

## PRICING PAID PLACEMENTS ON SEARCH ENGINES

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### ABSTRACT

The objective of this research is to identify the optimal pricing strategy for paid placements on search engines' "search-results" listings. To accomplish this we develop a mathematical model incorporating a constellation of parameters that describe buyers' online search intensity, competition among online sellers, and co-opetition between the online sellers and search engine. This model allows us to analyze three pricing strategies, namely pay-per-purchase (PPP), pay-per-click (PPC), and flat-fee (FF), for paid placement services. The paper then compares these pricing strategies in terms of their revenue potential for a search engine and identifies conditions when one pricing strategy is preferred over the other. Our analysis shows that PPC, the most popular pricing strategy, is not the optimal strategy to use when the proportion of buyers, who search online and end up buying online, is high. Instead the search engines would be better off by using PPP strategy. Another finding is that it is not always optimal to price paid-placements in proportion to their rank in the search results' listings. For instance, our analysis shows that when the proportion of buyers with low search intensity is high and a search engine is following a PPC pricing strategy, then it is better off charging a higher price for a lower-ranked listing.

Keywords: SEM, SEO, paid placement, pricing strategy, search engine, e-commerce

### 1. Introduction

Extensive research has been done on factors that influence online users' choice of one web site over others [e.g. Subramony 2002; Lightner & Eastman 2002]. However, there are hardly any studies on the role played by search engines in directing the online users, specifically potential online buyers, to particular websites despite that fact that search engines play a crucial role in web-based e-commerce transactions by bridging the gap between online buyers and sellers. Existing research on buyers' online-search behavior finds that the use of search engines to look for product and price information dominates other forms of online-search strategies [Sen et al. 2006]. This dependence of the browsing population on search engines makes it important that the sellers develop strategies that improve their visibility in the "search results" provided to the buyers. One strategy commonly used to improve visibility is to buy keyword-related banner advertisement on the "search results" page. However, a study from NPD Group [Bruemmer 2002] found that standard banner or button advertisements are not as effective as *search listings* when it comes to brand recall, favorable opinion rating and inspiring purchases. In unaided recall, *search listings* outperformed banners and buttons by three to one. However, just being listed in the search results is not enough. Sellers should aim to maximize the traffic that comes via search engines to their web site. To maximize this traffic, sellers need to ensure a preferential placement of their website address, i.e. it should appear in the top 20 matches. It's highly unlikely that a seller's site will be visited if it is listed in the engine, but in the "back pages" of results. Research has shown that users hardly ever go beyond the top 30 search engine listings for a single search. It is estimated that the

top 30 results receive over 90% of search traffic [Bruemmer 2002]. Sellers can improve their listing on the “search results” pages- (a) by search engine optimization (SEO)<sup>1</sup> e.g., making changes to their site code to make it more relevant and therefore more search engine compatible, and/or (b) by paying the search engines for preferred placements [Hansell 2001; Bhargava & Feng 2002; Sullivan 2002a]. SEO is something that all sellers can do, which makes it difficult to get any sustainable competitive advantage by just using this method. Furthermore, the initial results of an optimization campaign can take up to one hundred twenty (120) days after submission before the results become visible. Finally, paid-placement dominates as the SEM (search engine marketing) strategy of choice for most online sellers even when the total cost of implementing SEO is the same as that of implementing paid-placement, and SEO always results in a high ranking on search-results page [Sen 2005]. What should a seller do in the mean time? A potential strategy for gaining competitive advantage is by paying for the preferred-placement that result in a higher rank than the competitors in the search engines’ results page. Realizing the importance of preferential placement on search-results listings, search engines have started to sell these placements to augment their existing revenue strategy. Before we analyze various pricing strategies for these *paid-placements*, we would like to give a brief introduction of existing revenue generating strategies employed by search engines and why we feel that the study of optimal pricing strategy for *paid-placements* needs further investigation.

## 2. Search Engine Revenue Sources

Major sources of revenues for the search engines can be classified as follows (see *Appendix A* for specific examples).

- Paid Inclusion [Sullivan 2002b]: The search engine will guarantee to list pages from a web site. Unlike paid placement, this doesn't guarantee a particular position in the main search results.
- Paid Submission: This is where a search engine charges to process a request to be included in its listings. Typically, paid submission programs do not guarantee to list a site, only to review and possibly include it in a faster time frame than is normally done.
- Content Promotion: Many major search engines will promote an advertiser's content, or their own content, on their search results pages.
- Keyword-linked Banner Advertisement: All major search engines carry keyword-linked banner advertising, either using graphical banners or text banners.
- Paid Placement [Bhargava & Feng 2002; Sullivan 2002a]: Several major search engines carry paid placement listings, where sites are guaranteed a high ranking, usually in relation to desired search keywords.

In case of paid inclusion and paid submission all the sellers have to pay the relevant fee, which remains the same for all sellers and is solely determined by competition among search engines and the market share of each search engine. On the other hand, content promotions deals with a separate area on the search-results page that has been set aside for advertisements (e.g. banners and buttons) and the existing research has already addressed various aspects of this form of advertising on the Internet [e.g. Novak & Hoffman 2000]. Paid placements, however, are unique to search engines and a relatively new form of online promotion. They have yet to be investigated in terms of their pricing strategy and their effectiveness in generating traffic to the target sites. Furthermore, they offer a sustainable advantage to the sellers who pay for these placements, whether these sellers have an optimized website or not. For instance, if the seller’s website is already optimized, paid placements increase targeted visitors, branding, and reputation. On the other hand, if the seller’s site is not optimized, paid-placements are the only way to quickly get targeted search engine traffic. Given these advantages of paid placements for both the sellers and the search engines, we have decided to focus on identifying the optimal pricing strategy for this service.

The different types of pricing strategy that can be used by search engines for paid-placements can be broadly categorized as follows.

- Flat Pricing Strategy - Under this strategy the sellers pay a fixed fee to the search engine, irrespective of the number visitors they get or sales they make through the paid link. This fixed price could be determined by the search engine or could be solicited through an auction of paid placements.
- Variable Pricing Strategy - Under this strategy, the sellers pay on the basis of number of visitors they get or the amount of sales they make through the paid link. Pricing on the basis of Pay-Per-Click (PPC) would fall under this strategy, as would price based upon the actual sales of the seller. Auction of paid placements, by some search engines, where the sellers pay on the basis of click-through would also fall under this classification.

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<sup>1</sup>“What is SEO,” [http://www.high-search-engine-ranking.com/what\\_is\\_SEO.htm](http://www.high-search-engine-ranking.com/what_is_SEO.htm).

In the following section we develop an analytic model that allows us to compare alternative search engine pricing strategies for their paid placement services. The model is simple enough to permit analytic results while at the same time captures the essential features of buyers' online search intensity, competition among online sellers and the co-opetition between the search engine and the sellers. The model is then analyzed to identify the conditions when one pricing strategy is preferred to others by the search engine.

### 3. Elements of the Model

Suppose that a search engine provides links to two sellers, labeled A and B, and charges them differential prices for different positions in the search results. Without loss of generality we could think of Seller A as receiving the higher placement. The model analyzes three methods of pricing this paid-placement: (a) flat-fee payment (FF), payment by click-through (PPC), and payment by sales (PPP). In the first payment scheme both the paid-placements have a fixed but different price. In the second, each consumer that follows the link to Seller A results in a charge of  $c_A$  to the Seller A; the other seller would be charged  $c_B$  per click through. In the third pricing scheme, the search engine gets paid only if a consumer follows the links and ends up buying. The model further assumes that for the advertised product, the price charged by Seller A is  $P_A$  and the price charged by Seller B is  $P_B$ . Assumptions made in the model are as follows.

#### 3.1. Online Search

Consumers have a common valuation,  $V$ , for the merchandise/service that they want to purchase online, but they are uncertain about the sellers who offer the product/service and the prices charged for the product/service. Therefore, the model assumes that they search for vendors and product information [Detlor et al. 2003]. Let the proportion of buyers with low search intensity (i.e. they only canvass Seller A in this model) be  $\beta$ . Therefore, the proportion of buyers with high search intensity, i.e. those who canvass both Seller A and Seller B is  $1-\beta$ . A buyer's search intensity depends on several factors like his opportunity cost of time [Ratchford & Srinivasan 1993a, 1993b; Sen et al. 2006; Stigler 1961; Urbany et al. 1996], perception about online price dispersion [Manning & Morgan 1982; Marvel 1976; Morgan 1983; Ratchford & Srinivasan 1993a; Sen et al. 2006; Stigler 1961; Telser 1973; Urbany et al. 1996], and whether they have a preferred online seller or not [Sen et al. 2006]. Since, an individual's search intensity has been extensively researched using both analytical modeling [Gal et al. 1981; Manning & Morgan 1982; Morgan 1983; Stigler 1961; Telser 1973] and empirical studies [Ratchford & Srinivasan 1993a, 1993b; Urbany et al. 1996; Sen et al. 2006; Urbany et al. 1996], we assume  $\beta$  to be an exogenous variable. The demand for each seller is seen in *Figure 1*. Seller A could have the entire market if it prices below Seller B, but Seller B cannot gain complete market share even with a lower price because some of the shoppers do not search the web site of Seller B.

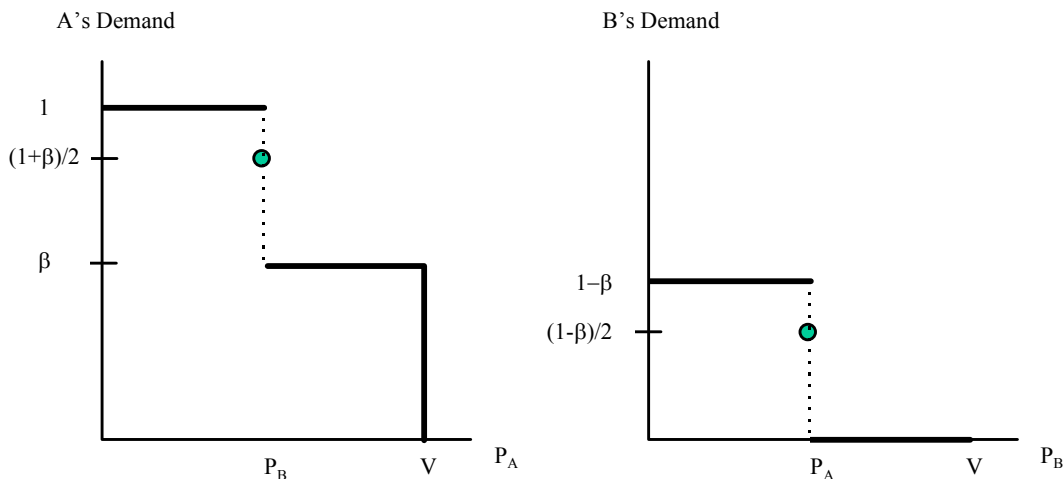


Figure 1: Demand for each seller

#### 3.2. Online Buyers

The model assumes that all online buyers who search online end up buying online. This assumption implies that buyers buy from one of the sellers listed on the "search results" page. This assumption is relaxed and its impact is analyzed later in the discussion section. In addition, we assume that all the buyers are in the market to buy the product and that they follow each link displayed on the "search results" page in a sequential order. The assumption

about sequential search is necessary to justify the paid placement strategy. If the buyers follow any *random* link on the “search results” page then it makes no sense for a seller to pay for getting listed in some particular position on the “search results” page.

### 3.3. Online Sellers

There are two online sellers in the market and both these sellers plan to remain in e-markets for an infinite period. These sellers are assumed to be future-oriented agent, i.e. they discount the future lightly and so have a high discount factor,  $\delta$ . Furthermore, both the sellers intend to *maximize the discounted-present value of their long term profits*. The model also assumes that the production costs (or the costs at which the seller may have bought the product from another seller/producer) for both the sellers is zero. This simply means that in the following analysis all prices have to be interpreted as a deviation from zero. Finally, we assume that the seller who gets the lower placement on search results listings (i.e. Seller B) adopts a *trigger strategy* [Fudenberg & Tirole 2000; Tirole 1998], i.e. when the first-placed seller (i.e. Seller A) tries to undercut its price, its response is to retaliate in a likewise manner and undercut the first-placed seller’s price. The first-placed seller (i.e., Seller A), on the other hand, does not *always* have the incentive to undercut the second-placed seller’s price since it has monopoly over the buyers who have low search intensity (i.e. canvass only Seller A).

### 3.4. Search Engine Competition

The model is developed for a single search engine, which we assume is operating in a monopoly situation. In reality, however, there is more than one popular search engine and the competition among these will have an impact on the maximum price that they can charge for the sponsored links. The initial analysis will focus on a single search engine. Later, in the discussion section, we will expand the analysis to include more than one search engine.

### 3.5. Information

Both the sellers and the search engine have complete and perfect information about buyers’ valuation of the product and the proportion of buyers with low and high search intensity.

## 4. Pricing Strategies

### 4.1. Pay-Per-Purchase (PPP) Pricing Strategy

The sellers pay according to the number of buyers who actually *buy* after finding the seller through the paid link on the search engine’s “search results” page. If the per-purchase rates are  $c_A$  and  $c_B$  for the first and second placement respectively, the single period profit functions for the two sellers are as follows:

#### Seller A

$$\begin{aligned} \pi_A &= \beta(P_A - c_A) && \text{If } P_A > P_B \\ \pi_A &= \frac{1}{2}(1 + \beta)(P_A - c_A)^2 && \text{If } P_A = P_B \\ \pi_A &= P_A - c_A && \text{If } P_A < P_B \end{aligned} \quad (1)$$

#### Seller B

$$\begin{aligned} \pi_B &= (1 - \beta)(P_B - c_B) && \text{If } P_A > P_B \\ \pi_B &= \frac{1}{2}(1 - \beta)(P_B - c_B) && \text{If } P_A = P_B \\ \pi_B &= 0 && \text{If } P_A < P_B \end{aligned} \quad (2)$$

#### 4.1.a Equilibrium Prices and Profits

For the profit functions given by *Equations (1) and (2)*, there is no pure strategy Nash equilibrium in prices (see *Appendix B*). In any period, Seller B will never allow Seller A to sell at a lower price because it results in minimal profits for Seller B in that and subsequent periods. This implies that if Seller A tries to undercut Seller B *in any period*, there will be price competition resulting in either (a) zero profits for Seller A (when  $c_A > c_B$  and Seller A is forced to sell at  $c_A$ ) and some profits for Seller B (it sells at  $c_A - \varepsilon$  and makes a profit of  $c_A - \varepsilon - c_B$ ) or (b) zero/negative profits for Seller B and some profits for Seller A (when  $c_A < c_B$ , Seller A sells at  $c_B - \varepsilon$  and Seller B sells at  $c_B$ ) *in subsequent periods*. In either case, the discounted present value of the long-term profits for *both the sellers* is lower than what it would be when their prices in each period are higher than Bertrand prices, because the model assumes a high discount factor [Tirole 1998]. Therefore, the two sellers have the option of either selling at the same price or selling at prices such that  $P_A > P_B$ . Now let us assume that there exists a price combination  $(P_A^*, P_B^*)$

<sup>2</sup> With equal price both the sellers equally share the number of buyers who visit both Seller A and Seller B.

such that  $P_B^* < P_A^*$  and both the sellers have no incentive to deviate from these prices in any period. This price equilibrium is referred to as *Undercut-Proof Equilibrium* [Shy 2001], where Seller B sets the highest price it can (i.e.,  $P_B^*$ ) while preventing Seller A from matching or undercutting  $P_B^*$ . More precisely, Seller B sets  $P_B^*$  as high as possible without causing Seller A's equilibrium profit level to be smaller than Seller A's profit level when Seller A drops its price such that  $P_A \leq P_B^*$ . Now, compared to selling at  $P_A = P_B$ , Seller A is better off selling at a higher price, i.e.  $P_A > P_B$  when  $P_B \leq \frac{2\beta P_A + (1-\beta)c_A}{1+\beta}$ . In addition, the price charged by Seller A should be such that  $P_A \leq V$ .

However, if Seller B increases its price such that,  $\frac{2\beta P_A + (1-\beta)c_A}{1+\beta} < P_B$ , Seller A would prefer to lower its price to the level of Seller B's price. This implies that any price combination such that  $P_A^* = P_B^* = P^* \leq V$  can be the equilibrium price, since for Seller B,  $\frac{2\beta P^* + (1-\beta)c_A}{1+\beta} < P^*$  is true for any  $P^*$ . However,  $P_A^* = P_B^* = P^* = V$  is the

only *pareto optimal* price at which both sellers maximize the discounted present value of their long-term profits. To summarize, the equilibrium prices that maximize the discounted present value of long-term profits for both the sellers are  $P_A^* = V$  and  $P_B^* = \frac{1}{1+\beta}[2\beta V + (1-\beta)c_A]$  and  $P_A^* = P_B^* = V$ . The discounted present value of long-term

profits for the sellers when they charge  $P_A^* = V$  and  $P_B^* = \frac{1}{1+\beta}[2\beta V + (1-\beta)c_A]$  in each period, are

$$\pi_A^* = \beta(V - c_A) \text{ and } \pi_B^* = (1-\beta)\left[\frac{2\beta V + (1-\beta)c_A}{1+\beta} - c_B\right] \quad (3)$$

Similarly, the discounted present value of long-term profits for the sellers when they charge  $P_A^* = P_B^* = V$  in each period are

$$\left. \begin{aligned} \pi_A^* &= \frac{1}{2}(1+\beta)(V - c_A) \\ \pi_B^* &= \frac{1}{2}(1-\beta)(V - c_B) \end{aligned} \right\} \quad (4)$$

Sellers' willingness to pay for the paid placements when  $P_A^* = V$  and  $P_B^* = \frac{2\beta V + (1-\beta)c_A}{1+\beta}$  is

$$\left. \begin{aligned} \pi_A^* \geq 0 &\Rightarrow c_A \leq V \\ \pi_B^* \geq 0 &\Rightarrow c_B \leq \frac{2\beta V + (1-\beta)c_A}{1+\beta} \end{aligned} \right\} \quad (5)$$

Similarly, Sellers' willingness to pay for the paid placements when  $P_A^* = P_B^* = V$  is

$$\pi_A^* \geq 0 \Rightarrow c_A \leq V \text{ and } \pi_B^* \geq 0 \Rightarrow c_B \leq V \quad (6)$$

For the search engine, profit maximizing prices (from *Equations (5) and (6)*) for the paid-placements, are

$$c_A^* = V \text{ and } c_B^* = \frac{2\beta V + (1-\beta)V}{1+\beta} = V \text{ and } c_A^* = V \text{ and } c_B^* = V \quad (7)$$

In an auction setting, bids are invited from sellers interested in buying paid placements. If two paid-placements are available, the highest bidder gets the first placement while the lowest bidder gets the second placement. When each seller is aware only about its' own maximum willingness to pay for the paid-placements, the Nash equilibrium is that both the sellers end up bidding their maximum willingness to pay [Fudenberg & Tirole 2000]. Seller A's and Seller B's maximum willingness to pay is given by *Equations (5) and (6)* and therefore this will be the price that the search engine would get for the two paid placements. On the other hand, if the search engine is setting the price, then it maximizes its revenues by estimating the maximum amount that the sellers are willing to pay. It can easily do so in this model since this amount depends on buyers' valuation of the product and the proportion of buyers with

low search intensity- information known to the search engine. This is again, the same amount as given by *Equations (5) and (6)*. Thus, with Pay-Per-Purchase (PPP) pricing strategy, irrespective of the value of parameter  $\beta$ , the search engine should always charge or get through auction the same price for both the paid-placements and this price should equal the buyers' maximum willingness to pay, i.e.  $V$ .

4.2. Pay-Per-Click (PPC) or Cost-Per-Click (CPC) Pricing Strategy

The sellers pay according to the number of buyers who actually *visit* the seller through the paid link on the search engine's search result's listings. The per-visit rates (or PPC) are  $c_A$  and  $c_B$  for the first and second placement respectively. The profit functions for the two sellers are as follows:

Seller A

$$\begin{aligned} \pi_A &= \beta P_A - c_A && \text{If } P_A > P_B \\ \pi_A &= \beta P_A + \frac{1}{2}(1-\beta)P_A - c_A = \frac{1}{2}(1+\beta)P_A - c_A && \text{If } P_A = P_B \\ \pi_A &= P_A - c_A && \text{If } P_A < P_B \end{aligned} \tag{8}$$

Seller B

$$\begin{aligned} \pi_B &= (1-\beta)(P_B - c_B) && \text{If } P_A > P_B \\ \pi_B &= \frac{1}{2}(1-\beta)P_B - (1-\beta)c_B = (1-\beta)\left[\frac{1}{2}P_B - c_B\right] && \text{If } P_A = P_B \\ \pi_B &= -(1-\beta)c_B && \text{If } P_A < P_B \end{aligned} \tag{9}$$

4.2.a Equilibrium Prices and Profits

*Table 1* summarizes the conditions for two possible equilibriums (see *Appendix C*) when the search engine charges on the basis of Pay-Per-Click (PPC).

Table 1: Equilibrium prices when PPC pricing strategy is used for paid-placements

Proportion of Buyers with Low Online Search Intensity	Relationship between $P_A$ and $P_B$	Optimal Pricing Strategy
$\frac{1}{3} < \beta \leq 1$	$\frac{1}{2}P_A < P_B \leq \frac{2\beta P_A}{1+\beta} < P_A \leq V$	$P_B^* < P_A^*$ Seller sells at $P_A^* = V$ Seller B sells at $P_B^* = \frac{2\beta V}{1+\beta}$
$0 < \beta \leq \frac{1}{3}$	$P_B = P_A \leq V$	$P_A^* = P_B^*$ Seller A sells at $P_A^* = V$ Seller B sells at $P_B^* = V$

*Table 2* summarizes the equilibrium profits for the two sellers, their willingness to pay for the paid placements and the revenue maximizing prices that a search engine can charge for the paid-placements.

Table 2: Optimal paid placement prices under Pay-Per-Click (PPC) pricing strategy

Proportion of Buyers with Low Online Search Intensity	$\frac{1}{3} < \beta \leq 1$		$0 < \beta \leq \frac{1}{3}$	
	Seller A	Seller B	Seller A	Seller B
Equilibrium profits	$\pi_A^* = \beta V - c_A$	$\pi_B^* = (1-\beta)\left[\frac{2\beta V}{1+\beta} - c_B\right]$	$\pi_A^* = \frac{1}{2}(1+\beta)V - c_A$	$\pi_B^* = (1-\beta)\left[\frac{1}{2}V - c_B\right]$
Maximum willingness to pay	$c_A \leq \beta V$	$c_B \leq \frac{2\beta V}{1+\beta}$	$c_A \leq \frac{1}{2}(1+\beta)V$	$c_B \leq \frac{1}{2}V$
Optimal paid-placement price	$c_A^* = \beta V$	$c_B^* = \frac{2\beta V}{1+\beta}$	$c_A^* = \frac{1}{2}(1+\beta)V$	$c_B^* = \frac{1}{2}V$

4.3. Search Engine Revenue

Flat Fee (FF): The sellers pay a flat fee for the paid placements irrespective of the number of sales they make or the number of visitors they receive via the search engine. The profit functions for the two sellers are as follows:

Seller A

$$\begin{aligned}
 \pi_A &= \beta P_A - c_A && \text{If } P_A > P_B \\
 \pi_A &= \beta P_B + \frac{1}{2}(1-\beta)P_B - c_A = \frac{1}{2}(1+\beta)P_A - c_A && \text{If } P_A = P_B \\
 \pi_A &= P_A - c_A && \text{If } P_A < P_B
 \end{aligned} \tag{10}$$

Seller B

$$\begin{aligned}
 \pi_B &= (1-\beta)P_B - c_B && \text{If } P_A > P_B \\
 \pi_B &= \frac{1}{2}(1-\beta)P_B - c_B && \text{If } P_A = P_B \\
 \pi_B &= -c_B && \text{If } P_A < P_B
 \end{aligned} \tag{11}$$

4.3.a Equilibrium Prices and Profits

Table 3 summarizes the conditions for the two possible equilibriums (see Appendix D) when the search engine charges a flat fee for the two placements.

Table 3: Equilibrium prices when FF pricing strategy is used for paid-placements

Proportion of Buyers with Low Online Search Intensity	Relationship between $P_A$ and $P_B$	Optimal Pricing Strategy
$\frac{1}{3} < \beta \leq 1$	$\frac{1}{2}P_A < P_B \leq \frac{2\beta P_A}{1+\beta} < P_A \leq V$	$P_A^* < P_B^*$ Seller sells at $P_A^* = V$ Seller B sells at $P_B^* = \frac{2\beta V}{1+\beta}$
$0 < \beta \leq \frac{1}{3}$	$P_B = P_A \leq V$	$P_A^* = P_B^*$ Seller A sells at $P_A^* = V$ Seller B sells at $P_B^* = V$

Table 4 summarizes the equilibrium profits for the two sellers, their willingness to pay for the paid placements and the revenue maximizing prices that a search engine can charge for the paid-placements.

Table 4: Optimal paid placement prices under Flat-Fee (FF) pricing strategy

Proportion of Buyers with Low Online Search Intensity	$\frac{1}{3} < \beta \leq 1$		$0 < \beta \leq \frac{1}{3}$	
	Seller A	Seller B	Seller A	Seller B
Equilibrium profits	$\pi_A^* = \beta V - c_A$	$\pi_B^* = (1-\beta)\frac{2\beta V}{1+\beta} - c_B$	$\pi_A^* = \frac{1}{2}(1+\beta)V - c_A$	$\pi_B^* = \frac{1}{2}(1-\beta)V - c_B$
Maximum willingness to pay	$c_A \leq \beta V$	$c_B \leq \frac{2\beta(1-\beta)V}{1+\beta}$	$c_A \leq \frac{1}{2}(1+\beta)V$	$c_B \leq \frac{1}{2}(1-\beta)V$
Optimal paid-placement price	$c_A^* = \beta V$	$c_B^* = \frac{2\beta(1-\beta)V}{1+\beta}$	$c_A^* = \frac{1}{2}(1+\beta)V$	$c_B^* = \frac{1}{2}(1-\beta)V$

5. Discussion

5.1. Optimal Search Engine Revenue Model

Table 5 compares the total revenues generated for the search engine for each of the aforementioned three revenue models, when (a) there is only one online search engine, and (b) all buyers who search the sponsored links end up buying from one of the sellers who pay for these links.

Table 5: Comparison of various revenue models

Revenue Model		$c_A^*$	$c_B^*$	Total Search Engine Revenues
Pay-Per-Purchase		$V$	$V$	$\frac{(1+\beta)}{2}V + \frac{(1-\beta)}{2}V = V$
Pay-Per-Click (PPC)	$\frac{1}{3} < \beta \leq 1$	$\beta V$	$\frac{2\beta V}{1+\beta}$	$\beta V + (1-\beta)\frac{2\beta V}{1+\beta} = \left[\frac{3-\beta}{1+\beta}\right]\beta V$
	$0 < \beta \leq \frac{1}{3}$	$\frac{1}{2}(1+\beta)V$	$\frac{1}{2}V$	$\frac{1}{2}(1+\beta)V + \frac{1}{2}(1-\beta)V = V$
Flat Fee	$\frac{1}{3} < \beta \leq 1$	$\beta V$	$\frac{2\beta V(1-\beta)}{1+\beta}$	$\beta V + \frac{2\beta V(1-\beta)}{1+\beta} = \left[\frac{3-\beta}{1+\beta}\right]\beta V$
	$0 < \beta \leq \frac{1}{3}$	$\frac{1}{2}(1+\beta)V$	$\frac{1}{2}(1-\beta)V$	$\frac{1}{2}(1+\beta)V + \frac{1}{2}(1-\beta)V = V$

Based on the comparative analysis of various pricing strategies, we propose the following.

**Proposition 1:** Irrespective of the pricing strategy adopted, the paid-placements should always be priced in proportion to the value of product or service being sold by the sellers who are paying for the sponsoring links (see Table 5).

The current strategy used by most search engines is to charge on the basis of click-through and price their sponsored links in proportion to the popularity of the keywords used to search for any product and service under consideration. It is based on the implicit assumption that more the number of people looking for a certain keyword, larger the size of online demand for products or services related to this keyword. A major drawback with this strategy is that it does not take into account the value of this product or service to the potential online buyer. For instance, under this scheme, online sellers who target a niche consumer segment and sell expensive products will pay a lot less since there will be relatively less number of online buyers searching for their product and services. Our analysis suggests that search engines would do better if they incorporate this product valuation in their pricing strategy. One way of doing so is to auction these paid placements. The auction will get a better price because competition among these sellers will result in each of them bidding in proportion to the maximum amount they are willing to pay, and this amount is influenced by the value of the product they are selling. This could be one possible justification for the increasing use of auctions to sell paid-placements (e.g. Google, Overture).

**Proposition 2:** The Pay-Per-Purchase Pricing Strategy weakly dominates the Pay-Per-Click and Flat-Fee Pricing Strategies.

When the proportion of buyers with low online search intensity is sufficiently low (i.e.  $0 < \beta \leq \frac{1}{3}$ ), the search engine is indifferent between using Pay-Per-Purchase, Pay-Per-Click, and Flat-Fee pricing strategy, since the payoff is essentially the same for all these strategies, i.e.,  $V$  (please refer to Table 5).

When the proportion of buyers with low online search intensity is sufficiently high (i.e.  $\frac{1}{3} < \beta \leq 1$ ), the total revenues for a search engine are largest with Pay-Per-Purchase pricing strategy. (*Proof:* Comparing the total revenues for various pricing strategies from Table 5, we have  $PPP > (PPC=FF)$  because  $V > \beta V \left[\frac{3-\beta}{1+\beta}\right]$ , is always true for  $0 < \beta \leq 1$ ). Since, there is some evidence to suggest that most buyers have low search intensity and visit only a few links [Detlor et al., 2003], we should expect PPP to dominate the paid-placement pricing strategy. Surprisingly, this pricing strategy is not yet evident in the search engine market. One reason could be that this strategy results in the research engine extracting maximum value from the transaction. Therefore, the advertisers (i.e. the sellers) have little incentive to buy paid placements prices in accordance with this purchase policy.



**Proposition 3:** *If the search engine adopts Pay-per-click (PPC) revenue model then the optimal pricing policy is to charge different prices for both the paid placements such that  $c_A^* < c_B^*$  when the proportion of buyers with low search intensity is relatively high (i.e.  $\frac{1}{3} < \beta \leq 1$ ), and  $c_A^* > c_B^*$  when the proportion of buyers with low search intensity is relatively low (i.e.  $0 < \beta \leq \frac{1}{3}$ ).*

A popular practice among search engines is to charge paid-placements in proportion to the rank of the placement in the search result's listings. Higher the rank, higher the price charged and vice versa. Our analysis suggests that this pricing policy maximizes the total revenues for the search engine only when *there are low proportions of buyers with low search intensity*, i.e. most buyers canvass both Seller A and Seller B. A more generalized way of saying this is that most buyers have high online-search intensity. When most online buyers prefer to canvass both Seller A and Seller B, both the sellers offer the same price (see *Table 1*), and equally share the residual demand, i.e. the number of buyers canvassing both sellers (see *Equations (8) and (9)*). However, Seller B's maximum willingness to pay is lower than that of Seller A, because its total demand is lower, and therefore Seller B's profit is lower than that of Seller A's. However, when the pricing strategy is PPC and the number of buyers who canvass both Seller A and Seller B is essentially low (since  $\frac{1}{3} < \beta \leq 1$ ), Seller B's willingness to pay for the second paid placement is higher than Seller A's willingness to pay for the first paid placement. One possible explanation for this counterintuitive result is as follows. When fewer buyers canvass Seller B also (i.e.  $\beta$  is high), it becomes a must for Seller B to price below Seller A's price so as to be able to sell to all the buyers who canvass both Seller A and Seller B. At the same time, since Seller B is facing fewer click-throughs it can afford to pay a relatively higher amount for each click. On the other hand, although Seller A charges a higher price, its maximum willingness to pay for each click-through is reduced because *all* the buyers canvass Seller A and therefore it has to pay for higher number of click-throughs.

A quick survey of search engine's paid-placement pricing strategies shows that most of them have adopted a PPC pricing strategy and that they charge a higher amount for the first placement and a relatively lesser amount for the lower listed paid-placements (please see *Appendix E*). One reason for this could be that the most people searching on these websites have relatively high search intensity (i.e.  $\beta$  is low) and therefore this is the optimal pricing strategy to pursue. From *Table 5*, we can see that (for PPC pricing strategy) when  $c_A^* > c_B^*$ ,  $\frac{c_A^*}{c_B^*} = 1 + \beta$  or  $\beta = \frac{c_A^*}{c_B^*} - 1$ . Computing  $\beta$  from  $c_A^*$  and  $c_B^*$ , for various keywords shows that  $\beta$  turns out to be less than  $\frac{1}{3}$  for the products associated with these keywords, supporting our finding that under PPC pricing strategy, search engines are better off charging  $c_A^* > c_B^*$  when  $0 < \beta \leq \frac{1}{3}$ .

*Propositions 1 to 3* are valid when all buyers who use the search engine end up buying online. This however, is not a realistic assumption since many potential buyers look for product information online do not make any purchase from the online sellers who invest in paid placement. Let us assume that the proportion of buyer who search the sponsored links and then actually buy from one of the sellers that sponsored the paid-placements, is  $\gamma$ . Under these conditions, the search engine revenues change only for Pay-Per-Purchase-pricing strategy, and are proportional to  $\gamma$ . However, there is no impact on the search engine revenues if the pricing strategy is PPC or FF since neither of these strategies depends on actual purchase.

By comparing the total revenues for each of the pricing strategies (*Table 6*) we arrive at the *Propositions 4*.

**Proposition 4:** *Both Pay-per-Click and Flat-Fee pricing strategies dominate the Pay-Per-Purchase pricing strategies when the proportion of buyers with low online-search intensity less than  $\frac{1}{3}$ . However, when the proportion of buyers with low online-search intensity is sufficiently high (i.e.  $\frac{1}{3} < \beta \leq 1$ ), then both FF and PPC pricing strategies are better than PPP pricing strategies only if  $\left[ \frac{\beta(3-\beta)}{1+\beta} \right] > \gamma$ .*

Table 6: Comparison of various revenue models

Revenue Model		$c_A^*$	$c_B^*$	Total Search Engine Revenues
Pay-Per-Purchase		$\gamma V$	$\gamma V$	$\gamma V$
Pay-Per-Click	$\frac{1}{3} < \beta \leq 1$	$\beta V$	$\frac{2\beta V}{1+\beta}$	$\left[ \frac{3-\beta}{1+\beta} \right] \beta V$
	$0 < \beta \leq \frac{1}{3}$	$\frac{1}{2}(1+\beta)V$	$\frac{1}{2}V$	$V$
Flat Fee	$\frac{1}{3} < \beta \leq 1$	$\beta V$	$\frac{2\beta V(1-\beta)}{1+\beta}$	$\left[ \frac{3-\beta}{1+\beta} \right] \beta V$
	$0 < \beta \leq \frac{1}{3}$	$\frac{1}{2}(1+\beta)V$	$\frac{1}{2}(1-\beta)V$	$V$

### 5.2. More than One Search Engine in the Market

Case for Market Consolidation: All the aforementioned propositions will hold even if more than one search engine is present in the online market, as long as the buyers can be segmented on the basis of their choice of search engine and the proportion of buyer who search the sponsored links and then actually buy from one of the sellers that sponsored the paid-placements is  $\gamma$ . In the presence of more than one search engine, each search engine will price its paid-placements in proportion to the number of buyers who use it. For our model, suppose there are  $n$  distinct search engines and  $\alpha_i$  represents the proportion of online buyers loyal to Search Engine  $i$ , then  $\sum_{i=1}^{i=n} \alpha_i = 1$ . By distinct search

engines, we mean that search engines, portals, and websites who have alliances and who solicit bids for paid placements from a single source are treated as one search engine. For instance, by successfully bidding for a paid link with Overture exposes a seller to traffic from several websites, including MSN, Yahoo!, AltaVista, InfoSpace, AlltheWeb and NetZero. Therefore, Overture and these allied websites are clubbed together as one search engine in our model. Pricing competition among the search engines is minimal because the demand for paid-placements far exceeds the supply of paid-placements - the number of paid-placements available with each search engine is limited by space allotted for paid-placements on these search engines. However, the sellers' expected revenues from the links placed with these search engines influence the price charged by each search engine. The proportion of online buyers loyal to various search engines, in turn, affects these expected revenues. For instance, Seller A's willing to pay for a placement with Search Engine  $i$  will be proportional to expected business that this paid-link can generate, which in turn is proportional to the number of buyers using Search Engine  $i$ . Therefore, a seller will be willing to pay more to a search engine with relatively higher market share. This relationship is evident in the pricing of paid-placements by various search engines following PPC pricing strategy. For instance, the larger PPC services like Overture and Google AdWords provide the most exposure (front page positions on places like Yahoo, MSN and Google), but they also typically charge the highest costs per click. Other PPC providers like ah-ha.com, Kanoodle, FindWhat and Looksmart get a bit less exposure, and they are typically much less expensive (please see *Appendix D*).

At present, all major search engines charge their paid-links on the basis of click-through, i.e. use PPC pricing strategy. Given this strategy, their total revenues will either be  $\alpha_i \left[ \frac{3-\beta}{1+\beta} \right] \beta V$ , (when  $\frac{1}{3} < \beta \leq 1$ ), or  $\alpha_i V$  (when  $0 < \beta \leq \frac{1}{3}$ ). In both the cases, a search engine will have to ensure that its operating costs do not exceed these total revenues (assuming that paid-placements are the only source of their income). Therefore, for any value of  $\beta$  (i.e. proportion of buyers with low search intensity), a higher market share gives more breathing space to a search engine (even if it has relatively higher operating costs) and increases the probability of its survival, while a low market share puts pressure on the search engine to lower its operating costs and in the process decreases its probability of survival. This could be a possible explanation of search engine consolidation taking place in the industry where search engines with relatively low market shares are combining with their larger competitors increase their "exposure" to the online browsing population. By doing so, they get better prices for their PPC-based revenue sources like paid-links and keyword-linked banners and improve their chances of survival.

### 5.3. Possibility of Fraudulent Click-through

Although, PPC is the optimal and dominant pricing strategy used by search engines to sell paid-placements, there is a serious concern about its misuse.<sup>3</sup> Click-through rates can be artificially increased by using automatic software [French 2004], or manually [Vidyasagar 2004]. This strategy of artificially increasing the click-through rate can be employed by search engine affiliates to improve their revenues from contextual advertising or by unscrupulous competitors who want to drain the paid-placement buyers' advertisement dollars. Fortunately, the paid-placement buyers can also use technology to minimize their risk of paying extra for these fraudulent clicks. They can use click fraud prevention software tools like Click Auditor<sup>4</sup>, which allows them to- (a) identify suspicious IP's from where the repeated click-throughs are being generated, (b) identify the geographical location of the clicker, especially important if all the sales come from one area (e.g. country) while a huge volume of clicks is originating from another country; and (c) monitor keywords with unusual click activity or keywords with declining conversion rates, which can be a good indicators of fraud.

## 6. Conclusion

Online searching is an integral part of online buyers' behavior and search engines are the most popular tools for conducting online search. Therefore, the search listings become a non-invasive, "pull marketing" strategy that works in the background. As a result, sellers are keen to advertise and promote themselves over search engines. Initial attempts like banner ads, pop-ups, and email marketing promotions use a "push marketing" strategy that interrupts the user's self-directed behavior and can be frustrating. Furthermore, their effectiveness, in terms of click-through, has gone down from about 2% to less than 0.5% in recent years. Therefore, the search engines have realized that banner advertisement as a source of revenue does not have the long-term growth potential that they are looking for. Conversely, paid placements on search engine "results-page"- (a) are unobtrusive, (b) can help users achieve their goals, and (c) are more effective than banner ads and pop-ups. These qualities make them attractive both to potential advertisers as a new promotional strategy and to search engines as a new revenue source.

Our model helps search engine vendors to get some insights about various strategies that they can use to price their paid-placements and recognize the conditions under which one strategy is better than the other. Surprisingly, our analysis shows that PPC, the most popular pricing strategy, is not the optimal strategy to use when most buyers have high search intensity. Another finding in this paper is that it is not always optimal to price paid-placements in proportion to their rank in the search results' listings. For instance, when most buyers have low search intensity a search engine follows a PPC pricing strategy, then it is better off by charging a higher price for a lower-ranked listing.

Like any analytical model, the proposed model has its limitations inherent in its simplicity and the assumptions behind it. However, we feel that it is realistic enough to provide us with a better understanding of the issue and some economic rationale behind the most popular pricing strategy currently employed by most search engines, i.e. Pay-Per-Click (PPC) or cost-per-click (CPC).

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<sup>3</sup> [http://www.alchemistmedia.com/CPC\\_Click\\_Fraud.htm](http://www.alchemistmedia.com/CPC_Click_Fraud.htm)

<sup>4</sup> [http://www.keywordmax.com/click\\_auditor.html](http://www.keywordmax.com/click_auditor.html)

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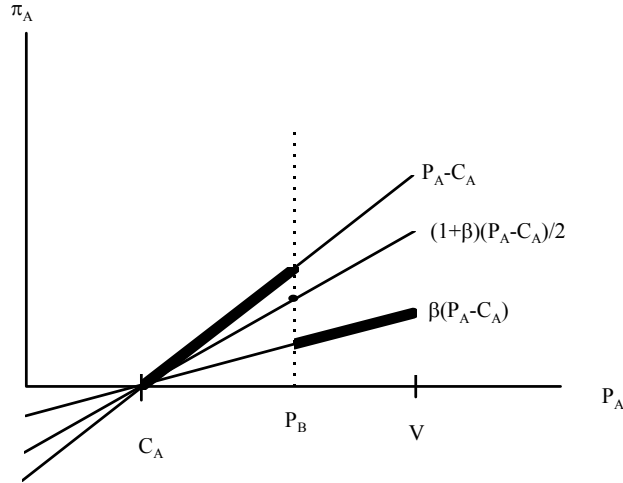
**APPENDIX A: Search Engine Revenue Strategies**

<b>Search Engine</b>	<b>Revenue Program</b>	<b>Information</b>
AllTheWeb (FAST)	Paid Placement	"Sponsored Search Listings" sold by Overture "Start Here" links sold by Lycos
	Paid Inclusion	May occur in main results
AOL Search	Paid Placement	"Sponsored Links" are paid links from Google
	Paid Inclusion	May occur in main results currently provided by Inktomi
	Content Promo	"Recommended Sites" generally lead to AOL or partner content
AltaVista	Paid Placement	"Products and Services" links sold by AltaVista or Overture
	Paid Inclusion	Occurs in main results and directory listings
Ask Jeeves	Paid Placement	"You may find this featured listing helpful" sold by Ask
	Paid Placement	"You may find these sponsored links helpful" links from Overture
	Paid Placement	"You may find these options useful" paid links from others
	Paid Inclusion	May occur in "Click Ask below for your answers" or "You may find my search results helpful" sections
Google	Paid Placement	"Sponsored Link" ads sold by Google appear at top and to right of main listings
	Paid Inclusion	None
HotBot	Paid Placement	"Sponsored Search Listings" sold by Overture
	Paid Inclusion	May occur in any results from Inktomi (look for Inktomi logo at bottom of page)
	Content Promo	In "Search Partners" and "From The Lycos Network" areas
Inktomi	Paid Inclusion	Paid inclusion program allows sites to be crawled more deeply in Inktomi's listings.
Look Smart	Paid Placement	"Featured Listings" sold by LookSmart
	Paid Inclusion	Commercial sites pay for listing
Lycos	Paid Placement	"Sponsored Search Listings" sold by Overture "Start Here" links sold by Lycos
	Paid Inclusion	May occur in main results provided by FAST
	Content Promo	"From The Lycos Network" area
MSN Search	Paid Placement	"Sponsored Sites" from Overture
	Paid Inclusion	May occur in "Web Directory" info from LookSmart or "Web Pages" info from Inktomi.
	Content Promo	In "Featured Listings" area
Overture (GoTo)	Paid Placement	Listings with "Advertiser's Max Bid" note are paid
	Paid Inclusion	Unpaid results from Inktomi may have paid inclusion listings

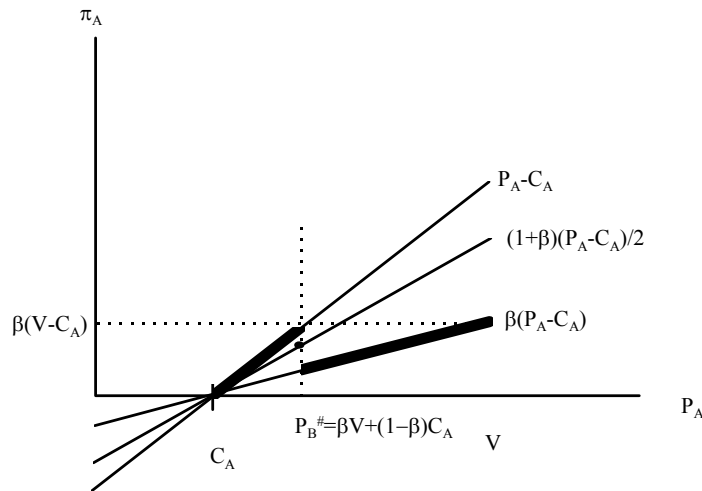
Netscape	Paid Placement	"Sponsored Links" from Overture, in future from Google
	Paid Inclusion	None
	Content Promo	Within "Matching Results"
Yahoo	Paid Placement	"Sponsor Matches" sold by Overture
	Paid Inclusion	"Yahoo Express" provides fast review and possible inclusion in main listings. Mandatory annual fee for commercial areas.
	Paid Submission	Within "Inside Yahoo!" area
Source: <a href="http://searchenginewatch.com/webmasters/paid.html">http://searchenginewatch.com/webmasters/paid.html</a>		

**APPENDIX B: Non-Existent Nash Equilibrium**

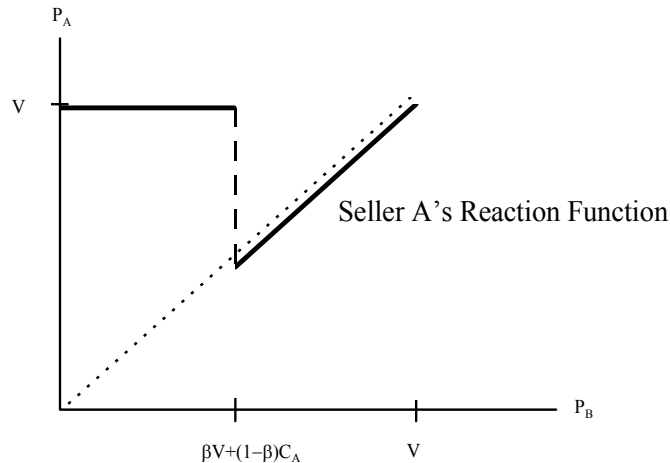
In the figure below we have a graph of the profit function of A given in Equation (1).



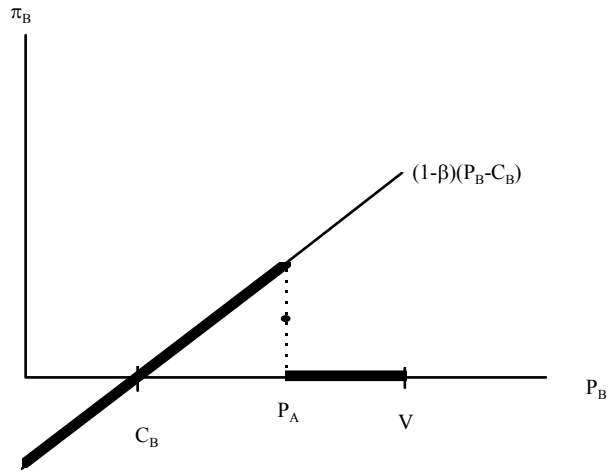
In this graph the price of seller B,  $P_B$ , is fairly high, so the profit maximizing price of A is a hair below  $P_B$ ; call this  $P_A = P_B^-$ . If  $P_B$  was much lower, it would pay the seller A to ignore the intense searchers and concentrate only on the low intensity searchers, setting price equal to  $P_A = V$ . In the figure below, we have identified the price of seller B,  $P_B^\#$ , when the focused targeting is just profitable.



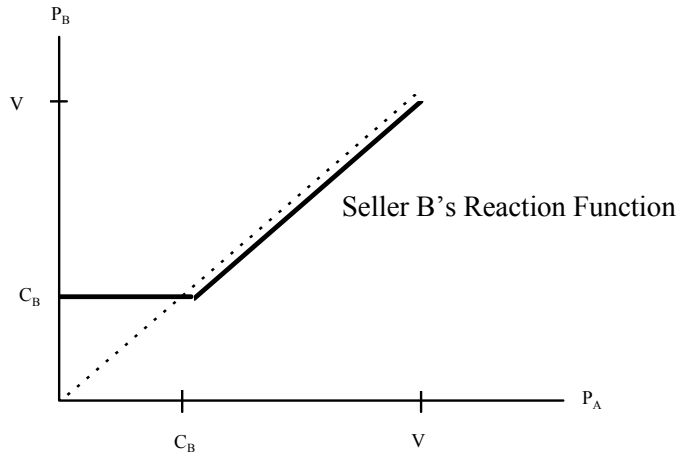
The reaction curve of firm A is seen below.



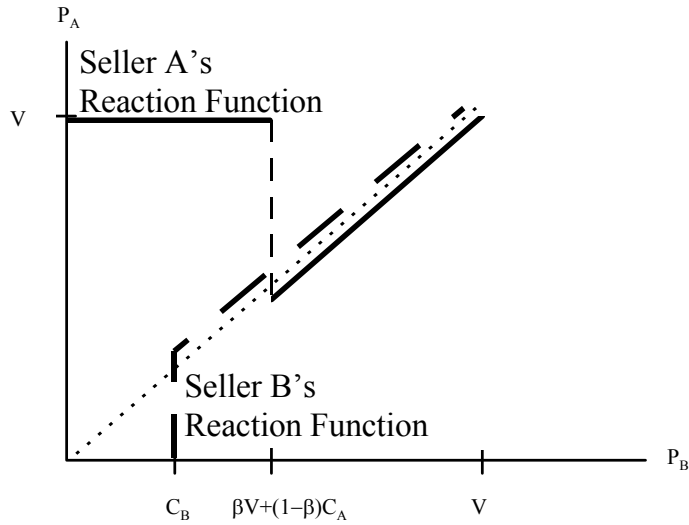
Similar analysis of Seller B has a profit function equivalent to *Equation (2)* as below.



Seller B always wants to undercut the price  $P_A$ , except when Seller A is pricing at B's cost or lower. The reaction function of seller B is seen below.



Putting the two reaction curves together, we get the following.



There is no Nash equilibrium in this game since the reaction curves do not intersect.



**APPENDIX C: Price Equilibrium**  
**When Search Engine Follows Pay-Per-Click (PPC) Pricing Strategy of its Paid Placements**

If we can identify a price combination  $(P_A^*, P_B^*)$  such that  $P_B^* < P_A^*$  and both the sellers have no incentive to deviate from these prices in subsequent periods then these prices represent the *Undercut-Proof Equilibrium* [Shy 2001]. We begin by comparing the profit functions of the two sellers when they sell at the same price, i.e.  $P_A = P_B$ , to their profits when Seller A sells at a price higher than that of Seller B (i.e. *Equations (8) and (9)*). Seller A is better off selling at a higher price, i.e.  $P_B < P_A \leq V$  when  $P_B \leq \frac{2\beta P_A}{1+\beta}$ . Similarly, by comparing the profit functions for Seller B, we identify the condition when Seller B would prefer to sell at a price lower than that of Seller A, and this condition is that  $\frac{1}{2}P_A < P_B$ . Thus, both the sellers will sell at prices  $P_A$  and  $P_B$  (such that  $P_A > P_B$ ), only when  $P_A \leq V$  and  $\frac{1}{2}P_A < P_B \leq \frac{2\beta P_A}{1+\beta}$ . For this condition to hold,  $\frac{2\beta P_A}{1+\beta}$  should be greater than  $\frac{1}{2}P_A$ , which is true only when  $\frac{1}{3} < \beta \leq 1$ , i.e. the proportion of buyers with low search intensity should essentially be high. The long-term *profit-maximizing* price equilibrium, i.e.  $P_A^* = V$  and  $P_B^* = \frac{2\beta V}{1+\beta}$  is sustainable because

- Seller B has no incentive to lower its price below  $\frac{1}{2}P_A$  (i.e.  $\frac{1}{2}V$ ) because if it does so it further reduces its profits.
- Seller B has no incentive to charge a price higher than  $\frac{2\beta V}{1+\beta}$  because if it does so then it ends up with a lower profit since Seller A would be better off by matching Seller B's price, resulting in zero profits for Seller B in subsequent periods (Assumption:  $\frac{1}{3} < \beta \leq 1$ ).

When  $0 < \beta \leq \frac{1}{3}$ ,  $P_B$  is better off by pricing such that  $\frac{2\beta P_A}{1+\beta} < P_B \leq \frac{1}{2}P_A$  (compare profit functions in *Equations (8) and (9)*). Therefore, rather than selling at a price  $P_B$ , such that  $\frac{2\beta P_A}{1+\beta} < P_B$  or  $P_B \leq \frac{1}{2}P_A$ , Seller B is better off matching Seller A's price. If "both the sellers selling at the same price" is equilibrium then any price between the Bertrand price [Bertrand 1883] and the monopoly price could be a possible equilibrium [Fudenberg & Tirole 2000]. However the *pareto optimal* price equilibrium that results in maximizing the NPV of long-term profits is the monopoly price, i.e.  $P_A^* = P_B^* = V$ . However, this equilibrium can be sustained only if  $0 < \beta \leq \frac{1}{3}$ , when Seller B is better off selling at  $P_B^* = V$  as compared to selling at  $P_B^* = \frac{2\beta V}{1+\beta}$ . In short, when  $0 < \beta \leq \frac{1}{3}$  both the sellers sell at  $V$  in every period to maximize the NPV of their long-term profits. When  $\frac{1}{3} < \beta \leq 1$ , Seller A sells at  $P_A = V$  and Seller B sells at  $P_B = \frac{2\beta V}{1+\beta}$  in every period.

**APPENDIX D: Price Equilibrium  
When Search Engine Follows Flat-Fee (FF) Pricing Strategy of its Paid Placements**

We need to identify a price combination  $(P_A^*, P_B^*)$  such that  $P_B^* < P_A^*$  and both the sellers have no incentive to deviate, i.e. the Undercut-Proof Equilibrium. Comparing *Equations (6a) and (6b)*, we find that Seller A is better off selling at a higher price than Seller B, i.e.  $P_B < P_A \leq V$  when  $P_B \leq \frac{2\beta P_A}{1+\beta}$ . Similarly, by comparing *Equations (7a) and (7b)*, we identify the condition when Seller B would prefer to sell at a price lower than that of Seller A, and this condition is that  $\frac{1}{2}P_A < P_B$ . Thus, both the sellers will sell at prices  $P_A$  and  $P_B$  (such that  $P_A > P_B$ ), only when  $P_A \leq V$  and  $\frac{1}{2}P_A < P_B \leq \frac{2\beta P_A}{1+\beta}$ . As we have already established, this condition holds only when  $\frac{1}{3} < \beta \leq 1$  and under this condition Seller A is better off by selling at price  $V$  and Seller B is better off by selling at a lower price  $\frac{2\beta V}{1+\beta}$ . When  $0 < \beta \leq \frac{1}{3}$ , Seller B is better off by selling at a price higher than  $\frac{2\beta P_A}{1+\beta}$  and Seller A is better off by matching Seller B's price. The *pareto optimal* outcome in this scenario is that both end up selling at price  $V$ .

**APPENDIX E: Price for Paid Placements Ranks  
as Reported by Popular Pay-Per-Click Search Engines on 02/13/2004**

**KEYWORD: Cruise**

Search Engine	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	IS $\beta < 1/3$
Overture	\$ 0.99	\$ 0.98	\$ 0.97	\$ 0.86	\$ 0.85	\$ 0.79	YES
FindWhat	\$ 0.54	\$ 0.53	\$ 0.51	\$ 0.47	\$ 0.46	\$ 0.46	YES
Kanoodle	\$ 0.38	\$ 0.38	\$ 0.37	\$ 0.36	\$ 0.35	\$ 0.29	YES
Epilot	\$ 0.25	\$ 0.24	\$ 0.23	\$ 0.20	\$ 0.19	\$ 0.18	YES
GoClick	\$ 0.25	\$ 0.24	\$ 0.23	\$ 0.22	\$ 0.20	\$ 0.16	YES

**KEYWORD: Health Insurance**

Search Engine	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	IS $\beta < 1/3$
Overture	\$ 3.52	\$ 2.96	\$ 2.95	\$ 2.46	\$ 2.45	\$ 2.04	YES
GoClick	\$ 1.41	\$ 1.40	\$ 0.95	\$ 0.89	\$ 0.35	\$ 0.30	YES
FindWhat	\$ 0.98	\$ 0.96	\$ 0.85	\$ 0.84	\$ 0.76	\$ 0.75	YES
Epilot	\$ 0.85	\$ 0.81	\$ 0.76	\$ 0.40	\$ 0.39	\$ 0.33	YES
Kanoodle	\$ 0.10	\$ 0.09	\$ 0.08	\$ 0.05	\$ 0.05	\$ 0.04	YES

**KEYWORD: Home Mortgage**

Search Engine	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	IS $\beta < 1/3$
Overture	\$ 5.91	\$ 5.90	\$ 5.88	\$ 5.87	\$ 5.27	\$ 5.00	YES
FindWhat	\$ 1.16	\$ 1.15	\$ 1.14	\$ 1.03	\$ 1.02	\$ 1.01	YES
Epilot	\$ 1.12	\$ 1.08	\$ 1.03	\$ 0.94	\$ 0.90	\$ 0.76	YES
GoClick	\$ 0.66	\$ 0.65	\$ 0.52	\$ 0.51	\$ 0.48	\$ 0.47	YES
Kanoodle	\$ 0.08	\$ 0.07	\$ 0.07	\$ 0.06	\$ 0.05	\$ 0.05	YES