Stress, Effort, and Incentives at Work

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Appendix 1

Suppose that $\pi(a) = a$, $g(a) = a$; $c(a) = a^2$ and let θ be uniformly distributed over the interval $[0,1]$ with $\theta^{av} = 0.5$ denoting the average value. Condition (**??**) becomes:

$$\frac{1}{1-a} \geq \frac{1}{a},$$

which holds if $a \geq 0.5$. The agent's choice of effort solves:

$$a^* \equiv \arg\max_a U = \tau^L + a\left(b + \tau^H - \tau^L - \theta\right) - (1-\theta)\, a^2,$$

yielding:

$$a^*\left(\tau^H, \tau^L, \theta\right) \equiv \min\{\hat{a}\left(\tau^H, \tau^L, \theta\right), \bar{a}\}, \text{ where } \hat{a}\left(\tau^H, \tau^L, \theta\right) = \frac{b + \tau^H - \tau^L - \theta}{2(1-\theta)}, \bar{a} = 1. \tag{1}$$

The second order condition is satisfied, as $-2(1-\theta) \leq 0$. with $\frac{\partial \hat{a}\left(\tau^H, \tau^L, \theta\right)}{\partial b} = \frac{1}{2(1-\theta)} > 0$ and $\frac{\partial^2 \hat{a}\left(\tau^H, \tau^L, \theta\right)}{\partial b \partial \theta} = \frac{1}{2(1-\theta)^2} > 0$ and with:

$$\begin{aligned} \frac{\partial \hat{a}\left(\tau^H, \tau^L, \theta\right)}{\partial \theta} &= \frac{b + \tau^H - \tau^L - 1}{2(1-\theta)^2}, \\ &= \frac{2\hat{a} - 1}{2(1-\theta)}. \end{aligned}$$

Thus, effort increases with the private benefit b at a rate that increases with the degree of stress susceptibility θ. Effort increases with stress susceptibility if $2\hat{a} > 1$. The principal chooses τ^H, τ^L to solve:

$$\begin{gathered} \max E_\theta\left[a\left(\Delta - \tau^H\right) - \tau^L\right] \\ s.t.\text{: } (1) \\ a\left(b + \tau^H\right) + (1-a)\left(\tau^L - \theta a\right) - a^2 \geq 0, \\ \tau^H, \tau^L \geq 0, \end{gathered}$$

which yields:

$$\begin{aligned} \tau^{H*} &= \frac{1}{2}\left(\theta^{av} + \Delta - b\right), \\ \tau^{L*} &= 0. \end{aligned}$$

Substituting for these values in the interior effort function (expression 1), we obtain:

$$\hat{a}(\theta) = \frac{\frac{1}{2}\left(\theta^{av} + \Delta + b\right) - \theta}{2(1-\theta)},$$

where $0 \leq \hat{a}(\theta) \leq 1$ provided that:

$$2 - \theta \geq \frac{1}{2}\left(\theta^{av} + \Delta + b\right) \geq \theta.$$

The expected utility of an agent with stress susceptibility θ is therefore:

$$U(\theta) = a^*(\theta)\left(b + \tau^H - \theta\right) - (1-\theta)\, a^{*2}(\theta),$$

which is decreasing in θ, as:

$$\frac{dU(.)}{d\theta} = a^*(\theta)\left[-1 + \theta a^*(\theta)\right] \leq 0.$$

The expected utility of the principal is instead given by:

$$\begin{aligned} V(\theta) &= a^*(\theta)\left(\Delta - \tau^{H*}\right) \\ &= a^*(\theta)\left(\Delta - \frac{1}{2}\left(\theta^{av} + \Delta - b\right)\right) \\ &= \frac{1}{2} a^*(\theta)\left(\Delta - \theta^{av} + b\right), \end{aligned}$$

which does not vary with θ if $a^* = \bar{a}$. For values such that $a^* = \hat{a}$:

$$\frac{dV(.)}{d\theta} = \frac{d\hat{a}(\theta)}{d\theta}\left(\Delta - \tau^{H*}\right) \begin{array}{ll} < 0 & \text{if } \hat{a}(\theta) < 0.5, \\ > 0 & \text{if } \hat{a}(\theta) > 0.5. \end{array}$$

and it therefore increases in stress susceptibility if the effort reward imbalance induces the agent to work harder.

Example. Let $b = 0, \Delta = 2$. The equilibrium effort is then: $a^*(\theta) \equiv \min\{\hat{a}(\theta), 1\}$ with:

$$\begin{aligned} \hat{a}(\theta) &= \left[\frac{\frac{1}{2}\left(\theta^{av} + \Delta\right) - \theta}{2(1-\theta)}\right]_{\Delta=2, \theta^{av}=0.5} \\ &= \frac{1.25 - \theta}{2(1-\theta)} > 0.5. \end{aligned}$$

and with $\hat{a}(\theta) \leq 1$ for $\theta \leq \frac{3}{4}$. As $\hat{a}(\theta)$ is strictly greater than 0.5, effort $\hat{a}(\theta)$ is increasing in θ.

The agent's expected utility for $\theta \leq \frac{3}{4}$, is therefore:

$$\begin{aligned} U(\hat{a}(\theta)) &= \left[\frac{\frac{1}{2}\left(\theta^{av} + \Delta\right) - \theta}{2(1-\theta)}\left(\frac{\Delta + \theta^{av}}{2} - \theta\right) - (1-\theta)\left(\frac{\frac{1}{2}\left(\theta^{av} + \Delta\right) - \theta}{2(1-\theta)}\right)^2\right]_{\Delta=2, \theta^{av}=0.5} \\ &= \frac{16\theta^2 - 40\theta + 25}{64(1-\theta)} \end{aligned}$$

which is strictly decreasing in θ for $\theta \leq \frac{3}{4}$. For $\theta > \frac{3}{4}$, $a^* = 1$ and the agent's utility is:

$$\begin{aligned} U(a^* = 1) &= \left[\left(\frac{\Delta + \theta^{av}}{2} - \theta\right) - (1-\theta)\right]_{\Delta=2, \theta^{av}=0.5} \\ &= 0.25. \end{aligned}$$

For $\theta \leq \frac{3}{4}$, the principal obtains:

$$\begin{aligned} V(\theta) &= a^*(\theta)\left(\Delta - \tau^H\right) \\ &= \left[\frac{\frac{1}{2}(\theta^{av} + \Delta) - \theta}{2(1-\theta)}\left(\Delta - \frac{1}{2}(\theta^{av} + \Delta)\right)\right]_{\Delta=2,\theta^{av}=0.5} \end{aligned}$$

which is strictly increasing in θ. For $\theta > \frac{3}{4}$, $a^* = 1$ and the principal obtains:

$$\begin{aligned} V(\theta) &= \left[\left(\Delta - \frac{1}{2}(\theta^{av} + \Delta)\right)\right]_{\Delta=2,\theta^{av}=0.5} \\ &= 0.75. \end{aligned}$$

Appendix 2

Table A1: Perceived Work stress and its work-related causes (POLS estimates)

Dep.Variable	Stress at work	Worried at home for work issues
	(1)	(2)
Bad Health due to Work	0.507***	0.273***
	(0.03)	(0.03)
Violence	0.417***	0.302***
	(0.04)	(0.03)
Constant	−0.250***	−0.150***
	(0.04)	(0.04)

Note: Obs.: 21,279. The two dependent variables are transformations of the original ones, obtained from the mapping of their ordered values onto the support of the standard normal distribution. The model is estimated by Probit-adjusted OLS (POLS).
Source: Authors' calculation.

Table A2: Summary statistics of $\hat{\theta}_1$ and $\hat{\theta}_2$ measures

Variable	Mean	Std. Dev.	Min.	Max.
$\hat{\theta}_1$	-0.25	0.902	-2.587	1.705
$\hat{\theta}_2$	-0.15	0.915	-1.669	2.138

Source: Authors' calculation.