Is SOA Superior?
Evidence from SaaS Financial Statements

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***Abstract*—We use audited financial statements to examine claims that service-oriented architecture (SOA) leads to higher profits relative to traditional software delivery models. Specifically, we examine vendors that rely on the Software-as-a-Service (SaaS) pricing model, and compare their performance to other firms that still use the traditional perpetual license model. We find that, relative to their peers, SaaS firms tend to have lower costs of goods sold as a portion of revenues. Compared to their software firm peers, SaaS firms are also younger, smaller, possess less financial leverage, and have higher costs (sales, general, and administrative) relative to revenues. Pure, per-unit costs of hosted SOA applications do not appear to be lower, however, compared to firms that specialize in retail provision of mass market software. This leads us to conclude that, despite the predictions of the most ardent adherents of SOA and SaaS, traditional vendors with sufficient economies of scale will not be intrinsically threatened by the new model.**

***Index Terms*—software, SOA, service oriented architecture, SaaS, Software-as-a-Service, pricing strategy, financial statements, information technology, performance, business process outsourcing**

I. Introduction

Traditionally, software is priced using a perpetual license model: once customers purchase it, they may use it for as long as they wish. In this paper, we consider the strengths and weaknesses of a new type of software pricing model associated with Service Oriented Architecture (SOA). Under the new model, known as Software as a Service (SaaS), customers are not charged for a perpetual license, but on a per-use basis of software that is accessed remotely using the Internet. Previous research (Alonso, et al, 2004 [1]; Erl, 2005 [2]; Moser and Melliar-Smith, 2007 [3]; Newcomer, and Lomow, 2005 [4]; de Souza and Cardozo, 2006 [5]; Zimmerman, et al, 2003 [6]) focuses on technical aspects of SOA; our study is the first we know of that examines the business implications of the SaaS pricing model (for more information on software pricing strategies, see PricewaterhouseCoopers, 2007 [7]). To compare SaaS and non-SaaS companies, we define three specific criteria and then conduct empirical tests using data derived from audited financial statements.

Our overall objective is to increase understanding of the financial performance of various industry categories that make up the IT and telecoms economic sectors, and to compare and contrast performance and drivers of profitability among these companies. Throughout, we use quarterly financial statements of publicly traded companies available in Compustat (also branded as Research Insight), which in turn is based on high-quality data reported by firms to the SEC (United States Securities and Exchange Commission). We employ a wide range of statistical methods, aggregating firms along industry groups and performing univariate and multivariate regression, t-tests, non-parametric median tests, and correlation analyses.

Our findings are relevant to the debate about SOA, and specifically, SaaS, along a number of dimensions. First, we find some initial evidence that the pricing model (traditional perpetual license vs. SaaS) leaves a detectable imprint on relationships among variables constructed from financial statements. Specifically, for SaaS firms only—but for no other category of firms—we find no statistical significance to the relationship between operating margin and inventory divided by the costs of goods sold. This would be consistent with the use of a subscription pricing model for SaaS firms, such that inventory is an essentially meaningless accounting item for them.

Second, we find that, on average, SaaS firms are younger, smaller, possess less financial leverage (debt), and have higher levels of sales, general, and administrative costs (SGA) as a portion of net sales compared to other firms in our data. Findings from multivariate regression analysis using operating margin as a dependent variable are also reported and analyzed in some detail.

Third, using analysis of cost structures among industries, we are able to address a key talking point presented by proponents of SOA. One argument in favor of the new model is that development costs will be lower, because the application is hosted only on one platform (generally, the Internet). The software of non-SOA firms is typically hosted at each client's location, on a number of hardware and middleware platforms, each of which have unique, custom-built, legacy operating systems that require expensive and labor-intensive customization of the new application being installed. For this reason, the argument goes, the costs per unit sold will be lower for SOA firms than for bespoke providers of IT legacy silos. The most ardent adherents of the SaaS model can even be heard to argue that subscription pricing of hosted applications will take over the software industry, leaving Microsoft and SAP as niche players in the relatively near future due to the cost advantages endemic to the new approach.

Our analysis confirms some aspects of this viewpoint, but disconfirms others. Compared with non-SaaS firms in the sample—including *all* publicly-traded IT and telecoms companies going back to 1994 using quarterly data—we find that SaaS firms had significantly lower costs of goods sold, expressed as a portion of net sales. This is certainly the case when we compare SaaS companies to "legacy" IT consultants and software providers that spend significant development resources creating client-specific solutions (customization). If SOA vendors are able to achieve a similar or superior level of functionality through cheap configuration as opposed to expensive customization, they could pose a serious threat to at least some traditional enterprise software providers in the IT consulting and business process outsourcing (BPO) industry categories. Thus, we confirm in part the beliefs of SOA adherents.

When we compare the costs of goods sold as a portion of sales between SaaS firms and their peers in the software space, however, we do not see a competitive advantage from the SOA model, in either of the two major industry comparison categories (applications software and systems software). In fact, perhaps due to the very large volume of retail customers, non-SaaS *software* companies have significantly *lower* costs of goods sold as a portion of sales. This leads us to believe that in the mass-market software space, the level of market share that would lead to the ubiquity of hosted, subscription software delivery along the SaaS model will have to be very high indeed before such firms are able to compete on a cost-per-unit basis with the likes of Microsoft or other providers of retail, mass-market software.

Although the variable cost per unit of production for hosted services is very small, it is likewise fairly inexpensive to ship a CD-ROM to a retail customer, or pre-install it on a purchased desktop or laptop. Other factors such as switching costs (Shapiro and Varian, 1999 [8]), negative affect associated with perceived or actual monopoly pricing power of firms like Microsoft, frequency of upgrades, functionality related to compatibility among integrated software applications—among a number of other factors that are similarly beyond the scope of the present study—might be more important than pure, per-unit cost advantages for the foreseeable future in at least some areas of the information technology and telecoms economic sectors.

In the next section, we review the data and specify the factors that demarcate SaaS from traditional software providers. Following that, we present summary statistics on the dataset that we constructed using Compustat (also known as Research Insight) financial statements. Then, we present multivariate findings related to the SOA/SaaS debate. The final section of the paper offers our conclusions, summarizes the major findings and their implications, and provides some directions for future research such as how SaaS delivery in an open source environment may deviate from the proprietary model that currently dominates the industry.

II. Data, SaaS Firms, and Industry Categories

A. Data

In this paper, our focus is on analyzing whether SaaS firms are different from other types of technology companies. Because of the young age and lack of many annual observations for a large number of SaaS firms, we used quarterly observations in the present analysis. We had data on 11 SaaS firms encompassing 158 firm-quarter observations for the multivariate analysis presented at the end of the paper. For each of the other industry groups, we had more than 1,000 firm-quarter observations.

B. Demarcating SaaS from Traditional Pricing

The starting point for our industry categorization is the GICS nomenclature of industry categories developed by Wall Street analysts (Morgan Stanley, 2006 [9]) to compare and contrast firms. We began by identifying all firms in the two-digit 45 (Information Technology) and 50 (Telecommunications Services) economic sectors. We then identified and separated out SaaS firms, and constructed other industry groupings within the 45 and 50 economic sectors, based on demarcation at the two-, four- or eight-digit GICS level as explained in more detail below.

What is a SaaS firm and how does it differ from more traditional providers of software or other business services? Given the novelty of SaaS as an emerging sector, we employed a list of such firms from PricewaterhouseCoopers[1] using the following criteria:

- Payment terms are in the form of a subscription as opposed to a perpetual or term license
- The majority (75% or more) of revenues generated by the firm come from software that is hosted not at the client's location, but at a facility maintained and owned by the SaaS provider
- The customer directly manipulates the software to execute a set of functions[2]

[1] Thanks to Galen Gruman, an industry expert in emerging software trends and principal co-author of [7], for providing this list.
[2] Thus, we exclude firms that provide pure outsourcing such that the customer does not directly manipulate the application; such firms are

Firms (with corresponding ticker symbols in parentheses) that meet these criteria with at least some available accounting data on Compustat include: At Road (ARDI), Click Commerce (CKCM), Commerce One (out of business, but historical data exist), Concur Technologies (CNQR), Kintera (KNTA), RightNow Technologies (RNOW), Salesforce.com (CRM), Taleo (TLEO), VerticalNet (VERT), WebEx (WEBX), Workstream (WSTM). These firms constitute our new "SaaS" category, and were removed from the other GICS categories assigned to them in Compustat to avoid duplication.

It is important for the reader to understand that these SaaS firms do not necessarily use a solely SaaS-based hosted software delivery model. It is also true that older, established firms such as IBM employ the SaaS delivery model for some of their products, and obtain a share of their total corporate revenues from such activity. Revenues from SaaS activities at IBM, however, are dwarfed by the amount of income that comes from non-SaaS business, whether in the form of traditional software delivery on CD-ROM or through business services outsourcing such as writing unique code for bespoke applications on legacy services located at the client's facilities. At this point in time, most firms do not report to the SEC which portions of company total revenues come from each specific operational division. Thus, under current standards of corporate accounting transparency, we could not separate the firm's gross income into SaaS-based revenues and non-SaaS-based revenues. For this study, we use a clear demarcation based on the source of the lion's share of revenue—if a firm receives 75% of its revenues or more from SaaS activity as defined above, it is considered a "SaaS" firm. If not, it is placed into one of the other different categories based on the Morgan Stanley industry classification codes, explained next.

C. Industry Categories for Comparison with SaaS Firms

Given the large number of other firms in the 45 and 50 GICS economic sectors, we group them into a manageable set of eight comparator groups, with corresponding GICS codes as shown in Table I. Our motivation in constructing these categories is to provide interesting comparison groups to SaaS firms, but without including such a large number of other groups that interpretation of findings becomes difficult. We also list example firms for each category—such firms are not necessarily "typical" in terms of size or financial performance to other members of the group, but they are listed to give the reader an impression as to the business model and typical customer base of firms in that industry. No firm is included in more than one category.

What criteria did we use to group and differentiate the firms? We wished to consider the financial statements of SaaS firms relative to other companies in a wide variety of IT and telecommunications industry groups in order to provide meaningful comparisons and contrasts. We also wanted to provide a manageable number of industry categories for which we had *a priori* reasons to believe would show some differences from—as well as similarities with—SaaS firms. For this reason, we maintained a very high level of specificity among software companies, differentiating such firms at the eight-digit GICS level. Thus, we include separate categories for system vendors (45103020) and application providers (45104010)[3]. In addition, we kept Internet companies (45101010), business processing outsourcing (45102020), and IT consulting firms (45102010) as distinct categories at the GICS eight-digit level. For the sake of contrast, we included three other groups that were differentiated at a much coarser level, including two related to hardware (IT hardware with GICS 4-digit level of 4520 and Semiconductor firms with GICS 4-digit level of 4530) and one final category for telecommunications services (GICS 2-digit level of 50).

III. Summary Statistics

We now turn to comparison of these eight categories among a large number of ratios and values that come directly from the financial statements provided in Compustat. In this section, we characterize industry categories using firm-quarter observations. Table I indicates the number of firms in each category, and the average age of firms in each category. The maximum potential number of observations per firm is 50, because the data cover four quarters each for 12.5 years (1Q1994 to 2Q2006). Few of the firms in our sample existed in 1994, so our data set contains more observations from recent years than from the 1990s. We performed some initial explorations concerning changes in financial ratios over time in certain industry groups, but no clear patterns emerged.

A. Comparing Age, Size, and Leverage: SaaS Firms are Different

Table I indicates for firms in each category average values of a number of measures over the time period since January 1, 1994. Several interesting characteristics emerge out of the various categories. On average, SaaS firms are newer than firms in any other category, and have lower leverage, which is consistent with their young age.[4] (Both findings are significantly better than the 1% level, with two-tailed t-test p-values of 0.000). In terms of size (total assets) and leverage (long-term debt over total assets), we see that SaaS firms are in fact quite similar to Internet companies, but taken together, the average firm in these two groups is smaller than firms in other categories (p-value of 0.0000). The two groups are also relatively young and have low leverage compared to other firms in the analysis (grouping the two industries and contrasting with other firms, t-tests for differences in mean leverage and mean age have p-values 0.000).

indicated in the Business Processing Outsourcing [BPO] industry sub-group, with GICS code 45102020

[3] We also grouped here the 20 companies listed as "home entertainment software" under the much more numerous software application firms.

[4] Overall, the correlation between firm age measured as years since IPO and leverage measured as long-term debt over total assets is positive and significant with p-value of 0.0055

TABLE I.

INDUSTRY CATEGORIES, GICS CODES, AND DESCRIPTIVE STATISTICS

Category Name	GICS Codes	Example Firm* (Not necessarily "typical")	# of Firms with Compustat Data	Average Age (Yrs. from IPO until 6/30/2006)	Average Total Assets (Millions $), 1994 - 2006	Average Leverage (LTD/TA**), 1994 - 2006
SaaS	Various	Salesforce.com	11	5.26	161.92	3.93%
SW Applications	45103010 and 45103030	Mentor Graphics	278	9.39	233.08	8.24%
SW Systems	45103020	Microsoft	84	9.97	1,383.78	8.30%
Telecom Services	All beginning with 50	Cingular	241	8.67	8,045.52	30.54%
Internet	45101010	Verisign	288	7.48	152.85	10.06%
IT Consulting	45102010	Unisys	102	10.00	329.60	7.69%
Business Process Outsourcing (BPO)	45102020	Paychex Inc.	55	9.55	2,037.04	13.95%
IT Hardware	All beginning with 4520	Seagate	619	10.65	1,450.54	10.96%
Semiconductors	All beginning with 4530	Intel	225	9.71	1,090.35	10.58%
All Firms in All Categories			1,846	9.39	1,737.88	12.35%

*Example firms are provided to give the reader an idea of the customer base, business model, and value proposition of firms in the category. Note that the named firm is identified because it is a familiar example of companies in its respective category, and can be larger or different in other important ways from other firms in the grouping.

**Long-term debt divided by total assets

B. Are Costs Lower for SaaS Companies?

As the final column of Table I indicates, IT and telecoms firms generally have fairly low levels of long-term debt, so interest payments form a relatively small part of recurring expenses. The three biggest line item costs from the income statement for such companies are: costs of goods sold (COGS); sales, general, and administrative costs (SGA); and research and development expenses (R&D). (On average, depreciation and amortization amounted to less than 10% of sales for observations in our sample; for the sake of thoroughness, however, we include this as an independent variable in the multivariate analysis presented at the end of the paper.)

Table II presents information on each major cost item from the income statement, expressed as a portion of net sales. The biggest expense category for SaaS firms was SGA, at a very high 134.48% of net sales. One explanation for this could be that SaaS firms are early in their life cycle, such that they are spending large amounts on attracting new customers. This is consistent with the fact that the other category of very new firms, Internet companies, also exhibits a SGA/Sales ratio in excess of 100%.

What of the arguments presented by proponents of SOA and SaaS that, due to single-platform application development, programming costs are held down relative to firms that develop multiple versions of the same software for different types of platforms? Can financial statements reveal any evidence to confirm or deny this perspective? Table II reveals that the COGS/Sales ratio is relatively small for SaaS firms (50.46%) among the categories in the table. Relative to the non-SaaS firms in the entire sample of IT and telecoms companies in the analysis, SaaS firms have lower COGS/Sales; this finding is significant at the 2% level when considering differences in mean values, and 1% when considering differences in median values.[5] At the same time, however, SaaS firms do not seem to be markedly different compared to other industries concerning their R&D expenditures as a portion of sales revenues.

Even controlling for age (because younger firms tend to do more R&D[6]), there is no significant association between status as a SaaS firm and research and development as a portion of net sales. It is interesting to note that "legacy" IT consulting services firms (GICS 45102010) perform very little research and development (only 5% of sales) but have very high COGS/Sales (69.08%, the highest for any industry in our analysis).[7] This is consistent with the view that such firms generate profits not from multiple sales of pre-packaged, stand-alone, existing applications (which would be revealed by very low COGS/Sales), but rather face high development costs associated with consulting time spent on customizing applications based on potentially widely idiosyncratic IT needs of their clients.

Do SaaS firms enjoy lower costs of goods sold than traditional software providers? For the two non-SaaS categories of software firms, application providers had COGS/Sales of 42.69% and systems vendors had COGS/Sales of 37.40%. It is likely, of course, that a big reason for these low costs is that such companies are relying on mass distribution of existing software at very low marginal production costs. Thus, the long-run cost of developing new software is to some degree obscured by looking only at COGS, which due to the GAAP "matching principle" is related only to period costs associated with the current quarter. Thus, we consider R&D expenses, as well as SGA, in addition to COGS as a way to incorporate long-run expenditures associated with innovating new software products.

We summed the three cost measures (SGA, COGS, and R&D) for each industry in order to compare the total cost of innovating, marketing, and producing the firm's offerings. Although it is true that R&D has long-term payoffs (and its benefits are not, like revenues and COGS, booked or measured in the quarter in which the sale takes place), looking at 12.5 years of quarterly data provides a crude measure of average R&D spending over time. Even under this loose definition, we do not see a low cost associated with SaaS firms compared to other types of IT and telecommunications firm. In unreported regressions using the sum of SGA, COGS, and R&D divided by sales as the dependent variable, and controlling for age, the coefficient of a constructed independent dummy variable taking the value of "1" for SaaS firms is not significantly different from zero (the coefficient for age is negative and marginally significant at the 14.7% level, providing weak evidence that younger firms have higher costs; but SaaS firms aren't different from firms in other categories as far as we could ascertain).

C. Profitability Metrics

We consider in a summary fashion measures of profitability that are based on information from the top of the income statement, and that do not depend on the firm's current degree of leverage or differences in taxation rates for interest, dividends, and capital gains (thus, we avoid using return on capital or other market-based performance measures). Our measures therefore incorporate pre-tax cash flows. Specifically, we analyze three different measures of profitability:

(1) Gross Margin = (Net Sales – COGS)/Net Sales

(2) Operating Margin =

(Net Sales – COGS – SGA – DepAmort)/Net Sales

(3) Berry Ratio = (Net Sales – COGS)/SGA

The first two measures are standard ratios used throughout the accounting and finance literature. The third measure (Berry Ratio) was developed to consider not only the level of profitability, but the "appropriateness of economic profits earned relative to the economic risks assumed" (PricewaterhouseCoopers, 2004 [10]). The Berry Ratio is primarily used for

[5] Using non-parametric test for difference in medians; SaaS firm median COGS/Sales is 35.35% whereas the rest of the sample has a median COGS/Sales ratio of 54.88%

[6] For our data set, the correlation between age and R&D/Sales is negative and highly significant, with p-value of 0.0000.

[7] Both findings have p-values of 0.0000 using two-tailed t-tests.

Table II.

Summary Financial Statement Statistics for Industry Categories

Category Name	GICS Codes	Example Firm* (Not necessarily "typical")	SGA/ Sales	COGS/ Sales	R&D/ Sales	(SGA + COGS + R&D)/Sales	Gross Margin**	Operating Margin***	Berry Ratio†
SaaS	Various	Salesforce.com	134.48%	50.46%	22.76%	153.21%	72.94%	-80.78%	72.94%
SW Applications	45103010 and 45103030	Mentor Graphics	74.81%	42.69%	22.76%	135.40%	103.52%	-12.79%	72.93%
SW Systems	45103020	Microsoft	75.33%	37.40%	21.45%	127.47%	108.98%	-13.24%	108.98%
Telecom Services	All beginning with 50	Cingular	52.88%	61.55%	33.41%	200.66%	169.90%	-32.28%	169.90%
Internet	45101010	Verisign	107.46%	68.87%	23.66%	169.37%	69.36%	-83.92%	69.36%
IT Consulting	45102010	Unisys	31.06%	69.08%	5.14%	117.68%	125.52%	-1.49%	125.52%
Business Process Outsourcing (BPO)	45102020	Paychex Inc.	31.93%	65.23%	7.80%	95.35%	191.21%	3.19%	191.21%
IT Hardware	All beginning with 4520	Seagate	44.65%	65.18%	19.23%	128.59%	121.28%	-8.41%	121.28%
Semiconductors	All beginning with 4530	Intel	45.04%	58.47%	29.91%	135.16%	141.22%	-5.66%	141.22%
All Firms in All Categories			57.12%	59.93%	22.33%	136.55%	40.07%	-18.55%	120.81%

*Example firms are provided to give the reader an idea of the customer base, business model, and value proposition of firms in the category. Note that the named firm is identified because it is a familiar example of companies in its respective category, and can be larger or different in other important ways from other firms in the grouping.
**Gross margin is defined as (net sales – cost of goods sold) / net sales
***Operating margin is defined as (net sales – costs of goods sold – sales general and admin costs – depreciation and amortization) / net sales
†Berry ratio is defined as (net sales – cost of goods sold) / sales general and admin costs

services and distribution companies, making it relevant for the focus of this paper.

The three rightmost columns of Table II present summary statistics on these measures. Not surprisingly, analysis of gross margin reflects the same underlying relationship as did the discussion of COGS/Sales presented above. We found that "traditional" software companies that provide either applications or systems had the highest gross margins, which is a testament to their low cost of goods sold. We also found that SaaS firms, with lower gross margins than traditional software companies, had higher gross margins compared to the other industries we considered.[8] It is interesting that, on average, SaaS firms had very low operating margins (again with Internet companies being the closest) and somewhat lower Berry ratios than firms in the other categories.

IV. Multivariate Regressions

A. Variables

Using operating margin as the dependent variable, we will consider its relationship with a number of accounting measures, which form the independent variables for our analysis:

(a) SGA/Sales
(b) Inventory (INV)/Cost of Goods Sold (COGS)
(c) Accounts Receivable (AR)/Sales
(d) Accounts Payable (AP)/Sales
(e) Depreciation and Amortization (DEP)/Sales

B. Model and Statistical Techniques

For the univariate analysis and statistics calculated above, we used simple t-test, nonparametric differences in medians, and ordinary least squares multivariate analysis to determine a number of basic findings by which to characterize relationships among variables in our data. For the purposes of multivariate value proposition driver models that use several observations of the same company over time, however, we need to consider the possibility that the error terms for a given firm will be correlated over time, especially since we are using quarterly data. Any such correlation violates the assumptions behind ordinary least squares; we therefore use generalized least squares analysis, with fixed effects at the firm level.[9] This allows us to consider an important issue: how will a given firm's level of profitability change over time as the independent variables change?

We estimate the following statistical model:

(i) $\text{Operating Margin} = b_0 + b_1\text{SGA/Sales} + b_2\text{INV/COGS} + b_3\text{AR/SALES} + b_4\text{AP/SALES} + b_5\text{DEP/SALES} + e$

where operating margin is defined as (net sales – costs of good sold – sales general and admin costs – depreciation and amortization) / net sales, b_0 is the intercept or constant term, e is the error term, and all independent variables are as defined above. Each independent variable can be considered to be a candidate for "value driver" status, so our regression results can help us pinpoint which aspect of a firm's financial performance is driving operating margin, and how this varies by industry.

C. Results of Multivariate Analysis

Table III summarizes the results of our analysis, and includes nine different estimations, one for each industry category. As is typical of profitability analysis, we find that the drivers of performance vary somewhat across industries, although there are some fairly clear patterns in terms of signs and significance levels of coefficients for the independent variables that we will specify.

Overall, the models have very good fit and level of explanatory power, with very high F-statistics and GLS (within) R^2 ranging from 73% (IT consulting) to 99% (SaaS). In each specification, at least three of our five independent variables have coefficients with high degrees of statistical significance (generally with *p*-values of 0.0000, indicating a very low chance that the relationship is due merely to random chance).

Some overall patterns emerge from the multivariate tests. The intercept is always positive and highly statistically significant, which when paired with the negative coefficients on most of the independent variables, is consistent with the low average operating margins for the data set as a whole. High costs (SGA), high accounts payable as a portion of sales, and high depreciation and amortization as a portion of sales are all associated with lower operating margins, as shown by the consistent negative sign and generally high level of significance for these coefficients. High levels of inventory as a portion of COGS are associated with higher operating margins (with generally positive coefficients that are highly statistically significant), perhaps indicating that firms with high operating margins are also stocking large quantities of goods to be sold in the near future. The coefficients for accounts receivable as a portion of sales are not consistent either in sign or level of significance among the nine specifications, but are negative and statistically significant for both of the physical infrastructure-dominated industries of IT hardware and semiconductors. This could indicate that companies in these industries that have high levels of receivables are having trouble getting customers to pay, irrespective of the book value of sales revenue; low operating margins for such firms might be a signal that current levels of revenue are not high.

We now consider some specific relationships between operating margin and the independent variables for each industry. First of all, recall that we found high levels of

[8] We performed (unreported) OLS regression analysis with error terms adjusted for heteroskedasticity using White's method, with gross margin as the dependent variable and industry dummies for each non-SaaS category as independent variables. We found that SaaS firms had significantly higher (with p-values of 0.01 or less for every category except semiconductors [p = 0.064] and telecom services [p = 0.011]) gross margins than every other category of firm except for software companies. The coefficients for the latter two industry category dummies were positive and significant at the 1% and 8% level, for systems and applications providers, respectively.

[9] The Stata command is xtreg with the fe extention—iis defines the firmcode for fixed effects, and tis are the time period (year)

Table III.
Performance Drivers by Industry

Dependent Variable: Operating Margin (Definition: {Net Sales – COGS – SGA – DeprecAmort}/Net Sales)

(Generalized least squares estimation with firm-level fixed effects; p-values in parentheses)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	SaaS	**SW Applications**	**SW Systems**	**Internet**	**IT Consulting**	**BPO**	**Telecom Services**	**IT Hardware**	**Semi-conductors**
Intercept	0.744*** (0.000)	0.820*** (0.000)	0.741*** (0.000)	0.674*** (0.000)	0.333*** (0.000)	0.470*** (0.000)	0.622*** (0.000)	0.416*** (0.000)	0.610*** (0.000)
SGA/Sales	-1.054*** (0.000)	-1.254*** (0.000)	-1.114*** (0.000)	-1.169*** (0.000)	-1.030*** (0.000)	-1.123*** (0.000)	-0.955*** (0.000)	-1.097*** (0.000)	-1.219*** (0.000)
Inventory/COGS	-0.011 (0.742)	0.048*** (0.000)	0.051*** (0.000)	0.037*** (0.004)	0.046*** (0.000)	0.051** (0.034)	0.037*** (0.000)	0.047*** (0.000)	0.070*** (0.000)
Accts. Receivable/Sales	0.003 (0.629)	-0.013 (0.277)	-0.021** (0.036)	0.032*** (0.003)	0.020*** (0.000)	0.002 0.668	0.042*** (0.000)	-0.033*** (0.000)	-0.202*** (0.000)
Accts. Payable/Sales	-0.136*** (0.010)	-0.106*** (0.000)	-0.041*** (0.002)	-0.136*** (0.000)	-0.121*** (0.000)	-0.001 (0.786)	-0.299*** (0.000)	-0.090*** (0.000)	-0.055*** (0.000)
DeprecAmort/Sales	-1.209*** (0.000)	-1.016*** (0.000)	-0.966*** (0.000)	-1.274*** (0.000)	-0.859*** (0.000)	-1.247*** (0.000)	-1.245*** (0.000)	-1.088*** (0.000)	-0.977*** (0.000)
Observations (Firms)	158 (11)	4,984 (227)	1,377 (60)	3,473 (215)	2,300 (91)	1,019 (39)	3,209 (171)	14,551 (533)	4,975 (190)
R^2 (GLS-Within)	0.99	0.80	0.97	0.91	0.73	0.83	0.97	0.91	0.84
F-Statistic	3,623.59*** (0.000)	3,935.60*** (0.000)	7,423.75*** (0.000)	6,411.36*** (0.000)	1,199.48*** (0.000)	925.70*** (0.000)	20,958.03*** (0.000)	29,893.97*** (0.000)	4,906.32*** (0.000)

†, *, **, and *** indicate significance at the 15%, 10%, 5%, and 1% levels, respectively

SGA as a portion of sales for SaaS firms relative to others in the data set. Across all industries, the correlation between the multivariate coefficients for this variable (SGA/sales) and the sum of SGA, COGS, and R&D over sales on average for each industry group is 36.54%, indicating that industries with higher total costs over sales tend to have a weaker relationship between costs and performance (operating margin). The strength of the relationship between SGA/Sales and operating margin for SaaS firms is fairly typical of the data set as a whole.

Second, we turn to accounts payable over sales. Only for telecom services firms is the coefficient for this variable higher than for SaaS companies (it is identical in magnitude to the coefficient for Internet firms). This is interesting, considering that accounts payable represent the firm's ability to obtain production inputs (such as intermediate goods, parts, or raw materials) on credit. This means that the operating margin for telecom services, SaaS, and Internet companies has a closer relationship with accounts payable over sales than for other types of firm. This might indicate that, especially for newer or riskier firms that are pushing the technology envelope, suppliers are interested in seeing high operating margins before they are willing to provide parts and materials on credit.

Finally, we note that SaaS firms are the exception to the rule followed in other industry groups to the significant relationship between inventories/COGS and operating margin (the coefficient for inventories/COGS in column (1) is not statistically significant). This might be due to the fact that we have fewer observations for SaaS firms (158) relative to the other industry categories, but is also potentially an artifact of the meaninglessness of inventory for SaaS firms; its relationship to operating margin should be expected to be tenuous at best. Although the weakness of the relationship between book value of inventories and performance also applies to other services companies (such as BPO, applications and system software providers, Internet and consulting firms), it might be especially telling for SaaS firms, which by explicit definition (the first criterion of our demarcation) use subscription pricing as opposed to shipping of physical product (e.g., a CD-ROM) with an accompanying perpetual or term license.

V. Conclusion and Summary

We analyzed financial statements for all publicly-traded companies in the Information Technology (GICS 45) and telecommunications (GICS 50) economic sectors using quarterly firm-level Compustat data from 1994 to 2006. We used a novel categorization of firms that met three specific criteria for Software as a Service (SaaS) designation, and constructed eight other categories with which to contrast and compare SaaS firms. We analyzed the categories, finding that SaaS firms were younger, smaller, and less leveraged than other firms in the sample. We then turned to some comparisons of cost structure and profitability drivers, contrasting SaaS to eight other industry categories.

What are the implications of our analysis concerning cost structure? If the value proposition of SOA and the accompanying SaaS pricing strategy is in lower costs per unit sold (due to the luxury of being able to develop only one set of code, for example), it seems that the new model will not seriously threaten firms with very large distribution (an example would be Microsoft's Windows operating system); the latter already face essentially zero variable costs of production/distribution once the fixed cost of writing the code for a particular version of the software is completed. In fact, the cost per unit of SaaS firms is actually higher than for application and system software providers, at least during the time period covered by the data analyzed here.

On the other hand, we found evidence that SOA firms might very well threaten companies with high levels of development expenditures. One example of this would be legacy systems, which have traditionally been highly *customized* (meaning, portions of the software are built from scratch for each client). A SOA competitor with sufficient ability to *configure* functionality but with low per-client development costs (obtained, for example, by using superficially altered interface that is specific to each client but which relies on the identical underlying code or as we discuss below using open-source software) might pose a very real threat to firms with high per-unit costs of goods sold.

Vendors that build bespoke IT silos for their clients might be especially vulnerable to SOA competitors, particularly if the latter can deliver the desired degree of functionality. Of course, in the long run, SaaS firms might achieve large enough distribution to obtain positive economies of scale that will decrease the variable cost of production and even begin to rival firms with very large market shares. A number of other issues might be relevant here, such as frequency of upgrades, perpetual license vs. subscription service, extent of first mover advantages, and switching costs (Shapiro and Varian, 1999 [8]), etc. Consideration of such factors goes beyond the scope of the present study, which is concerned with financial statement analysis.

Another intriguing issue relates to open source SOA.[10] Our SaaS firms use a proprietary model for their software releases, as opposed to open-source, standardized Application Program Interfaces (API). Some vendors are adopting or at least considering using a standard API that would allow clients to make superficial changes but all clients would utilize the same underlying code. In theory, use of standard API would allow a vendor to take advantage of the development cost savings attributed to SaaS firms that use a proprietary API.

Would it be more profitable for a SaaS firm to develop its own, proprietary code over which it has a (at least temporary) monopoly, or should it adopt an open source approach that makes the underlying code widely available? In the latter model, a SaaS firm would have to generate economic profits not from use of the software itself, which in all likelihood would quickly become a

[10] We thank Dr. Louise Moser for pointing out this fascinating alternative method of hosted delivery.

commodity. Ancillary services or features such as speedy and reliable customer support, education and training of personnel on the software's uses and features, or even fees for data storage and/or actual hosting might provide a good business model if a comparative advantage (e.g., speed of order execution) could provide barriers to entry against potential competitors. Whether an open source solution is able to financially out-perform and dominate the proprietary SaaS implementation examined here is a very interesting question that we leave for future empirical research.

In summary, our analysis of financial statements generated a number of concrete findings relative to determining profitability drivers in the industries we studied. We estimated nine different specifications of our statistical model, one for each category of companies, using operating margin as the dependent variable.

Three major findings emerged from this analysis. First, we found very good fit and high levels of explanatory power for our models. Second, we found that the relationship between SGA over net sales with operating margin is related to overall costs, such that in industries with higher levels of costs (defined by the sum of SGA, R&D, and COGS over sales), a less strong relationship between SGA/Sales and profitability prevails. Finally, we found that for SaaS providers, unlike other types of firm in our analysis, the relationship between inventory/COGS and operating margin is not statistically significant. This finding provides preliminary evidence that confirms the possibility that the pricing model—by definition based on subscription as opposed to license of physically shipped software for SaaS companies—leaves a detectable footprint on financial statements.

Our analysis of SaaS firms takes place while this industry group is not very far along its developmental path. As the industry matures, it will be interesting to revisit each of these findings at some point in the future. In the meantime, other statistical methods—such as use of firm-level matching—would be useful to confirm or disconfirm the central findings of this analysis.

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