

## Protocol

# Project: Performance Related Pay, Stress and Social-Evaluative Threat (SET)

PIs: Keith Bender (Economics, Aberdeen), Julia Allan (Institute of Applied Health Sciences, Aberdeen); Daniel Powell (Institute of Applied Health Sciences, Aberdeen); Ioannis Theodossiou (Economics, Aberdeen)  
Research Fellow: Nicole Andelic (Economics, Aberdeen)

## Overview

Recent research in economics examines the relationship between health and different types of work contracts. Of particular interest is the study of contracts where workers' pay is contingent upon their performance at work – 'performance-related pay' or PRP. Performance-related contracts have long been advocated by economists as the most efficient of payment schemes. However, a recent paper (Bender & Theodossiou, 2014) uses a large survey of British workers to demonstrate that performance-related pay (PRP) is associated with poorer self-reported health and that this may be caused by increased levels of stress. The present project investigates the links between PRP and stress using standard experimental economics methods along with biological markers of stress (salivary cortisol). This experiment is part of a three-year ESRC grant, and the protocol presented is the next phase of research following the first series of studies with the same base experimental design (approved in CERB/2019/12/1831).

## Background

In the 1776 book, *Wealth of Nations*, Adam Smith observes, "*Men....when liberally paid by the piece, are very apt to overwork themselves, and to ruin their health and constitution in a few years*". Thus, as early as the mid-18<sup>th</sup> century, it was observed that there may be a link between performance-related pay (PRP) and worker health. Despite this, the (mostly economics) literature to date on PRP has focused primarily on productivity with only a handful of studies exploring the possible impact of PRP on health.

There are three main pathways through which PRP may influence health. Firstly, as PRP explicitly incentivises higher output / faster work, PRP workers may take more risks at work, increasing the likelihood of injury (Freeman & Kleiner, 2005; Bender, Green, & Heywood 2012; Artz & Heywood, 2015). Secondly, in order to maximise outputs and therefore payment, PRP workers may choose to work longer hours, forgoing healthy or restorative behaviours such as exercise or sleep and engaging more frequently in unhealthy coping behaviours such as smoking and drinking (Artz, Green, & Heywood, 2020; Bender & Theodossiou, 2014). Thirdly, as PRP is inherently time pressured and payment is variable rather than fixed (i.e. uncertain), performance related contracts may elevate workers' stress levels, in turn increasing the risk of stress-related health conditions. This third explanation is supported by Dohmen and Falk (2011) who show that PRP workers report higher rates of stress than others, and Bender and Theodossiou (2014) who demonstrate using large scale panel survey data that workers who spend more time on PRP contracts have higher stress levels and significantly increased odds of poor health outcomes.

The present project broadly focuses on this third possibility, aiming to directly test different aspects of the hypothesised relationship between PRP and stress in a series of controlled laboratory experiments. In the original pilot experiment that preceded this project

(Allan, Bender, & Theodossiou, 2020; CERB/2015/5/1198), volunteers were randomly allocated to complete basic mathematical calculations for either a fixed fee, or for a PRP payment where payment depended on the number of calculations correctly completed. The study demonstrated that those allocated to PRP did, as hypothesised, display higher levels of self-reported stress and elevated cortisol levels. Following this, the first experiment in this project found robust effects of PRP on stress when using a randomised crossover design, establishing causal direction when all other variables are held equal.

While the first experiment focused on establishing the causality of PRP affecting stress, job stress may be affected by other factors which may make the effect of PRP on stress even stronger. One such factor, found in the psychology literature, is the threat of being negatively evaluated by others, known as a *social-evaluative threat* (SET) (Dickerson & Kemeny, 2005; Kemeny, Gruenewald, & Dickerson, 2004). SET is likely to occur in situations when performance is being evaluated in some way, and where poor performance could reveal a lack of ability, thereby threatening the social self. For example, SET may occur when individual performance is compared to (or will potentially be compared to) the performance of others, or while performing a task in the presence of an audience (who will evaluate that performance). Both competition/comparison with peers and performance monitoring are common features in real world work settings. The potential effect of these situational factors on stress is the focus of the current experiment.

In this proposed experiment, as in the studies approved by CERB/2019/12/1831, volunteers from the student population will be asked to complete simulated work tasks for either fixed or PRP payments. However, the current experiment includes the addition of a cross-over session with a SET manipulation: Participants will be allocated to either a PRP or nonPRP contract. Within these payment conditions, they will participate in one session including a SET manipulation and one control condition, while completing both self-reports and objective measures (salivary cortisol) of experienced stress. Consequently, there will be two groups of volunteers that take part in two conditions each; (1) SET PRP; (2) SET nonPRP; (3) control PRP; (4) control nonPRP. Stress levels in the SET groups will be compared with the two control groups.

## **Methods**

Design: Mixed-design experiment.

Participants & Recruitment: Participants (N=200) will be recruited using the Department of Economics' online database of individuals interested in participating in research (ORSEE). The system will be set to send a weblink to direct potential participants to study information sheets and possible dates for participation to registered users. Those who are interested in participating after reading the study information sheet can email the research team questions before making a decision about participation. If they decide to participate, they can directly sign up for the session they would be willing to attend. On attending the chosen participation session, potential participants are given another copy of the information sheet and are asked to complete a written consent form. Participants are asked to refrain from eating, drinking alcohol, smoking, brushing their teeth or engaging in strenuous exercise for 120 minutes prior to test sessions to ensure the accuracy of the cortisol measures taken. When data collection is completed participants receive a debrief via email. The participant information sheet, consent form and debrief sheet have been uploaded as separate documents.

Procedure: Participants attend a group session (20 participants per session/11 participants per session if social distancing is advised) in the Scottish Economics Experimental Laboratory (SEEL) and are provided with another copy of the information sheet and the consent form<sup>1</sup>. Each session will take place at 2pm to control for cortisol fluctuation due to circadian rhythms. Prior to each first session the experimenters will randomly allocate the session to either a SET condition or a control session as well as to a PRP or nonPRP contract. This will be done through an online randomiser to avoid experimenter bias. When seated, participants are asked to relax for 10 minutes (they will be given the opportunity to colour in pictures), after which, they will complete the Pre-Task Questionnaire and provide the first of four saliva samples. Next, participants practice the simulated work task with three example questions common to all participants. After this, participants in the SET condition will be informed of their additional parameters. Control participants will not receive any additional information. All participants are then randomly allocated (by the z-tree computer programme) into either PRP (paid 20p per correct answer within 10 minutes) or nonPRP (single fixed payment of £5 for completion of the 10 minute task). An information screen is displayed that makes clear the payments in each condition. Participants then have 10 minutes to complete 50 questions in the simulated work task. On completion of the task, participants provide a second saliva sample and complete the Post-Task Questionnaire. After 10 minutes, the third saliva sample is taken and after a further 10 minutes, a fourth and final saliva sample is taken. Once complete, participants are thanked for their time, paid for participating and reminded to return for their cross-over session the following week. The cross-over session the following week will match the payment contract as before but will alternate condition (SET/control) from the first week. All participants will be emailed a debrief sheet once the experiment is completed.

Simulated Work Task: Work performance is measured using a computerised mental arithmetic task. The 'work task' is a series of basic mathematical calculations (e.g.  $32 + 15 = ?$ ) displayed one at a time on a computer screen. All participants complete a number of practice calculations to familiarise themselves with the task before starting. Participants allocated to a PRP contract earn a particular amount of money (20p) for each calculation they complete correctly within 10 minutes, up to a maximum of 50 questions. Participants allocated to a nonPRP contract will earn a fixed amount (£5) as long as they correctly answer at least 10 of the 50 questions within the time available. All participants receive a participation payment of £7.50 regardless of performance.

Social-Evaluative Threat Conditions: Each session will be randomly allocated to a SET/control condition and each participant will be randomly allocated to the PRP or nonPRP group (N=100 per group). In the SET condition, prior to the work task but after the practice task, participants will be informed that all individual scores on the work task will be displayed on a leaderboard during the session. This manipulation is designed to induce SET by raising the possibility at the start of the experiment that individual performance will be compared to the performance of other participants. However, once the experiment begins, it will be apparent to participants that the leaderboard uses participant identification numbers rather than names so participant scores will not actually be revealed in any identifiable way.

In addition to this, one member of the lab staff will walk around the lab, looking at participants and their computers during their tasks, much like a supervisor may check on performance in a job. Participants will be told that lab staff will be present during the work

---

<sup>1</sup> During the pandemic, additional precautions will be taken as approved by the Exemption Group and Health, Safety and Wellbeing on 15<sup>th</sup> Oct 2020. The approval confirmation and approved protocol are included with the ethics application.

task and that their performance will be monitored and assessed. This manipulation is designed to induce SET by drawing participants' attention to the fact that their performance is being evaluated. In reality, no evaluation will take place since all payments are determined by the computer counting the number of correct answers in the maths task.

In the control condition, the experiment proceeds as standard with none of the additional SET manipulations present.

Self-Report Measures: Perceived stress and effort expended are measured in all four experiments using self-report items (see attached questionnaires). Prior to the stress task participants complete the GHQ-12 which consists of 12 items rated on a four-point scale from "not at all" to "much more" (GHQ); (1) How stressed do you feel today? (2) Have you recently been able to concentrate on whatever you are doing? (3) Have you recently lost much sleep over worry? (4) Have you recently felt constantly under strain? (5) Have you recently felt you couldn't overcome your difficulties? (6) Have you recently been feeling unhappy or depressed? (7) Have you recently been losing confidence in yourself? (8) Have you recently felt that you were playing a useful part in things? (9) Have you recently felt capable of making decisions about things? (10) Have you recently been able to enjoy your normal day-to-day activities? (11) Have you recently been able to face up to problems? (12) Have you recently been feeling reasonably happy, all things considered? Participants also completed two additional items; (13) How exhausted do you feel today? on the same 4-point scale and (14) How would you rate your arithmetic skills? (rated on a 5-point scale from "very well" to "very well").

After the task stress is measured using four self-report items developed by Dohmen and Falk (2011); (1) After the task, how stressed do you feel? (2) How much effort did you exert solving the questions during the previous 10 minutes? (3) After the task, how exhausted do you feel? and (4) Did you feel under strain when solving the mathematical problems in the previous 10 minutes? Each item is answered on a 4-point scale from "not at all" to "much more". To evaluate the presence of social-evaluative threat, participants in the SET treatment will also be asked (5) After the task, do you feel at risk of being negatively evaluated by others? and (6) Do you feel that others will believe that your performance reflects your ability? As with the Dohmen and Falk (2011) items, the items will be rated on a 4-point scale from "not at all" to "Very much". Participants will also be asked an adapted version of question 14 from before the task: (7) After the task, how would you rate your arithmetic skills? To control for potential confounders the second survey will be accompanied by a list of everyday activities (which they were previously asked to refrain from participating in) and medication types which may affect cortisol<sup>2</sup>. Participants will be asked to indicate if any of the items apply to them but will not be asked to provide any further detail. The second survey will also include socio-demographic information such as gender, age, year and area of study. The information will be used as control variables during statistical analysis.

---

<sup>2</sup> The following seven medication types are listed: 1) Selective serotonin reuptake inhibitor (SSRI), tricyclic anti-depressants, antipsychotics, benzodiazepines or narcotic/non-narcotic pain reliever. 2) Selective serotonin reuptake inhibitor (SSRI), synthetic steroids, antifungal, opiate agonist, uterine-active agent, diuretic antidiuretic, sympathomimetic agents (e.g. decongestant), phenothiazines or monoamine oxidase inhibitor. 3) Corticosteroids (anti-inflammatory oral, nasal, topical or ophthalmic treatment). 4) Hypolipidemic, statins, resins, synthetic steroid or progestin only pills (e.g. progestin-only contraceptive). 5) Alpha adrenergic receptor antagonist, alpha adrenergic receptor agonist (e.g. treatment of ADHD), beta adrenergic receptor antagonist or beta adrenergic receptor agonist (e.g. treatment of asthma). 6) Anti-cholinergic (e.g. treatment of asthma or IBS) or cholinergic. 7) Estrogen replacement therapy or contraceptives.

**Objective Measures:** Biological stress responses are measured using salivary cortisol. Each participant is provided with sealed, sterile swabs (Salivettes) which they remove from packaging when instructed and chew for 60 seconds. Once the swab is saturated, participants place it into a pre-labelled collection tube and seal. The experimenter collects the samples and transfers them immediately to a dedicated, locked freezer in a locked research room, clearly labelled as containing biological samples, and only accessible by the immediate research team. Samples are stored in batches before being packaged and transported for cortisol analysis by an external laboratory. For transport, the samples are appropriately packed (with cold blocks, absorbent material and waterproof outer packaging) and sent by courier, labelled as containing biological samples (category B / 3773).

**Facilities / Test Session Location:** The experiment will be carried out at the University of Aberdeen's Scottish Experimental Economics Laboratory (SEEL), housed in the Department of Economics in the Edward Wright Annexe F06. SEEL is a state-of-the-art facility allowing up to 20 subjects to participate in a computerised experiment at a time (or 8 subjects during times of social distancing). The experiments are carried out using the computer program, z-tree (Fischbacher, 2007), a common program in experimental economics. All experiments are overseen by the project research fellow and at least one additional member of the research team.

### **Ethical Issues**

This experiment raises three potential ethical issues. Details of how each will be handled are outlined below:

#### **1. Appropriate collection and handling of saliva samples.**

In line with the previously conducted and CERB-approved studies, all saliva samples will be collected, handled, stored and transported in accordance with best practice guidelines. Specifically, samples will be collected non-invasively by participants themselves (chewing a swab). Swabs will then be sealed into pre-labelled tubes and transferred to a securely locked, dedicated freezer in a locked research room. Swabs will be securely stored here in batches until ready to transport to an external laboratory for analysis. On dispatching, all relevant guidelines will be followed. Samples will be appropriately packed (with cold blocks, absorbent material and waterproof outer packaging) and sent by courier, labelled as containing biological samples (category B / 3773). All researchers have completed University health and safety training and will be provided with disposable gloves to wear while transferring sample tubes into cold storage.

During the pandemic, additional precautions will be taken. Participants will be encouraged to use the hand sanitiser on the desk between each task. Researchers will put on new disposable gloves before setup, the experiment, post-experiment disinfection and transferring the samples to the freezer. Researchers will wear full PPE during the experiments, and participants are given disposable face masks to wear when entering/exiting the lab. All safety procedures are detailed in the attached SOP (approved by the Exemption Group and Health, Safety & Wellbeing).

#### **2. Inducing stress.**

The experiment investigates human responses to stress. The stress is induced through the work task (the calculations) as well as through the SET manipulations (the peer comparison/monitoring condition). As demonstrated in the initial studies of this research

programme, the stress induced in such paradigms is mild and temporary. In the present study, to ensure that there is the potential for negative comparison (i.e. SET), participants will be given a brief explanation to make the conditions more salient (“The performance of all participants will be displayed on a leaderboard at the end of the task. Lab staff will be present during your work task. Your performance will be monitored and the performance will influence your payment.”). However, to ensure that any additional stress induced by the SET manipulation is transient, no actual peer comparison or staff evaluation will take place (i.e., the leaderboard will be anonymised so individual scores are not personally identifiable to others and lab staff will monitor, but not actually evaluate, performance). Performance in all three conditions will be assessed by the z-Tree software which determines the compensation for the subjects. Furthermore, the presence of lab staff is routine in case participants experience difficulties with their work stations so the presence of staff does not represent a departure from the standard experimental condition.

Therefore, the stress induced is mild and importantly is no greater than would be experienced in everyday life, for example when participating in class tutorials. Participants are fully informed prior to being asked for consent (in the study information sheets) that the studies are about responses to stress, and that they are free to withdraw from the experiments at any time without penalty. In addition, participants are fully debriefed about the aims of each experiment as soon as each experiment has finished. Participants are free to withdraw from the studies at any time.

### 3. Participant payment

An inherent part of the study is that participants can earn either a fixed sum of £5 or £0.20 per correct question (up to a maximum of £10) depending upon the contract to which they are allocated. This is to replicate the conditions of interest in the study, i.e. a real-life fixed salary- or PRP-job contract. Here it is important to note that the earnings are too small to have implications for participants’ personal finances. In addition to conditional earnings, participants will be paid a nominal fee to compensate them for their time (£7.50). This figure is broadly in line with a minimum wage payment for 1 hour of time and ensures that participants are not disadvantaged (in lost earnings) for taking part in the study.

### 4. COVID-19

To maintain 2-metres throughout the experiment the maximum number of volunteers was set to 8 participants during each session. The study was also limited to using only healthy volunteers from the student population that was already present on campus and health checks (health questionnaire and temperature check) was carried out on all students before the experiment. Students were asked to arrive using a randomly staggered approach to avoid queuing in the hallways.

## References

- Allan, J.L., Bender, K., & Theodossiou, I. (2020). Performance Pay and Low Grade Stress: An Experimental Study. *Work: A Journal of Prevention, Assessment & Rehabilitation*, 67(2), 449-457.
- Artz, B., Green, C. P., & Heywood, J. S. (2020). Does performance pay increase alcohol and drug use?. *Journal of Population Economics*, 1-34.

- Artz, B., & Heywood, J.S. (2015). Performance Pay and Workplace Injury: Panel Evidence. *Economica*, 82(S1), 1241-60.
- Bender, K., Green, C., & Heywood, J. (2012). Piece rates and workplace injury: Does survey evidence support Adam Smith. *Journal of Population Economics*, 25, 569-90.
- Bender, K., & Theodossiou, I. (2014). The Unintended Consequences of the Rat Race: The Detrimental Effects of Performance Pay on Health. *Oxford Economics Papers*, 66, 824-47.
- Dickerson, S.S., & Kemeny, M.E. (2004) Acute Stressors and Cortisol Responses: A Theoretical Integration and Synthesis of Laboratory Research. *Psychological Bulletin* 130(3), 355-91.
- Dohmen, T., & Falk, A. (2011). Performance Pay and Multidimensional Sorting: Productivity, Preferences and Gender. *American Economic Review*, 101, 556-90.
- Fischbacher, U. (2007). z-Tree: Zurich toolbox for ready-made economic experiments. *Experimental Economics*, 10(2), 171-178.
- Freeman, R.B., & Kleiner, M. (2005). The Last American Show Manufactures: Decreasing Productivity and Increasing Profits in a Shift from Piece Rates to Continuous Flow Production. *Industrial Relations*, 44(2), 207-30.
- Kemeny, M.E., Gruenewald, T.L., & Dickerson, S.S. (2004). Shame as the emotional response to threat to the social self: implications for behaviour, physiology and health. *Psychological Inquiry*, 15, 153-160.