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A Software-as-a-Service case

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Abstract

Software vendors are increasingly adopting Software-as-a-Service (SaaS) pricing model, whereby software is offered as a web-based service in exchange for a subscription fee. In addition, software vendors become increasingly interested in using bundling of services to maximize their market penetration, revenue and, or profits. The objective of this paper is aimed at presenting and demonstrating a method that can be used to estimate consumer-level reservation prices for a set of SaaS offerings, to show how the method can be used to categorize different services based on the heterogeneity of reservation prices, and thirdly, to determine the optimality of different bundling strategies. A conjoint analysis study is used to determine the reservation prices of the services and to assess what price-bundle combinations are most attractive. Next a simulation model is used to show that the optimality of different bundling strategies. The results underline the importance of a value-based perspective on SaaS pricing models in pursuing different objectives of software vendors. To achieve profit maximization, software vendors should consider mixed price-bundling strategies in which bundles are offered at a discount. In case SaaS offerings complement a core service as well as entail high contribution margins (i.e. the services are reinforcing) a pure price-bundling strategy may be considered to target highly profitable customers. To achieve revenue maximization, mixed price-bundling should be considered for SaaS offerings with competing characteristics. In case the SaaS offerings are reinforcing, an unbundled strategy should be considered.

Keywords: Bundling, pricing, conjoint analysis, reservation prices, software-as-a-service

1. Introduction

The software industry continues to go through a major transformation in the way software is delivered. Computing today involves the use of many software packages, but only a few packages are used on a daily basis. This infrequent usage pattern often does not justify purchasing full licenses and therefore motivates a need for a more flexible way to use and pay for the usage of software [1]. Therefore, software vendors are increasingly adopting the Software-as-a-Service (SaaS) model. In the SaaS model, vendors host applications at a central location, for instance enterprise resource planning (ERP) and customer relationship management (CRM) systems. SaaS presents the embodiment of a one-sided market model for developing and delivering IT services, wherein services flow in a linear fashion from vendors to customers, with revenues flowing in the opposite direction. SaaS offers customers greater flexibility to switch vendors. Switching vendors is difficult with packaged software, which generally has a modular structure, allowing customers to extend their systems over time by adding new modules. With packaged software, customers experience high costs when switching, resulting in *lock-in* and give a software vendor a monopoly position over existing customers [2].

However, SaaS providers have to deal with reduced gross margins as a result of the high fixed operation costs involved in the hosting infrastructure [3]. This makes achieving economies of scale increasingly important [4]. Reduced switching costs pose new challenges to software vendors in terms of customer retention and profit generation. Carefully crafted service pricing and bundling strategies offer several opportunities. First, bundling has the potential to increase and stabilize *customer retention levels*. Customers who subscribe to a bundle of services are less likely to leave for a better deal that affects only one of the service components in the bundle. Furthermore, it is recognized that promotional bundle discounts are strongly related to the customer's perceived value for a given bundle and consequently the *customer's willingness to switch* to the provider. Also, a firm can apply bundling to its product line to increase *market penetration*. Offering a bundle at a special price encourages customers to subscribe to the entire bundle who would otherwise only subscribe to some of the components. And finally, bundling allows firms to apply *price discrimination* to enhance revenues and profits. Hence, SaaS providers can apply bundling and pricing strategies to attain and retain market penetration, revenue and profit levels.

It has been recognized that, in order to apply these strategies successfully, one of the key activities to be carried out is an *economic value analysis*. "Economic value analysis is a tool designed to comprehend and to quantify the sources of value of a given product for a group of potential customers" [5]. Customer value can be seen as the maximum price people are willing to pay for a product or service. Economists call this the *reservation price*. "The reservation price is the highest price that a given person will accept and still purchase the good. In other words, a person's reservation price is the price at which he or she is just indifferent between purchasing or not purchasing the good" [9]. Insight into the reservation price and its heterogeneity supports SaaS providers in determining pricing and bundling strategies aimed at either maximizing market penetration, revenue or profits. Several researchers have attempted to estimate consumer-level reservation prices. Some focus on single-service or single-product bundling [10-11] or on the bundling of a relatively low number of products or services (3 or fewer) [12], which makes the direct application of these methods to larger and more heterogeneous product-lines, like SaaS bundles more difficult. The goal of this paper is threefold. Firstly, it is aimed at presenting and demonstrating a method that can be used to estimate consumer-level reservation prices for a set of SaaS offerings. Secondly, its aim is to show how the method can be used to categorize different services based on the heterogeneity of reservation prices, which is important for determining optimal bundling strategies. And thirdly, it is aimed at determining the optimality of different bundling strategies for pursuing market penetration, revenue and profitability objectives.

All this is realized by determining the most suitable research approach and method given the goals of this paper. The research method is then applied to categorize and estimate reservation prices from a set of ten services from a large software vendor. Using a simulation model, several hypotheses are tested and the optimal bundling strategies for different types of services and objectives are determined.

The paper is structured as follows. In section 2, a review on bundling, pricing and reservation price literature is carried out, on the basis of which hypotheses are formulated. In section 3, the research approach, experimental design and simulation model are discussed. In section 4, the analysis is carried out and the results discussed. In section 5 and 6, the managerial implications, conclusions, limitations and future research areas are provided.

2. Literature review and hypotheses formulation

A definition of bundling. Adams & Yellen [13] define bundling as “selling goods in packages”. Guiltinan [5] stresses that bundles are marketed at a special (discount) price, while Stremersch & Tellis [6] note that bundles consists of separate items for which different markets exist. In this paper the following *definition of bundling* is adopted: “bundling is the marketing and selling of separate services as a single package for a single price”, which underlines the fact that bundling is more than merely “selling a package”. For reasons of decreased price sensitivity, increasing purchase likelihood, perceived savings, perceived sacrifices and one-bill convenience, it has been recognized that the way the bundles are marketed has a significant influence on their perceived customer value [6]. The services included in a SaaS provider’s product line can contain diverse services, which address different customer segments with different levels of willingness to pay. In this paper, the focus is on the use of bundling to increase a SaaS provider’s revenue through price discrimination [7], making it possible to address consumers who are willing to buy the bundle at a discount, but who would otherwise only buy one of the items.

Bundling strategies. There are several types of *bundling strategies*, which can be differentiated on the basis of two characteristics: (1) the *bundle focus* and (2) the *bundle form*. With regard to the former, a bundling strategy can focus on [6]: (1) *price-bundling*, (2) *product bundling* or (3) *both*. In the case of price-bundling, two or more non-integrated and in our research non-related services are sold as a package at a ‘discount’ price. The total value of the package delivered to the customer equals the sum of the components’ customer value. With product bundling, two or more services are sold as a package for a ‘single’ price. The integration between the components enhances the individual value of each component, which means that the total customer value of the package is more than the sum of the components’ customer value. The additional value being created can be translated into revenues by offering the bundle. In this paper, the focus is on the price-bundling of non-integrated and non-related services only. The second characteristic involves the *bundle form* [14]: (1) *unbundling*, (2) *mixed-bundling* and (3) *pure bundling*. In the case of unbundling, services can only be subscribed to separately. With mixed bundling, services can be subscribed to both separately or as a bundle. With pure bundling, the services can only be subscribed to as a bundle. The challenge for firms is to determine which bundle focus and bundle form to pursue.

Next to bundle form, bundle composition plays a role. Bundle composition can be about mutually reinforcing services (e.g. communication and presence information for mobile communication), complementary (e.g. mobile phone and subscription), unrelated (e.g. ringtones and weather information on a mobile) or competing (e.g. ring tones service A and B). The focus in this paper is choosing the optimal bundling strategy for different types of non-integrated and non-related services. While normally in service bundling the services are interdependent in terms of demand, we are focussing on services that are all related to administration practices, but can be considered to be unrelated (see table 2). We expect to acquire insight which services, that from a supply side are perceived to be unrelated, might appear to be complementary or supplementary when we analyses the demand side.

Pricing schemes and methods. Software vendors can apply different *pricing schemes* for charging customers for the use of their SaaS offerings. The pricing schemes for SaaS offerings extend the known schemes for packaged software. Common pricing schemes for SaaS include a per time-period fee, an on-demand fee based on per-use such as with packaged software, per-transaction or per-feature, and free access (the so called freemium model). A per-time period fee is sometimes dubbed as *renting* [15]. The customer has to renew his contract if he wants to continue using the service after the expiry date. In all cases, it is useful to have insight into how much value a customer attaches to a charging unit. However, here the focus is on presenting a method for SaaS offerings with a per time-period fee.

Kotler [38] outlines several *pricing methods* for setting the pricing level of these charging units. In this paper, the focus is on *perceived-value* or *value-based pricing*. We make this choice because quantifying and communicating customer value plays a large role in the success of introducing new SaaS offerings. The idea is to price services (just) below the consumer's reservation price. The reservation price is determined by the surplus value of the service and the perceived fairness of transaction. "The surplus value of products and services is the difference between the economic value assigned to them and their price. The perceived fairness of the transaction is influenced by the price paid compared with internal reference prices" [8]. The internal reference price is the price level that is considered fair. The challenge in the case of value-based pricing is to apply a method that can accurately determine the perceptions of the customer [16].

Optimality of bundling strategies. An important factor in determining which strategy is optimal involves the heterogeneity in conditional reservation prices [6]. There are two types of heterogeneity: (1) *asymmetry* and (2) *variation*. Consider two services: A and B. An asymmetric distribution occurs when, for service A, one customer segment has a lower conditional reservation price than another, while for service B the former customer segment has a higher conditional reservation price than the latter. This asymmetric distribution in conditional reservation prices leads to a negative correlation between the service preferences [13] In the case of the second type of heterogeneity, variation, there are large differences in reservation prices for the bundle. A high

variation occurs when the perceived customer value is high within one customer segment and low within another segment.
The *optimality* of a pricing and price-bundling strategy depends on the deviation from 'first-order price discrimination', whereby each consumer is charged an individual price such that a SaaS provider does not diminishes its profits [17]. According to Adams & Yellen [13], there are three conditions under which a pricing scheme is optimal:

- *Exclusion:* consumers are excluded from subscribing to a service if the reservation price is below the costs of providing the service;
- *Inclusion:* a consumer for which the reservation price exceeds the costs of providing the service actually subscribes to the service;
- *Extraction:* from all consumers who subscribe to the service do not realize any consumer surplus (i.e. the price paid is equal to the willingness to pay).

Because SaaS providers are often restricted from applying personalized pricing (i.e. service prices are pre-defined), the heterogeneity of conditional reservation prices affects the deviation from these three conditions.

Hypotheses. Guiltinan [5] argues that services can be either reinforcing or competing. Services are reinforcing if the subscription of a customer to one service increases the likelihood of that customer also subscribing to another service. In other words, the conditional reservation prices are positively correlated. Services are competing if that likelihood is reduced. In other words, the conditional reservation prices are negatively correlated. Bundling is especially beneficial in cases where conditional reservation prices are negatively correlated, as this would lead to a reduction in the price variation for the bundle [6]. We hypothesize that:

H1: *When a firm's goal is to maximize revenue, mixed price-bundling is the best strategy if the services are (partially) competing in terms of demand.*

For the same reason, it is hypothesized that:

H2: *When a firm's goal is to maximize revenue, unbundling has the least adverse impact on revenue if services are mutually reinforcing in terms of demand.*

Schmalensee [40] states that the higher the normalized difference between the average reservation price for the service and costs of subscribing to the service is, the more likely the price-bundling of services are to enhance profits. On the other hand, Stremersch & Tellis [6] note that the price-bundling of high contribution margin services (i.e. the difference between the price and the variable costs of provisioning) are better able to raise profits. The higher the contribution margin the lower the extra induced sales quantity should be to make a bundle discount profitable. Bouwman, Haaker, & De Vos [19] argue that services may either be *complementing/enhancing* or *supplementing*. Enhancing services directly increase the benefits of the core service/experience, while supplementing services extend benefits in new directions . We hypothesize that:

H3: *When a firm's goal is to maximize profits, pure price-bundling has the least adverse impact on profits if services are complementing the core service/activity and services are mutually reinforcing in terms of demand.*

For the same reason, it is hypothesized that:

H4: *When a firm's goal is to maximize profits, pure price-bundling has the most adverse impact on profit if services are supplementing the core service/activity and services are (partially) competing in terms of demand.*

Because pure price-bundling is a special type of mixed price-bundling for which the separate services' prices are extremely high and unbundling is a special type mixed bundling for which the price of the bundle is extremely high [6] the following is hypothesized:

H5: *When a firm's goal is to maximize profits, mixed price-bundling is either the best strategy or no worse than any other strategy regardless of the types of services.*

The goal of market penetration is not to exclude customers from subscribing to any service. Stremersch & Tellis [6] argue that revenues from a bundle are always higher (if conditional reservation prices are asymmetric) or equal (if conditional reservation prices are symmetric) to the revenues from the separate services. We hypothesized that:

H6: *When a firm's goal is to maximize market penetration first and profits second, pure price-bundling is either the best strategy or no worse than any other strategy.*

These hypotheses indicate under what conditions and for what objectives specific bundling strategies may be optimal. Several methods need to be applied to test hypotheses applicability to SaaS offerings.

3. Method

In this section the methods are discussed for measuring customer value, quantifying customer value in monetary value and evaluating different bundling and pricing strategies for different performance objectives. The research design process follows the standard procedure for conjoint surveys [20]. For the first step, a part-worth function model was used. The regression coefficients represent the utilities of each service. For the second step, the full profile method was used. For the third step, a fractional factorial design was used. Using an orthogonal array, a subset of combinations of attribute levels was created. We selected 10 add-on services in such a way that there shouldn't be reinforcing mechanism or interaction (see table 1). In determining the price attribute level, conditional pricing was used, while the design remains orthogonal and unencumbered by prohibitions. The assumed prices for the services were specified by carrying out a competitor study. The prices can be low (25% discount), regular or high (25% surcharge) (see table 1). The bundle price is calculated on the basis of the services included in the bundle and the discount level as indicated by the price attribute. This resulted in 16 profiles/bundles with different combinations of services at different pricing levels. Two additional profiles were included to test the predictive validity of the conjoint measurement data.

Table 1: The ten included services in the conjoint Experiment

Service	Description	Low / Regular / High price		
1. Book keeping	Vouchers are processed for by an administrator	22.50	30.00	37.50
2. Accounting	Administration is verified and taxes are declared.	22.50	30.00	37.50
3. Invoicing	Digital and postal invoicing on receipts.	7.50	10.00	12.50
4. Time registration	Registration of billable hours.	3.75	5.00.	6.25
5. Expense registration	Registration of made expenses for a customer.	3.75	5.00	6.25
6. Mileage registration	Keep track of your mileage expenses.	3.75	5.00	6.25
7. Project collaboration	Plan and manage a project involving multiple members.	11.25	15.00	18.75
8. Project acquisition	Matching of possible project requests with your profile.	7.50	10.00	12.50
9. Debt collection	Initiate a debt collection procedure for defecting customers.	7.50	10.00	12.50
10. Pay rolling	Remunerating yourself on a monthly basis	7.50	10.00	12.50

The fourth step was carried by collecting response via an online web survey in 2010. The questionnaire was distributed via freelancer portal sites and a general mailing list. People were selected on the basis of sector characteristics and the number of employees. A total of 70 respondents participated in the study, 23 respondents were eliminated which did not show any intent to subscribe to the presented service bundles. The vignettes that were presented showed the bundle composition and the bundle price. For the fifth step, a 7-point rating scale was used to measure the purchase intention. Next, part-worth utilities for individual respondents were calculated using ordinary least squares (OLS). Constrained nonlinear regression (CNLR) was used to constrain the price coefficients to be negative or positive for treating possible price reversals and to investigate whether the predictive validity of the model could be improved

Reservation price estimation method. Generally speaking, to estimate the consumer-level reservation prices from the conjoint analysis, the utility of the no-choice option needs to be estimated. This no-choice utility level determines the minimally required utility from a service(bundle) will it be preferred over the no-choice. A choice from an individual for the no-choice option implicates that none of the alternative services in the set gives the individual sufficient utility to consider subscribing to at least one of the services. Following this line of reasoning, the utility of the no-choice is determined by the utility of the individual's *status quo* and the utility of each of the alternatives in the consideration set (i.e. the utility of the no-choice option is not necessarily *zero*). Following Kohli & Mahajan [10], it is assumed that an individual *i* prefers service *s* over his or her consideration set if:

$$U_{is|\sim p} + U_i(p) \geq U_i * + \varepsilon, \quad (1)$$

- where U is|~p is the utility of service *s* for individual *i excluding* the utility of price from service *s* (or in case conditional pricing is applied: the utility of service *s* for individual *i including* the utility of the regular price level),
- Ui(p) is the utility contribution of the *absolute* monetary price level *p* to individual *i*'s utility for a service,
- U_i* is the highest utility of any option (including the *no-choice option*) in his or her consideration set and
- ε is a small value (here it is assumed that ε equals 0) selected by the user in any application of the model.
- s_i is the estimate of the individual's reservation price r_i for service *s* if equation 1 is satisfied as an equality, that is, it is the price at which the utility of item s exceeds by ϵ the utility of the most preferred item in consumer i's evoked set. As U_i (p) is assumed to be a single-valued, decreasing function of price, a single reservation price p_{is} is estimated for each customer.

According to Kohli & Mahajan [10] equation (1) holds in case the utility of the chosen base case option *equals* the utility of the no-choice option. In our case (and other applications of traditional conjoint analysis) the utility of the base case option is inversely related to the utility of the no-choice, and hence is not equal to the no-choice option. Therefore, in order to simulate consumer choice and to determine reservation price p_i for which equation (1) is satisfied as an equality, it is necessary to prevent the incorporation of the no-choice option's utility in equation (1). Jedidi & Zhang [11] show that traditional conjoint analysis can be augmented for this purpose. Their approach shows that it is legitimate to use the utility of a chosen base case option as the utility of the no-choice option, in which case the following formula can be applied in calculating the reservation price for service bundle r_i (Sb) and simulating consumer choice:

$$r_i(Sb) = \frac{\Delta p}{U_{\Delta p}} \left(\sum_{s=1}^{N} \frac{U_{is}}{\Delta s} s\right) \quad (2)$$

- where $r_i(Sb)$ is the reservation price for the service bundle,
- Δp is the change in price from the regular price level, where Δp= p-25%, 0, or p +25%
- $U_{\Delta p}$ is the change in utility from that price change, actually the ß's from the dummy's in a linear conjoint analysis, and
- $\frac{U_{is}}{\Delta s} s$ is the change in utility for including service *s* in the bundle.
- Σ s=1, N refers to of summation of the utilities of the services in the bundle

The first fraction can be seen as the exchange rate between units of utility and difference in price. The changes in utility invoked by including a service in the bundle, as compared to the base case, may be multiplied by an exchange rate to calculate the

reservation price for the service (bundle). To make interpretation easier, an empty bundle may be chosen as the base case. If dummy coding is applied to code bundle-price combinations, the constant from the part-worth utility function equals the utility of the base case. Jedidi & Zhang's theoretical derivations validate the common practice of converting attribute utility changes to monetary values.
The part-worth utilities of the services can be translated into reservation prices by applying formula 2. In case conditional pricing is used, as we do here, r_i equals the reservation price *deviation* from the regular price level. In its application, the service coefficients vary among the customers, while the discount and surcharge price coefficients are fixed. According to formula 2, the reservation price for a service is equal to the ratio of the service coefficient with respect to either the discount or surcharge price coefficient (depending on whether a service is considered too expensive or too cheap). By fixing the price coefficients, the distribution of the reservation price has the same form as the distribution of the service's coefficient. Here it is assumed that the service coefficients are all normally distributed and the reservation prices for the services are also normally distributed. This makes it possible to compare the different strategies for the different services. It also prevents incorrectly signed price coefficients from creating implausible reservation prices and near zero price coefficients from creating extreme high or low reservation prices. As far as the service coefficients are concerned, we see no reason for restriction, because customers could value a service at a regular price as either positive or negative.
Simulation model specification. The hypotheses can be tested via two types of models: (1) analytical models and (2) simulation models. In the first approach an analytical model of consumer behaviour is used to deduce the optimality of different bundling strategies for different service characteristics (e.g. reinforcing, competing, enhancing and supplementing characteristics). An alternative approach concerns the use of a simulation model. Instead of analytically computing the outcomes of a specific bundling and pricing strategy, simulation is used to test the optimality of bundling and pricing strategies. To this end, a spreadsheet-model was specified, for which the following steps were carried out:

- For the services under consideration, an array of reservation prices is specified by the user on the basis of the conjoint analysis;
- For the services under consideration, the user specifies the cost levels of providing one unit of the service;
- For the three different bundling strategies, the reservation prices of the three offerings are calculated by the program. It is assumed that a bundle's reservation price is equal to the sum of the component's reservation prices;
- For the three different offerings, an array of prices is specified which the program tries to optimize;
- Based on the reservation prices and the prices of the offerings, the program calculates the consumer surplus;
- Based on the consumer surplus, the actual sales levels are calculated according the following rules: a consumer buys an offering if and only if the consumer surplus is positive and the consumer surplus is the highest among the offerings. In case the consumer surplus of the bundle equals the consumer surplus of one of the components, the consumer buys the bundle. If the consumer surplus of an offering equals zero, the consumer buys the offering;
- Based on the calculated sales levels, the specified cost levels and the calculated optimal prices, the program calculates the revenue and profit per offering.

To determine the optimal prices, the optimization tool *Evolver* from Palisade was used.

4. Results

The aggregate conjoint model. Multiple linear regression analysis was used to estimate the aggregate main-effects model. The results of this analysis are shown in table 3. Because conditional pricing is applied the presented utilities cannot be interpreted independently from the pricing attribute. Consequently, the utility coefficients indicate whether on average the reservation price is below (negative sign) or above (positive sign) the regular price of the service. For example, it can be calculated that, on average, the reservation price of the accounting service is 13 percent above the regular price of the service. Also, on average, the respondents perceive that their reservation price is 3 percent below the regular price of the book-keeping service. Services with a positive utility (2, 3, 4, 5 and 10) may be regarded as enhancing the administrative core activity/service, and services with a negative utility (1, 6, 7, 8 and 9) may be regarded as unrelated supplementing services, that open new avenues for business development for SaaS providers. Needless to say, this classification would only hold for the target segment respondents represent.

Table 2: Average importance, calculated part-worth utilities and positiveness of services

Services	Importance	Part-worth utility Coefficient	Standard Deviation	Percentage positive	P
1. Bookkeeping	9.848	-.029	.699	51.1%	ns
2. Accounting	9.959	.215	.648	59.6%	.047
3. Invoicing	7.689	.040	.606	61.7%	ns
4. Time registration	6.171	.029	.406	55.3%	ns
5. Expense registration	8.143	.088	.575	59.6%	ns
6. Mileage registration	8.058	-.098	.580	46.8%	ns
7. Project collaboration	9.228	-.173	.628	36.2%	ns
8. Project acquisition	7.001	-.114	.493	44.7%	ns
9. Debt collection	7.821	-.178	.539	44.7%	ns
10. Pay rolling	9.455	.125	.737	61.7%	ns
Constant		2.420	1.321		
Pricing	16.629				
Low price (25% discount)		.293	.403	80.9%	
Regular price		.059	.350	55.3%	
High price (25% surcharge)		-.351	.344	10.6%	

Model fit: Average Pearson's R = .989 (P < .000). *Average Kendall's Tau* = .919 (P < .000). *Average Kendall's Tau for Holdouts* = 1.000. *Aggregated Pearson's R* = .219 (P < .000). *Aggregated Kendall's Tau* = .155 (P < .000). *Aggregated Kendall's Tau for Holdouts* = .289

The individual conjoint models. The estimation of individual level coefficients enables the analysis of variation (e.g. through standard deviation measures) and asymmetry (e.g. through correlation measures) of conditional reservation prices. The overall outcomes of this analysis have been appended to table 3. The Pearson's R of 0.989 (P < 0.000), Kendall's Tau of 0.919 (P < 0.000) and Kendall's Tau for Holdouts of 1.000 respectively indicate a good fit, consistency in rating the profiles and predictive validity of the individual-level models. A high variation in preferences exists for all services. The preferences for the pay-rolling service show the largest variation (SD = 0.737), which is a logical observation, because this service is, a priori, only relevant for 47 percent of the respondents. The preferences for the time registration service, which is relevant to 72 percent of the respondents, are the most homogeneous (SD = 0.406). Services with a high variation may be good candidates for bundling because delivering these services as an unbundled offering either excludes many consumers from

subscribing or gives consumers a high consumer surplus in their subscription to the service.Table 2 also shows the *relative importance* of the bundle attributes for the overall perceived value. It can be concluded that price is an important attribute in people's intention to subscribe. Although making a careful bundle composition is critically important, as the price attribute is relatively important, pricing discounts can significantly increase people's intention to subscribe to certain service bundles.
The *positiveness* indicates the share of the respondents that positively assess the value of a service relative to its costs at an advertised price equal to the regular price. The unrelated services (2, 3, 4, 5 and 10) have the highest levels of positiveness and can be considered to be complementing. While services (1, 6, 7, 8 and 9) have the lowest levels of positiveness and therefore are more supplementary in nature.
Table 3 shows the asymmetry of conditional services preferences. From the total of 45 estimated coefficients, only the 7 statistically significant coefficients are shown.

Table 3: Asymmetry of conditional service preferences

Services		Pearson's Correlation	P
1. Bookkeeping	2. Accounting	.327	.025
1. Bookkeeping	4. Time registration	.351	.015
3. Invoicing	4. Time registration	-.371	.010
3. Invoicing	5. Expense registration	.363	.012
6. Mileage registration	8. Project acquisition	.374	.010
7. Project collaboration	10. Pay rolling	-.427	.003
8. Project acquisition	9. Debt collection	,291	,047

To summarize, both from an extraction and an exclusion point of view, the price-bundling of the invoicing and the time registration services would be most profitable because of its complementing characteristics to the core service/activity and its effects on lowering the variation in conditional preferences for the bundle. However, it would appear that the price-bundling of other negatively correlated services can also be optimal in case a higher discount applies to the bundle.
Simulation of bundling strategies. With the use of the reservation price estimation method, a simulation was carried out for different bundling strategies for four combinations of services. To calculate the maximum profit of each strategy, it was assumed that the variable cost of each unit of service was 75 percent of the regular price. The results of the simulation are shown in table 5. From a *revenue maximization* perspective, a mixed bundling strategy is always the best if the bundled services are (partially) competing (A3 & B3). This means that hypothesis 1 can be accepted. It can also be seen that an unbundling strategy is not worse than any other strategy in cases where the service are mutually reinforcing (C3 & D3). In fact, the optimized mixed bundling strategy for reinforcing services turns out to be an unbundling strategy with an extremely high price for the bundle, which confirms hypothesis 2.
From a *profit maximization* perspective, it can be seen that the pure price-bundling of complementing and reinforcing services do not adversely affect profit levels compared to a mixed bundling strategy (C2). The complementing characteristics create a high normalized difference between costs and price. Because of the reinforcing characteristics of the bundled services, demand for the bundle is not reduced much compared to the separate offerings. Hypothesis 3 can therefore be accepted.

Table 4: Optimality of different bundling strategies for different types of services under different objective

			Revenue maximization			Profit maximization			Market penetration maximization		
	Services		Total revenue	Total profit	Contribution margin	Total revenue	Total profit	Contributi on margin	Total revenu e	Total profit	Pene-tration
A. Bundling competing and complementing services											
1. Unbundled	3	4	429	88	21%	351	111	32%	75	-431	97%
2. Bundled	3	4	418	-10	-2%	390	98	25%	32	-496	100%
3. Mixed	3	4	445	89	20%	441	119	27%	32	-496	100%
B. Bundling competing and supplementing services											
1. Unbundled	7	10	586	65	11%	464	157	34%	131	-691	94%
2. Bundled	7	10	617	73	12%	503	110	22%	127	-735	98%
3. Mixed	7	10	710	137	19%	509	172	34%	127	-735	98%
C. Bundling reinforcing and complementing services											
1. Unbundled	3	5	435	90	21%	367	117	32%	102	-393	94%
2. Bundled	3	5	415	100	24%	328	115	35%	160	-335	94%
3. Mixed	3	5	435	90	21%	340	118	35%	216	-271	94%
D. Bundling reinforcing and supplementing services											
1. Unbundled	6	8	370	10	3%	269	85	32%	71	-420	93%
2. Bundled	6	8	325	44	14%	231	74	32%	19	-487	96%
3. Mixed	6	8	372	12	3%	277	90	32%	24	-486	97%

On the same note, supplementing services imply a low normalized difference between costs and price (B2). The competing characteristics adversely affect the profit, which means that hypothesis 4 can be accepted, and because, when it comes to maximizing profits, a mixed bundling strategy is the best or at least equal to any other strategy (A3, B3, C3 & D3), hypothesis 5 can therefore be accepted.
From a *market penetration* perspective, it can be seen that a pure price-bundling strategy is not always the best strategy to maximize market penetration (C2 & D2). For some services, a mixed bundling strategy achieves a higher market penetration, because some consumers show negative reservation prices which offset the positive reservation price of the other service (D3). In this case, an additional unbundled offering would maximize penetration, although under the condition that the use of the positively valued service is only possible if the negatively valued service is also used. In other words, the use of the former service is conditional upon the usage of the latter. Whether this is actually the case depends on the design of the services. Therefore hypothesis 6 can only be fully accepted in case the usage of either service is unconditional.

5. CONCLUSIONS

Six hypotheses were tested using the simulation model, in which the results of a conjoint analysis were used in the reservation price estimation method. All hypothese were accepted with the notion that hypotheses 6 was accepted under the condition that the use of either of the bundled services does not depend on the use of any of the other services. Otherwise, a mixed bundling strategy may be best.

Our results illustrate how a set of methods, conjoint analysis, reservation price estimation methods and simulation, can be applied to optimally bundle and price a set of SaaS offerings. The methods that have been used in this study have some limitations. The focus of the research was on *main* effects for these unrelated services and not in interaction effects. Secondly, in transforming conjoint utilities into reservation prices, the price coefficient was fixed. Thirdly, the service and price coefficients involve random errors and may involve cases of price insensitivity.
Future research is needed to test and improve the predictive validity of the reservation price estimation method. For practical research a promising area of study is the adoption of conjoint analysis or other suitable methods for optimally designing of transaction-bundle based SaaS offerings.
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References

[1] B. Fenicle, T. Wahls, A secure methodology for interchangeable services, Information and Software Technology, 46 (2004) 343-349.
[2] D. Postmus, J. Wijngaard, H. Wortmann, An economic model to compare the profitability of pay-per-use and fixed-fee licensing, Information and Software Technology, 51 (2009) 581-588.
[3] T. Hall, Is SOA Superior? Evidence from SaaS Financial Statements, Journal of Software, 3 (2008) 1.
[4] D. Chou, A. Chou, Analysis of a new information systems outsourcing practice: software-as-a-service business model, International Journal of Information Systems and Change Management, 2 (2007) 392-405.
[5] J. Guiltinan, The price bundling of services: a normative framework, The Journal of Marketing, 51 (1987) 74-85.
[6] S. Stremersch, G. Tellis, Strategic bundling of products and prices: A new synthesis for marketing, The Journal of Marketing, 66 (2002) 55-72.
[7] L. Stole, Price discrimination and competition, Handbook of Industrial Organization, 3 (2007) 2221-2300.
[8] A. Hinterhuber, Towards value-based pricing—An integrative framework for decision making, Industrial Marketing Management, 33 (2004) 765-778.
[9] H. Varian, Intermediate Economics - A Modern Approach, 6th Edition ed., W. W. Norton and Company, New York, London, 2003.
[10] R. Kohli, V. Mahajan, A reservation-price model for optimal pricing of multiattribute products in conjoint analysis, Journal of Marketing Research, 28 (1991) 347-354.
[11] K. Jedidi, Z. Zhang, Augmenting conjoint analysis to estimate consumer reservation price, Management Science, 48 (2002) 1350-1368.
[12] C. Breidert, Estimation of willingness-to-pay, Wiesbaden, 2005.
[13] W. Adams, J. Yellen, Commodity bundling and the burden of monopoly, The Quarterly Journal of Economics, 90 (1976) 475-498.
[14] E. Penttinen, Bundling of information goods, past, present and future, Helsinki School of Economics, Working Papers W-373, (2004).
[15] M.A. Cusamo, The changing labyrinth of software pricing, Communications of the ACM, 50 (2007) 19-22.
[16] P. Kotler, Marketing Management Millenium Edition, Tenth Edition ed., Prentice-Hall, New Jersey, 2000.

[17] A. Pigou, N. Aslanbeigui, The economics of welfare, Transaction Publishers, 2001.
[18] R. Schmalensee, Gaussian demand and commodity bundling, Journal of Business, 57 (1984) 211-230.
[19] H. Bouwman, T. Haaker, H. De Vos, Mobile service bundles: the example of navigation services, Electronic markets, 17 (2007) 20-28.
[20] P. Green, V. Srinivasan, Conjoint analysis in consumer research: issues and outlook, Journal of Consumer Research, 5 (1978) 103.
[21] P. Green, V. Srinivasan, Conjoint analysis in marketing: new developments with implications for research and practice, The Journal of Marketing, 54 (1990) 3-19.
[22] B. Orme, Three Ways to treat Overall Price in Conjoint Analysis, in: Research Paper Series, Sawtooth Software, Inc., Sequim, WA, 2007.