Information and Subsidies: Complements or Substitutes?*

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Abstract

Does providing information about a product increase or decrease the impact of price subsidies on purchases of the product? This question is of particular relevance for health products in developing countries where both informational campaigns and price subsidies are common policy instruments. We conduct a randomized field experiment selling an unfamiliar health product in Zambia to identify the potential complementarity or substitutability between (i) provision of information and (ii) a price subsidy. We find that providing additional information about the product significantly increases the impact of the price subsidy on take-up. Taken by itself, the information intervention has no significant impact on demand while the price subsidy substantially increases demand. However, evaluation of either intervention in isolation fails to capture the significant complementarity between the two.

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1 Introduction

Governments and NGOs commonly use both informational campaigns and price subsidies in attempts to increase the use of health products and other socially beneficial technologies in developing countries (Hecht and Shah 2006). The optimal deployment of these policy instruments depends on the way they interact in the policy maker’s production function; if providing households with information about a product changes the demand function, it may also affect the policy maker’s optimal level of a price subsidy.

Information can impact demand in two broad ways. First, providing information can affect the overall level of demand. For instance, information can increase demand by allowing consumers to purchase more appropriate products (Tadelis and Zettelmeyer 2011). Or, if the quality of the product does not match consumers’ ex ante expectations, providing information can change the average perception of quality (Caswell and Mojduszka 1996). Second, and more important for our purposes, providing information can change the elasticity of demand (and thus the impact of price subsidies). For example, information can increase the dispersion of consumers’ valuation, which rotates the demand curve clockwise, making demand less sensitive to price (Johnson and Myatt 2006). But, if consumers’ initial beliefs are more heterogeneous than their valuations, information will have the exact opposite effect. Moreover, information can reduce the extent of consumers’ price-based inference, thus making demand more sensitive to price (Judd and Riordan 1994). Hence, the impact of information on the level and the slope of the demand curve is fundamentally an empirical question.

In this paper, we estimate the causal impact of information on the effectiveness of price subsidies. Using door-to-door marketing in Lusaka, Zambia, we offered a new, unfamiliar water purification product for sale to 487 households, randomly varying both the price subsidy and the information provided. We offered this novel, target product alongside a familiar substitute product (Clorin), which we sold at its regular market price of 800 Zambian Kwacha (around 0.17 USD). We varied the price of the target product from zero (full subsidy) to 1200 Kwacha (no subsidy). This variation allows us to estimate the quantity demanded across the full range of relevant subsidy levels. We varied the information by telling some subjects simply that the new product is “an alternative water purification solution that is not available for purchase in Zambia but that we are offering this month only for sale to randomly selected households in your area.” Other subjects were given the opportunity to in-

\footnote{The novel product is not available for sale in Zambia, but based on estimated costs of production and distribution, its market price under perfect competition would be around 1200 Kwacha}
pect the product and were also told that “the solution contains the same ingredients as regular Clorox but the strength or concentration of the ingredient is higher.” We refer to these two groups of households as uninformed and informed, respectively. The information treatment attempts to isolate the informational component present in many marketing demand generation campaigns from other aspects of those campaigns that may impact consumers’ marginal utility of the product directly (Becker and Murphy 1993).

Our main specification compares the impact of the price subsidy on purchase behavior across uninformed and informed households. Overall, 34 percent of households purchase the target product. The probability that an uninformed household purchases the product increases by 3.4 percentage points for every 100 Kwacha increase in the price subsidy. Among the informed households, this effect is 5.4 percentage points. In other words, information and subsidies are complements: providing consumers with additional information about the product increases the effectiveness of price subsidies by about 60 percent. A variety of alternative specifications yield qualitatively similar results: more informed consumers are more responsive to subsidies.

As in many other field experiments, our ability to generalize beyond our specific product, context, and intervention is limited. As we mentioned earlier, there is a variety of mechanisms through which information can impact demand. The interaction between information and subsidies would in general depend on the relative importance of those mechanisms given the product and the setting. Despite its limited generalizability, however, our paper makes two substantive contributions.

First, we find that the complementarity between two commonly used policy instruments, subsidies and information, can be quite large; in our setting, the impact of price subsidies is 60 percent greater among the informed households. The magnitude of this point estimate highlights the potential importance of taking complementarities into account when designing policy interventions. Second, previous work on pricing of health products in developing countries (Dupas 2009, Ashraf, Berry and Shapiro 2010, Cohen and Dupas 2010) has focused almost exclusively on products that are familiar. Our study reveals that optimal pricing may be quite different for products that are novel and unfamiliar.

Our paper relates to several strands of existing literature. Numerous studies have estimated the impact of information programs (Jalan and Somanathan 2008) and price subsidies (Kremer and Miguel 2007, Ashraf, Berry and Shapiro 2010, Cohen and

\[2\] The English language script is in the Appendix. Scripts were administered in Nyanja.

\[3\] By this we mean any campaign or intervention that aims to induce more individuals to use the product.
Dupas 2010) in isolation. Our paper is more closely related to the small literature that examines interactions between the two policies. Dupas (2009) compares purchase decisions at various levels of subsidies for insecticide treated mosquito nets, with information treatments that alternatively stress the health or financial benefits of malaria prevention. In constrast to our results, she finds that neither information treatment affects the demand function. One potential interpretation of the difference between our finding and hers is that information is likely to have a greater impact for products that are unfamiliar, such as the one we used.\textsuperscript{4}

Our paper is also related to a literature outside of development, namely the work in marketing that presents both theory and evidence on the interaction between prices and advertising by profit-maximizing firms. Early work by Prasad and Ring (1976) documents greater price sensitivity among consumers exposed to greater amounts of advertising. More recent work by Kaul and Wittink (1995) surveys marketing research on the effect of advertising on price sensitivity and concludes that non-price advertising tends to decrease price sensitivity, though evidence is mixed. Economic theory has also explored the interaction between advertising and prices (Milgrom and Roberts 1986, Lewis and Sappington 1994), but rigorous consumer-level empirical identification and extensions to applications in development are lacking.

The paper proceeds as follows. The next section describes the design and the implementation of the field experiment. Section 3 presents the empirical results. Section 4 discusses the results and concludes.

\section{Experimental design}

Our experimental design is straightforward. We varied both how much information we provide to consumers and how much we subsidize the product we are asking them to buy. These two orthogonal sources of variation allow us to assess the complementarity between information and subsidies.

To increase the chance that our informational intervention had an impact, we decided to use a novel, unfamiliar good as our target product. Specifically, we imported two varieties of water purification products: AquaGuard and WaterGuard from Uganda and Kenya respectively. Initially, these were intended to represent branded (Uganda) versus unbranded (Kenya) products to assess the potential interaction of treatment effects with branding. However, the two imported products were

\textsuperscript{4}Berry et al. (2011) examine an interaction between price subsidies and provision of information about the market price of the product. They find that the impact of subsidies is not affected by the provision of this information.
identical in the size and shape of their bottles and focus groups gave mixed responses as to which looked more “branded.” Accordingly, the two novel products, which were balanced across treatments, are pooled throughout the analysis. For the remainder of the paper we refer to both AquaGuard and WaterGuard as the target product.

Our experiment was implemented in collaboration with Society for Family Health (SFH). SFH is a social marketing firm that sells Clorin, the commonly used water purification system, in Zambia. SFH is a non-profit organization that distributes Clorin through door-to-door marketing and aims to set prices to maximize take-up and use rather than profits.

While the basic logic of our design could have been implemented by simply offering the target product for sale, based on discussions with SFH we also offered Clorin for sale at its standard price alongside the target product. One benefit of doing so was to make the households’ interaction with the marketers less unusual by presenting, alongside the target product, a familiar product at a familiar price. Accordingly, the details of our design are as follows.

A team of 6 marketers worked in 6 low-to-middle income compounds in Lusaka over a period of approximately 4 weeks in August and September of 2007. Lack of street addresses and detailed maps made ex ante random sampling infeasible, so marketers were instructed to visit every fifth house along a street. If no one was home in the target house, they visited the house to the right, and if that also failed, then the house to the left, before counting another 5 houses along the street. Marketers traveled in groups of two to a different compound each day.

The marketing scripts were designed to make the interaction similar to other door-to-door marketing campaigns in Lusaka. Scripts were pre-printed to reflect the 26 conditions: informed vs. uninformed crossed with 13 different subsidy levels from K0 (price = K1200) to K1200 (price = zero) in K100 increments. Scripts were provided to marketers in random order and they were instructed to use them in that order. Checks of ordering according to position along selected streets confirmed that the randomization was followed. Either 18 and 19 observations were collected in each condition for a total of 487 observations.

In all treatments, a single female marketer approached the house, introduced herself as being a representative of SFH and asked to speak with the female head of household. If the female head was not present, the visit was terminated, and the marketer continued to the next house in the sampling scheme. If the female head was present,

5 The price was not framed as a subsidy to the consumer, in keeping with the NGO’s typical pricing approach.

6 One treatment combination (informed, subsidy of K900) contains only 17 observations due to a failure of a single marketer to meet her target on the final day of data collection.
available, the marketer explained that she was selling water purification solutions.

All subjects were told that two types of purification solutions were available and only a single bottle could be purchased of either Clorin at the standard price of K800, or the target product at K[randomly determined price]. The two products were shown to the respondent inside a plastic display case. All subjects were told that the target product is sold in other countries but is not available for purchase in Zambia except for randomly selected households in the area for a short time. In the informed treatment, the marketer opened the display case and removed both bottles for the respondent to inspect. In addition, the informed subjects were given detailed information about the similarity between the target product and Clorin, including the fact that the two products have the same active ingredient and same treatment instructions. The target product had a slightly higher concentration so the bottle was slightly smaller to offer the same treatment capabilities.

After hearing the information about the products, subjects were asked whether they would like to purchase either a bottle of Clorin or a bottle of the target product. The marketers made it clear that the household could purchase at most one bottle of at most one product. After subjects completed their purchase decisions, marketers asked a brief set of survey questions including one on perceptions of the products’ qualities. In addition, the marketers recorded any free-form comments and were trained on a set of pre-scripted responses to frequently asked questions.

Some aspects of our experimental design might appear contrived. However, door-to-door marketing is very common in Lusaka, particularly in the low-to-middle income compounds where the study was implemented. Moreover, products are often brought to Zambia from other countries for short-term off-loads of production surpluses. An informal survey identified many products that were available only for short periods of time in Lusaka in the past, including cooking pots from South Africa, cosmetics from the United Kingdom and candy from the United States. Accordingly, we think it plausible that most of the households in our sample did not suspect that they were a part of an experiment, except perhaps those who were offered the target product for free. Excluding those subjects from our analyses only strengthens our findings.

3 Results

3.1 Separate impact of information and subsidies

While our main focus will be assessing the interaction between information provision and price subsidies, we begin our analysis by examining the independent impact of
each of these interventions. Table 1 fully describes all the choice data from our experiment. The Table reports the number of households that purchase Clorin and the number of households that purchase the target product in each of the 26 conditions. Throughout the paper we will focus on purchase of the target product as the outcome variable.

As we discussed earlier, providing information can either increase or decrease demand. Information allows consumers to select more appropriate products and to use them more appropriately; this force can lead information to increase demand. On the other hand, consumers’ initial beliefs about quality might be optimistic, which could lead information to decrease demand. Pooling over all subsidy levels, 32% of the uninformed households purchase the target product; providing information increases that fraction to 37%. This difference, however, is not statistically significant ($p = 0.252$).

Pooling across the two information conditions, we examine the impact of subsidies on purchases by considering a linear probability model:

$$
 Purchase_i = \alpha + \beta_S \times \text{Subsidy}_i + \varepsilon_i \tag{1}
$$

where $i$ indexes households, $Purchase_i$ is an indicator variable for whether the head of household purchased the target product, and $\text{Subsidy}_i \in \{0, 1, ..., 12\}$ is the extent of the price subsidy, in units of K100, we offered to household $i$. Column (2) of Table 2 reports the regression estimates with robust standard errors to correct for heteroskedasticity. Each additional K100 subsidy increases probability of purchase by 4.4 percentage points ($\beta_S = 0.044$). This effect of subsidy on purchases is highly significant ($p < 0.01$).

### 3.2 Complementarity of information and subsidies

In this subsection we turn to our main question: are information and price subsidies complements or substitutes? As before, we utilize a linear probability model, but using a logit or a probit instead yields similar results. Our main regression is:

$$
 Purchase_i = \alpha + \beta_S \times \text{Subsidy}_i + \beta_I \times \text{Information}_i \\
+ \beta_C \times \text{Subsidy}_i \times \text{Information}_i + \varepsilon_i
$$

where $\text{Information}_i$ is an indicator variable for whether the household was informed and other variables are defined as earlier. Column (3) of Table 2 reports the estimates. For households given no subsidy, the informational intervention is estimated
to decrease purchases by 7 percentage points ($\beta_I = -0.070$), but this effect is not significant. Among the uninformed households, the probability of purchase increases by 3.4 percentage points for each additional K100 in subsidies ($\beta_S = 0.034$). In contrast, among the informed households, each additional K100 in subsidies increases purchases by 5.4 percentage points ($\beta_S + \beta_C = 0.054$). In other words, providing consumers with information increases the effectiveness of price subsidies by 60%. This effect is marginally significant, just shy of the conventional 5% level ($p = 0.055$).

4 Discussion

We present simple evidence on the interaction between two interventions designed to increase demand for a novel health product. We find that the marginal impact of a price subsidy is greater if consumers are also given information about the product. This result indicates that information and subsidies are complements in the NGO’s production function and that program evaluation and intervention design can be improved by considering interactions across demand generation strategies.

While our design is simple, it controls for many of the complexities associated with the introduction of new health products in developing countries, such as repeated purchases (Dupas 2010), learning from own experience and the experience of others (Oster and Thornton, forthcoming), and expectations of future prices (Berry, Fischer and Guiteras 2011). Some of our design features, however, come at a cost. For instance, we intentionally give subjects a one-shot decision to avoid inter-temporal substitution and endogenous information acquisition. Yet, the decision to take up a new health product is typically a dynamic one, and our design ignores the nuances of repeated purchase opportunities and information dissemination. In this sense, our findings complement Dupas’ (2010) two-stage design in which random variation in prices in the first period is followed by endogenous learning and a second purchase opportunity. Her results show a positive relationship between price subsidies and endogenous information dissemination, while we show a positive interaction between price subsidies and exogenously provided information.

While we remain agnostic about the specific mechanism that drives our results, our findings are consistent with consumers making inferences about product quality from product price. In many models of this phenomenon (e.g., Judd and Riordan 1994), consumers’ inference makes demand less sensitive to price since lower prices

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7 Recall that information we provided to informed households suggested that the target product was very similar to Clorin. Hence, it is not surprising that for households who were offered no subsidies on the target product, i.e., for whom the target product was 50% more expensive than Clorin, providing this information made Clorin seem more attractive than the target product.
signal lower quality. Hence, providing consumers with information reduces the role of inference, thus makes the demand curve flatter, and in turn makes price subsidies more effective.

Our ancillary data provide some support for this interpretation of the results. In the survey conducted after the purchase decision we asked subjects about their perceptions of the relative quality of the two products. We find that the perceived quality of the target product relative to Clorin is negatively related to the subsidy level. Moreover, informed subjects’ perception of quality is less affected by the subsidies, though this interaction effect is both small and statistically insignificant. Finally, the free-form comments from the subjects also support a role for inference. The comments include that “free one can’t be good,” “it’s better that’s why it’s expensive,” and “how you tell if something is better is by the price.”

Whatever the mechanism behind our results, the substantial complementarity between information and subsidies implies they will more effective when applied in unison. Identifying the contexts in which subsidies and information act as complements seems like an important consideration in future research.
References


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<tr>
<th>Subsidy treatment</th>
<th>None</th>
<th>Clorin Uninformed</th>
<th>Target</th>
<th>None</th>
<th>Clorin Informed</th>
<th>Target</th>
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<tbody>
<tr>
<td>1200</td>
<td>3/19</td>
<td>4/19</td>
<td>12/19</td>
<td>3/19</td>
<td>3/19</td>
<td>13/19</td>
</tr>
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<td>1100</td>
<td>9/19</td>
<td>3/19</td>
<td>7/19</td>
<td>4/18</td>
<td>0/18</td>
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</tr>
<tr>
<td>1000</td>
<td>4/18</td>
<td>1/18</td>
<td>13/18</td>
<td>6/19</td>
<td>2/19</td>
<td>11/19</td>
</tr>
<tr>
<td>900</td>
<td>11/19</td>
<td>2/19</td>
<td>6/19</td>
<td>9/17</td>
<td>0/17</td>
<td>8/17</td>
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<td>800</td>
<td>7/19</td>
<td>5/19</td>
<td>7/19</td>
<td>13/19</td>
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<td>700</td>
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<td>8/18</td>
<td>0/18</td>
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<td>3/19</td>
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<td>2/19</td>
<td>4/19</td>
</tr>
<tr>
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<td>1/19</td>
<td>4/19</td>
<td>13/19</td>
<td>4/19</td>
<td>2/19</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>136/245</td>
<td>31/245</td>
<td>78/245</td>
<td>127/242</td>
<td>26/242</td>
<td>89/242</td>
</tr>
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</table>

Notes: Purchase frequencies over treatment population by subsidy and information treatments.
Table 2: Impact of subsidy on purchase probabilities

<table>
<thead>
<tr>
<th>Purchase target product</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsidy</td>
<td>0.044</td>
<td>0.034</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.008)</td>
<td></td>
</tr>
<tr>
<td>Information</td>
<td>0.049</td>
<td>-0.070</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.043)</td>
<td>(0.068)</td>
<td></td>
</tr>
<tr>
<td>Subsidy * Information</td>
<td></td>
<td></td>
<td>0.020</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.011)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.318</td>
<td>0.078</td>
<td>0.113</td>
</tr>
<tr>
<td></td>
<td>(0.030)</td>
<td>(0.038)</td>
<td>(0.054)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.001</td>
<td>0.120</td>
<td>0.126</td>
</tr>
<tr>
<td>N</td>
<td>487</td>
<td>487</td>
<td>487</td>
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<tr>
<td>Mean of Dependant Variable</td>
<td>0.343</td>
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<td>0.343</td>
</tr>
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</table>

Notes: All outcomes are binary and estimates are from linear probability models. Robust standard errors in parentheses. Subsidies are in K100.
Appendix: Marketing script

Marketer: ____________________ House plot no: ________________
Date: ________________ Compound: ________________
Alt Product: WG __ AG __ Nearby landmark: _____________

STEP 1 Hello and how are you? My name is ______________________________ and I am representing the Society for Family Health.

STEP 2 ‘Is the female head of the household here?’
________ Yes it’s me! Yes let me go get her. (⇒ Go to STEP 3)
________ No she is not here. (⇒ Go to STEP 9)

STEP 3 We are going today to randomly selected households in your area, in order to make water purification solutions available for sale from SFH.

As you may know, Clorin is a water purification treatment, usually sold in retailers at around 800 Kw per bottle. Today we would like to offer to sell you a single bottle of water purification solution. We have two types of water purification solution available.

INFO TREATMENT ONLY: I would like to tell you a few things about the alternative water purification solution. The solution contains the same ingredients as regular Clorin but the strength or concentration of the ingredient is higher. As you can see, the bottle is smaller than the regular Clorin bottle. The way that the alternative product kills germs is the same as regular Clorin, and it will have the same effect on the taste of the water.

[REMOVE BOTTLES FROM DISPLAY AND SHOW CUSTOMER INFORMATION ON BOTH BOTTLES: concentration, volume, use instructions]

The lid measurements are designed for the same size water containers as the regular Clorin bottle (20 liters), but since it is stronger, you should follow the measurement instructions on the bottle. The way you treat water with the alternative water purification solution is the same as regular Clorin. Mix, shake and wait for 30 minutes.

The first for sale is the regular Clorin you are accustomed to seeing in stores. We can offer that to you for 800 Kw. The second is an alternative water purification solution that is not available for purchase in Zambia but that we are offering this month only for sale to randomly selected households in your area. The product will not be available after this short term sale period. It is available for sale in other countries all the time. We can offer that to you for PRICE Kw.

STEP 4 Would you be interested in purchasing one of these two bottles of water purification solution today?
________ Yes (⇒ Go to STEP 5)
________ No (⇒ Go to STEP 7)

Reason for no purchase, if volunteered (do not prompt): ____________________

STEP 5 Would you like to buy the Clorin for K800 or the alternative water purification solution for KPRICE?
________ Clorin
________ Alternative

STEP 6 Wonderful. If you wouldn’t mind, could you sign this receipt for my supervisor? [Complete receipt and have recipient sign.]

⇒ Go to Questions