RC24349 (W0709-056) September 18, 2007
Mathematics

IBM Research Report

Capacity and Value Based Pricing Model for Professional Services

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<u>Capacity and Value Based Pricing Model for Professional Services</u>

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Background

The capacity and value based pricing (CVBP) Model for professional services was derived out of a need for a new way to think about how professional service "products" should be priced in a competitive marketplace. In general, the price of any product or good should represent an aggregate of the value assigned to the various attributes of the good (for which there may be a rather large number). For services, in particular, there are several views on how this pricing decision should be undertaken. Traditionally the pricing decision in professional services has fallen into the category of what is called "cost-plus" pricing, see for example Scardino et al., 2005. Cost-plus is the idea that service engagements are priced based on the costs incurred by the provider in supplying their services plus some pre-determined margin on these costs. While this is a feasible way to price service goods, it is not necessarily the most effective way, with respect to overall profit, to approach the pricing problem.

In the face of this de facto pricing method companies have sought ways to more accurately price their products based on the value that is provided to the client. It is our assumption that if pricing is more closely correlated with value, then profit margins can be increased without having to significantly increase staff or workload. It was in this vain that the CVBP Model was developed, in an effort to systematically correlate "value," along with several other attributes, into the price of professional services. The "stand-alone" value of the product is essentially one dimension of the pricing grid, and should be considered in the context of other variables, such as available capacity, when determining the price of a particular service. The term "stand-alone" value is meant to connote the value of a product absent of external factors such as time, delivery, competition, etc.

While this may seem contradictory, it is easily understandable if one thinks about the products that consumers purchase. For instance, one may have some perception about chewing gum. However, depending on what time of day it is or the situation in which one finds oneself, the value one subscribes to chewing gum changes. An instance of that may be after a meal or before a meeting, the value is higher. The "stand-alone" value of a good is thus the value of that good (or service) in the absence of special circumstances such as above. The CVBP Model attempts to incorporate that "stand-alone" value, along with other variables, to arrive at a set of improving prices in a systematic way. It is important to note that the Model itself does not derive the "stand-alone" value of the service, but incorporates that parameter, along with a host of others, in determining a price.

The CVBP Model defined in this paper is meant to place the pricing decision for a particular service on a macroscopic level, by considering how the service fits into the context of all the other offerings of the provider, given various constraints, of which we explicitly model provider capacity. To be clear, the objective of the model is to allow the firm to maximize expected profits over a particular time period via the pricing decision variable. Thus, the Model considers a finite time period over which to maximize revenue.

The model and its output can be used in at least two ways. One is by the consultant that is negotiating the services contracts, to aid in setting prices for the work. This is in line with the recommendation of Nagle and Holden, 1995 and Presian 2005, who all advocate that value-based pricing authority is best moved from marketing and product development managers out to people who are closer to understanding the actual value of the services to the customer. Alternatively, a second and more sophisticated approach is to develop a web-based reservation system through which potential clients can try different scenarios for engaging in a service contract with the service provider; depending on the nature of the contract, its start date, its conditions, etc., the proposed price would vary, and the potential customer can then make an informed choice directly. While Philips 2005 argues that it is impossible to discern individual customer value at the point of sales, real time access to and integration of data behind this type of reservation system make the reality of "on-demand" value pricing feasible. In both approaches described here, the CVBP Model can assist the service provider in increasing profits and smoothing demand.

Literature Review

In his 2005 book entitled Pricing and Revenue Optimization, Phillips defines value based pricing as an approach that sets prices based on an estimate of how customers "value" the good or service being sold. While presenting a number of the classic mathematical formulations for price optimization, it is interesting to note that none of the models explicitly consider value.

Using mathematical modeling to price various kinds of services is not new, as exemplified by Baron et al., 2005 in formulations to price shared computer services. Like most services pricing models to date, they do not explicitly consider value to the customer in their formulation. Earlier works by authors such as Blank et. al 2001 touch on customer value in pricing for revenue maximization, but their approaches are not rigorous in the use of mathematical modeling, and they generally consider products and not services.

Note that Wilson 1993 overviews a number of mathematical approaches considering utility functions to model customer preferences in pricing decisions, but none explicitly consider value. Dube et al, 2006 offer the most comprehensive treatment, in terms of a mathematical model formulation, for revenue management of services. Similar to Dube et al, the CVBP model considers a utility function of price and a multinomial logit form to model discrete choice decision making.

The pricing approach of the CVBP Model also has some resemblance to menu-based pricing according to customer value recommended by Auguste et al., 2006 for situations where the service provider's competitive advantage revolves around skills their customer does not want to maintain. The menu-based pricing, or reservation system approach as described in the previous section, is consistent with the philosophy of Mohammed, 2005, who emphasizes that customers choose the price they are willing to pay based on the value they receive from a product or service.

Bona and Thompson, 2005 touch on the concept of process bundling as it relates to the pricing of business applications. They point out that the idea of value pricing is not new in itself, but it is new when considered together with process bundling. Note that here, bundling has some similarity but is related more to the context of services offerings as opposed to software products.

The increasing interest in use of value-based pricing for services is evident in the emergence of guides such as the book for consultants by Weiss, published in 2002, which offers advice on how to best work with clients to establish fair, mutually agreeable fees that are grounded in client value. In their 2005 report, Hedin et al noted professional service providers who were already using value-based pricing approaches in select client situations and had even developed tools to support their approach. Shoemaker 2003 takes aim at the topic of customer loyalty and how it can be protected or undermined via pricing decisions for services, underscoring the need to be diligent in value pricing of services.

For enterprise software, a business that is closely related to professional services through the tendency for companies or third parties to offer complementary integration services, Konary 2005 claims that value-based pricing is currently rare. However, she also claims that companies such as SAP are trying to move in the direction of value pricing. An interesting observation in geographical differences in value pricing adoption is noted by Harris and Matzke, 2005, who report that acceptance of value-based pricing, appears to be stronger in business cultures where the concept of professional services is newer, such as in Asia Pacific countries. In general, the interest and adoption of value based pricing approaches for services appears to be growing rapidly and globally. This in turn motivates the development of more sophisticated decision making approaches for value price setting, such as that offered by the CVBP Model described in detail in the next sections.

Model Definition

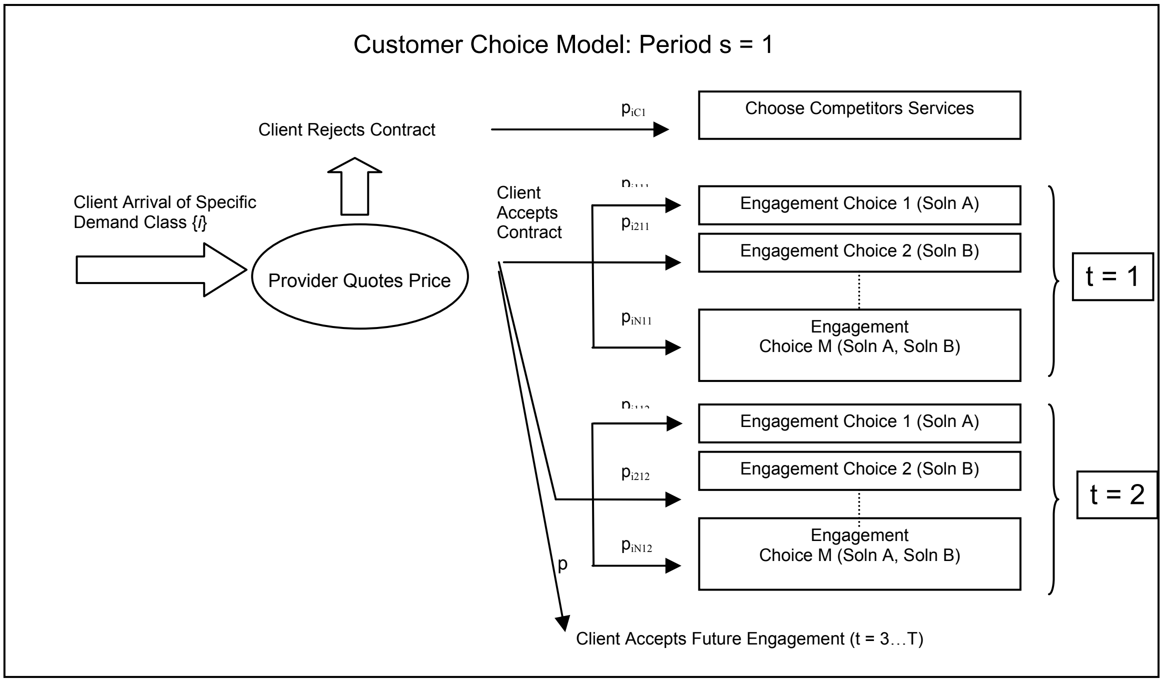
Professional service contracts are referred to as *engagements*, which are defined by the type of work to be performed as well as the conditions under which it should be performed. The work must be specified very clearly to be able to optimize profit of such labor-based services. In particular, the work must be characterized by the jobs to be performed, using a standardized language for describing job types.

Labor is referred to as *resources*. Resources, which are therefore human resources, must be classified. We make use of a classification of the resources by skill set, following Hu et al., 2007. Job types should be associated then with skill sets, where more than one skill set may be able to perform a job type, and vice-versa. For example, the job of computer programming can be accomplished by a resource with skill set in Java development, C programming, etc. Similarly, the skill set of IT applications architect may be able to perform the jobs of website development as well as applications integration.

This careful and highly structured characterization of services work and of labor skills is an important part of profit management for the services industry, in much the same way as a bill-of-resources allows for effective supply chain optimization.

On the demand side, customers can be grouped together into segments for the purpose of categorizing the types of services that they typically request, the urgency of the work, and the prices they are willing to pay. Customer segmentation is typical on an individual level, such as in airline seat revenue management, and we apply the same notion to business-to-business customers of professional services. Examples of customer segments are by industry type, by size of the customer's business, or other relevant factors that permit classifying customers into categories that have different price and time sensitivities.

The figure below gives an example of the CVBP Model structure in terms of the choices that are made available to the customers and the service offerings of the service provider. The client-provider interaction begins on the left-hand side, when a client of demand class i arrives in the first period, $s = 1$. This client, seeking a particular solution, goes to the provider, and subsequently receives a menu of engagements from which to choose, as represented by the engagement choices on the right hand side of the figure. The client now has the choice from among the available engagements, some of which may include solutions that were not originally sought by the client. For each engagement type, the client then has the ability to choose when he would like the engagement to begin, as denoted by the $t = 1$, $t = 2$, $t = 3$, etc., time periods. Depending on the engagement type, the timing of the engagement, and the available resource capacity at each time period, the client will be provided with an initial price quote. In addition to these choices, the client always has the option of going with a competitor, or choosing not to purchase the engagement at all, as represented by the top right box in the figure.



The contracts between the customer and the service provider are useful for the model building. Contracts specify the duration of the engagement and the nature of the work to be performed, as well as the price, billing parameters, and penalty clauses. These elements should be captured as part of the profit management problem for services.

The CVBP Model is defined through several inputs and parameters which consist of the following:

- $N \equiv$ The number of customer segments that have been specified a priori. In general, the markets for a given product can be segmented based on how a particular portion of the market values the product. On the most atomic level segmentation can take place on an individual basis, which would result in each customer being charged a price based on his true value of the product. This results in what is known as first degree price discrimination or "perfect price discrimination," which is in general impracticable. More often, customer segments represent a natural classification, such as by industry, size, etc. The Model presented here can handle any level of segmentation because it takes the segmentation, and associated information, as an input. The Model will ultimately suggest a palette of prices to be offered to the various segments for the particular services.

- $M \equiv$ The number of engagement types under consideration. An engagement is assumed to consist of, at a minimum, the fulfillment of one service, but it can also consist of all available services at a given firm. Allowing an engagement to consist of more than one service permits capturing the value associated with services that are purchased as a bundle, and helps to come to an understanding of how to price the bundle of services.

- $T \equiv$ The number of time periods under consideration. As mentioned before, the Model as it is currently constructed considers a finite period over which to maximize expected profit through pricing. The pricing decision in our Model is highly dependent on dynamic aspects, and consequently, the selection of this parameter has an impact on the pricing decision.

- $R \equiv$ The number of skill or job types necessary to complete all services under consideration in the Model. The various skill types required for a particular service directly impact the cost of implementing that service, and consequently are important in the final pricing decision.

- $d_i^s \equiv$ The aggregate demand over all engagements for a customer segment *i*, in a given period *s*. This parameter may be forecasted through historical customer data.

- $\mu_{ij} \equiv$ The average contract length, in days, of engagement type *j*, for customer segment *i*. The total engagement cost of engagement type *j* for customer segment *i* will depend both on the daily cost as well as the length of the contract. For a particular engagement type we capture some of this variation through the customer-segment dependent parameter, μ_{ij}.

- $\rho_k^t \equiv$ The daily pay rate for a resource of skill-type *k*, for period *t*. ρ_k^t is a given parameter which further helps to characterize the cost associated with a given engagement.

- $z_k^t \equiv$ Represents the "inventory" available for a particular skill type *k* in period *t*. In other words, it represents the capacity level that is currently available to service the various engagements. This parameter is critical in that the price is directly affected by the current level of capacity, in addition to expected future capacity.

- $v_{ij} \equiv$ Represents the utility a customer from segment *i* would receive from an engagement of type *j*, at no cost. This parameter represents the "stand-alone" value that was discussed earlier. This is provided as an input to the Model, and represents one factor in determining a customer's overall utility, or how they feel about the product.

- $\alpha_{ij} \equiv$ represents the sensitivity of customer segment *i* to the price of engagement type *j*.

- β_{ij} ≡ represents the sensitivity of customer segment *i* to a delay in the commencement of an engagement *j*. This parameter attempts to capture how a particular segment values the immediate begin of an engagement, as opposed to a delay in the project start.

Both sets of parameters, ν, α and β, require calibration based on historical data about customer choices or may be estimated from expert's opinions.

- θ ≡ is a parameter of the logit probability function that indicates the uncertainty level of customers.

- $A \in \Re^{MxR}$ = Daily staffing matrix. Element a_{jk} represents the percent of total time that a resource of skill-type *k* is required to work on an engagement of type *j*. Determining A may require a significant amount of work (see Hu et al., 2007). However, such a staffing matrix is of use not only in our CVBP Model of pricing professional services, but would represent a valuable input to a workforce optimization program as well.

Decision Variables and Auxiliary Computations

Price, our primary decision variable, directly affects the values of our auxiliary computations, which in turn affect the overall expected output. Changes in the price ultimately affect demand via changes in customer utility, which in turn affects a customers' probability of requesting a particular service. In our Model we have established prices along four dimensions.

- r_{ij}^{st} ≡ The price of engagement of type *j* for customer segment *i*, given that the current period is *s*, and the engagement begins in period *t*.

- U_{ij}^{st} (r) ≡ The utility of a customer of segment *i*, for an engagement of type *j*, given that it is period *s*, and the solution engagement will commence in period *t*. These are computed as a function of the price.

- p_{ij}^{st} (r) ≡ The probability of a customer of segment *i* accepting an engagement of type *j*, given that the current period is *s*, and the engagement commenced in period *t*. These are computed as a function of the price and utility.

- g_j^t (r) ≡ The expected number of active engagements of type *j* at time *t*, as a function of prices and probabilities.

Decision Model Description

Objective Function:

$$\max_r \sum_{j=1}^{M}\sum_{t=1}^{T}\left[\sum_{s=1}^{t}\left(\sum_{i=1}^{N} d_i^s p_{ij}^{st}(r) r_{ij}^{st} - g_j^t(r) \sum_{k=1}^{R} a_{jk}\rho_k^t\right)\right]$$

Our objective function represents the expected profits over the finite time horizon that we are considering. The inner terms represent our expected profit function for a particular engagement package subscribed to by a customer of type j, at time s, and to commence the work at time t.

$$PROFIT_{ij}^{st}(r) = d_i^s p_{ij}^{st}(r) r_{ij}^{st} - g_j^t(r)\sum_{k=1}^{R} a_{jk}\rho_k^t \ ,$$

where $d_i^s p_{ij}^{st}(r) r_{ij}^{st}$, when summed over all indices, represents the total revenue obtained from signed engagements within the given time horizon. From this we subtract the total cost of providing these engagements, which is represented by $g_j^t(r)\sum_{k=1}^{R} a_{jk}\rho_k^t$. While the costs may accrue over the course of providing the engagement, for the sake of bookkeeping, we assume all costs are incurred upfront. This expected cost is calculated by multiplying the expected number of engagements of type *j*, and multiplying that by the time required from skill type *k*, and multiplying that by the cost per period of that particular skill type. When summed over the appropriate variables, we obtain the total costs incurred in our respective time horizon.

Eqn (2) (Capacity Constraint):

$$\sum_{j=1}^{M} a_{jk} g_j^t(r) \ \le z_k^t, \forall t = 1...T, \forall\ k = 1...R$$

This equation constrains the number of engagements we are able to commit to, based on the capacity available in each period. As noted before, z_k^t represents the capacity of skill-type *k* available in period *t*. Thus, the resources required by the total service commitments cannot exceed the available capacity in period *t*. The term $\sum_{j=1}^{M} a_{jk} g_j^t(r)$ represents the expected required capacity in period *t*. This expected capacity is calculated by multiplying the expected number of engagements of type *j*, $g_j^t(r)$, by the percent of total time that a resource of skill-type *k* is required to work on an engagement of type *j*. We assume that the necessary time required to complete the project, by a particular skill-type is spread evenly across each period. Thus, if engagement *j* takes 20 periods to complete, and resource *k* is required for 30% of the total periods, then in each of the 20 periods resource *k* will be required for 30% of that period. If the periods represent days, then resource *k* commits 0.3 days to that engagement in each period. Consequently, after summing across each engagement for a given period, and a given skill type, we can ascertain the total capacity necessary to complete our expected engagements in period *t*, for which we cannot exceed z_k^t .

Eqn (3):

$$g_j^t(r) = \sum_{i=1}^{N}\sum_{s=1}^{t}\left[\sum_{v=\max(t-\mu_{ij}+1,s)}^{t} d_i^s\ p_{ij}^{sv}\ (r)\right] \quad \forall\ j=1\ldots N, \forall\ t=1\ldots T$$

The function $g_j^t(r)$ calculates the expected number of active engagements of type *j* at period *t*. The calculation consists of three summations. The first summation $\sum_{i=1}^{N}$ is defined to sum across all customer segments. The next summation $\sum_{s=1}^{t}$ sums across all time periods from time period 1, until our current time period *t*. The third nested summation, $\sum_{v=\max(t-\mu_{ij}+1,s)}^{t} d_i^s p_{ij}^{sv}(r)$, begins at ν = max (t-$\mu_{ij}$ + 1, s) and sums until *t*. To understand the logic behind ν = max (t-μ_{ij} + 1, s), we must first make sense of the summand, $d_i^s p_{ij}^{sv}(r)$. The term denotes the expected number of engagements of type *j*, for customer segment *i* that were purchased in period *s* and that will begin in period ν. Engagements can only have been purchased in periods up until time *t*, which explains why our second summation stops at time *s* = *t*. To understand the last summation, it helps to note that at time *t* there are two types of engagements which are being serviced. 1) Those engagements that were purchased prior to period *t*, with the intent that they begin in time period *t*. 2) Those engagements that began in a period prior to *t*, but because of the length of the contract, they still require resources at time *t*. At time *t*, for a particular engagement, and customer type, we know the average time it takes to complete such an engagement, which was earlier denoted by μ_{ij}. Consequently any engagement of type *j* for segment *i*, which started in the time frame from [*t* - μ_{ij} + 1, *t*] will still be taking up resources at time *t*. The reason we take the maximum of the two starting points is to eliminate instances when *t* - μ_{ij} + 1 ≤ 0.

Eqn (4) (Utility):

$$U_{ij}^{st}(r_{ij}^{st}) = v_{ij} - \alpha_{ij} * r_{ij}^{st} - \beta_{ij} * (t-s) \quad \forall\ s,t=1\ldots T, \forall\ i=1\ldots N, \forall\ j=1\ldots M$$

For a given price charged, we determine the utility that would be provided to customer *i*, if they purchased engagement *j* in period *s*, to begin in period *t*. The parameters were previously defined, but the linear structure of the function should be noted. The function subtracts from the "stand-alone" value of the engagement, the price sensitivity multiplied by the price, along with the delay sensitivity multiplied by the delay of implementation (*t*-*s*).

Eqn (5) (Logit):

$$p_{ij}^{st}(r) = \frac{e^{\theta\, U_{ij}^{st}(r_{ij}^{st})}}{e^{\theta\, U_{i0}^{s}} + \sum_{t'=s}^{T}\sum_{j'=1}^{M} e^{\theta\, U_{ij'}^{st'}(r_{ij'}^{st'})}} \quad \forall\ s,t=1\ldots T, \forall\ i=1\ldots N, \forall\ j=1\ldots M$$

The multinomial logit Model is used to Model the discrete choice decision making which occurs when a client agrees to purchase a particular engagement package. The probability that a given customer segment *i* chooses engagement of type *j*, given that the current period is *s*, and the engagement commences in period *t* is given through the logit Model, by weighting the utility of a given engagement with respect to all other options. The θ parameter, which we allow to vary between 0 and 1, provides a level of "uncertainty" in our probability determination. If θ = 0, the probabilities are completely independent of customer utility, with every choice occurring with equal probability. As θ tends to 1, the utility has a higher influence on the final probability distribution. The 0'th choice, which appears only in the denominator, represents a competitor and serves to anchor the prices about some point. Without such a competitor term in the logit function, the optimization problem would be unbounded with prices tending to infinity. The competitor represents the fact that the demand in not captive to this service provider.

Eqn (6) (Monotonicity Constraints):

$$r_{ij}^{st} \geq r_{ij}^{s(t+1)} \quad \forall s, t \geq s = 1 \ldots T, \forall\ i = 1 \ldots N, \forall\ j = 1 \ldots M$$

These constraints are designed to place bounds on the price of a particular engagement depending on what period it will begin, relative to the same engagement in different periods. The constraints are used to implement desired price policies. In many cases, the price charged in period *s* for engagement *j* to customer *i* should decrease in *t*. In other words, the price for the same product, to the same customer, should be reduced if the customer is willing to purchase now, but have the commencement delayed. In some cases, such as may occur at the end of a billing period, it is desirable to encourage customers to purchase and commence service earlier. In this case, the monotonicity constraints would be reversed, such that the opposite holds.

Eqn (7) (Non-Negativity Constraints):

$$r_{ij}^{st} \geq 0 \quad \forall\ s, t = 1 \ldots T, \forall\ i = 1 \ldots N, \forall\ j = 1 \ldots M$$

These constraints are included to ensure that prices are non-negative.

Decision Model Testing

We formulated a suite of several tests to observe the effects of various parameters on the Model, in addition to understanding how the Model performed when compared with traditional cost-plus pricing. In particular, the first two tests discussed below are concerned with how the Model compares with alternative pricing mechanisms, while the remainder is concerned with how the Model responds to parameter adjustments.

CVBP MODEL v. Cost-Plus Pricing

In order to compare the two pricing mechanisms, we designed a suite of four test data sets. Each set consisted of 2 customer types, 4 job types, 4 solution types (including one bundled solution), and a 5 period time horizon. The four sets varied in the following ways:

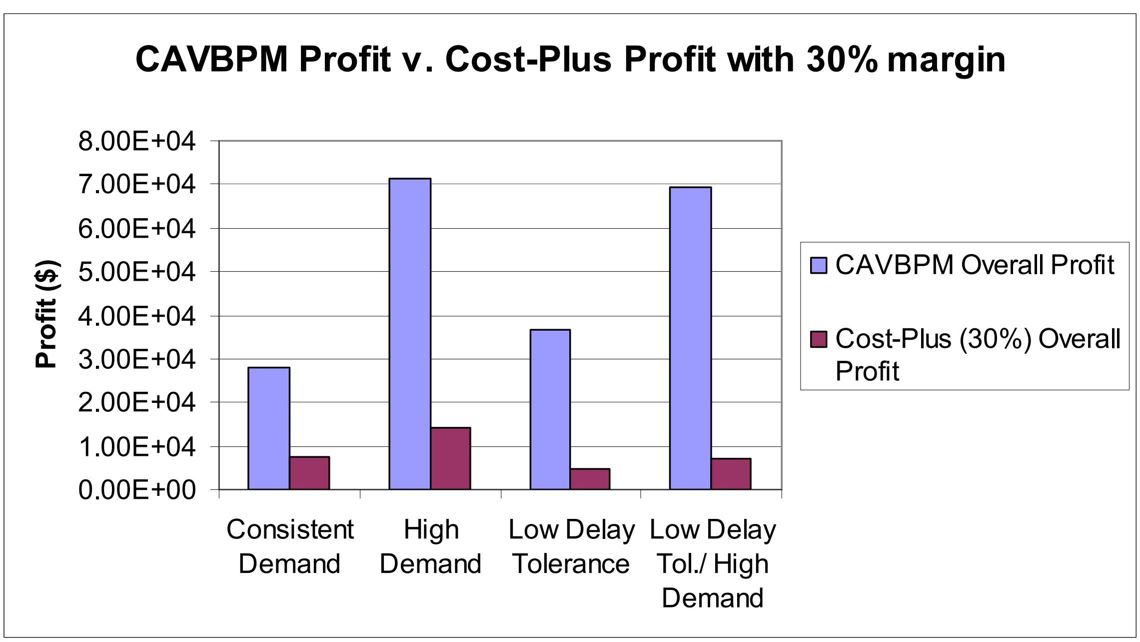
Set 1 (Consistent Demand Set): This set was considered our baseline set, and was created so that a comparison could be made across variations on this set. Specifically, this set had a consistent expected demand in each of the 5 time periods, meaning that the demand for services was the same in all periods.

Set 2 (High Demand Set): A variation of the first set, this set is identical to the first set, with the exception of the inclusion of one period of high demand (50x) relative to that of the other periods.

Set 3 (Low Delay Tolerance): Going back to set 1 as a baseline, we defined set 3 such that one of the customer types was more sensitive to delay (30x) than the other customer type.

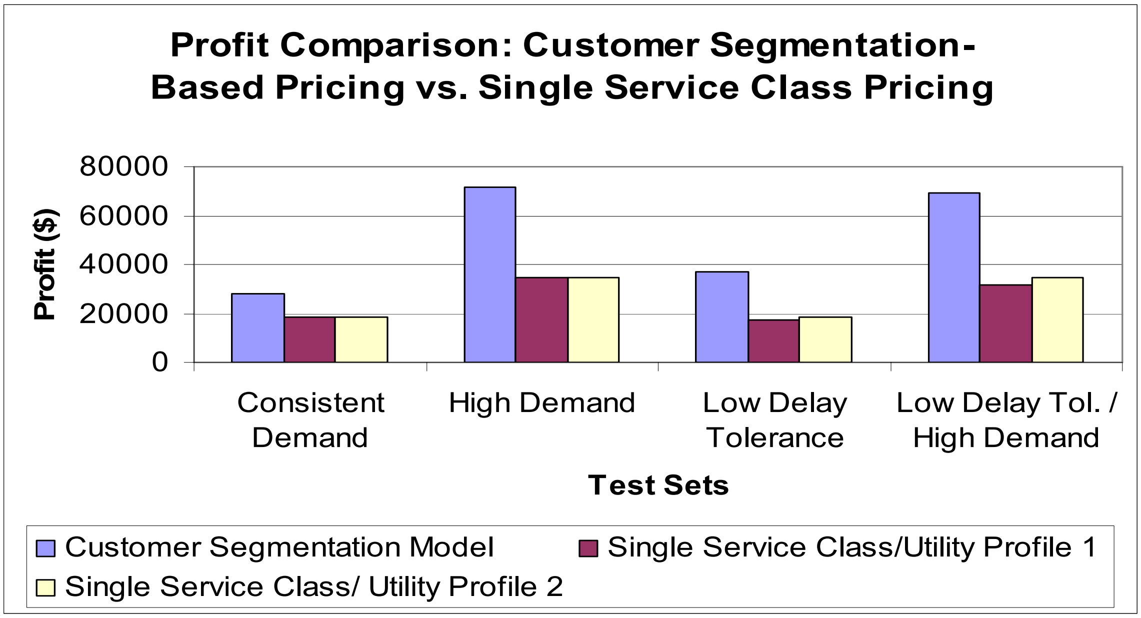
Set 4 (Low Delay Tolerance/ High Demand): Extending Set 3 with its low delay tolerance customer type, we created set 4 by increasing the demand from both customer types for one period.

Working from these four sets, a comparison was made of the overall expected profit generated by the CVBP Model for these scenarios versus the profit generated by a pure cost-plus pricing scheme with a 30% margin (assuming the same demand). As one can see in the below graph, the CVBP Model outperformed cost-plus pricing in all scenarios, by an average percent increase of 14.4%. Certainly, had the appropriate margin been chosen the CVBP Model profit would have been equal to that of cost-plus pricing (assuming the same demand). However, unlike the CVBP Model, we lack a suitable framework from which to choose the appropriate margin, and consequently it would have to be chosen ex-post to generate similar revenues to those generated by the Model.



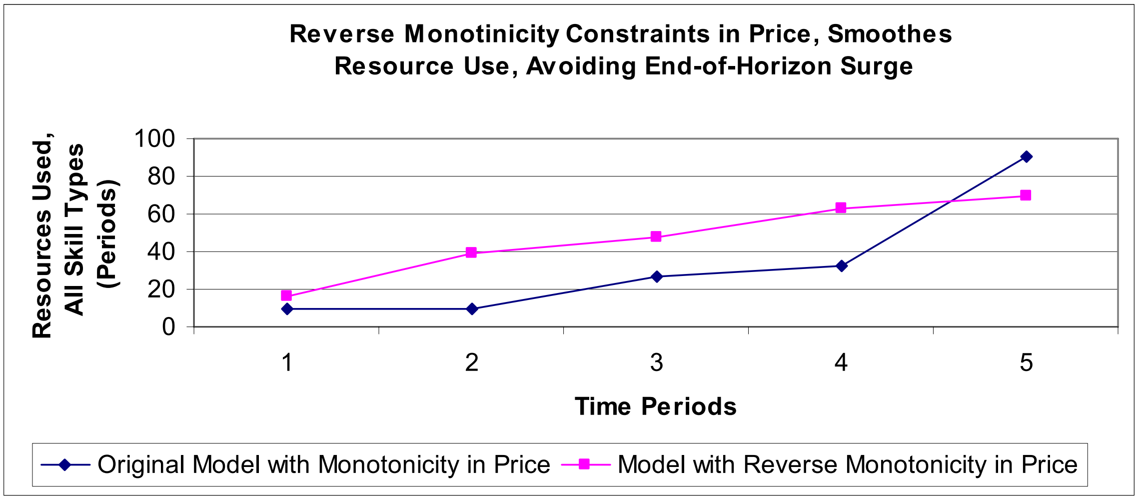
CUSTOMER SEGMENTATION ANALYSIS

Using the same four test data sets we then sought to understand how the segmentation of the customer base effects expected overall profit. To do this we ran, for each set, one version of the set with two customer segments, another version using the first of the original two customer segments, and the last version with the second of the original two customer segments. As can be seen from the graph, the segmented set, as expected, produces are higher expected overall profit. On average, segmenting the customer base led to a 49.23% profit improvement over the option 1 case, and a 44.40% profit improvement over option 2.



MONOTONICITY CONSTRAINT ANALYSIS

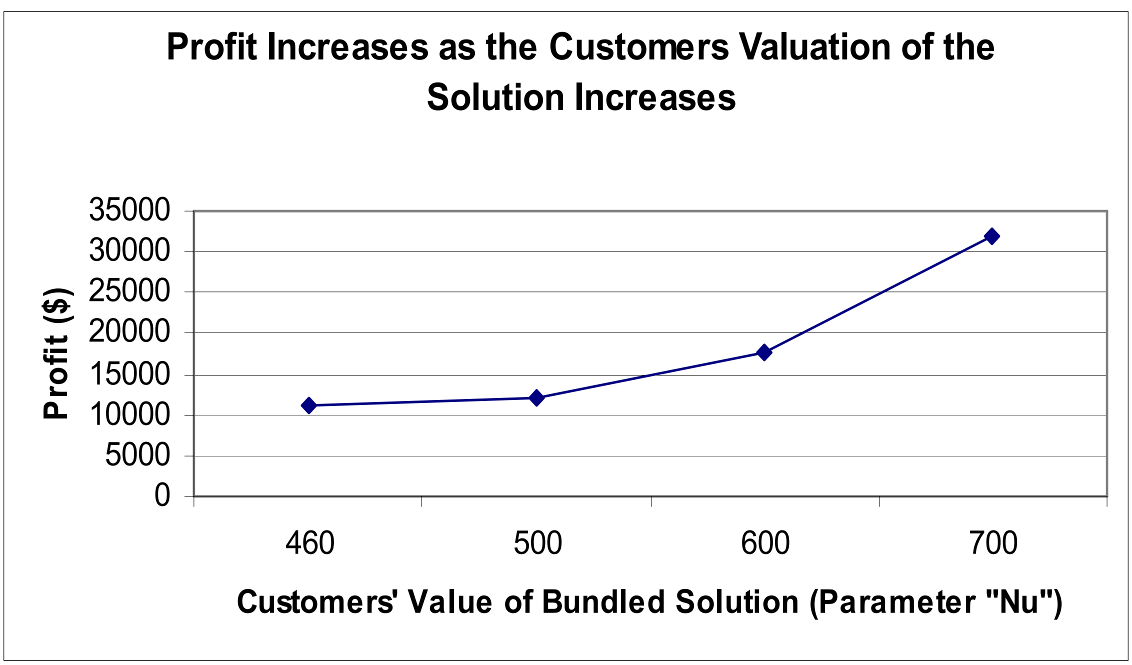
As alluded to earlier, it may be the case that decreasing the price for a particular engagement, if a customer agrees to delay the start of the project, may not be the best constraint. In fact, it may be more appropriate to reverse this constraint, in the hopes that by providing discounts for immediate servicing one could smooth the demand and resource utilization over a given time horizon, so that the "peak-effect" that occurs at the end of the sales quarter might be avoided. To test whether or not reversing our monotonicity constraints actually helps to this end we ran a scenario, using the first set, with the original monotonicity constraints, and one with the reverse monotonicity constraints. As can be seen from the graph, we see the resource utilization for the reverse monotonicity set is higher than that of the original set in every period expect for the last period of the horizon. The resource utilization is more evenly distributed under the reverse monotonicity constraints, which demonstrates the ability of the CVBP Model to modify demand patterns. This result has implications for resource scheduling and planning.

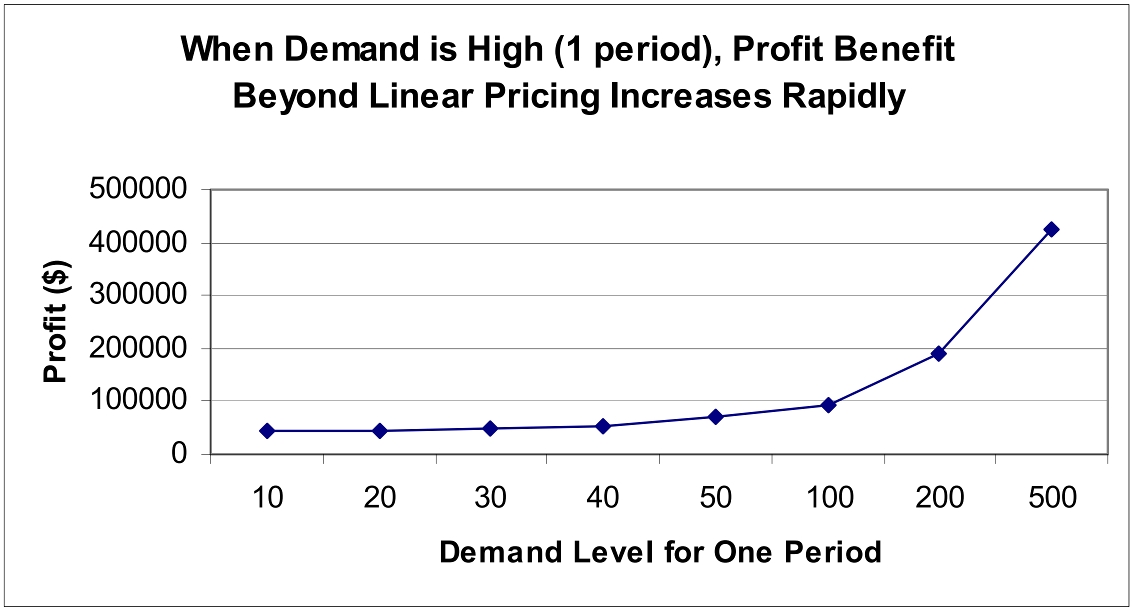


UTILITY, DEMAND, AND COMPETITOR PRICE INCREASES

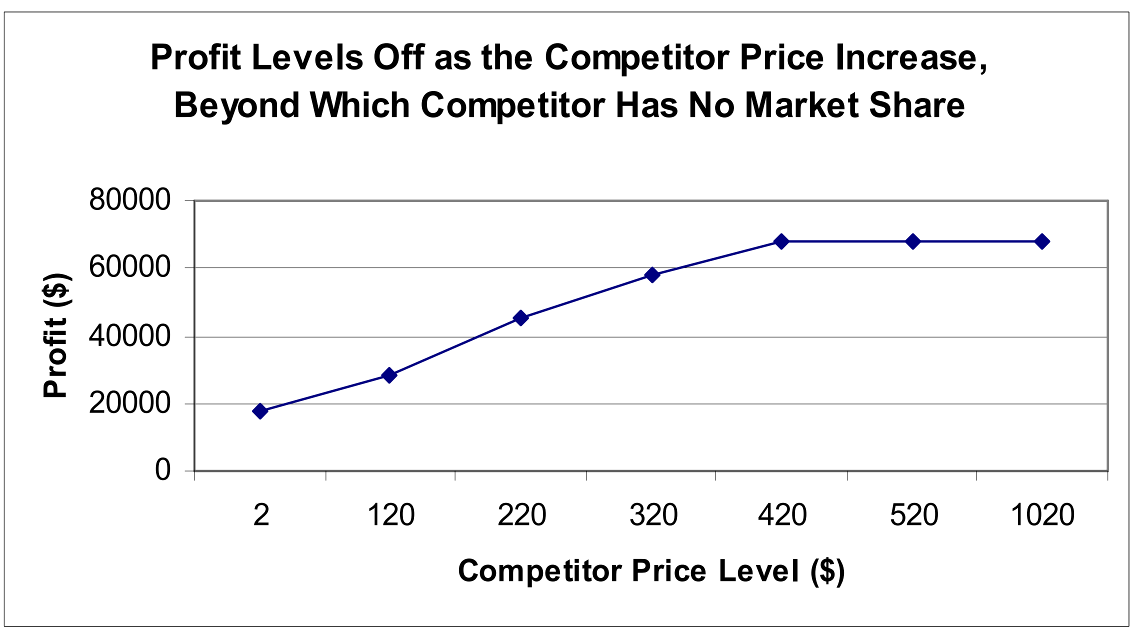
The following three testing scenarios were conducted in order to better understand the effects of certain parameters of interest within the CVBP Model. Namely, how customer utility, customer demand, and competitor price increases affect pricing and expected profits. To look at the effects of utility increases on overall expected profits we took our base set, and while keeping all other parameters the same, we increased the ν_{ij} value for the 4th solution by the intervals outlined in the graph below. Doing this, we see, as one would expect, that the overall expected profit also increases in response to this change.

Expanding on the construction of set 2, we ran several scenarios in which we systematically increased the expected demand for one period while keeping all other parameters the same. Again, as one would expect, in response to increased demand, prices adjust accordingly to leverage the company's position as service provider. As a consequence overall expected profits also increase in this scenario.



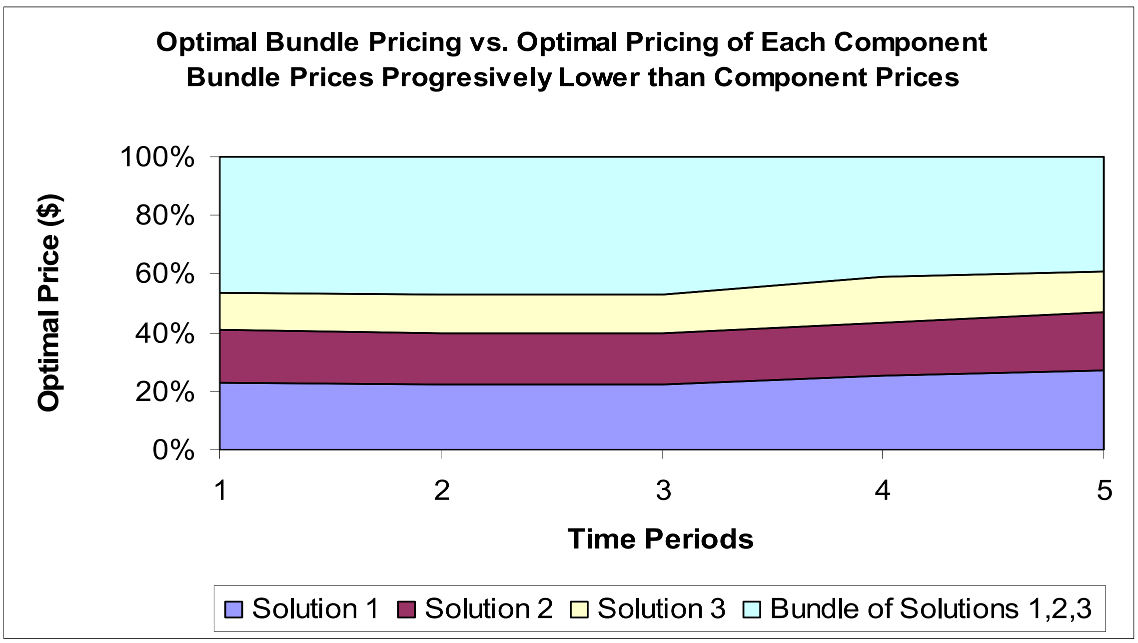


One of the most important effects of the CVBP Model to understand is how it responds to competition. To test this, we took our base set and ran several scenarios in which we consistently increased the representative competitor's price. As we can see from the graph, as the competitor price increases the expected overall profit again increases, which is not only indicative of competitors overpricing themselves, but also indicative of the model produced pricing adjusting to an appropriate level where they can capture more demand at increased prices. An interesting result is that at around $420 (in our particular scenario) the competitor has completely priced itself out of the market and our profits hit a plateau at which they stay for all competitor pricing above this threshold level.



BUNDLES

Analysis on bundle pricing compared to component pricing is important in understanding how the CVBP Model deals with bundles both within periods and over time. In conducting this analysis we ran an instance of the model over our base set, and then looked at the price of the bundled solution, along with the price of individual components. Initially, we see that the price of the bundled solution is close to that of the individual components. The graphical representation shows the sum of the CVBP Model-produced prices for the bundle and components. On the graph we note that the bundle price represents a bit less than 50% of the total, which indicates that the bundle of solutions is priced slightly less than the sum of its components. However, as the horizon progresses, the bundle becomes cheaper relative to the price of components.



Conclusions

This paper introduced a capacity and value based pricing (CVBP) model for professional services. The paper builds upon work done for modeling workforce and professional services in workforce management (Hu et al, 2007) and also takes inspiration from the revenue management literature. The application of revenue management techniques to the pricing of professional services appears to be new. At the same time, it appears from the state-of-practice to be quite timely and potentially important to the future of business service pricing. The results illustrate, as expected, that benefits can be had by segmenting demand and performing differentiated pricing, both to smooth demand as well as increase revenue.

While this is a first step, we would recommend other researchers to develop models to address this important question. Our approach deals in some respect with the contracting decision, by including two time phases: the time the customer reserves a service and the time it is to begin.

However, in professional services there are in some cases a third time phase: the development and negotiation of an initial contract between a customer and a vendor. That phase usually includes much back-and-forth, and is not represented in our model. Rather, our model represents a more automated view of pricing, as appropriate for projects within a larger contract, or for small-and-medium businesses that deal with larger service providers and have less opportunity for direct negotiation (but are rather price takers).

In summary, we hope that this paper will stimulate others to explore this very rich area of pricing for professional services.

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