

Protocol

Project: Performance Related Pay and Stress Introducing penalties

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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-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 performance related pay and stress using standard experimental economics methods along with biological markers of stress (salivary cortisol). The experiment is part of a three-year ESRC grant which follows on from a previously completed pilot study and subsequent replication (CERB/2015/5/1198; and CERB/2015/5/1198 - Amendment 1).

Background

In *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-18th century, it was observed that there may be a link between performance related pay (PRP) and worker health. Despite this, the 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; 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 (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 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 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. The experiments allocate volunteers from the general undergraduate student population to complete simulated work tasks under different conditions for either

fixed or PRP payments while completing both self-reports and objective measures (salivary cortisol) of experienced stress. In the original experiment that preceded this series (Allan et al, 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. The present series of experiments builds on this initial work and aims to examine how different characteristics of PRP (autonomy over selection, intensity, anticipation and perceived stakes) affects the resultant stress.

Methods

Participants & Recruitment: Participants 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.

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 (or selecting) 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 (or selecting) 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 regardless of performance.

Self-Report Measures: Perceived stress and effort expended are measured in all four experiments using self-report items. 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 a thirteenth item; (13) How exhausted do you feel today? 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 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 cortisol¹. 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 information will be used as control variables during statistical analysis.

Objective Measures: Biological stress responses are measured in all four experiments 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: All experiments will be carried out at the University of Aberdeen's Scottish Economics Experimental Laboratory (SEEL), housed in the Department of Economics. SEEL is a state-of-the-art facility allowing up to 20 subjects to participate in a computerised experiment at a time. 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.

Experiment 2.2: Introducing Penalties

Rationale: In many real-life PRP jobs, there are explicit penalties (beyond foregone earnings) for failing to meet performance targets. The threat of such a penalty may further increase stress.

Aim: To determine whether penalising poor performance impacts the stress response of participants paid by PRP.

Design: Between-participants experiment.

Participants: n=150

¹ 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.

Procedure: Participants attend a group session (8 participants per session) in the Scottish Economics Experimental Laboratory (SEEL) and are provided with a copy of the information sheet and the consent form. When seated, participants are asked to relax for 10 minutes (they will be given the opportunity to colour in pictures), after which, they 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. They are then randomly allocated (by the z-tree computer programme) into one of three conditions; PRP (paid 20p per correct answer within 10 minutes; no penalty), PRP+penalty (paid 20p per correct answer within 10 minutes, and ‘fined’ 10p per incorrect answer within 10 minutes) or nonPRP (fixed payment for completion of the 10 minute task, no penalty). 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 and paid for participating. All participants will be emailed a debrief sheet once the experiment is completed.

Ethical Issues

This experiment raises two key 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 study, all saliva samples will be collected, handled, stored and transported in accordance with best practice guidelines. Specifically, they 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 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.

2. Inducing stress.

All experiments investigate human responses to stress. The stress induced is mild and importantly is no greater than would be experienced in real life. 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, a maximum of three weeks after participation. Participants are free to withdraw from the studies at any time.

3. 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.

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