Heterogeneous Search Costs in a Market with Hidden Fees

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Abstract

This paper models a market in which one firm sells a good with a public base price and a hidden additional fee. Consumers are separated by high and low search costs and have the opportunity to incur their search cost to learn the true value of the add-on price. The firm has a discontinuous profit function that models its trade off between increasing the base price and losing consumers who drop out of the market. Results show that in a market with many low cost consumers, the firm has an incentive to charge a lower base price than it does in a market with many high cost consumers. This lower base price also leads to positive consumer welfare for both high and low cost consumers.

1 Introduction

Often consumers find themselves surprised by unexpected fees, taxes, and surcharges appearing on their cell phone and cable bills. Similarly, many consumers buy a product with a low base price without taking into account the prices of add-ons. According to Consumer Reports, hidden fees appear in industries consumers encounter every day: mutual funds, IRAs, bank accounts, credit cards, cable, and cell phone services. One study, conducted by BillShrink.com estimated that 80 percent of Americans overpay on their cellphone service by more than 800 million per year. According to the Consumer Financial Protection Bureau, in January 2010 alone, consumers paid $901 million in credit card late fees. These additional fees that consumers often do not anticipate appear to be an extremely profitable revenue stream for firms. In his book Gotcha Capitalism, Sullivan (2007) writes that in 2006 an average consumer paid $946 per year in unexpected fees. These fees add up to a $45 billion total.

In recent years, regulations have been implemented in efforts to better inform consumers of the true price of their purchases. One regulation is the Credit CARD Act of 2009, which limited credit card companies’ ability to increase interest rates, required late fees to be “reasonable and proportional”, and clarified monthly statements. A more recent regulation is the 2011 Airline Passenger Protection act. This act required airlines to include taxes and fees in published prices, increased flexibility for consumers to hold or cancel reservations without penalty, and required airlines to reveal their baggage fees.
In this paper, we explore a market with one firm selling one good with a base price and a high or low hidden add-on price. Consumers are separated by search costs (high and low), and they can choose to incur their search cost and learn the true value of the add-on price. In this model, all consumers view the base price set by the firm and have the option to incur their search cost to discover the true value of the add-on price. The firm faces a trade off between selling to a larger fraction of the market and charging a higher base price. We find that as the number of low cost searchers in the market increases, the firm prefers to sell to the entire market at a lower base price and overall consumer surplus is positive at this price.

2 Related Literature

This paper most closely resembles the work done by Ellison and Wolitzky (2009) who model an oligopoly market where firms set their price obfuscation level by choosing how long it takes a rational consumer to discover the true price of the good. The authors assume convex search costs, contrary to the binary high/low search costs modeled in this paper. They conclude that obfuscation leads consumers to believe their future search costs are higher and negatively impacts consumer welfare by adding a cost to consumers and allowing firms to charge higher prices. The work by Ellison and Wolitzky (2009) also draws on Milgrom (1981). Milgrom (1981) explores a model that determines how much information a salesperson reveals and subsequently how consumers interpret this information (or lack of information). Ellison (2005) assumes there are two firms each producing two goods: one high quality and one low quality good. Consumers know the price of the low quality good, but must visit the store to ascertain the price of the high quality good. Consumers know the price of the low quality good, but must visit the store to ascertain the price of the high quality good. Unlike my model with varying search costs, all consumers in Ellison’s (2005) model incur a sunk cost to search for the price of the high quality good. Ellison (2005) concludes that in this market, firms will have an incentive to shroud the price of the high quality good. Gabaix and Laibson (2006) and Heidhues, Koszegi, and Murooka (2012) take a behavioral approach to the shrouded price markets. Gabaix and Laibson (2006) incorporate both naive and sophisticated agents in their model, where naive agents are unaware of the add on price if it is shrouded. Even if a firm decides to unshroud, only some naive agents see the true add on price. When a firm shrouds its add on prices, sophisticated consumers calculate an expected value of the add on price and can potentially choose to substitute away from buying the firm’s add on good. The authors conclude that a shrouded price equilibrium would exist in a market with enough naive consumers. Similarly, Heidhues et al. (2012) models an shrouded price market with both naive and sophisticated agents. In their model, the hidden fees are unavoidable (e.g. a surcharge or fee that must be paid after purchasing
the good), and sophisticated agents know the price of the add-on, even if it is shrouded. They conclude that a shrouded price equilibrium will exist in a market with a binding price floor on the base good and enough naive consumers.

3 Model

This paper models consumer search costs in markets with hidden fees with a monopolist and a unit mass of consumers. The firm sells one good which has a public base price, $p$, along with a hidden add-on price, either $a_L$ or $a_H$. The production costs of the firm are fixed, and thus can be considered 0 in this model. We assume “Nature” assigns the probability that a firm has $a_L$, which occurs with probability $q$, where $(0 \leq q \leq 1)$. Consumers are separated by search costs, where a proportion $\gamma$ of the population has low search cost, $c_L$ and $1 - \gamma$ has a high search cost, $c_H$ $(0 \leq \gamma \leq 1)$. All consumers have the same valuation for the good, $v$. The firm and consumers know the underlying probability that each add-on price occurs ($q$) and the distribution of consumers by search types ($\gamma$). We assume the firm does not know the true value of $a_i$ when setting its price to avoid the possibility that its base price could signal information regarding the true value of $a_i$ to consumers. This paper focuses on how a market of consumers with heterogenous search costs affect a firm’s pricing strategies. First, the firm chooses the base price, $p$, for its good; this price will be known to all consumers. Next, each consumer decides whether or not he or she would like to incur their (known) search cost and discover the true price of the hidden fee. If the consumer does not chose to search, he still knows the expected price of the hidden fee, where $E(a_i) = q(a_L) + (1 - q)a_H$. Based on the base price and his beliefs about the add-on price, the consumer will then decide whether to buy the good, where not buying the good yields a payoff of 0. We assume that consumers who are indifferent will buy the good. Since $a_L < a_H$, if consumers would not buy even if they knew with certainty that the add-on price were $a_L$, then no one would have an incentive to search. Similarly, if everyone would buy even if they knew with certainty the add-on price were $a_H$, again no one would have an incentive to search. In order to make an interesting case, we look at the scenario when consumers who search buy if they learn the add on price is $a_L$, which occurs with probability $q$, but do not buy if they believe the add on price is $a_H$, which occurs with probability $1 - q$. Therefore, searching consumers buy with probability $q$. For this case, we require $p + a_L \leq v < p + a_H$.
4 Analysis

To solve for the optimal price for the firm, we must solve backwards to determine how the consumer will behave at each stage of the decision making process. First, we must determine the conditions under which a consumer would buy the good given his information, and then determine the conditions under which the consumer would search for more information. Given the consumer’s behavior, we can then determine the firm’s pricing decisions.

The consumer will make his decision to buy after he has decided whether or not he has searched. If the consumer has searched, he knows the real value of the add-on price, but he has already incurred his search cost, $c_i$. Note, in the model we stated that a consumer will only buy after searching only if he learns $a_L$. The payoff for a searching consumer who buys the good is $v - p - a_L$. If the consumer has not searched, he will buy the good if $v - p - E(a_i) > 0$, since he would receive a payoff of 0 if he did not buy the good. Knowing how he will behave in the final stage (the buy/not buy decision), the consumer will then calculate an expected value of searching, denoted $E(S)$, where

$$E(S) = q(v - p - a_L) + (1 - q)(0) - c_i$$  \hspace{1cm} (1)

The consumer knows with probability $q$, he will discover the add on price is $a_L$ and he will purchase the good, yielding a payoff of $v - p - a_L$. With probability $1 - q$, the consumer will learn the price of the add-on is $a_H$, and therefore not buy the good, yielding a payoff of 0. Since the consumer chose to search, they will include their search cost, $c_i$, in their expected value calculation. On the other hand, a consumer will chose not to search in two scenarios where searching would have no value to him: (1) the base price is low enough so he will buy with certainty or (2) the base price is so high the consumer will not buy with certainty.

Now we must solve for the price threshold where consumers change from buying if they do not search to not buying if they do not search. This occurs when $p = v - E(a_i)$ or

$$p = v - qa_L - (1 - q)a_H$$  \hspace{1cm} (2)

For prices below this threshold, non-searchers will still buy the good. In contrast, for prices above this threshold, non-searchers will not buy the good. These price intervals will further break down as we examine how the consumers' search costs will determine their behavior. In each interval, there will be prices such that no one searches for additional information, everyone searches, or only consumers with cost $c_L$ will search.
Table 1: Firm Price and Profit

<table>
<thead>
<tr>
<th>$p_i$</th>
<th>Price</th>
<th>Market Share</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$p_1$</td>
<td>$v - a_H + c_L/(1-q)$</td>
<td>1</td>
<td>$v - a_H + c_L/(1-q)$</td>
</tr>
<tr>
<td>$p_2$</td>
<td>$v - a_H + c_H/(1-q)$</td>
<td>$1 - \gamma + q\gamma$</td>
<td>$(1 - \gamma + q\gamma)(v - a_H + c_H/(1-q))$</td>
</tr>
<tr>
<td>$p_3$</td>
<td>$v - a_L - c_H/q$</td>
<td>$q$</td>
<td>$q(v - a_L - c_H/q)$</td>
</tr>
<tr>
<td>$p_4$</td>
<td>$v - a_L - c_L/q$</td>
<td>$q\gamma$</td>
<td>$(q\gamma)(v - a_L - c_L/q)$</td>
</tr>
</tbody>
</table>

(since $c_L < c_H$, if a high cost consumer searches, then the low cost consumers will search as well). These price intervals are summarized in Table 1.

As the price increases at each threshold, a fraction of the consumers will drop out of the market. Consumers make the decision to search based upon their expectations of the add-on price. For prices below the threshold $p = v - E(a_i)$, consumers search in order to avoid paying $a_H$. Thus a consumer will decide to search if their expectation of the “penalty” they would pay when (unknowingly) buying a good with add-on price $a_H$ is greater than their search cost $c_i$. There is value in searching for the consumer if

$$c_i \leq (1 - q)(p + a_H - v). \quad (3)$$

Obviously, since $c_L \leq c_H$, the base price that gives $c_L$ consumers incentive to search is lower than the public price that gives $c_H$ an incentive to search. This threshold is increasing with respect to $p$, so as the base price increases, consumers are more likely to search for information regarding the add-on price. Since in this interval consumers who do not search still buy the good, as the price increases they are more likely to search in order to avoid paying above their valuation (in particular, they want to avoid paying $a_H$).

When the price is above $v - E(a_i)$, consumers only search in hopes of the opportunity to take advantage of the low add-on price $a_L$. In this price interval, consumers will search if their search cost is less than the benefit they would receive from buying a good with add-on price $a_L$. There is value in searching for the consumer if

$$c_i \leq q(v - p - a_L). \quad (4)$$

This threshold is decreasing with respect to $p$, which implies as a firm charges a higher base price, consumers are less likely to search, because in this interval consumers who do not search do not buy the good. At low prices in this interval, all consumers search for additional information. However, as the price increases and the value of searching decreases, consumers will drop out of the market entirely (first the high cost consumers, then the low cost consumers).
In the first interval \([0,p_1]\), the price is low enough that every consumer chooses not to search for additional information yet still buys the good. We found this threshold by solving for prices where even the low cost searcher has no incentive to search:

\[ c_L \geq (1 - q)(p + a_H - v) \]  

(5)

In the next interval, \((p_1, p_2]\), consumers with low search costs will decide to search, and they will not buy if they discover the hidden fee is \(a_H\). However, the base price is still low enough for high cost searchers to choose not to search and still buy the good. Therefore, the proportion of consumers buying the good at prices on this interval is \(1 - \gamma + q\gamma\), where \(1 - \gamma\) is the fraction of high cost searchers buying, while \(q\gamma\) is the fraction of low cost searchers who discover \(a_L\) when they search (leading them to buy). The next interval can actually be split into two intervals: \((p_2, v - E(a_i)]\) and \((v - E(a_i), p_3]\). Non-searchers will switch from buying to not buying at the price \(p = v - qa_L - (1 - q)a_H\). Intuitively, this means that the base price has become high enough so that the consumers who do not search already believe their expected value of searching is less than their potential payoff. Consumers no longer search to avoid \(c_H\), but rather search in hopes of discovering and taking advantage of \(a_L\). In the lower interval, both types of consumers chose to search, thus the proportion of consumers buying is \(q\), the probability that a consumer discovers \(a_i = a_L\). In the next interval, the base price is above the threshold \(v - E(a_i)\), so consumers who do not search will not buy the good. However, since both cost types are still searching in this interval, the proportion of consumers buying at this base price is still \(q\). Thus, the profit function for these two intervals would be a continuous line. In the next interval, \((p_3, p_4]\), the price is so high that the high cost searchers will decide both not to search for additional information and not buy the good. The only consumers purchasing the good are low cost searchers who discover the hidden fee is \(a_L\), or \(q\gamma\). Finally, when the base price is above \(p_4\), no one will decide to incur their search cost and no one will purchase the good.

The profit function is discontinuous due to the discontinuous consumer demand in the model. Since the firm is selling to a constant fraction of consumers on each interval, clearly the firm will maximize profit on that interval by charging the highest price on that interval. This maximum profit level will be attained at one of the prices in the set \(\{p_1, p_2, p_3, p_4\}\). While the firm would like to charge the highest price possible, it must consider the fraction of consumers that are leaving the market as the price increases. The firm knows it will capture the entire market by charging \(p_1\). Increasing the price from \(p_1\), the firm will first lose low cost searchers who discover the firm’s add on price is \(a_H\). This drop in market share could be significant if the probability the add-on price is \(a_H\) is large (low \(q\)) or the number of low cost searchers is high (high \(\gamma\)).
For example, if the firm knows the probability it charges $a_H$ is high, then it would probably want to keep consumers from searching, because there is a high chance they will discover $a_H$ and not buy the good at all. Thus, the firm must weigh the trade-offs between raising the price and losing market share based on $q$ and $\gamma$.

We now determine how the optimal price level changes with respect to the values of $v$ and $a_i$. To simplify this analysis, first suppose $\gamma = 1$ (i.e. only low cost searchers exist in the market). With all low cost searchers in the market, these consumers will always search for more information when $p_i \in (p_1, p_4]$ and only buy when they discover $a_L$. Notice from Table 1 that when $\gamma = 1$ the market share for prices on $(p_1, p_4]$ is constant at $q$. Therefore, the firm will maximize its profit at either $p_1$ or $p_4$. Profit at $p_1$ would be higher than at $p_4$ if the following inequality holds:

$$
(v - a_H + c_L/(1-q)) - (q)(v - a_L - c_L/q) \geq 0.
$$

(6)

First, let’s define this price threshold as $G(v, q, a_H, a_L, c_H, c_L)$. Taking partial derivatives with respect to $v$, $a_H$, and $a_L$, we can see how this threshold changes with small changes in $v$ and $a_i$.

**Proposition 1** As the consumers’ valuation of the good increases, the price threshold increases:

$$
\partial G/\partial v = (q - 1)^2 > 0.
$$

(7)

As $a_H$ increases, the price threshold decreases:

$$
\partial G/\partial a_H = q - 1 < 0.
$$

(8)

As $a_L$ increases, the price threshold increases:

$$
\partial G/\partial a_L = q(1-q) > 0.
$$

(9)

We see the derivative with respect to $v$ is positive, implying that as $v$ increases the firm would prefer to charge $p_1$. While both profit at $p_1$ and $p_4$ are increasing with respect to $v$, profit at $p_4$ is increasing at rate of $q\gamma$, which is less than the rate of increase of profit at $p_1$ (which is 1). Thus as consumers value the good more, it becomes more profitable for the firm to sell to everyone at a lower base price, rather than lose high cost consumers who see $a_H$ at the higher base price.
Since this partial derivative with respect to $a_H$ is negative, we see that if $a_H$ increases, the above threshold will decrease, making $p_4$ more profitable to the firm than $p_1$. As $a_H$ increases, $p_1$ decreases because a higher add-on price gives consumers a greater incentive to search for information in hopes of avoiding buying a good with add-on price $a_H$. However, the value of $p_4$ is not affected by changes in $a_H$, because when consumers see the price $p_4$, they are searching for information in hopes of discovering $a_L$ and purchasing the good.

As $a_L$ increases, the firm would prefer to capture the entire market and charge $p_1$ instead of $p_4$. The value of $p_1$ does not change with respect to $a_L$ because $p_1$ is in the range of prices where consumers search in order to avoid paying $a_H$. On the other hand, the value of $p_4$ is decreasing with respect to $a_L$. Therefore, any additional profit the firm would gain by charging $p_4$ is decreasing, making the price $p_1$ a better option.

The derivative with respect to $q$ cannot precisely be signed, since its sign depends on relative values of $q$, $c_L$, $v$, and $a_L$.

$$\frac{\partial G}{\partial q} = (2v - a_L)(2q - 1) + a_H - c_L$$

Clearly, $2v - a_L > 0$ since $v > p + a_L$, and $2q - 1 > 0$ for $q > 1/2$. However, the sign of $a_H - c_L$ cannot be determined. If $q > 1/2$ and $a_H - c_L > 0$, the derivative is positive, implying as $q$ increases (from $1/2$) firms would prefer to charge $p_1$ over $p_4$. As the probability of buying a good with add-on price $a_L$ becomes more certain, then the cost of searching begins to outweigh the benefit of knowing the true add-on price.

See Appendix for similar analysis when $\gamma = 0$. Since all comparative statics apply for $\gamma = 0$, we can assume they will hold true for $0 < \gamma < 1$.

Next, we evaluate the firm’s price incentives if we allow $\gamma$ to vary. We will consider the threshold that compares the profit levels at $p_1$ and $p_2$ and the profit levels at $p_3$ and $p_4$. As previously mentioned, the firm’s tradeoff is between increasing the price and keeping consumers in the market. By looking at the threshold that compares profit levels, we can determine the firm’s price setting strategy. Results show that the firm will choose to optimize its price at one of the exterior prices ($p_1$ or $p_4$).

**Proposition 2** The threshold, $K(v,a_L,a_H,c_L,c_H,q)$, such that the profit at $p_1$ is greater than the profit at $p_2$ is

$$(v - a_H + c_L/(1-q)) - (1 - \gamma + q\gamma)(v - a_H + c_H/(1-q)) \geq 0.$$  

The threshold, $Y(v,a_L,a_H,c_L,c_H,q)$ such that the profit at $p_4$ is greater than the profit at $p_3$ is

$$q\gamma(v - a_L - c_L/q) - q(v - a_L - c_H/q) \geq 0.$$  

8
Now we can again explore how these thresholds change with respect to \( \gamma \)

\[
\frac{\partial K}{\partial \gamma} = (1 - q)(v - a_H + c_H/(1 - q)) = (1 - q)p_2 > 0 \tag{13}
\]

As we can see, this derivative is positive which implies as \( \gamma \) increases, the firm would prefer to charge \( p_1 \) over \( p_2 \). The number of consumers that drop out of the market at \( p_2 \) is increasing, thus the firm would prefer to capture the entire market at the lower price, \( p_1 \).

The derivative of \( Y \) with respect to \( \gamma \) is

\[
\frac{\partial Y}{\partial \gamma} = q(v - a_L - c_L/q) = qp_4 > 0. \tag{14}
\]

Since the derivative of this threshold is positive, we know as \( \gamma \) increases, the firm will prefer to charge \( p_4 \) over \( p_3 \). As more low cost searchers enter the market, the firm will lose more of its market share when it increases its price from \( p_3 \) to \( p_4 \).

These two results show us that as \( \gamma \) increases, the firm will choose to charge one of the exterior prices, \( p_1 \) or \( p_4 \). As previously mentioned, at prices below \( v - E(a_i) \), consumers search to avoid \( a_H \), and at prices above \( v - E(a_i) \), consumers search to take advantage of \( a_L \).

Now that we know the firm will chose its optimal price at either \( p_1 \) or \( p_4 \), we next must look at the threshold that compares profit at both of these prices and determine how it varies with respect to \( \gamma \). The threshold such that the profit at \( p_1 \) is greater then or equal to the profit at \( p_4 \) (allowing \( \gamma \) to vary) is the function \( F(\gamma, v, q, a_L, a_H, c_L) \), where

\[
F = (v - a_H + c_L/(1 - q)) - (q\gamma)(v - a_L - c_L/q) \geq 0. \tag{15}
\]

If we look at how this threshold changes with respect to \( \gamma \), we can determine

\[
\frac{\partial F}{\partial \gamma} = q(v - a_L - c_L/q) > 0. \tag{16}
\]

Thus, as the number of low cost searchers in the market increases (\( \gamma \) increases), the firm would prefer to set the price at \( p_1 \) rather than \( p_4 \). They will move to \( p_1 \) if they want to prevent consumers from searching and discovering \( a_H \). With more low cost searchers in the market, more consumers will have an incentive to search as the firm raises its price above \( p_1 \), meaning the firm loses more consumers.
Now that we have discussed the firm’s profit maximization, we will now look to consumer welfare at prices $p_1$ and $p_4$. At $p_4$, total consumer welfare equals 0, because the firm knows exactly who will purchase the good (high cost searchers who discover $a_L$), they can set $p_4$ so that they extract all of the surplus at that price. We must determine the sign of consumer welfare at $p_1$ to determine if consumers are always better off at $p_1$ or $p_4$

$$q(a_H - a_L) - c_L/(1 - q) > 0. \tag{17}$$

From previous analysis, we discovered that at $p_1$ consumers will not incur their search cost. It must be true that $p_1 \leq E(s)$. The following equation must hold:

$$v - a_H + c_L/(1 - q) < v - qa_L - (1 - q)a_H. \tag{18}$$

This reduces to

$$q(a_H - a_L) - c_L/(1 - q) > 0. \tag{19}$$

This result proves that consumers attain the highest welfare at price $p_1$. Due to the mixture of search cost types in the market, the firm must set $p_1$ low enough so that neither group of consumers chooses to search, which leads to a positive consumer surplus at $p_1$. By similar calculations, we see that when we separate consumers by type, both high and low cost consumers attain highest welfare at $p_1$. Do high or low cost consumers prefer more of a certain type of consumers in the market? As previously mentioned, as the number of low cost searchers in the market increases, the firm will have an incentive to price at $p_1$. Both types of consumers will benefit from more low cost searchers in the market. Low cost consumers want more of their own type in the market to avoid the scenario in which the firm prices at $p_4$, and low cost consumers incur their search cost and ending up paying a higher base price if they buy the good. High cost consumers want more low cost consumers in the market, because at price level $p_4$, high cost consumers have completely dropped out of the market instead of gaining by buying.

5 Discussion

This model has some very strict assumptions that do not perfectly capture these markets with hidden fees and consumers with search costs. In reality, consumers probably have a search cost that is drawn from some continuous distribution of costs. Similarly, firms are not typically limited to only two add-on fees,
but rather have the option to choose from a continuous distribution of prices. If consumers had continuous search costs, then the firm would not be facing a discontinuous profit function, however they would face the same trade-off of raising their price or having consumers drop out of the market. These extensions most likely would not change the qualitative results found in this paper. An interesting extension to this model would be to assume that consumers do not perfectly calculate $E(a_i)$ (quasi-Bayesian). Suppose consumers falsely believe that the underlying probability of $a_L$ is high. Then the firm would be able to charge a higher public price, regardless of the true probability $q$. If consumers mistakenly believe that the probability of discovering $a_H$ is high, then the firm will need to lower its price to keep consumers in the market. Believing that the probability of $a_H$ is high, all consumers would chose to search at lower public prices. However, these consumers will discover $a_H$ with a lower probability than they anticipated, implying they will still buy the product. While the firm will lose the consumers who discover the add-on price is $a_H$, they will only lose the portion of the market corresponding with the true probability of $q$. Suppose the firm knew its own hidden fee, but the fee is still unknown to the consumers (a more realistic assumption). The price set by the firm may signal the true underlying hidden fee to the consumers. Suppose the firm sets its price assuming consumers cannot infer the true value of the add-on price from the base price. For example, if the firm knows $q = 0$ (i.e. $a_i = a_H$), it will maximize profit at either $p_1$ or $p_2$ (market share drops to 0 when $q = 0$). Again, if the consumers discover the add-on price is $a_H$, no consumers will buy the good. If the firm sets the price at $p_1$, consumers will see this as a signal that $a_i = a_H$ and no one will purchase the good. Consumers know the trade offs the firm faces and the information about $a_i$ that the firm has. If the consumers have this information, they know the firm would maximize profit at $p_1$ if the firm knows its add-on price is $a_H$. On the other hand, if the firm discovers its add-on price is $a_L$, they will maximize profit at either $p_3$ or $p_4$ (since the market share on the interval $[0, p_3]$ will be 1 and the market share at $p_4$ will be $\gamma$). If consumers learn the add on price is $a_L$, they will all buy at either $p_3$ or $p_4$, so the firm would maximize profit at $p_4$. If a firm knows its add-on price is $a_L$, it is able to charge $p_4$ and still capture the entire market. Since the firm chooses different prices based on its own knowledge of $a_i$, it reveals the true value of $a_i$ to the consumers.

6 Conclusion

In a market with hidden fees and heterogenous consumer search costs, a firm has an incentive to price at one of the “extremes”. When choosing to raise its base price, the firm sacrifices part of the market share. As the price increases, more consumers have an incentive to search for the true value of $a_i$, and these searchers only
purchase the product if they learn $a_L$. Overall, consumers are best off when the firm charges the low price, $p_1$. At this price, no consumers incur their search cost, yet they all purchase the good (and subsequently pay either $a_L$ or $a_H$). A market with more low cost consumers will push the price down to $p_1$. Essentially, if the firm believes that enough consumers can easily discover the true add-on price, the firm would prefer to charge a lower base price. In this scenario, the firm captures the entire market and benefits from some consumers paying $a_H$. Both types of consumers benefit from having more low cost searchers in the market, because the firm sets the price low enough so that even the low cost searchers have no incentive to discover the true value of $a_i$.

7 Appendix

Consider the other extreme where $\gamma = 0$ and take the same partial derivatives. When $\gamma = 0$, only two prices could potentially maximize profit for the firm: $p_2$ and $p_3$. With no high cost searchers, no consumers will drop out of the market when the price is between $p_1$ and $p_2$. The threshold such that the profit from charging $p_3$ is greater than the profit from charging $p_2$ is

$$(q)(v - a_L - c_H/q) - (v - a_H + c_H/(1 - q)) \geq 0$$  \hspace{1cm} (20)

Define this price threshold as $H(v, q, a_H, a_L, c_H, c_L)$. The partial derivatives of this function are the following:

$$\frac{\partial H}{\partial v} = -(q - 1)^2 < 0$$  \hspace{1cm} (21)

$$\frac{\partial H}{\partial a_H} = 1 - q > 0$$  \hspace{1cm} (22)

$$\frac{\partial H}{\partial a_L} = -q(1 - q) < 0$$  \hspace{1cm} (23)

First, as consumers’ valuation of the good increases, the threshold decreases, thus making $p_2$ more attractive for the firm’s selling price. Since no one is dropping out of the market due to their high search cost, the firm would prefer to capture the entire market by charging $p_2$. The firm would rather keep consumers from searching and avoid the risk that the consumer discovers $a_H$ and chooses not to buy the good. As $a_H$ increases, the threshold increases and the firm would prefer to charge $p_3$ over $p_2$. Looking at the above chart, $p_2$ is decreasing in $a_H$, so firms would rather charge the higher price even though they will sell to less people. As $a_H$ increases, the additional profit a firm receives from charging $p_3$ outweighs the firm’s loss in
market share. Finally, we see the opposite effect occurring as $a_L$ increases. Since $p_3$ is decreasing in $a_L$, the firm would prefer to charge $p_2$ as $a_L$ increases. The additional profit a firm would receive by charging $p_3$ does not outweigh the loss in market share that occurs by charging that price.
8 References


