A model of job-stress and burnout

Arghya Ghosh* Kieron J. Meagher†
UNSW Sydney ANU

Abstract

Job-stress develops when the demands of work exceed the resources that a worker has for managing these demands. Chronic job-stress reduces work capacity, causing burnout, resulting in a loss of utility for workers and a loss of revenue for firms. We present a model of job-stress and burnout and show how they arise from organizational design and product market conditions. Firms have heterogeneous efficiency and hence differ in the cost of providing job resources. In equilibrium, some firms are a great place to work, never causing burnout, some firms are moderate quality workplaces and do cause burnout, while the worst workplaces result in employees quitting before they are burnt out. As competition increases, burnout increases in both extensive and intensive margins: the possibility of burnout arises in more firms, and workers become more likely to experience burnout in each firm. Autonomy enables workers to manage higher levels of stress, but it also impacts job demands by inducing changes in firms' investment in resources. Ex-post mismatch causes inefficiency by introducing an information asymmetry (only a worker knows if they are mismatched) resulting in under-investment in resources and excessive quitting.

Keywords: job demand, resources, job-stress, burnout, competition, autonomy, mismatch.
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*UNSW Business School, Sydney NSW 2052, Australia. *email:* a.ghosh@unsw.edu.au
†Research School of Economics, H.W. Arndt Building, Australian National University, Canberra, ACT 0200, Australia. *email:* kieron.meagher@anu.edu.au

1 Introduction

Job stress is a major contributing factor to depressive disorder[1] which cost the United States $210.5 billion in 2010 (Greenberg et al., 2015). Estimates of the annual cost of work stress in the EU were as high as $187 billion (Hassard et al., 2014, 2018). Job stress in 2023 remains at a record high level according to Gallup (2023).[2]

Job stress develops when the demands of work exceed the resources that a worker has for managing these demands (Karasek, 1979; Demerouti et al., 2001; Maslach et al., 2001). Chronic workplace stress, unless successfully managed, leads to burnout. Burnout encompasses psychological burnout, where workers feel exhausted, ineffective and cynical about their jobs (Maslach and Jackson, 1981), but also a number of serious medical conditions including insomnia, depression, hypertension and heart disease. These issues contribute to both lower on the job performance and more absences from work (Schaufeli and Bakker, 2004; Lerner and Henke, 2008). Thus, burnout poses a significant threat not only to the health of workers but also to the health of organizations.

The psychological approach has provided extensive empirical evidence on the job characteristics (in particular job demands and resources) that contribute to burnout but is unable to explain the role of organisational design and industrial competition in producing these job characteristics. We provide the first formal theoretical model tying product market competition through organisational design to worker burnout. We argue that the economic analysis of an industry should include the impact of production on workers, and that the mental and physical health of workers should be considered alongside the more traditional focus on wages.

The seminal contributions of Selye (1936, 1956) were the first to identify the negative impact of chronic stress on health through physiological pathways. Lazarus

[1] Globally, depression is the third largest source of lived disability (James et al., 2018).

[2] According the Gallup State of the Global Workplace 2023 Report, roughly 40% of workers reported their job was very or extremely stressful. Almost three-quarters of workers believe that they have more on-the-job stress than a generation ago, continuing a trend in place before the pandemic.

(1966) identified the importance of looking at stress through a cognitive lens: the stress we experience is determined in part by the way in which we interpret events. These contributions set the stage for the development of the enormous literature on sociophsycological risks from work.

The Job-Demand Control (JDC) model of Karasek (1979) combines and delineates negative job characteristics (job demands) from positive characteristics, in this case control. Job demands initially focused on work pressure but has expanded in the literature to cover a range of factors including dealing with difficult people or emotional situations, cognitive demands, tedium/repetition, and red tape (Bakker and Demerouti, 2017). Control covers characteristics like autonomy (control of ones own work) as well as broader ways in which authority can be delegated including decision latitude.

Johnson and Hall (1988) and Johnson et al. (1989) added lack of support (isolation) at work which has expanded to cover support and conflict with both supervisors and coworkers. As the list of positive and negative factors expanded Demerouti et al. (2001) provided a convenient organising framework, JD-R, around job demands and resources, where resources are a range of positive job characteristics that buffer negative job demands. Resources can range from practical concerns like an accounting system that provides useful and timely information to more ephemeral dimensions like meaning and recognition.

Another important strand of the literature has grown out of the Maslach burnout inventory, Maslach and Jackson (1981): exhaustion, cynicism and inefficacy.[3] The prevalence of this psychological burnout has become so common it is now recognised by the World Health Organisation as an official work related condition. The stress mechanism provides a common causal pathway and as a result variations of the JDC/JD-R/Maslach framework have been applied to stress related illnesses such as depression and heart disease as well as to stress related aspects of job performance such as burnout/engagement and turnover.[4]

[3]See Maslach et al. (2001) for an extensive review article and Maslach and Leiter (2022) for an accessible and practical book level discussion.

[4]See OECD (2013) for an extensive overview and synthesis of this literature and OECD/EU

We develop a simple, two-period model with a continuum of workers and firms, where workers can choose to work at a stress-free job, or at a firm that involves stress. Accumulation of stress over time reduces effective work capacity and can cause burnout if the stress level arising from workload exceeds a threshold level.[5] Burnout negatively impacts both firms and workers. Consistent with the empirical finding that burnout is associated with a host of negative psychological and physical consequences we assume that burnout results in a loss of utility for workers. Firms lose too, as burnout makes the worker ineffective resulting in a loss of output, and consequently a reduction in profits.

An important element of our model is uncertainty regarding the threshold stress level beyond which a particular worker experiences burnout. Neither a worker nor his employer knows that threshold ex-ante, although both know the distribution of the threshold and consequently the likelihood of burnout. Firms can always prevent burnout by providing adequate resources to the workers. In anticipation of burnout, workers can also quit their stressful jobs at the end of the first period. Despite these options—available to workers and firms—burnout occurs in equilibrium with positive probability.

An advantage of explicit equilibrium analysis is that it enables us to examine how the prevalence of burnout varies with the efficiency/productivity of firms, product market conditions (e.g., the extent of competition), and organizational design (e.g., autonomy).

The probability of burnout varies non-monotonically with the productivity of firms. Firms with high productivity invest adequate resources to support their workers and prevent burnout. Firms with low productivity do not offer adequate support, but workers avoid burnout by quitting and moving to a stress-free job in the second period. Moderately productive firms support their workers with some resources so that the workers do not quit, but the level of resources is inadequate

(2018) for some discussion of the its health consequences.

[5]Excessive workload can take various forms; e.g., overtime work, night-shifts, and working in the weekends. See Sato et al. (2020) for a causal analysis of the effect of work schedule on mental health.

to prevent burnout.[6]

An increase in competition increases the likelihood of burnout. In our base model, we assume a fixed price that the firms take as given, and model an increase in competition as an exogenous reduction in price.[7] When prices are endogenously determined, we capture increased competition as an increase in the number of firms, and/or a reduction in entry costs. Irrespective of the notion of competition, we find that burnout increases as price declines with increased competition.

As competition increases, burnout increases in both extensive and intensive margins: the possibility of burnout arises in more firms, and workers become more likely to experience burnout in each firm. The perceived loss from burnout declines as the loss of output (due to burnout) becomes less costly when prices decrease with competition. That in turn prompts relatively more productive firms to cut back investment in resources which leads to greater burnout.[8]

Our theory lends support to the recent empirical trade literature which finds that increased import competition can have a negative impact on workers' health. Using longitudinal data on mental health for British residents and measures of import competition in more than 100 industries over 1995–2007, Colantone et al.

[6]Heterogeneous firms—where the source of heterogeneity is efficiency/productivity—occupy centrestage in the modern trade literature (see, for example, Melitz (2003) and Eaton and Kortum (2002)). Heterogeneity in productivity also underpins macroeconomic models (Hopenhayn, 1992) where firm dynamics is a key element. This literature focuses on efficiency gains arising from the reallocation of resources from efficient to inefficient firms. Heterogeneous efficiency plays an important role in our framework too but we focus on the likelihood of burnout which has a subtle, non-monotone association with the efficiency of firms.

[7]This is a natural assumption in a small open economy setting where firms take the world price as given.

[8]Not all firms reduce resources though in response to increased competition. Some low-productivity firms—who do not provide any resources when competition is weak—choose to invest resources with increased competition, since, for these firms, retaining workers and tolerating losses from burnout becomes less costly in comparison to the alternative: hiring new workers. This highlights the need for going beyond the simple classification of job demands and resources. Despite increased investment in resources, burnout increases in these firms because of a fundamental shift in the workplace. Rather than quitting, workers stay with these firms as resources increase but nevertheless, they experience burnout because the amount of resources provided are insufficient to prevent burnout.

(2019) find that import competition has a significant negative impact on individual mental health. Exploiting over 40 million individual observations on health and mortality, Adda and Fawaz (2020) find that import levels had a detrimental effect on physical and mental health of US workers who perform routine tasks. The mortality hazard of workers in manufacturing increased by up to 6% per billion-dollar import increase.[9]

Autonomy—lack of which is often blamed for increased stress—has nuanced effects on resource provision, and consequently on burnout. We model increased autonomy as an increase in the threshold level of stress beyond which a worker becomes ineffective.It might seem inevitable that increased capacity to manage stress leads to lower burnout, but that conclusion presumes that firms continue to provide the same level of resources. However, resource provision does not stay the same except for firms with very low productivity which provide zero resources irrespective of the degree of autonomy.

Autonomy and resources could be substitutes or complements in our model. Highly productive firms cut back resources in response to increased autonomy, since, investment in resources is costly while conferring autonomy is not (at least when autonomy has no negative impact on output).[10] Despite cutbacks, these firms still provide sufficient resources to prevent burnout. Moderately productive firms increase investment in resources, as the marginal benefit—reduction in the probability of burnout—from an additional dollar of investment in resources—is higher with increased autonomy. Burnout becomes less likely in these firms too.

[9] In contrast to Colantone et al. (2019) and Adda and Fawaz (2020)—who examine the effects of import competition—Hummels et al. (2021) investigate the effects of export competition on health outcomes. They combine Danish data on individuals' health with Danish matched worker-firm data, and find that as firm sales increase, workers log longer hours and experience higher probabilities of stress and depression, heart diseases, and strokes. In the short run, when firms' labor supply is fixed, firms respond to increased export demand by increasing the workload of existing workers, which adversely affects the health of these workers.

[10] Conferring autonomy can be costly if the flexibility arising from autonomy leads to a loss in output. That in turn can increase stress as meeting the same production target will require more hours. We assume that output loss is negligible to highlight that even when autonomy seems beneficial for workers, firms might respond very differently on both fronts—providing resources and conferring autonomy—depending on their efficiency levels.

Surprisingly, burnout increases in the high-end of low-productivity firms, which switch from zero to positive provision of resources with increased autonomy. Increased resources facilitate retention but create the possibility of burnout.

There is a long history in economics of examining authority relationships through the lens of the principal-agent model (Mirrlees, 1976; Holmstrom, 1979; Hart and Grossman, 1983), although these models initially focused mainly on asymmetric information and incentive contracts. Asymmetric information remained the focus but Aghion and Tirole (1997) and Prendergast (2002) introduced the idea of delegation authority/control in order to utilise (and incentivize) the use of agents' private information. Instead of focusing on the transfer of authority downwards an alternative perspective is to focus on the flow of information or problems upwards (Radner, 1992; Garicano, 2000; Van Zandt, 1999; Garicano and Van Zandt, 2012).

Policies aimed at reducing burnout improve equity by reducing the variance in ex-post utility.[11] Workers in moderately productive firms receive higher wages as that compensates for the expected loss in utility from burnout. Workers in these firms who do not experience burnout enjoy the highest utility. Workers who do get burnt out however receive the lowest utility as the extra wage covers only the expected loss in utility and not the full loss in utility. Differences in ex-post utility across workers make the case for policy intervention on equity grounds.

An efficiency rationale for policy intervention arises in an extension of the model where we allow the possibility of mismatch between firms and workers. By mismatch, we refer to a misalignment of values or organizational culture which a worker truly learns only after working at the firm. Mismatch adds to job stress in the sense that even with unchanged resources meeting production targets requires putting more effort. We assume that only the worker learns the true extent of the mismatch. Private information regarding mismatch gives rise to inefficiency.[12]

[11] Note that ex-ante expected utility is the same for all workers as they are homogeneous and all have access to a stress-free outside option of equal value.

[12] Instead of setting different wages for workers with different degrees of mismatch, private information compels firms to choose a cutoff degree of mismatch and set a common wage for all workers whom the firms wish to retain. However, this implies that infra-marginal workers earn

Firms provide insufficient resources which in turn leads to excessive quitting in equilibrium. Overall burnout, however, can increase or decrease compared to the full information benchmark, since, while insufficient resources increase the probability of burnout for a retained worker, excessive quitting decreases that probability since the likelihood that a worker is retained is lower under private information.

2 A brief history of job stress and burnout

2.0.1 Stress and Burnout

What causes job/workplace stress?

- Job/Work-related stress occurs when the demands of work (job demands) exceed the resources (job resources) we have for managing those demands.

What causes burnout?

- Chronic workplace stress

2.0.2 Some numbers

Burnout

- 2022-2023 AFLAC Workforces Report—1200 employers and 2001 employees—suggests that more than 50% of American workers were experiencing at least moderate levels of burnout

higher wages and higher utility than the level necessary to retain them. The inability to customize wages according to mismatch type induces firms to set a lower wage and retain fewer workers than is optimal from a total surplus perspective.

- APA's 2021 Work and Well-being Survey of 1,501 U.S. adult workers — Across the board saw heightened rates (79%) of burnout in 2021, nearly 3 in 5 employees reported negative impacts of work-related stress ... a 38% increase since 2019.

Job Stress

- Job stress is a major contributing factor to depressive disorder which cost United States USD 210.5 billion in 2010
- Estimates of the annual cost of work stress in the EU are as high as USD 187 billion (Hassard et al., 2014, 2018)

2.0.3 Burnout

- WHO guidelines (ICD-11, 2019):
  - A syndrome conceptualized as resulting from chronic workplace stress that has not been successfully managed.
  - It is characterized by three dimensions: exhaustion, disengagement, and reduced professional efficacy.
  - Refers specifically to phenomena in the occupational context and should not be applied to describe experiences in other areas of life.
- The term "burnout" has been used widely since the onset of Covid-19. No new guidelines has been used but there is a recognition that it can happen in spheres unrelated to work
  - Burnout can happen to anyone — from new moms and caregivers to kids in youth sports. But perhaps the biggest burnout culprit is the modern workplace.Mayo Clinic Press, April 6, 2023

2.0.4 Burnout

American Psychological Association 12 May 2023 (Employers need to focus on workplace burnout: Here's why)

- Workplace burnout associated with a host of negative organizational, psychological, and even physical consequences, including:
  - Psychological - Depression, Insomnia, Psychological Distress
  - Physical - Heart disease, Headaches, Musculoskeletal pain
  - Organizational - Absenteeism, Job dissatisfaction, Presenteeism
- When workers are suffering from burnout, their productivity drops, and they may become less innovative and more likely to make errors. If this spreads throughout an organization, it can have a serious negative impact on productivity.

  Loss in utility for workers, loss in revenue for firms

2.0.5 Aside: Evolution of the concept and measurement

- History/evolution of the concept:
  - Maslach and Leiter (2022): The Burnout Challenge
- Maslach (2018)
  - In contrast to this individualistic, "blaming the person for their own problem" approach focusing on the employees, the attention needs to be on the employers
  - six critical areas: workload, control, reward, community, fairness, and values

  - psychologists must partner with other experts—in sociology, political science, economics, public health, architecture, etc. – to collaborate in designing the healthy workplaces of the future

- Measurement
  - Burnout: Maslach burnout inventory (MBI); Maslach and Leiter, HBR 2021: How to measure burnout accurately and ethically
  - Stress: Heart Rate Variability, Cortisol level, Perceived Stress Scale (PSS)

2.0.6 Job Demand and Control (JD-C)

- More demanding job $\rightarrow$ poor health outcomes, including poor psychological well-being.
- Autonomy help indiviudals organize their work to better suit their own needs, aiding their health
- Karasek, 1979; Karasek et al., 1998; Johnson and Hall, 1988; Karasek, 1990; Leka and Houdmont, 2010, ...

2.0.7 Whitehall study

- Mortality rates among male British civil servants aged 20-64.
- Controlling for standard risk factors, the lowest grade still had a relative risk of 2.1 for CHD mortality compared to the highest grade (Marmot, 1994).
- One possible explanation of the remaining grade differences in CHD mortality is grade differences in job control and job support (Marmot, Kogevinas and Elston, 1987).
- Blood pressure (BP) at work was associated with "job stress",
  - The rise in BP from the lowest to the highest job stress score was much larger among low grade men than among upper grade men.

- BP at home, on the other hand, was not related to job stress level.

2.0.8 Job Demand and Resources (JD-R)

[Evangelia Demerouti and Arnold Bakker]

All types of job characteristics can be classified in one of two categories – job demands and job resources

- Job demands: all requests forcing individuals to put greater effort and energy into their tasks to achieve goals and satisfy needs
  - workload, time pressure, emotionally and cognitively challenging interactions with others, high responsibility, new projects, and challenging demands.

- Job resources: physical, psychological, social, or organizational characteristics of the work that are functional to achieving goals and reducing the psychological costs associated with job requests
  - work autonomy, feedback relating to performance, support, supervision, coaching, and time control

Recent years have seen a corresponding empirical literature develop, mainly focusing on the centralisation versus decentralise decision: Delmastro (2002), Colombo and Delmastro (2004), Lo et al. (2016), Bandiera et al. (2021). The positive empirical association between competition and decentralization is established in Bloom et al. (2010) and Meagher and Wait (2008). Relational contracts[13] should help facilitate delegation of control and this idea is explored empirically in terms of national trust culture in Bloom et al. (2012) and directly in terms of individual employee

[13]The theory of relational contracts is developed in Baker et al. (2002) and Levin (2003). For empirical analysis of relational contracts and performance see Blader et al. (2015) and Blader et al. (2020).

trust in Meagher and Wait (2020) and Liu et al. (2022). Theoretically, coordination between business units could be a driver for centralization (Alonso et al., 2008b) or similarly economies of scale in decision-making (Meagher and Wait, 2008), this relationship is confirmed in McElheran (2014) and Meagher and Wait (2014). Instead of delegating a principal can utilise decentralised private information by agents sending messages: Dessein (2002); Alonso et al. (2008a); Rantakari (2008); Friebel and Raith (2010); Alonso et al. (2015). The joint empirical analysis of authority and communication is covered in Katayama et al. (2018)

3 Model

Consider a two-period model with a mass of M firms and a mass of N individuals where $N > 2M$. Each individual is endowed with one unit of labor in each period which he can use to work for a firm, or at a stress-free job (e.g., self-employment) where he earns $\bar{w} > 0$ per period. Working at a firm involves stress which diminishes the capacity to work effectively. Later, we describe how a reduction in effective capacity gives rise to the possibility of burnout resulting in loss in utility for the worker and loss in output/revenue for the firms.

Each firm employs at most one worker in each period $t(= 1, 2)$ at wage w_t and produces y_t units of output using labour (l_t)—provided by the worker—and costly resources (r) according to the following production technology:

$$y_t = \begin{cases} l_t + r & \text{if} \quad l > 0 \\ 0 & \text{otherwise} \end{cases} \tag{1}$$

The specification above implies that labour is essential to production. However some substitution is possible between labour and resources if the level of labour is positive. This captures the idea, that once a worker is hired, a manager can support him with resources but she cannot perform the work by herself.

Each firm faces a production target $y_t = 1$ in both periods. If the target is met, the firm sells that one unit of output at a price p. Else, if the target is not met,

the firm earns zero.[14] Prior to production, a firm trains a worker using h units of its resources. In addition, at the beginning of period 1, the firm makes a fixed investment which produces a per period flow of r resources for an investment cost of $\frac{\theta r^2}{2}$. Recall, equation (1) shows the r units of resources support the worker in meeting the production target.

We assume that firms are heterogeneous in their ability to provide support,θ. The distribution θ has pdf $f(\theta)$ and cdf $F(\theta)$ with support $[0, \bar{\theta}]$. The distribution of firms by θ is uniform with M firms of each type θ, giving a total mass of M firms in the economy.[15]

We assume the cost of hiring and training a worker, h, is neither too high nor too low:

$$\bar{w} < h < \frac{\bar{\theta}}{8}. \tag{2}$$

If training costs are sufficiently low all firms will churn workers: replacing existing workers every period so that second period employment never occurs. Conversely, if hiring costs are sufficiently high all firms will retain all workers in the second period. Intermediate hiring costs are the interesting case because both kinds of behavior are possible, depending on a firms efficiency type θ.

Now let us turn to workers, each of whom are endowed with one unit of labor per period, giving a total lifetime endowment of two units per worker. One unit of labor enables a worker to produce one unit of output in a stress-free environment.

[14]While we use y to denote output and p to denote price, they can also be used to denote task and value respectively. A task is either complete ($y_t = 1$) or incomplete ($y_t = 0$). In a more complex production process, completing the task has a (internal) value for firm measured by the shadow price p. In this way our approach can be extended to larger and more complex firms.

[15]The sources of differences in firm efficiency are still to some degree a mystery. As Syverson (2011)'s survey article shows, productivity/efficiency differences are large and persistent even within narrowly defined industrial fields, implying that the scientific aspects of technology are not the full explanation. There are a number of partial explanations focusing on how firms are managed. Better management practices imply better finacnial performance Bloom and Van Reenen (2007); Bloom et al. (2013). Better managed firms are better at implementing common IT solutions Bloom et al. (2012), better at managing human resource Bender et al. (2018); Cornwell et al. (2021) and better at avoiding tax to increase profits Bilicka and Scur (2021). Relational contracts/trust allow the use of non-contractible organizational solutions, Meagher and Wait (2020) producing better financial performance, Porta et al. (1997)

Indeed, in such environments, employing one worker ensures $y_t = 1$ even with $r = 0$. Stress at work reduces workers' overall capacity to work effectively. We model that loss in capacity as a reduction in a workers lifetime labour endowment from two units to $1 + \bar{l}$ units where $\bar{l} \sim U(0, 1)$. The distribution of $\bar{l}$ is common knowledge to both workers and firms, but neither a firm nor its employee know his $\bar{l}$.

A worker experiences burnout in period t if his accumulated supply of labor (including period t) exceeds his effective (accumulated) capacity at t. Given our parameter assumptions this can only occur in the second period, that is when

$$l_1 + l_2 > 1 + \bar{l}. \tag{3}$$

When burnout occurs the worker suffers a disutility of u_0 and his employer loses the workers output (the worker fails to meet his production target).

While workplace stress creates the possibility of burnout, it does not imply that burnout necessarily occurs in equilibrium. First, note that, burnout can occur in period 2 only. Since $y_1 = 1$, equation (1) implies $l_1 \leq 1$ for all $r > 0$. Thus, the threshold $1 + \bar{l}$ that triggers burnout can only be reached in period 2.

Second, to avoid loss in revenue, a firm can always choose to prevent burnout by choosing r slightly higher than $\frac{1}{2}$. Then, $l_1 = l_2 < \frac{1}{2}$ (from (1)) which implies $l_1 + l_2 < 1$, i.e. the burnout condition in (3) never holds.

Third, burnout might seem inevitable when $r = 0$, since then $l_1 = l_2 = 1$ and as we know from (3), $l_1 + l_2 = 2$ which (almost) always triggers burnout. However, both firms and workers rationally anticipate burnout with certainty in period 2 and would act accordingly. Either the firm would hire a new worker (in order to avoid the loss of output) or the worker quits the firm and opts for a stress-free job in period 2. Both these options avoid employee burnout in the workplace.

Given both firms and workers can undertake various actions to avoid burnout, a natural question to ask is: does burnout ever occur in equilibrium? Indeed, knowing fully well that burnout can arise if a worker stays with its employer for multiple periods, why does a firm retain workers and why does a worker stay

with the firm voluntarily? These are the questions we address next. In addition, we explore the relationship between competition and employee burnout.

4 Analysis

Throughout the analysis in this section we assume that $p > \bar{w} + h$ which ensures that any firm—irrespective of efficiency level—can operate profitably by hiring and training a new worker every period.

Consider $r \geq 0$. Labor required to meet the production target in two periods is given by:

$$l_1 = l_2 = 1 - r \tag{4}$$

If a worker works for the same firm in both period burnout occurs if $l_1 + l_2 = 2(1-r) > 1+\bar{l}$, or equivalently $\bar{l} < 1-2r$. Given $\bar{l} \sim U(0,1)$, a worker experiences burnout with probability

$$b = \max\{1 - 2r, 0\} \tag{5}$$

Note that possibility of burnout arise only in period 2. Since $y_1 = 1$, equation (1) implies $l_1 \leq 1$ for all $r > 0$. Thus, the threshold $1 + \bar{l}$ that triggers burnout can only be reached in period 2.[16] Worker's expected utility (expected payoff) in period 2 is $w_2 - bu_0$. Given the workers can earn $\bar{w}$ elsewhere, $w_2 - bu_0$ must be at least as high as $\bar{w}$. Assuming that the firm has all the bargaining power, it follows that

$$w_2 = bu_0 + \bar{w}. \tag{6}$$

If the firm chooses to retain the worker in period 2, its expected profit in period 2 is $(1-b)p - bu_0 - \bar{w}$.

Alternatively, instead of retaining the worker the firm can hire a new, previously self-employed worker at $\bar{w}$, train him at a cost h and earn $p - \bar{w} - h$ in profits. The possibility of worker burnout does not arise as a worker experiences burnout only in second period of his employment at a firm. Instead of hiring a

[16] Limiting the possibility of burnout in period 2 simplifies the analysis.

new worker in the second period, a firm retains its period 1 worker if and only if the following holds:

$$(1-b)p - bu_0 - \bar{w} \geq p - \bar{w} - h \implies h \geq \max\{1-2r, 0\}(p+u_0), \tag{7}$$

where the second inequality follows from substituting the expressions for b and w_2 from (5) and (6) into the first inequality.

Firms retain period 1 workers when the cost of training (h) exceeds the expected loss from burnout—revenue p plus worker compensation w_0 (beyond $\bar{w}$). Recasting the retention condition in terms of r gives the following inequality:

$$r \geq \frac{1}{2}\left(1 - \frac{h}{(p+u_0)}\right) \equiv \underline{r}. \tag{8}$$

4.1 Retention

Suppose $r \geq \underline{r}$ holds. Anticipating retention and $w_2 = \bar{w} + bu_0$, a worker accepts wage w_1 in period 1 as long as $w_1 + w_2 - bu_0 \geq 2\bar{w}$ which holds for all $w_1 \geq \bar{w}$. Full bargaining power of firms implies

$$w_1 + w_2 = 2\bar{w} + bu_0 \tag{9}$$

or equivalently $w_1 = \bar{w}$ (given (6)).

Under retention, the maximum possible revenue for a firm is $2p$, which requires its worker to not experience burnout and hence it sells two units of output at price p. From that, we subtract the wage bill $w_1 + w_2$, training cost h, resource costs $\frac{\theta r^2}{2}$, and expected lost revenue (due to the possibility of burnout) which gives a firm's expected profit from retention:

$$\pi^R = 2p - 2\bar{w} - h - b(r)(p+u_0) - \frac{\theta r^2}{2} \tag{10}$$

Observe that a firm will never choose $r > \frac{1}{2}$. When $r = \frac{1}{2}$, $b = \max\{1-2r, 0\} = 0$, i.e. $r = \frac{1}{2}$ prevents burnout with certainty. Any further increase in r beyond $r = \frac{1}{2}$

only adds to costs which strictly lowers profits. This upper bound on r together with (8) implies a firm must choose $r \in [\underline{r}, \frac{1}{2}]$ should it decide to retain its worker from period 1.

Conditional on retention—i.e., conditional on (8) being satisfied—the value of r that maximizes π^R in (10) is given by:

$$r^R(\theta, p) = \begin{cases} \frac{1}{2}, & \text{if} \quad \theta \leq 4(p+u_0) \\ \frac{2(p+u_0)}{\theta} & \text{if} \quad \theta \in [4(p+u_0), \frac{4(p+u_0)^2}{p+u_0-h}] \\ \underline{r} & \text{if} \quad \theta \geq \frac{4(p+u_0)^2}{p+u_0-h} \end{cases} . \tag{11}$$

Relatively efficient firms with $\theta \leq 4(p+u_0)$ provide more support than is necessary for retention. Indeed they provide enough support to their workers so that none of them experiences burnout. Let us refer to this group of firm as Group E(fficient).

The second group, Group I(nefficient) say, comprises relatively inefficient firms with $\theta \geq \frac{4(p+u_0)^2}{p+u_0-h}$ who provide the bare minimum support, $\underline{r}$, to retain their workers.

In between the two extreme groups, there is Group M comprising firms with moderate levels of efficiency. This group of firms, with $\theta \in [4(p+u_0), \frac{4(p+u_0)^2}{p+u_0-h}]$, choose intermediate levels of support which are more than the minimum level (to ensure retention) but still not enough to prevent burnout entirely.

Note that $r = r^R(p, \theta)$ is optimal for a restricted set of values of r which satisfy (8) and ensure retention. What happens when the retention restriction, equation (8), is removed? To answer that question we first need to consider the values of r which do not satisfy (8).

4.2 Churning

Suppose (8) does not hold, that is $r < \underline{r}$. From the discussion preceding (8), it follows that no firm retains its period 1 worker as the expected cost due to possible burnout of the retained worker is higher than the cost of training and hiring a new worker (from the pool of individuals who are self-employed in period 1).

There is churning of entire workforce in the sense that self-employed and firm employees switch positions in period 2. Each firm hires a worker for only one period. In each period, it offers $w_t = \bar{w}$ for $t = 1, 2$. As a newly hired period 2 worker does not experience burnout, firms do not invest in costly resources to support their workers. Irrespective of θ, each firm chooses $r = 0$. Workers work for one period in firms. In that period they supply $l_t = 1$ which ensures the production target is met each period and firms earn $2p$ in revenues. Subtracting the wage bill ($2\bar{w}$) and training costs ($2h$) from $2p$ yields the expected profit for each firm:

$$\pi^C = 2(p - \bar{w} - h) \tag{12}$$

Note, unlike retention, in the churning case a firm's profits does not depend on θ and is certain.

4.3 Optimal r

From the discussion above, it follows that the optimal value of r is one of the two: $r^R(p, \theta)$ or 0. Either a firm chooses $r = r^R$ and retain its workers or a firm chooses $r = 0$ and hires a new worker every period. A firm chooses $r = r^R(p, \theta)$ and retains its period 1 worker if and only if $\pi^R|_{r=r^R(p,\theta)} \geq \pi^C|_{r=0}$, or equivalently,

$$h \geq b^R(p + u_0) - \frac{\theta(r^R(p, \theta))^2}{2}. \tag{13}$$

where $b^R = \max\{1 - 2r^R(p, \theta), 0\}$ Substituting the value of $r^R(p, \theta)$ from (11) into (13) and simplifying we find that (13) holds if and only if $\theta < \frac{2(p+u_0)^2}{p+u_0-h}$. Combining this finding with the expression of $r^R(p, \theta)$ in (11) we find the optimal value of r:

$$r^*(\theta, p) = \begin{cases} \frac{1}{2}, & \text{if } \theta \leq 4(p + u_0) \\ \frac{2(p+u_0)}{\theta} & \text{if } \theta \in [4(p + u_0), \frac{2(p+u_0)^2}{p+u_0-h}] \\ 0 & \text{if } \theta \geq \frac{2(p+u_0)^2}{p+u_0-h} \end{cases} \tag{14}$$

Observe that, even when r is unrestricted, Group E—the group with relatively

efficient firms identified earlier during the discussion of retention strategy—continue to provide $r = \frac{1}{2}$ which prevents burnout. Group I—the group with relatively inefficient firms—choose $r = 0$ once the churning option becomes available. Despite lack of support, burnout does not take place in these firms either as no worker stays in these firms for two periods. With the availability of the additional option (i.e., churning), Group M—the middle group—splits into two. Relatively inefficient ones in the middle group with $\theta \in [\frac{2(p+u_0)^2}{p+u_0-h}, \frac{4(p+u_0)^2}{p+u_0-h}]$ choose $r = 0$. Like Group I, these firms employ workers for only one period, and thus the workers do not experience burnout while working for the firm.

Burnout occurs with positive probability only in relatively efficient firms in Group M with $\theta \in [4(p+u_0), \frac{2(p+u_0)^2}{p+u_0-h}]$. These firms choose $r = \frac{2(p+u_0)}{\theta} (< \frac{1}{2})$ and burnout occurs in these firms with probability

$$b = 1 - \frac{2(p+u_0)}{\theta} \equiv b^*(\theta, p) \tag{15}$$

This group exists, i.e., the interval $[4(p+u_0), \frac{2(p+u_0)^2}{p+u_0-h}]$ is non-empty if and only if $p + u_0 < 2h$. Proposition 1 summarizes the findings. To avoid clutter, we work with $u_0 = 0$. This is of little consequence, except the wage structure becomes flat and indeed the same $w_1 = w_2 = \bar{w}$ for all firms (irrespective of θ).

4.4 Equilibrium

Given a fixed price p, an equilibrium consists of resources invested by the firms $r^*(\theta, p)$, workload

$$l_t^*(\theta, p) = 1 - r^*(\theta, p),$$

and wages

$$w_t^*(\theta, p) = \begin{cases} \bar{w} + b^*(\theta, p)u_0, & \text{if } \ t = 2, \theta \in [4(p+u_0), \frac{2(p+u_0)^2}{p+u_0-h}] \\ \bar{w} & \text{otherwise} \end{cases}$$

where $t = 1, 2$, $\theta \in [0, \bar{\theta}]$, and $r^*(\theta, p)$ and $b^*(\theta, p))$, $\theta \in ()$ are given by equations (14) and (15) respectively. Workers not employed by firms in period t work in stress-free self employment and earn $\bar{w}$.

Having developed the components of the model we turn to the results.

5 Equilibrium Burnout

5.1 Equilbrium analysis

We begin by characterizing equilibrium burnout. We then investigate the role of product market competition, first for a given exogenous level of competition and then for an endogenous level of competition based on free entry.

The first key result is that, summarising the previous analysis, stressors vary by a firm's managerial efficiency and as a result burnout can occur in equilibrium but only for firms of moderate efficiency.

Proposition 1. Employee burnout at workplace

Suppose $\bar{w} < h < \frac{\bar{\theta}}{8}$.

(a) For all $p \in (\bar{w} + h - u_0, 2h - u_0)$*, there exists*

$$\theta_A \equiv 4(p + u_0), \quad \theta_C \equiv \frac{2(p + u_0)^2}{p + u_0 - h} \tag{16}$$

such that all firms with moderate level of efficiency, namely $\theta \in (\theta_A, \theta_C)$ *choose a strictly positive level of support* $r^* = \frac{2(p+u_0)}{\theta}$*, period 1 workers stay voluntarily with the same firms in period 2, and yet they experience burnout in period 2 with strictly positive probability*

$$b^*(\theta, p) \equiv 1 - \frac{4(p + u_0)}{\theta}. \tag{17}$$

(b) Furthermore,

i) relatively efficient firms with $\theta < \theta_A$ *retain all period 1 workers in period 2, choose sufficiently high level of support,* $r^* = \frac{1}{2}$*, such that no worker experiences burnout.*

(ii) relatively inefficient firms with $\theta > \theta_C$ do not provide any support (i.e., $r^* = 0$) and replace its entire workforce in period 2. Despite lack of support, no worker experiences burnout at his place of period 1 employment, as all period 1 workers quit their jobs at firms and opt for self-employment in period 2.

Proof. Immediate from the proceeding anaylsis. □

Proposition 1 focuses on intermediate values of h and p. Recall from equation (2) burnout can only occur for intermediate levels of h (relative to $\bar{w}$ and θ). The price must also be sufficient to cover the cost of wages and hiring, but also effects the feasibility of the three strategies: churning, burning and supporting. By focusing on this parameter range firms following all three organisational strategies co-exist in equilibrium:

1. *Group A (supporting)* comprising relatively efficient firms with $\theta \leq \theta_A$ which provide sufficient support to its workers such that, despite continuing with the same firm, none of its workers experience burnout.

2. *Group B (burning)* comprising moderately efficient firms which provide some support but not high enough to prevent burnout. This is the only group of firms where workers can experience burnout with strictly positive probability.

3. *Group C (churning)* comprising relatively inefficient firms with $\theta \geq \theta_C$ which do not provide any support but workers avoid inevitable burnout by switching to self employment in period 2.

When $p + u_0 > 2h$, burnout does not arise in equilibrium as Group B disappears. When $p + u_0 < w + h$ Group C—which provides no support—does not survive. Group C firms incur an additional fixed cost h in period 2 for training a new worker. If competition intensifies so much so that p drops below $\bar{w} + h$ incurring fixed cost no longer remains a viable option.

Hereafter, we restrict our attention to $p \in (\bar{w} + h - u_0, 2h - u_0)$ and shift our analysis to the role of competition.

6 Burnout Policies

6.1 Equity and Efficiency

The occurrence of burnout in equilibrium is efficient so there is no grounds for policy intervention to increase efficiency.

However ex post initially identical workers have heterogenous health outcomes: some get burnout and some do not. Thus there is ex post inequality and this has become a focus of public attention and policy intervention in terms of a workplace health and safety obligation on the part of employers with regard to psycho-social risks. see EU, UK, Australia etc.

To the degree that extra public health expenditure occurs due to burnout there are additional political economy motivations, perhaps even macro level efficiency, to regulate minimum resources provided by employers.

6.2 Minimum Psycho-Social Working Conditions

Now consider a government mandated minimum level resources, $r_{\min}$. A natural candidate for $r_{\min}$ is $\underline{r}$, as defined by equation (8). This is the level of r at which all firms would chose to retain their first period employees in the second period because hiring a new workers is more costly than the expected loss due to burnout.

Assume the conditions of Proposition 1, then firms in group A and B firms are already choosing r in excess of $r_{\min}$ so there is no change in their behaviour and hence no change in the level of burnout their employees experience.

The impact on group C (the churn firms) is more subtle. See figure ... DRAW a PICTURE The relatively less efficient firms in this group will switch from churning ($r = 0$) to compliance at the minimum level $r_{\min}$. Relatively more efficient firms in group C will choose $r^*(\theta, p) > r_{\min}$. In both cases employees will stay with the firm in the second period, rather than churning, and as a result will experience burnout with positive probability. Thus for this group the policy causes an increase in the ex post occurrence of burnout. Since groups A and B had no

change in burnout the overall impact of minimum psycho-social work standards of this type is to increase the prevalence of burnout.[17]

Remember to reconsider these policies again with endogenous p. The insight there is that in the $r_{\min}$ policy. The endogenous price will go up in this case because the group C firms are producing in a more costly way (churn was there profit maximising/cost minimising choice). When price increase the loss of a unit of output due to burnout increase, thus firms in group B will have more incentive to invest in resources leading to an increase in $r^*(\theta, p')$. So in the long run with endogenous prices the impact of minimum working conditions on the level of burnout is less than in the short run (p fixed). But it is ambiguous if the level of burnout is lower than under no regulation.

6.2.1 Subsidy

An alternative policy approach is to subsidise directly the cost of implementing r. One version is that a firm's cost of r is observable and they get some fraction of this cost in subsidy.

Subsidy at a given price level increase the resource provision by group B, which lowers burnout in these firms. However for group C firms only the relatively more efficient firms will switch

to investing in resources and in doing so will increase the burnout occurring at originally group C firms (the less efficient group C firms continue with the churn strategy).

[17] If $r_{\min}$ is sufficiently high so as to start impacting group B firms then the result is more complex. The number of firms at which burnout occurs will still be greater (all firms) compared to without regulation. However while the probability of burnout increases in group C firms it will decrease in the group B firms for which the minimum working conditions constraint binds.

7 Competition with exogenous market prices

Recall M is the mass of firms at each θ thus the law of large number to gives the following.[18]

Proposition 2. Burnout and competition

Suppose $\bar{w} < h < \frac{\bar{\theta}}{8}$ *and* $p \in (\bar{w} + h - u_0, 2h - u_0)$. *The total number of workers experiencing burnout is given by*

$$B(p) = M \int_{\theta_A(p)}^{\theta_C(p)} b^*(p, \theta) f(\theta) d\theta \tag{18}$$

where the values of $\theta_A(p)$, $\theta_C(p)$, *and* $b^*(p, \theta)$ *are as stated in Proposition 1. As competition increases—which we capture via a reduction in price—the number of workers experiencing burnout increases. That is* $B'(p) < 0$.

Furthermore, as competition increases, burnout occurs in more firms (extensive margin), and in each firm more workers (intensive margin) experience burnout, that is

$$\theta_A' > 0, \qquad \theta_C' < 0 \qquad \text{and} \qquad \frac{\partial b^*}{\partial p} < 0 \tag{19}$$

Proof. We have

$$b^*(p, \theta) = 1 - \frac{4(p + u_0)}{\theta}, \quad \theta_A(p) \equiv 4(p + u_0), \quad \theta_C(p) \equiv \frac{2(p + u_0)^2}{p + u_0 - h}.$$

Observe that $b^*(.)$ is strictly decreasing in p and $\theta_A(p)$ is strictly increasing in p. Finally, note that

$$\frac{d\theta_C(p)}{dp} = \frac{2(p + u_0)(p + u_0 - 2h)}{(p + u_0 - h)^2} < 0$$

where the inequality follows from noting that $p + u_0 < 2h$. □

[18] There are a continuum of firms of each type θ so the expectation of the number of workers experiencing burnout converges to a constant.

Consider first the intensive margin

$$b^*(p,\theta) = 1 - \frac{4(p+u_0)}{\theta}$$

which captures the likelihood of burnout in a firm. A firm loses p dollars in period 2 revenues if burnout occurs. As p declines, the amount of lost revenue declines which induces firms to invest less resources. That in turn leads to higher burnout.

To understand the impact of competition on extensive margin, express equilibrium profits of a firm as follows:

$$\pi^*(p,\theta) = \begin{cases} \bar{\pi} - \frac{\theta}{8}, & \text{if } \theta \leq \theta_A(p) \\ \bar{\pi} - b^*(p,\theta)p - \frac{\theta(r^*(p,\theta))^2}{2} & \text{if } \theta \in [\theta_A(p), \theta_C(p)] \\ \bar{\pi} - h & \text{if } \theta \geq \theta_C(p) \end{cases}$$

where $\bar{\pi} = 2p - 2\bar{w} - h$ represent the maximum possible profit of any firm. As price declines, $\bar{\pi}$ declines equally for all firms. A change in price p does not have any additional impact on profits for the most efficient group A firms ($\theta \leq \theta_A(p)$) which choose $r^* = \frac{1}{2}$ or the most inefficient group C firms ($\theta > \theta_C(p)$) which choose $r = 0$. However, for group B firms, where workers experience burnout, a reduction in price lowers

$$b^*(p,\theta)p + \frac{\theta(r^*(p,\theta))^2}{2} = p + u_0 - \frac{2(p+u_0)^2}{\theta}$$

since

$$\frac{d(p + u_0 - \frac{2(p+u_0)^2}{\theta})}{dp} = 1 - \frac{4(p+u_0)}{\theta} = \frac{\theta - \theta_A(p)}{\theta} > 0$$

for all firms in Group B.

While profits decrease for all firms with increased competition, it decreases less for Group B firms. As a result firms on the margin switch to Group B. The firm on the margin between Group A and Group B, i.e. $\theta = \theta_A(p)$ switches from choosing $r = \frac{1}{2}$ — which prevents burnout — to choosing $r < \frac{1}{2}$ which raises the possibility of burnout. Similarly, the firm on the margin between Group B and

Group C, i.e. $\theta = \theta_C(p)$ switches from $r = 0$ and churning workers to choosing $r > 0$ and retaining workers. But with retention comes the possibility of burnout since $\theta = \theta_C(p)$ chooses $r < \frac{1}{2}$. As workers experience burnout in more firms, and more workers experience burnout in each firm, overall number of workers experiencing burnout increases with competition.

We have assumed that price p is given and modeled an increase in competition as an exogenous reduction in p. This description fits well with a small open economy which treats the world price as given. Domestic price faced by the consumers is world price plus a specific tariff or world price multiplied by one plus ad valorem tariff. Trade liberalization — which is often modeled as a reduction in tariffs — lowers domestic price which benefits consumers. This positive impact of trade liberalization is well known. Wages stay the same for workers in firms belonging to Group A and Group C where burnouts do not occur. Wages for workers in Group B firms increase at least weakly[19] Though wages do not decline and prices do not increase, employment condition worsens for some workers. Competition prompts firms to invest less resources to support workers and, as a result, more workers experience burnout in the workplace.

7.1 Market Equilbrium

7.1.1 Market equilibrium for a given M

Now we consider environments where prices are endogenously determined. Assume that consumers buy only once (if at all) at the end of period 2. Continue to assume that M as given. For any given M and p, aggregate output supply over two periods is given by:

$$S(p, M) = 2M - B(p) = M\left(2 - \int_{\theta_A(p)}^{\theta_C(p)} b^*(p, \theta) f(\theta) d\theta\right) \tag{20}$$

[19] Weakly because firms' liability might be limited to w_2 in which case, like the other two groups, these firms also pay $2\bar{w}$ in wages.

Observe that $S_p(.) > 0$ since $B'(p) < 0$. Furthermore, $S_M(.) > 0$. Thus the industry supply curve is upward sloping in price and it shifts outward as the number of firms increases.[20]

Let $D(p)$ denote the demand for the good at price p where $D'(p) < 0$ and $D(0) > 2M$. For any given M, market equilibrium is given by (i) price $p(M)$ that solves[21]

$$S(p(M), M) = D(p(M)) \tag{21}$$

and (ii) associated resource allocation $r(\theta, p(M))$, workload $l_t(\theta, p(M))$, and wages $w_t(\theta, p(M))$ where $r(.)$, $l_t(.)$. and $w_t(.)$ are as defined for a given p as per section 4.4.

As M increases, the supply curve shifts outwards, equilibrium price declines which benefits consumers. Wages remain unchanged or increase weakly, but employment condition for workers decline in a group of firms with moderate levels of efficiency. As competition increases, both the number of workers and the proportion of workers experiencing burnout increase.

7.1.2 Free entry equilibrium

Suppose in order to enter the market firms need to incur $K_0 + K(M)$ at the beginning of period 1, where $K'(M) > 0$.[22] Firms learn their own θ after incurring $K_0 + K(M)$. A free entry equilibrium is an endogenously determined mass of firms, M^*, and associated market equilibrium where $M = M^*$ solves the following:

$$2p(M) - 2\bar{w} - h - \int_0^{\bar{\theta}} C(\theta, M) f(\theta) d\theta = K_0 + K(M) \tag{22}$$

[20] The possibility of burnout plays a central role in generating the upward sloping supply curve. In the absence of burnout, the supply curve is vertical: $S(p) = 2M$ for all values of p for which it is profitable to produce.

[21] Assume parameterizations are such that the intersection between demand and supply is in the upward sloping segment of the supply curve.

[22] Operating a firm requires, say one unit of skilled labor or capital or both. These are economy-wide scarce resources. The value of the scarce resource increases as more firms demand it. However, perfectly competitive firms take these values as given. Effectively, we are assuming an upward sloping supply curve for capital or skilled labour.

and

$$C(\theta, M) = \begin{cases} \frac{\theta}{8} & \text{if } \theta \leq \theta_A(p) \\ b^*(p(M), \theta)p(M) + \frac{\theta(r^*(p(M),\theta))^2}{2} & \text{if } \theta \in [\theta_A(p), \theta_C(p)] \\ h & \text{if } \theta \geq \theta_C(p). \end{cases} \tag{23}$$

That M^* is unique follows from noting that the righthand side is strictly increasing in M and the lefthand side is strictly decreasing in M. As K_0 declines, M increases which lowers price and increases burnout.

7.1.3 Welfare implications

A common theme across various notions of competition is that burnout increases as competition increases. Naturally, restricting competition lowers burnout. Does that provide a sufficient reason to restrict competition? No, not at least if we go by traditional utilitarian welfare which weighs interests of consumers, workers, and firms equally. We work in an environment with perfect competition and no externalities where competitive equilibrium is efficient.

As burnout results in lost output, it might seem that a slight decrease in competition can lower burnout and improve welfare. However, note that a worker takes into account the possibility that he might experience burnout. Knowing that a firm offers higher wage to compensate for the risk of burnout. Thus, the effect arising from burnout is fully internalized.

There is ex-post inequality arising from burnout. Group B workers who do not suffer burnout enjoy the highest utility while those who suffer burnout enjoy the lowest utility. Utility of everyone else—who works at other firms or in stress-free jobs–lies between the two. A social welfare function that puts some weight on inequality might prompt intervention that restricts competition.

8 Control and Autonomy

Autonomy, or more generally control over one's work, can reduce stress. Psychologically motivated empirical papers explain this using theories like Self Determination. However, more practically, from an economic perspective, given the power to make choices about the details of their work, workers will naturally make choices to benefit themselves. The point that is not explicit in the economic literature on delegation is that for many workers the private benefits of their choices includes the reduction of work stressors.

The project selection moral hazard models introduced by Aghion and Tirole (1997) and Prendergast (2002), emphasize that workers/agents are choosing projects, not simply effort levels on a pre-specified task, and that the projects themselves have utility payoffs to the agent. Projects can be as grand an acquisition or merger, but for most workers, they can be as simple as what time to start and when to take a break.

The empirical literature on the stress-reducing impacts of autonomy is vast. The Job Demands Control literature was in part motivated by earlier observations on the superior health and longevity of those with more authority. A large literature has shown the connection between autonomy and depression (both self-reported and clinically diagnosed), longevity, heart disease, cortisol levels and high blood pressure. Both in cross-sectional and longitudinal studies.

The two literature that focus on burnout, following Maslach and Jackson (1981) and Demerouti et al. (2001), both include measures on control. As (Maslach et al., 2001, p414) observes, control need not be just a prosaic concern: "It is distressing for people to feel responsible for producing results to which they are deeply committed while lacking the capacity to deliver on that mandate.".

To capture how autonomy/control can lower the stress produced by a given workload, we amend the threshold condition for burnout slightly as follows:

$$l_1 + l_2 \geq 1 + \bar{l} + \eta a(1 - \bar{l}) \tag{24}$$

where $a \in \{0, 1\}$ captures autonomy and $\eta \in [0, 1)$ captures the effect of autonomy on loosening the workload threshold. Allowing for autonomy recaptures a part ψ of the missing endowment, i.e. $1 - \bar{l}$, which is lost due to stress. As equation (24) reflects, autonomy reduces but does not remove the possibility of burnout. Note, we introduce two variables, a and η, instead of capturing the effect with a single variable. This separation highlights that a, is a decision variable for the firm, while the other one, η, is a parameter which captures the effectiveness of a. Firms might not choose autonomy in which case $a = 0$. Firms might opt for autonomy but it might not reduce any stress at all in which case $\eta = 0$.

As Aghion and Tirole (1997) point out, yielding control is not necessarily costless from a firm's point of view because the worker's choice may conflict to some degree with the interests of the firm. This degree of conflict of interest defines incentive alignment. For example, it is well documented that dealing with customers can be a significant stressor (Demerouti et al. (2001); Bakker and Demerouti (2017)). In the context of their field experiment with a large bakery chain Friebel et al. (2017) report that employees preferred to do back room work in order to avoid customers, leading to significant revenue loss for the employer.

To capture the possibility of autonomy leading to output loss we amend the production technology slightly as

$$y_t = l_t + r - \phi a \tag{25}$$

where $\phi \in (0, 1)$ capture the effect of a firm's choice of autonomy on output. Modified threshold condition in (24) together with slightly amended production technology in (25) changes the probability of burnout to:

$$b = \max\left\{ \min\left\{ \frac{1 - 2r - (\eta - 2\phi)a}{1 - \eta a}, 1 \right\}, 0 \right\} \tag{26}$$

Note that the expression for burnout is the same as before when $a = 0$.

Consider the case where autonomy has output effects, $\phi > 0$, but no direct relation to stress, i.e. $\eta = 0$. In this case, the probability of burnout increases with

autonomy, as autonomy simply reduces output for a given (l_t, r_t) combination. In this situation, a firm will not confer autonomy to its workers, and the analysis in the main section continues to hold.[23]

Instead of considering all possible combinations of η and ϕ, in we focus on the optimistic case where $\eta > 0$ and $\phi \approx 0$. Autonomy relaxes the stress threshold enabling the worker to manage more stress but it has a negligible impact on output. Proposition 3 below captures the how the responses of firms differ qualitatively depending on a firm's efficiency level.

Proposition 3. *Suppose $\eta > 0$ and $\phi \approx 0$. Let $a^*(\theta)$, $r^*(\theta)$, and $b^*(\theta)$ denote the equilibrium values of autonomy, resources, and probability of burnout in a type θ firm. We have*

$$(a^*(\theta), r^*(\theta), b^*(\theta)) = \begin{cases} (1, \frac{1-\eta}{2}, 0) & \text{if } \theta \in A' \\ (1, \frac{2(p+u_0)}{(1-\eta)\theta}, 1 - \frac{4(p+u_0)}{(1-\eta)\theta}) & \text{if } \theta \in B' \\ (0, 0, 0) & \text{if } \theta \in C' \end{cases}$$

where $A' \equiv [0, \frac{4(p+u_0)}{(1-\eta)^2}]$, $B' \equiv [\frac{4(p+u_0)}{(1-\eta)^2}, \frac{2(p+u_0)^2}{(1-\eta)^2(p+u_0-h)}]$, $C' \equiv [\frac{2(p+u_0)^2}{(1-\eta)^2(p+u_0-h)}, \bar{\theta}]$.

Proposition 3 says that relatively efficient firms confer autonomy ($a = 1$), but inefficient firms do not. To understand why, note that autonomy benefits firms only if the firms retain workers. Autonomy reduces stress which means retained workers are less likely to suffer burnout in period 2. Relatively efficient firms in Group A' and Group B' retain workers and confer autonomy. Inefficient firms in Group C'—the group of churning firms—do not retain workers which makes them indifferent between $a = 1$ and $a = 0$ when there is no loss in output (i.e., $\phi = 0$). If autonomy leads to a loss in output, no matter how small, Group C' firms strictly prefer $a = 0$. [24]

[23] In fact, the effect can be worse. If some degree of autonomy is mandated, for example by government employment law or workplace health a safety mandate, then not only does burnout increase, but supply also declines causing an increase in prices. Thus we might end up with two bads: Higher burnout and higher prices.

[24] Choosing $a = 1$ implies $y_1 = l_1 + r - \phi$. Conferring autonomy becomes costly. Group C' firms have to provide $r = \phi > 0$ to meet production target $y_1 = 1$, because l_1 is already at full capacity

While firms in both groups A' and B' confer autonomy to their workers, autonomy impacts resource provision quite differently in these two groups. Consider a firm $\theta_1 \in A \cap A'$. When $a = 0$, firm θ_1 provides $r = \frac{1}{2}$ and prevents burnout. With the availability of the additional instrument, autonomy, firm θ_1 cuts back resources from $r = \frac{1}{2}$ to $r = \frac{1-\eta}{2}$ which is sufficient to prevent burnout. Thus, autonomy and resources act as substitutes for firm θ_1. Now consider $\theta_2 \in B \cap B'$. Firm θ_2 equates the marginal cost of resources, θr, with the marginal benefit of resources, $\frac{2p}{(1-\eta)\theta}$ which is higher in the presence of autonomy (i.e., effectively when $\eta > 0$). Higher marginal benefit prompts firm θ_2 to invest more resources. Thus, autonomy and resources act as complements for firm θ_2.

Whether autonomy and resources are complements or substitutes has important implications for workers and the incidence of burnout. As autonomy is accompanied by lower resources in firm θ_2, $l_1 + l_2$ increases, implying that workers spend more time on stressful work. Nevertheless, they do not get burnout as autonomy enables them to manage more stress. On the other hand, workers at firm θ_2 not only enjoy more autonomy but also spend less time on stressful work. The probability of burnout declines, but nonetheless, remains positive in firm θ_2. Can burnout ever increase in a firm when it confers autonomy—a voluntary option, that the firms can forgo if it does not increase profits? Surprisingly, the answer is yes. With higher marginal benefit from an extra dollar of investment in resources, some Group C firms with relatively high θ, say firm θ_3 might join group B'. In the absence of autonomy, these firms churn out workers every period, while when autonomy is available as an additional instrument, they might decide to provide resources and retain workers despite the possibility of burnout.

The discussion above highlights the nuanced relationship among the three—autonomy, resources, and burnout—and in particular, how that relationship depends on the efficiency of firms. It might seem puzzling that the prevalence of burnout remains unchanged despite a cutback in resources (e.g., firm θ_1), or that burnout increases despite an increase in both autonomy and resources (e.g., firm θ_3). However, once viewed through the lens of economics, these outcomes arise

(i.e., $l_1 = 1$). These firms find it more profitable to save resource costs by choosing $a = 0$ and $r = 0$.

naturally as equilibrium outcomes in an optimization framework with utility-maximizing workers and profit-maximizing firms with heterogeneous efficiencies.

9 Mismatch

Many important job characteristics are either non-contractible, or are 'experience goods' not fully known to workers until after they start employment. For example, fairness[25] in the treatment of workers or the values shaping input and output choices.[26]

Maslach and Leiter (2022) points out that there can be various sources of mismatches between a worker and a firm and these mismatches can add to stress. Mismatch might be aspects of personality type, some people find they like dealing with customers while others do not, and hence the documented stressor of "dealing with difficult people" might have an idyosyncratic component.

After working for one period, a worker might find that the organization is not a good match. The worker might quit, or might stay if the wage is suitably high. Is it in a firm's interest to retain these workers with high wages and what is the implication for burnout? We address these questions in this section.

[25]This can cover both fairness of rewards with regard to effort/contribution and procedural fairness is handling employment disputes, see for example Boedker et al. (2017)

[26]While Saloner et al. (2000) argue mission and vision statements are so generic as to be close to useless, corporate social responsibility strategies, Mintzberg (1983), are wide spread, and appear to contribute to employee satisfaction, commitment and retention Brammer et al. (2007); Collier and Esteban (2007); Carnahan et al. (2017). Burbano (2016) in particular demonstrates, via a field experiment, the importance of meaningful work and that people choose to give up pay for more meaning.

9.1 Mismatch and Job Stress

To capture the mismatch—which a worker only learns after staying at a workplace in period 1—we amend the period 2 production function as follows:

$$y_2 = l_2 + r - m,$$

where $m \sim G[\underline{m}, \bar{m}]$ captures the extent of mismatch between a firm and worker,

$$\underline{m} < 0 < \bar{m},$$

and the mean is zero. As m increases, the mismatch worsens. Both firms and workers know $G(.)$ in period 1, but only a worker know his m after period 1. Note that, since r is fixed, the only channel for adjustment in period 2 is l_t. Stress declines when $m < 0$ while it increases when $m > 0$. This simply captures the idea that the same work environment might amplify the job stress for some and mute it for some others.[27]

Workload in period 2 changes from $l_2 = 1 - r$ to $l_2 = 1 - r + m$ which in turn changes the probability of burnout to

$$b(r, m) = \max\{1 - 2r + m, 0\}$$

Note that, now, not only firms are heterogeneous, workers are heterogeneous too. Facing a wage of w_2, a worker m stays with his period 1 employer if and only if

$$w_2 - b(r, m)u_0 \geq \underline{w}$$

A firm's choice of w_2 effectively reduces to the choice of cutoff m, say $\hat{m}$, where

$$w_2 = \underline{w} + b(r, \hat{m})u_0 = w_2(\hat{m}, r)$$

[27] In this sense mismatch is akin to horizontal differentiation. In a multiple employee setting the idiosyncratic shocks might be imperfectly correlated across individuals reflecting common experiences such as a psychopathic boss.

A worker with mismatch $m \leq \hat{m}$ will stay with the firm. A worker with mismatch worse than $\hat{m}$ rejects the period 2 offer and quits at the beginning of period 2. If worker from period 1 quits, the firm incurs hiring costs h and hires a new worker at wage $\underline{w}$. The firm's expected period 2 profit is given by

$$\begin{aligned}\pi_2(\hat{m}, r) &= \int_{\underline{m}}^{\hat{m}} ((1 - b(r, m))p - w_2(\hat{m}, r))g(m)dm + (p - \underline{w} - h)(1 - G(\hat{m})) \\ &= p - \underline{w} - c(\hat{m}, r)\end{aligned}$$

where

$$c(\hat{m}, r) \equiv \int_{\underline{m}}^{\hat{m}} (b(r, m)p + b(r, \hat{m})u_0)g(m)dm + h(1 - G(\hat{m}))$$

denotes a firm's expected cost in the second period.

The profit-maximizing value of $\hat{m}$ for a given r—say $\hat{m}(r)$—is implicitly given by the following equation:

$$(b(r, \hat{m}(r))(p + u_0) - h)g(\hat{m}(r)) + G(\hat{m}(r))u_0 = 0. \tag{27}$$

Using $\hat{m} = \hat{m}(r)$ we can express overall profit of any firm θ by

$$\pi(r, \theta) = 2p - 2\underline{w} - c(\hat{m}(r), r) - \frac{\theta r^2}{2}.$$

which is maximized at $r = r^*$ where

$$2(p + u_0)G(\hat{m}(r^*)) - \theta r^* = 0. \tag{28}$$

In equilibrium, a firm θ invests r^* and retain all period 1 workers with $m \leq m^* \equiv \hat{m}(r^*)$—where (r^*, m^*) solve (27) and (31). A retained worker m experiences burnout with probability $b(r^*, m)$. The worse the mismatch, i.e. the higher the value of m, the higher the probability of burnout. Workers with too high m, namely $m > m^*$ quit the firm and opt for a stress free job in period 2.

Insufficient resources, excessive quitting

We now investigate the social optimally of r^* and m^* against a total surplus (profit and worker utility) benchmark. Consider the total surplus in period 2 arising from a firm-worker pair. Suppose the firm invests r and the worker employed at the firm learns m at the end of period 1. Period 2 surplus from employment choice, that is retention versus churning, are respectively $(1 - b(r, m))p - b(r, m)u_0$ and $p - h$. Equating the two gives the cutoff type $\tilde{m}(r)$ where

$$b(r, \tilde{m}(r))(p + u_0) = h. \tag{29}$$

Period 2 surplus is maximized, with regard to employment choice, if retention occurs for $m \leq \tilde{m}(r)$ and quitting for $m \geq \tilde{m}(r)$, with neutrality on the boundary.

From (27) we know that

$$b(r, \hat{m}(r))(p + u_0) < h \equiv b(r, \tilde{m}(r))(p + u_0)$$

where the identity follows from (29). Since $b(r, m) = 1 - 2r + m$ is increasing in m, it immediately follows that

$$\hat{m}(r) < \tilde{m}(r). \tag{30}$$

That is, for any given r, the equilibrium level of retention is socially insufficient, and as a consequence, too many workers quit for any given r. This occurs because, when a firm contemplates retaining the marginal type $\hat{m}$, it has to offer $w_2(\hat{m}, r)$ for all types $m \leq \hat{m}(r)$. Thus, for a profit-maximizing firm, the cost of increasing m is not only increased probability of lost revenue p and extra wages to the marginal type $\hat{m}$, but also increased wages for all infra-marginal workers $m \leq \hat{m}$. This prompts firms to be more selective regarding retention.

Expected total surplus for the same firm-worker pair in period 1—when θ is

known but m is not—is given by:

$$\int_{\underline{m}}^{\tilde{m}} ((1 - b(r, m))p - b(r, m)u_0)g(m)dm + (p - h)(1 - G(\tilde{m})) - \frac{\theta r^2}{2}.$$

which is maximized at $r = r^{\text{opt}}$ where

$$2(p + u_0)G(\tilde{m}(r^{\text{opt}})) - \theta r^{\text{opt}} = 0. \tag{31}$$

Total surplus is maximized when a firm θ invests r^{opt} and retains any period 1 worker with type $m \leq m^{\text{opt}} \equiv \hat{m}(r^{\text{opt}})$—where $(r^{\text{opt}}, m^{\text{opt}})$ solves (27) and (31). A retained type m worker experiences burnout with probability $b(r^{\text{opt}}, m)$. Workers with $m > m^{\text{opt}}$ quit the firm.

It is straightforward to show that

$$r^* < r^{\text{opt}} \quad \text{and} \quad m^* < m^{\text{opt}} \tag{32}$$

where the first inequality reflects insufficient investment in resources (by firms) and the second one implies excessive quitting (by workers). From both perspectives — total surplus maximization and profit maximization — the perceived benefit from preventing burnout for a retained worker is the same: $(p+u_0)$. However, as reflected in the inequality $\hat{m}(r) < \tilde{m}(r)$, a firm retains fewer worker types than is optimal. As a consequence, a firm's perceived benefit from investment in resources, $(p + u_0)G(\hat{m}(r))$, is strictly lower than $(p + u_0)G(\tilde{m}(r))$. This results in insufficient investment in r.

That too many workers quit in equilibrium follows from noting that profit-maximizing cutoff type m^* is strictly lower than surplus-maximizing cutoff type m^{opt}. The proof follows from noting that

$$m^* \equiv \hat{m}(r^*) < \tilde{m}(r^*) < \tilde{m}(r^{\text{opt}}) \equiv m^{\text{opt}}.$$

First inequality follows from applying (30), and the second inequality follows

from noting that

$$\tilde{m}(r) = 2r - 1 + \frac{h}{p + u_0}$$

is increasing in r—more workers stay as r increases—and $r^* < r^{\text{opt}}$.

Burnout

The equilibrium probability of burnout at a firm is given by

$$b^* = \int_{\underline{m}}^{m^*} b(r^*, m)g(m)dm.$$

When r and cutoff m are chosen to maximize total surplus, then, the probability of burnout is given by

$$b^{\text{opt}} = \int_{\underline{m}}^{m^{\text{opt}}} b(r^{\text{opt}}, m)g(m)dm.$$

Whether b^* is strictly higher/lower than b^{opt} is ambiguous. As profit-maximizing firms invest insufficient resources, $b^* > b^{\text{opt}}$ for any $m \in [\underline{m}, m^*]$ who are retained under both objectives—profit maximization and surplus maximization. However, $m \in [m^*, \bar{m}]$, who are more prone to burnout for any given r, quit in equilibrium, but stay with the firm under surplus maximization. This creates the possibility that $b^* < b^{\text{opt}}$.

While the probability of burnout alone can be lower in profit-maximizing equilibrium, the probability that a worker either experiences burnout or quits, is strictly higher. This follows from recognizing that the probability of the complementary event—period 1 worker stays with the firm and does not quit is strictly lower under profit-maximizing equilibrium. That is,

$$\int_{\underline{m}}^{m^*} (1 - b(r^*, m))g(m)dm < \int_{\underline{m}}^{m^{\text{opt}}} (1 - b(r^{\text{opt}}, m))g(m)dm$$

where the inequality is due to the fact that $b(r^*, m) > b(r^{\text{opt}}, m)$ and $m^* < m^{\text{opt}}$.

The fact the workers learn their degree of match or mismatch over time, and their employers do not, introduces inefficient organisational design, in terms of resources. As a result, and in contrast to the findings of previous sections, it is no longer the case that the level of burnout which occurs in equilibrium is necessarily efficient.

10 Conclusion

We present the first economic theory model of job related stress and how burnout is related to the classic dimensions of organisational design as well as product market conditions. Burnout in our model covers a wide range of negative health outcomes induced by stress such as the psychological burnout, depression and anxiety disorders, high blood pressure, heart disease and death.

Burnout is produced by the persistence of job demands which is modeled as a target workload. In the base model firms can invest in resources which provide support to workers and reduce the probability of burnout.

Firms are heterogeneous in their efficiency and hence their cost of providing resources. As a result in equilibrium some firms are a great place to work, never causing burnout, some firms are moderate quality workplaces and do cause burnout in expectation while the worst workplaces result in employees quitting before they are burntout. Under full information this outcome is efficient but introduces inequality, since for moderate workplaces it is a chance whether an employee is unlucky and develops burnout. These results are in stark contrast to the existing literatures in psychology, epidemiology and management in which jobs that produce burnout are assumed to be prima facie bad.

By developing a theoretical framework in which the provision of resources is a costly investment for a firm we are able to identify how market conditions flow through and affect the level of burnout in an industry. Importantly increased competition tends to increase the prevalence of burnout. This has important policy implications especially in evaluating globalization.

Two extensions are considered based on the empirical literature: autonomy and mismatch. Autonomy helps lower burnout by allowing workers more control of their work and its outcomes, but the choice of autonomy is affected by the alignment of firm and worker interests. Ex post mismatch introduces an information asymmetry (only a worker knows if they are mismatched) introducing under investment in resources and excessive quitting, showing a pathway for inefficient outcomes compared to the full information case.

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A Appendix

A.1 Period 2 wage

Group B firms—where burnout occurs—pay

$$w_1 = \bar{w}, \quad w_2 = \bar{w} + bu_0$$

in period 2 which implies total wage bill is

$$2\bar{w} + bu_0.$$

That a worker receives w_2 with certainty might be perceived as generous. Given that the worker accepts the work voluntarily and the firm makes zero revenues in case of employee burnout, one might argue that a worker receives nothing or a fraction of its wage, say αw_2, should the firm fail to meet its target.

Suppose that is the case. Then, a worker accepts the 2nd-period contract if and only if

$$(1-b)w_2 - b(u_0 - \alpha w_2) \geq \bar{w}.$$

Assuming full bargaining power of firms, we get:

$$w_2 = \frac{\bar{w} + bu_0}{1 - b(1-\alpha)}.$$

The worker accepts employment at the firm in the first period if $w_1 + (1-b)w_2 - b(u_0 - \alpha w_2) \geq 2\bar{w}$. Assuming full bargaining power of firms, we get $w_1 = \bar{w}$. Consequently, expected wage bill is:

$$w_1 + (1 - b(1-\alpha))w_2 = 2\bar{w} + bu_0$$

which is the same as when the firm pays $w_1 = \bar{w}$, and $w_2 = \bar{w} + bu_0$ with certainty.