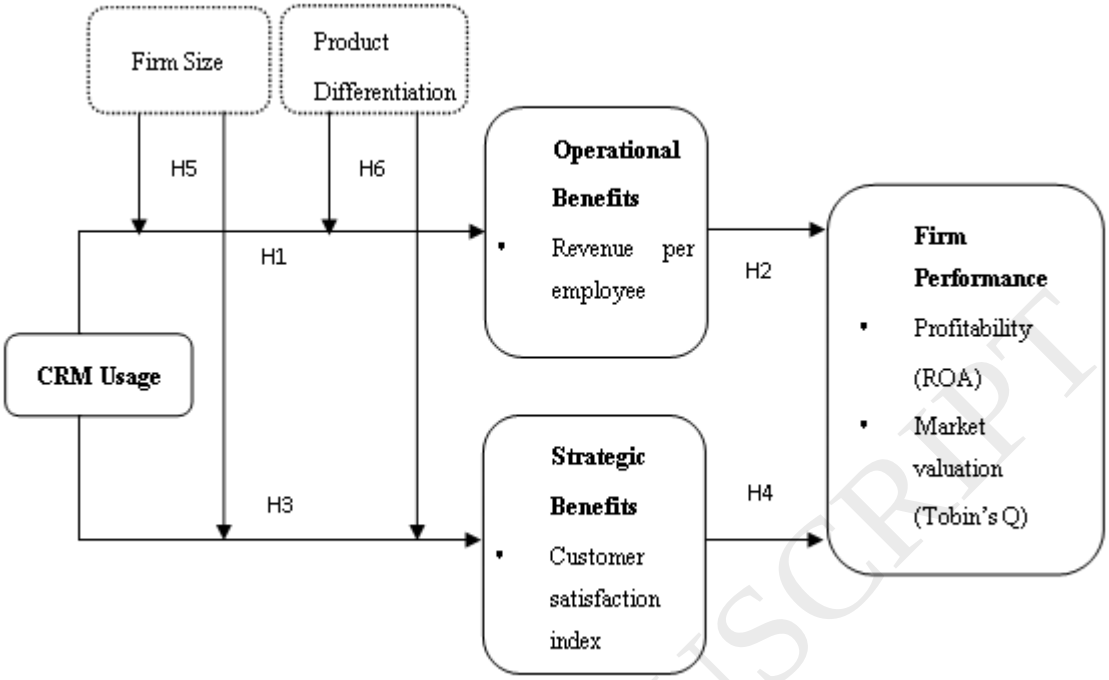

Fig. 1. Research hypotheses

Table 1 Performance metrics for business value of IT and CRM.

Classification	Performance metric	Literature	Type of IT	Result
4. Process performance	Selling expense ratio	Radhakrishnan et al. [58]	IT investment	**
		Xue et al. [74]	IT investment	**
	Revenue per employee	Aral et al. [5]	ERP/SCM/CRM	** / **/ —
		Radhakrishnan et al. [58]	IT investment	**
	Inventory turnover	Aral et al. [5]	ERP/SCM/CRM	** / **/ —
		Radhakrishnan et al. [58]	IT investment	**
		Xue et al. [74]	IT investment	—
	Receivables turnover	Aral et al. [5]	ERP/SCM/CRM	** / **/ —
		Radhakrishnan et al. [58]	IT investment	—
		Xue et al. [74]	IT investment	—
	Payables turnover	Radhakrishnan et al. [58]	IT investment	**
		Xue et al. [74]	IT investment	**
	Customer satisfaction	Mithas et al. [54]	CRM	**
		Dardan et al. [20]	CRM	**
		Bhansali and Brynjolfsson [9]	CRM	**
5. Firm performance	ROA	Aral et al. [5]	ERP/SCM/CRM	—/ **/—
		Hendricks et al. [32]	ERP/SCM/CRM	**/ **/—
	ROE	Aral et al. [5]	ERP/SCM/CRM	—/ **/ —
	Profit margin	Aral et al. [5]	ERP/SCM/CRM	—/—/ —
	Return on sales	Hendricks et al. [32]	ERP/SCM/CRM	**/ **/—
		Aral and Weill [6]	IT investment	**
6. Stock market performance	Long-term abnormal return	Hendricks et al. [32]	ERP/SCM/CRM	**/—/—
	Tobin's Q	Chari et al. [15]	IT investment	**
		Bardhan et al. [7]	IT investment	**

		Xue et al. [74]	IT investment	**
		Liu et al. [49]	CRM	—

**: Significant improvement；--: not significant or worsen

Table 2 Descriptive statistics for performance metrics and controlling variables.

Variable	**Mean**	**Standard deviation**	**Smallest**	**Median**	**Largest**
CRMuse	0.1414	0.2397	0	0	0.9946
ASuse	0.5115	0.3758	0	0.5328	1
SCMuse	0.2335	0.3263	0	0.0199	1
RevenuePerEmp	0.3443	0.5837	0.0061	0.2229	17.211
ACSI	74.314	7.1151	53	75	91
ROA	0.0187	0.2231	-8.7715	0.0351	3.7900
Tobin's Q	1.5963	0.9694	0.8045	1.2259	9.9018
ITassets	0.0026	0.0062	0	0.0012	0.1647
ITlabor	0.0618	0.0878	0	0.0345	1
ITlaborcost	0.0282	0.0589	0	0.0124	1.5929
Agrowth	0.0853	0.5503	-0.9932	0.0478	37.011
Sgrowth	0.0794	0.2893	-0.9964	0.0648	12.617
Egrowth	0.0274	0.5184	-0.9918	0.0043	40.111
Size	3.1131	0.6698	0.0154	3.0889	5.4067
Leverage	0.6101	0.2793	0	0.5932	6.8274

(Note: The ACSI observations described in Table 3 and Table 4 are subsamples of the whole sample)

Table 3 Correlation matrix for performance metrics and controlling variables.

	CRMuse	*ASuse*	*SCMuse*	*RevenuePerEmp*	*ACSI*	*ROA*	*Tobin's Q*	*ITassets*	*ITlabor*	*ITlaborcost*	*Agrowth*	*Sgrowth*	*Egrowth*	*Size*	*Leverage*
CRMuse	1.00														
ASuse	0.25	1.00													
SCMuse	0.21	0.30	1.00												
RevenuePerEmp	0.04	0.05	-0.00	1.00											
ACSI	0.11	0.01	0.05	-0.23	1.00										
ROA	0.02	0.05	0.02	0.03	0.38	1.00									
Tobin's Q	0.03	-0.03	0.06	-0.02	0.36	0.11	1.00								
ITassets	0.01	0.01	0.02	-0.07	-0.01	-0.21	0.13	1.00							
ITlabor	0.05	0.07	-0.04	0.04	-0.09	0.02	-0.02	-0.02	1.00						
ITlaborcost	0.00	-0.01	-0.01	-0.01	0.06	-0.14	0.04	0.00	0.00	1.00					
Agrowth	-0.00	0.01	-0.01	-0.01	0.06	0.17	0.07	-0.10	0.02	0.00	1.00				
Sgrowth	0.01	0.03	0.01	0.06	0.03	0.11	0.12	-0.12	0.03	0.23	0.45	1.00			
Egrowth	-0.01	-0.01	-0.01	-0.03	0.04	0.06	0.03	-0.04	0.01	0.00	0.25	0.19	1.00		
Size	0.00	0.01	-0.09	-0.18	0.04	-0.07	-0.13	-0.18	-0.16	-0.35	0.06	0.12	0.11	1.00	
Leverage	-0.01	-0.03	-0.12	0.13	-0.30	-0.32	-0.10	0.04	0.00	0.10	-0.09	-0.05	-0.05	0.15	1.00

Table 4 Operational benefits of CRM.

	RevenuePerEmp (million $)	***RevenuePerEmp*** (million $)
CRMuse	0.0982***(0.0317)	
ASuse	-0.0038 (0.0214)	-0.0001 (0.0282)
SCMuse	-0.0002 (0.0240)	0.0887*** (0.0323)
Agrowth	-0.0486** (0.0222)	-0.1118*** (0.0303)
Sgrowth	0.2458 (0.0386)	0.2785*** (0.0449)
Egrowth	-0.0175 (0.0130)	-0.0439** (0.0190)
Year Dummies	(controlled)	(controlled)
Industry Dummies	(controlled)	(controlled)
Adjusted R^2	0.08	0.06
Mean VIF	1.22	1.31
Breusch-Pagan test	P=0.000	P=0.000

(Standard errors are shown in parentheses, ***: p<0.01 **: p<0.05 *: p<0.1

VIF: variance inflation factor, Breusch-Pagan test is the test for heteroskedasticity)

Table 5 Strategic benefits of CRM.

	ACSI	***ACSI***
CRMuse	2.6025* (1.5209)	
ASuse	-2.7613** (1.2027)	-1.3411 (1.3022)
SCMuse	-4.4689*** (1.6585)	-2.5566 (1.8529)
ITlaborcost	90.403 (63.849)	149.78 * (77.963)
ITassets	-20.834 (40.437)	-33.492 (51.856)
Manufacturing	9.3032*** (0.6904)	9.3934***(0.8035)
Adjusted R^2	0.37	0.26
Mean VIF	1.16	1.28
Breusch-Pagan test	P=0.000	P=0.000

Table 6 Impacts of CRM's operational and strategic benefits on firm performance.

	ROA	***ROA***	***Tobin's Q***	***Tobin's Q***
RevenuePerEmp (Million $)	0.0073*** (0.0027)		0.0134 (0.0126)	
ACSI		0.0027*** (0.0009)		0.0242*** (0.0079)
Leverage	-0.3446*** (0.0083)	-0.2046*** (0.0232)	0.0671* (0.0393)	0.0402 (0.2116)
Size	0.0633*** (0.0036)	-0.0299** (0.0131)	0.0900*** (0.0157)	-0.4128*** (0.1193)
Year Dummies	(controlled)	(controlled)	(controlled)	(controlled)
Industry Dummies	(controlled)	(controlled)	(controlled)	(controlled)
Adjusted R^2	0.21	0.27	0.08	0.21
Mean VIF	1.13	1.52	1.13	1.52
Breusch-Pagan test	P=0.000	P=0.000	P=0.000	P=0.000

Table 7 CRM's impact on revenue per employee: moderating effects.

			RevenuePerEmp(million $)		
	(High revenue)	(Low revenue)	(High product differentiation)	(Low product differentiation)	(Whole sample)
CRMuse	0.0716***	0.0347	0.0290	0.1694***	-1.6420***
	(0.0152)	(0.0612)	(0.0532)	(0.0317)	(0.1366)
ASuse	0.0435	-0.0005	0.0040	-0.0005	0.0042
	(0.0498)	(0.0096)	(0.0378)	(0.0203)	(0.0212)
SCMuse	0.0050	-0.0108	-0.0299	-0.0113	0.0024
	(0.0537)	(0.0109)	(0.0407)	(0.0239)	(0.0234)
Agrowth	-0.1189***	-0.0091	-0.0344	-0.0227	-0.0479**
	(0.390)	(0.0138)	(0.0453)	(0.0212)	(0.0219)
Sgrowth	0.5536***	-0.0139	0.3025***	0.1490***	0.2065***
	(0.0802)	(0.0204)	(0.0618)	(0.0442)	(0.0385)
Egrowth	-0.0033	-0.1409***	-0.0909	-0.0113	-0.0180
	(0.0184)	(0.0193)	(0.0579)	(0.0092)	(0.0129)
*CRMuse*Size*					0.5077***
					(0.0416)
*CRMuse*Differentiation*					-0.4911***
					(0.1016)
Year Dummies	(controlled)	(controlled)	(controlled)	(controlled)	(controlled)
Industry Dummies	(controlled)	(controlled)	(controlled)	(controlled)	(controlled)
Adjusted R^2	0.10	0.10	0.10	0.11	0.11

Table 8 CRM's impact on customer satisfaction: moderating effects.

			ACSI		
	(High revenue)	(Low revenue)	(High product differentiation)	(Low product differentiation)	(Whole sample)
CRMuse	13.874***	-0.7419	1.6807	4.2578*	-48.089
	(2.9270)	(1.8337)	(2.0627)	(2.3014)	(24.575)**
ASuse	-5.0805***	-2.3084	-2.7105	-2.8191	-5.2298**
	(1.5871)	(1.7900)	(1.7350)	(1.7105)	(2.0076)
SCMuse	-5.8855*	-4.7941**	-8.1585***	-2.4696	-2.6314
	(3.0801)	(2.2015)	(2.6839)	(2.0678)	(2.9064)
ITlaborcost	549.78**	25.254	157.19**	-18.761	230.55
	(246.07)	(73.169)	(73.784)	(164.48)	(154.73)
ITassets	-41.900	-21.920	-24.116	127.64	-32.679
	(504.18)	(43.333)	(42.069)	(591.38)	(60.366)
Manufacturing	10.685***	8.5763***	10.084***	9.1399***	11.830***
	(1.0795)	(0.9906)	(1.0573)	(1.0300)	(1.1479)
*CRMuse*Size*					12.922**
					(5.7444)
*CRMuse*Differentiation*					-24.658*
					(13.794)
Adjusted R^2	0.50	0.34	0.37	0.38	0.39

Appendix. Regression results for implicit endogenous factors

Table A-1 Influential factors on CRM usage.

	P(CRM=1)	
Size	1.0947***	(0.0304)
ASuse	0.2667***	(0.0493)
SCMuse	0.3999***	(0.0541)
ITlabor	-1.2950***	(0.2239)
ITlaborcost	9.2236***	(0.9511)
Agrowth	0.0795	(0.0542)
Sgrowth	-0.4118***	(0.0889)
Egrowth	-0.2346***	(0.0871)
Year Dummy	(controlled)	
Industry Dummy	(controlled)	
Pseudo R^2	0.25	
LR-χ^2	2712..8***	

Table A-2 Operational benefits of CRM: endogeneity test.

	RevenuePerEmp(million $)
CRM	0.1549*** (0.0363)
Λ	-0.0431* (0.0251)
ASuse	-0.0218 (0.0302)
SCMuse	-0.0059 (0.0142)
Agrowth	-0.1256*** (0.0319)
Sgrowth	0.3242*** (0.0491)
Egrowth	-0.0405** (0.0194)
Year Dummy	(controlled)
Industry Dummy	(controlled)
Adjusted R^2	0.06

Table A-3 Strategic benefits of CRM: endogeneity test.

	ACSI
CRM	2.5104* (1.4246)
Λ	-0.9531 (0.9620)
ASuse	-1.4835 (1.3541)
SCMuse	-2.7125 (1.8700)
ITlaborcost	148.35* (78.644)
ITassets	-41.261 (52.449)
Manufacturing	9.3492*** (0.8128)
Adjusted R^2	0.27