**IPRPD**
International Journal of Business & Management Studies
ISSN 2693-2547 (Print), 2693-2555 (Online)
Volume 03; Issue no 08: August, 2022
DOI: 10.56734/ijbms.v3n8a5

# An Empirical Study of Software Companies' Merger and Acquisitions in the Software-as-a-Service Market

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## Abstract

*This study examines the herding behavior of software companies when they merge and acquire (M&A) SaaS firms to compete in the market. Through an empirical analysis of 71 companies in SIC 737 industries from 2003- 2017, we find that firms try to imitate their peer competitors' M&A activities and their imitation decisions are contingent on the resources and capabilities. Specifically, firms with more slack resources are more likely to develop SaaS products and services by themselves instead of acquiring an existing SaaS firm. Creating their own SaaS products could bring more stable and reliable profits in the long term, even though firms may have low profit margins in the short term. Thus, these firms do not consider acquiring the developing process through M&A. Our findings have managerial implications for on-premises companies in their transformation to cloud-based businesses.*

**Keywords:** SaaS, Cloud Computing, Competitive Actions, Mergers and Acquisitions, Herding Behavior

## 1. Introduction

Mergers and acquisitions (M&A) are competitive actions that firms take to enhance their competitive advantages, especially in highly competitive markets (Haleblian et al., 2012). Firms are motivated to merge or acquire other firms intending to capture and leverage synergistic resource exchanges, overcome barriers to entry into a market, increase market shares, reduce competitors, and strengthen their reputation and images (Uhlenbruck et al., 2017; Zilber et al., 2002). In a hypercompetitive environment, firms' M&A decisions are often influenced by their competitors' strategic actions, stimulating the actions of the market leaders. However, this kind of M&A may not work for all companies. Therefore, understanding how firms respond to their peer's M&A activities is necessary from a strategic management perspective.

The software industry has transitioned from an on-premises to a SaaS business model in the past fifteen years. SaaS could transform the on-premises companies' competitive landscape through a new platform for creating and delivering business value (Markides, 2006). This disruptive innovation forces the on-premises software companies to enter the SaaS market via M&A. Therefore, we have witnessed numerous M&A by established on-premises software companies. Through M&A, established on-premises software firms immediately obtain the resources to enter the SaaS market. This paper examines how software companies respond to their peers' strategic M&A. We study the herding effect in which firms imitate the strategic actions of the market leaders and the moderating effects of organizational resources and capabilities.

Strategic decisions of SaaS by the software firms are under-investigated, with most of the studies focusing on price models (Ma et al., 2012), the development of cloud offering typologies (Marston et al., 2011), and the software quality control. Yet, there is a lack of systematic understanding of software companies' SaaS development strategies under peer pressure. Our study investigated the competitive actions taken by the publicly traded software companies in computer programming, data processing, and other computer-related services from 2003 to 2017. We found a herding behavior exists in software firms' M&A of SaaS companies. Firms with high organizational profitability are more likely to M&A to counter their peers' competition. In contrast, firms with a more considerable amount of slack are less likely to take similar moves.

The study can contribute to the existing literature in the following ways. First, we advance the understanding of herding effects in the software industry by revealing whether firms have the propensity to imitate their peers in a hypercompetitive environment. Second, we expand the cloud computing literature by empirically examining the software companies' M&A decisions under peer pressure. Third, we introduce a new method into IS literature to identify the causal relationship between herding behavior and the firms'

strategic decisions. Quantifying causal herding effects in organizational contexts is notoriously tricky due to simultaneity and unobserved correlated factors (Manski, 1993). To reduce such methodological problems, we introduce a method that provides researchers with an efficient way to prove the causal effects of herding. We also show that intensified peer pressure stimulates firms to take aggressive actions and drives overinvestment. Finally, from a policy perspective, the study would be useful to improve our understanding of the herding effects in specific contexts to anticipate better situations where the herding is likely to happen.

The remainder of this study is structured as follows: section 2 provides the relevant literature and theoretical background of the study, we give a brief overview of the academic background of the study, followed by section 3, which is hypotheses development. Next, we explain the data collection, variable measures, and econometric analysis in section 4. We then present the results, followed by a discussion of the key findings in section 5, the potential contribution of the research, and future research direction in section 6.

## 2 Literature Review

The study is closely related to three streams of literature. The first stream is cloud computing literature related to the applications and characteristics of SaaS. As one of the most popular cloud services, SaaS is a software distribution model in which software applications are hosted on a remote server (cloud-based), delivered as an on-demand service, and accessed by multiple users through the web browser (Mell and Grance, 2011). The SaaS market is anticipated to grow at a compound annual growth rate (CAGR) of 21.20% during the forecast period 2018-2023[1]. To provide SaaS, the incumbent firms should adjust the business model, including the marketing and sales tactics, product development and management, and daily operations model (Chappell, 2012) to fit into the new business model (Sun et al., 2007). Previous research related to the SaaS has investigated the revenue model of SaaS (Choudhary and Zhang, 2015; Ojala and Tyrvainen, 2011), risks and opportunities of the cloud services (Benlian et al., 2009), and the competitions, changes, or impacts evoked by SaaS (Fang et al., 2008). They also evaluated the effects of offering SaaS on firm performance (Ge and Huang, 2014). Though previous literature has quantified the value of SaaS by examining how it changes the traditional business model (Susarla et al., 2009), the fundamental understanding of the strategic decisions of the IT vendors, which are the pillar of cloud computing, is starkly limited. The past few years have witnessed a bunch of firms jumping onto the cloud bandwagon, such as SAP, Oracle, Google, and Microsoft. The coexistence of on-premises products and cloud-delivered services model has become common in the software industry. How the incumbent firms in the software industry would react to their peers' actions facing the emerging market is yet unclear.

The second stream of literature is related to the strategy literature regarding firms' sourcing decisions. The question of why firms choose external sourcing, i.e., M&A, instead of internal research and development (R&D) investment has been extensively explored (Arora et al., 2014; Fabrizio, 2012). It is suggested that external sourcing, often achieved through the firm's M&A decision, is an exploration of resources, whereas internal development exploits the resource. M&A is the firm's choice of whether to conduct a particular transaction inside the organization or outside through a market exchange (Santos and Eisenhardt 2005). Internal development through R&D is preferred over external sourcing as market demand uncertainty and technology proprietary increases (Robertson and Gatignon, 1998). However, external sourcing could help the firm obtain competitive advantages in the market (Chatterjee, 1990).

Regarding how firms develop their products or services, Hoffmann and Schaper-Rinkel (2001) found that two factors could affect the firm's choice to conduct M&A activities: environment and firm characteristics. It is suggested that the firm's internal capabilities play important roles in determining its sourcing decision. Their peer's activities in the market are also important drivers (Capron and Mitchell, 2009). Xue et al. (2011) found that the firm's governance decision could be affected by the environment: in an uncertain environment, the firms are more likely to pursue external sourcing. Though these studies have shown the importance of environmental characteristics, existing literature has not yet clearly understood whether the peers' sourcing decisions would affect the firm's decisions.

The third stream of literature is related to herding effects on a firm's strategic actions. Herding occurs among a group of economic agents when the agent's utility of adopting a practice increases with the proportion of others who adopt that practice (Shi et al., 2017). Herding effects emerge in many circumstances. For instance, herding could affect the lender's behavior in the microloan market, and listings by the well-funded borrower tend to attract more funding (Zhang and Liu, 2012). Similarly, Herzenstein et al. (2011) found that the lenders have a greater likelihood of bidding on an auction with more bids in a loan auction. In online shopping, customers often observe others' decisions before making their own. Shopping on eBay is suggested to be affected by the people who would follow other customers' choices (Simonsohn and Ariel 2008). At the organization level, the studies in herding are relatively sparse. Most of the existing literature

[1] https://www.reuters.com/brandfeatures/venture-capital/article?id=81233

examines the organization's herding behavior in new technology or practices adoption. For instance, Angst et al. (2010) found that the hospital's adoption of IT innovation is affected by the prior adopters' usage of new technologies. The herding effects would also exist in the firm's market entry decision. Hsieh and Vermeulen (2013) suggested that there exists a pattern that the firm is inclined to follow its competitors' decisions in entering the market. Direct encounters between firms' peers lead to herding effects, making imitative moves such as market entry more likely (Hsieh and Vermeulen, 2013). However, there is a lack of research on herding effects for repeated strategic decisions such as the firm's M&A decision.

## 3. Hypotheses Development

### *3.1 Competitive Pressure and Sourcing Strategy*

Firms that operate their business in the same industry are often regarded as their peers, offering similar products and aiming at similar customers. Market commonality and resource similarity make peers compete more fiercely in that they have overlaps in their operating business (Chen, 1996; Hoberg and Phillips, 2010). Thus, a firm is more likely to be threatened by its peers' strategic actions and respond to their actions with specific measures (Chen and MacMillan, 1992). In a competitive intensive industry such as the software industry, peers' actions could be essential information sources for a firm when making strategic decisions. As a "Schumpeter" industry, the industry is considered to have a low entry, and innovation diffuses quickly in this industry (Li et al., 2010). Thus, firms pay attention to the actions of their peers to keep up with the innovative paces and maintain competitive advantages in the market.

The emergence of SaaS as an innovation has brought the industry both challenges and opportunities: new entrants providing SaaS in the software industry could obtain first-mover advantages in the market (Makadok, 1998). The incumbents in the industry might take action to embrace the innovation, either internally developing SaaS to compete against the existing SaaS vendors in the market or acquiring existing SaaS firms in the market to obtain access to the technology immediately. Some firms are strongly motivated to take aggressive actions in the market by carrying out a wide range of competitive activities. In contrast, others are less motivated to respond aggressively. M&A of SaaS-related firms, though costly, could help obtain access to the relevant resources faster than the internal R&D investment. The acquirer may then realize an improvement in its competitive position or its competitive advantage upon completing an acquisition (Hitt et al., 2001). The gains from the acquisition signal to the peers that the acquirer has enhanced its capability to get advantages in the market (Chen et al., 2007); thereby, the rivals shall view the acquisition as a competitive threat.

Enhanced competitive pressure can increase the likelihood of investment in SaaS. Indeed, incumbent firms feel threatened by the potential gale of innovation and are motivated to invest in it (Gilbert, 2006). Under uncertainty, as suggested by the herding effects (Avery and Zemsky, 1998), firms interpret peers' prior entry as a signal of market attractiveness. When the peers externally source their SaaS development process, the signaling effects are even more substantial regarding the market's potential size and consumers' willingness to pay. We consider that the herding effects will be more potent when many of a firm's peers encounter each other in the market, increasing the probability that they will act similarly. Firms that are a part of this group of peers but do not follow suit—that is, they do not provide SaaS when others do—will expose themselves to reputational risk (Zwiebel, 1995). Thus, when a firm's peers are acquiring SaaS companies, the focal firm is more likely to take similar strategic movements, i.e., acquiring SaaS firms as a strategic move.

External sourcing of technology is not risk-free. Failure rates of mergers and acquisitions are typically between 60 to 80 percent (Homburg and Bucerius, 2006; Marks and Mirvis, 2001). Firms such as SAP AG reported disappointing performance of the acquired SaaS businesses *ex-post* takeovers[2]. However, under the peer's pressure to expand the SaaS by M&A, a firm likely takes similar or even aggressive actions to maintain their competitive advantages in the market (Heart et al., 2010). Therefore, we hypothesize that:

**H1: Peers' SaaS-related M&A decisions increase the probability of a focal firm's SaaS-related M&A decisions.**

### *3.2 Moderating Effects of Organizational Context*

An incumbent's response to such a threat arises from interactions between peer pressure and firms' current resources, which is consistent with what the resource-based view (RBV) has suggested (Arora et al., 2014; Fuentelsaz et al., 2015). The RBV emphasizes heterogeneity across firms and views the variation in resources and capabilities as one of the important drivers in strategic decisions. Applying the RBV of the firm to the governance decision suggests that a firm's resources and capabilities condition its incentive to acquire external resources.

As suggested by the resource dependence view, organizational behavior is likely to be affected by external factors. However, it is also suggested that a firm's competitive actions require support from its resources.

[2] https://tbri.com/blog/money-cant-buy-saas-performance/

Competitive action is the media through which firms can employ their resources from different perspectives and gain competitive advantages (Ndofor et al., 2011). Even under the same level of peer pressure, firms might vary considerably in their responses to peer pressure because their resource combination is the prerequisite for the decision.

***Organization Slack***. Every stage of a firm's production might assess the make-or-buy choice to minimize the governance costs (Santos and Eisenhardt 2005). However, such a choice depends on the firm's resource combination. Organizational slack is one of the widely explored capabilities related to the firm's sourcing strategies. Slack is often considered a "cushion of resources" measured by a firm's excess resources. It allows a firm to adapt to environmental changes, quickly modify its strategy, and pursue riskier opportunities (Haleblian et al., 2012; Wan and Yiu, 2009). Slack enables a firm to perform a wide range of strategic behaviors, including being an actor in a merger and acquisition wave (Haleblian et al., 2012). Peer's acquisition of SaaS-related firms could enhance their competitive position in the market, threatening the focal firm. However, slack allows firms to act to exploit specific opportunities and react to threats in the competitive environment. When the firm's peers are acquiring SaaS firms to increase their competitive advantage in the SaaS market, a firm with more considerable slack is likelier to take a similar strategic decision following their peers to maintain their competitive position in the market.

**H2: Under the same level of competitive industry pressure, firms with more significant slack are more likely to make similar moves following their peers.**

***Organizational Profitability***. External sourcing often raises appropriation concerns because of difficulties in screening and transferring the external capabilities into the firm. The ability to transform the resource into profits requires controlling the stocks of resources and the firm's capacity to deploy resources for the desired result. Hence, to obtain resources from outside the organization, firms commonly need to own stocks of resources and the skills required to deploy the resources. M&A allows firms to obtain majority control of other entities and transfer external knowledge into the firm. However, externally acquired resources do not always fit the firm's internal systems and processes, demanding retraining changes in the flow of the production process (Fabrizio, 2012). Firms vary in their abilities to turn resources into profits through the organization, government, and production management. Organizations with higher capabilities in profitability are expected to show relatively low levels of absenteeism, tardiness, and voluntary turnover (Angle and Perry, 1981; Santhanam and Hartono, 2003). They are profiting from the external technological resources required for integrative knowledge about complex business activities, including the ability to produce a new generation of software services that combine knowledge of multifaceted technical advances, services skills, and changes in customer demand (Parmigiani and Mitchell, 2009). Firms with higher capabilities to profit from their resource combination are then more capable of achieving competitive advantages through acquisition. In other words, the acquisition of external resources would, in return, affect a firm's production process, which firms could better handle with higher capabilities to profit from the resources. Thus, organization profitability positively moderates the relationship between peer pressure and the firm's M&A decisions. As a result, we consider that:

**H3: Under the same level of direct competitive pressure, firms with higher profitability are more likely to make similar moves following their peers.**

## 4. Data Collection

We investigated the publicly traded firm under SIC 737 in computer programming, data processing, and other computer-related services from 2003 to 2017 from COMPUSTAT. SIC 737 is closely related to cloud computing services: most of the firms in the industry provide on-premises software before the era of cloud services. However, in the past decades, many firms in this industry have jumped on the bandwagon of cloud services providing the chance to examine the firm's decisions in SaaS-related M&A activities.

News articles are important information sources of the firm's decision without additional analyses (Herold et al., 2006). Firms usually manage media coverage to influence their market capital during important corporate events such as their M&A activities. Thus, we collected the merge & acquisition activities of the firms from news articles from the news database Factiva. Factiva enables us to identify relevant articles and press releases based on the firm's name. If a news article discusses a firm in sufficient detail, it will match the article to the focal firm. We selected the list of potential news sources, including all English-language media sources from all the major news and business publications and Newswire services in Factiva. The primary newspaper sources such as *USA Today, The Wall Street Journal,* and *The New York Times,* among many others. This suggested that our media source covers multiple media outlets rather than unique news events.

We then used the keyword search to identify the M&A announcement we need. We use the words *"acquire," "merge," "M&A,"* and variations to identify the M&A deals of a focal firm. Typically, this type of

article would be entitled in the format of "Firm A acquired Firm B." For each M&A deal, we retrieve information about the terms of the transaction and the key dates in the merger process from the news announcements. We analyzed the content to identify the number of M&A activities. The statements usually provide a narrative introduction of both the acquiree and acquirer from which we would be able to locate the information of acquirer and acquiree. Specifically, we then used a batch of keywords including "*Software as a Service*," "*SaaS*," "*cloud computing*," "*on demand*," "*pay per use*," and variations with dashes to identify the SaaS-related M&A activities from the articles.

To construct peer groups, we obtained the four-digit primary SIC and the secondary SIC from the business segment of each firm from the COMPUSTAT segment file. We used the segment data to construct partially overlapping groups of peers as direct peers: the first-degree peers (Shi et al. 2017). We define first-degree peers as firms operating in at least one common industry. For instance, if firm A operates in both SIC 7371 and SIC 7372, firm B operates in SIC 7372 and SIC 7373, then they are regarded the first-degree peers or direct peers. The direct competitors have similar resource structures and compete for similar customer bases and market resources. Thus, they are suggested to interact intensively and respond to each other's market activities (Shi et al., 2017; Uhlenbruck et al., 2017).

To control the firm's capabilities and performance, we also collected the firm's financial data. The economic data is downloaded from the database COMPUSTAT. We used the data to construct variables related to the firm's abilities and financial performance.

### *4.1 M&A in the SaaS market*

We provide the M&A trend regarding the number of total M&A and the number of SaaS-related M&A in a given annual year in Figure 1. As shown in Figure 1, the software industry has gone through several M&A waves from around 2007, 2011 to 2012, and 2014 to 2015, suggesting that the M&A decision approach in the industry obtain competitive advantages in the market. In addition, we observed an increasing trend in the M&A related to SaaS. The growing trend began to become prominent in the market in 2011 when the market witnessed many firms jump on the bandwagon of cloud services. Thus, increasing peers' pressure in the market could stimulate a firm to join the SaaS-related M&A tides. We list the companies with the highest number of SaaS-related M&A in the past decades in Table 1. We found that even though pure SaaS company such as Salesforces.com has a relatively high level of involvement in acquiring SaaS companies, the traditional on-premises firms like Oracle, VMware even Microsoft has acquired some SaaS-related firms to extend their business to the cloud. This suggests that the IT firms that originally concentrated their business on on-premises software have expanded their business to the cloud service through internal R&D investment and the acquisitions of external companies. For some of the giants in the software industry, acquisition is a meaningful way to maintain their competitive advantages in the market.

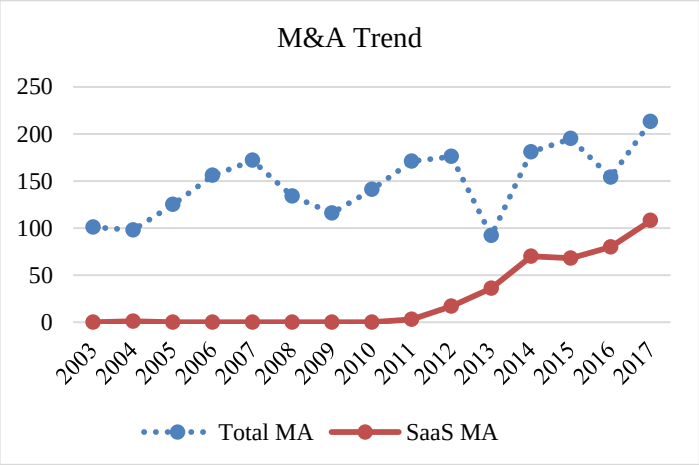


**Table 1 Number of SaaS M&A**

| | Company Name | Number of SaaS M&A |
|---|---|---|
| **1** | Salesforce.Com Inc | 18 |
| **2** | Descartes Systems Group Inc | 15 |
| **3** | Ebix Inc | 14 |
| **4** | Asure Software Inc. | 13 |
| **5** | Logmein Inc | 13 |
| **6** | Oracle Corp | 11 |
| **7** | Peak Positioning Technologies | 11 |
| **8** | Envestnet Inc | 10 |
| **9** | Open Text Corp | 10 |
| **10** | Callidus Software Inc | 9 |
| **11** | Vmware | 9 |
| **12** | Upland Software Inc | 9 |
| **13** | Microsoft Corp | 9 |
| **14** | Design Media Solutions Inc | 9 |
| **15** | Citrix Systems Inc | 9 |

| | | |
|---|---|---|
| **16** | Blackbaud Inc | 8 |
| **17** | Micro Focus Intl Plc | 8 |
| **18** | SS&C Technologies Hldgs Inc | 7 |
| **19** | Symantec Corp. | 6 |
| **20** | Analytixinsight Inc | 5 |
| **21** | Akamai Technologies Inc | 5 |
| **22** | Halogen Software Inc | 5 |
| **23** | BMC Software Inc | 5 |
| **24** | EMC Corp | 5 |

### *4.2 Variable Measurement*

*Dependent variable*

*SaaS_MA*. The variable is measured as the number of firms' SaaS-related acquisitions. To develop their SaaS-related products or services, the firms could choose to external sourcing the development of SaaS. One way is to conduct merger and acquisition activities. The dependent variable measures the total number of SaaS-related M&A activities annually.

*Independent variable*

*A total number of M&A.* Firms M&A decisions are regarded as critical strategic decisions that could affect investors' perception. The total number of M&A represents the total number of M&A activities in the year. Firms also develop different contracting capabilities that influence the relative costs and benefits of sourcing from outside suppliers. Just as firms can develop the ability to manage interfirm alliances (Kale et al., 2002), they can grow and exploit the capability to design contract terms that are suited to the characteristics of the given transaction (Argyres and Mayer, 2007).

*Absorptive capacity*. The firm's absorptive capacity is measured by the proportion of R&D investment to sales. The variable is often used to measure the firm's capacity for absorbing and taking advantage of external knowledge (Cohen and Levinthal, 1990).

*Slack.* Slack is measured as the total revenue divided by working capital. Slack indicates firms' possession of excess resources, allowing them to pursue risky decisions and new opportunities (Iyer and Miller, 2008).

*ROS.* The total assets divided by sales measure return on sales. The variable is used to measure the firm's ability to obtain profits. In other words, this could be an indicator of the firm's performance. Firms with higher profit ratios are allowed to pursue riskier opportunities and turn the risk into profits.

*Other controls.* In addition to the above firm's capabilities, we also control the firm's characteristics in the analyses. For example, we used the natural logarithm number of employees to measure the firm size (Ahuja and Katila, 2001). The Herfindahl-Hirschman Index (HHI) controls the industry concentration at the industry level. It is calculated by squaring the market share of each firm competing in a market and then summing the resulting numbers. In addition, we also incorporate the year dummies in the analyses. Table 2 summarizes the variable definitions and measures.

| **Variable** | **Measurement** | **Data Source** | **Reference** |
|---|---|---|---|
| *Dependent variable* | | | |
| SaaS_MA | Number of SaaS-related mergers and acquisitions | Factiva, SEC filings, | (Arora et al., 2014) |
| *Independent variables and control variables* | | | |
| Peer_MA | The average number of peer SaaS-related mergers and acquisition | COMPUSTAT | (Shi et al., 2017) |
| NMA | Total number of mergers and acquisitions | COMPUSTAT | (Cloodt et al. 2006) |
| Absorptive Capacity (Abcam) | Abcap= $\frac{R\&D\,\text{exp}ense}{sales}$ | COMPUSTAT | (Cohen and Levinthal 1990) |
| Slack | Slack=$\frac{Working\ capital}{total\ revenue}$ | COMPUSTAT | (Iyer and Miller 2008) |
| ROS | $ROS = \frac{Sales}{TA}$ | COMPUSTAT | (Santhanam and Hartono 2003) |
| HI | $HHI = \sum mktshare^2$ | COMPUSTAT | (Van de Grande 2013) |
| Firm size | Log (number of employees) | COMPUSTAT | (Ahuja and Katila 2001) |

**Table 2 Summary of Measures and Data Sources**

## 5. Model Estimation and Results

### *5.1. Estimation Model*

Our dependent variable is the count number of SaaS-related M&A activities per year so that we could use the Poisson model or negative binomial model. However, if the variance of the dependent variable is larger than its mean, we then consider the negative binomial model as suitable for our study. Compared with the Poisson model, the negative binomial model is employed to deal with the overdispersion issue in the data. We used a fixed-effects negative binomial model since we have structured panel data. The expectation of the dependent variable is specified as follows (Allison and Waterman, 2002):

$$E\ [y_{it}|x_{it}, \varepsilon_{it}] = exp\ (\alpha + X_{it}\beta + \varepsilon_{it})$$

The mass function is then specified as:

$$f(y_{it}|\lambda_{it}, \theta_i) = \frac{\Gamma(\lambda_{it} + y_{it})}{\Gamma(\lambda_{it})\Gamma(y_{it} + 1)}\left(\frac{\mu_{it}}{\mu_{it} + \lambda_i}\right)^{y_{it}}\left(\frac{\lambda_i}{\mu_{it} + \lambda}\right)^{\lambda_i}$$

Where the $\Gamma$ is the gamma function, the $\lambda_i$ is constant for each individual. $\mu_{it}$ is estimated through the link function depending on the covariates:

$$ln\,\mu_{it} = \delta_i + \beta X_{it}$$

In the fixed-effect estimation, estimator $\beta$ can be conditioned on the mass function:

$$f\ (y_{it}\ldots\ldots y_{iT}|\sum y_{it}) = \frac{y_{i1}!\ldots y_{iT}!}{\Gamma(1 + \sum_t y_{it})}\prod_t\left(\frac{\mu_{it}}{\sum_t \mu_{it}}\right)^{y_{it}} \propto \prod_t\left(\frac{exp(\beta X_{it})}{\sum_s exp(\beta X_{is})}\right)^{y_{it}}$$

We used one-year lagged explanatory variables to address the concerns of causal inference and potential endogenous issues in the analyses (Blundell et al., 1999; Cloodt et al., 2006). We include the interaction term between peers' herding behavior and the focal firm's complementary asset in our model to test the moderating effect of the firm's characteristics on the impacts of herding behavior pressure on the firm's M&A behavior. Summary statistics are reported in Table 3A. The dependent variable ranges from 0 to 10, with the mean of 0.07 suggesting that most of the time, the acquisition of SaaS-related firms is low. The number of acquisitions varies significantly from firm to firm, providing us with variations to investigate M&A activities across the firms. The average number of peers' SaaS-related M&A ranges from 0 to 10, with a mean of 0.51. The average number of peers' total M&A ranges from 0 to 17, with a mean of 0.33. These indicate the variation of focal peers' M&A activities. The total number of M&A varies from 0 to 21, with an average of 0.42. Firms also vary in their abilities. Firm ROS goes from -91 to 542, with 1.46, as its mean. The variable slack varies from -5835 to 3405, with a mean of -5.19 in the dataset, suggesting a great variety across these firms, supporting our argument that the firms vary greatly in their abilities. In addition, there are no highly correlated variables, as shown in Table 3B, which indicates that we would not suffer from multicollinearity issues in our analyses.

| | Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|---|
| 1 | SaaS_MA | 5,325 | 0.07 | 0.49 | 0.00 | 10.00 |
| 2 | peer_MA | 4,062 | 0.08 | 0.51 | 0.00 | 10.00 |
| 3 | peer_NMA | 4,062 | 0.33 | 1.28 | 0.00 | 17.00 |
| 4 | NMA | 5,325 | 0.42 | 1.34 | 0.00 | 21.00 |
| 5 | ROS | 5,222 | 1.46 | 13.73 | -91.25 | 542.00 |
| 6 | Slack | 5,011 | -5.19 | 148.20 | -5835.00 | 3405.70 |
| 7 | Abcam | 4,499 | 48.15 | 329.19 | 0.00 | 9875.00 |
| 8 | firm size | 5,209 | 4.20 | 2.85 | -6.91 | 12.39 |
| 9 | HI | 4,886 | 64.89 | 32.78 | 0.00 | 100.00 |

**Table 3A Summary Statistics**

| | Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SaaS_MA | 1 | | | | | | | |
| 2 | peer_MA | 0.19 | 1 | | | | | | |
| 3 | peer_NMA | 0.13 | 0.55 | 1 | | | | | |
| 4 | NMA | 0.40 | 0.06 | 0.05 | 1 | | | | |
| 5 | ROS | -0.01 | 0.02 | 0.01 | -0.01 | 1 | | | |
| 6 | Slack | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | | |
| 7 | Abcam | -0.01 | -0.01 | -0.02 | -0.03 | 0.00 | 0.19 | 1 | |
| 8 | firm size | 0.18 | 0.10 | 0.09 | 0.37 | 0.00 | 0.09 | -0.13 | 1 |
| 9 | HI | -0.15 | -0.10 | -0.20 | -0.09 | 0.01 | -0.03 | 0.02 | -0.14 |

**Table 3B Variable Correlations**

### *5.2 Estimation Results*

The main results are reported in Table 4. We found that the peers' herding behavior does affect the focal firms' M&A decisions. When a firm's peers are conducting SaaS-related M&A decisions, the focal firm is likelier to do a SaaS-related merger and acquisition to keep up with their peers' actions in the market. Column (1) in table 1 shows that if the average number of peers' SaaS-related M&A increases by 1, the expected number of the focal firms' SaaS-related M&A increases by around 1.09. This suggests that the focal firm's M&A is affected by its peers' decisions. In addition, we found that the peers' total number of M&A could affect the firm's decision in SaaS products development. Column (5) in Table 4 shows that if the average number of peers' total M&A decision increase by 1, the number of SaaS-related M&A of the focal firm would increase by 1.13. A higher average total number of M&A decisions in the peer groups indicate a higher likelihood that the peers in the industry incline to acquire external knowledge through the M&A activities. Suppose a focal firm's peers are conducting M&A decisions. In that case, it is more likely to stimulate the focal firm to jump on the bandwagon of SaaS tides through M&A and obtain external knowledge to increase their knowledge base.

However, considering that the firms could vary according to their resource and abilities, the effects of peer herding behavior might differ from one firm to firm. We found that the firm's capabilities would moderate the impact of peers' herding behavior. Column (2) shows ROS would positively moderate the relationship between the number of peers' SaaS-related M&A activities and the number of focal firms' SaaS M&A. This suggests that if a firm has higher abilities to profit from resources, they are more likely to acquire external resources. Their abilities decide that they are more capable of profiting from their firm resource. Acquiring firms would add to their existing firm resource from which they would be able to turn into profits. However, we found that the slack would negatively moderate the relationship between the peers' M&A and the focal firm's M&A choices. Organization slack refers to the available resources that the firm could use to conduct risky searches and seek new opportunities. When a firm focal witness its peers jumping onto the bandwagon of SaaS, a firm with more slack might consider internalizing the SaaS instead of acquiring an existing SaaS firm. This could be due to the consideration there are first-mover advantages in the SaaS market. Internalizing the developing process of SaaS services could be riskier for the incumbents as they could not become the first movers in the market and get the first movers' advantages. However, developing their own SaaS products could be more stable and reliable long-term, bringing them latter but higher profits. Thus, these firms do not consider externalizing the developing process a better choice. In addition, they are eligible to explore alternative competitive new products or services to counter the trend of SaaS development. The moderating effects are similar in the relationship between the peer groups' total number of M&A activities and the focal firm's SaaS-related M&A actions.

| Variable | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| peer1NMA | 0.083** | 0.084*** | 0.087*** | 0.086*** | | | | |
| | (0.032) | (0.032) | (0.032) | (0.032) | | | | |
| L.peer1NMA | -0.066 | -0.188** | 0.005 | -0.110 | | | | |
| | (0.042) | (0.078) | (0.055) | (0.088) | | | | |
| peer1MA | | | | | 0.121** | 0.127** | 0.125** | 0.125** |
| | | | | | (0.054) | (0.055) | (0.057) | (0.059) |
| L.peer1MA | | | | | 0.058 | -0.162 | 0.058 | -0.162 |
| | | | | | (0.081) | (0.103) | (0.080) | (0.000) |
| L.ROS_peer1NMA | | 0.074** | | 0.070* | | | | |
| | | (0.038) | | (0.039) | | | | |
| L.slack_peer1NMA | | | -0.156* | -0.155* | | | | |
| | | | (0.080) | (0.080) | | | | |
| L.ROS_peer1MA | | | | | | 0.163*** | | 0.164*** |
| | | | | | | (0.042) | | (0.062) |
| L.slack_peer1MA | | | | | | | -0.053 | 0.027 |
| | | | | | | | (0.210) | (0.213) |
| L.NMA | -0.062 | -0.060 | -0.062 | -0.062 | -0.057 | -0.061 | -0.056 | -0.062 |
| | (0.045) | (0.046) | (0.045) | (0.046) | (0.045) | (0.045) | (0.046) | (0.046) |
| L.Abcap | -0.143*** | -0.140*** | -0.144*** | -0.142*** | -0.140*** | -0.140*** | -0.140*** | -0.140*** |
| | (0.043) | (0.042) | (0.043) | (0.042) | (0.043) | (0.042) | (0.043) | (0.042) |
| L.ROS | 0.029 | -0.011 | 0.031 | -0.004 | 0.028 | -0.009 | 0.028 | -0.010 |
| | (0.028) | (0.074) | (0.027) | (0.072) | (0.029) | (0.071) | (0.029) | (0.079) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| L.slack | 0.468 | 0.465 | 0.547* | 0.539* | 0.449 | 0.475 | 0.458 | 0.47 |
| | -0.296 | -0.294 | -0.299 | -0.296 | -0.301 | -0.298 | -0.302 | -0.3 |
| firmsize | 0.700*** | 0.727*** | 0.723*** | 0.745*** | 0.703*** | 0.736*** | 0.705*** | 0.736*** |
| | -0.235 | -0.233 | -0.233 | -0.232 | -0.24 | -0.237 | -0.239 | -0.236 |
| HHI | 0.072* | 0.073* | 0.081* | 0.081* | 0.083* | 0.085** | 0.084* | 0.084** |
| | -0.042 | -0.042 | -0.044 | -0.043 | -0.043 | -0.042 | -0.043 | -0.042 |
| Log likelihood | -202.412 | -200.716 | -200.214 | -198.575 | -204.695 | -202.578 | -204.663 | -202.574 |
| $Chi^2$ | 128.61 | 131.62 | 133.81 | 136.13 | 123.86 | 176.48 | 124.17 | 125.73 |

**Table 4 Estimation Results**

Note: 792 observations of 71 firms from 2003 to 2017. Year dummies are included. *, p<0.10, **, p<0.05, ***, p<0.01

The casual herding effects are suggested to be hard to identify. It is hard to rule out the simultaneous problem. To resolve such an endogenous problem, we introduce the M&A of the second-degree peers as the instrumental variable. We constructed the second-degree peers of a focal firm from the data. Here, we used their marketing activities as the instrumental variable in the following analyses. The second-degree peer is defined as follows: if a firm j is not firm i's peer but is the peer of firm i's peer, then we classify firm j as firm i's second-degree peers (De Giorgi et al., 2010). We illustrate what second-degree peers are in figure 2. The reason that we construct the second-degree groups is to use them as the instrumental variables. As figure 2 shows, Microsoft has direct peer Saba software, and Lattice Inc is suggested to be Microsoft's second-degree peer. We further used the control function to estimate the model. Our study considers the average number of second-degree peers a reasonable instrumental variable. As illustrated in Figure 2, we believe that the marketing activities of the second-degree peers (e.g., Lattice Inc) would affect the decision of the first-degree peers (e.g., Saba software). Still, there is no reason to believe that the actions of second-degree peers would affect the focal firm (e.g., Microsoft). We consider that the herding behavior of the second-degree peers would affect the decision of first-degree peers. However, there is no solid reason to consider that the M&A decision of the second-degree peers would affect the focal firm's decision. Thus, we believe that the M&A activities of the second-degree peers are a valid instrument (Shi et al., 2017). The two-stage control function is adopted in that we have a nonlinear model in our analyses. The control function could be used in handling the endogenous explanatory variables in nonlinear models (Wooldridge, 2015). In our case, we used the fixed-effect negative binomial model in the second stage, and the control function is suitable for estimating the instrumented fixed-effect negative binomial model. Results from the control function are reported in Table 5. The results further support our arguments that peer pressure would stimulate the focal firm to take more aggressive actions in jumping onto the SaaS bandwagon.

To further illustrate the effects of peer pressure on the firm's strategic decision, we then use alternative dependent variables in the analyses. We recorded the dependent variable as a dummy, i.e., aggressiveness. A dummy variable measures the aggressiveness: if the firm had a more significant number of SaaS-related M&A activities than the average number of M&A conducted by its peers, then we coded the dummy as 1; else, we coded it as 0. It measures whether the firm would be more aggressive in the M&A decision under the peers' pressure. The results are mainly consistent with our main results suggesting the herding effects exist.

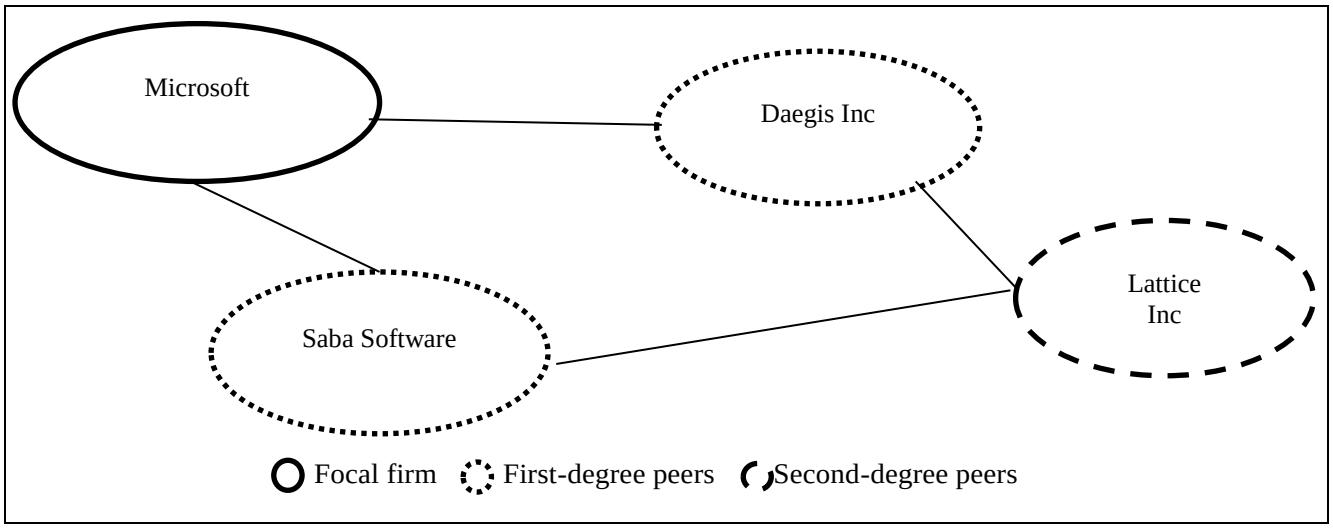


**Figure 2**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| Variable | DV=SaaS_MA | | | | | | | |
| peer1MA | | | | | 0.117** | 0.122** | 0.128** | 0.129** |
| | | | | | (0.054) | (0.055) | (0.058) | (0.059) |
| L.peer1MA | | | | | -0.227 | -0.656 | -0.347 | -0.753 |
| | | | | | (0.478) | (0.496) | (0.518) | (0.554) |
| peer1NMA | 0.087*** | 0.092*** | 0.095*** | 0.100*** | | | | |
| | (0.032) | (0.032) | (0.033) | (0.033) | | | | |
| L.peer1NMA | -0.107** | -0.255*** | -0.027 | -0.174* | | | | |
| | (0.055) | (0.064) | (0.065) | (0.098) | | | | |
| L.ROS_peer1NMA | | 0.084*** | | 0.083** | | | | |
| | | (0.021) | | (0.039) | | | | |
| L.slack_peer1NMA | | | -0.153* | -0.153* | | | | |
| | | | (0.086) | (0.090) | | | | |
| L.ROS_peer1MA | | | | | | 0.168* | | 0.169 |
| | | | | | | (0.090) | | (0.129) |
| L.slack_peer1MA | | | | | | | -0.128 | -0.074 |
| | | | | | | | (0.234) | (0.241) |
| L.NMA | -0.064 | -0.064 | -0.061 | -0.061 | -0.055 | -0.056 | -0.050 | -0.054 |
| | (0.045) | (0.045) | (0.045) | (0.046) | (0.046) | (0.046) | (0.046) | (0.048) |
| L.Abcap | -0.141*** | -0.137*** | -0.142*** | -0.138*** | -0.139*** | -0.138*** | -0.139*** | -0.153*** |
| | (0.043) | (0.042) | (0.043) | (0.042) | (0.043) | (0.042) | (0.043) | (0.042) |
| L.ROS | 0.030 | -0.017 | 0.032 | -0.012 | 0.028 | -0.015 | 0.029 | -0.017 |
| | (0.029) | (0.074) | (0.027) | (0.074) | (0.029) | (0.074) | (0.028) | (0.075) |
| L.available_slack | 0.440 | 0.427 | 0.524* | 0.504* | 0.426 | 0.436 | 0.441 | 0.429 |
| | (0.297) | (0.294) | (0.299) | (0.296) | (0.305) | (0.303) | (0.305) | (0.303) |
| firmsize | 0.704*** | 0.734*** | 0.719*** | 0.741*** | 0.685*** | 0.712*** | 0.684*** | 0.627** |
| | (0.233) | (0.232) | (0.233) | (0.232) | (0.244) | (0.240) | (0.244) | (0.249) |
| HI | 0.075* | 0.076* | 0.083* | 0.084* | 0.080* | 0.078* | 0.080* | 0.072* |
| | (0.043) | (0.042) | (0.044) | (0.044) | (0.043) | (0.041) | (0.043) | (0.040) |
| Rei | 0.095 | 0.134** | 0.069 | 0.111* | 0.176 | 0.304 | 0.252 | 0.369 |
| | (0.059) | (0.058) | (0.055) | (0.057) | (0.291) | (0.279) | (0.317) | (0.306) |
| Year dummies | Included | | | | | | | |
| Log-likelihood | -201.129 | -198.147 | -199.407 | -196.551 | -204.520 | -202.024 | -204.367 | -202.401 |
| $Chi^2$ | 131.87 | 187.61 | 134.69 | 138.35 | 122.55 | 125.53 | 122.72 | 128.09 |
| Observations | 792 | 792 | 792 | 792 | 792 | 792 | 792 | 792 |
| Number of firms | 71 | 71 | 71 | 71 | 71 | 71 | 71 | 71 |

**Table 5 Two-stage Control Function Estimation Results**

Note:*, p<0.10, **, p<0.05, ***, p<0.01.

## 6. Discussion

The study investigated a firm's M&A decision in the SaaS market under its peers' pressure to answer whether there exists herding behavior in the SaaS market. Strategic information such as the M&A decisions has multifaceted implications for various parties, including competitors in the market and investors. Therefore, investigating the firm's M&A decision is essential in understanding its strategic orientation in the SaaS market. Especially when the firms face critical technology and business changes in the environment, how the peers' decisions would affect a firm's strategic choices in the niche of the new market is unclear. The study, however, seeks to find out the herding effects in the market that stimulate the firms to jump on the bandwagon of SaaS-related M&A waves. In addition, the study constructed second-degree peers to identify the casual herding effects on M&A decisions.

The study would be able to contribute in the following ways. First, we extend the current literature on cloud computing and firms' M&A decision by evaluating the peers' M&A decisions in the SaaS market. As a disruptive technology, SaaS has changed the games in the software industry that the incumbents have to respond to the transformation of the business to the cloud to maintain their competitive advantages. Though the firms could choose internal development through R&D investment, the pressure from their peers might stimulate them to take different actions. However, we found that when a firm's peers are acquiring the SaaS

firms to accelerate the process of SaaS development, the focal firm would also respond to their peers' threats by acquiring them.

Secondly, from a methodological perspective, the study introduces a new methodology to measure the causal effects of peers' pressure. We quantify causal herding effects in organizational behaviors using a novel identification strategy of partially overlapping. Constructing partially overlapping peer groups not only represents the marketplace reality that firms belong to multiple strategic groups and compete with different sets of peer firms in each group but also addresses challenges related to simultaneity and correlated unobservable that may bias the estimation of the herding effect.

Third, the study enables us to understand the contagion process in firms' strategy decisions in entering a new market. In this context, firms rely on the M&A decision of their peers to decide their own M&A strategy in the source market. The information about its peers' M&A decisions has multifaceted implications for the market competitors and investors. The firm in the industry, however, would be able to extract information through their peers' decisions and better evaluate the potential of the market. On the other hand, the peers' jumping on the SaaS bandwagon would also stimulate the firm's intention to seek for external resources to maintain the competitive advantages in the market.

The study could also have important implications for the managers regarding their strategic decisions, such as M&A in the market. For example, when considering how they extend their business scope or enter new markets, they might consider whether their peers are taking aggressive moves in the new market and how they could keep up with their paces in the market, i.e., through M&A. However, they might also seek other ways to counter the strategic decisions of their peers by internalizing their developing process of new services or products to avoid the risks of acquiring external resources. Overall, the firm shall pay attention to their peers' strategic decisions but realize that the herding effects might be one of the factors driving them to conduct M&A activities in the market.

**Limitation and Future Research**

The study investigated how the peers' M&A activities in the SaaS market would affect focal firms' M&A decisions. However, we could not obtain the amount of each M&A activity, so we used the number of M&A of the peers as the explanatory variable. Our findings show that an increase in the number of peers' M&A would increase a focal firm's acquisition of SaaS firms. However, we do expect that the amount of the acquisition would achieve similar results.

The current stage of our study focuses on how the peers' M&A would affect the focal firms' M&A decisions. There is a positive relationship between the peers' M&A and the focal firms' M&A decisions moderated by the firms' capabilities. However, we didn't distinguish whether the acquisition of SaaS in the market would help the firm to achieve better.

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