Does Price Have a Payoff?
A Comparison of the Traditional NGO Model
With the Micro-Consignment Model

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Abstract

Various non-governmental organizations (NGOs) have sought to alleviate the problem of limited access to clean drinking water in Guatemalan villages by providing them with water filters. While traditional NGOs donate filters for free, some NGOs operating under the new “micro-consignment” model sell them. By comparing these two different NGO approaches in a two-period theoretical framework, it is shown that the goals of generating the greatest household utility and inducing the highest maintenance effort for the filter are incompatible. In most cases, a free filter maximizes household utility, while charging a price induces more maintenance effort.

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I. INTRODUCTION

One of the ways that the World Health Organization plans to achieve its Millennium Development Goal of cutting in half the number of people without access to clean drinking water is to increase the number of rural households with direct connection to drinking water. Although the percentage of Guatemalan families with water faucets in their homes increased from 34% in 1990 to 53% in 2002 (Martin & Elmore, 2007), the quality of faucet water is still dubious. There is no federal authority or comprehensive water laws regulating the national water supply; rather, each municipality is responsible for maintaining and supplying its own water (Spillman, Webster, Alas, Waite, & Buckalew, 2000). In addition, a vast number of rural Guatemalans still obtain their drinking water from lakes and streams, rainwater cisterns, and shallow wells. Contaminated water puts people at risk of being exposed to and contracting water-borne illnesses such as dysentery and cholera (Spillman et al., 2000). Due to the lack of regulation and oversight, pollution and deforestation have also had a severe negative impact on water quality. With Guatemala’s GDP per capita adjusted for purchasing power parity at a mere $4,907 in 2010 and over 50% of the population under Guatemala’s stated poverty line, it is not hard to see why these problems continue to exist today.

There have been efforts by various academic groups and non-governmental organizations (NGOs) to try to improve the quality of drinking water for rural Guatemalans. In 2002, a team from the University of Missouri-Rolla constructed a well in Lemoa, a small village in Guatemala, to provide its residents with an uncontaminated water source. Although the locals would have benefited from drawing water from this deep ground well, follow-up studies showed that residents were reluctant to use the new water source, and instead continued to rely on their traditional sources. One main obstacle to switching water sources is that water consumption
patterns are habitual and tend to be hard to change (Martin & Elmore, 2007). Since many Guatemalans are unaware of the link between increased risks of certain illnesses and drinking contaminated water, they see no reason to change the way they obtain drinking water.

NGOs have taken a different approach by bringing the uncontaminated water source directly to the household level with portable water filters. Any type of water—rain water, water collected from lakes or rivers, faucet water—can be run through these filters to remove various pollutant particles and organic matter. However, as mentioned before, organizations need to be aware of the consumption habits and perceptions Guatemalans have about drinking water before investing significant monetary and human capital to introduce a new product like the water filters to rural areas. Even something as simple as filtering water before consumption could be a difficult behavior to establish if the same water usage patterns have been passed down for generations.

Clearly, these NGOs have the potential to create a significant positive impact on the lives of rural Guatemalans if they can distribute the water filters and ensure that they are used properly. There are various ways in which an NGO could operate, however, so it is important to analyze which would best serve the needs of the population on which the NGO is focusing its resources. Traditionally, socially conscious organizations have been funded through donations because profit-driven organizations have been viewed as incompatible with creating positive social impact. A new hybrid model has recently appeared, called social entrepreneurship. Social consciousness is woven into a conventional business model so that creating positive impact is as important as generating profit, if not more so. One type of social entrepreneurship is “micro-consignment”, for which Community Enterprise Solutions (CE Solutions) is known. CE Solutions is a U.S.-based NGO that works with Soluciones Comunitarias (Sol Com)—a for-
profit Guatemalan organization established by CE Solutions, comprised of mostly women entrepreneurs—to sell products such as water filters and reading glasses to rural Guatemalans. My analysis will focus on water filters.

The micro-consignment model works through a few simple steps. First, CE Solutions teaches the entrepreneurs about the dangers of using contaminated water and how the filter can solve these problems. Next, the NGO trains the entrepreneurs to conduct publicity and sales campaigns. Finally, the entrepreneurs receive the water filters free of charge, and are told to sell each filter for $49. After a filter is sold, the entrepreneurs pay back CE Solutions $40 for the cost of each filter, while keeping a premium of $3.75 for themselves and putting the remaining $5.25 into Sol Com, the Guatemalan enterprise that CE Solutions created. Since there are no start-up costs for the entrepreneurs in this micro-consignment model, it eliminates the risk associated with taking out a microfinance loan. If the entrepreneurs find that they cannot sell any filters, they can return their entire inventory to CE Solutions and have no more obligations.

CE Solutions argues that, in addition to benefits for the entrepreneurs, the micro-consignment model benefits the buyers as well; its staff believes that the buyers will value the filters more because they had to pay for them, which leads them to increase their usage of the filters and better maintain them as compared to those who received filters for free from other organizations. Additionally, the price will induce a selection effect, so that only the households that need the filters the most will buy them. CE Solutions’ argument, therefore, is that the micro-consignment model is better than the traditional NGO model of donations because it not only generates earnings for the entrepreneurs, but is also more sustainable (the cost of goods sold is covered by the Guatemalan households’ payments) and takes into account human behavior (by realigning incentives). Because of this belief, while CE Solutions is funded by donations, it does
not ever give out its products for free. Although CE Solutions and its micro-consignment model have been receiving a lot of media attention as of late, there have been no rigorous studies done to test whether any of its claims are actually true.

Helps International (Helps) is another American NGO that operates in Guatemala. Helps has many initiatives, such as the providing of education and economic development programs in various regions of the country and the selling of water filters and energy-efficient wood-burning stoves to families. Again, we will focus our analysis on water filters. The main difference between CE Solutions and Helps is that the latter is not against providing products for free to the local population; for example, on its website, there is a link specifically asking for donations so Helps can provide Guatemalan families with water filters free of charge. Helps International gives out free filters when its staff believes immediate relief is necessary, such as after Tropical Depression 12E in October of 2011. It also sells filters for $40 each to church groups, as well as other NGOs—including CE Solutions. The church groups go on mission trips to Guatemala and give out the filters, while CE Solutions gives the filters to its entrepreneurs to sell.

There is yet another organization—Safe Passage—that provides adult literacy and early childhood development programs to families that live in the vicinity of the Guatemala City garbage dump. Safe Passage partnered with the NGO Water Charity to donate water filters to adult literacy homes and early education centers, where multiple families can access them. They then held workshops to teach adults good hygiene practices, as well as how to properly use the water filters. Helps International, Safe Passage, and Water Charity are all examples of organizations donating filters, usually on a one-time basis to each participating household, rather than CE Solutions’ ongoing selling of filters through the micro-consignment model.
The purpose of my research is two-fold: 1) to theoretically gauge which NGO model—selling or donating—has a greater positive impact, with impact defined as household utility; and 2) to test whether CE Solutions’ statement is true that the micro-consignment model induces more maintenance effort from the households than a donation model would. These points are important because NGOs should seek to maximize the positive impact that they create, subject to costs, as well as fulfill their claims as closely as possible. Given that my results will show the effectiveness of each NGO’s program, they should be taken into consideration by NGOs when assessing their operations, and are something for new organizations to analyze while designing their operating model. Additionally, the findings could be useful to donors who need an objective basis by which to judge whether an organization deserves their money.

My analysis will be derived from a few steps. First, a literature review examines what previously published work suggests about my topic. Next, I build a preliminary theoretical framework considering only the impact on households, and assuming no operating costs for the NGOs. I then expand my model to include the entrepreneurs and see what happens when operating costs are included for the NGO. The expanded model will also examine how the probability that the NGO goes back to the village impacts the results. Lastly, I will draw a conclusion from my results to answer the question of whether selling or donating is the better operating model for NGOs, and consider areas beyond the scope of this paper that could be topics for future research.

II. LITERATURE REVIEW

Public health, marketing, and behavioral and development economics literatures all relate to the topic of NGO efficacy. For public health, most developed countries have used the Health Belief Model (HBM) as the main theoretical framework for health attitudes and risk perception.
The HBM states that individuals will actively seek to avoid unhealthy behaviors when they: 1) recognize the risk of the behavior and its serious nature; 2) believe there is a course of action that will reduce that risk; and 3) believe that the potential benefits of the action outweigh its potential costs (Martin & Elmore, 2007; Ronis, 1992). Applying this model to our present study, it implies that Guatemalans need to first realize that the water they are drinking is most likely to be contaminated and can make them sick. Second, they have to believe that passing the water through a water filter will reduce that risk. Lastly, the benefits of using filtered water, which may include reducing the number of sicknesses and hospital visits due to water contamination, must outweigh the costs—which are the costs of acquiring and maintaining the filter. Thus, it seems that educating people about safe water usage is just as important as providing them access to a filter, because if they do not know the harmful impacts of drinking unfiltered water, they have no incentive to go through the hassle of using a filter.

An abundance of marketing literature has examined the relationship between product perception and price. All products have both intrinsic and extrinsic cues from which potential buyers can judge their quality. Intrinsic cues are physical characteristics of the product, such as size, style, and weight. However, since Guatemalans probably do not have exposure to a wide array of filters and their important characteristics, they cannot rely on the intrinsic cues when deciding whether to purchase a filter. That means extrinsic cues such as packaging, peer evaluation, and price become relatively more important (Schiffman). People often rely on price as an indicator of product quality, and consumers have a range of acceptable prices, rather than a single price, at which they would buy something (Dodds, Monroe, & Grewal, 1991; Schiffman; Zeithaml, 1988). Not only would people avoid buying a product that they consider too expensive, but they would also avoid a product if its price is too low, because they would question the
quality of the product (Dodds, et al., 1991). Looking at the price that CE Solutions is charging Guatemalans for water filters, however, it is clear that price is not in danger of being too low. As mentioned before, the household must pay $49 for a filter, which is 1% of $4,907—the 2010 Guatemalan GDP per capita adjusted for purchasing power parity. Thus, the models in the next sections need only consider whether the price is currently too high.

The perceived product value has been defined as perceived quality less perceived sacrifice; perceived quality is the total benefit that the consumer thinks the product will bring her, and perceived sacrifice is the total cost, monetary and otherwise. The greater the perceived value, the greater is the consumer’s willingness to pay (Dodds, et al., 1991; Zeithaml, 1988). I will assume in my model that the rational household defines the amount of improvement in water quality from using the filter as perceived quality, and the effort spent taking care of the filter and the monetary cost (if purchased) as perceived sacrifice. If CE Solutions’ argument is true, then introducing a monetary price would increase both the perceived quality and perceived sacrifice of the filter, although the net effect on its perceived value would vary depending on the magnitude of the increases in perceived quality and sacrifice.

The sunk-cost fallacy is an idea found in behavioral economics. It explains people’s tendency to make decisions based on the size of their previous investments rather than the size of expected future returns (Ayton & Arkes, 1998; Gino, 2008; Solomon). A real-life example of this type of behavior is that people use paid advice much more than free advice (Gino, 2008). When applied to the water filter situation, it means people should be more reluctant to “waste” the filters that they have purchased instead of obtained for free, which could be manifested both in more frequent usage as well as more maintenance effort. Similarly, prospect theory is the idea that people are more motivated by losses than gains (Ayton & Arkes, 1998; Kahneman &
Tversky, 1979). One way to interpret the prospect theory would be that someone who paid for a water filter has more to lose by not taking proper care of it than someone who received it for free. The other way to interpret it is that if households know they received the filter as a one-time donation and that its value will be lost if they do not properly maintain it, that threat could be enough motivation for the households to take good care of the filter even without having paid money for it.

The endowment effect is a related but slightly different idea; it states that people’s perceived value of a product increases merely by owning it (Kahneman & Knetsch, 1991). Because this means that people’s initial product valuation and therefore willingness to pay prior to owning the product is lower than their eventual valuation after they do own the product, a problem could arise for NGOs like CE Solutions that sell filters. Households without filters may not be convinced that water filters are a worthy investment for their money, even though they would value the filter more highly after owning it. If that is the case, the micro-consignment model would lead NGOs to not reach as many families as would potentially benefit from using a filter. Another way that the endowment effect could be used as an argument against micro-consignment is that the mere act of owning the water filter would make the household value it more, regardless of whether it was bought or given. This phenomenon was observed in a study done with insecticide treated mosquito nets (ITNs) in the Ugandan village of Mwizi—almost three quarters of people who had received several of these nets for free were unwilling to resell even one net at the maximum price set by the researchers (Hoffmann, Barrett, & Just, 2009). Therefore, CE Solutions’ contention that making Guatemalans pay for the filters will make them care more about the filters may be invalid.
There are two more recent empirical studies focusing on ITNs that are most relevant to my research. The first examines the effects of micro-credit on ITN adoption rate in rural Orissa, India (Tarozzi, Mahajan, Blackburn, Kopf, Krishnan, & Yoong, 2011). The experiment design included three groups: a group that received ITNs for free (Free), another group that was given the opportunity to buy the nets at full cost with a microfinancing option (MF), and a control group that received neither option. They found that 52% of households in the MF group purchased at least one ITN despite its high cost, which amounted to 3 to 5 times the daily agricultural wage in the study area. However, what they found about uptake and usage rates was contrary to the belief that paying increases usage rates. Conditional on ownership, the self-reported usage rates were higher in the Free group versus those in the MF group, with 77% usage rate during peak mosquito season for the Free group and 36% for the MF group. As reference, the control group’s ITN usage rate was 7%. More surprisingly, there were no decreases in malaria and anemia prevalence in either of the treatment groups. The authors of this paper suggest two possible reasons for the lack of health improvement: low ITN usage rates as a percentage of the total population, and no monitoring of actual ITN usage.

The second study was conducted in Kenya (Cohen & Dupas, 2010), and it involved selling ITNs to pregnant women at various price levels in 20 different prenatal clinics. The prices ranged from zero to 40 Kenyan shillings, meaning that even at the highest price charged, 90% of the ITNs’ cost was still subsidized. The experimenters also tested for the women’s hemoglobin levels (anemia rates) in order to determine how badly they needed the ITNs. The results of the experiment showed no correlation between the price paid and usage rate. In some cases, the women who received the ITNs for free used them more than those who paid. Additionally, the price did not induce a selection effect; the women who purchased the ITNs at higher prices were
no sicker than those who purchased at lower prices or received the ITNs for free. The only effect of charging for the ITNs was to drastically decrease demand. Clearly, the results of this study, as well as the abovementioned study conducted in India, serve as further evidence against the micro-consignment model since they negate the argument that making the villagers pay for the product will increase their frequency of usage or induce selection based on their need for the product.

Past theories and research do not clearly prove either the traditional donation model or the new micro-consignment model as better than the other. While sunk-cost fallacy suggests that selling would be better, prospect theory could be used to support either side, and endowment effect suggests that donating would be better. Although the empirical research on ITNs that I have included in this section supports the traditional NGO model, there are potential weaknesses in these studies, such as confounding factors and omitted variable bias, as well as inaccuracies arising from self-reporting. The next sections will attempt to fill this gap in existing research and avoid the shortcomings of data analysis by demonstrating theoretically which NGO model should make more positive impact in Guatemala.

III. Basic Model

It is not immediately clear from past research which NGO model would generate more household utility, nor whether the selling model would induce more maintenance effort. I will deduce the answers by starting with a simple two-period model of a rural Guatemalan household faced with the option of buying a water filter at the beginning of each of the two periods. For simplicity, I assume no discounting for the second period. The variables in this model are:

\[ v_H = \text{value of using filtered water in one period}, \]
\[ v_L = \text{value of using unfiltered water in one period}, \]
\[ \Delta = v_H - v_L, \text{ where } \Delta \leq \frac{1}{2}, \]
\[ p = \text{price of water filter}, \]
\[ e = \text{effort spent maintaining the filter in the first period, where } e \geq 0, \]
\[ q(e) = \text{probability that the water filter still works in the second period,} \]
\[ \text{where } q(e) = 2\sqrt{\alpha + e} \in [0, 1], \]
\[ \alpha = \text{intrinsic quality of the filter, where } 0 \leq \alpha < \Delta. \]

To build this model, it is necessary to assume that the household understands the difference between the value of filtered water \( v_H \) and unfiltered water \( v_L \). \(^1\) I refer to this difference as \( \Delta \) for brevity \( (\Delta = v_H - v_L) \); \( \Delta \) therefore represents the improvement in quality by switching from unfiltered to filtered water in one period. The upper bound for \( \Delta \) will be \( \frac{1}{2} \) throughout this model so that the probability of the filter surviving to the second period will not exceed one, since the probability will depend on the value of \( \Delta \) in certain scenarios. Effort is constrained to be a non-negative number, because no household would actively exert energy to damage the water filter.

Since this model only spans two periods, the household will not need to exert any effort in the second period to ensure the filter lasts until the third period. Effort will positively affect the probability that the filter still works in the second period, although its marginal positive effects will be decreasing in scale. The intrinsic quality of the filter affects how long it will function, so that all else equal, a higher quality filter is more likely to still work in the second period. Additionally, this value is less than the improvement in water quality from using a filter; this is a reasonable assumption to make, since the using the filter should create a drastic difference in water quality exceeding the intrinsic quality of the filter. For now, I assume that the household

\(^1\) This assumption may not be completely accurate and I will discuss its implications in the conclusion.
always decides to purchase in the first period, and I will later test under what conditions this last assumption holds true. Note that the numerical values of the variables have been chosen to fit the constraints of this model, and are not necessarily directly translatable into a unit of measure.

The household’s total utility across the two periods given that it purchases a filter in the first period would be:

\[ u_f = \{v_H - p - e\} + \{q(e)v_H + \max \{v_H - p, v_L\}\} \text{, assuming purchase at } t = 1. \]

I use the subscript “f” to denote purchasing a filter in the first period. This function shows that the utility in period one would be the value of filtered water minus the price of the filter minus the cost of maintaining the filter. The utility in period two would be the probability that the filter still functions properly in the second period multiplied by the value of filtered water, plus the probability that the filter does not work in the second period multiplied by the maximum of either purchasing another filter or reverting back to unfiltered water.

To solve for the maximization condition in period two of the utility function, I consider two different scenarios. In the first scenario, the price of the filter exceeds or is equal to the difference in utility from using filtered water as compared to using unfiltered water in one period \((p \geq \Delta \text{ or } p \geq v_H - v_L)\). This can be rewritten as \(v_H - p \leq v_L\), which clearly shows that the filter is too costly; the household would just choose to revert back to unfiltered water in the second period if the filter breaks down rather than repurchase. I will assume that the household will not repurchase when indifferent (price is equal to the added benefit of using filtered water in one period). In this case, its utility function is:

\[ u_{f1} = \{v_H - p - e\} + \{q(e)v_H + \max \{v_H - p, v_L\}\}, \text{ when } p \geq \Delta. \]

I use the subscript “1” to denote scenario one, where price exceeds added benefit of filtered water in one period. In the second scenario, which I denote with the subscript “2,” the price of
the filter is less than the added benefit in one period \((p < \Delta \text{ or } p < v_H - v_L)\). This can be rewritten as \(v_H - p > v_L\), implying the household will repurchase in the second period if the filter breaks down. The utility in this case is:

\[
u_{f_2} = \{v_H - p - e\} + \{q(e)v_H + [1 - q(e)][v_H - p]\}, \text{ when } p < \Delta.
\]

Now that I have established the two different price scenarios, I will maximize the utilities with respect to the amount of effort the household spends to maintain the filters in order to solve for equilibrium effort: \(^2\)

\[
e_{f_1}^* = \max \{\Delta^2 - \alpha, 0\}, \text{ when } p \geq \Delta,
\]

\[
e_{f_2}^* = \max \{p^2 - \alpha, 0\}, \text{ when } p < \Delta.
\]

Using the equilibrium effort solutions, I can find \(q(e^*)\). Recall:

\[
q(e) = 2\sqrt{\alpha + e} \in [0,1].
\]

Therefore:

\(^2\) \(\max_e u_{f_1} = \{v_H - p - e\} + \{q(e)v_H + [1 - q(e)][v_H - p]\} \text{ when } p \geq \Delta,\)

\[
\frac{\partial u_{f_1}}{\partial e} = 0 = -1 + \frac{1}{\sqrt{\alpha + e}} \Delta,
\]

\[
\frac{1}{\sqrt{\alpha + e}} \Delta = 1,
\]

\[
\sqrt{\alpha + e} = \Delta,
\]

\[
e_{f_1}^* = \Delta^2 - \alpha.
\]

\(\max_e u_{f_2} = \{v_H - p - e\} + \{q(e)v_H + [1 - q(e)][v_H - p]\} \text{ when } p < \Delta,\)

\[
\frac{\partial u_{f_2}}{\partial e} = 0 = -1 + \frac{1}{\sqrt{\alpha + e}} p,
\]

\[
\frac{1}{\sqrt{\alpha + e}} p = 1,
\]

\[
\sqrt{\alpha + e} = p,
\]

\[
e_{f_2}^* = p^2 - \alpha.
\]
\[ q(e_{f_1}^*) = \max\{2\Delta, 2\sqrt{\alpha}\}, \text{ when } p \geq \Delta, \]
\[ q(e_{f_2}^*) = \max\{2p, 2\sqrt{\alpha}\}, \text{ when } p < \Delta. \]

Notice that something very interesting emerges in case one—the household’s incentives are independent of price. Price does not affect the amount of exerted effort and thus also does not impact the likelihood of the filter still working in period two. Additionally, any increases in price in this region will strictly reduce the household’s utility, since price enters negatively into the utility function. Given that the NGO’s objective should be to maximize household utility, the aforementioned reasons prove that the case in which price is greater than the filter’s added benefit in one period cannot be an optimal solution. This means that I can eliminate case one and focus my attention solely on case two, where price is less than the added benefit of using the filter in one period. Substituting the equilibrium solutions for case two back into the utility function gives the household’s equilibrium utility: \(^3\)

\[ u_{f_2}(e_{f_2}^*) = 2v_H + p^2 - 2p + \alpha. \]

The other interesting thing to note is that the filter’s quality actually factors negatively into equilibrium effort, but positively into equilibrium utility. In addition, it has no effect on the probability of the filter surviving into the second period when the effort level is positive. This can be explained by the fact that if the household knows it is using a high quality filter that will likely still function in the next period without requiring much maintenance, the household will decrease its maintenance effort, which will thus increase its utility. Subsequently, the reduced

\(^3 u_{f_2} = \{v_H - p - e\} + \{q(e)v_H + [1 - q(e)][v_H - p]\},\]
\[ u_{f_2}(e_{f_2}^*) = \{v_H - p - p^2 + \alpha\} + \{2pv_H + [1 - 2p][v_H - p]\}, \]
\[ u_{f_2}(e_{f_2}^*) = v_H - p - p^2 + \alpha + 2pv_H + v_H - p - 2pv_H + 2p^2, \]
\[ u_{f_2}(e_{f_2}^*) = 2v_H + p^2 - 2p + \alpha. \]
effort associated with a higher quality filter means that it is no more likely to survive to period two than a low quality filter for which the household exerts more maintenance effort. The only case where the filter’s intrinsic quality would affect its survival rate is when the household exerts no maintenance effort. Intuitively, a higher quality filter will last longer in that case. Thus, this model suggests that giving the household the highest quality filter may not be optimal, since it does not mean the filter will last longer.

Now I will test under what conditions my initial assumption—that the household will purchase a filter in the first period—holds true when price is less than the filter’s added benefit in one period. That assumption implies that the utility of purchasing in the first period must exceed the utility of not purchasing in the first period. If the household does not purchase in the first period, it will still need to make the purchasing decision in the second period. In that case, utility across the two periods would be the value of unfiltered water from the first period, plus the maximum of either the value of filtered water minus the price of the filter or the value of unfiltered water from the second period. I use the subscript “n” to denote no filter purchase in the first period:

\[ u_n = v_L + \max \{ v_H - p, v_L \}. \]

Since I have already eliminated the case where price exceeds the filter’s added benefit in one period, I know that the rational household will decide to purchase in period two. The household’s total utility across the two periods would thus be the value of unfiltered water from the first period, and the value of filtered water minus the price of the filter from the second period:

\[ u^*_n = v_L + v_H - p, \text{ when } p < \Delta. \]
As mentioned before, the household would only choose to purchase in period one if its total utility is greater than its total utility from waiting until the second period to purchase. Recall the equilibrium utility for the household that purchases in the first period:

\[ u_{f2}(e_{f2}^*) = 2v_H + p^2 - 2p + \alpha. \]

If purchasing earlier generates greater utility that purchasing later, or \( u_{f2}(e_{f2}^*) > u_n^* \), then the inequality would be:

\[ 2v_H + p^2 - 2p + \alpha > v_L + v_H - p. \]

After simplification, it becomes:

\[ \Delta - p > -p^2 - \alpha. \]

It is quite clear that this inequality always holds in equilibrium. Since one of the model’s assumptions is that the price charged is less than the added benefit of using the filter in one period \((p < \Delta)\), I know the left side of the inequality is positive. The right side of the inequality is always negative, since the negative of two positive numbers is negative. Therefore, this inequality holds unconditionally, which implies that when the price is less than the added benefit of using filtered water in one period, the household will always choose to purchase in the first period rather than wait until the second period. This makes sense intuitively, because if the household would even choose to purchase in the second period, it would definitely choose to purchase in the first period, where its potential gain is even greater given the filter may function in both periods if enough maintenance effort is exerted.

Since all the assumptions hold unconditionally, I can now drop all subscripts for simplicity. Let me further examine the solutions in order to find the optimal price range for the NGO that is selling the filters. Recall:

\[ e^* = \max \{p^2 - \alpha, 0\}. \]
In order for the NGO to use price as the way to ensure that the household exerts positive effort:

\[ p > \sqrt{\alpha}, \]

or that the price has to exceed the square root of the intrinsic quality of the filter. There is also an upper bound for price. I demonstrated previously that price must be lower than the added benefit of using the filter, which means that the optimal price range in which the NGO should operate is:

\[ \sqrt{\alpha} < p < \Delta. \]

What about for the NGOs giving out the filter for free? This is merely a special case when the price is zero. Household equilibrium effort, probability of the filter surviving to the second period, and household utility is if it receives a free filter would be:

\[ e^* = \max\{p^2 - \alpha, 0\} = 0, \text{ when } p = 0, \]
\[ q(e^*) = \max\{2p, 2\sqrt{\alpha}\} = 2\sqrt{\alpha}, \text{ when } p = 0, \]
\[ u(e^*) = 2v_H + \alpha, \text{ when } p = 0. \]

Notice that when the filter is free, the rational household will choose to expend no effort on the filter’s maintenance—since effort is costly—and subsequently, the probability of the filter functioning in the second period is solely dependent on its intrinsic quality. When I substitute those equilibrium values back into the utility function, the equilibrium household utility across the two periods would be the value of using filtered water in both periods plus the intrinsic value of the filter. The above outcome indicates that the household’s utility is actually maximized

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\( ^4 \) \( e^* = p^2 - \alpha > 0, \)
\( p^2 > \alpha, \)
\( p > \sqrt{\alpha}. \)

\( ^5 \) \( u(e^*) = 2v_H + p^2 - 2p + \alpha, \)
\( u(e^*) = 2v_H + \alpha, \text{ when } p = 0. \)
when it receives the filter for free, since the maximum possible utility cannot exceed the value of filtered water in both periods plus the intrinsic value of the filter. This brings me to the end of the basic model, which shows that if the NGO can obtain the filter for free, it should give the filter to the people for free.

RESULTS: The 3 conclusions drawn from the basic model are summarized below in order of importance.

1. \( p^* = 0 \).

   *If the NGO’s goal is to maximize household utility, it should give out the filter for free, thus maximizing household utility.*

2. \( \sqrt{\alpha} < p < \Delta \).

   *If the NGO’s goal is to induce maintenance effort from the household, it should charge a price that is greater than the square root of the filter’s intrinsic quality and less than the added benefit of using the filter in one period. When price is outside that range, it no longer affects the household’s effort level, but strictly reduces household utility.*

3. \( e^* = \max\{p^2 - \alpha, 0\} \),

   \( q(e^*) = \max\{2p, 2\sqrt{\alpha}\} \).

   *The intrinsic quality of the filter negatively affects the household’s equilibrium effort, and thus has no effect on the probability that the filter still functions in the second period. The better the filter, the less the household feels a need to take care of it, so the likelihood of the filter still functioning in the second period will be the same regardless of its quality.*
IV. EXPANDED MODEL

In the basic model, I showed that when assuming the NGO has no operating costs and will be in the village in both periods, giving out the filter for free will generate the greatest household utility. In the expanded model, I modify those assumptions so that they more accurately reflect the real world situation. First of all, the assumption that the NGO will definitely return to the village in the second period is not completely accurate; for example, many donations are one-time events. Secondly, the NGO cannot obtain the filters free of charge. As mentioned before, each filter from Helps International costs $40. Lastly, the basic model only considers the utility of the household, but not the utility of the entrepreneur who is earning a premium on each filter that she sells through the micro-consignment model. In the expanded model, there will be two separate utility functions to represent the NGOs: one function to represent the NGOs that donate the filters to the households, and another to represent the NGOs that sell the filters. In addition to using the variables that are defined in the previous section, which retain the same assumptions, I add in a few more variables here. These new variables are:

\[ \beta = \text{probability that the NGO will return to the village at } t = 2, \text{ where } \beta \in [0,1], \]
\[ c = \text{cost of the filter to the NGO, where } c < \Delta \leq \frac{1}{2}. \]

For simplicity, I will assume:

\[ \alpha = 0, \]

which essentially eliminates the intrinsic quality of the filter (\( \alpha \)) as a variable for consideration. The reason for this is because the main focus of the expanded model will be to compare the tradeoff between the household having to pay for the filter so that the NGO’s operations are sustainable in the next period, versus the household receiving the filter for free but facing some probability of the NGO will not be able to return to the village with more free filters in the next
period. Additionally, I assume that both the selling NGOs and the donating NGOs use the same type of filter, so there is no need to compare filter quality. Therefore, the new equation for the probability that the filter will still function in the second period simply becomes:

\[ q(e) = 2\sqrt{e}. \]

To explain the assumptions behind the expanded model, there are several reasons why an NGO like Helps or Water Charity may not return to a village in which they have just given out free water filters. Because their operations depend entirely on donations, which are finite, they probably do not have enough money to go to every Guatemalan village; therefore they may see it as a better allocation of their resources to go to a village they have not previously visited. Additionally, many of the donations they make to the villagers are made on a one-time basis in emergency situations. Regardless of the reason, since it is reasonable to assume that the NGO donating free filters will not definitely return to the village, the probability that it will return can be represented by \( \beta \), which is some value between zero and one. I use the subscript “d” to denote a donated filter. The household’s utility across the two periods then becomes:

\[ u_d = \{v_H - e\} + \{q(e)v_H + [1 - q(e)][\beta v_H + (1 - \beta)v_L]\}. \]

As before, the household will maximize utility by choosing the optimal level of effort. Price is not in this equation because the household does not pay a monetary price, and cost is not in this equation because it does not factor into the household’s decisions. Unlike in the previous model, where the optimal decision for the household is to expend no effort since it is guaranteed a filter in the next period if the current filter breaks, the household now is uncertain whether it can receive a replacement. If the NGO does not return and the filter breaks down, the household must go back to using unfiltered water. Due to the threat of this undesirable outcome, the optimal effort is no longer zero, even though the filter is free. I again maximize utility with respect to
effort to find the equilibrium effort level and subsequently the probability that the filter will still function in the second period:  

\[ e_d^* = [\Delta(1 - \beta)]^2, \]

\[ q(e_d^*) = 2\Delta(1 - \beta). \]

I substitute these equilibrium values back into the utility function to get:  

\[ u_d(e_d^*) = v_H + v_L + \beta^2\Delta^2 + \Delta^2 - 2\beta\Delta^2 + \beta\Delta. \]

I will use these equations to represent the NGO that donates filters. Now I need to model the total utility generated across two periods when the NGO gives the filter to the entrepreneur to sell, which will include both the utility of the household and the entrepreneur. The cost of the filter \(c\) will be the new variable to consider. I use the subscript “s” to denote the selling case. The gain to the entrepreneur for each filter she sells is the difference between the price of the filter and its cost. In the first period, the overall utility of the village is the value of filtered water minus both the price of the filter and the effort of maintaining it (household utility), plus the price minus the cost (entrepreneur utility). In the second period, if the filter still functions, the household gains the utility from using filtered water, and the entrepreneur gains nothing, since the household does not purchase another filter. If the filter breaks, then the household gains the

---

\[ \max_{e_d} u_d = [v_H - e] + \{q(e)v_H + [1 - q(e)][\beta v_H + (1 - \beta)v_L]\}, \]

\[ \frac{\partial u_d}{\partial e} = -1 + \frac{\partial q(e)}{\partial e} v_H - \frac{\partial q(e)}{\partial e} \beta v_H - \frac{\partial q(e)}{\partial e} v_L + \frac{\partial q(e)}{\partial e}\beta v_L, \]

\[ \frac{1}{\sqrt{e}}[v_H - v_L - \beta(v_H - v_L)] = 1, \]

\[ \Delta - \beta\Delta = \sqrt{e}, \]

\[ e_d^* = [\Delta(1 - \beta)]^2. \]

---

\[ u_d(e_d^*) = v_H - [\Delta(1 - \beta)]^2 + 2\Delta(1 - \beta)v_H + [1 - 2\Delta(1 - \beta)][\beta v_H + v_L - \beta v_L], \]

\[ u_d(e_d^*) = v_H + v_L + \beta^2\Delta^2 + \Delta^2 - 2\beta\Delta^2 + \beta\Delta. \]
utility from using filtered water minus the cost of purchasing another filter, and the entrepreneur again gains the price of the filter minus its cost. This model assumes that the price is below the benchmark level of the added benefit of using the filter in one period. The utility to the villagers in this case—which includes both the household and the entrepreneur—is:

\[ u_s = (v_H - p - e) + (p - c) + (q(e)v_H + [1 - q(e)](v_H - p) + (p - c)). \]

This can be simplified into:

\[ u_s = \{v_H - c - e\} + \{q(e)v_H + [1 - q(e)](v_H - c)\}. \]

After simplification, price no longer matters in the overall utility of the village in the general form of this equation. Instead, only the filter’s cost matters. This would be true if price were merely a welfare transfer from the household to the entrepreneur—the price charged for the filter is a cost to the household but a gain for the entrepreneur, leading to a net sum of zero. Just because the price has disappeared from the overall utility function, however, does not mean it is irrelevant, since the household’s decision-making process is determined by the price. Since nothing has changed for the household by adding the entrepreneur into the model, the previous equilibrium values for household effort and probability of the filter functioning in the second period still hold. I can therefore substitute these values into this new utility function. Recall the equilibrium solutions from the basic model after eliminating \( \alpha \):

\[ e^*_s = p^2, \]
\[ q(e^*_s) = 2p. \]

The utility function would thus become:

\[ u_s(e^*_s) = \{v_H - c - p^2\} + \{2pv_H + (1 - 2p)(v_H - c)\} \]
This demonstrates that the price still matters in equilibrium. In fact, when I maximize utility with respect to price, the optimal price is equal to the filter’s cost:  

\[ p^* = c \]

There are a couple of takeaways from this solution. The first is that the entrepreneurs would earn no wages for their efforts if they did only charge a price equal to the filter’s cost. More importantly, though, this solution proves that by charging a markup of 20%, CE Solutions is not operating in a way that brings the greatest benefit to the Guatemalan villages. To address the former concern of the entrepreneurs’ wage, it is unlikely that they would be willing to work for free, so this solution does not seem to make sense at first. That price is also not what is used in practice, since CE Solutions includes the 20% markup to compensate the entrepreneurs and bring extra money to the entrepreneur’s business venture, Sol Com. However, to approach this problem from the NGO’s perspective, the NGO’s goal should be to maximize positive impact on the local population. If a higher price merely meant a transfer of welfare from the household to the entrepreneur as assumed in the general form of the utility function, that would not be a problem, but in equilibrium the price disproportionately affects the household as compared to the entrepreneur. This is due to the fact that price also impacts the household’s effort level, which is a cost to the household but does not impact the entrepreneur’s utility. Therefore, CE Solutions should charge only for the filter’s cost, and could pay the entrepreneurs with the donations that it receives instead of making the households pay that extra amount. Lastly, keep in mind that one of the models’ constraints is that CE Solutions does not subsidize its products because it wants

\[ \max_{p} u_s = \{v_H - c - p^2\} + \{2pv_H + (1 - 2p)(v_H - c)\}, \]

\[ \frac{\partial u_s}{\partial p} = 0 = -2p + 2v_H - 2v_H + 2c, \]

\[ p^* = c. \]
its operations to be sustainable, meaning it would never charge a price lower than the filter’s cost. The optimal price I have derived satisfies this constraint.

How then does CE Solutions justify charging the household a price that is significantly higher than optimal? I mentioned before that CE Solutions is in favor of charging households a price to encourage them to take care of the filters, thereby lengthening the filters’ life. That means perhaps CE Solutions’ goal is not utility maximization, but effort maximization. So, let me examine whether the micro-consignment model will achieve one of their claims that selling will induce more maintenance effort from the households than the traditional donating model. Since the price that maximizes household utility occurs when it is equal to the cost of the filter, I can replace price with cost everywhere it appears in the household’s effort, probability, and utility functions: $^9$

$$e_s^* = c^2,$$

$$q(e_s^*) = 2c,$$

$$u_s(e_s^*) = 2v_H + c^2 - 2c.$$

Interestingly, in equilibrium, this utility function reduces to the same exact equilibrium utility function from the basic model if I add back in $\alpha$. This makes sense since the goal of the NGO should be to maximize household utility, so that equilibrium will not change even after adding in the entrepreneurs. This model will assume that the hypothetical selling NGO is charging the optimal price rather than the high price that CE Solutions charges to test whether an NGO that sells filters could induce more household effort than an NGO that donates when both

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$^9$ $u_s(e_s^*) = \{v_H - c - c^2\} + \{2cv_H + (1 - 2c)(v_H - c)\}$,

$u_s(e_s^*) = v_H - c - c^2 + 2cv_H + v_H - c - 2cv_H + 2c^2$,

$u_s(e_s^*) = 2v_H + c^2 - 2c$. 
are operating optimally. This comparison is simple, since I already solved for the equilibrium effort levels in both cases. What I expect is that when the probability of securing enough donations to allow the NGO to go back to the village with more filters in the second period \( \beta \) is in a certain range, donating would induce more effort. Then there would be a cutoff point, after which selling would induce more effort. Assuming effort is greater than zero, then I am comparing:

\[
e^*_d = [(1 - \beta)]^2, \quad e^*_s = c^2.
\]

If selling induces more effort than donating, then:

\[
c^2 > [\Delta(1 - \beta)]^2
\]

The result after solving for \( \beta \) is:\(^\text{10}\)

\[
\beta > 1 - \frac{c}{\Delta}
\]

This tells me that only when the probability that the NGO can go back to the village in the second period exceeds the threshold of \( 1 - \frac{c}{\Delta} \) would it be better to sell than to donate, even if the selling NGO is charging the optimal price equal to the filter’s cost. One of the reasons behind this is the prospect theory, as discussed in the literature review—if the household knows it will not receive another filter in the second period if the one it owns breaks, it will expend more

\(^{10}\) Since effort is a parabolic function, there is another solution for \( \beta \), but it is irrelevant to this model given that it is outside the bounds \( \beta \in [0,1] \); thus it will not be considered.

\[
c^2 > [\Delta(1 - \beta)]^2,
\]

\[
\frac{c}{\Delta} - 1 > -\beta,
\]

\[
\beta > 1 - \frac{c}{\Delta}.
\]
effort taking care of the filter now, regardless of whether or not the filter cost the household any money. Conversely, if the household thinks it is very likely that the NGO will return to the village in the next period and give out another free filter if the one it currently has breaks, it would have less incentive to take care of the filter. In that situation, the NGO should sell the filter in order to induce the household’s effort.

Now I will go through the same comparison for utility. I want to know if there is a cutoff level for $\beta$ such that on one side, a selling model will generate more utility, while on the other side, a donating model would generate more utility. Since the model has already proven that CE Solutions is not maximizing utility, let me again suppose that the selling NGO is charging the optimal price equal to the filter’s cost. Recall:

$$u_d(e^*_d) = v_H + v_L + \beta^2 \Delta^2 + \Delta^2 - 2\beta \Delta^2 + \beta \Delta,$$

$$u_s(e^*_s) = 2v_H + c^2 - 2c.$$

If an NGO generates more utility through selling than donating filters, then:

$$2v_H + c^2 - 2c > v_H + v_L + \beta^2 \Delta^2 + \Delta^2 - 2\beta \Delta^2 + \beta \Delta.$$

As it turns out, it is not viable to solve this equation analytically because in almost all cases, the utility on both sides fluctuates depending on the specific values for the added benefit of using the filter in one period and the cost of the filter. Instead, I will solve it by looking at three critical points of $\beta$: $\beta = 1$, $\beta = 0$, and the vertex of the utility function with respect to $\beta$. I begin by looking at $\beta = 1$, meaning the NGO is definitely going to return to the village in period two:

$$u_d(e^*_d) = 2v_H, \text{ when } \beta = 1.$$

How does $2v_H$ compare to $2v_H + c^2 - 2c$? It is quite clear that household utility is higher in the donating rather than the selling model, since $c < \frac{1}{2}$. The intuition behind this outcome is that

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11 $2v_H > 2v_H + c^2 - 2c$ because $0 > c^2 - 2c$ given that $c < \frac{1}{2}$. 
when the NGO can afford to return to the village in the next period and provide the household with another free filter—and does so—the household would not have to incur the monetary cost of buying the filter and the labor cost of maintaining the filter. The household’s utility would thus be higher than if it buys the filter. When $\beta = 1$, it is the same case as the basic model, where the assumptions are that the filter does not cost the NGO anything and that the NGO will return to the village in period two. Again, this proves that setting a price of zero (donating) will create more utility than setting a price of the filter’s cost (selling).

Next, I focus on the case where the NGO definitely will not return in period two ($\beta = 0$):

$$u_d(e_d^*) = v_H + v_L, \text{ when } \beta = 0.$$  

It is not immediately clear here how $v_H + v_L$ compares to $2v_H + c^2 - 2c$ because depending on the exact values of the added benefit of using a filter in one period and the filter’s cost, the utility from the selling model exceeds utility from the donating model in some cases, and vice versa. This means I need to simplify the inequality and plug in numerical values. If the utility generated by the selling NGO exceeds the utility generated by the donating NGO, then the inequality becomes:  

$$\Delta > 2c - c^2.$$  

The sensitivity table that follows shows what combinations of values for $\Delta$ and $c$ would allow the above inequality to hold. If the inequality does not hold, it means donating would generate more household utility:

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12 If $u_s(e_s^*) > u_d(e_d^*)$ then $2v_H + c^2 - 2c > v_H + v_L$,

$$\Delta > 2c - c^2.$$
The table shows that when the cost of the filter \( c \) is much lower than the added benefit from using a filter \( \Delta \), it makes more sense for the NGO to sell the filter. However, as the difference between those two values decreases, it becomes better to give the filter out for free. Additionally, as the values of \( \Delta \) and \( c \) increase, the difference between the two variables also has to increase in order for selling to be better.

Finally, I consider the vertex of the parabola, which occurs at:

\[
u_d(e_d^*) = v_H + v_L + \beta^2 \Delta^2 + \Delta^2 - 2\beta \Delta^2 + \beta \Delta,
\]
\[ \beta = 1 - \frac{1}{2\Delta}. \]

When I substitute this back into donating model’s utility function, it becomes:

\[ u_d(e_d^*) = 2v_H - \frac{v_H}{2}, \text{ when } \beta = 1 - \frac{1}{2\Delta}. \]

This means I am comparing \(2v_H - \frac{1}{4}\) to \(2v_H + c^2 - 2c\). After simplification, I see that in order for selling the filter to generate more utility than donating the filter:

\[ c^2 - 2c > -\frac{1}{4}. \]

The table below shows what values of cost will allow this condition to hold:

<table>
<thead>
<tr>
<th>(c)</th>
<th>(c^2 - 2c)</th>
<th>Donate or Sell</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>-0.19</td>
<td>Sell</td>
</tr>
<tr>
<td>0.2</td>
<td>-0.36</td>
<td>Donate</td>
</tr>
<tr>
<td>0.3</td>
<td>-0.51</td>
<td>Donate</td>
</tr>
<tr>
<td>0.4</td>
<td>-0.64</td>
<td>Donate</td>
</tr>
</tbody>
</table>

The indifference point occurs at \(c \approx 0.134\), above which it is clear that donating the filter would always generate more utility than selling it.

From examining these three critical points, the model demonstrates that as the likelihood of the NGO returning to the village in the second period increases, all else equal, the acceptable

\[
\frac{\partial u_d(e_d^*)}{\partial \beta} = 0 = 2\beta \Delta^2 - 2\Delta^2 + \Delta, \\
2\beta \Delta^2 = 2\Delta^2 - \Delta, \\
\beta = 1 - \frac{1}{2\Delta}.
\]
range for the filter’s cost (which translates into the price charged by the selling NGO) decreases. This is proven by the fact that when $\beta$ is at its lowest possible value of zero—meaning the NGO has no chance of returning—charging for the filter is acceptable if the added benefit of using the filter is much higher than its cost. Moving to the vertex of $\beta$, which is some value between zero and one, the acceptable range of filter costs becomes smaller, regardless of how much added value the filter will bring to the household. Lastly, at the upper bound of $\beta$ at one, when the NGO will definitely return, it is undeniably better to give the filter out for free than to sell.

These results indicate that the goal of inducing the highest amount of household maintenance effort does not correspond with the goal of achieving the highest household utility. Earlier in this section, the model proved that when the probability that the NGO will return to the village is high enough, it is better to sell the filter if the NGO’s goal is to maximize effort. Again, this is because if the household knows it can probably obtain another filter free of charge in the next period if its filter from this period breaks, it has less incentive to spend time maintaining the filter. When the NGO’s goal is to maximize the utility of the local population, then the reverse is true; as the likelihood of the NGO returning to the village increases, the acceptable price to charge decreases. This is because if the NGO can afford to come back to the village and give out more filters, it makes no sense to make the villagers pay, both in terms of the monetary price and in terms of their effort to take care of the filter. Therefore, while CE Solutions’ claim may be true in that charging for the filter makes the household care more about its use and maintenance, that is not enough reason to do so if CE Solutions is truly an NGO with the goal of doing the greatest good in the poor Guatemalan villages.

RESULTS: The 3 conclusions drawn from the expanded model are summarized below in order of importance.
1. All else equal, the traditional NGO operating model of donations brings more utility to the local population than the new operating model of micro-consignment.

2. The goals of maximizing household utility and effort are incompatible with each other. If the NGO can afford to return to a village in the next period to provide filters to households whose filters have broken, the NGO should donate the filters in order to maximize utility, but it should sell the filters to maximize household effort. If the probability that the NGO can return to the village is low, then whether it is better to sell or donate would depend on the exact values of the filter’s cost and the added benefit of using it.

3. If the NGO charges a price for the filter in order to induce effort, it should be equal to the filter’s cost. Any price above that will strictly decrease the household’s utility and is not an optimal solution.

V. CONCLUSION

Access to clean water is still a pressing issue in Guatemala, and various non-governmental organizations have sought to alleviate the problem. Many traditional NGOs donate water filters to the local population, while CE Solutions, operating under the new micro-consignment model, sells the filters instead. Past research does not clearly show which NGO operating model would generate more household utility. For example, while the sunk-cost fallacy suggests selling would be better, the endowment effect suggests that donating would be better. Additionally, there have been no studies done on whether CE Solutions’ claim is true, that charging a price induces more household maintenance effort than giving out the product for free.

By building a basic two-period model in which I assumed zero operating costs for the NGO and its ability to return to the village in the second period, I showed that the price that maximizes household utility is zero, meaning that donating is indeed better than selling. If the
NGO sells the filters to induce the households’ maintenance effort, the price charged should be lower than the added benefit from using the filter in one period. If the price is above that point, the household’s effort would no longer depend on price, and so price only serves to decrease household utility. However, the aim to merely induce household effort is not optimal in and of itself, since the monetary cost as well as the effort cost creates disutility for the household.

In the expanded model, I added cost considerations for the NGO, as well as a chance that the NGO does not return to the village in the second period. First, I proved that CE Solutions is not operating optimally because the price it charges is above the cost of the filter. Additionally, this model demonstrated that the goals of maximizing household effort and maximizing household utility are incompatible with each other. If the goal is utility maximization, as the probability that the NGO can afford to go back to a village and provide more filters to the local population increases, the acceptable range prices to charge decreases. This is because even if the household paid a low price, its utility would still be higher if it paid nothing at all. On the other hand, if the NGO’s goal is purely to maximize effort, it should sell the filter at a price equal to its cost if the likelihood of returning is above a threshold level in order to incentivize the households to maintain their filters. If the probability of the NGO returning is very low, it is justifiable to charge for the filter only if the filter’s cost is very low and the added benefit of using the filter is very high. Otherwise, the threat of not having a filter to use in the next period is enough to ensure that the household expends effort to take care of the filter even when it is received for free.

As mentioned in the basic model, one of the main assumptions in both models is that the household knows the difference in value of filtered versus unfiltered water, but as demonstrated by the example in one Guatemalan village of the residents’ reluctance to switch to using well water, this may not be completely accurate. If people are not educated about the importance of
using clean water, then none of this paper’s findings would even be applicable. Therefore, organizations should not overlook the importance of teaching the villagers about water safety, because their habits and decisions will be affected by that knowledge. Merely having the filter does not help the household if it does not use it. Further research could be done to find the most effective method through which to disseminate water safety information.

One of the shortcomings of using theoretical models is that the number of variables that can be considered is significantly fewer than in empirical models. For example, I was not able to incorporate the various other factors that may influence a household’s decisions towards the filter, such as family income and education level. Additionally, I only considered two periods rather than more extended periods, which could more accurately represent the lifetime of the household and the long-term operations of the NGO. Expanding this model theoretically and testing it with empirical data would provide further insights. Since so many resources go to NGOs, which have been hailed by some as the critical vehicle to fix the problems that governments and businesses cannot address, it is important to continue research in this field to ensure that NGOs are fulfilling their claims of making the world a better place.
Works Cited


