

# **The power of reframing incentives**

## **Field experiment on (students') productivity**

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### **Abstract**

The study aims to test the framing effect on productivity of students in one of higher education institutions in Egypt, through using "Bonus Marks" incentive scheme that is commonly used in the Egyptian Universities.

The goals of this study are to investigate whether the non-monetary incentive has an effect on individuals' productivity, and whether individuals' output and productivity are affected by the incentive frame, in addition to testing if demographic characteristics of individuals are to affect their productivity responses to incentives framing. We are not aware of studies that have explicitly studied the relative effectiveness of non-pecuniary incentives framed as either gains or losses in the Middle East higher educational context. Therefore, this paper would present the first step for future research in this area.

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## 1 Introduction

In the light of scarcity of financial resources and the modest effectiveness of financial rewards, policy makers and firms should look for alternative and more cost-effective means to increase individual efforts/productivity. Since economics is all about people's behavior, Insight into behavioral economics can be useful within this regard.

Behavioral economics is the study of the effects of psychology on economic decision-making. It has three core ideas; the first of them is the fact that people generally act on "rules of thumb"<sup>2</sup> as opposed to rational thinking. The second idea is that people's thinking of a problem is affected by how the problem is presented; which is called "Framing"; the third idea in behavioral economics is market inefficiencies, which describes outcomes when the unexpected happens; a concept applies to the stock market<sup>3</sup>.

When considering trends in economics, the emotional decision-making should be taken into account to give the most reliable view. Our emotions, in some cases, guide us beyond what is rational. Humans have been found to be risk seeking in case of decisions regarding gains and risk averse in case of decisions regarding losses; in other words, individuals have a strong tendency to avoid losses and acquire gains (Kahneman and Tversky, 2000).

The work divided into 5 sections, organized as follows; after this introduction, we will discuss the theoretical background of the notion of framing. The following section will provide some selected empirical evidence about framing effect. Then Section four will present the field experiment, starting with the field background, and then the experiment design followed by the results. After that discussions and analysis of the results will be presented. The final section concludes the study.

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<sup>2</sup> A rule of thumb refers to any principle that is mostly true in the majority of situations. For example "you get what you pay for", this is true in most cases. However, sometimes cheaper products are just as good, if not better, than the brand with the highest price. The rational decision in this case is to buy the cheaper product. Most people, however, would buy the more expensive product, thinking that it is superior.

<sup>3</sup> Market efficiency means that stock price reflect all the available information in the market. Therefore, no investor has the privilege of predicting what will happen in the future before the other investors. As for Market inefficiency, it is anything that happens to oppose the previous idea, in a non-rational way. An example of this is selling overvalued stocks, and then purchasing undervalued stocks with the earned money. If done correctly, investors can make a lot of money this way, even if it does not seem rational.

## 2 Theoretical background

A frame in social theory consists of a schema<sup>4</sup> of interpretation, i.e. a collection of anecdotes<sup>5</sup> and stereotypes<sup>6</sup> that individuals rely on to understand and respond to events<sup>7</sup>. In other words, people build a series of mental filters through biological and cultural influences. They use these filters to make sense of the world. The choices they then make are influenced by their creation of a frame.

Framing effect is one striking cognitive bias<sup>8</sup>, it is a notion that was first introduced by Amos Tversky and Daniel Kahneman in 1972 (Kahneman and Frederick, 2002). This notion was a major factor in the emergence of behavioral economics<sup>9</sup> and the development of Prospect theory.

The power of framing is considered one of the pedestals within behavioral economics, that new field of studying the effects of social, cognitive and emotional factors on the economic decisions of individuals and institutions, as well as the consequences on market prices and resource allocation. These recent approaches are principally concerned with the bounded rationality of economic agents.

Behavioral models, typically, integrate insights from psychology with the Neo-classical economic theory; they address a particular market anomaly<sup>10</sup> and modify standard Neo-classical models by describing decision makers as using heuristics and being subject to framing effects. In general, economics

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<sup>4</sup> describes any of many concepts, including an organized pattern of thought or behavior, a structured cluster of pre-conceived ideas, a mental structure that represents some aspect of the world, a specific knowledge structure or cognitive representation of the self, a mental framework focusing on a specific theme that helps us to organize social information, structures that organize our knowledge and assumptions about a given issue, and are used for interpreting and processing information.

<sup>5</sup> An anecdote is a short, amusing story about a real incident or person.

<sup>6</sup> Stereotypes are standardized and simplified conceptions of people based on some prior assumptions.

<sup>7</sup> (Frame analysis; Goffman, Erving. *Frame Analysis: An essay on the organization of experience*).

<sup>8</sup> A cognitive bias is a pattern of deviation in judgment that occurs in particular situations, leading to perceptual distortion, inaccurate judgment, illogical interpretation, or what is broadly called irrationality, (Kahneman and Tversky, (1972), Baron, (2007), Ariely, (2008)).

<sup>9</sup> Earning Kahneman a Nobel Prize in 2002.

<sup>10</sup> Usually related to Behavioral biases by economic agents or related structural factors, such as unfair competition, lack of market transparency, regulatory actions, etc.

continues to sit with the Neo--classical framework, although the standard assumption of rational behavior is often challenged.

Microeconomics was closely linked to psychology<sup>11</sup> during the classical economics era<sup>12</sup>. Nevertheless, economists tended to reshape the discipline as a natural science throughout the development of Neo-classical economics. They developed the concept of homo-economicus, whose psychology was fundamentally rational. This led to unintended and unforeseen errors. However, many important Neo--classical economists<sup>13</sup> employed more sophisticated psychological explanations.

With economic psychology emerging in the 20th century<sup>14</sup>, expected utility and discounted utility models began to gain acceptance, generating testable hypotheses about decision making, given uncertainty and inter-temporal consumption respectively. Eventually, Observed and repeatable anomalies have challenged those hypotheses<sup>15</sup>. In the 1960s, cognitive psychology started to focus on the brain as an information processing device. Psychologists specialized in this field<sup>16</sup> began to compare their cognitive models of decision-making under risk and uncertainty to economic models of rational behavior.

Three themes –including framing - predominate in behavioral economics (Shefrin, 2002):

- Heuristics: People often make decisions based on approximate rules of thumb, instead of strict logic.
- *Framing: The collection of stories and stereotypes -that make up the mental-emotional filters - individuals rely on to understand and respond to different events.*

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<sup>11</sup> For example, Adam Smith wrote *The Theory of Moral Sentiments*, which proposed psychological explanations of individual behavior, including concerns about fairness and justice, (Nava Ashraf et al., 2005) and Jeremy Bentham wrote extensively on the psychological underpinnings of utility.

<sup>12</sup> classical school of economic thought that was originated in the late 18th century. It has reached maturity with the works of Adam Smith, David Ricardo and John Stuart Mill. The theories of the school, focused on economic growth and economic freedom, stressing laissez-faire ideas and free competition.

<sup>13</sup> Including Francis Edgeworth, Vilfredo Pareto and Irving Fisher.

<sup>14</sup> in the works of Gabriel Tarde, George Katona and Laszlo Garai

<sup>15</sup> Further steps were taken by the Nobel prizewinner Maurice Allais, for example in setting out the Allais paradox, a decision problem he first presented in 1953 which contradicts the expected utility hypothesis.

<sup>16</sup> such as Ward Edwards, Amos Tversky and Daniel Kahneman

- Market inefficiencies: include mis-pricings, non-rational decision making, and return anomalies.

*As for "the power of Framing"; it is the way options and alternatives were presented to individuals have been noticed to influence individual decisions.*

In the early 1960s, Psychologists have discovered a gap between consumers' willingness to pay (WTP) and consumers' willingness to accept (WTA) (Coombs et al., 1967, Slovic and Lichtenstein, 1968). Emotions play a guiding role in this regard; they are the tools we use to simplify the world into general rules of thumb, as they allow our brains to take shortcuts and approximate rational thinking.

In 1980, the economist Richard Thaler has proposed his new term: "*Endowment Effect*". The term refers explicitly to the opportunity cost underweighting and the role of property right in influencing consumers' evaluations and hence affecting their choices.

The endowment effect was described as inconsistent with the standard economic theory that stated that a person's WTP for a good should be equal to his WTA as a compensation for being deprived of that good. In expected utility theory, the individual only cares about absolute wealth, not relative wealth in any given situation<sup>17</sup>.

The endowment effect is based theoretically on the value function within the prospect theory<sup>18</sup> that is presented in Figure 1 (Tversky and Kahneman, 1979). Prospect theory used cognitive psychology to explain various divergences of economic decision making from Neo-classical theory, it has been an example of generalized expected utility theory which was meant to present more accurate description of preferences compared to expected utility theory by sketching how people choose between probabilistic alternatives and evaluate potential losses and gains.

The prospect theory claims that transporters (carriers) of utilities make change relative to a reference point (ownership or non-ownership reference) rather than absolute levels. People's satisfaction and hence choices are driven by the comparisons they make. Accordingly, they value a thing more once it becomes theirs.

The Prospect theory describes the decision processes in two stages; editing and evaluation. In the editing stage, individuals follow some heuristic to classify outcomes of a given decision. Then they decide which outcomes they see as basically identical, set a reference point and then consider lesser outcomes as losses and greater ones as gains.

In the next evaluation phase, individuals behave as if they would compute a value (utility), based on the potential outcomes and their respective probabilities,

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<sup>17</sup> The expected utility is characterized by that the rational agent is indifferent to the reference point.

<sup>18</sup> In the original formulation the term prospect referred to a lottery.

and then choose the alternative that has a higher utility. The following Figure 1 shows this idea:

Figure 1 shows a s-shaped individual value function, its center is the individual's point of reference from where any change will be seen as either a loss or a gain. The value function takes a sigmoid<sup>19</sup> asymmetric shape, the concave gain side illustrates risk seeking and convex loss side illustrates loss aversion with diminishing sensitivity, which indicates that gains for smaller values are psychologically larger than equivalent increases for larger quantities (Tversky and Kahneman, 1981).

When the individual is about to make a decision; if he would look from a certain reference point respectively at gains and losses of the same absolute size, he would figure out that the losses *seem to have* a greater value than the gains<sup>20</sup>.

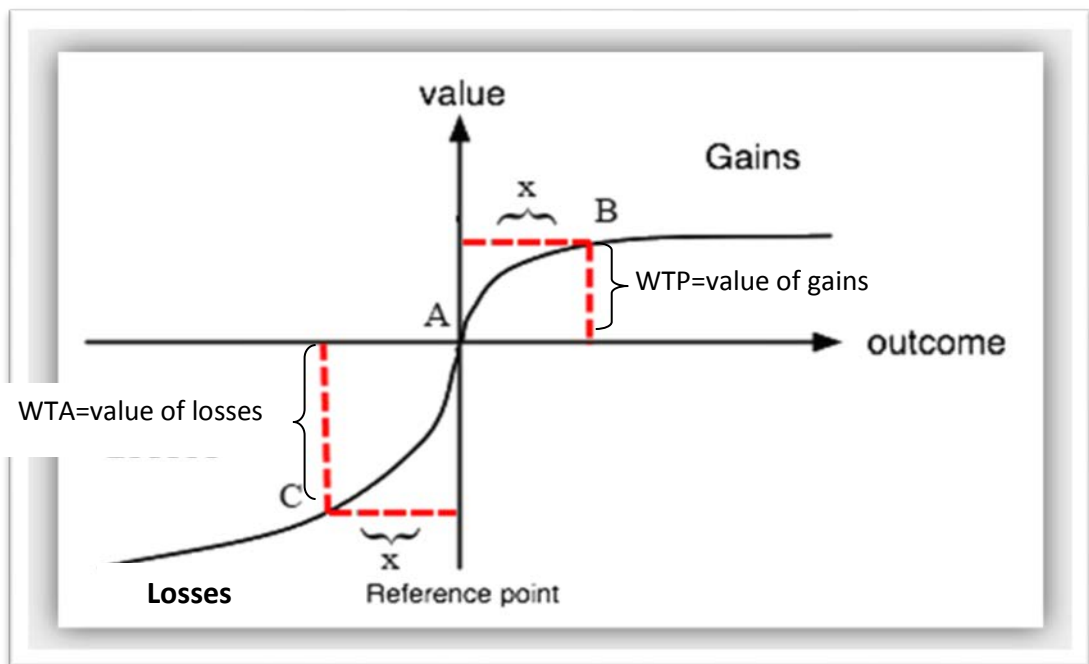


Figure 1: Value function within the Prospect Theory

Figure 1 shows an individual owning "A" amount of a good, when he is asked how much he would be WTP to acquire X outcome (moving from A to B), and how much he is willing to accept as a compensation to sell the same X

<sup>19</sup> Sigmoid means resembling the lower-case Greek letter sigma ( $\varsigma$ ) or the Latin letter S

<sup>20</sup> The difference between \$10 and \$20 seem bigger than the difference between \$1000 and \$1010 and losing \$100 hurts more than gaining \$100 yields pleasure.

when he owns it (moving from A to C), his reply would show that  $WTA > WTP$ . This result is simply because the value function for gains is less steep than the value function for losses. Accordingly, 4 principles for framing can be listed (Thaler, 1999):

- *Segregate gains, as the gain function is concave:* The perceived value of a series of gains as separate entities is greater than the perceived value of them combined. Split goodies up into multiple pieces and use them as bait to keep the user happy. A series of smaller successes is better than a few big ones. As gains are integrated, their combined perceived value diminishes.
- *Integrate losses, as the loss function is convex:* You are better off telling it all as it is. When losses are integrated, their combined negative value diminishes.
- *Integrate smaller losses with larger gains (to offset loss aversion):* It is possible to “cover up” losses by combining it with a gain that has a larger perceived positive value than negative value of the loss.
- *Segregate small gains from larger losses:* Segregate small gains from larger losses, as the gain function is originally steep, so segregating it can bring more value than using a small gain to reduce a large loss.

Deeper insight analysis shows no contradiction between the endowment effect and Neo-classical economic theory (Hanemann, 1991). Figure 2 explains that rationale

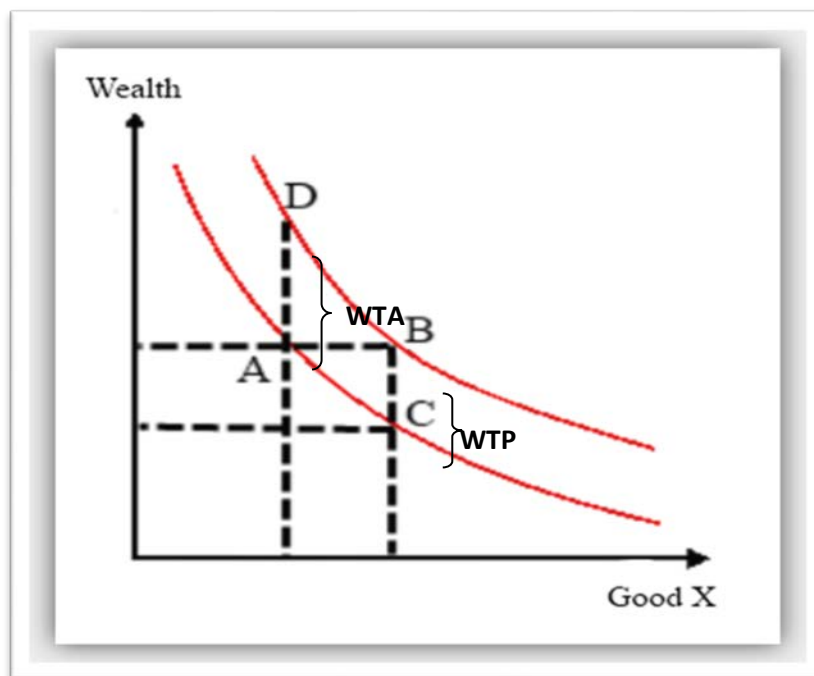


Figure 2: Endowment effect and indifference curves

Figure 2 shows two indifference curves for good X and wealth. An individual is asked how much he would be WTP in order to move from A (where he has  $X_0$  of good X) to point B (where he has the same wealth and  $X_1$  of good X). His WTP would be represented by the vertical distance between C and B since the individual is indifferent to being at A or C.

On the other hand, if the same individual is asked to indicate how much he would be WTA in order to move from B to A. His WTA would be represented by the vertical distance between A and D as he is indifferent to either being at point B or D<sup>21</sup>.

Following what is stated above, when people face the same option in different formats, they may take inconsistent choices, based on the language (frame) of the option whether it focuses on losses or gains. This paper is going to experiment such anomaly for non-monetary<sup>22</sup> incentives.

### 3 Empirical evidence of Framing

Since the beginning of this century, framing effect has been a part of sociology, political science and economics scholarly work on several topics such as social movements; political opinion formation and economic decision making.

That behavioral bias has been verified through several laboratory experiments (Ellingsen et al, 2008). However, many economists undervalue such results on the ground of poorly designed experiment or because of mistakes made by inexperienced laboratory subjects who learn over the time how to overcome such weakness (Hossain and List, 2009).

Recently, some studies have extended these results from the lab into the field. However, few field experiments have confirmed a significant economic effect of reframing<sup>23</sup> due to the difficulty associated with clean field and the complexity of separating the frame effect.

Framing proved to have a significant power on voters for *alternative political options*; people have shown preference to an economic agenda when high employment rates are proposed, but they are against it when the complementary

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<sup>21</sup> Shogren et al. (1994) has reported findings that lend support to Hanemann's hypothesis.

<sup>22</sup> Closely similar to the term: "non-pecuniary incentives" like rewards and test scores.

<sup>23</sup> Two remarkable studies in that: one tackled the status quo effect, which reveals the power of the status quo when agents make retirement allocations or insurance decisions (Samuelson and Zeckhauser, 1988) and the other recent study has proved the role of framing manipulation in increasing workers` productivity (Hossain and List, 2009).



unemployment rates are highlighted in the agenda (Druckman, 2001b). Rugg<sup>24</sup> demonstrated a framing effect in a poll for same option expressed differently, as 62% of people *disagreed with allowing public condemnation of democracy*, but only 46% of people *agreed to forbidding public condemnation*. The framing effect accounts for the 16% disparity in these effectively similar decisions (as cited in Plous, 1993). Therefore, framing could have negative social and political implications. Also, Druckman (2001b) pointed out that these effects could discredit public opinion, rendering polls as doubtful sources of information.

Framing has its effect *on encouraging people early payments*. Gätcher et al. (2009) reported 93% of PhD students registered early when presented a loss frame, described as a penalty fee, as opposed to 67% students registering early when presented a positive frame in the form of a discount.

Carmon and Ariely (2000) have done four studies of value assessments of tickets to NCAA<sup>25</sup> Basketball games, in order to explore the difference between consumer's buying- and selling-price estimates; such gap is to reflect a simple interpretation of *loss aversion*. The results of the four studies have maintained strongly the asymmetric buying/selling-features processing effects<sup>26</sup>, and therefore, strengthened the support for the endowment effect.

Kahneman et al. (1990) supported the "*endowment effect*" even in market settings with opportunities to learn through running several experiments, where coffee mugs<sup>27</sup> are randomly given to half the subjects then markets for the mugs are conducted.

In the labor context, Hossain and List (2009) framed conditional incentives on employees within a natural field experiment<sup>28</sup>. The results supported the prevalence of *loss aversion* in a natural labor market; along with stronger behavioral biases among groups than individuals. Moreover, the experiment results supported *the power of simple framing manipulations* in enhancing productivity, and showed that losses frame brought out significantly higher effort, and projected that 1% increase in productivity purely due to the framing of incentive schemes implies economically significant long-term growth of the economy.

On the other hand, similar insights from behavioral economics proved to be extended to the *non-financial incentives*. Recent advances in behavioral

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<sup>24</sup> Cited in Plous, 1993.

<sup>25</sup> National Collegiate Athletic Association.

<sup>26</sup> Where the premium that seller demanded (compared to the buyer) showed the impact of loss aversion from the seller side.

<sup>27</sup> Representing consumption objects.

<sup>28</sup> The experiment was executed with Wanlida Group Co., a high tech Chinese enterprise engaged in the production and distribution of consumer electronics.

economics have shown that non-material rewards could have considerable motivational power. Kosfeld and Neckermann (2010) have studied the impact of status and social recognition on worker performance in a field experiment. Students in the award treatment were offered a symbolic congratulatory card from the organization honoring the best performance. Results show that students in the award treatment outperform students in the control treatment by about 12% on average.

Based on the theoretical support along with empirical evidence granted for framing effect, firms and policy makers should get use of *framing financial/non-financial incentives* in enhancing individual work effort whether in production, education or training.

In the light of general uneasiness among educators with using financial incentives, together with financial limitation in general, educators and policy makers would be advised to find out alternative and more cost effective means to increase individual effort. This paper is extending the previous studies by *testing the effect of framing non-financial incentives on individual work effort*, through using field experiment on university students. The results are expected to be beneficial in the context of the education sector and also within the production sector.

*Henceforth, this paper is intended to test the framing effect on productivity when the incentive is non-pecuniary (bonus grades for undergraduate students), and the output is non-monetary as well.*

## 4 The experimental study

This section will present a background of the experiment field, then a part about the experimental design showing the steps and procedures of the experiment conduction followed by the results of the experiment and their analysis, finally a part for analysis and discussion of results will be presented.

### 4.1 Background of the experiment field

This study has reported data from a natural field experiment conducted on Credit Hours System students at the Faculty of Engineering – Cairo University (CHS - CUFE).

(CHS – CUFE) offers seven different programs of Engineering<sup>29</sup>. For graduation from any program, students are required to successfully complete

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<sup>29</sup> List of the offered programs is in Table A-1 of the paper's Annex.

courses<sup>30</sup> that take at least 180 Credit Hours (CHs), 24 credit hours of them are University-Core Courses.

Regarding University-Core Courses; students are required to successfully complete all the compulsory courses and 6 credits hours of its elective courses<sup>31</sup>. Grades are assigned to students for each course according to their credit hours, and then GPA is calculated<sup>32</sup> for each student at the end of each semester.

Principals of Economics for non majors (GENN-221), is one of the compulsory University-Core Courses with two Credit Hours (2CH). In spring 2012, (GENN-221) was offered and 67 students were registered in the course that was scheduled for 15 weeks, throughout students are assessed by: Assignments, Quizzes, attendance, Mid-Term Exam and Final Exam as illustrated in Table 1 below.

Table 1: GENN-221 (Spring 2011/2012): Student Assessment time table

<b>Task</b>	<b>Marks</b>	<b>Remarks</b>
4 Assignments	20	On weeks: 3,5,11,13
2 Quizzes	14	On weeks: 7, 14
Attendance <sup>33</sup>	6	Students should attend at least 75% of all the lectures to enter the final exam
Mid-Term Exam	20	On week (9)
Final Exam	40	After week (15)
<b>Total Marks</b>	<b>100</b>	

GENN221 seems to be a good representative field for the population, as it contains students of both genders with diversified majors and GPAs and also different levels completed CHs.

<sup>30</sup> University-core courses, College-core courses, Program-core courses.

<sup>31</sup> Details are in Table A-2 of the paper's Annex.

<sup>32</sup> The method of GPA calculation is stated in the paper's Annex.

<sup>33</sup> Attendance marks were not included in our experiment data as seen they are not measuring the students` productivity.

## 4.2 Experimental design/set-up

The experiment revolved around using different bonus incentive frames with GENN221 university students in order to test if simple non-monetary incentives and their reframing would influence individuals' productivity or not.

*Accordingly, the experiment aims to test the following behavioral principals:*

*Test (1): if students' specialization affects their academic attainment of non-major course.*

While conducting the experiment it seemed interesting to find out if the student's major would affect his/her education attainment or not. Therefore, we ran a regression model to investigate the effect of several demographic factors on students' grades in GENN221 course aside from the incentive issue.

*Test (2): Whether non-monetary incentive has a positive effect on student productivity.*

The non-monetary incentive in our experiment is bonus marks given to students, motivating them for more education attainment. We started the test by looking at the effect of such incentive on the grades, and then we repeated the test using the incentive's effect on productivity<sup>34</sup> to represent the student effort to attain the GENN221 course content.

For conducting test (2), we applied both "One sided t-test" and "Wilcoxon test" on pre and post incentive productivity.

*Test (3): if Individuals' productivity is affected by the incentive frame.*

That test is checking if the non-pecuniary ownership increases individuals' utility and therefore enhances their productivity motivated by avoiding a loss.

For that test two incentive frames were designed, both are inherently the same incentive but each with different language. Afterwards, they were randomly distributed on students;

*Frame (S):* is the Stick/Punishment design where students were *granted* the bonus marks before accomplishing their extra task; later on if they didn't done that task they will be "*punished*" by taking away some of their owned marks.

*Frame (C):* is the Carrot/Reward design where students were *not granted* any bonus marks until they accomplish the extra task, which means that students will have a "*Reward*" in form of bonus marks if they achieve that extra task.

If frame (S) appears to have higher productivity effect compared to frame (C) then we would accept extending the prospect theory for non-monetary incentives<sup>35</sup>. If frame (C) effect shows higher or equal effect, then we would reject extending the prospect theory for non-monetary incentives.

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<sup>34</sup> Student productivity in percentage = student grade in a certain task/maximum grade for that task)\*100

<sup>35</sup> And in cases when productivity cannot be traded for money.

In order to reach a result for Test (3) we used "Wilcoxon test-statistic" to test for the difference in the treatments differences. Additionally, we use the raw data to estimate a model, in which we regress the "student's grade under the incentive scheme" on dummy variables for the reward and punishment treatments. Moreover, raw data were used to estimate a univariate model of CRD with fixed effect.

The experiment conducted in this study is a Completely Randomized Design (CRD) with 6 covariates, one of them is categorical which consists of 3 dummy variables representing 4 categories of student's major.

The experiment duration is 9 weeks divided into two rounds as illustrated in Table 2. Subjects of the experiment are 67<sup>36</sup> GENN221 undergraduate students (spring 2012). Both groups are exposed randomly to two treatments (stick frame and carrot frame)<sup>37</sup>, both are related to educational attainment. It is worth noting that all students did not know that they are under experiment. Table 2 presents a summary of the experimental design.

Table 2: Experimental Design

<b>Groups</b>	<b>Number of subjects</b>	<b>Extra Task</b>	<b>Round (1): Week1-week 4</b>	<b>Round (2): Week 5-week 9</b>
G-1	32 <sup>38</sup>	Self education attainment of chapter three	Baseline	Punishment/stick treatment
G-2	29 <sup>39</sup>		Baseline	Reward/carrot treatment
	61			

First group (G-1) contains 32 students and second group (G-2) consists of 29 students, both groups` task is to achieve high level of education attainment that is measured through the course assessment format previously shown in Table 1.

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<sup>36</sup> Later on as the experiment proceeded we missed data of 6 subjects.

<sup>37</sup> as illustrated earlier in this paper.

<sup>38</sup> One student of G-1 didn't complete the experiment (he did not sit for the midterm exam), another student dropped GENN221 course from his spring semester CHs.

<sup>39</sup> One student of G-2 didn't complete the experiment (he did not sit for the midterm exam), one student dropped GENN221 course from his spring semester CHs, two students did not receive their personal letters of incentives.

*In Round (1), from February 16-March 14:*

some basic data about every subject were collected as covariates (independent variables)<sup>40</sup>, both groups were observed and assessed normally before the treatments. By the end of that round (on 14<sup>th</sup> of March), students were announced with their grades as a measurement for their course attainment productivity<sup>41</sup>.

*In Round (2), from March 15 - April 12:*

- on 15<sup>th</sup> of March; all students were informed about their extra task, which is self studying of chapter three in their course textbook by their selves without lecture illustration.

- *Two incentive schemes (treatments) were framed to motivate students to do that extra task.*

\* Treatment (1): Punishment scheme/stick frame was replicated 32 times. Where each student was granted 2 marks pre-midterm exam, but if he/she did not accomplish the extra task, he/she will be "punished" by losing 2 marks of his/her overall course score.

\* Treatment (2): Reward scheme/carrot frame was replicated 29 times. That treatment did not give student any bonus marks in advance, but the student gained a "reward" in form of 2 marks after he/she achieve his/her extra task .

- G-1 was given the stick frame, and G-2 was given the carrot frame. Each student received a personal letter<sup>42</sup> contains all instructions about the incentive scheme he/she is in<sup>43</sup>.

- On 29<sup>th</sup> of March; students were informed about their grades according to each student's incentive frame<sup>44</sup>.

- On 12<sup>th</sup> of April, students sat for a midterm exam that contains "*bonus questions box*", in order to test their self learning productivity<sup>45</sup>. Then their midterm exam papers were corrected and overall course score<sup>46</sup> were announced.

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<sup>40</sup> Student`s gender, major, number of completed credit hours and GPA.

<sup>41</sup> Student assessment at the end of round (1) was out of 17 marks (2 assignments and 1 quiz).

<sup>42</sup> In order to evade the peer effect on the student behavior.

<sup>43</sup> Copies of the 2 frames personal letters are provided in the paper's Annex.

<sup>44</sup> This is the students marks score pre midterm.

<sup>45</sup> The student can choose to refuse the incentive by simply not answering the "bonus question".

Since the goal of the study was to implement a natural field experiment, *we should refer to the following experimental notes of interest:*

- The students were under fixed grading system according to (CHS - CUFE) internal regulations guidelines for GENN221 course<sup>47</sup>. The bonus marks for both treatments represent 10% of the total return in grades for highest-graded student<sup>48</sup>.
- In order to minimize information transmission between groups under different treatments, students were handed personal incentives letters in round (2) to eliminate the peer effect.
- Students in the baseline rounds did not receive letters when they were working within the baseline weeks.
- As for language of the treatments, we deliberately did not call the reduction in grades in the punishment treatment a "fine" or "punishment" to lessen potential depressing (physiological) connotations. Instead, we were interested in making the reward and punishment treatments purely two different languages (frames) of the same incentive.
- The experiment's central dependant variable is the student's productivity that is calculated for all rounds by: student grade for each task/ the max total grade for that task.
- By including the pre-treatment period (baseline) and under-treatment control (baseline) period, the entire experiment lasted 9 weeks, and 61 of (CHS - CUFE) students participated in the experiment.

### 4.3 Experiment's Results

The experiment started with 67 students in Round (1), then 2 students dropped the course and 2 students didn't get their incentive letters also 2 students didn't enter the midterm exam. Therefore, we end up with 61 subjects and we applied unbalanced CRD. For statistical calculation we used SPSS statistical package (PASW Statistics 18).

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<sup>46</sup> Overall score announced was an assessment of 9 out of 15 weeks of the GENN221 course.

<sup>47</sup> There are two reasons why our particular framing treatments might not produce results that are significantly different from one another. First, the framing treatment is a passive one, the punishment treatment is not a particularly powerful variant.

<sup>48</sup> The bonus box is equivalent to 2 marks added to the total 40 marks of the mid tem exam.

Tables C-1 and C-2 in the appendix enclose the raw data of the field experiment and their descriptive statistics. Table C-1 presents student gender, major, GPA and the number of completed CHs for 61 students as well as their grades before and after the incentive. Table C-2 shows statistical summary for the raw data. While Table C-3 reports the field mean and standard deviation (SD) of students' grades and students' productivity pre- and under both incentive frames: stick and Carrot.

As a start, it would be interesting to know the effect of demographic factors on students' course attainment in general during Round (1), and test if student's major affects his/her course grade/productivity. For that we conducted the following linear regression model.

$$GPre_i = \mu + \beta_1(Gender_i) + \beta_2(GPA_i) + \beta_3(CHs_i) + \beta_4M1_i + \beta_5M2_i + \beta_6M3_i + \varepsilon_i \quad (1)$$

where

$$\varepsilon_i \sim N(0, \sigma^2)$$

$GPre_i$ : student (i) grade pre incentive (Round 1)

$\mu$  is the grand mean (intercept)

$Gender_i$ : Dummy variable = 0 for female and 1 for male

$GPA_i$ : GPA level of student (i)

$CHs_i$ : completed credit hours of student (i)

$M$  covariate is categorical consists of 3 dummy variables representing 4 categories of student's major:

$M1_i = 1$  if student is CCE major, = 0 otherwise

$M2_i = 1$  if student is CEM or STE or WEE major, = 0 otherwise

$M3_i = 1$  if student AET or PPC is major, = 0 otherwise

$M1_i = M2_i = M3_i = 0$  if student is MDE major

The results in Table C-4 presents that regression, where the second column tells that student's GPA increases his/her grades by 2.4 at  $p < 0.05$ . major, gender and CHs were insignificant in affecting student's grades.

Alternatively we regressed the effect on student's productivity:

$$PPre_i = \mu + \beta_1(Gender_i) + \beta_2(GPA_i) + \beta_3(CHs_i) + \beta_4M1_i + \beta_5M2_i + \beta_6M3_i + \varepsilon_{ij} \quad (2)$$



Same results were reached as shown in Table C-5, GPA has significant effect on productivity by 0.132 at  $p < 0.05$ , and all other independent variables remained insignificant. Accordingly, we can reach the first result for Test (1):

*Result (1): GPA is the only demographic variable that significantly affects the student's productivity, whereby the students' major does not affect their productivity.*

Tentatively, Table C-2 statistics show that grades on average became more than 25% higher under the incentive treatments compared to the base line of Round (1). Having comparisons for students' grades pre- and under treatment period, it is available to compare the effects of having incentives on grades and production in order to find out the outcome for Test (2). We started by pooling the incentive treatment for that comparison then we applied T-test to check if there is a difference in students' grades before and after the incentive. Table C-6 proved significant difference in student grades at  $P\text{-value} < 0.05$ , and the positive intervals in the T- test indicate that the differences are in favor to after incentives grades. Same results were shown when conducting t-test on log (grades). However results were insignificant when applied t-test on productivity. Moreover, we have conducted Wilcoxon test and the results in Table C-7 supported the same outcome. By that, we reveal the Result (2)

*Result (2): There is evidence that non-pecuniary (Bonus Marks) incentives can be used to enhance student/individual grades, but there is no evidence that non-pecuniary incentives can be used to enhance student/individual productivity*

However, for better insights of the incentive effects, we moved to carry out Test (3). Table C-3 demonstrated that group G-1 achieved 14.47 marks on average in the first round (pre-treatment) then under stick (punishment) treatment their average grades became 18.35 marks. This implies that G-1 punishment treatment has increased students' attainment by 3.76 marks.

However, group G-2, in the first round reached average marks (pre-treatment) equal to 14.59, and then under carrot (reward) treatment their average grades became 18.04. This means that For G-2 reward treatment has increased students' attainment by 3.45 marks.

These raw data on average suggest minor differences across treatments of about 0.31<sup>49</sup> mark and very trivial difference in productivity, which indicates doubts about a significant effect of incentive framing on grades or productivity, therefore, further thorough data analysis is needed.

*For that, we followed three techniques:*

*First*, we calculated the Wilcoxon test-statistic to test for the "difference" in the "grades/productivity differences" due to Carrot and Stick framing. Table C-8 illustrates the results that do not accept any significant differences between the

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<sup>49</sup>  $3.45 - 3.76 = 0.31$  grade

two treatments difference in affecting neither student grades nor student productivity.

*Second*; to complement the above conclusion, we estimated a model in which we regress students` grades in Round (2) on dummy variables for the reward and punishment treatments.

$$G_i = \mu + \beta_1 Stick_i + \beta_2 Carrot_i + \beta_3 GPA_i + +\beta_4 CHS_i + \beta_5 Gender_i + \varepsilon_i \quad (3)$$

Additionally we proceed conducting the same model but on productivity instead of grades:

$$P_i = \mu + \beta_1 Stick_i + \beta_2 Carrot_i + \beta_3 GPA_i + +\beta_4 CHS_i + \beta_5 Gender_i + \varepsilon_i \quad (4)$$

where:

$G_i$ : *The grade of student (i)*

$P_i$ : *the Productivity of student (i)*

$Stick_i$ : *dummy variable*

= 1 if punishment treatment is applied on student i, and  
= 0 otherwise

$Carrot_i$ : *dummy variable*

= 1 if Reward treatment is applied on student i, and  
= 0 otherwise

*Both of these dichotomous variables equal zero for baseline round pre-treatment.*

$\varepsilon_i \sim N(0, N^2)$ .

Upon doing so, Table C-9 showed that carrot coefficient exactly equal to the stick coefficient (+3.7) at a significant level  $p < 0.05$ . However, Table C-10 presented that neither Stick nor Carrot frames has any significant effect on student productivity. Therefore, framing the incentive has no effect on "incentive effect on grades"

*In order to isolate the framing (treatment) effect, we used a model of unbalanced CRD covariate with fixed effect.*

$$G_{ij} = \mu + T_i + \beta_1(GPA_{ij}) + \beta_2(CHS_{ij}) + \beta_3(M1_{ij}) + \beta_4 M2_{ij} + +\beta_5 M3_{ij} + \beta_6 Gender_{ij} + \beta_7 Round1productivity_{ij} + \varepsilon_{ij} \quad (5)$$

and,

$$P_{ij} = \mu + T_i + \beta_1(GPA_{ij}) + \beta_2(CHS_{ij}) + \beta_3(M1_{ij}) + \beta_4 M2_{ij} + +\beta_5 M3_{ij} + \beta_6 Gender_{ij} + \beta_7 Round1productivity_{ij} + \varepsilon_{ij} \quad (6)$$

where:

$$\varepsilon_{ij} \sim N(0, \sigma^2)$$

$P_{ij}$ : student (j)Grade under frame (i), j= 1,2, 3, 4.....32

$P_{ij}$ : student (j)productivity under frame (i), j= 1,2, 3, 4.....32

$\mu$  is the grand mean (intercept)

$T_i$  is the treatment effect:

i= 1 for Stick treatment, and i=2 for Carrot treatment

When i=1: j runs from 1 till 32

When i=2: j runs from 1 till 29

Results of Regressions (5) and (6) are presented in Tables C-11 and Table C-12, we reached the same conclusion regarding the framing effect on grades and productivity, and assured the insights gained from regressions (3) and (4) regarding no significant effect of framing on grades or on productivity.

*Result 3: There is no evidence that framing non-financial incentive enhances grades or productivity.*

Aside from any treatment, in Table 3 below, GPA had significant effect on grades and productivity before treatment and after any treatment. However, no demographic factors showed any significant effect before/after treatment, except for CHs which turned up to have an effect on students' grades and productivity after incentive, but with very low coefficient equals to .022 and .001 respectively

Table 3: Demographic factors effects

	Before incentive		Under incentive	
	On grades	On productivity	On grades	On productivity
GPA Coeffiecient	Significant	Significant	Significant	Significant
CHs coeffiecient	Insignificant	insignificant	Significant	Significant
Gender	Insignificant	insignificant	insignificant	insignificant
Majors	Insignificant	insignificant	insignificant	insignificant

<sup>50</sup> Details are shown in Tables C-11 and C-12.

#### 4.4 Analysis and discussion

Table 4 summarizes all the results we have come up with through this field experiment study.

Table 4: Results summary

Test	Hypothesis	Result	Notes
Test (1): if students` major affects their economic course attainment.	H0: student`s Major does not affect his course grade/productivity H1: student`s Major affects his course grade/productivity.	Result (1): Do not reject H0  Tables C-4 & C-5	GPA is the only demographic variable that affects significantly the students` productivity, whereby the student`s major does not affect his/her productivity.
Test (2): Whether non monetary incentive has a positive effect on student grades/ productivity.	H0: No difference between student`s grades/before and after incentives. H1: there is difference between student`s grades before and after incentives and in favor to after incentive.	Result (2): do not reject H1  Table C-6	There is evidence that non-pecuniary incentives can be used to enhance student/individual grades,
	H0: No difference between student`s productivity before and after incentives. H1: there is difference between student`s productivity before and after incentives and in favor to after incentive.	Result (2): do not reject H0  Table C-7	but there is no evidence that non-pecuniary incentives can be used to enhance student/individual productivity
Test (3): if Individuals` productivity is affected by the incentive frame.	H0: Treatment frame has no effect on student grades H1: Treatment frame has no effect on student grades	Result (3): Do not reject H0 Tables C-8, C-9 & C-11	There is no evidence that framing non-financial incentive increases grades
	H0: framing non financial incentive cannot be used to enhance productivity. H1: framing non financial incentive can be used to enhance productivity.	Result (3): Do not reject H0 Tables C-8, C-10 & C-12	There is no evidence that framing non-financial incentive enhances student productivity.

The results show the inability to extend the prospect theory for non-monetary incentives in the case of bonus marks given to students of higher education in Egypt, even though these "bonus marks" are a commonly used incentive scheme in Egyptian universities. These findings are reasonable, even though the researcher has not expected them!

The results of our field experiment in Table 4 enforce disappearance of framing effect. Hereby, several features of the reached results worth further analysis and discussion:

- Students' grades and productivity in "non-major course" are influenced only by their GPA level, which makes sense, as high GPA students exert more effort to take advantage of the additional grades. Whereas, different majors did not show any effect on students' grades or productivity. This result confirms that there is no problem with assembling students from different majors in the same GENN221 class.
- Recall from Principal-Agent theory; An incentive is simply defined as a means of urging people (agents) to do more of a good thing (that the principal wants) and less of the bad thing, i.e. Improve their performance or exert greater efforts. There are three basic flavors of incentive: economic, social and moral (Levitt & Dubner, 2006).
- Accordingly, if the aim of the principal is to increase agent's productivity he should design an incentive scheme that direct the agent's behavior towards the same aim. The results showed increasing students' grades after giving them bonus marks incentive, but their productivity did not increase. Such result can be explained by analyzing the behavior of the student and course instructor in the framework of the principal-agent theory:
  - The student in our experiment is the agent, who aims at maximizing his utility function. The principle is the course instructor who wants to maximize his utility as well.
  - When the instructor gives the incentive in form of bonus marks; it represents a negative part the principal's utility function, he aims to increase student's productivity; that represents a positive part in the principal utility function.

*The instructor utility function (principal side)*

$$U_p = x - y$$

$$U_p = f(a) - s[f(a)]$$

*The student utility function (Agent side)*

$$U_A = y - a$$

$$\because x = f(a)$$

$$\therefore U_A = s[f(a)] - c(a)$$

For the incentive to be efficient, the principal (instructor) should design the incentive in a way that maximizes his utility function, with applying both participation constraint (PC)<sup>51</sup> and incentive compatibility constraint (ICC)<sup>52</sup>.

$$\text{Max} : U_p = f(a) - s[f(a)]$$

Subject that:

$$U_A = s[f(a)] - c(a) \geq \bar{U} \quad (\text{PC})$$

$$s[f(a^*)] - c(a^*) \geq s[f(a)] - c(a) \quad (\text{ICC})$$

for all values of (a)

Where (a) is the level of effort by the agent (student) and ( $\bar{U}$ ) is the maximum level of utility could be achieved from alternative options (opportunity cost). The efficient incentive design should end up with an agent's ( $a^*$ ) that is exactly the same targeted from the principal side that is achieved by:

$$\rightarrow MP(a^*) = MC(a^*)$$

Where ( $a^*$ ) is the targeted effort/behavior from the principal side.

- The results of our experiment showed that students didn't go towards the level of productivity that the instructor wanted. That indicates that *incentive compatibility constraint was not achieved within this incentive design.*
- Whereby, from the student side; exerting more effort in that course (increase their productivity), would represent a negative part in his/her utility function. Therefore, students would need enough compensation to be added to their utility function.
- In our experiment, students did not increase their productivity after giving them the bonus marks incentive, which implies that this was not enough compensation for them.

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<sup>51</sup> Ensures agent's participation in the transaction with the principal. (we couldn't differentiate in our experiment between students who refused to participate and those who participated but with zero productivity).

<sup>52</sup> Is that requires agents to prefer to act in accordance with the behavior that the principal wants.

- Owning or gaining more grades compared to possess money is different in its psychological impact on individuals and thus differ in behavioral response. Let us think about the benefit (compensation) that a student will achieve if he takes the decision of exerting more effort in the GENN221 course. How would a student evaluate getting 10% bonus marks?
  - Higher education in the Middle East has special features that differ from the western higher education, where students try hard to get the university certificate without caring that much about having more grades, especially if their grades without the bonus marks are enough for them to pass the course. Students feel that their decision of increasing productivity would imply:

*First:* high opportunity cost in form of foregoing leisure time, particularly if they can pass the course without the bonus marks.

*Second:* no enough compensation, especially when the labor market doesn't care about student's grades at the end of the story. that makes bonus marks of low value from students' perspective.

- Students evaluate utility function; they compare between the benefit and cost resulted from taking any decision. Then they includes both in their expected value of the utility function. Accordingly, one reason of no significant effect on productivity is "low incentive value" compared to the "cost of increasing productivity".
- It is worth saying that, higher students' grades due to "bonus marks" incentive is a misleading indicator for incentive efficiency, because the principal's aim was not increasing the grades but increasing the productivity that the incentive failed to achieve at the end. Therefore, we can say that bonus marks commonly given to university students - in the Middle East - is not the appropriate incentive to increase productivity and academic achievement of students.
- By that, we can say that bonus marks appeared to be low powered incentive. consequently, it would be worthy to conduct the same experiment with higher bonus marks (20%, 30%, and 40%) instead of 10% in our experiment, and see if the productivity will increase or not under several treatments. Additionally, Changing the incentive type seems to be crucial in order to achieve higher level of student productivity in our case. In this regard, we asked GENN221 students - after announcing their grades- to state some incentives that would increase their productivity in the course. *They noted the following:*
  - Most of students agreed that "Bonus Marks" work like a Magic Wand to increase student learning effort, but they noted that the bonus marks should be high enough to trigger students to exert more effort in the

course (they mentioned 5%-8% of the total course grades, they found 2% very low).

- Moreover, they stated some complementary catalysts along with the bonus marks to increase the bonus marks power like giving monetary incentives even symbolic<sup>53</sup>, offering other signals to ease their access to the labor market like; recommendation letters, training opportunities, field trips, free of charge advanced economic courses and social activities.
- They mentioned their preference for teamwork that brings us to the peer effect role in supporting the incentive power. Likewise, they revealed their preference being assigned to the extra tasks in periods away from the peak studying periods of their major courses.
- Additionally, they proposed different frames of presenting the incentives like setup students contests where groups of students compete for the first three places, along with applying incentives segments<sup>54</sup>.
- The third result of our experiment revealed no framing power on grades, since punishment frame has affected grades with the same positive coefficient value as reward frame. While neither of them has significant effect on productivity. This confirms result (2) of a significant impact of incentive on grade while no significant impact on productivity. Hereby, we should recall that sensitivity of the “framing effect” – its appearance and in some cases its disappearance – has long been a point of study since the discovery of the “framing effect” by Kahneman & Tversky. However, there is little agreement as to the reasons for this sensitivity. The “ambiguity-ambivalence hypothesis” (Wang, 2008) aims at explaining "cue priority" in the sensitivity of this effect by paying particular attention to people’s cue priority: it states that the framing effect occurs when verbal framing is used to compensate for the absence of higher prioritized decision signs (Shimizu & Udagawa , 2011) .
- "Framing effect disappearance" in our experiment could be partially explained by; bounded rationality; that makes sense in the absence of students` experience to feel the difference, all they care about is to get the grades. Moreover, the course instructor has noticed low level of care along with low level of good attention to incentive schemes from the students' side. The instructor said:

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<sup>53</sup> the team with the highest ranking , every member gets (7 bonus marks + 50 LE ), 2nd best team will receive (5 bonus marks + 30LE), and 3rd best gets (2 bonus marks+10 LE).

<sup>54</sup> Table A-4 in the paper`s Annex presents a proposed incentive plan by one of the course students.



*"One student came to me after knowing her final grade and said; I never thought I would have that bad feeling to lose my granted bonus marks"*

Moreover, Hossain & list (2009) concluded a significant framing effect within groups, while insignificant effect among individuals. That shed a light on the role of peer effect in redirecting the individual behavior<sup>55</sup>. Based on this finding, different results are expected if the same experiment is conducted among team-groups of work in the same course.

*Consequently, prospect theory cannot be extended to capture bonus marks as non-monetary incentive in the higher education in Egypt.*

## 5 Conclusion

Understanding the sources of individual productivity has gained new insights with the evolution of behavioral economics, whereby psychology has a role to play.

This study relied on the theoretical foundation of the endowment effect within the prospect theory (Tversky & Kahneman, 1979); whereby, people may take irrational economic decision because of the frame presentation of the option, whether it focuses on losses or gains. The theory claimed that ownership evaluation is greater than non-ownership evaluation of the same thing for the same person (i.e. WTA>WTP).

Since the beginning of this century, framing effect has been a part and parcel of sociology, political science and economics scholarly work on several topics such as social movements, political opinion formation and economic decision-making. Such behavioral bias has been confirmed through several laboratory experiments (Ellingsen et al, 2008). Even though, the reasons behind "framing effect" sensitivity –its appearance and in some cases its disappearance – are vague and have long been a point of study since the discovery of the "framing effect".

This paper presents one of the first investigations of framing effect on students` productivity in higher education in Egypt. The study used "Bonus Marks" as a non-financial incentive scheme given to students at Cairo University registered in a non-major course, as it is the most popular student-incentive used in Egyptian Universities.

Nine weeks field experiment was conducted on 67 engineering students at Cairo University. To test three things; firstly, the effect of student`s specialization on his grades and productivity; secondly, if bonus marks, as non-monetary

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<sup>55</sup> This is based on a behavioral economics idea about herding and group think. Where people will follow whatever is popular like "HERD", thinking as a group of people not as individuals. Sometimes, people do believe rationally that their actions will harm the economy, but they tack such action because everyone else is doing it.

incentive, would increase student`s grades and productivity; and thirdly, whether reframing bonus marks incentives would affect individual grades and productivity.

The field experiment evidenced that students' grades and productivity in the "non-major course" were influenced only by their GPA level while different majors did not show any effect. This result confirms that there is no problem with assembling Engineering students from different majors in the same class.

The results showed increasing students' grades due to bonus marks incentive, but their level of productivity has not increased as the instructor wanted. This implies "low incentive benefit" compared to the "cost of increasing productivity" from students' perspective, therefore, the incentive compatibility constraint was not achieved within the incentive design.

This could be explained by; high opportunity cost in form of foregoing leisure time, particularly if the student can pass the course without the bonus marks, and in light of the Egyptian labor market features that does not care about student`s productivity in a non-major course.

Accordingly, we can say that bonus marks given to university students - particularly in the Middle East - are a low-powered incentive and not the efficient scheme to increase productivity and academic achievement for students. Changing the incentive type is recommended if student productivity is the target. Additionally, as were suggested by students - increasing the size of bonus marks, recommendation letters, training opportunities, field trips, social activities and student contests are all proposed alternatives or complements with the bonus marks worth to be tested within a similar experiment.

Moreover, the field experiment concluded disappearance of framing effect on grades and on productivity of students. Therefore, there is inability to extend the prospect theory in our case, where the incentive is non-monetary and the output is non-monetary as well.

This could be partially explained by different students' perspectives of the benefits compared to the opportunity costs (student evaluation of the gains), unlike the case when the incentive is monetary and the output is monetary as well. The absence of students` experience to feel the difference along with low level of care and attention could also present some explanation.

This study presents nothing about the long-term consequences. In future work, we plan to address potential long-term consequences of incentives and framing over subjects and time. Moreover, it would be worthy to encounter the peer effect in redirecting the individual behavior by conducting the same experiment on groups. In addition, further research is needed to assure these results on a broader field scope, different types of incentives and frames, and more grades as bonus marks.

This analysis is a mere first step, further research is crucial to find out more about productivity triggers particularly in the Middle East, and how to get benefit from framing power especially when financial resources are limited.

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## Annex A

Table A-1: Programs of Engineering at (CHS – CUFE)

<b>(CCE)</b>	<b>Communication and Computer Engineering Program</b>
<b>(CEM)</b>	<b>Construction Engineering and Management Program</b>
<b>(STE)</b>	<b>Structural Engineering Program</b>
<b>(WEE)</b>	<b>Water Engineering and Environment Program</b>
<b>(AET)</b>	<b>Architectural Engineering and Technology Program</b>
<b>(PPC)</b>	<b>Petroleum and Petrochemical Engineering Program</b>
<b>(MDE)</b>	<b>Mechanical Design Engineering Program</b>

Table A-2: University-Core Courses - (CHS – CUFE)

Code	Title	Credits	Type
GENN101	Technical Writing	2	Compulsory
GENN102	Fundamentals of Management	2	Compulsory
GENN201	Communication and Presentation Skills	2	Compulsory
GENN204	Accounting	2	Compulsory
GENN210	Risk Management and Environment	2	Compulsory
GENN221	Economics	2	Compulsory
GENN301	Ethics and Legislation	2	Elective
GENN311	Technical Writing in Arabic	2	Elective
GENN321	Foreign Language	2	Elective
GENN326	Marketing	2	Elective
GENN327	Selections of Life-long Skills	2	Elective
GENN331	Service Management	2	Elective

Table A-3: GPA calculation

Grades will be assigned to student for each course ( A = 4.0; B = 3.0; C = 2.0 ; D = 1.0; F = 0; )
And each course has Credit Hours. If courses will have 3 Credit Hours per course, at end of the semester, professor assigns grade of B to Course Database, Grade A to Course Networks and Grade A to course Software Testing. GPA is calculated as follows:
<ul style="list-style-type: none"> <li>• Total Grades = Sum of (Grade * Credit Hours)= <math>B*3 + A*3 + A*3 = 3*3+4*3+4*3 =33</math></li> <li>• Total Credit Hours = <math>3+3+3 = 9</math></li> <li>• GPA = Total Grades/Total Credit Hours = <math>33/9 = 3.66</math></li> </ul>

Table A-3: GPA calculation

<p>For my personal view, incentives that I suggest to increase the performance of students may be as following:</p> <p><b><u>A- Plan A:</u></b>  Dividing the class into groups and each two groups has to compete around one chapter such that the doctor will ask both some question and the group will answer more will win in the first round then winners meet at the second around by asking in another chapter till we have only one winner group.  The same have to be done in the other class of the other doctor and the first of both classes have to meet in a final competition, and the same for the second and the third.</p> <p><b><i>The winner group (number 1) :</i></b>  1- 4 bonus marks.  2- A certificate from the doctor that they are the FIRST in the economics for year 2012.</p> <p><b><i>The winner group (number 2) :</i></b>  1- 3 bonus marks.  2- A certificate from the doctor that they are the Second in the economics for year 2012.</p> <p><b><i>The winner group (number 3) :</i></b>  1- 2 bonus marks.  2- A certificate from the doctor that they are the Third in the economics for year 2012.</p> <p><i>For the other groups each group even lose or win will have 1 bonus mark due to their effort and participation but for the ones whom the doctor will see that they did not study they will not take anything.</i></p> <p><b><u>B- Plan B:</u></b>  Dividing the class into groups and each group have to make a presentation about a certain chapter, and the group that will get more score from audience and doctor will get 2 bonus marks while all the other groups that do good job will have 1 bonus mark.</p>
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## Annex B: Personal incentives Letter to students (GENN221-spring)<sup>56</sup>

Copy of the "Punishment scheme/stick frame" personal letter:

**Dear -----** ,

We are glad to let you know that you have been chosen for a bonus marks scheme. The bonus will be a (+2) marks given to you before you enter the midterm exam. Please be sure that at the moment you receive this letter you already have the (+2) bonus marks, however, in order to maintain this extra (+2) bonus you need to answer the bonus question in your midterm exam correctly. If you didn't answer that question you will lose the bonus marks, but your original grades will not be affected.

This bonus question will test your study of chapter three in your course textbook, this chapter is not covered within the course lectures.

**For example:**

Now you already have a (+2) before you enter the midterm exam. You scored in the exam was 15 out of 20 your grade will automatically be 17 out of 20 bending you answered the "bonus question" correctly. However, if you don't answer the bonus question in your midterm exam you will lose the bonus marks and your final grade will be 15 out of 20

*Please note that in order to ensure the efficiency of this new grading technique we strongly advice that you don't share the details of this letter with any of your peers or friends.*

Kindly note that there is no obligation what so ever for you to accept this bonus technique and you can choose to **refuse it by simply not answering the "bonus question"**. Non acceptance will not affect your usual grading or evaluation in any way.

Please don't hesitate to contact your professor if you have any further questions about the information contained in this letter.

Warm Regards,  
 Prof. Suzanna El Massah  
[suzanna.elmassah@feps.edu.eg](mailto:suzanna.elmassah@feps.edu.eg)

**Understanding and Acknowledgement:**

*I hereby affirm that I have read and understood all the information contained in this letter. I understand the extent of all information mentioned including bonus scheme, conditions of acquiring the extra bonus marks and the freedom to accept or refuse this bonus scheme as illustrated above. Accordingly, I agree to accept the conditions mentioned in the above letter.*

---

56 Arabic translations of letter was enclosed to each student.



Date  
Signature

**Copy of the "Reward scheme/carrot frame" personal letter:**

**Dear-----,**

We are glad to let you know that you have been chosen for a bonus marks scheme. The bonus will be a (+2) marks in your midterm exam. This bonus will be subject to your answer for the "Bonus question" in your exam. If you answer this question you will get your extra marks, If you don't answer the question you'll not get any extra marks and your exam will be graded in the usual way. i.e. Nothing will be deducted from your grades.

This bonus question will test your study of chapter three in your course textbook, this chapter is not covered within the course lectures.

**For example:**

If your score in the exam was 15 out of 20 and you answered the bonus question correct, you will get a (+2) marks and your final Grade will be 17 out of 20.

If your score in the exam was 15 out of 20 and you answered the bonus question wrong, your final grade will not change and remain 15 out of 20.

If your score in the exam was 15 out of 20 and you didn't answer the bonus question, your final grade will not change and remain 15 out of 20.

*Please note that in order to ensure the efficiency of this new grading technique we strongly advice that you don't share the details of this letter with any of your peers or friends.*

Kindly note that there is no obligation what so ever for you to accept this bonus technique and you can choose to **refuse it by simply not answering the "bonus question"**. Non acceptance will not affect your usual grading or evaluation in any way.

Please don't hesitate to contact your professor if you have any further questions about the information contained in this letter.

**Warm Regards,**

*Prof. Suzanna El Massah*  
[suzanna.elmassah@feps.edu.eg](mailto:suzanna.elmassah@feps.edu.eg)

**Understanding and Acknowledgement:**

*I hereby affirm that I have read and understood all the information contained in this letter. I understand the extent of all information mentioned including bonus scheme, conditions of acquiring the extra bonus marks and the freedom to accept or refuse this bonus scheme as illustrated above. Accordingly, I agree to accept the conditions mentioned in the above letter.*

Date  
Signature

**Annex C**<sup>57</sup>

Table C-1: Field Experiment Data

Student code	Gender	Major	GPA	CHs	R1grades	Treatment	R2grades
1074009.00	0	AET	1.90	151.00	13.50	1	16.20
1083005.00	1	PPC	3.84	129.00	15.50	1	19.30
1083651.00	1	CEM	2.20	56.00	13.00	1	18.30
1084648.00	0	AET	2.20	110.00	12.50	1	18.30
1092447.00	1	CEM	2.50	34.00	.0	1	13.00
1093195.00	1	PPC	1.60	45.00	7.00	1	14.20
1109011.00	0	WEE	3.26	87.00	15.00	1	20.90
1109032.00	1	WEE	3.56	70.00	12.50	1	18.90
1072057.00	1	CCE	2.92	169.00	16.50	1	21.00
1074025.00	1	AET	1.78	150.00	.0	1	19.50
1074028.00	1	AET	2.97	168.00	17.00	1	21.00
1081296.00	1	PPC	2.90	127.00	17.00	1	15.10
1081306.00	1	MDE	2.70	122.00	16.50	1	19.00
1083058.00	1	PPC	3.25	128.00	12.00	1	19.00
1083408.00	1	PPC	3.49	130.00	16.50	1	20.00
1091174.00	1	MDE	1.67	42.00	16.50	1	18.50
1092026.00	1	STE	3.27	89.00	16.50	1	18.00
1092112.00	0	CCE	3.51	90.00	17.00	1	20.00
1092125.00	1	CCE	3.72	95.00	17.00	1	21.00
1092301.00	1	STE	2.32	88.00	16.00	1	16.00
1092409.00	1	PPC	2.45	69.00	12.00	1	17.00
1093483.00	1	CEM	1.60	36.00	16.50	1	14.40
1093484.00	1	PPC	2.40	75.00	16.50	1	17.20
1094068.00	1	MDE	2.91	93.00	17.00	1	22.00
1094172.00	1	STE	2.70	89.00	16.50	1	19.50
1098202.00	1	CEM	2.60	83.00	17.00	1	19.00
1101053.00	1	PPC	3.00	55.00	17.00	1	16.80
1101064.00	1	STE	2.92	57.00	17.00	1	18.00
1101065.00	1	STE	2.98	55.00	16.00	1	17.00
1105030.00	1	MDE	3.20	90.00	17.00	1	20.00
1105035.00	1	MDE	3.59	90.00	17.00	1	21.00
1108059.00	1	STE	3.53	91.00	16.00	1	18.00
1083084.00	1	PPC	2.98	127.00	16.00	2	20.90

<sup>57</sup> All the tables in Annex C are outputs of using SPSS statistical package (PASW Statistics 18).

1084662.00	0	AET	2.48	116.00	14.00	2	15.70
1085170.00	1	MDE	3.73	164.00	16.50	2	21.50
1091193.00	0	AET	2.10	83.00	12.50	2	14.20
1092002.00	0	CCE	2.20	83.00	17.00	2	21.00
1092011.00	1	CCE	2.46	91.00	13.50	2	15.90
1092213.00	1	PPC	2.10	76.00	12.50	2	16.80
1092235.00	1	CCE	2.10	83.00	15.50	2	18.80
1093024.00	1	PPC	3.57	111.00	16.00	2	22.00
1093127.00	0	MDE	1.96	66.00	15.00	2	13.90
1094173.00	1	STE	2.64	111.00	14.50	2	15.70
1098456.00	1	STE	2.57	78.00	10.50	2	17.70
1072105.00	0	AET	2.78	168.00	17.00	2	18.50
1083074.00	1	PPC	2.50	125.00	17.00	2	20.00
1091226.00	1	STE	2.05	77.00	9.50	2	16.50
1092208.00	1	STE	2.42	88.00	11.50	2	17.50
1092230.00	1	CEM	2.20	65.00	16.50	2	20.00
1092280.00	0	AET	2.30	75.00	5.00	2	19.50
1093092.00	1	CEM	2.90	90.00	16.50	2	19.50
1093396.00	1	PPC	2.17	55.00	16.50	2	15.80
1095056.00	1	MDE	2.94	87.00	17.00	2	16.50
1095122.00	0	CCE	2.43	78.00	6.50	2	18.50
1095150.00	1	MDE	3.53	91.00	17.00	2	17.50
1095217.00	1	MDE	2.75	88.00	17.00	2	17.50
1095348.00	1	MDE	2.85	89.00	17.00	2	18.50
1098196.00	1	STE	2.60	89.00	15.50	2	17.00
1098403.00	1	STE	2.70	89.00	16.50	2	20.50
1101058.00	1	STE	3.12	55.00	16.50	2	20.00
1103068.00	1	PPC	2.52	50.00	17.00	2	15.70

Table C-2: Field experiment descriptive statistics

	N	Mean	Std. Deviation
GPA	61	2.7061	.56996
CHs	61	91.9836	32.91782
Round1grades	61	14.5246	3.86698
Round2grades	61	18.2000	2.18510

Table C-3: Grades &amp; Productivity pre &amp; under Two incentive frames

Frame		Round1grades	Round2grades	Round1productivity	Round2productivity
Stick	Mean	14.4688	18.3469	.8511	.9173
	Std. Deviation	4.41028	2.20790	.25943	.11040
Carrot	Mean	14.5862	18.0379	.8580	.9019
	Std. Deviation	3.24056	2.18688	.19062	.10934
Total	Mean	14.5246	18.2000	.8544	.9100
	Std. Deviation	3.86698	2.18510	.22747	.10926

Table C-4: Parameter Estimates for students` pre incentive grades

Parameter	B	Std. Error	T	Sig.	95% Confidence Interval		Partial Eta Squared
					Lower Bound	Upper Bound	
Intercept	9.032	2.818	3.206	.002	3.384	14.681	.160
Gender	.832	1.318	.631	.531	-1.810-	3.473	.007
GPA	2.245	.925	2.427	.019	.390	4.099	.098
CHs	.004	.017	.255	.800	-.029-	.038	.001
M1	-1.417-	1.808	-.784-	.437	-5.042-	2.208	.011
M2	-1.939-	1.380	-1.405-	.166	-4.705-	.828	.035
M3	-2.298-	1.405	-1.636-	.108	-5.114-	.518	.047

H0: student`s Major does not affect his course grade.

H1: student`s Major affects his course grade.

Table C-5: Parameter Estimates for students` pre incentive productivity  
 Dependent Variable:Round1productivity

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	.531	.166	3.206	.002	.199	.864
Gender	.049	.078	.631	.531	-.106-	.204
GPA	.132	.054	2.427	.019	.023	.241
CHs	.000	.001	.255	.800	-.002-	.002
M1	-.083-	.106	-.784-	.437	-.297-	.130
M2	-.114-	.081	-1.405-	.166	-.277-	.049
M3	-.135-	.083	-1.636-	.108	-.301-	.030

H0: student`s Major does not affect his course productivity.

H1: student`s Major affects his course productivity.

Table C-6: T- test for difference between pre and under incentive grades/log (grades)/productivity

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair1	Round2grades - Round1grades	3.67541	3.82469	.48970	2.69586	4.65496	7.505	60	.000
Pair2	logRound2grades - logRound1grades	.09293	.10864	.01414	.06462	.12125	6.570	58	.000
Pair3	Round2productivity- Round1productivity	.05561	.22063	.02825	-.00089-	.11212	1.969	60	.054

H0: No difference between student`s grades before and after incentives.

H1: there is difference between student`s grades before and after incentives and in favor to after incentive.

-----  
 H0: No difference between student`s productivity before and after incentives  
 H1: there is difference between student`s productivity before and after incentives & in favor to after incentive.

Table C-7: Wilcoxon test for difference between pre & under incentive grades/log(grades)/productivity

	Round1grades - Round2grades	loground1grades - logRound2grades	Round1productivity - Round2productivity
Z	-6.226 <sup>-a</sup>	-6.059 <sup>-a</sup>	-1.270 <sup>-a</sup>
Asymp. Sig. (2-tailed)	.000	.000	.204

H0: No difference between student`s grades/log(grades)before and after incentives.

H1: there is difference between student`s grades/log(grades) before and after incentives and in favor to after incentive.

-----  
 H0: No difference between student`s productivity before and after incentives  
 H1: there is difference between student`s productivity before and after incentives and in favor to after incentive

Table C-8: Wilcoxon test for difference in differences between the Stick and Carrot effect on grades/productivity

	GradespostpreC - GradespostpreS	productivitypostpreC - productivitypostpreS
Z	-.789 <sup>-a</sup>	-.703 <sup>-a</sup>
Asymp. Sig. (2-tailed)	.430	.482

H0: No difference in student`s grades/productivity difference between Stick and Carrot frames

H1: there is difference in student`s grades/productivity difference between Stick and Carrot frames

Table C-9: pooled grades and incentive frames

Dependent Variable: pooled grades

Parameter	B	Std. Error	T	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	8.765	1.602	5.472	.000	5.591	11.939
sticknew	3.668	.624	5.877	.000	2.431	4.904
carrotnew	3.684	.645	5.708	.000	2.405	4.962
GPApooled	1.851	.516	3.584	.001	.828	2.874
CHspooled	.013	.009	1.426	.157	-.005-	.032
Gender	.551	.734	.751	.454	-.903-	2.005
M1pooled	-.260-	1.004	-.259-	.796	-2.250-	1.730
M2pooled	-1.052-	.768	-1.370-	.173	-2.574-	.469
M3pooled	-1.488-	.783	-1.902-	.060	-3.039-	.062

H0: framing non financial incentive cannot be used to enhance grades.

H1: framing non financial incentive can be used to enhance grades.

Table C-10: pooled productivity and incentive frames

Dependent Variable: pooled productivity

Parameter	B	Std. Error	T	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	.541	.092	5.897	.000	.360	.723
sticknew	.056	.036	1.568	.120	-.015-	.127
carrotnew	.059	.037	1.608	.111	-.014-	.133
GPApooled	.103	.030	3.468	.001	.044	.161
CHspooled	.001	.001	1.287	.201	.000	.002
Gender	.031	.042	.742	.459	-.052-	.115
M1pooled	-.021-	.058	-.358-	.721	-.135-	.093
M2pooled	-.062-	.044	-1.398-	.165	-.149-	.026
M3pooled	-.085-	.045	-1.899-	.060	-.174-	.004

H0: framing non financial incentive cannot be used to enhance productivity.

H1: framing non financial incentive can be used to enhance productivity.

Table C-11: Fixed Effect treatment on grades

Dependent Variable: Round2grades

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	11.727	1.538	7.627	.000	8.642	14.813
GPA	1.328	.495	2.686	.010	.336	2.321
CHs	.022	.008	2.630	.011	.005	.039
M1	.965	.910	1.061	.293	-.860-	2.790
M2	-.080-	.705	-.114-	.910	-1.494-	1.334
M3	-.576-	.723	-.797-	.429	-2.027-	.875
Gender	.213	.666	.320	.750	-1.124-	1.550
Round1grades	.051	.068	.753	.455	-.086-	.188
[Frame=1]	.079	.480	.165	.869	-.884-	1.043
[Frame=2]	0 <sup>a</sup>	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

H0: Treatment frame has no effect on student grades

H1: Treatment frame has no effect on student grades



Table C-12: Fixed Effect treatment on productivity

Dependent Variable:Round2productivity

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	.586	.077	7.627	.000	.432	.741
GPA	.066	.025	2.686	.010	.017	.116
CHs	.001	.000	2.630	.011	.000	.002
M1	.048	.045	1.061	.293	-.043	.140
M2	-.004	.035	-.114	.910	-.075	.067
M3	-.029	.036	-.797	.429	-.101	.044
Gender	.011	.033	.320	.750	-.056	.077
Round1productivity	.044	.058	.753	.455	-.073	.160
[Frame=1]	.004	.024	.165	.869	-.044	.052
[Frame=2]	0 <sup>a</sup>	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

H0: Treatment frame has no effect on student productivity

H1: Treatment frame has no effect on student productivity.