The Relationship between Monetary Incentives, Status, and Physical Activity

Working Draft

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Abstract

Introduction

We conduct a field experiment to better understand the role of status and monetary incentives as motivation to increase physical activity.

Methods

We conducted a field experiment over three days with college students and staff members from a large university. We distributed pedometer watches and randomly assigned ‘status’ based on relative physical activity, and monetary incentives. We observed physical activity using pedometers to measure daily step counts.

Results

We find that status alone does not induce a change in physical activity. When status is combined with monetary incentives, however, we find a change in the number of daily steps. This effect is heterogeneous. On average, individuals who were assigned low status due to low step count walked 11345 steps and those who were assigned high status for their high step count walked 20273 steps. Individuals assigned to the low status increase the number of steps by 12% (1375 steps), while those with who earned a high status for their high physical activity decrease the number of steps by 25% (5202 steps). An income treatment with exogenous status—uncorrelated with physical activity— provides robustness to our findings and, together with the control treatment, rules out potential experimenter demand effects and other factors driving these early associations.

Conclusions

Our results call for a cautionary approach for analyzing the role of status, in many cases unobserved, for physical activity intervention programs.

1 Introduction

Insufficient physical activity is recognized as one of the contributing factors for various health risks --- mortality and morbidity. Albeit increased cardiorespiratory fitness can reduce health related risks, in the United States, for example, only 23% of adults meet the federal physical activity guidelines for aerobic and muscle-strengthening activity.[1, 2, 3, 4, 5]People are more sedentary today, likely due to structural changes in their living and working environments, particularly for particular socioeconomic status.[6] Previous studies document that socioeconomic status affects the physical activity.[7, 8, 9, 10] For instance, the intensity of physical activity increases with higher income level, which also applies to adolescents.[8, 9, 10] Giles-Corti and Donovan (2002) comment that low socioeconomic status groups perceive walking sidewalks or shopping as physical activities or perceive their neighborhoods as less attractive, resulting in higher physical inactivity.[11] Additionally, the perceived neighborhood safety in low socioeconomic status areas impedes physical activity for the elders.[12]

The influence of status on human behavior in purchasing goods and services has been well documented.[13, 14, 15, 16,] One of the key components of status is that a desirable status has to be visible to others. People infer the value of person, status, from luxury goods which implies scarcity. Thus, status itself involves the respectfulness from others.[17] In this regard, social media provide potential channels to showcase a desirable physical activity status with an increasing number of media posts related to physical activity.[18] Few studies explore the social effects such as, receiving feedback about their activity or gamification physical activity as a group with financial incentive have been explored as a vehicle to increase physical activity.[19, 20]Prior studies explore the influence of status on physical activity and any potential drivers for physical inactivity among low socioeconomic status area.[7, 8, 9, 10, 11, 12] However, it is unclear how status may affect the most

vulnerable populations, though some studies have explored the effect of incentives on individuals with poor health.[21, 22, 23]

In this study, we contribute to two different strands of literature related to physical activity intervention programs: non-financial and financially incentivized programs. Non-financial programs for physical activity include providing health-related education, reminders to exercise, e-health interventions via electronic platforms and devices, the use of mobile trackers or pedometers, and classroom-based physical activity.[24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39]Other non-financial incentives used to promote physical activity have been through social comparison and peer effects. In previous literature, scholars have found that effects from peers and status recognition have a positive effect on physical activity.[19, 40, 41, 53, 54, 55]

Meanwhile, an emerging literature assesses the effects of financial commitment devices on physical activity in field experiments.[42, 43, 44] Several studies found that providing monetary incentives increases the number of visits to the gym.[45, 46, 47, 48, 49, 50, 51, 52] However, a few studies also found that the highest attendance rate is observed when the incentive is consistently provided.[45, 56]

The effect of financial commitment interventions on physical activity varies by individual characteristics, particularly by the level of physical activity. For example, the largest increase in gym attendance during the incentive periods is mainly contributed by participants who do not regularly attend the gym.[46, 56] The attendance rate also increases with financial incentives for those who regularly visit the gym; however, the magnitude is smaller than for those who do not regularly go to the gym.[46, 56] Some concerns about crowding out intrinsic motivation by utilizing extrinsic

rewards have been raised in previous psychology and economics studies.[57, 58, 59, 60, 61. 62, 63] For instance, higher financial incentives for healthy behavior may reduce enjoyment in physical activity and pursuing healthy diets.[64] In that sense, the highly active group experiences less enjoyment or interest in exercising when monetary payments are implemented. A potential explanation based on expected utility theory might be that highly active individuals may derive utility from receiving monetary payments and they need less physical activity to achieve the same level of utility. In this regard, we explore the heterogeneous effect of incentives and status for low-activity and high-activity individuals.

Overall, previous interventions showed modest increases in physical activity, particularly for low-activity individuals. To our knowledge, little is known about the mechanism in heterogeneous effects in physical activity level for low- and high-activity groups related to status and monetary incentives. The question of whether intervention programs affect the level of physical activity of highly active individuals is important to evaluate any potential unintended effects of these interventions.

In this article, we implement a randomized controlled trial to evaluate the effects of status and monetary incentives on physical activity. The main objective of this study is to explore whether status and monetary incentives may differentially incentivize or erode the motivation of highly active versus low-activity individuals. We assign a high or low status based on relative physical activity in the group. Our study utilizes status, which reflects low- and high-activity groups, with exogenously assigned payments to explore the role of status. We find that designing physical activity intervention programs should require consideration for those who are already physically active.

2 Methods

2.1 Sample characteristics

We recruited 313 participants from the pool of students (undergraduate and graduate) and staff members on campus at a large university between September 2019 and March 2020[1]. Of those, 284 completed all three visits[2]. Our sample characteristics, balance test results, and distribution of treatments can be found in tables A1-A4 in the appendix. Subjects agreed to participate in a three-consecutive-day experiment, approved by the university's Institutional Review Board. Participants were asked to attend all three days at the same session time.

2.2 Experimental Treatments

All participants first received the same informational session where pedometers were distributed[3]. The first period (Period 1) provides a baseline for the number of steps without any intervention. Then, participants were randomly assigned to one of four conditions at the session level. The conditions determined how status was assigned, as well as how this information affected subjects' payments. We created an environment where we assigned status based on the step count relative to the step count of others in the same session. The number of steps was measured again in Period 2 to identify the effects of the treatments relative to the baseline[4].

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[1] All data was collected before the local COVID-19 lockdown mandates

[2] 313 people started the experiment; however, only 284 completed all three visits. A power calculation estimates about 55 participants based on (Hajat et al. 2019) to observe an effect of 80% power.

[3] Pedometer distributed was Fanmis unisex pedometer watch military multifunctional 50M waterproof digital outdoor sports watch, chosen primarily for a waterproof pedometer wrist worn device that does not provide walking reminders to avoid priming our participants.

[4] This article is part of a larger study that also measured the correlation between physical activity and food purchases. Physical activity and food purchases were recorded again in day 3, but they are not relevant to our research question. The additional measures occurred after the completion of our experimental conditions so it does not affect our results.

In the "Control-No Status" condition, no status was assigned to any participant, and all participants earned $10. In the "Status Fixed Payment" treatment, status was assigned based on the number of steps during Period 1; that is, when the step count information was collected, the monitors split the group in half. The group with a higher step count (relative to the median) was assigned "High" status and the other half was assigned "Low" status. Participants were then asked to move to one side of the room that corresponded to their earned status. Regardless of status, participants in this treatment earned $10. In the "Status with Monetary Incentives" treatment, status was assigned based on the number of steps as in the Status Fixed Payment treatment, but each status was paid differentially, such that those in the High status and in the Low status received $15 and $10, respectively. Finally, in the "Income with Exogenous Status" treatment, participants completed a 5-minute, 10-question general knowledge quiz after their step data had been collected. After they completed the quiz, the monitors graded the quiz and assigned "High" status to those who ranked in the top half and Low status to those who ranked in the lower half. This treatment is implemented to rule out the possibility that subjects changed their behavior based on a setting where status was not connected to their physical activity or the monetary incentive, hence measuring any potential experimenter demand effects. Similar to the other two treatments, participants were asked to sit with their corresponding status group and were paid by status.

2.3 Timeline

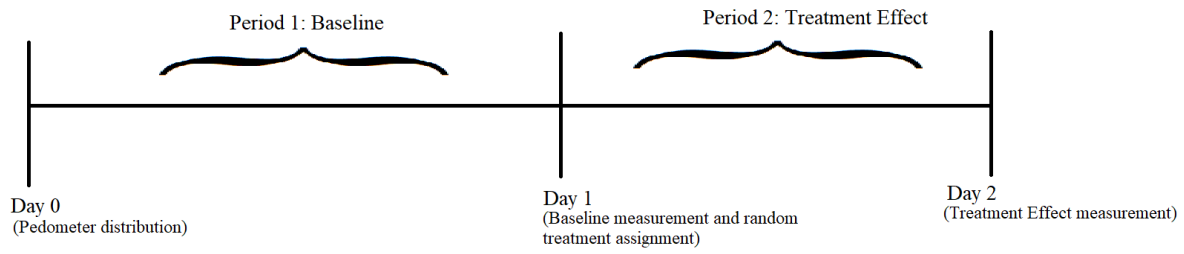

Figure 1: Experimental Timeline

The procedure consisted of Day 0 (Set Up), Day 1 (Baseline Measurement and Random Assignment), and Day 2 (Treatment Effect Measurement). Day 0 was the informational session. Participants were given instructions and pedometers. They were told they would be required to participate in all three days to receive full payment and would be required to wear their pedometers for the duration of the experiment. Participants received a compensation of $10 per visit ($30 for all three visits) plus any additional earnings according to their assigned treatment and status. The instructions were read to participants by one of the monitors. Once the instructions were read, and questions were answered, the monitors handed out the pedometers. Each participant was then asked to place the pedometers on their wrist, after which the monitors attached a uniquely numbered zip tie, ensuring that the pedometer could not be easily removed, and that removal would be easily identified by the unique zip tie number. Once the pedometer was attached to the participant, the monitors cleared the pedometer to ensure the total step count was reset to zero and that the step function was turned on. After all the participants had their pedometer and zip tie attached, they were dismissed until the next day.

When the participants returned for Day 1, the monitors checked the step count of each participant, which served as the baseline step count. The monitors used a covered clipboard to record the cumulative step count of every participant, associating data through the unique zip tie number. Monitors first cut off the zip tie and requested that the participant remove the pedometer. Once the baseline step count was collected for each participant, a status was assigned based on their randomly assigned treatment and the additional payment for each status was announced. Specifically, the monitors split the room for “high” status and “low” status by writing these labels on the white board and instructed that the participants move to their corresponding status level

once their status level was announced with their zip tie number. The participants observed each other as the zip tie number and status were announced. Participants had no prior knowledge that a status would be assigned, nor how it would be assigned, until this point in the study. Participants earned additional money according to the treatment and status assigned, as well as their daily participation fee. At the end of the sessions, participants placed the pedometers back on their wrist and were zip tied with a new, uniquely identified zip tie. The pedometers were also set to zero at this time by the session monitors.

Day 2 proceeded much the same as Day 1 for collecting the number of steps for the treatment (Period 2). The step data collected in Period 2 served as the treatment effect on physical activity behavior from the randomly assigned treatment in Day 1. Participants received their daily participation fee plus any additional earnings. They were informed that they could keep the pedometer and were dismissed. For the 3-day period, the average compensation was approximately $50 plus the pedometer watch.

2.4 Statistical Analysis

Our statistical analysis was conducted using Stata version 17.0. We conducted a power analysis to determine our sample size, an orthogonality test to check the balance of our sample, *t*-tests for the results reported in the next section, a multiple hypothesis test, as well as linear regressions.

We had 313 participants start the study. Of those, 284 completed all three visits. The ones who did not complete the study either did not show up for the following days for unknown reasons or removed their ziptie which disqualified them to continue the study. We only included the 284 participants who completed the study in our analyses.

We used *t*-tests to compare the behavior of the treatment groups. Specifically, we analyzed whether the group changed their step behavior from the baseline behavior to the treated behavior. We also looked at behavior across groups, that is, whether the change in steps was significantly different across groups.

We conducted a linear regression to explore the change in steps between Periods 1 and 2, as reflected in Table 1. Our outcome variable was change in steps and we regress it on status by treatment. The first specification in Table 1 includes no controls, while specifications 2 and 3 include the sociodemographic controls of gender, age, year in school, household size, and race. Specification 3 also includes a control for income. Our regression equation (1) is

$$\Delta Y = B_F * A_H + B_M * A_H + B_E * A_H + \sum_{i=3}^{K} \gamma_i * sociodemograhic\ controls + e \qquad (1)$$

where ΔY is $Y_2 - Y_1$, B_R, $R = \{F, M, E\}$ denotes an indicator variable for each treatment, and A_H is an indicator for high performance.

3 Results

For all treatments, we used the step count measured during Period 1 as a baseline. In the appendix Figure A1, we present a graph showing all the baseline measurements across the randomly assigned treatments. The randomization was successful, and we find no difference in these baseline measurements. Figure A2 features the total step count on Period 1 (baseline) and Period 2 (treatment) for the Control group. As we would expect, the total number of steps between those two days did not significantly change; we can therefore conclude that the activity trackers did not induce changes in physical activity in our experiment.[65, 66, 67, 68]

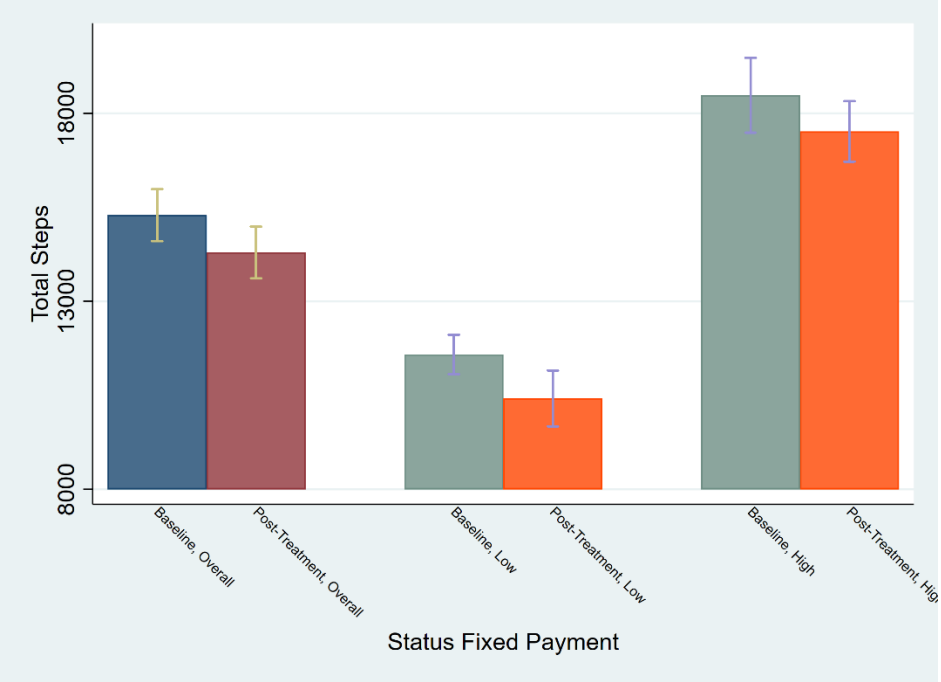

Figure 2: Change in total steps, Status Fixed Payment treatment

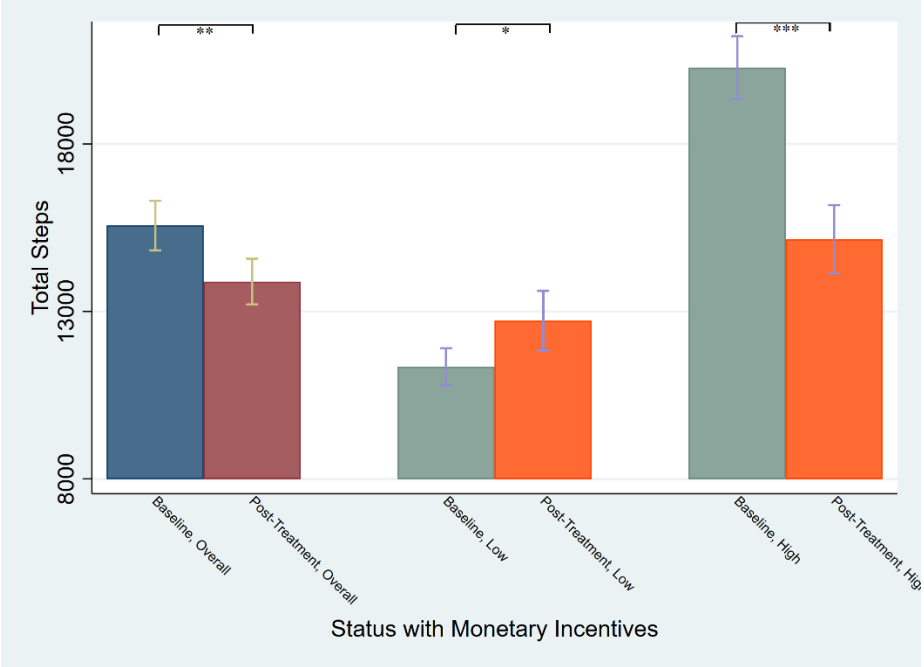

Figure 3: Change in total steps, Status with Monetary Incentives treatment

Result 1. *A status solely based on physical activity behavior does not change the number of steps.*

Figures 2 and 3 show the total step count for Period 1 and Period 2 for the Status Fixed Payment and the Status with Monetary Incentives treatments, respectively. The first two sets of bars in these graphs are the total step counts for the overall treatment, for which we observe no significant difference when status was assigned based on physical activity but carried no monetary incentives. However, when physical activity status was combined with monetary incentives, we observe an overall decrease in steps. The analysis showcases a differential effect by participants with low- and high-activity.

Result 2a. *Monetary incentives for those with low status (i.e., low physical activity) increase the number of steps.*

Result 2b. *Monetary incentives for those with high status (i.e., high physical activity) decrease the number of steps.*

When we separate the physical activity with monetary incentives treatment by the status assignment, we observe differences. Those assigned a low status in Period 1 increased their step count 12%. Conversely, those assigned a high status in Period 1 reduced their step count by 25%. Hence, the overall decrease in steps is largely driven by a reduction in the number of steps among participants with high status (and high physical activity level).

Result 3. *A status exogenous to physical activity does not change physical activity even when a monetary reward is given for the conferred status.*

In Figure A3, we present the total step count of those who were randomly assigned to the Exogenous Income Status treatment. As expected, there is no change in physical activity overall or by status assignment between Period 1 and Period 2. This result provides robustness to the main results as it helps to rule out any experimenter demand effects of using the pedometers or other factors driving the results in our study. When we break down the Exogenous Income Status treatment by the types in the group, as seen in Figure A3, the result remains the same [5].

Table A5 in the appendix reflects the results of a multiple hypothesis test, which confirm the results that the high-status group in the Monetary Incentives treatment did decrease their step count between Periods 1 and 2 but show now effect for the low-status group.[69] We further explore the effect on the change in steps between Period 1 and Period 2 through a regression, as displayed in Table 1, to include control variables. The outcome variable is change in steps, and we regress it on the status by treatment, and sociodemographic control variables. Our regression equation (1) is

$$\Delta Y = B_F * A_H + B_M * A_H + B_E * A_H + \sum_{i=3}^{K} \gamma_i * sociodemograhic\ controls + e \qquad (1)$$

where ΔY is $Y_2 - Y_1$, B_R, $R = \{F, M, E\}$ denotes an indicator variable for each treatment, and A_H is an indicator for high performance The results in Table 1 align with the unconditional results in figures 2 and 3, where we observe no effect in the Status Fixed payment treatment, the Low Status with Monetary Incentives group increases their step count by 12%, and the High Status with

[5] While no status was assigned in the Control treatment, we explored the difference in step count for high physical activity types and low physical activity types between the two periods. We observe no differences in step count. When separating the exogenous treatment between the two types, we see an increase in step count for the low physical activity type ($p < 0.01$), but not for the overall treatment.

Monetary Incentives treatment results in over a 25% decrease in the number of steps. The results for the low- and high-performance groups are robust to the inclusion of sociodemographic control variables. We can further confirm from Table 1 that the exogenous treatment has no effect on the number of steps, regardless of status assignment.

4 Discussion

We find two contrasting effects when physical activity is incentivized with status and monetary rewards. Those who are low-performers (i.e., low physical activity types) increase their step count by 12%, while those who are high performers (i.e., high physical activity types) decrease their step count by 25%. While low performers seek to attain higher status, we observe a crowding-out effect for high performers. With a study that is short-term like ours, we may expect to find a large magnitude in our effect sizes. However, we find no effect when physical activity is awarded only by status with a fixed payment or the income treatment unrelated to physical activity. The exogenous treatment provides validity to these early associations and rules out experimenter demand effects or other potential drivers for the results in the main treatments.

Our findings from the Status with Monetary Incentives treatment are consistent with those from previous literature regarding financial incentives and incentivized activity more broadly in the social economy. Specifically, previous literature shows that when monetary incentives are offered, the intrinsic motivation for physical activity is reduced.[50, 62] Our findings add to the literature by exploring the combination of status and monetary incentives in the realm of physical activity and providing evidence that for those who are highly active, their intrinsic motivation may be reduced and that this effect may be observed early in the intervention.[56] This effect may be better observed in a longer-term study to observe intrinsic motivation. Meanwhile, we find that for those with low

physical activity, the combination of status and monetary incentives increases their physical activity. Previous literature further suggests that people with low physical activity increase their activity in response to monetary incentives.[48] Status based on performance does not hinder this effect for people with low physical activity, and in fact status among peers may provide a mechanism to encourage physical activity. A simpler explanation could be that high performers learn that relative to others, they have a much higher step count and can attain the same level of status even with a much lower step count. Low physical activity individuals need to increase the number of steps to reach a higher status. This phenomenon has been documented in other domains when individuals receive ranking feedback on performance. [71, 72]

While we observed these early associations over the span of three days, we focused solely on positively framed incentives. However, we did not explore negatively framed incentives. For physical activity, scholars have looked briefly at financial disincentives; however, in order to implement these, justifications need to be strong and they will likely not encourage a positive behavioral change or, even worse, reduce motivation to exercise. [73]

4.1 Limitations

A limitation to our study is its short-term nature, however, this is an exploratory analysis. Furthermore, unobserved individual differences may affect how individuals respond to incentives; this variation may affect the observations that could be made in a short-term study. We also note the pedometer may not be of the highest quality on the market; however, we mostly used it to measure relative performance. Our study provides some foundation that may prove useful for a longer-term study. We also note that the incentives may be different from what an employee wellness program may offer. Future work could explore different incentive structures in the form of nudges provided in phone apps that might also interact with status in different

contexts. For example, successful nudges could implement procedures where subjects can showcase their goal-achievement progress across social media outlets. Studies of this nature can measure the impact on the overall population and on different subgroups of individuals with varying levels of susceptibility to status.

5 Conclusions

Our early association results call for a cautionary approach to the role of status in physical activity intervention programs. For example, over two thirds of worksites in the United States offer employees a workplace wellness program and England's government implemented a pilot to motivate exercise using financial incentives. [74] In addition, various interventions in which people earn money for partaking in exercise activities (i.e., Achievement app, Lympo app, or Sweatcoin), bet on the achievement of activity goals (i.e., StepBet app), or earn money that is donated to charities (i.e., Charity Miles and PK Rewards), have been introduced. Status in field experiments may be a source of unobserved treatment variation that may need to be further studied and quantified.

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Tables

Table 1: Regressions on change in steps, Social Status Treatments

	(1)	(2)	(3)
Fixed Payment, Low	-1218.6	-376.3	-450.3
	(1230.4)	(1625.9)	(1856.4)
Fixed Payment, High	-771.1	-125.9	-424.1
	(772.1)	(1252.4)	(1424.8)
Monetary Incentives, Low	**1566.6****	**2524.1****	**2530.7****
	(671.1)	**(832.3)**	**(916.9)**
Monetary Incentives, High	**-5011.8***	**-4460.3****	**-4892.8****
	(2497.4)	**(1972.8)**	**(2004.5)**
Exogenous, Low	659.6	1474.0	1280.8
	(1270.1)	(1590.9)	(1841.9)
Exogenous, High	805.2	1014.5	979.8
	(1145.7)	(1141.5)	(1295.6)
Constant	-191.1	4167.4	4762.0
	(428.4)	(3556.8)	(3835.8)
Controls?	No	Yes	Yes
N	284	265	230
*R*2	0.111	0.176	0.2095

Standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, **** $p < 0.01$

Note: Specification (1) includes no controls while specifications (2) and (3) include them. Specification (2) does not include the high-income dummy variable as a control since approximately 15% of the sample opted to not disclose their income level; however, the magnitude and significance levels between specification (2) and (3) reflect similar results.