‘Incentives to Persevere’

Elif Incekara-Hafalir ¹
Grace HY Lee ²
Audrey KL Siah ²
Erte Xiao ³

¹ University of Technology Sydney
² Monash University (Malaysia)
³ Monash University
Incentives to Persevere

Elif Incekara-Hafalir  
University of Technology Sydney  
elif.incekarahafalir@uts.edu.au

Grace HY Lee  
Monash University (Malaysia)  
grace.lee@monash.edu

Audrey KL Siah  
Monash University (Malaysia)  
audrey.siah@monash.edu

Erte Xiao*  
Monash University  
erte.xiao@monash.edu

Abstract
Achieving success often requires persistent efforts. We study the effectiveness of two reward mechanisms, all-or-nothing and piece-rate, to incentivize full completion of repeated tasks over a period of time. Data from two randomized controlled trials show that the full completion rate under the all-or-nothing mechanism does not differ from that under the regular piece-rate mechanism. However, when given the choice between the all-or-nothing and piece-rate mechanisms in a third (self-select) treatment, a significant number of participants chose the all-or-nothing mechanism despite the risk. The overall full completion rate is significantly higher in the self-select treatment than the piece-rate treatment. Our results highlight the importance of choice in incentivising persistent efforts.

Keywords: perseverance; incentives; self-control; field experiments

JEL codes: C93, D91

* Corresponding author: Erte Xiao, Department of Economics, Monash University, Clayton, VIC, 3800. Email: erte.xiao@monash.edu. Phone: +(61)99052385
1. Introduction
Perseverance plays an important role in predicting success and achievement (Beattie, Laliberté, & Oreopoulou, 2018; Duckworth, 2016; Heckman & Kautz, 2012; Heckman, Stixrud, & Urzua, 2006). Becoming an expert in a field requires one to engage in repeated practice for years. In organizations, completing a project normally requires employees to exert continuous hard work for a long period of time. In school, to learn a subject, students must complete multiple tasks over several months. Persistent effort, however, is hard. Every day people face all kinds of temptations distracting them from continuing what they have started, especially when they have little personal interest in the tasks. While some people can rely on their own stamina, many do not have enough willpower to sustain effort intrinsically. It is therefore important to investigate whether we can design external mechanisms to incentivize persistent efforts.

In this paper, we compare two types of reward mechanisms. One is a piece-rate mechanism, commonly used to incentivize efforts, where there is a reward for each task completed. The other is an all-or-nothing mechanism where efforts are rewarded if and only if all the required tasks are completed. Thus, the all-or-nothing mechanism explicitly incentivizes persistent effort by placing a high cost on giving up. Importantly, we introduce a self-select mechanism, where participants have the option to choose between the piece-rate and all-or-nothing reward mechanisms. The self-select mechanism is motivated by the hypothesis that the reward mechanism may be more effective when participants can choose what fits them best. Additionally, given the risk involved in the all-or-nothing mechanism, the self-select mechanism might also be more acceptable in practice and therefore more feasible.

We theoretically analyze the impact of each mechanism on full task completion. First, compared with the piece-rate mechanism, the all-or-nothing mechanism can be a double-edge sword. On one hand, it provides a commitment device that helps incentivize full completion (an encouragement effect). On the other hand, under this mechanism, those who doubt their ability to complete all tasks may quit at the beginning (a discouragement effect). Thus, the full completion rate in the all-or-nothing mechanism can be either higher or lower compared with the piece-rate mechanism. In contrast, the self-select mechanism allows participants to sort themselves into the mechanism that works best for them. As a result, it avoids the potential backfire of the all-or-nothing mechanism as those who would have quit
under all-or-nothing could simply choose the piece-rate mechanism. On the other hand, those who perform better under all-or-nothing can benefit from having this option available. We show that as long as there is a significant number of participants who self-select the all-or-nothing mechanism, the self-select mechanism will perform better than the piece-rate mechanism.

We conduct field experiments to provide empirical evidence on the effectiveness of the all-or-nothing and self-select mechanisms on promoting full completion as compared with the piece-rate mechanism. In particular, based on findings from theoretical analysis, we investigate the following questions: Does the all-or-nothing mechanism promote or inhibit the full completion rate compared to the piece-rate mechanism? Do people choose the all-or-nothing reward mechanism when given the option? Is the self-select mechanism effective at promoting persistent effort compared to the piece-rate mechanism? We investigate these questions for tasks both with and without intrinsic value in two different randomized controlled trials. Differentiating between these two types of tasks is relevant when considering the all-or-nothing mechanism. When there is no intrinsic value, the only reward for completing tasks is the external incentive provided by the mechanism. Therefore, under the all-or-nothing mechanism, individuals will not continue once they fail. In contrast, for tasks with intrinsic value, individuals may be willing to continue performing tasks after the failure even though there is no external reward for their effort. The intrinsic value also provides additional motivations for choosing all-or-nothing in the self-select mechanism.

We conducted the first study in the setting of coursework where persistent effort is important for the learning outcome. The targeted tasks were weekly quizzes. We randomly assign students one of three treatments. In all treatments, students were told that the quizzes were worth 10 marks in total. Students in the baseline (Piece-rate) treatment were told that the 10 marks would be spread equally across each quiz. In the All-or-nothing treatment, students were awarded 10 marks only if they completed all the quizzes and they would receive 0 if they missed any. In the Self-select treatment, students were given a choice between the two marking mechanisms.  

---

1 To differentiate between the treatment and the mechanism, the treatment names always start with capital letters and the reward mechanism names always start with lower case letters.
We find that, compared with the baseline Piece-rate treatment, the All-or-nothing treatment did not increase the full completion rate. Interestingly, in the Self-selection treatment, more than half of the students chose the all-or-nothing mechanism in spite of the risk and this group of students achieved the highest full completion rate. As a result, the full completion rate is significantly higher in the Self-selection treatment than the Piece-rate treatment. The advantage of the Self-selection mechanism is consistent with theoretical predictions.

We also observe that among the few students who missed one task under the all-or-nothing mechanism, most were willing to continue to work on the tasks although they would not receive any credit for them. This suggests that students may have intrinsic incentives for completing the task in addition to the direct rewarded credit. For example, students might believe the quizzes could help them do well in other assignments such as the mid-term or final exams.

To provide empirical evidence for the effectiveness of the mechanisms in the context of tasks with little or no intrinsic value, we conduct a second study in which subjects were recruited to participate in a survey study. Participants were told they would receive one survey each week for the following four weeks. As in the first study, there were three treatments. In the baseline (Piece-rate) treatment, participants were rewarded for each survey they completed. In the All-or-nothing treatment, participants were rewarded if and only if they completed all four surveys. In the Self-select treatment, participants could choose one of the two reward mechanisms. We observe that 20% of participants still chose the all-or-nothing mechanism in the Self-select treatment. The full completion rate in the Self-select treatment remains significantly higher than in the baseline. As in the first study, there is no difference in the full completion rate between the baseline and All-or-nothing treatments. Data from these two studies, thus, provides converging evidence for the importance of choice when designing incentive mechanisms to promote persistent efforts.

The rest of the paper is organized as follows. Section 2 provides the background and literature review. Section 3 presents a theoretical analysis of the comparison of the mechanisms. Section 4 reports the findings from the first study where the mechanisms are examined in the context of coursework. Section 5 presents the results of the second study where the mechanisms are applied to rewarding performance in tasks of little intrinsic value. Section 6 concludes and discusses the policy implication of the findings.
2. Background and Literature

This study contributes to the literature investigating the effects of internal and external factors on perseverance. A number of studies have found that non-cognitive skills and psychological factors, such as self-control, grit, conscientiousness, and growth mindset, are important for perseverance (Almlund, Duckworth, Heckman, & Kautz, 2011; Claro, Paunesku, & Dweck, 2016; Tangney, Baumeister, & Boone, 2004). More recently, research has examined the effectiveness of external interventions, such as classroom education programs or peer pressure, on perseverance (Alan, Ertac, & Boneva, forthcoming; Bettinger, Ludvigsen, Rege, Solli, & Yeager, 2018; Buechel, Mechtingen, & Petersen, 2018). This line of research often focuses on willingness to undertake challenging tasks and/or to continue working on hard tasks after an initial failure. Our paper examines another aspect of perseverance: repeated engagement in tasks that extend over a long period of time (e.g. 10000 hours of deliberate practice). As we demonstrate below, the time horizon of the tasks is important as, due to exogenous shocks, it introduces uncertainty about the cost of completing individual tasks. Such exogenous shocks might play a key role in the failure to persevere.

This paper also relates to the literature investigating the effects of different commitment devices on helping people achieve their long term goals, particularly goals requiring self-control (Bryan, Karlan, & Nelson, 2010; Himmler, Jäckle, & Weinschenk, 2019). In relation to our study, we may roughly classify the previously analyzed commitment devices as either piece-rate or all-or-nothing types. Piece-rate types are those where there is a positive reward for each success in taking a desirable action. Bundling an instantly gratifying experience (e.g. listening to page-turner low-brow audio novel) with actions requiring exertion of self-control (e.g. exercising) decreases the cost of exerting an effort at each instance (Milkman, Minson, & Volpp, 2014). Buying a flat-rate gym membership resulting in a decrease in the pay-per-visit mental cost of gym visits for every gym visit (DellaVigna & Malmendier, 2006). Signing up for deposit collection services decreases the transaction cost of making future deposits into a savings account – a reward for each deposit (Ashraf, Karlan, & Yin, 2006). Like the piece-rate treatment in our paper, a common feature of these examples is that individuals are rewarded for each success and a failure has little impact on either the size of reward for previous successes or on subsequent actions.
In contrast, another type of commitment device similar to our all-or-nothing mechanism is one where the reward explicitly requires persistent effort over a period of time. For such commitment devices, a failure will have a significant negative impact on the rewards for both earlier and later efforts. That is, the marginal return for an effort can be zero or significantly reduced due to either a subsequent or preceding failure. For example, Kaur, Kremer, & Mullainathan (2015) study a non-linear dominated contract at a workplace where, each day, workers can choose a target and receive half of the piece-rate if they fail to reach the target. Likewise, under a deposit contract for smoking cessation (Giné, Karlan, & Zinman, 2010), smokers lose their entire deposit if they give in to temptation even once during a set timeframe; a one-time failure means none of the previous days of abstinence is rewarded. Another example is a lump-sum payment conditional on the full completion of a certain number of gym visits (Acland & Levy, 2015; Charness & Gneezy, 2009).

To the best of our knowledge, there is no study systematically comparing the all-or-nothing and the piece-rate mechanisms at promoting persistent efforts. We fill this gap in the literature by providing both theoretical analysis and empirical evidence for the comparison between the two mechanisms. We also study such cases both where the mechanisms are exogenously enforced and where decision-makers have the freedom to make a choice between the two mechanisms. The importance of choice has not received much attention in research on commitment to-date. An exception is Ariely and Wertenbroch's (2002) study of the effect of self-imposed deadlines for class assignments compared to exogenously set deadlines. They found that performance under self-imposed deadlines is lower than performance under exogenously imposed, evenly spaced deadlines due to the suboptimal timing of chosen deadlines. On the other hand, self-imposed deadlines achieve a better outcome than that under maximally delayed deadlines. Conversely, Burger, Charness, and Lynham (2011) show that externally imposed deadlines actually lower performance.
3. Theoretical analysis

We use the quasi-hyperbolic discounting model to analyse the decision making processes (Laibson, 1997; O’Donoghue & Rabin, 1999; Phelps & Pollak, 1968). A risk neutral decision maker (henceforth, DM) discounts the future utility streams starting with today by \( \{1, \beta\delta, \beta^2\delta^2, \ldots\} \). The exponential discount factor, \( \delta \), captures impatience and \( \beta \) captures the present bias. Present bias implies that taking an action with a current cost and future benefit looks less attractive than taking the same action in a future period. We assume \( \delta=1 \) to simplify the analysis. We focus on sophisticated decision makers who are aware of their present bias and therefore value commitments (Basu, 2011; Kaur et al., 2015; O’Donoghue & Rabin, 1999).

The optimal plan for a present biased DM changes over time. A model of at least three periods allows us to investigate the implications of such changes. For ease of exposition, we can think of a DM at different periods as different selves, strategically interacting with each other. The period-zero-self is assigned to one of the two rewarding mechanisms or selects one of them if given the option. In the latter case, she chooses the mechanism that maximizes her expected lifetime utility. The period-one-self decides whether to complete each task given the reward mechanism. For simplicity, we include only two tasks in period one. The reward, if any, is received in period two.

The effort cost to complete a task, is low, \( c_L \), with probability \( 0.5 < p < 1 \) and high, \( c_H \), with probability \( 1-p \). The uncertainty about the cost captures the fact that the probability of completing a task repeatedly over a period of time is also affected by some exogenous factors. For example, if the DM gets sick, or a new movie comes out and working on the task requires the DM to resist additional temptation, the effort cost would increase. Such exogenous shocks might play a key role in the failure of finishing tasks that require persistent engagement over a long period of time. More often, individuals perform the task sometimes when it is relatively easy but fail at other times when exerting an effort is costlier.

---

2 Other well-known intertemporal choice models include the planner-doer model (Shefrin & Thaler, 1988), the dual-self model (Fudenberg & Levine, 2006), the temptation model (Gul & Pesendorfer, 2001), and the internal commitment model (Benhabib & Bisin, 2005). We use the quasi-hyperbolic discounting model because of its tractability and prevalence to analyse this type of self-control problems.

3 Grouping the two tasks in the same period simplifies the analysis and will not change the qualitative model predictions as long as the choice of the mechanism takes place before task completion and the reward is given after the tasks.
We restrict our focus to cases where the reward is always higher than cost, specifically $c_L < c_H < r$. In these cases, the period-zero-self wants to complete all the tasks as a result of her lifetime utility maximization, but the period-one-self may not complete them because of self-control problems and/or exogenous factors. We compare the full task completion rate under piece-rate, $f^p$, and under all-or-nothing, $f^a$, when they are exogenously assigned. Later, we compare the full task completion under the self-select mechanism, $f^s$, to the one under piece-rate, $f^p$.

3.1 Piece-rate versus all-or-nothing

The utility maximization problem for the period-one-self under the piece-rate is:

$$e_i^* = \arg\max_{e \in \{0, 1\}} e_i(-c + \beta r)$$  \hspace{1cm} (1)

where $c \in \{c_L, c_H\}$ is the cost of the effort to complete the task, $e_i$ is the binary effort decision for each task $i$, $\beta$ is the present bias, and $r$ is the reward for completing the task. The task completion decision under the piece-rate mechanism depends on the discounted benefit, $\beta r$, in comparison to the cost, $c$. Solving this problem shows that there are three types of behaviour:

- **Type T1**, $\beta r \geq c_H$, always completes a task: $f^p = 1$.
- **Type T2**, $\beta r \leq c_L$, never completes: $f^p = 0$.
- **Type T3**, $c_L < \beta r < c_H$, completes each task only if the cost is low: $f^p = p^2$.

In contrast to the piece-rate mechanism, the all-or-nothing mechanism requires the DM to use backward induction to solve the problem because the decision on the first task is affected by the expected outcome of the second task. The utility maximization problem for the second task is:

$$e_2^*(e_1, c_2) = \arg\max_{e_2 \in \{0, 1\}} e_2(-c_2 + 2\beta r e_1)$$  \hspace{1cm} (2)

where $c_2 \in \{c_L, c_H\}$ is the cost for task 2. The equation above shows that a necessary condition for the DM to work on the second task is the completion of the first task (i.e. $e_1 = 1$).
Comparing (2) to (1), we see that it is easier to complete the second task under all-or-nothing than under piece-rate once the first task is already completed. As a result, the T1 type under piece-rate will still complete both tasks under all-or-nothing regardless of the cost. Likewise, the T2 type under piece-rate will still do nothing under all-or-nothing. The T3 type is the only group who may act differently under all-or-nothing. Thus, her performance determines the overall difference between the two mechanisms.

To see how the T3 type performs under all-or-nothing, we write the utility maximization for the first task as:

$$e_1^* = \arg\max_{e_1 \in \{0, 1\}} e_1 \left[ (1 - p) e_2^* (e_1, c_H) [2 \beta r - c_H] + (1 - p) e_2^* (e_1, c_H) [2 \beta r - c_H] ] + (1 - p) e_2^* (e_1, c_H) [2 \beta r - c_H] \right]$$

The first task decision depends not only on the cost of the current task but also on the expected cost of the second task and the prospect of whether the second task will be performed. In equation (3), the first term is the cost of the current task. The second (third) term is the difference between the discounted benefit from completing both tasks and the cost of completing the second task when the cost is low (high). Combining (2) and (3), we find that the T3 type can be further divided into four types, as elaborated below, that vary on whether the DM is encouraged or discouraged by the expected performance in the second task (see details in Appendix A.1).

Depending on the parameter values, for some DMs, completing the first task will lead them to complete the second task regardless of the cost, which in turn encourages them to complete the first task. We call this an encouragement effect. When the encouragement effect is large enough, the DM will complete the first task regardless of the cost. We call this type the encouraged DM and her full completion rate is \( f_A = 1 \). When the encouragement effect is not large enough to convince the DM to complete the first task regardless of the cost, she completes it only when the cost is low. We call this type the conditional encouraged DM and her full completion rate is \( f_A = p \).

In contrast to the encouragement effect, for some other types of DM, if the first task has been completed, they will complete the second task but only if the cost is low. As a result, when deciding whether or not to complete the first task, the DM will be discouraged by the risk that the effort to complete the first task will be wasted if
the second task cost is high. We call this a *discouragement effect*. If the
discouragement effect is strong enough, the DM will not complete the first task even
if the cost is low. We call this type the *discouraged DM* and her full completion rate
is \( f^A = 0 \). If the discouragement is not as strong, the DM will take the risk and complete
the first task when the cost is low, hoping that the cost for the next task will also be
low. We call this type the *conditional discouraged DM* and her full completion rate is
\( f^A = p^2 \).

We compare the above four possible full completion rates of T3 types under
all-or-nothing to those under piece-rate, which is always \( p^2 \). We find that all-or-
nothing can improve the full completion rate for the two encouraged types, but can
backfire for the discouraged one and has no impact for the conditional discouraged
one. Parameter values such as the size of the reward \( r \), effort costs \( (c_L, c_H) \) with their
probability \( p \), and the present bias \( \beta \) will determine the DM’s type and thereby the
difference in the full completion rate between the all-or-nothing and the piece-rate
mechanisms. Our first proposition specifies the types for whom the full completion
rate differs under two mechanisms.

**Proposition 1**: Under all-or-nothing,

1) if \( \max \left\{ \frac{c_H}{2r}, \frac{(1+p)c_L + (1-p)c_H}{2r} \right\} \leq \beta < \frac{c_H}{r} \), the DM is a (conditional) encouraged
type and is more likely to complete both tasks compared to piece-rate.

2) if \( \frac{c_L}{r} \leq \beta < \min \left\{ \frac{(1+p)c_L}{2pr}, \frac{(1+p)c_L + (1-p)c_H}{2r} \right\} \), the DM is a discouraged type and is
less likely to complete both tasks compared to piece-rate.

*Proof.* See Appendix A.1.

Proposition 1 suggests that the all-or-nothing mechanism is risky: it may decrease the
full completion rate if a significant number of decision makers are of the discouraged
type.

It is important to note that the encouragement and discouragement effects
occur because of the interdependence of the tasks under all-or-nothing, not because of
the present bias \( \beta \). The present bias, however, creates a conflict between the period-
zero-self and the period-one-self. Specifically, the period-zero-self wants the period-
one-self to make more patient decisions than what period-one-self actually prefers.
Therefore, for some types of DM, the utility maximizing option for the period-zero-
self may be to choose the all-or-nothing mechanism so as to strip away the reward from partial completion and thereby force the period-one-self to complete both tasks. This is similar to the idea of many commitment models that restrict the choice set to commit one to the best outcome (Giné et al., 2010; O’Donoghue & Rabin, 2001). On the other hand, for some other types of DM, the period-zero-self may prefer the non-commitment option (the piece-rate mechanism) if she realizes that the all-or-nothing mechanism discourages her future self from performing the tasks. We elaborate below how the choice of the all-or-nothing mechanism changes depending on individual types and the corresponding differences in full completion rate between the Self-select and the Piece-rate treatments.

3.2 Piece-rate versus Self-select

To compare the full completion rate between the Piece-rate and the Self-select treatments, we first analyse how the DM chooses between the piece-rate and the all-or-nothing mechanisms by comparing the expected lifetime utility of each. We have shown that in both mechanisms, T₁ type DMs will always complete all the tasks and T₂ types will never work on any tasks. Thus, these two types will be indifferent between the two mechanisms. Here we assume that both types will choose the piece-rate mechanism because it is the status quo familiar to them (e.g. students usually receive credit for the work done for each assignment).

We have demonstrated above that T₃ type DMs will perform each task under the piece-rate mechanism as long as the cost is low (fᵦ= p²). But they act differently under the all-or-nothing mechanism depending on whether they are encouraged or discouraged. Below, we elaborate how the period-zero-self chooses a mechanism maximizing the expected lifetime utility depending on the encouragement/discouragement effect (see Appendix A.1 for details of the proof):

- **Encouraged DM**: The period-one-self will do all tasks for sure under all-or-nothing (i.e. f₄=1). Anticipating this, the period-zero-self strictly prefers all-or-nothing since the utility is the highest when all the tasks are completed.

- **Conditional encouraged DM**: As explained above, under all-or-nothing, the period-one-self of this type completes the second task as long as the
first task is completed and will complete the first task only if the cost is low. Thus, the probability of full completion under all-or-nothing is $f^a = p$, which is higher than that under piece-rate ($p^2$). However, the downside of all-or-nothing for this type is that the period-one-self will not work on any tasks when the first task cost is high. In contrast, under piece-rate, zero completion occurs only when the cost of both tasks is high. That is, the all-or-nothing mechanism increases the probability of zero completion compared to piece-rate ($1 - p$ vs. $(1 - p)^2$). As a result, overall, the expected utility under piece-rate is higher than that under all-or-nothing (see Appendix A. 1 for details). Thus, the period-zero-self will choose the piece-rate mechanism.

- **Discouraged DM**: The DM will not engage in either of the tasks under the all-or-nothing mechanism. Thus the period-zero-self will choose the piece-rate mechanism.

- **Conditional discouraged DM**: We have demonstrated above that this type of DM achieves the same full completion rate under both mechanisms ($f^a = f^p = p^2$). Furthermore, under all-or-nothing, the period-one-self will not complete the second task if the first task is not completed. Thus, the probability of zero completion is higher under all-or-nothing than under piece-rate ($1 - p$ vs. $(1 - p)^2$). As a result, the expected utility under piece-rate is higher than under all-or-nothing, causing the period-zero-self to choose the piece-rate mechanism (see Appendix A. 1 for details).

Our analysis shows that, under the self-select mechanism, only the encouraged DM chooses all-or-nothing with all other types preferring the piece-rate mechanism. The self-select mechanism eliminates the risk of discouragement from an exogenously imposed all-or-nothing mechanism. Hence, the self-select mechanism can achieve a higher full completion rate than the piece-rate mechanism as long as there is a significant number of encouraged DMs in the population.

**Proposition 2**: Encouraged DMs, defined by $\frac{(2 - p)c_H + p c_L}{2r} \leq \beta < \frac{c_H}{r}$, strictly prefer the all-or-nothing mechanism and always achieve full completion whereas the full completion rate for them would be only $p^2$ under piece-rate. All other types will
choose the piece-rate mechanism. Therefore, the self-select treatment improves the full completion rate only if there is a significant number of encouraged DMs in the population.

Proof. See Appendix A.1.

Note that empirically, we cannot easily identify a DM’s type as we cannot observe all parameter values. However, since only the encouraged type will choose the all-or-nothing mechanism, Proposition 2 predicts that the self-select mechanism should improve the full completion rate only if there is a significant number of DMs choosing all-or-nothing.

Taking all these together, our analysis predicts that the all-or-nothing mechanism can be risky: it may not always improve the full completion rate and it can even lead to lower full completion. In contrast, the self-select mechanism does not have the risk of achieving a lower full completion rate than the piece-rate mechanism, and it can effectively promote the full completion rate as long as a good number of DMs are willing to choose all-or-nothing. Next, we report data from two studies that test the predictions.

4. Study 1

4.1. Experiment Design
Study 1 involves 343 undergraduate students enrolled in the introductory microeconomics course between July and October 2016, a compulsory unit for the bachelor of business and commerce degree. For each week of lectures during the semester, the lecturer created pre-lecture content to facilitate learning at home. Each week, the lecturer gave students an online quiz that tested their understanding of the course content prior to the lecture. There were 9 quizzes that contributed a total of 10% (10 marks) towards each student’s final grade in the unit. Each online quiz involved 10 multiple-choice questions that were available for five days through the
online learning platform. Students could use up to five attempts and they needed to score at least 50% in order to earn their credit.\(^4\)

We implemented randomization at the tutorial level. At the beginning of the semester, students were randomly allocated to different tutorial sessions. We randomly assigned each tutorial session one of the three treatments: Piece-rate, All-or-nothing, or Self-select. In the Piece-rate treatment, the 10 marks would be spread equally across each quiz and students would receive credit for each quiz that they completed. In the All-or-nothing treatment, the students received the 10 marks only if they completed all the online quizzes, and they received 0 otherwise. In the Self-select treatment, we gave students the choice between the piece-rate and all-or-nothing options. Students made their decisions during the first tutorial session. To ensure the consistency of treatment implementation in each tutorial session, we provided each tutor a script to read during the tutorial. The script explained how the quizzes would be marked (see Appendix B.1).  

4.2 Results  
Table 1 reports the number of participants in each condition. In the Self-select treatment, 80 out of 154 students selected the all-or-nothing marking mechanism. There is no gender difference in the observed choices. About 53% of female and 51% of male students chose all-or-nothing. Our focus is the success rate of completing all the quizzes.\(^5\)

Figure 1 plots the distribution of the number of quizzes missed. Across all treatments, very few students missed three or more quizzes. Thus, we pool those students together in Figure 1. A majority (about 68.9%) of students completed all the quizzes even in the baseline. Such a high full completion rate suggests that the motivation to work on the quizzes is relatively high. This high motivation is likely to be because of the indirect value of the quizzes in addition to the direct credit awarded for completion. As is a common feature of in-semester exercises, working on the quizzes could potentially help students perform well in the final exam. We will return to this in the Discussion section. Compared with the baseline (Piece-rate) treatment,  

\(^4\) All the students who attempted the quiz earned the credit. Thus, the task is mainly effort-based.  
\(^5\) Some students registered the course late and only got the access to the online course materials after the first week lecture and/or tutorial. In those cases, students were told that only the quizzes starting from week 2 would affect their mark. In view of this, our data analysis includes only quizzes starting from week 2 and we count the quiz in week 2 as the first task.
the full completion rate is only slightly higher in the All-or-nothing treatment and the difference is not significant (74.4% vs. 68.9%, Z-test, p=0.406).

In contrast, the full completion rate in the Self-select treatment is significantly higher than in the baseline (79.9% vs. 68.9%, Z-test, p=0.046). Figure 1 shows further that such an increase of the full completion rate can be mainly attributed to the 68.9% students who self-selected the all-or-nothing mechanism. The full completion rate of this group of students is 82.5%, much higher than the completion rate of 68.9% in the Piece-rate treatment (Z-test, p=0.036). For those who selected the piece-rate mechanism, the full completion rate is higher than but not significantly different to the average of the Piece-rate treatment (77% vs. 68.9%, Z-test, p=0.235). Thus, the increase in the full completion rate in the Self-select treatment is mainly driven by those who chose the all-or-nothing mechanism.

Probit regression analysis of the full completion rate confirms our results reported above. In addition to the treatment condition variables, we also include in the regressions the gender and/or whether the course unit is compulsory for the student as independent variables. Regression results reported in Table 2 show that being in the Self-select treatment significantly increases the probability of full completion. In every model we ran, we found that being assigned to the Self-select rather than the Piece-rate treatment has a marginal effect of increasing the likelihood of full completion by at least 10%.

4.3 Discussion

Our results show that the self-select mechanism can significantly improve the full completion rate. Conversely, the all-or-nothing mechanism, if exogenously imposed (All-or-nothing treatment), does not improve the full completion rate compared with the Piece-rate treatment. This result is in line with our theoretical predictions. As stated in Proposition 2, encouraged DMs will choose the all-or-nothing mechanism and the self-select mechanism will be effective only if there is a significant number of DMs of this type. Observing more than half the students choosing all-or-nothing suggests that the all-or-nothing mechanism is encouraging for a significant number of students who can employ this mechanism as a commitment device to achieve full completion. As predicted in our model, those who choose the all-or-nothing mechanism drive up the full task completion rate.
One observation inconsistent with the theoretical analysis, however, is that most of those who missed a quiz still continued to work on quizzes in the following weeks, even though they would not receive marks for the completion under the all-or-nothing mechanism. First, in the All-or-nothing treatment, among the 21 students who missed at least one task (and thus receive 0 credit), only one has not done any task. All the other 20 students still worked on tasks after failing once. Second, we observe only 2 out of 86 students in All-or-nothing who decided not to try from the very beginning. This indicates that quizzes provided an intrinsic reward for students in addition to the marks directly received upon completion, because the quizzes in principle should help students learn better and perform well in the final exam. In Appendix A.2, we extend our theoretical analysis by including the possibility of an intrinsic reward in the model. Our analysis shows that the theoretical results we stated in previous propositions still hold, and the model with intrinsic reward makes additional predictions: 1) there will be decision makers who continue to work on tasks after a failure; 2) intrinsic reward creates an additional motivation to choose the all-or-nothing mechanism. Thus, the observation of the students who chose the all-or-nothing mechanism in the Self-selection treatment does not provide conclusive empirical evidence whether DMs would still make this choice where tasks have little or no intrinsic reward. As the choice of the all-or-nothing mechanism in the Self-selection treatment is the key for its effectiveness, we run another study with a task that minimizes any potential intrinsic value.

5. Study 2

5.1. Experiment Design
In this study, we design a survey task such that the reward for the task is only cash and it is unlikely that subjects can benefit from this task in any other regard. We distributed invitation flyers in tutorial classes. The flyers contained only general information of earnings in Malaysian Ringgit (RM) for filling out a survey without detailing the incentive mechanisms (see Appendix B.2). We distributed three sets of flyers that had identical content except for different Quick Response (QR) codes. Each QR code on a flyer represented a unique URL that assigned the subjects to different treatments. When participants scanned the QR code using their smartphones, they were directed to a website where they were informed about the payment scheme.
for completing surveys. In case some participants were unable to access the QR code, we also provided an email contact for participants to receive a link to the website.

In the Piece-rate treatment, subjects were informed that they could earn RM5 for each of the four surveys they completed. In the All-or-nothing treatment, they were told that they would receive RM20 only if they completed all four surveys and RM0 if they missed any. In the Self-select treatment, subjects, if they chose to participate, could select how they would like to be paid according to either the piece-rate or the all-or-nothing scheme. The wording for each option was the same as in the other two treatments. Subjects were told that they had up to five days to complete each survey and that each survey contained multiple-choice questions that took approximately 10 minutes to complete. In all three treatments, subjects were told that the payment would be made at the end of the fourth week (see Appendix B. 3 for details).

In each treatment, subjects could decide whether to participate in the survey or not after reviewing the payment information. If they decided to participate, they would expect to receive one survey via email in each of the following four weeks. In our theory analysis, we assume sophistication in that DMs hold correct beliefs regarding their future present bias. A partially naïve period-zero-self, however, may underestimate the present bias they would experience in the future, incorrectly thinking of their period-one-self as an encouraged type when they are, in fact, a discouraged type. Such DMs may choose the all-or-nothing mechanism but do not participate in any of the four surveys.6 Thus, choosing the all-or-nothing mechanism but consequently not completing any survey might be an indicator of partially naïve DMs.

5.2 Results
In each treatment, more than 200 students scanned the QR code to access the information page of the survey. Table 3 reports, for each condition, the number of students who signed up after reviewing the information (including the payment scheme). We observe 22% of students (32 out of 143) in the Self-select treatment

6 A completely naïve DM would never choose all-or-nothing over piece-rate as she is completely unaware of her present bias. We do not analyze completely naïve DMs as this case is not as interesting. The predictions for this type are the same under piece-rate and all-or-nothing. Under self-select, she always chooses piece-rate and performs accordingly.
chose all-or-nothing. Combining this with the observation from the first study, our data suggest that the intrinsic value of the tasks is an important factor, but not the only one, in determining individuals’ willingness to choose the risky all-or-nothing commitment device. As with Study 1, there is no gender difference in the choice of all-or-nothing (20 out of 86 females and 12 out of 57 males).

Figure 2 plots the distribution of the number of completed surveys in each treatment. Unlike the first study, we observe a significant number of zero completions in all treatments, possibly because of the lack of intrinsic motivation for the task. We also observe that the Self-select mechanism has two effects: it not only increases the rate of full completion but also decreases the rate of zero completion. In particular, compared with the Piece-rate treatment, the Self-select treatment achieves a significantly higher full completion rate (34% vs. 24.91%, Z-test, p=0.016) and a lower zero completion rate (48.18% vs. 57.89%, Z-test, p=0.025). In contrast, while the All-or-nothing treatment does not achieve a higher full completion rate than the Piece-rate treatment (25.09% vs. 24.91%, Z test, p=0.96), its zero-completion rate is slightly higher than the Piece-rate treatment although the difference is not significant (63.8% vs. 57.89%, Z-test, p=0.15).

As in Study 1, we find that the higher full completion rate in the Self-select treatment is mainly attributed to those who self-selected all-or-nothing. To see this, we calculate the full completion rate for those who chose all-or-nothing and those who chose piece-rate separately. As only those who signed up in the Self-select treatment made the choice between the two mechanisms, our comparisons are based on only those who signed up in each treatment. Among those who chose all-or-nothing in the Self-select treatment, 78% of them completed all four surveys. The full completion rate is only 54.05% for those who chose piece-rate, which is almost the same as the full completion rate of those who signed up in the Piece-rate treatment (53.79%).

These observations are consistent with our theory predictions. The higher full completion rate in the self-select mechanism indicates a significant number of encouraged DMs in the population. Despite the number of encouraged DMs, the result of no difference in the full completion rate between the Piece-rate and All-or-nothing treatments implies a significant number of discouraged DMs, canceling out the effects of encouraged ones in the All-or-nothing treatment. The significant number of both encouraged and discouraged types also explains the treatment
differences in the zero-completion rate as shown in Figure 2. While the encouragement effect of all-or-nothings lowers the zero-completion rate as compared to piece-rate, the discouragement effect increases the zero-completion rate. As a result, the all-or-nothing mechanism may not reduce the zero-completion rate and can even lead to a higher zero completion rate. In contrast, the self-select treatment achieves a lower zero-completion rate than the piece-rate treatment because it eliminates the discouragement effect of all-or-nothing while maintaining the encouragement effect.

As mentioned above, our design allows us to learn whether there are partially naïve DMs who overestimate their self-control, choosing all-or-nothing in the Self-select treatment but failing to complete any tasks. Our data suggest this is not the case. The proportion of participants who signed up but failed to complete all surveys is, overall, very low in all treatments (about 10% or less). In particular, only 4 participants in the Self-select treatment chose all-or-nothing while completing no tasks.

We reported above that in Study 1, those students who missed one task in the All-or-nothing treatment continued working on the tasks even though they would not be awarded any credit for individual task completion. We argued that this was evidence for the high intrinsic value of the tasks. Due to the low intrinsic value of the survey tasks, we expect few participants to continue completing surveys in the All-or-nothing treatment if they missed one. We observe 34 out of the 131 participants who signed up in the All-or-nothing treatment missed the first survey. 30 of these 34 participants did not complete any of the following three surveys. One participant completed the second survey and then stopped. The other three completed the remaining three surveys. This extremely low rate of attempt after missing the first task significantly contrasts with Study 1 and is strong evidence that the online surveys indeed lack intrinsic value and thus participants would not work on them without the extrinsic reward.

6. Discussion and conclusions
Perseverance is critical in achieving success. Daily temptation or extra duties arriving stochastically, however, often distract one from continuing what one has started. Hence, because of self-control problems, achieving a long-term goal requiring persistent efforts is hard for many. Designing efficient external incentive mechanisms
may be important in helping individuals to exert consistent efforts. In this paper, we compare the effectiveness of three mechanisms on promoting persistent efforts over time. One is the conventional piece-rate mechanism that rewards each completed task and thus does not target perseverance directly. Another is an all-or-nothing mechanism that explicitly requires consistent efforts by rewarding only consistent compliance. The all-or-nothing mechanism is useful for dealing with self-control problems but it comes with the risk that people might be discouraged from trying at all, or might withdraw completely after a one-time failure. Indeed, we find the all-or-nothing mechanism, when exogenously imposed, is not effective.

A self-select mechanism shows promise in promoting full completion. Theoretically, only people who can utilize the all-or-nothing mechanism would choose it, and those who would have been discouraged by the all-or-nothing mechanism can go with the piece-rate mechanism. Indeed, our two experimental studies show that a significant number of individuals are willing to choose the risky all-or-nothing mechanism, especially when the tasks have high intrinsic value. Those who self-select the all-or-nothing mechanism achieve a significantly higher full completion rate than people assigned to the piece-rate mechanism, which also leads to the overall improved outcome under the self-select mechanism.

The findings from our experiment offer useful policy insights in domains such as education, health and organization management, where persistent efforts over a long period of time are important. In recent decades, much research has been conducted into helping children do well academically. One key challenge is how to train students to be perseverant. Different monetary reward mechanisms have been designed and tested, but with mixed results (Fryer, 2011; Leuven, Oosterbeek, & van der Klaauw, 2010; Levitt, List, Neckermann, & Sadoff, 2016). These mixed results indicate that the problem may not be the lack of monetary incentives. Students, especially those who grow up in adverse circumstances, likely already have sufficient material incentives to get a good education and change their life prospects. Yet, they may not know how to make decisions to achieve success. Study 1 shows that simple changes in incentive mechanisms may help. A commitment device, such as the all-or-nothing marking mechanism can be quite helpful when this option is offered to students.

Recent research on performance management has emphasized the importance of intrinsic motives. While intrinsic motivation is surely important, many tasks are
boring and involve consistent and tedious work (often more boring and time-
demanding than the survey tasks in Study 2). Efforts in such cases have to be
motivated by external rewards. Our second study shows that allowing agents to self-
select the reward mechanism can be beneficial. First, it attracts more individuals to
engage in the tasks (e.g. a higher sign up rate in the survey tasks). Second, individuals
are willing to choose the all-or-nothing mechanism even when the tasks have little
intrinsic value, and those that do perform significantly better.

It worth noting that introducing all-or-nothing as an option also makes it
easier to implement in practice compared with exogenously enforcing the mechanism.
In many institutions, individuals are likely used to the conventional piece-rate types of
reward mechanism. Given its risk, adopting a new all-or-nothing mechanism can be
challenging. Introducing it as an option can presumably avoid potential resistance.

We take a first step to understanding the working of the all-or-nothing
mechanism and how the option of such a rewarding mechanism affects behavior.
There remain many interesting and important questions for further investigation. For
example, in both studies, we observe participants who chose the all-or-nothing
mechanism, failed, and received zero reward. How would such a failure affect one’s
choice in the future? Will such people no longer choose the commitment, or will they
learn from the negative experience and try harder next time? We find the self-select
treatment wins mainly because of those who chose the all-or-nothing mechanism.
Would it be helpful to design mechanisms that nudge more to “self-select” the all-or-
nothing mechanism? We are conducting follow up studies to address these interesting
questions.
<table>
<thead>
<tr>
<th>Treatments</th>
<th># of obs.</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline(Piece-rate)</td>
<td>103</td>
<td>51</td>
<td>52</td>
</tr>
<tr>
<td>All-or-nothing</td>
<td>86</td>
<td>35</td>
<td>51</td>
</tr>
<tr>
<td>Self-select</td>
<td>154</td>
<td>83</td>
<td>71</td>
</tr>
<tr>
<td>piece-rate</td>
<td>74</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>all-or-nothing</td>
<td>80</td>
<td>44</td>
<td>36</td>
</tr>
<tr>
<td>Total</td>
<td>343</td>
<td>169</td>
<td>174</td>
</tr>
</tbody>
</table>
Table 2. Probit regression analysis of the full completion in Study 1

<table>
<thead>
<tr>
<th></th>
<th>Regression (1)</th>
<th>Regression (2)</th>
<th>Regression (3)</th>
<th>Regression (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All-or-nothing</td>
<td>0.162 (0.20)</td>
<td>0.220 (0.20)</td>
<td>0.199 (0.20)</td>
<td>0.263 (0.20)</td>
</tr>
<tr>
<td>Self-select</td>
<td>0.343** (0.17)</td>
<td>0.331* (0.18)</td>
<td>0.361** (0.17)</td>
<td>0.352** (0.18)</td>
</tr>
<tr>
<td>Female</td>
<td>0.562*** (0.15)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compulsory</td>
<td></td>
<td>0.611** (0.31)</td>
<td>0.682** (0.32)</td>
<td></td>
</tr>
<tr>
<td>Cons.</td>
<td>0.494*** (0.13)</td>
<td>0.235 (0.15)</td>
<td>-0.097 (0.33)</td>
<td>-0.433 (0.35)</td>
</tr>
<tr>
<td>Pseudo R²</td>
<td>0.01</td>
<td>0.05</td>
<td>0.02</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Numbers in the parenthesis are the robust standard errors.

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level
<table>
<thead>
<tr>
<th>Treatments</th>
<th># of scans</th>
<th># of signups</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>Female</td>
<td>Male</td>
<td></td>
</tr>
<tr>
<td>Baseline (Piece-rate)</td>
<td>285</td>
<td>132</td>
<td>73</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>All-or-nothing</td>
<td>279</td>
<td>131</td>
<td>60</td>
<td>71</td>
<td></td>
</tr>
<tr>
<td>Self-select</td>
<td>247</td>
<td>143</td>
<td>86</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>piece-rate</td>
<td>111</td>
<td>66</td>
<td>45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>all-or-nothing</td>
<td>32</td>
<td>20</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>811</td>
<td>406</td>
<td>219</td>
<td>187</td>
<td></td>
</tr>
</tbody>
</table>
Figure 1. Distribution of quiz completion rate by treatment (Study 1)
**Figure 2.** Distribution of number of surveys completed by treatment (Study 2)
**Figure 3.** Zero completion types by treatment (Study 2)

a) No sign up

![Graph showing zero completion types by treatment for Study 2 (no sign up).](image1)

b) Sign up but complete none

![Graph showing zero completion types by treatment for Study 2 (sign up but complete none).](image2)
References:


Buechel, B., Mechtenberg, L., & Petersen, J. (2018). If I can do it, so can you! Peer effects on perseverance. *Journal of Economic Behavior & Organization, 155,*


Appendix A.1

We model a decision maker (DM) with a present bias by using quasi-hyperbolic discounting (Phelps and Pollak 1968, Laibson 1997). DM solves an intertemporal choice problem over three periods. Period zero, \( t = 0 \), is to choose a mechanism or to be assigned to a mechanism. Period 1, \( t = 1 \) is to make actual task completion decisions, and period 2, \( t = 2 \) is to receive the reward. For simplicity, we assume two tasks taking place in period one (specifically at \( t = 11 \) and at \( t = 12 \)).

The task completion cost might be low, \( c_L \) with probability \( p > 0.5 \) or high, \( c_H \) with probability \( 1 - p \), and there is a fixed reward denoted by \( r \), for each task completed under the piece-rate mechanism. Under all-or-nothing (A-or-N) mechanism, the reward is \( 2r \) if the agent completes both tasks and zero otherwise.

We make the following assumptions to narrow our focus:

1. We assume that the period-zero-self always prefers the future selves to exert effort regardless of the cost. This is because we are interested in analyzing task completion for a DM who is interested in completing the tasks but is unable to do so either because of self-control problems or because of exogenous shocks:

\[ c_L < c_H < r \]  

2. The low cost is more likely than the high cost:

\[ 0.5 < p < 1 \]  

3. The DM has a preference for immediate gratification (self-control problem) and she is sophisticated about her self-control problem:

\[ 0 < \beta < 1 \]  

4. For simplicity we assume there is no exponential discounting:

\[ \delta = 1 \]

Let us call the two tasks to be completed in period 1 as task-11 and task-12 respectively.

**Proof of Proposition 1.** Under piece-rate, there are three types of DM:

- **T1 type:** \( \frac{c_H}{r} \leq \beta \), always complete
- **T2 type:** \( \beta < \frac{c_L}{r} \), never complete
- **T3 type:** \( \frac{c_L}{r} \leq \beta < \frac{c_H}{r} \), complete if cost is low

The problem under all-or-nothing is more complex. We will analyze it in three different parts covering all possible cases stated below:
1. $\frac{1+p}{p} < \frac{c_H}{c_L}$
2. $2 < \frac{c_H}{c_L} \leq \frac{1+p}{p}$
3. $\frac{c_H}{c_L} \leq 2$

1. Under the first case, $\frac{1+p}{p} < \frac{c_H}{c_L}$, we have the following inequalities:

$$\frac{c_L}{2r} < \frac{c_L}{r} < \frac{c_H}{2r} < \frac{c_H}{r}.$$ 

Note that a necessary condition for the DM to complete the second task at $t=12$ is the completion of the first task at $t=11$. We will not restate this condition for each case to keep the writing concise.

(a) If $\frac{c_H}{c_L} \leq \beta$: DM will complete both tasks regardless of the cost. She is $T1$ type who *always* completes the tasks regardless of the cost and the mechanism.

(b) If $\frac{c_H}{c_L} \leq \beta < \frac{c_H}{2r}$, DM at $t=12$ completes the task regardless of the cost. We analyze the DM’s decisions at $t=11$ below.

i. Facing a high cost, $c_H$, she completes the task if

$$\frac{c_H + pc_L + (1-p)c_H}{2r} \leq \beta < \frac{c_H}{r}.$$ 

Under the all-or-nothing mechanism, a DM satisfying the condition above completes both tasks regardless of the cost. Because the DM at $t=12$ compares the cost of task completion with the cumulative benefit to be received in the future. This is why this type does the task regardless of the cost under all-or-nothing while doing that task only when the cost is low under piece-rate. Moreover, the DM at $t=11$ completes the first task even at a high cost since the expected cost per task is lower than the piece-rate case because of the possibility of a low cost at $t = 12$. We call her the $T3a$ *encouragement* type.

ii. Facing a low cost, she completes the task if $\frac{c_L + pc_L + (1-p)c_H}{2r} < \beta$, which is satisfied since $\frac{c_L + pc_L + (1-p)c_H}{2r} < \frac{c_H}{2r}$. This is the $T3b$ *conditional encouragement* type. Such DMs complete the second task regardless of the cost, however the task completion is conditional on a low cost for the first task.

(c) If $\frac{c_H}{c_L} \leq \beta < \frac{c_H}{2r}$, the period-12-self will complete only if the cost is low. Period-11-self’s optimal actions are as follows:

i. Facing a high cost, she compares the expected cost of $c_H + pc_L$ to the expected benefit of $2\beta pv$. This DM would exert an effort only if:

$$\frac{c_H + pc_L}{2pr} < \beta.$$ 

However, there is no DM satisfying this condition since $\frac{c_H}{2r} < \frac{c_H + pc_L}{2pr}$. 

32
ii. Facing a low cost, she exerts an effort only if:

\[
\frac{c_L + p c_L}{2 p r} \leq \beta < \frac{c_H}{2 r},
\]

expecting the period-12-self to exert an effort under low cost. This type exists since \( \frac{1+p}{p} < \frac{c_H}{c_L} \). This is the \( T3c \) \textit{conditional discouragement} types. She completes the first and second tasks only when the cost is low.

iii. If \( \frac{c_H}{p} \leq \beta < \frac{c_L + p c_L}{2 p r} \), she never exerts an effort for the first task because of the risk of not completing the second task. This is the \( T3d \) \textit{discouragement} type.

(d) If \( \beta < \frac{c_H}{p} \), she acts exactly the same as the \( T3d \) type under A-or-N mechanism, but differently under piece-rate. This is the \( T2 \) \textit{never type}.

Below, we write the full completion rates in the first two columns, \( f_i^r \), and zero completion rates in the last two columns, \( n_i^r \), for each type \( i \) under each mechanism \( r \in \{A\text{(ll-or-nothing)}, \ P\text{(iece-rate)}\} \).

<table>
<thead>
<tr>
<th></th>
<th>( f_i^A )</th>
<th>( f_i^P )</th>
<th>( n_i^A )</th>
<th>( n_i^P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>T3a</td>
<td>1</td>
<td>( p^2 )</td>
<td>0</td>
<td>( (1-p)^2 )</td>
</tr>
<tr>
<td>T3b</td>
<td>( p )</td>
<td>( p^2 )</td>
<td>( (1-p) )</td>
<td>( (1-p)^2 )</td>
</tr>
<tr>
<td>T3c</td>
<td>( p^2 )</td>
<td>( p^2 )</td>
<td>( (1-p) )</td>
<td>( (1-p)^2 )</td>
</tr>
<tr>
<td>T3d</td>
<td>0</td>
<td>( p^2 )</td>
<td>1</td>
<td>( (1-p)^2 )</td>
</tr>
<tr>
<td>T2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

From the table, \( T1 \) and \( T2 \) types do not act differently under different mechanisms. The \( T3a \) encouragement type performs better under the all-or-nothing compared to piece-rate, because the full completion rate is one under all-or-nothing although it is \( p^2 \) under piece-rate. Similarly, the zero completion rate is zero under all-or-nothing whereas it is \( (1-p)^2 \) under piece-rate. The \( T3b \) conditional encouragement type also performs better under all-or-nothing although \( T3d \) discouragement and \( T3c \) conditional discouragement types perform worse. Notably, the \( T3d \) discouragement type does not even try to do any task and never completes under all-or-nothing whereas she completes fully \( p^2 \) of the time under piece-rate.
We summarize the conditions for types as below:

**T1**, always if \( \frac{c_H}{r} \leq \beta \)

**T3a**, encouragement if \( \frac{c_H + p_c L + (1 - p)c_H}{2r} \leq \beta < \frac{c_H}{r} \)

**T3b**, conditional encouragement if \( \frac{c_H}{2r} \leq \beta < \frac{c_H + p_c L + (1 - p)c_H}{2r} \)

**T3c**, conditional discouragement if \( \frac{c_L + p_c L}{2p r} \leq \beta < \frac{c_H}{2r} \)

**T3d**, discouragement if \( \frac{c_L}{r} \leq \beta < \frac{c_L + p_c L}{2p r} \)

**T2**, never if \( \beta < \frac{c_L}{r} \)

2. Under the second case, \( 2 < \frac{c_H}{c_L} \leq \frac{1 + p}{p} \), we again have:

\[
\frac{c_L}{2r} < \frac{c_L}{r} < \frac{c_H}{2r} < \frac{c_H}{r}
\]

(a) If \( \frac{c_H}{r} \leq \beta \), the DM is the T1 type as in case 1a.

(b) If \( \frac{c_H}{2r} \leq \beta < \frac{c_L}{r} \), the period-12-self completes regardless of the cost. The DM’s actions at \( t=11 \) are as follows:

i. Facing a high cost, she completes if \( \frac{c_H + p_c L + (1 - p)c_H}{2r} \leq \beta < \frac{c_H}{r} \)
   This is the T3a encouragement type.

ii. Facing a low cost, she completes if \( \frac{c_L + p_c L + (1 - p)c_H}{2r} \leq \beta < \frac{c_H + p_c L + (1 - p)c_H}{2r} \)
   This is the T3b type.

iii. If \( \frac{c_H}{2r} \leq \beta < \frac{c_L + p_c L + (1 - p)c_H}{2r} \)
   The DM does not complete the first task, giving the T3d discouragement types.

(c) If \( \frac{c_H}{r} \leq \beta < \frac{c_H}{2r} \), the period-12-self will complete if the cost is low. The DM takes the following actions at \( t=11 \):

i. Facing a high cost, she completes if \( \frac{c_H + p_c L + (1 - p)c_H}{2r} < \beta \) which is not possible since \( \frac{c_H}{2r} < \frac{c_H + p_c L}{2p r} \).

ii. Facing a low cost, she completes if \( \frac{c_L + p_c L}{2p r} < \beta \) and \( \beta < \frac{c_H}{2r} \), which is not possible since \( \frac{1 + p}{p} > \frac{c_H}{c_L} \).

As a result, the DM will never complete a task if \( \frac{c_L}{r} \leq \beta < \frac{c_H}{2r} \), being the T3d discouragement type.

(d) If \( \frac{c_H}{r} \leq \beta < \frac{c_H}{2r} \), the DM never completes regardless of the cost or mechanism. She is type T2.
Therefore, the full and no completion rates are as below:

<table>
<thead>
<tr>
<th></th>
<th>( f_i^A )</th>
<th>( f_i^P )</th>
<th>( n_i^A )</th>
<th>( n_i^P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>T3a</td>
<td>1</td>
<td>( p^2 )</td>
<td>0</td>
<td>( (1-p)^2 )</td>
</tr>
<tr>
<td>T3b</td>
<td>( p )</td>
<td>( p^2 )</td>
<td>( (1-p) )</td>
<td>( (1-p)^2 )</td>
</tr>
<tr>
<td>T3d</td>
<td>0</td>
<td>( p^2 )</td>
<td>1</td>
<td>( (1-p)^2 )</td>
</tr>
<tr>
<td>T2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

The cutoffs for the *always, encouragement, and never* regions are the same as before. However the cutoffs for the *conditional encouragement* and *discouragement* types are as follows:

\[
T3b, \quad \frac{c_L + p c_L + (1-p)c_H}{2r} \leq \beta < \frac{c_H + p c_L + (1-p)c_H}{2r} \\
T3d, \quad \frac{c_L}{r} \leq \beta < \frac{c_L + p c_L + (1-p)c_H}{2r}
\]

3. Under the third case, \( \frac{c_H}{c_L} < 2 \), we have:

\[
\frac{c_L}{2r} < \frac{c_H}{2r} < \frac{c_L}{r} < \frac{c_H}{r}
\]

(a) If \( \frac{c_H}{r} \leq \beta \), we have T1 types.

(b) If \( \frac{c_L}{r} \leq \beta < \frac{c_H}{r} \), the DM completes the second task regardless of the cost. DM’s optimal action at \( t=11 \) is given as follows:

i. Facing a high cost, the DM completes the first task if \( \frac{c_H + p c_L + (1-p)c_H}{2r} \leq \beta < \frac{c_L}{r} \), giving the \( T3a \) encouragement type.

ii. Facing a low cost, the DM completes the first task if \( \frac{c_L + p c_L + (1-p)c_H}{2r} \leq \beta < \frac{c_H + p c_L + (1-p)c_H}{2r} \), giving the \( T3b \) conditional encouragement type.

iii. If \( \frac{c_L}{r} \leq \beta < \frac{c_L + p c_L + (1-p)c_H}{2r} \), DM never exerts an effort, being the \( T3d \) discouragement type.

(c) If \( \frac{c_L}{r} \leq \beta < \frac{c_H}{r} \), the period-12-self will exert an effort regardless of the cost. The analysis of the DM at \( t=11 \) is as follows:

i. Facing a high cost, she completes the first task if \( \frac{c_H + p c_L + (1-p)c_H}{2r} \leq \beta < \frac{c_L}{r} \), which is not possible.

ii. Facing a low cost, she completes the first task if \( \frac{c_L + p c_L + (1-p)c_H}{2r} \leq \beta < \frac{c_H + p c_L + (1-p)c_H}{2r} \), which is not possible.

As a result, the DM will never complete a task if \( \frac{c_H}{2r} \leq \beta < \frac{c_L}{r} \).

She is the T2 never type.

(d) Similarly the DM with \( \beta < \frac{c_H}{2r} \) is also a T2 type.

Therefore, the full and no completion rates are the same as under case 2. Conditions for the types are also the same.
For all three cases, the probability of full completion is strictly higher under all-or-nothing compared with the piece rate only when the DM is of an encouragement or conditional encouragement type. If the DM is a discouragement type, however, the probability of full completion is lower under all-or-nothing showing that all-or-nothing may backfire.

Proof of Proposition 2.

For each DM type, we calculate the expected utility at period zero under each mechanism:

$$EU^{P-rate} = \begin{cases} \beta [2p^2 (r - c_L) + 2 (1 - p)^2 (r - c_H)] + 2p (1 - p) (2r - c_L - c_H)] & \text{T1} \\ \beta [2p^2 (r - c_L) + 2p (1 - p) (r - c_H)] & \text{T3a} \\ \beta [2p^2 (r - c_L) + 2p (1 - p) (r - c_H)] & \text{T3b} \\ \beta [2p^2 (r - c_L) + 2p (1 - p) (r - c_H)] & \text{T3c} \\ \beta [2p^2 (r - c_L) + 2p (1 - p) (r - c_H)] & \text{T3d} \end{cases}$$

The DM at period zero strictly prefers all-or-nothing under self-select treatment only when she is the encouragement type. Below, we summarise the full and no completion rates under the three mechanisms:

$$f^S = s_1 + s_{3a} + s_{3b} + s_{3c} + s_{3d}$$

Below, we write the full task completion rate under each mechanism:

$$f^P = s_1 + s_{3a} + s_{3b} + s_{3c} + s_{3d}$$

$$f^A = s_1 + s_{3a} + s_{3b} + s_{3c}$$

$$f^S = s_1 + s_{3a} + s_{3b} + s_{3c} + s_{3d}$$

<table>
<thead>
<tr>
<th>Region</th>
<th>$f^S$</th>
<th>$f^A$</th>
<th>$f^P$</th>
<th>$n^S_i$</th>
<th>$n^A_i$</th>
<th>$n^P_i$</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>T3a</td>
<td>1</td>
<td>1</td>
<td>$p^2$</td>
<td>0</td>
<td>0</td>
<td>$(1-p)^2$</td>
</tr>
<tr>
<td>T3b</td>
<td>$p^2$</td>
<td>$p$</td>
<td>$p^2$</td>
<td>$(1-p)^2$</td>
<td>$(1-p)$</td>
<td>$(1-p)^2$</td>
</tr>
<tr>
<td>T3c</td>
<td>$p^2$</td>
<td>$p^2$</td>
<td>$p^2$</td>
<td>$(1-p)^2$</td>
<td>$(1-p)$</td>
<td>$(1-p)^2$</td>
</tr>
<tr>
<td>T3d</td>
<td>$p^2$</td>
<td>0</td>
<td>$p^2$</td>
<td>$(1-p)^2$</td>
<td>1</td>
<td>$(1-p)^2$</td>
</tr>
<tr>
<td>T2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Let $s_T$ denote the proportion of DMs in region $T \in \{1, 2, 3a, 3b, 3c, 3d\}$. Below, we write the full task completion rate under each mechanism:
Comparing self-select to piece-rate, we get:

\[ f^S - f^P = s_{3a}(1 - p^2) \]  \hspace{1cm} (5)

The self-select mechanism will be effective if there is a significant number of encouraged DMs.

Comparing the all-or-nothing to piece-rate, we get:

\[ f^A - f^P = s_{3a}(1 - p^2) + s_{3b}(p - p^2) + s_{3d}(-p^2) \]  \hspace{1cm} (6)

Although encouragement and conditional encouragement full completion rates are higher, the discouragement full completion rate is lower under the all-or-nothing. Therefore, the effectiveness of all-or-nothing depends on the share of each type. If the share of discouragement types are high enough, it may cancel the positive effect of all-or-nothing coming through encouragement types, and it may even backfire.

As for the full completion rate, below we write zero completion rates under each mechanism:

\[ n^P = (s_{3a} + s_{3b} + s_{3c} + s_{3d})(1 - p)^2 + s_2 \]

\[ n^A = (s_{3b} + s_{3c})(1 - p) + s_{3d} + s_2 \]

\[ n^S = (s_{3b} + s_{3c} + s_{3d})(1 - p)^2 + s_2 \]

Comparing piece-rate to self-select:

\[ n^P - n^S = s_{3a}(1 - p)^2 \]  \hspace{1cm} (7)

Therefore, a significant increase in full completion rates in self-select in comparison to piece-rate should be accompanied by a significant decrease in zero completions.

\[ \blacksquare \]
Appendix A.2

In order to focus on the effect of the intrinsic reward, we simplify the problem by assuming that the intrinsic reward \( w \) is high enough such that

\[
r < w
\]

Under the piece-rate mechanism, the cutoffs are similar to the analysis under Proposition 1, except for the inclusion of the intrinsic reward, \( w \), this time:

- **T1 type:** \( \frac{c_H}{r+w} \leq \beta \), always complete
- **T2 type:** \( \beta < \frac{c_L}{r+w} \), never complete
- **T3 type:** \( \frac{c_L}{r+w} \leq \beta < \frac{c_H}{r+w} \), complete only with low cost

Since we analysed all possible cases under Proposition 1, we make the following further assumption to minimise the number of cases to analyse under all-or-nothing with intrinsic rewards:

\[
\frac{2(r+w)}{w} < \frac{c_H}{c_L}
\]

This assumption means that the intrinsic reward is high enough that the decision maker may find it optimal to complete the second task with low cost without completing the first instead of completing both tasks.

Therefore, we have:

\[
\frac{c_L}{2(r+w)} < \frac{c_L}{r+w} < \frac{c_L}{w} < \frac{c_H}{2(r+w)} < \frac{c_H}{r+w} < \frac{c_H}{w}
\]

and the DM follows the plan below under the all-or-nothing mechanism.

1. If \( \frac{c_H}{r+w} \leq \beta \): The DM will always exert an effort. She is the T1 type.
2. If \( \frac{c_H}{2(r+w)} < \beta < \frac{c_H}{r+w} \): The DM at \( t=12 \) will complete if she completed in the previous period or if she faces a low cost.
   
   (a) Facing \( c_H \), she will complete only if:

   \[
   2\beta(r+w) - (c_H + pc_L + (1-p)c_H) > \beta pw - pc_L
   \]

   Rearranging and simplifying:

   \[
   \frac{c_H(2-p)}{2(r+w) - pw} < \beta
   \]

   Since \( \frac{c_H}{2(r+w)} < \frac{c_H(2-p)}{2(r+w) - pw} < \frac{c_H}{r+w} \), the DM satisfying the following conditions will complete in both periods regardless of the cost:

   \[
   \frac{c_H(2-p)}{2(r+w) - pw} \leq \beta < \frac{c_H}{r+w}
   \]

   This is T3a type.
(b) Facing \( c_L \), she will complete only if:

\[
2\beta (r + w) - (c_L + pc_L + (1 - p)c_H) > \beta pw - pc_L
\]

Rearranging and simplifying:

\[
\frac{c_L + (1 - p)c_H}{2(r + w) - pw} < \beta
\]

Therefore, the DM satisfying the following condition will complete both tasks if the first task cost is low:

\[
\max \left\{ \frac{c_H}{2(r + w)}, \frac{c_L + (1 - p)c_H}{2(r + w) - pw} \right\} < \beta
\]

This is the \( T3b.1 \) type. This type is different to the \( T3b \) type as she may still do the second task if the cost is low, irrespective of the first task completion.

Consequently, a DM satisfying the following condition will do only the second task if the cost is low:

\[
\frac{c_H}{2(r + w)} < \beta < \min \left\{ \frac{c_H}{2(r + w)} , \frac{c_L + (1 - p)c_H}{2(r + w) - pw} \right\}
\]

We call such DMs \( T3d.1 \) types. They are different to \( T3d \) types since they may still do the second task without completing the first.

3. If \( \frac{c_H}{w} < \beta < \frac{c_H}{2(r + w)} \): the DM will do the second task only if the cost is low regardless of the previous period action. The analysis for the t=11 decision is below:

(a) Facing \( c_H \), she will complete the first task if:

\[
2p\beta (r + w) + (1 - p)\beta w - (c_H + pc_L) > \beta pw - pc_L
\]

Rearranging and simplifying:

\[
\frac{c_H}{2p(r + w) + (1 - 2p)w} < \beta
\]

Since \( \frac{c_H}{2p(r + w) + (1 - 2p)w} < \frac{c_H}{2p(r + w) + (1 - 2p)w} \), there is no DM satisfying this.

(b) Facing \( c_L \), she will complete the first task if:

\[
2p\beta (r + w) + (1 - p)\beta w - (c_L + pc_L) > \beta pw - pc_L
\]

Rearranging and simplifying:

\[
\frac{c_L}{2p(r + w) + (1 - 2p)w} < \beta
\]

Since \( \frac{c_L}{2p(r + w) + (1 - 2p)w} < \frac{c_L}{w} \), a DM satisfying the following condition will do the task in each period if the cost is low regardless of the previous action:
\[
\frac{c_L}{w} \leq \beta < \frac{c_H}{2(r + w)}
\]

This is the piece-rate behavior. We call this type \(T3c.1\) which, again, different to \(T3c\), because the DM is still willing to do the second task, at a low cost, even if she has not completed the first task.

4. If \(\frac{c_L}{r+w} \leq \beta < \frac{c_H}{w}\): the DM will do the second task if the cost is low and if the task was completed in the previous period.

(a) Facing \(c_H\), the DM will do the task if:

\[
2p\beta(r + w) + (1 - p)\beta w - (c_H + pc_L) > 0
\]

Rearranging and simplifying:

\[
\frac{c_H + pc_L}{2p(r + w) + (1 - p)w} < \beta
\]

Since \(\frac{c_L}{w} < \frac{c_H + pc_L}{2p(r + w) + (1 - p)w}\)\(^1\) there is no DM satisfying this condition.

(b) Facing \(c_L\), the DM will do the task if:

\[
2p\beta(r + w) + (1 - p)\beta w - (c_L + pc_L) > 0
\]

Rearranging and simplifying:

\[
\frac{(1 + p)c_L}{2p(r + w) + (1 - p)w} < \beta
\]

Therefore, a DM satisfying the following condition will complete the first task if the cost is low:

\[
\frac{(1 + p)c_L}{2p(r + w) + (1 - p)w} \leq \beta < \frac{c_L}{w}
\]

This is the conditional discouragement type, \(T3c\). Consequently, the DM will not do any task if:

\[
\frac{c_L}{r + w} \leq \beta < \frac{(1 + p)c_L}{2p(r + w) + (1 - p)w}
\]

This is the discouragement type, \(T3d\).

5. If \(\beta < \frac{c_L}{r+w}\): the DM will never do a task, creating the \(T2\) type.

\(^1\)Rearranging and simplifying the inequality gives \(\frac{2pr+w}{w} < \frac{c_H}{c_L}\), which is true since \(2p + \frac{w}{w} < 2(r + w) + \frac{w}{w}\) and by assumption \(6\).
A few points are noteworthy from our analysis above. As a difference from the case without intrinsic motivation, we have three new types, which are T3b.1, T3c.1, and T3d.1. The common feature of these types is that they may still complete the second task under the all-or-nothing mechanism even if they did not complete the first task. This is because of the intrinsic value of the task. Below are the expected utility calculations:

<table>
<thead>
<tr>
<th></th>
<th>EU_{A\rightarrow N}</th>
<th>EU_{A\rightarrow P}</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>$\beta[2p^2 (r + w - c_L)] + 2 (1 - p)^2 (r + w - c_H) + 2p (1 - p)(2(r + w) - c_L - c_H)]$</td>
<td>$\beta[2p^2 (r + w - c_L)] + 2 (1 - p)^2 (r + w - c_H) + 2p (1 - p)(2(r + w) - c_L - c_H)]$</td>
</tr>
<tr>
<td>T3a</td>
<td>$\beta[2p^2 (r + w - c_L)] + 2p (1 - p)(r + w - c_L)]$</td>
<td>$\beta[2p^2 (r + w - c_L)] + 2 (1 - p)^2 (r + w - c_H) + 2p (1 - p)(2(r + w) - c_L - c_H)]$</td>
</tr>
<tr>
<td>T3b.1</td>
<td>$\beta[2p^2 (r + w - c_L)] + 2p (1 - p)(r + w - c_L)]$</td>
<td>$\beta[2p^2 (r + w - c_L)] + p (1 - p)(2(r + w) - c_L - c_H) + (1 - p)p(w - c_L)]$</td>
</tr>
<tr>
<td>T3c</td>
<td>$\beta[2p^2 (r + w - c_L)] + 2p (1 - p)(r + w - c_L)]$</td>
<td>$\beta[2p^2 (r + c_L)]$</td>
</tr>
<tr>
<td>T3c.1</td>
<td>$\beta[2p^2 (r + w - c_L)] + 2p (1 - p)(r + w - c_L)]$</td>
<td>$\beta[2p^2 (r + w - c_L) + 2p (1 - p)(r + w - c_L)]$</td>
</tr>
<tr>
<td>T3d</td>
<td>$\beta[2p^2 (r + w - c_L)] + 2p (1 - p)(r + w - c_L)]$</td>
<td>$\beta[p(w - c_L)]$</td>
</tr>
<tr>
<td>T3d.1</td>
<td>$\beta[2p^2 (r + w - c_L)] + 2p (1 - p)(r + w - c_L)]$</td>
<td>$\beta[p(w - c_L)]$</td>
</tr>
<tr>
<td>T2</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

According to this table, the period-zero-self strictly prefers all-or-nothing not only if she is the encouragement type, but also if she is a new conditional encouragement type too, T3b.1. Because of the intrinsic reward, the new conditional encouragement type does not give up completely after a failure. As a result, we can summarise the full and zero completion rates as follows:

<table>
<thead>
<tr>
<th></th>
<th>$f_i^S$</th>
<th>$f_i^A$</th>
<th>$f_i^P$</th>
<th>$n_i^S$</th>
<th>$n_i^A$</th>
<th>$n_i^P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>T3b</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>T3a</td>
<td>1</td>
<td>1</td>
<td>$p^2$</td>
<td>0</td>
<td>0</td>
<td>$(1 - p)^2$</td>
</tr>
<tr>
<td>T3b.1</td>
<td>$p$</td>
<td>$p$</td>
<td>$p^2$</td>
<td>$(1 - p)^2$</td>
<td>$(1 - p)^2$</td>
<td>$(1 - p)^2$</td>
</tr>
<tr>
<td>T3c</td>
<td>$p^2$</td>
<td>$p^2$</td>
<td>$p^2$</td>
<td>$(1 - p)^2$</td>
<td>$(1 - p)^2$</td>
<td>$(1 - p)^2$</td>
</tr>
<tr>
<td>T3c.1</td>
<td>$p^2$</td>
<td>$p^2$</td>
<td>$p^2$</td>
<td>$(1 - p)^2$</td>
<td>$(1 - p)^2$</td>
<td>$(1 - p)^2$</td>
</tr>
<tr>
<td>T3d</td>
<td>$p^2$</td>
<td>0</td>
<td>$p^2$</td>
<td>$(1 - p)^2$</td>
<td>1</td>
<td>$(1 - p)^2$</td>
</tr>
<tr>
<td>T3d.1</td>
<td>$p^2$</td>
<td>0</td>
<td>$p^2$</td>
<td>$(1 - p)^2$</td>
<td>$(1 - p)$</td>
<td>$(1 - p)^2$</td>
</tr>
<tr>
<td>T2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Type T3d.1 may not exist, which does not affect our main results.
The cutoffs for types are as follows:

\[ T_1, \text{ if } \frac{c_H}{r+w} \leq \beta \]

\[ T_{3a}, \text{ if } \frac{c_H(2-p)}{2(r+w)-pw} \leq \beta < \frac{c_H}{r+w} \]

\[ T_{3b.1}, \text{ if } \max \left\{ \frac{c_H}{2(r+w)}, \frac{c_L(1-p)c_H}{2(r+w)-pw} \right\} \leq \beta < \frac{c_H(2-p)}{2(r+w)-pw} \]

\[ T_{3d.1}, \text{ if } \frac{c_H}{2(r+w)} \leq \beta < \min \left\{ \frac{c_H}{2(r+w)}, \frac{c_L(1-p)c_H}{2(r+w)-pw} \right\} \]

\[ T_{3c.1}, \text{ if } \frac{c_L}{w} \leq \beta < \frac{c_H}{2(r+w)} \]

\[ T_{3c}, \text{ if } \frac{(1+p)c_L}{2p(r+w)+(1-p)w} \leq \beta < \frac{c_L}{w} \]

\[ T_{3d}, \text{ if } \frac{c_L}{r+w} \leq \beta < \frac{(1+p)c_L}{2p(r+w)+(1-p)w} \]

\[ T_2, \text{ if } \beta < \frac{c_L}{r+w} \]

For each type, the lower bound for \( \beta \) with intrinsic motivation is smaller than the lower bound for \( \beta \) without intrinsic motivation. For example, the lower bound for \( T_1 \) with intrinsic motivation, \( \frac{c_H}{r+w} \), is smaller than the lower bound for the same type without intrinsic motivation, \( \frac{c_H}{r+w} \) (see the cutoffs derived in the proof of proposition 1). This means that a decision maker with intrinsic motivation will never be classified as a lower type than the type she would have been classified as if she did not have intrinsic motivation. Moreover, the new types we found when there is intrinsic motivation, namely \( T_{3b.1} \) and \( T_{3c.1} \), are less likely to complete no tasks in comparison to \( T_{3b} \) and \( T_{3c} \) types, as we explained above.

We can write the full task completion rate under each mechanism as follows:

\[ f^P = s_1 + s_{3a}p^2 + s_{3b.1}p^2 + s_{3c}p^2 + s_{3d}p^2 \]

\[ f^A = s_1 + s_{3a} + s_{3b.1}p + s_{3c}p^2 + s_{3c.1}p^2 \]

\[ f^S = s_1 + s_{3a} + s_{3b.1}p + s_{3c}p^2 + s_{3c.1}p^2 + s_{3d}p^2 \]

Comparing the self-select to siece-rate, we get:

\[ f^S - f^P = s_{3d}(1-p^2) + s_{3b.1}(p - p^2) \]

This means that the self-select mechanism will be effective if there is a significant number of decision makers who are encouraged or conditional encouraged given intrinsic motivation.
Appendix B

Appendix B. 1

Instructions given in the tutorials (Study 1):

**Piece-rate treatment**
You will be awarded according to the number of online quizzes that you complete and score at least 50% {i.e., if you complete and score at least 50% in 6 out of the 9 quizzes, you will receive (6/9) *10 = 6.7 marks}.

**All-or-nothing treatment**
You will be awarded 10 marks only if you complete and score at least 50% in all the online quizzes and you will receive 0 if you miss any.

**Self-select treatment**
Please choose one of the following options:

1. You will be awarded according to the number of online quizzes that you complete and score at least 50% {i.e., if you complete and score at least 50% in 6 out of the 9 quizzes, you will receive (6/9) *10 = 6.7 marks}.

2. You will be awarded 10 marks only if you complete and score at least 50% in all the online quizzes and you will receive 0 if you miss any.
Appendix B. 2

A sample of recruitment form (only the barcode and the contact email vary across treatments)

Online Survey

**Earn up to RM20 in CASH $$$ by filling up simple online survey questions**

(Open to Monash’s undergraduate students only)

If you are interested to participate, please fill up a simple online application form by scanning the QR code:

OR

![QR Code]

(Note: you may login to your Monash’s student email or any other google email account to access the form)

Email [MonashMalaysiaSurvey3@gmail.com](mailto:MonashMalaysiaSurvey3@gmail.com), we will send you the application form.
Appendix B. 3 Invitation form

- Piece-rate treatment

Invitation to Participate in Online Survey

* Required

Your participation will involve you completing up to four different online surveys (one per week over four weeks). Each survey contains multiple-choice questions and will only take approximately 10 minutes to complete.

You will be rewarded RM5 in cash for each online survey that you complete. For example, if you complete 3 out of 4 online surveys, you will be rewarded RM5 x 3 = RM15 in cash. You will receive your earnings at the end of the forth week. *

☐ Yes, I wish to participate

☐ No, I do not wish to participate

NEXT

Never submit passwords through Google Forms.
• All-or-nothing treatment

Invitation to Participate in Online Survey

* Required

Your participation will involve you completing up to four different online surveys (one per week over four weeks). Each survey contains multiple-choice questions and will only take approximately 10 minutes to complete.

You will be rewarded RM20 only if you complete all the 4 online surveys and you receive 0 if you missed any. For example, if you complete 3 out of 4 online surveys, you will receive 0. You will receive your earnings at the end of the forth week. *

- Yes, I wish to participate
- No, I do not wish to participate

NEXT

Never submit passwords through Google Forms.
Self-select treatment

Invitation to Participate in Online Survey

* Required

Your participation will involve you completing up to four different online surveys (one per week over four weeks). Each survey contains multiple-choice questions and will only take approximately 10 minutes to complete.

If you wish to participate, please choose either "Option 1" or "Option 2" to indicate how you would like to be rewarded for your participation. You will receive your earnings at the end of the forth week. *

Option 1: You will be rewarded RM5 in cash for each online survey that you complete. For example, if you complete 3 out of 4 online surveys, you will be rewarded RM5 x 3 = RM15 in cash.

Option 2: You will be rewarded RM20 in cash only if you complete all the 4 online surveys and you receive 0 if you missed any. For example, if you complete 3 out of 4 online surveys, you will receive 0.

☐ No, I do not wish to participate

NEXT

Never submit passwords through Google Forms.