THE CONFLICTING EFFECTS OF SUBSIDIES: ARE THEY ALWAYS BENEFICIAL?

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Introduction

Monetary benefits such as subsidies designed to encourage certain behavior often work as one would expect, which is to increase the occurrence of the behavior. However, changing incentives can also have unanticipated consequences and instead reduce that behavior. A prominent example of this would be in blood donations. Claudia Niza tested her hypothesis that there is not sufficient evidence to prove monetary benefits increase blood donations. She found in her experiment that there was not enough evidence to sufficiently say that subsidies increase the behavior, instead it showed to have a negative effect. A majority of participants in favor of the monetary subsidy were those who were not blood donors, and the majority of donors were in favor of non-monetary reward (Niza 2013).

This paper examines the effects of subsides on pro-social behaviors, meaning behaviors that benefit others. The goal of this research is to present the effects of subsidies on ECU undergraduate students' choice of pro-social activities in an economics lab experiment setting. This will allow us to compare the cost-effectiveness and efficiency of a range of subsidies. Our research will use the data of which activities local students in an economics lab experiment. In our research and previous cases, it is shown that often times subsidies lead to no additional benefits due to participants switching from one beneficial or pro-social practice to a newly subsidized one. The crowding out effect of intrinsic value also leads to subsides having lower effectiveness. Subsidies also face the risk of granting incentives to an activity that a participant would participate in regardless. To achieve our goal, we will measure the crowding out of intrinsic value effect.

Background

One of the primary factors leading to a decrease in a subsidy's effectiveness is the crowding out of intrinsic value. In a 2002 study by Bruno S. Frey, and Reto Jegen, "Motivation Crowding Theory", this effect was called the "hidden cost of reward". The author's theory states that external intervention from monetary rewards or punishments undermine the intrinsic motivation to participate in a behavior and may diminish that activity. Typically, when using a monetary incentive, the participation in the activity follows the supply curve. As the reward is increased the behavior should also increase, but due to crowding out of intrinsic value this is not always the case. Once the incentive has increase to where all intrinsic value has been crowded out, the supply of this behavior will directly follow the supply curve as you increase the incentive the activity will also increase (Frey and Jegen 2002). However, this is not cost effective as once intrinsic value is removed the cost of increasing participation via monetary incentives is high. The study then presents two examples of incentives crowding out intrinsic motivation. In example one, the authors present the scenario of once a child receives a monetary incentive for a chore such as mowing the lawn, he will expect a reward each time a chore is performed, or the child will not do chore without pay. The second example presents a scenario of a musical instructor presenting gold stars for time practiced, once introduced the students no longer strive to learn new pieces instead the students would practice previous pieces to gain a gold star. In conclusion, if an activity has intrinsic motivation, external incentives have been shown to have adverse effects.

The study, "Economic Incentives and Social Preferences: Substitutes or Complements?" by Samuel Bowles and Sandra Polanínia-Reyes, supports the theory of incentives crowding out intrinsic value. The authors state that intrinsic value often motivates people more than an incentive would be due to the claim that incentives crowd out social preferences. Often the

presence of an incentive creates more adverse effects than benefits. The incentive may change a participant's belief about an action removing the intrinsic motivation. To support this the authors, present the case of a Norwegian hospital. The hospital introduced fines for length of stay in an attempt to reduce these stays. Once introduced the opposite effect was actually observed. With the fine the intrinsic motivation was removed and now the patients felt they were paying for their stay, so the average patients stay lengthened. Another case they observed was regarding firemen's sick days. Once the sick days changed from the previous unlimited, to 16 per year, the amount that called in sick increased tenfold (Economic incentives). Once the perception of sick days was changed, the firemen decided that they felt as if they had to use all 16. This led to many calling in sick around the holidays. In conclusion, when incentives are introduced the participants are focused on maximizing their payoff and non-economic motives will be crowded out.

Another issue with subsidies is the additionality of the subsidy. In some situations, subsidies have not led to net gains in participation. The study "Spillovers from targeting of incentives: Exploring responses to being excluded" by Francisco Alpízar, Anna Nordén, Alexander Pfaff, and Juan Robalino, examines the behavior of the group that is excluded from a subsidy. In this study, an experiment was designed to measure the participation of a group that was excluded from the subsidy. This study indicated that once a group is excluded from a subsidy, they are less likely to participate in the pro-social behaviors. The participants were shown to be less likely to participate than before the incentive was introduced. Due to the group excluded from the subsidy's decline in participation the overall increase in participation was greatly reduced. This experiment also presented evidence to suggest monetary incentives did not increase the behavior in the already high contributing portion. This situation can indicate cost

ineffectiveness of a subsidy. In conclusion, in measuring the effect of a subsidy, the effect on those who are excluded and those who are already high participation must be considered.

Next the study, "Additionality: The Next Step For Ecosystem Service Markets" by Karen Bennet proposes a few issues with monetary incentives such as subsidies. This research expands upon a few of the additionality issues. One issue they present is the issue companies offsetting their pollution levels by purchasing credits from companies over-complying to regulations. In this scenario, no additional benefit is made and the subsidy goals have likely not been met. This research then mentions another issue with monetary incentives. The authors mention the issue of incentives paying for a behavior that would have already been produced. If a participant would have performed the activity regardless of the incentive, then there is not an additional benefit and the incentive is cost inefficient. The goal of a monetary incentive should be to incentivize switching from a non-beneficial practice to a pro-social behavior, instead of either incentivizing those who are already participating in the behavior or incentivizing participants to switch from an unsubsidized pro-social behavior to the newly incentivized one. In conclusion, change in overall participation from when no incentive is present to when an incentive is present must be monitored and examined when evaluating the effects and efficiency of this incentive.

The studies above present numerous reasons as to why incentives sometimes fail or have adverse effects. The reasons presented above indicate the importance of intrinsic motivation in a behavior, and the importance of measuring net effects from changing from no incentive to an incentive.

Purpose of study

The purpose of our study is to measure the crowding out effect of intrinsic value on our subjects. With the data gathered from Dr. Howard's previous research, we will be able to see

under what conditions do subsidies increase overall participation in our pro-social behaviors. We hypothesize that crowding out will be most pronounced when multiple pro-social actions are mutually exclusive. Crowding out will be less pronounced when they are mutually inclusive, meaning multiple pro-social behaviors can be selected in combination. This should maximize participation as the participation rates for our unsubsidized pro-social behavior should remain high.

Next, we will compare participation rates when no subsidy is present to our subsidized scenarios to analyze the effect of subsidies on each technologies participation. Next, we will analyze these results only in our mutually inclusive rounds and compare them to our previous results to analyze if our hypothesis of the crowding out of intrinsic value effect will not be shown.

Methodology

In our experiment the data was collected through an economics lab experiment during 12 sessions occurring between February 2015 and February 2016. Each session consists of 21 rounds of choices for the participant. In these sessions, 25 participants are divided into groups of five for runoff purposes in the experiment.

Our experiment is designed to measure the participation rates for each activity based off of which subsidy is present. During each round subjects are presented with the choice of which technology to choose to participate in. The three technologies presented are as follows

Tech 1 (Selfish),

Tech 2 (BMPLow)

Tech 3 (BMPHigh)

In this experiment the students are presented with a payoff formula of:

Payoff = Yield – Total Group Runoff

At the end of each session, they would receive a payoff based on the result of this formula. Following is the values associated with each technology's payoff formula:

Tech 1: Yield=150, Individual runoff =20

Tech 2 (BMPLow): Yield=130, Individual runoff =10

Tech 3 (BMPHigh): Yield = 110, Individual runoff = 0

As seen above Tech 2 and Tech 3 are the pro-social behaviors as they are the runoff reducing behavior with BMPlow reducing half of the runoff and having a lower individual yield from tech 1 and BMPHigh having no runoff but the lowest individual yield. This presents the public goods issue where our participants are incentivized to pick the technology with the highest individual payoff but largest negative consequence in this case runoff. If all of our participants were to choose technology 1 it would maximize their own payments but the total benefits to their group would decrease as their payoff is based on the summation of the group runoff. Conversely, choosing either of the BMPs reduces individual payment relative to technology 1 but increases total payments to the group.

To offset the incentive of choosing Tech one, subsidies are introduced in some rounds of the experiment to further incentivize our run-off reducing behavior. We introduced a full and half subsidy for each pro-social behavior. Once subsidies are introduced their payoff formula is now as follows:

Payoff = Yield + Subsidy – Total Group Runoff

The subsidies values are as follows

Half subsidy BMPLow: 5

Half Subsidy BMPHigh: 10

Full Subsidy BMPLow: 10

Full Subsidy BMPHigh: 20

These subsidy values are designed so that a half subsidy will make up for half the loss in payoff caused by choosing a pro-social technology and a full subsidy will make up for the full loss in payoff.

The choices and scenarios presented vary based on the round and session. In session's 7-12 (mutually inclusive example) our participants now have the option of choosing both pro-social behaviors. In the rest of our sessions, they can only choose one technology. The subsidies also vary based on the round. Each round would consist of a multiple baseline rounds with no subsidy. Then subsidies, varied based on the round. After the baseline of round one the subsidy would vary the rest of the rounds changing every four rounds.

With the experiment design we have 21 choices from each individual in a 25-participant group. This provides 525 results per session, and with our 12 sessions we have a sample size of 6,300. Participants responses are recorded and entered into the data application Stata. Using this application, we gather a raw count for each time a pro social behavior was chosen in each scenario. With this raw count we can compare it to the total times that behavior was an option in each scenario to develop a participation percentage.

After finding our participation rates, we can test our hypotheses that full subsidies will provide the largest increase in participation, and the crowding out effect of intrinsic value will not be shown (or at least be less pronounced) in the mutually inclusive rounds. To test these, we will run T-test to compare the participation rates of each behavior when a subsidy is present compared to the participation when no subsidy is present. Each T-test will provide us with a resulting P-value to measure if the results are statistically significant. Our participation

percentages, T-score, and P-value will give us an indication of the conditions that cause our participation to be maximized and if the crowding out of intrinsic value effect is shown.

Results

Table 1: Subsidy vs Participation Round 1-21

Panel A of Table 1 represents the number of times an activity was participated in given which form of subsidy was presented. Panel B shows the percentage that this activity was chosen for each scenario, T-score given by testing the null hypothesis that the percentage in a cell is equal to the percentage when no subsidy is present. Essentially the T-test is testing the hypothesis that the subsidy had no effect in the selection of the selected technology. Regarding the percentages, one important note is that they will not total 100% as our activities are not mutually exclusive.

As presented in table 1, we can observe that as a subsidy is applied the enrollment for the behavior is increased. Inversely participation in the unsubsidized behavior declines. The half subsides have shown to have a much weaker effect. The percent increase for the BMPlow participation given that there was a half subsidy for BMPlow was 16.59 percentage points., while the participation in BMPhigh given this subsidy declined 11.26 percentage points. A half Subsidy for BMPlow resulted in a net increase in prosocial behavior of only 5.33 percentage points.

Reviewing the results of the full subsidy of BMPlow, we can observe that a BMPlow participation improved drastically. In this scenario, participation for BMP low rose 31.05 percentage points, and BMPhigh declined 17.9 percentage points. This results in a net increase in prosocial behavior of 13.15 percentage points.

In the scenario where a half subsidy BMPhigh was introduced the results were similar. The subsidized behavior (BMPhigh) increased participation by 15.17 percentage points. while the unsubsidized prosocial behavior fell 3.09 percentage points, resulting in a gain of total participation of 12.08 percentage points.

Again, once we introduce a full subsidy the participation increases drastically. With the full subsidy, the participation in BMPhigh now rose 22.51 percentage points with the participation in BMPlow only falling 4.2 percentage points. This scenario provided the largest total gain in participation in prosocial behaviors with 18.31 percentage points.

In the data subsidizing BMPhigh resulted in a larger participation rate than the same subsidy applied to BMPlow. In conclusion, like our hypothesis, the subsidized behavior increased while the unsubsidized prosocial behavior would have a slight decline. Assuming these two behaviors have the same prosocial impact, subsidizing BMPhigh would yield the best results.

Table 2: Mutually inclusive example results

Table 2 was formed by analyzing only the mutually inclusive sample (sessions 7-12). In this scenario we can observe that the effects were similar except participation in the unsubsidized behavior did not drastically decline.

When presented with a half subsidy for BMPlow the participation in that activity rose 13.67 percentage points, while BMPhigh participation only fell by 3.76 percentage points. In the case for BMPhigh the P value was not statistically significant so we cannot reject the hypothesis that the means differ between participation and not participating in this activity. This subsidy led to an increase of 9.91 percentage points of total participation.

Once presented with a full subsidy for BMPlow we can observe similar results. This time the participation in BMPlow rose more drastically by 23.67 percentage points. while BMPhigh only fell 8.67 percentage points. Again, the P value for BMPhigh was not statistically significant so we cannot reject that the means differ. The total participation rose 15 percentage points.

The half subsidy for BMPhigh had more interesting results. Participation in BMPhigh rose 18.75 percentage points while BMPlow actually also rose 1.55 percentage points. Total participation rose 20.3 percentage points.

When presented with the full subsidy for BMPhigh the participation in that activity rose 19.93 percentage points while BMPlow only declined 0.52 percentage points. The total gain in participation was 19.41 percentage points.

In the mutually exclusive sample, we can observe that participants were much more willing to participate in the unsubsidized prosocial behavior. The optimal subsidy in this scenario is the BMPhigh as it leads to the largest gain in total participation.

Conclusions

Using the data above, conclusions can be drawn about our hypotheses. We can observe the effects our incentives have on participants. When presented with an incentive the participation in that behavior increases while the participation in other technology options decrease. This represents a valuable gain when the "other technology" is technology 1, but represents crowding out when participation decreases in the other prosocial technology. The larger the subsidy value the more the participation increased as it would maximize a participant's payout. Once the participants are given the option to choose both runoff reducing technologies the participation for the unsubsidized pro-social behavior declines less. This indicates the crowding out effect of intrinsic value effect is not shown in our mutually inclusive example.

Since the participants can still choose the pro-social behavior without incentives there is still intrinsic motivation for the behavior. In conclusion, a mutually inclusive scenario increases our participation while minimizing the adverse effects of incentives.

Table 1: Subsidy vs Participation Round 1-21

	No subsidy	Half subsidy of BMPlow	Full subsidy of BMPlow	Half subsidy of BMPhigh	Full subsidy of BMPhigh
Panel A: Raw Counts					
BMPlow Participation	550	575	745	278	366
BMPHigh Participation	653	319	241	509	792
Neither Participated in	698	435	327	305	335
Total times	1700	1175	1175	950	1300
Panel B: Percentages					
BMPlow Participation	32.35%	48.94% [-5.6370] ***<0.001	63.40% [-13.5929] ***<0.001	29.26% [4.7493] ***>0.001	28.15% [5.9110] ***>0.001
BMPHigh Participation	38.41%	27.15% [2.9905] ***0.0028	20.51% [7.0475] ***<0.001	53.58% [-10.9324] ***<0.001	60.92% [-16.2636] ***<0.001
Neither Participated in	41.06%	37.02% [2.1790] ***0.0294	27.83% [4.5735] ***<0.001	32.11% [7.3457] ***<0.001	25.77% [8.8440] ***<0.001

Notes: T-scores presented in brackets. *, **, and *** indicate statistical significance at the 90, 95, and 99% level respectively.

Table 2: Mutually inclusive example

	No subsidy	Half subsidy of BMPlow	Full subsidy of BMPlow	Half subsidy of BMPhigh	Full subsidy of BMPhigh
Panel A: Raw Counts					
BMPlow Participation	405	316	371	204	292
BMPHigh Participation	361	194	167	260	398
Neither Participated in	360	194	150	128	178
Total times	925	550	550	450	675
Panel B: Percentages					
BMPlow Participation	43.78%	57.45% [-7.9453] ***<0.001	67.45% [-12.2754] ***<0.001	45.33% [-2.6698] ***.0076	43.26% [-2.1782] ***0.0295
BMPHigh Participation	39.03%	35.27% [-1.2651] 0.2060	30.36% [0.8701] ***0.3844	57.78% [-10.1260] ***<0.001	58.96% [-12.3142] ***<0.001
Neither Participated in	38.92%	35.27% [2.1790] ***0.0294	27.27% [4.5735] ***<0.001	28.44% [7.3457] ***<0.001	26.37% [8.8440] ***<0.001

Notes: T-scores presented in brackets. *, **, and *** indicate statistical significance at the 90, 95, and 99% level respectively.

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