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Research Report

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Tapping into People's Impatience for Better Environmental Subsidies

This policy brief is concerned with the efficient allocation of subsidies for eco-friendly products. Examples include subsidies for cargo or e-bikes, electric cars, and energy efficient building retrofits. Inefficiencies arise when subsidies are allocated to consumers who would have bought eco-friendly products even without subsidies (inframarginal consumers). This crowds out consumers who buy eco-friendly products only when they are subsidised (marginal consumers). We show how to exploit the relative impatience of inframarginal consumers in order to increase the share of marginal consumers receiving the subsidy – thus increasing the overall efficiency of the subsidy – by lengthening the time between consumer subsidy application and subsidy receipt. We propose a uniform wait time auction which maximizes the number of marginal consumers receiving the subsidy.

POLICY RECOMMENDATIONS/KEY MESSAGES

- Environmental subsidies for cargo e-bikes, e-cars, and energy efficient building retrofits are important tools for reducing pollution, improving public health, and tackling climate change.
- Inefficiencies arise when windfall gains accrue for inframarginal consumers (i. e. consumers who would have bought the eco-friendly product even without a subsidy), thus crowding out marginal consumers (consumers who only purchase with a subsidy).
- Delaying the provision of the subsidy and the subsidised product helps to screen out impatient inframarginal consumers.
- We discuss the possibility of employing a uniform wait time auction to maximize the number of marginal consumers who receive the subsidy.

INTRODUCTION

Many environmental subsidies exist

Subsidies for the purchase of eco-friendly products are a central instrument for governments to make citizen behaviour more environmentally friendly. The objective of such subsidies is to shift investments or consumption from a less desirable area to a more desirable one.[1] Examples include KfW loans for energy efficient building retrofits or subsidies for electric vehicles.[2] Recently, many cities have started to provide subsidies for cargo bikes. Compared with other larger investments such as electric vehicles, which require additional investments such as charging infrastructure, the increased use of bikes will have an immediate impact in cities on traffic, pollution and health. Despite the large increase in the uptake of electric cargo bikes, however, they are still pricy investments. Subsidies can therefore be successful in improving the take-up rate.

Unconditional subsidies are inefficient

Typically, subsidies for eco-friendly products are available to all consumers and are not restricted by individual characteristics like income or wealth. Although these features make them politically desirable and their introduction easy, unconditional subsidies like these are inherently inefficient. The reason is that they are paid to everyone who is eligible for subsidies, including those who would buy the targeted product anyway. These consumers are known as inframarginal consumers. In general, however, it is better to subsidise consumers who would otherwise be unable or unwilling to purchase the eco-friendly product. These consumers are known as marginal consumers. Often these types of subsidies are seen as unfair because those with large incomes benefit the most (e.g. those who own a house or can afford an expensive car). This negative effect is increased when there is a limited budget for the subsidy.

Example: unconditional subsidies

Consider the following stylized example. Suppose that Kevin and Eva both wish to buy cargo bikes. Kevin can easily afford the cargo bike and will buy it no matter what, while Eva cannot afford the bike without the subsidy. Moreover, there is only enough money in the budget to subsidize either Eva or Kevin. Both efficiency and fairness suggest that the subsidy should be given to Eva. Nonetheless, an unconditional subsidy program cannot discriminate between the two applicants. That is, no matter how exactly such a subsidy is designed, in some cases Kevin will receive the subsidy instead of Eva. In this case, the same number of cargo bikes would have been adopted even without spending any money on a subsidy, as Kevin would have bought the bike anyway, and Eva would not have been able to buy the cargo bike otherwise.

SCREENING ON IMPATIENCE

Screening on impatience improves efficiency

One potential solution to the resulting inefficiency problem makes use of people's impatience (Globus-Harris, 2020). In real-world markets, there are numerous consumers with varying degrees of patience. The basic mechanism is to move the payment of the subsidy to a later date and require consumers to delay their purchase if they want to receive the subsidy, instead of making it available immediately.

The overall idea is that, while all consumers dislike having to delay purchasing a product, for inframarginal consumers, there is a tipping point. Buying the product right away without the subsidy is preferred to buying the product at some point in the future with the subsidy. Thus, a carefully designed delay will induce impatient inframarginal consumers to buy the product right away without using the subsidy. In contrast, marginal consumers will never buy the product without

1 A CO_2 price is usually seen as a more efficient solution to induce environmentally friendly behaviour. Although both subsidies and CO_2 pricing serve the same aim, the former is considered to be "carrots" and the latter "sticks." Subsidies are therefore very likely to remain a key instrument for policymakers. In this policy brief, we suggest an improvement to unconditional subsidies in case other measures are not feasible or desirable. Please see also the opinion piece by Achim Wambach on this topic: https://www.zew.de/AM8580-1

2 Similar subsidies are also used to achieve ends in other sectors not related to the environment. Examples include wage subsidies for firms who hire unemployed workers, sales promotions in the form of discounts or allowances, or vehicle scrappage programmes.

the subsidy, meaning that they are, in a sense, infinitely patient. The delay increases the overall adoption of the environmental product by changing who will end up receiving the subsidy. At least some inframarginal consumers will prefer to buy the product without the subsidy right away and more marginal consumers will end up with a subsidy, leading to a higher adoption of the product overall.

Example: Screening with impatient inframarginal consumers

Recall that under the unconditional subsidy, either Kevin or Eva gets the subsidy. In particular, we cannot rule out the undesired outcome where Kevin gets the subsidy and Eva does not get to buy the cargo bike. By contrast, a system that induces a delay between application for and use of the subsidy can achieve a more efficient outcome. In particular, with a sufficiently long delay, Kevin will always buy the bike directly without applying for a subsidy, ensuring that Eva will receive the subsidy. In this case, the efficient outcome of both Eva and Kevin switching to a cargo bike is achieved.

Clearly, the main challenge is to choose appropriate wait times. One the one hand, delays should be long enough to screen different consumer types. On the other hand, very long delays may be impractical. Choosing precise wait times requires knowledge on consumer population, which oftentimes is infeasible.

UNIFORM WAIT TIME AUCTION

Uniform wait time auction

We propose a uniform wait time auction which induces consumers to reveal their level of patience and, at the same time, maximizes the number of marginal consumers receiving the subsidy. Consumers bid with the longest time they are willing to wait for purchasing the product and thus the subsidy. After a certain deadline (see also Hakimov et al. (2021)), the bids are collected and the subsidy is awarded to the most patient consumers until the budget is used up. The amount of time they have to wait to both purchase the product and receive the subsidy, is determined by the most patient consumer who does not receive the subsidy. In such an auction, consumers are better off if they truthfully report their maximum willingness to wait.

While this delays the payment of the subsidy, it also ensures that the number of marginal consumers receiving the subsidy is maximized. That is, as marginal consumers are willing to wait longer than inframarginal consumers (after all, they would not buy the product without the subsidy), they will submit higher wait time bids and will thus be subsidized first. In the example above, Eva would outbid Kevin and receive the subsidy, although at a delay equal to Kevin's bid. Note that, as long as Kevin is not extremely patient, waiting a few months for receiving the subsidy is both in the best interest of Eva and the issuers of the subsidy.

Compared to a fixed time delay, which is relatively straightforward to implement but requires more details on consumers to make an optimal choice on the delay time, the uniform wait time auction directly reveals the optimal wait time, albeit at the cost of a more complex procedure.

Importantly, in case long wait times are a concern, a maximum wait time could be set in the auction (say, half a year). Here, the outcome of the proposed auction will still be weakly better than just fixing a wait time upfront.

IMPLEMENTING A DELAYED SUBSIDY

Screening on impatience does not lead to higher costs

Implementing subsidies with a delay does not require any knowledge about consumers. It simply needs to be ensured that applicants only receive the subsidy if they delay their purchase so that additional bureaucratic costs are not accrued in obtaining information about consumers. Such a subsidy scheme is powerful in the sense that consumers self-select whether they wish to receive a subsidy and, likewise, nobody is actively excluded from the programme. Further, it ensures that the budget is used more efficiently and distributed more fairly.

At first glance, such subsidies might seem counterintuitive. After all, apart from increasing the overall adoption of the targeted eco-friendly product, encouraging a fast adoption will often be another important goal of subsidies.

However, there are several reasons to expect that a fast adoption is not compromised in wait time auctions. First, as the wait time increases, more and more consumers will choose to buy the product right away without the subsidy. Therefore, long wait times can lead to comparable levels of early adopted products (first by infra-marginal consumers) as would an unconditional subsidy without any time delay requirements. Second, a uniform wait time auction will select the lowest wait time that ensures the maximal number of marginal consumers get the subsidy. Finally, behavioural factors give reason to believe that the wait time required to ensure that the maximum number of marginal consumers receive the subsidy should be within reasonable bounds. If, for example, consumers are “present biased”, i. e. they overvalue the present, the resulting optimal wait time will be shorter than when consumers are fully rational (see De Groote and Verboven, 2019).

Mechanisms to implement delays in practice

There are several mechanisms in place that allow for screening on impatience and that can either be used as an alternative or in combination with a uniform wait time auction.

- Wait lists: Wait lists have already been introduced by some cities for applicants that could not receive the subsidy due to, say, a yearly budget limit. However, being on a waiting list often only means that one is reminded as soon as subsidies are available again. Providing actual priorities to those on waiting lists is one way to screen on impatience because applicants have to wait for the next round of subsidies, which typically occur the following year.
- Shifting budgets: Wait lists can be further improved as a screening device if the available budget is shifted from the beginning of the year to the end of the year or spread out across the year. If fewer subsidies are available in the beginning of the year, more applicants end up on a waiting lists. This results in increased waiting times and impatient inframarginal consumers who buy the product immediately.
- Staggered pay-off mechanism: Offering a small early subsidy and rewarding patient applicants with a larger late subsidy. This will also lower wait times when a uniform wait time auction is used.

While screening on impatience will generally increase the adoption of the eco-friendly products in comparison with unconditional subsidies, overall, the benefit of screening on impatience will depend on the product type and the exact implementation of the subsidy. Introducing such a subsidy should, therefore, be accompanied by a rigorous analysis of its effects on consumer demand.

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