An Empirical Study on the Impact of Price Discounts on Sales in Software-as-a-Service (SaaS) Market

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Abstract

The information technology (IT) industry has witnessed the rapid growth of cloud computing in the past several years. According to Gartner Inc., a research group specialized in IT, and Forbes (2016), while the global market revenue of cloud computing was $58.6 billion in 2009, it reached $175 billion in 2015, recording an approximately 300% growth for the previous six years. Market revenue is expected to grow to $204 billion in 2016 (Gartner 2016). This study examines the impact of price discounts on sales of SaaS applications in the context of the video gaming industry. The findings of this study will enhance several theoretical foundations by providing empirical evidences, as well as offer useful implications to practitioners in the SaaS industry who consider using a price discount(s) in order to increase the sales of their products.

Keywords: SaaS, Cloud Computing, Price Discounts, Video Gaming

1. INTRODUCTION

Cloud computing generally refers to the IT-related services offered through the Internet, including the services for networks, servers, storage, and applications (Mell and Grance 2011), and infrastructures such as the hardware and systems software in the datacenters that are providing these services (Armbrust et al. 2010). Cloud computing can be categorized into three service models by the capability provided to users: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) (Mell and Grance 2011).

IaaS provides the highest level of control on the infrastructure to the users, offering the capability to control the infrastructure including storage, networks, and other underlying computing resources. PaaS offers users the capability to build, manage, and refine the applications in the datacenters of the providers while not offering access for change to the infrastructure. The consumers of SaaS can have the capability to have access to the applications of the service

provider on a thin client interface with SaaS, having the least level of control on the cloud computing infrastructure.

Within the cloud computing services, SaaS is the most popular and widely used cloud computing service, and as such is driving the overall growth of the industry. As an example, in 2015, approximately 61% of the industry revenue was generated from SaaS applications such as human capital management, emailing, web conferencing, and web documenting services (Technology Business Research 2015). Additionally, the widespread use of portable computing devices such as smartphones and tablets contributed to and continues to contribute to the growth of SaaS. According to Cisco VNI Mobile 2015 report, 81% of mobile data traffic was generated by SaaS services and it is expected to increase by 90% in 2019, primarily from audio and video streaming, online storage services, and online video gaming (Cisco 2016).

The video gaming industry is one of the IT domains that has actively adopted SaaS platforms due to its capability to offer interactions between the users and updated game contents. For example, a large portion of mobile app games are based on a SaaS platform (Lowthorpe et al. 2013). The users access to the server of the service provider and enjoy games via thin clients on mobile devices. The dominant format of conventional video games is also moving from tangible software packages to SaaS platforms. As an example, Steam.com, which generated approximately 15% of the PC video gaming industry revenue in 2014, highly relies on SaaS platforms in its service (Vellanki 2016).

Price discounts are one of the most popularly employed and effective marketing promotions for increasing product sales (Chen et al. 2012; Dawson and Kim 2009; Sheng et al. 2007; Yin and Jin-Song 2014). Due to the predominant effect on sales increases, it has been widely investigated in various product domains such as apparel (Alford and Biswas 2002), food (Mishra and Mishra 2011), electronics (Della Bitta et al. 1981; Sheng et al. 2007), and automobiles (Goldberg 1996). The studies commonly reported a positive impact of price discounts on the consumer's value perception of the products (Alford and Biswas 2002; Della Bitta et al. 1981), intention to purchase and purchase incidence (Mishra and Mishra 2011), and net profit of the product (Lee and Rosenblatt 1986; Monahan 1984).

Although the effect of price discounts on sales was examined in various domains, it has been barely investigated in the context of SaaS. Additionally, the prior studies mainly relied on survey methods in a controlled experimental setting (Alford and Biswas 2002; Mishra and Mishra 2011; Sheng et al. 2007) or analytical modeling (Lee and Rosenblatt 1986; Monahan 1984) while few researchers discussed the impact with empirical market data.

This study examines the impact of price discounts on sales of SaaS applications in the context of the video gaming industry, adopting a large panel of data including 188,546 observations of 5,867 video game applications that are based on SaaS platforms. Particularly, it seeks to clarify (1) the effectiveness of price discounts, (2) the impact of discount rate on sales, (3) the impact of discounted price on sales, and (4) the number of competitors using price discounts on the sales of each SaaS application. The findings of this study will enhance the theoretical foundations of perceived value theory, utility theory, and competition theory by providing empirical evidences on the theories. The study also will offer useful implications to the practitioners of the SaaS industry who consider price discounts in order to increase the sales of their products.

2. LITERATURE REVIEW

This research seeks to examine the impact of price discounts on the sales of SaaS, one of the product types of cloud computing services. Therefore, this section discusses the prior studies related to price discounts and cloud computing.

Research on Impact of Price Discounts
The prior studies on price discounts mainly focused on the impact of the discount on the perceived value of the product and the buying intention. In addition, these studies were based on an experimental method or an analytical modeling approach. These studies reported that a higher level of price discount rate induces a higher value perception on a proposed product and a higher buying intention (Alford and Biswas 2002; Della Bitta et al. 1981; Nusair et al. 2010), They also illustrated that the impact can differ by product type (Mishra and Mishra 2011), whether bundled with multiple products (Sheng et al. 2007), demographics such as gender, age, and ethnicity (Goldberg 1996), initial price before discount (Coulter and Coulter 2007), and the level of price discounts (Coulter and Coulter 2007; Lee and Rosenblatt 1986; Monahan 1984). Within the information systems discipline, Ghose and Han (2014) reported that an optimized level of price

discounts on mobile apps can maximize the revenue of app developers.

While investigating the impact of price discounts on the sale of product, the prior studies discussed the impact in the context of conventional, tangible products (Alford and Biswas 2002; Coulter and Coulter 2007; Della Bitta et al. 1981; Goldberg 1996; Mishra and Mishra 2011; Sheng et al. 2007), which are different than that of IT-related products and services.   Although the recent study of Ghose and Han (2014) discussed the impact based on empirical data collected from the mobile app market, its focus was on the overall dynamics of the mobile app market economy, rather than the effect of price discounts.

Research on Cloud Computing

One of the most popular topics in cloud computing literature has been the conceptual discussions on a new technology, cloud computing (Armbrust et al. 2010; Buyya et al. 2009; Mell and Grance 2011; Qian et al. 2009; Vouk 2008; Weinhardt et al. 2009). These studies discussed concepts, systems structures, stakeholders, technologies related to cloud computing, and potential topics for cloud computing research.   In computer engineering disciplines, many studies focused on the technical aspects of cloud computing. They introduced new technologies related to cloud computing (Ekanayake and Fox 2009; Foster et al. 2008; Marinos and Briscoe 2009; Yan et al. 2009; Zhang et al. 2010) and evaluated technical performance of the cloud computing technologies (Calheiros et al. 2011; Jackson et al. 2010; Ostermann et al. 2009; Yu et al. 2010).   In the academic field of management information systems, the research mainly discussed managerial aspects of cloud computing in the context of business.   Researchers investigated the perception of business practices on cloud computing platforms (Leavitt 2009; Marston et al. 2011; Pearson et al. 2009), the adoption of cloud computing (Behrend et al. 2011; Ercan 2010; Kim 2011; Low et al. 2011; Sultan 2010), and privacy and security concerned issues in using the cloud computing platform (Kaufman 2009; Li et al. 2009; Subashini and Kavitha 2011; Takabi et al. 2010).

Although multiple disciplines have explored cloud computing, few prior studies have investigated the sales of cloud computing products employing empirical market data.   Therefore, this study will be one of the first attempts to examine the dynamics of the sales of cloud computing products, particularly SaaS, while discovering the impact of price discounts on sales.

3. HYPOTHESIS DEVELOPMENT

Addressing the purposes of this study, specific research hypotheses are developed based on the theories and findings of prior studies concerning price discounts.

Price Discount and Sales of SaaS

Price discounts are one of the most effective methods to increase sales according to several studies (Chen et al. 2012; Dawson and Kim 2009).   The reason can be explained with two theoretical viewpoints: price fairness evaluation and utilitarian motivation of consumers.   In the evaluation of fairness of a product price, consumers may use two types of price: perceived price and internal reference price (Sheng et al. 2007).   Perceived price refers to the price recognized by a consumer, which is generally a listed price of a product, while internal reference price means a price that plays as a scale to evaluate the appropriateness of the perceived price. If the perceived price is lower than the internal reference price, consumers may believe it is inexpensive (Kalyanaram and Winer 1995; Maxwell 2002). Hence, the internal reference price has a significant influence to the purchase decision of consumers (Sheng et al. 2007). Price discounts are known to decrease the internal reference price of consumers. Due to the decreased internal reference price, consumers tend to perceive a product at a regular price more expensive than that of a discounted price. Therefore, consumers prefer a product offered at a discounted price to that of a regular price.

Another explanation for the effectiveness of price discounts is a utilitarian motivation of consumers, which is a critical determinant of intention to purchase.   Utilitarian motivation refers to a tendency to seek for a rational, efficient, and goal driven decision to complete a task (Batra and Ahtola 1991; Hirschman and Holbrook 1982).   Therefore, consumers with the motivation are more likely to purchase a desired product when it is offered at a discounted price because they can satisfy their need at a lower cost.

In the e-commerce environment, price discounts are found to increase the purchase intention of online shoppers (Chevalier and Goolsbee 2003; Earl and Potts 2000; To et al. 2007) and actual sales and profits from products. According to the research conducted by Ghose and Han (2014), the sales and profit from mobile apps tend to increase when they are offered at a discounted price. Similar to mobile apps, SaaS applications are software distributed in the online marketplaces. Therefore, it can be predicted that the consumers are more likely to buy SaaS

applications when they are offered at a discounted price and consequently, contribute to their sales increase. Therefore, the following hypothesis is introduced;

H1: Price discounts have a positive impact on the sales increase of a SaaS application.

Price Discount Rate and Sales of SaaS
In making purchase decisions, consumers pay significant attention to a price discount rate as well as whether a desired product is a part of a price discount. Prior studies on price discount rate commonly indicated that consumers highly focus on the discount rate (Chen et al. 1998; Coulter and Coulter 2007; Heath et al. 1995) because the rate can closely address the gap between the perceived price and the internal reference price on a desired product.

Likewise, the consumers in the SaaS market would perceive a desired product more valuable when it has a higher discount rate. Particularly, given that the SaaS market is a highly competitive domain where multiple vendors provide similar applications (Murphy 2015), a high level of price discount rate should be a competitive advantage that can increase the sales while attracting more consumers. Thus, the following hypothesis is proposed;

H2: Price discount rate has a positive impact on the sales increase of a SaaS application.

Discounted Price and Sales of SaaS

Another important dimension of price discounts is the amount of discounted price, which is an actual saving in the perspective of consumers. The amount is known to generate more interest from potential consumers by increasing the perceived value of the product (Della Bitta et al. 1981).

As well as increasing the purchase intention of potential customers, the discounted price stimulate market demands on the product. Prior research concerning the impact of price discounts on supply and demand illustrated that the amount of discounted price has a proportional relationship with the quantity of product ordered (Hui-Ming and Yu 1997; Lee and Rosenblatt 1986) and overall sales volume (Raju 1992).

The price range of SaaS applications varies, from free to higher than $7,000. In the dataset employed in this study, it ranges from $0.5 to $199. Therefore, the impact of discount rate will highly differ by the initial price of the application. For example, the saving from 20% discount on an application for $0.5 is simply $0.1 while it is $1,400 on an application for $7,000.

Therefore, SaaS application consumers should consider the amount of discounted price when making their purchase decision. They would more likely to purchase a desired application when its discounted price is larger. Consequently, the sales of the application would increase. This discussion induces the following hypothesis;

H3: The amount of discounted price has a positive impact on the sales of a SaaS application.

Number of Competitors Offering Price Discounts and Sales of SaaS

Competitive intensity, which refers to the degree of competition in a product category, should be considered in estimating the impact of price discounts on sales, particularly for the highly competitive SaaS market. It is known to have a negative relationship with potential sales increase, suggesting that if there are more competitors, it is more difficult to achieve sales increase (Raju 1992). Likewise, the impact of price promotion would be subject to the competitive intensity. If many competitors offer their products at a discounted price, consumers would perceive the discount promotion less attractive and consequently, each product will have less chances to increase its sales (Kopalle et al. 1999).

In the SaaS market, consumers can easily find multiple applications offering price discounts at their point of purchase such as Amazon Web Services and Microsoft Azure. Similar to the consumers in conventional markets, they would perceive the price discounts less attractive as more applications offer them. Therefore, the following hypothesis is suggested;

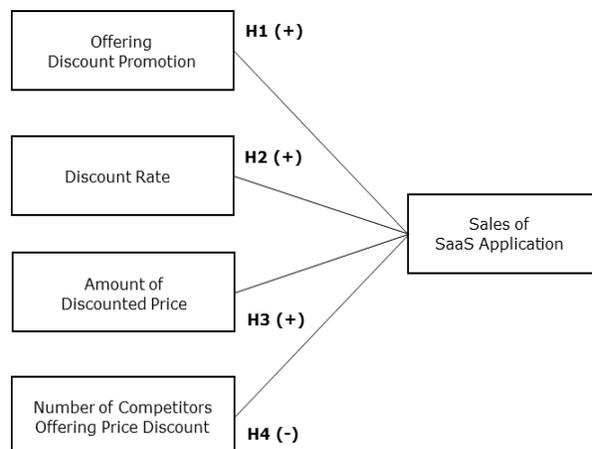Figure 1 illustrates the research model to summarize the hypotheses proposed.

Figure 1: Research Model

H4: The number of current SaaS applications offering price discounts has a negative impact on the sales.

4. HYPOTHESIS TEST

Dataset

The data for this research were collected from two sources: steamspy.com and steamdb.info. Steamspy.com provides a sales tracking service for online video games served by Steam, which is the largest online video game service provider in the world using SaaS platforms. The number of active user accounts is approximately 40 million, which accounts for more than 50% of downloadable PC games (Chiang 2011; Mudgal 2012; Reinhardt 2012). Steamspy.com offers various data including daily sales, total number of owners, price, active players, and average playtime. Although the data is collected by a sampling approach using approximately 100,000 to 150,000 user accounts per day, they are known to be highly accurate (Gilbert 2015) within a 0.33% error margin (Orland 2015). The data concerning discount rate (%) and discounted price were collected from steamdb.info. The website provides a summary of various information about video game applications including data about users, game applications, and promotion deals. The data adopted in this study were collected daily for four months, from November 13 2015 to March 11 2016. It contains 188,546 observations of 5,867 video game applications based on SaaS platforms.

Empirical Models

Two econometric models examine the proposed hypotheses. Model 1 tests Hypothesis 1, investigating the difference in sales between applications offered at a discounted price and those at an original price. The dependent variable of Model 1 is *DailySales*, which stands for daily sales volume of each application while the independent variable is *DiscountDummy*, which represents whether an application is offered at a discount price or original price, (c.f., discount price =1, original price = 0). It includes three controls, *Price* presenting actual price at the point of sales, *UserScore* meaning the average of evaluation from former consumers, and *Owners* standing for the total number of owners of each application.

Model 1

DailySales$_i$
$= a_0 + a_1 DiscountDummy_i + a_2 Price_i + a_3 UserScore_i + a_4 Owners_i + \varepsilon_i$

Model 2 tests Hypotheses 2, 3, and 4, which examines the impact of promotional factors related to price discounts. While the dependent is *DailySales*, the independents are *DiscountRate* representing the percentage of the discount (H2), *DiscountedPrice* standing for the amount of price discounted (H3), and *TotalPromotions* meaning the total number of applications offered at a discounted price (H4). It also contains *UserScore* and *Owners* as control variables.

Model 2

DailySales$_i$
$= \beta_0 + \beta_1 DiscountRate_i + \beta_2 DiscountedPrice_i + \beta_3 TotalPromotions_i + \beta_4 UserScore_i + \beta_5 Owners_i + \varepsilon_i$

Analysis Results

OLS (Ordinary Least Squares) estimation is adopted for testing the proposed hypotheses. In addition, since the dataset adopted for this research is a time series data, which is highly subject to the violation of OLS assumptions, GLS (General Least Squares) estimation and OLS with robust errors are employed to enhance the robustness of the analysis (Baltagi 2008; Freedman 2012).

The analysis results for Model 1 are illustrated in Table 1, including R-squared, coefficients, and P-values. R-Squared of OLS and robust OLS is 0.3203, indicating that 32.03% of total variance of *DailySales* is explained by the independent variables of Model 1. The results are consistent across OLS, GLS, and OLS with robust standard errors. The coefficient for *DiscountDummy* (a_1) testing Hypothesis 1 is positive and significant at the 1% level. This supports that if a SaaS application offers a price discount, it tends to have higher sales than that application that does not. Therefore, Hypothesis 1 is supported.

Dependent : *DailySales*	OLS	GLS	Robust OLS
R-Squared	0.3203	-	0.3203
Constant	1056.88**	1056.88**	1056.88**
Discount Dummy	144.66**	144.66**	144.66**
Price (control)	37.81**	37.81**	37.81**
UserScore (control)	2191.62**	2191.62**	2191.62**
Owners (control)	0.0025**	0.0025**	0.0025**

**p < 5%, ** p < 1%

Table 1: Analysis Results of Model 1

Table 2 illustrates the analysis results for Model 2, testing Hypotheses 2, 3, and 4. R-squared of the OLS and robust OLS for Model 2 is approximately 0.43, indicating that the independents explain 43% of total variance of *DailySales.* The overall results remain constant in OLS, GLS, and Robust OLS. For Hypothesis 2, the coefficient for *DiscountRate* (β_1) is positive and significant at the 5% level. It suggests that a higher discount rate for a SaaS application has a positive impact on its sales increase, supporting Hypothesis 2. Likewise, the coefficient for *DiscountedPrice* (β_2) is positive and significant at the 1% level, presenting a positive relationship between the amount of discounted price and SaaS application sales. It indicates that if the difference between initial price and discount price is larger, the sales is more likely to increase, supporting Hypothesis 3.

Dependent : *DailySales*	OLS	GLS	Robust OLS
R-Squared	0.4296	-	0.4298
Constant	1018.05**	1018.05**	1018.05**
Discount Rate	558.38*	558.38*	558.38*
Discounted Price	12.55**	12.55**	12.55**
Total Promotions	-0.074**	-0.074**	-0.074**
UserScore (control)	25.28**	25.28**	25.28**
Owners (control)	0.0032**	0.0032**	0.0032**

**p < 5%, ** p < 1%

Table 2: Analysis Results of Model 2

With regard to Hypothesis 4, testing the relationship between the number of competitors offering price discounts and sales of a SaaS application, the coefficient for *TotalPromotions* (β_3) is negative and significant at the 1% level. It suggests that as more SaaS applications offer price discounts at the marketplace, each SaaS application offering the promotion tends to have lower sales. Therefore, Hypothesis 4 is supported.

Figure 2 summarizes the analysis results of the above hypothesis test.

5. DISCUSSION AND CONCLUSION

This research investigated the impact of price discounts on the sales of SaaS applications in the context of the online video gaming market. Additionally, it examined the impact of discount rate and discounted price, as well as the number of the competitors offered at discount prices.

First, support for Hypothesis 1 suggests that SaaS applications offered at a discount price tend to have a higher sales volume than those at a non-discount price. This result is consistent with the findings of previous studies that employed theoretical perspectives of price fairness evaluation and utilitarian motivation. This also implies that consumers in the SaaS market have a similar consumer behavior with those in other markets. In addition, the results also suggests that price discounts would be an effective marketing promotion to increase sales volume in the SaaS application market. Therefore, practitioners in the domain area may consider price discounts to increase their sales.
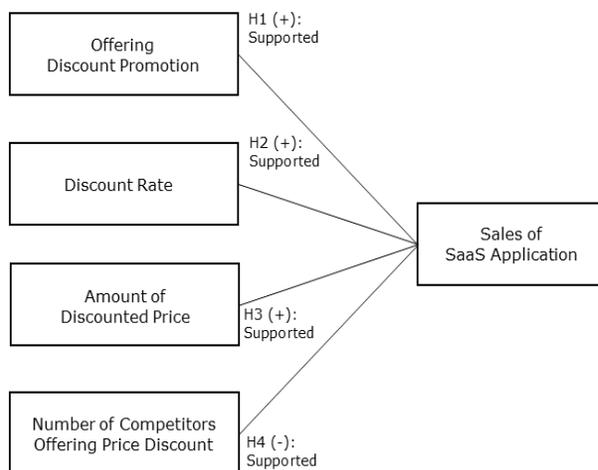

Figure 2: Hypothesis Test Results

Concerning the level of price discounts, both discount rate and the amount of discounted price are found to have a positive impact on the sales of SaaS application. Support for Hypothesis 2 indicates that discount rate has a positive relationship with SaaS application sales. Support for Hypothesis 3 implies that the amount of discounted price has a positive relationship with the sales. As well as discount rate, therefore, the absolute difference between initial price and discount price plays an important role in increasing sales of SaaS applications. Therefore, practitioners in the market need to consider both promotional factors when designing pricing strategies for sales increases.

With regard to Hypothesis 4, the number of competitors offering price discounts is found to have a negative relationship with sales of SaaS applications. Therefore, as the number of the applications offered at a discounted price increases, the sales of each application adopting the same discount promotion would decrease. This finding provides a meaningful implication to practitioners who consider at what time they should offer a price discount. The time for their price discounts suggested by this study would be more effective when less competitors are using the same discount pricing strategy than when more are.

6. LIMITATIONS AND FUTURE RESEARCH

Although this is one of first empirical studies to investigate the impact of price discounts within the SaaS domain, there are several limitations, particularly with regard to the data used in this study. The study adopted a dataset for SaaS based upon online video games, which are hedonic products consumed for entertainment and enjoyment. However, the primary SaaS applications are consumed for practical purposes, including emailing, conferencing, and web documenting services. Therefore, the analysis results concerning the impact of price discounts may be different from the aforementioned practical applications.

Although the number of competitors offering price discounts is found to have a negative impact, this study did not distinguish direct and indirect competitors in its analysis. For example, a video gaming application in RPG (Role Playing Game) genre would not directly compete with those in different game genres, nor significantly related to the sales of the other types of games. However, they were not separated in the analysis and therefore, the result may be different if estimated with more thoroughly categorized data. Finally, the dataset includes the sales for only four months although it contains a large number of observations. Future research may adopt a more comprehensive dataset that can provide more generalizable findings and implications from the analysis.

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