

**Donor Product-Subsidies to Increase
Consumption: Implications of Consumer
Awareness and Profit-Maximizing
Intermediaries**

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Abbreviated Abstract: Increasingly, donors that subsidize socially-desirable products in the developing world are shifting from distributing through non-commercial to commercial channels, ceding control of the product price to for-profit intermediaries. This paper advises a donor as to how the donor's loss of price control and the level of consumer awareness—defined as the fraction of the consumer population that is informed of the product's benefits— influence the donor's optimal subsidy and utility: First, in shifting to the commercial channel, the donor should increase (decrease) the subsidy when consumer awareness is low (high). Second, with the commercial channel, the donor should be prepared to increase the subsidy as awareness increases, which is contrary to her actions with a non-commercial channel. Third, contrary to the lesson obtained with non-commercial distribution, with commercial distribution the donor can be hurt by increased awareness. This occurs when awareness is moderate, and the implication is that then the donor should be wary of encouraging entities (e.g., governments, non-governmental organizations) to institute campaigns that increase the awareness of the product's benefits. The intermediary's decision of whether to target either only informed consumers or the broad market drives our results.

Extended Abstract: Donors fund subsidies to lower the price, and hence increase the purchase and use, of socially-beneficial products in the developing world. For example, malaria is estimated to cause more than 200 million illnesses and 600,000 deaths annually (World Health Organization 2013). Because the recommended drugs to treat malaria, artemisinin combination therapies (ACTs), are expensive to produce, they are unaffordable to many in sub-Saharan Africa, the region which bears the heaviest burden of malaria (Morris et al. 2014). Historically, donor efforts to lower the cost of malaria drugs have focused on non-commercial channels, such as public health systems. In recent years, donors have shifted their efforts in subsidizing recommended malaria drugs to commercial channels, because for-profit firms such as drug shops are an important source for those seeking treatment for malaria (Adeyi and Atun 2009, Morris et al. 2014). A key distinction between these two types of

channels, and a cause for concern for donors in making this transition, is that for-profit firms control the price (Arrow et al. 2004, Adeyi and Atun 2009).

Similarly, donors fund subsidies to increase the purchase and use of improved cook stoves (ICS) because they are more energy-efficient and less-polluting than traditional cook stoves. Historically, donor efforts to lower the price of ICS have focused on non-commercial channels, with distribution through non-governmental organizations or government agencies (World Bank 2010). These organizations sell the product to consumers at the fixed, reduced price dictated by the subsidy program. In recent years, donors have shifted their efforts to commercial channels (Gaul 2009, Broder 2010, World Bank 2010, Simon et al. 2014). Although donors can recommend a price to the for-profit firms that distribute the ICS, those firms control the price. For example, the World Bank (2010) documents that in a United States Agency for International Development program in Bangladesh, for-profit firms sold the ICS at a price much higher than what the Agency had recommended. See Gaul (2009) for additional examples in which donors provide price-setting ICS producers with per-unit subsidies.

A key common element in the malaria drug- and ICS-subsidy examples is the shift to distribution through commercial channels, wherein the donor gives up control over the price. A second common element is that demand for the product is influenced by both the price and consumer awareness of the product's benefits, which is often limited (see Cohen et al. 2010 and Morris et al. 2014 for ACTs, and Gaul 2009, World Bank 2010 and Mobarak et al. 2012 for ICS). Specifically, only a fraction of the population is aware of the effectiveness of the recommended malaria drugs, and only a fraction of the population is aware of the fuel-cost savings and reduced-pollution benefits of ICS.

The purpose of this paper is to advise a donor as to how the nature of the distribution channel and the level of consumer awareness influence her subsidy-design decision and utility. Specifically, we explore how the donor's loss of price control and how the awareness level—defined as the fraction of the consumer population acquainted with the product that is informed of the product's benefits—influence the donor's optimal subsidy and utility. We show how and why the donor's loss of price control *reverses* the impact of awareness on the donor's optimal subsidy and utility.

Intuitively, the donor benefits from consumers' increased awareness of the product's benefits because such awareness makes consumers more prone to purchase, increasing the sales quantity. Indeed, when the donor controls the price, she always benefits from increased awareness—due to this sales quantity effect. Our first contribution is to demonstrate when and how the presence of a price-setting intermediary reverses this result. The driver behind this reversal—and indeed all of our key results—is the intermediary's strategic market-targeting decision. As awareness increases, it becomes increasingly attractive for the price-setting intermediary to abandon the segment that is not informed of the product's benefits. Convincing the intermediary to continue to serve the broad market requires that the donor increase the subsidy. So long as awareness is not too high, it is optimal for the donor to incur this additional cost. Consequently, when the awareness is moderate, the donor's utility *decreases* in the awareness.

Our second contribution is to demonstrate how the presence of a price-setting intermediary changes the optimal subsidy, and how the subsidy is affected by the awareness level. First, accounting for the intermediary's market-targeting decision leads the donor to optimally *increase* the subsidy as awareness increases through a moderate range. This reverses the result when the donor controls the price, wherein the optimal subsidy never increases in the awareness. Second, the presence of a price-setting intermediary weakly increases the donor's subsidy if and only if awareness is sufficiently low. More precisely, when awareness is moderately low, the donor *strictly increases* the subsidy so as to persuade the intermediary to serve the broad market. As awareness increases it becomes increasingly expensive for the donor to persuade the intermediary to serve the broad market. Consequently, the donor gives up on serving the broad market more quickly when she distributes through a price-setting intermediary. Therefore, the presence of a price-setting intermediary causes the donor to *strictly decrease* the subsidy when awareness is moderately high.

The managerial contribution of these reversal results is to provide insight to donors that are shifting from distributing products through non-commercial channels to commercial channels. The results provide guidance by illuminating when lessons obtained in a setting with a non-commercial channel continue to hold and when they are reversed.