



**A fresh look at self-employment, stress and health:
Accounting for self-selection, time, strain and gender**

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Abstract

Purpose: Past research on self-employment and health yielded conflicting findings. Integrating predictions from the Stressor-Strain Outcome model, research on challenge stressors and allostatic load, we predict that physical and mental health are affected by self-employment in distinct ways which play out over different time horizons. We also test whether the health impacts of self-employment are due to enhanced stress (work-related strain) and play out differently for men and women.

Methodology: We apply non-parametric propensity score matching in combination with a difference-in-difference approach and longitudinal cohort data to examine self-selection and the causal relationship between self-employment and health. We focus on those that transit into self-employment from paid employment (opportunity self-employment) and analyse strain and health over four years relative to individuals in paid employment.

Findings: Those with poorer mental health are more likely to self-select into self-employment. After entering self-employment, individuals experience a short-term uplift in mental health due to lower work-related strain, especially for self-employed men. In the longer-term (4 years) the mental health of the self-employed drops back to pre-self-employment levels. We find no effect of self-employment on physical health.

Originality/value: This article advances research on self-employment and health. Grounded in stress theories it offers new insights relating to self-selection, the temporality of effects, the mediating role of work-related strain, and gender that collectively help to explain why past research yielded conflicting findings.

Practical implications: Our research helps to understand the nonpecuniary benefits of self-employment and suggests that we should not advocate self-employment as a 'healthy' career.

Key words: self-employment, work-related stress, mental health, physical health, propensity score matching, time, Understanding Society

Introduction

Today, more people than ever before are choosing self-employment. The self-employed are those who work for their own account and risk (cf. Hebert and Link, 1982), for example, through running their own limited company or as a sole trader. In the UK, the growth of self-employment in the last decade is seen as supporting the country's recent economic recovery (Wales and Amankwah, 2016). Paradoxically, the risk-taking self-employed are often rewarded by a sustained loss of income after moving from employment into self-employment (Carter, 2011; Patel and Ganzach, 2018). This led to suggestions that the self-employed are compensated for by nonpecuniary benefits (Xu and Ruef, 2004) such as autonomy or procedural utility (Benz and Frey, 2008) and consequently have higher mental and physical health and wellbeing than the wage employed (Stephan, 2018; Nikolova, 2019).

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5 Yet, research comparing the mental and physical health of self-employed individuals with
6 those of employees is marked by mixed and inconclusive findings. Some studies document
7 health benefits of being self-employed (Nikolova, 2019; Stephan and Roesler, 2010), other
8 studies find lower health among the self-employed (e.g., Benavides, Benach, Diez-Roux and
9 Roman, 2000; Cardon and Patel, 2015; Patel, Wolfe and Williams, 2019) and still other
10 studies find no differences (e.g., Dolinsky and Caputo, 2003; Perry and Rosen, 2001)
11 between the self-employed and employees. This study builds on the Stressor-Strain-Outcome
12 model (Koeske and Koeske, 1993) to unpack the mixed findings of past research. Firstly, it
13 assesses work-related strain as a key stress process through which self-employment may
14 affect health. Secondly, it draws attention to the timing of effects (for instance, work stress
15 does not impair health immediately). Thirdly, it accounts for the possibility that more stress-
16 resistant individuals or those with prior health problems selectively self-select into self-
17 employment. Finally, this study also examines whether health benefits only possibly accrue
18 for some self-employed but not others and in doing so draws attention to the gendered nature
19 of self-employment (e.g., Minniti, 2009).
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33 There is broad agreement in the literature that the work characteristics of the self-employed
34 differ from those in employment (Stephan, 2018 for a review). Working for oneself entails
35 high amounts of autonomy (Benz and Frey, 2008) as well as high levels of stressors such as
36 uncertainty, high workload, long hours and complex tasks (e.g., Rauch, Fink and Hatak,
37 2018). Yet research rarely investigates the experience of strain (i.e. 'stress')¹ resulting from
38 the combination of autonomy and stressors which is the key mechanism in the development
39 of poor health outcomes (see Stressor-Strain-Outcome model, Koeske and Koeske, 1993).
40 Indeed, research findings on whether the self-employed experience more or less 'stress' than
41 employees are also mixed (e.g. Hessels, Rietveld and Van der Zwan, 2017 find less stress,
42 Cardon and Patel, 2015 find more stress among the self-employed), and they are rarely
43 measured and related to health outcomes in the same study². Moreover, the timing of stress
44 and health effects of self-employment remains poorly understood. For instance, even studies
45 drawing on longitudinal or cohort data typically aggregate these data rather than investigate
46 the development of strain or health over time (e.g. Nikolova, 2019)³.
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58 Stress processes do not affect health overnight but unfold over time. In the short-term,
59 exposure to stressors results in the mobilization of extra energy (Selye, 1976) and can
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3 improve performance and possibly mental health. For instance, research on employees has
4 documented positive effects of so-called challenge stressors which overlap with the key
5 stressors commonly argued to be characteristics for the work of the self-employed such as
6 high workload and demands, complexity, and high levels of responsibility (e.g., Cavanaugh,
7 Boswell, Roehling, & Boudreau, 2000). Yet continued long-term exposure to high levels of
8 stressors results in the build-up of the physiological stress response (allostatic load) that is a
9 precursor to the development of mental and physical illness (McEwen, 1998, 2004).

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17 Finally, there is an increasing recognition that answering whether the self-employed
18 experience better or worse health than employees requires accounting for selection bias. This
19 is because particular types of individuals may be more likely than others to pursue self-
20 employment. While there is some agreement that self-selection is likely important (Stephan,
21 2018), authors differ in their views of the type of self-selection taking place. Some suggest
22 that particular stress-resistant individuals become self-employed (Baron, Franklin and
23 Hmieleski, 2016) whereas others suggest that those with existing physical or mental health
24 issues may be more likely to opt for self-employment (Rietveld, van Kippersluis and Thurik,
25 2015; Wiklund, Hatak, Patzelt and Shepherd, 2018).

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34 The purpose of this research is to address the above concerns within one study based on a
35 conceptual model that integrates insights from the Stressor-Strain-Outcome model with
36 research on challenge stress and allostatic load to understand how self-employment may
37 affect mental and physical health in unique ways over time (specifically, a period of four
38 years) and to examine the mediating role of strain. In an extension of extant research, our
39 study first empirically establishes whether self-selection into self-employment takes place
40 and then accounts for its effects when relating self-employment to mental and physical health
41 over time. We use a cohort sample from *Understanding Society* in the Great Britain and focus
42 on individuals who enter self-employment from employment (at t_0) and compare these to
43 those who stay in employment over the same time period (at t_0 , t_1 and t_2 , i.e. 2 and 4 years).
44 Thus, our approach limits known heterogeneity in self-employment by focussing on so-called
45 opportunity self-employment in contrast to self-employment out of unemployment, i.e.
46 necessity entrepreneurship (Binder and Coad, 2016; Nikolova, 2019). We further examine
47 possible gender differences in strain and health outcomes.

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60 We make several contributions to the literature. First, by combining the matching

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3 methodology with the difference-in-difference approach and longitudinal data, we can
4 empirically estimate and then control for self-selection effects as well as generate causal
5 insights into the link of self-employment and health. In terms of the nature of self-selection
6 effects, we find that those with *lower* mental health are more likely to self-select into self-
7 employment in line with the view that self-employment offers flexibility to tailor work
8 arounds one's individual needs (Wiklund et al., 2018). Put differently, individuals with lower
9 health capital proactively seek out the nonpecuniary benefits of self-employment. Thus our
10 findings offer novel evidence to the debate on whether those with better or lower health self-
11 select into self-employment (Rietveld et al; 2015; Wiklund et al., 2018). Methodologically,
12 our study advances quantitative theory-testing entrepreneurship and health research by
13 obtaining estimates of the causal impact of self-employment on mental and physical health in
14 a way that aligns with calls for studies to use standard matching estimators in combination
15 with difference-in-differences methodology to improve the quality of nonexperimental data
16 (Blundell and Costa Dias, 2000, also Anderson, Wennberg and McMullen, 2019). The
17 difference-in-differences matching estimator has the additional advantage of eliminating
18 unobserved time-invariant differences in health between self-employed individuals and wage
19 employees that standard matching estimators fail to eliminate (Smith and Todd, 2005). Our
20 research design and analytical approach thus facilitate improved causal inference that helps to
21 make more accurate predictions about entrepreneurship and health phenomena.
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38 Second, building on recent calls that entrepreneurship research needs to pay more attention to
39 time and temporal processes (Levesque and Stephan, 2019), we reveal a new temporal effect
40 of self-employment on work stress and mental health. This effect is consistent with a
41 honeymoon effect of those who newly engage in self-employment and with shorter-term
42 positive effects of challenge stressors (which are prevalent in the work of the self-employed),
43 but which wear off over time. Moreover, we identify empirically a key theoretical mechanism
44 informed by the Stressor-Strain-Outcome model: the temporary uplift in mental health is due
45 to (mediated by) the self-employed experiencing lower work-related strain (less job-related
46 depressive affect and anxiety). Our findings, tracing a population-representative sample of
47 newly self-employed and of wage employees over four years, suggest that the health benefits
48 of self-employment may have been exaggerated in past research. Although entering self-
49 employment provides a temporary emotional uplift and higher mental well-being, in the
50 longer-term (four years) these effects appear to wear off. Moreover, we could not identify any
51 impact on physical health. In sum, considering the timing of effects helps to understand why
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3 past research reports conflicting finding for mental health and stress, both are only
4 temporarily enhanced.
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8 Finally, our findings extend research on the gendered nature of self-employment to stress and
9 health. We find that the uplift in mental health driven by lower work-related strain is only
10 experienced by self-employed men, not by self-employed women. These findings help to
11 identify the boundaries of the mechanism through which self-employment affects health and
12 add to the body of research on heterogeneity in entrepreneurship. To date this research has
13 focussed on contrasting opportunity and necessity entrepreneurs (broadly understood, see
14 Stephan, 2018 for a review). Our study instead showcases important gender-based
15 heterogeneity in a sample of opportunity entrepreneurs and raises concerns on how self-
16 employed women can experience the well-being benefits of self-employment.
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25 The remainder of the paper is structured as follows. In Section 2 we review the literature on
26 self-employment and health followed by elaborating our hypotheses. Section 3 explains data
27 and methodology. Section 4 describes the empirical results and Section 4 discusses the results.
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32 **Literature review**

34 Thriving organisations depend on having a healthy and productive workforce. Likewise, high
35 performing new firms depend on having healthy and productive entrepreneurs. Nonetheless,
36 many societies now face a mounting challenge of stress and health in the workplace. The
37 World Health Organization (WHO) defines health as a state of complete physical, mental and
38 social well-being and not merely the absence of disease or infirmity.⁴ An independent review
39 of mental health and employers in the UK reveals that around 15% of people at work in the
40 country have symptoms of an existing mental health condition and that the annual cost of
41 mental health to employers is between £33 billion and £42 billion (Stevenson and Farmer,
42 2017). Self-employed people work in environments considerably different from their
43 organisationally-employed counterparts. They are frequently burdened by uncertainty, market
44 fluctuations, and threat of loss of assets, which incurs considerable stress and impairs health
45 (Rauch et al., 2018; Tetrick, Slack, Da Silva & Sinclair, 2000). However, whether they
46 experience better or worse health at work than employees is still a matter of conceptual and
47 empirical inquiry. Results comparing the mental and physical health of the self-employed and
48 employees have been mixed and inconclusive. Appendix 1 provides details of individual
49 studies. In the following, we give an overview.
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5 First, there are studies that found a positive relationship between self-employment and mental
6 or physical health. For example, Stephan and Roesler (2010) compared entrepreneurs' and
7 employees' health in a national representative sample from the German National Health
8 Survey 1998 where mental and physical health were diagnosed by physicians and
9 supplemented with physiological measure. Employing a case-control design, they found that
10 entrepreneurs showed significantly better overall mental and physical health as well as lower
11 blood pressure, lower prevalence rates of hypertension, and somatoform disorders. Yoon and
12 Bernell (2013) investigated the effect of self-employment on health, access to health care,
13 and health behaviors. They analyzed 13,435 self-employed and salaried workers in the US.
14 They found that self-employment is positively associated with perceived physical health, and
15 is negatively associated with having diabetes, high blood pressure, high cholesterol and
16 arthritis. Mental health outcomes were not significantly associated with self-employment.
17 Rietveld, Bailey, Hessels and van der Zwan (2016) examined the relationship between health
18 and entrepreneurship on a sample of 4555 business owners and wage-workers in four
19 Caribbean Basin countries. Health status was measured by an index comprising five
20 dimensions (mobility, self-care, ability to perform usual activities, pain/discomfort,
21 anxiety/depression). They found that business owners were healthier than wage-workers.
22 Goncalves and Martins (2018) examined the impact of self-employment on health as
23 measured by hospital admissions based on a representative sample of 100,000 individuals for
24 the period from 2005 to 2011 in Portugal. They found that the likelihood of hospital
25 admission of self-employed individuals is about half that of wage workers. Nikolova (2019)
26 studied the physical and mental health consequences of self-employment, utilizing German
27 longitudinal data for the period 2002–2014. She found that necessity entrepreneurs
28 experience improvements in their mental but not physical health, while opportunity
29 entrepreneurship leads to both physical and mental health gains. Tetric et al. (2000)
30 compared business owners with wage workers and examined stressors and occupational
31 health in a sample of 160 self-employed individuals and wage workers from Michigan, USA.
32 They found that business owners experienced less emotional exhaustion.
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55 Second, other studies find a negative relationship between self-employment and health. For
56 example, Jamal (1997) examined the relationship between work experience and well-being in
57 a sample of 235 self-employed and employed individuals in Canada. He found that the self-
58 employed experienced more psychosomatic health problems, although there were no
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3 differences in mental health. Benavides, Benach, Diez-Roux & Roman (2000) compared
4 associations between types of employment and health indicators in a sample of 15146 self-
5 employed and employed individuals in 15 EU countries from the Second European Survey on
6 Working Conditions in 1995. Health was measured by three health indicators (overall fatigue,
7 backache, and muscle pain). They found that the self-employed were more likely to report
8 fatigue and backache. Benach, Gimeno, Benavides, Martinez & del Mar Torné (2004)
9 conducted a follow-up study using survey data from the Second (1995) and Third (2000)
10 European Survey on Working Conditions. They came to the similar conclusion. Andersson
11 (2008) investigated happiness and health between the self-employed and wage earners, using
12 data from the Swedish Level-of-Living Survey from 1991 and 2000. Health was measured by
13 two indicators, namely mental health problems and poor general health. She found that
14 becoming self-employed enhanced the probability of having mental health problems,
15 although there were no differences in general health between wage-earners and the self-
16 employed.

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29 Lee and Kim (2017) examined the effect of transition into self-employment on physical
30 health, using longitudinal panel data from five Waves of the Korea Retirement and Income
31 Study. They found that those who became self-employed experienced significantly greater
32 odds of reporting subjective poor physical health. Patel, Wolfe and Williams (2019) used
33 three different studies to examine the relationship between self-employment and allostatic
34 load, i.e. a compound index made up of several physiological indicator (e.g. neuroendocrine,
35 cardiovascular, immune) and representing a physiologically accumulated stress response
36 (McEwen, 1998). They found that self-employment is marginally positively related to
37 allostatic load and that allostatic load marginally mediates the relationship between self-
38 employment and physical, but not mental, health. They also found that those who are self-
39 employed for longer periods have a higher allostatic load, suggesting overall poor physical
40 health.

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51 Thirdly, there are studies that have found no differences in overall health conditions between
52 the self-employed and organizationally-employed workers. For example, Dolinsky and
53 Caputo (2003) investigated health and female self-employment, using data from the Mature
54 Women's Cohort of the National Longitudinal Survey of Labor Market Experience
55 (NLSLME) in the United States. They found that self-employment had no significant effect
56 on health status. Similarly, Parslow, Jorm, Christensen, Rodgers, Strazdins & D'souza (2004)
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3 examined the associations between work stressors and mental health in organizationally
4 employed and self-employed workers, and with the numbers of general practitioner (GP)
5 services used by these two employment groups. Using data from the PATH Through Life
6 Project in Australia, they found that self-employment offered men no health benefit. However,
7 women who were self-employed reported worse physical health than their organizationally
8 employed counterparts. Toivanen, Griep, Mellner, Vinberg & Eloranta (2016) analysed
9 mortality differences between the self-employed and paid employees, using the Total
10 Population Register data in Sweden. They found mixed results. Mortality is lower among
11 those self-employed who run a limited liability company, but mortality is higher among those
12 self-employed operating as sole proprietors in the trade and transportation sector.
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22 These mixed findings in the existing literature render it difficult to draw general conclusions
23 about the relationship between self-employment and health. Such contrasting evidence and
24 gaps in our understanding encourage a closer examination of the precise nature and causes of
25 the nonpecuniary benefits with regard to health that may be derived from self-employment.
26 While the reason for the inconsistent findings of past research are likely numerous⁵, we
27 believe among the most relevant and interesting for enhancing our understanding of self-
28 employment and health are the following concerns: a lack of accounting for self-selection and
29 for the timing of effects, as well as a weak understanding of the mediating stress processes
30 and the gendered nature of entrepreneurship and self-employment. We discuss them in turn.
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40 *Self-selection*

41 There is some recognition in the entrepreneurship literature that self-selection into
42 entrepreneurship may take place, yet past research on entrepreneurship and health rarely
43 accounts for self-selection (see Appendix 1, column 'endogenous selection control'). An
44 example of a study that accounts for self-selection and where doing so alters the effect of
45 self-employment on health is Rietveld, van Kippersluis and Thurik (2015). They examined
46 self-employment and health in a sample of 13449 self-employed and employed individuals
47 from the United States (1992-2010) Health and Retirement Study. Health was measure by
48 three indicators: number of health conditions, self-reported health and mental health. The
49 self-employed were generally healthier than wage workers, both in terms of subjective health
50 outcomes as well as in more objective outcomes such as the absence of chronic conditions.
51 However, their results suggest that the health differences can be attributed to a selection
52 effect, namely healthier individuals self-select into self-employment. Two other studies
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3 employ propensity score matching or case-control designs to account for systematic
4 differences in demographic profiles and occupational contexts between self-employed and
5 organisationally employed (Cardon and Patel, 2015; Stephan and Roesler, 2010). However,
6 they do not compare result with and without matching thus it is unclear to what extent the
7 relationship between self-employment and health may be altered. One further notable
8 approach was Nikolova (2019) who combined entropy balancing with difference-in-difference
9 (DID) to account for self-selection problems.

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17 The theoretical discussion regarding self-selection is also little developed. Some authors
18 suggest that particular stress-resistant individuals become self-employed, and this is linked to
19 specific personality traits such as hope, optimism, resilience and self-efficacy (Baron,
20 Franklin and Hmieleski, 2016). However, these specific traits are also closely related with
21 mental health, for instance, they correlate negatively with anxiety or depression (Arvey et al.,
22 2011). This speaks for a self-selection effect similar to that identified by Rietveld et al.
23 (2015), namely that healthier individuals self-select into self-employment. Considering that
24 the self-employed work long and intense hours and must deal with many stressors, it seems
25 plausible that it would attract healthier individuals. At the same time, however, others have
26 suggested that self-selection into self-employment takes place based on poor health, whereby
27 those with existing physical or mental health issues may be more likely to opt for self-
28 employment (Wiklund et al., 2018). This is because self-employment offers significant
29 flexibility to design one's own work in line with one's needs and thus can help to
30 accommodate for physical or mental health issues.

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43 Since empirical evidence and theoretical arguments on self-selection are still nascent and
44 different authors predict contrasting effects, we formulate a research question instead of a
45 directional hypothesis:

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48 *Research question 1: Is there a self-selection effect such that either more or less*
49 *healthy individuals are more likely to enter self-employment compared to wage*
50 *employment?*
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54 55 *The Timing of Health Impacts*

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57 The timing of stress and health effects of self-employment remains poorly understood. The
58 reason is that most research is conducted cross-sectionally (Stephan, 2018) and thus cannot
59 speak to the timing of effects. Yet even studies drawing on longitudinal or cohort data
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3 typically aggregate these data rather than investigate the development of strain or health over
4 time (e.g. Nikolova, 2019). An exception is the work by Binder and Coad (2016) who
5 investigate life satisfaction but not mental or physical health over the first three years of self-
6 employment. However, considering the time might help to understand the mixed findings of
7 past research, because it may take time before self-employment affects stress or health. Put
8 differently, it is unlikely that a person's health is immediately affected after that person
9 becomes self-employed. Our longitudinal data allow us to trace individuals over 4 years after
10 they first entered self-employment from employment. This is a time frame in which we may
11 even observe different effects for mental and physical health. The reason is that *relative* to
12 physical health, mental wellbeing and mental health are likely more immediately affected as
13 they are more strongly rooted in (emotional) experiences, whereas physical health is
14 relatively more affected by physiological changes resulting from long-term exposure to
15 stress. In the short-term, exposure to stressors results in the mobilization of extra energy and
16 can improve performance (Selye, 1976). In response to stressors the body mobilizes extra
17 energy to deal with the demands that are placed upon it. However, faced with persistent stress
18 over time this response becomes eventually exhausted (Selye, 1976, also McEwen, 1998).

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32 Work on stress in employees has documented positive effects of so-called challenge stressors
33 which describe work stressors that entail opportunities to learn, achieve goals and to grow
34 (Lepine, Podsakoff, & Lepine, 2005, p.765). These stressors trigger positive emotions and
35 prompt an increase in effort and in turn enhance performance and work-related wellbeing
36 (Lepine, et al., 2005; Podsakoff, LePine, & LePine, 2007). The self-employed face many
37 typical challenge stressors (Stephan, 2018) such as high workload, intense job demands, job
38 complexity, and high responsibility (Cavanaugh et al. 2000; Lepine et al., 2005). In other
39 words, the self-employed work intensely and for long hours, while also bearing full
40 responsibility (personally and legally) for their work. Yet their hard work also means they
41 earn more income and learn new things especially when they first become self-employed and
42 later on when engaging in new contracts. Thus their intense work has an upside that allows
43 them to grow as a person as well as potentially to grow their business; after all they are
44 working for their own account and whilst stressful there is also a sense of mastering
45 challenges and thriving.

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58 In sum, research on stress and challenge stressors in particular suggests that in the short-term
59 certain stressors that are common for the self-employed can have positive effects on well-
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3 being and mental health. Yet in the longer term the continued exposure to high levels of
4 stressors results in the build-up of the physiological stress response (allostatic load) that is a
5 precursor to the development of both mental and physical illness (McEwen, 1998, 2004).
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7 This suggests that immediately after becoming self-employed we may see an upswing in
8 mental health that is likely to wear off over time. There is unlikely to be an upswing in
9 physical health however as the intense work in self-employment still puts strain on the body,
10 that the body can compensate for in the short- but not in the longer-term. Unfortunately, there
11 is little existing research to go by regarding the precise timing of effects and definition of
12 short- and long-term. For the purposes of our study we use a two-year time window as an
13 indicator of the shorter term and four years after becoming self-employed as a proxy for the
14 longer-term. This fits with the differentiation of new entrepreneurs and established
15 entrepreneurs in worldwide research on entrepreneurship by the Global Entrepreneurship
16 Monitor (Reynolds et al., 2005). Taken together, we posit that

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26 *H1a: Self-employed individuals experience better mental health than individuals in*
27 *wage work after entering self-employment, i.e. in the shorter term (two years after*
28 *entering self-employment).*

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H1b: The mental health benefits of self-employment are not sustained over the longer
term (four years after entering self-employment).

H2: Self-employed individuals experience poorer physical health than individuals in
wage work in the longer term (four years after entering self-employment).

The Stress Process: Work-related Strain as a Mediator

We also propose that it is important to understand and test why and how self-employment affects health. According to the Stressor-Strain-Outcome model (Koeske and Koeske, 1993) environmental demands (stressors) lead to strain which in turn impairs health. Research on self-employment and health is often implicitly or explicitly guided by the Stressor-Strain-Outcome model, yet researchers assume rather than empirically test and establish that strain is indeed a key mechanism through which self-employment affects health. Strain results from the exposure to a stressor, which are work demands that “require sustained physical and/or psychological effort and are therefore associated with certain physiological and/or psychological costs” (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001, p.501). Strain is typically captured through negative affective experience, e.g. ‘feeling stressed’ (e.g., Hessels, Rietveld and Van der Zwan, 2017). Key measures of work related strain are those of

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3 activated negative affect (job anxiety) and low-activation negative affect (job depression,
4 e.g., Warr et al. 2014).
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8 Just as with research on self-employment and health, research on whether the self-employed
9 experience more or less 'stress' than employees is also mixed (e.g. less stress in Hessels,
10 Rietveld and Van der Zwan (2017) and more stress in Cardon and Patel (2015) among the
11 self-employed). Moreover, strain is rarely measured and related to health outcomes in the
12 same study. Above, we suggested that (challenge) stressors are plentiful in self-employment
13 and that they can in the short-term lead to positive emotion, enhanced motivated and
14 performance, thus positively impact mental health. We may observe a similar pattern for
15 strain, which may be lifted by the positive emotional effects of challenge stress. However,
16 considering just how demanding and intense the work of the self-employed can be, it is
17 unlikely that this positive response can be sustained over time. Thus,
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27 *H3a: Self-employed individuals experience less work-related strain than individuals*
28 *in wage employment in the shorter-term.*
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30 *H3b: Self-employed individuals experience more work-related strain than individuals*
31 *in wage employment in the longer-term.*
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36 Guided by the Stressor-Strain-Outcome model, we further propose that strain mediates the
37 effect of self-employment on health and thus helps explain how self-employment impacts
38 health.
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41 *H4: The effects of self-employment on mental health (H4a) and physical health (H4b)*
42 *are mediated by work-related strain.*
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46 *The Moderating Effect of Gender*

47 Heterogeneity in self-employment has attracted much research attention and may also help to
48 understand some of the mixed findings in past research. Several studies suggest that
49 individuals who pursue self-employment as a choice (opportunity entrepreneurs) rather than
50 for lack of employment options (necessity entrepreneurs) derive greater well-being or health
51 benefits (Stephan, 2018 for an overview). The measures of opportunity and necessity
52 entrepreneurs vary, yet one of the most robust operationalizations is whether the business was
53 started by someone who was previously employed (opportunity entrepreneurship) or
54 unemployed (necessity entrepreneurship). Since these effects are fairly well understood and
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3 opportunity entrepreneurs are more numerous in our context (the UK), we restrict our sample
4 to opportunity entrepreneurs and draw attention to gender as an often overlooked source of
5 heterogeneity that determines whether individuals can derive health benefits from self-
6 employment.
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11 Self-employment and entrepreneurship are stereotypically male careers (Gupta, Turban,
12 Wasti, and Sikdar, 2009; Lewis, 2006) which helps to explain why women are less likely to
13 become self-employed compared to men. Indeed, women are in part disadvantaged in self-
14 employment because they are expected to underperform, a belief that stems from the misfit
15 with the gender stereotype and persists despite evidence to the contrary (Marlow and
16 McAdam, 2013 for a review). For instance, women find it more difficult to access finance
17 (Marlow and Patton, 2005; Minniti, 2009). Thus, being self-employed is more demanding for
18 women as they have to overcome a lack of legitimacy inherent in the stereotypical view of
19 self-employed as a male carer and which is likely shared by funders, customers and suppliers.
20 At the same time, women also face additional constraints from home (Carter, 2011). Women
21 are still primarily responsible for household duties and caring for children and the elderly
22 around the world (Altintas & Sullivan, 2016; Arráiz, 2018). Self-employed women appear to
23 be no exception, indeed evidence from Sweden suggests that self-employed women
24 experience more time-related strain in their life than either their counterparts in
25 organizational employment or self-employed men (Haggqvist, Toivanen, and Vinberg, 2015).
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39 In sum, considering the already high demands of self-employed work, the additional demands
40 upon self-employed women stemming from the household and the additional difficulties in
41 operating due to a perceived lack of legitimacy are likely to make self-employment more
42 stressful for women compared to men. Empirical research is scarce, although the findings of
43 one study drawing on large-scale Australian data align with this rationale. It found that self-
44 employment offered men no health benefits, but self-employed women had worse physical
45 health than their organizationally employed counterparts (Parslow et al., 2004). Hence, we
46 propose that
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54 *H5: Self-employed women compared to self-employed men experience more strain*
55 *(H5a) as well as lower mental (H5b) and physical (H5c) health.*
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60 Figure 1 summarizes our general research framework. Figure 2 depicts the time-related

effects that we hypothesize.

--- Figure 1 and 2 here ---

Data and Methods

Sample

The data used for this research are from *Understanding Society*, the largest UK Household Longitudinal Study (UKHLS). It is a nationally representative, household-based longitudinal survey of approximately 100,000 individuals in 40,000 households in the United Kingdom. The survey focused on collecting high quality longitudinal data about subjects such as health, work, education, income, family, and social life to help understand the long term effects of social and economic change. Households recruited at the first round of data collection in 2009 are visited each year to collect information on changes to their household and individual circumstances. So far, *Understanding Society* has released data from nine waves of survey. The data used for this research are from Wave 2, Wave 4 and Wave 6. *Understanding Society* first included work-related strain measures in Wave 2 (2010-2012) and repeated them in Wave 4 (2012-2014) and Wave 6 (2014-2016). It contains data about many work and wellbeing-related characteristics and has been used in research on self-employment (e.g. Henley, 2017; Reuschke, 2016) and health (e.g. Bryan, 2012; Chandola & Zhang, 2018; Davillas and Pudney, 2017; Patel et al., 2019).

We started our initial sampling frame with Wave 2, which is marked as t_0 , and then incorporated data from Wave 4 (t_1) and Wave 6 (t_2). In each wave, respondents were asked if they considered themselves (a) self-employed or (b) an employee. As we focused on transition from employment into self-employment, we identified the cohort of self-employment as one who was an employee at t_0 (Wave 2) and transited into self-employment at t_1 (Wave 4, 2012-2014) and stayed in self-employment at t_2 (Wave 6, 2014-2016). A comparative cohort is one who was an employee at all three waves (t_0 , t_1 , t_2). After data cleansing, our final sample consisted of a cohort of 174 self-employed people and 9696 salaried employees followed over the three waves.

Measures

Health. We measured an individual's health in two dimensions, mental health and physical health. Our measures of mental health and physical health are the scale score calculated from *Understanding Society's* self-completion SF-12 module which includes 12 questions from the

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3 SF-36 Health Survey (Version 1). These include: 2 questions concerning physical functioning,
4 2 questions on role limitations because of physical health problems, 1 question on bodily pain,
5 1 question on general health perceptions, 1 question on vitality (energy/fatigue), 1 question
6 on social functioning, 2 questions on role limitations because of emotional problems, and 2
7 questions on general mental health (psychological distress and psychological well-being).
8 The measure of mental health is the SF-12 Mental Component Summary (MCS) score, and
9 the measure of physical health is the SF-12 Physical Component Summary (MCS) score.
10 Both measures convert valid answers to the survey questions into a single mental and
11 physical functioning score respectively, resulting in a continuous scale, ranging from 0 (low
12 functioning) to 100 (high functioning). The reliability and validity of SF12 has been tested
13 and confirmed for measuring self-reported health status in the general population world-wide
14 (Ware, Kosinski, Dewey & Gandek, 2001; Gandek, Ware, Aaronson, Apolone, Bjorner,
15 Brazier et al., 1998; Lundberg, Johannesson, Isacson & Borgquist, 1999).

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27 *Work-related strain.* We used anxiety and depression as two indicators of work-related strain.
28 *Understanding Society's* work conditions module includes two measures of 'affective well-
29 being' (job-related anxiety and depression). The two measures use the job-related wellbeing
30 items originally developed by Warr (1990). Job Anxiety items come from Warr's three-item
31 "Anxiety-Contentment" scale, and job depression items come from Warr's three-item
32 "Depression-Enthusiasm" scale. Both scales use a Likert-type response format.
33 *Understanding Society* dataset automatically calculates two indexes of job anxiety and job
34 depression as measures of psychological distress. A higher score in both indexes indicates
35 higher levels of work-related strain. The measures have demonstrated high reliability and
36 validity and have been used to test job stress (e.g. Kerr, McHugh, and McCrory 2009;
37 Rothmann 2008).

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48 *Self-employment.* Our main independent variable is self-employment. Individuals who are in
49 paid job in all three Waves are identified as employees and coded as 0, and individuals who
50 transited from employment into self-employment at t_1 and remained in self-employment at t_2
51 are identified as self-employed and coded as 1. Our measure of self-employment is consistent
52 with past research which has labeled it opportunity entrepreneurship (Binder & Coad, 2016;
53 Nikolova, 2019), in contrast to necessity entrepreneurship, i.e. self-employment out of
54 unemployment (Binder & Coad, 2016; Nikolova 2019). We do not consider individuals who
55 move from unemployment into self-employment as their number is very low in advanced
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economies (Binder and Coad, 2016) such as the UK.

Control variables. Consistent with earlier studies (e.g. Cardon and Patel, 2015; Hessels et al., 2017), we controlled for age (years), gender (1 = male), education (1: no degree to 6: degree level), marital status (1 = married), job-related income (monthly gross income in GBP), and regions. Regions were ranked by population density and were coded using 11 dummy variables – London, Northwest, Southeast, West Midlands, Yorkshire and the Humber, East of England, Northeast, East Midlands, Southwest, Wales, Scotland, Northern Ireland. Finally, three Wave dummy variables were included in our analysis to capture the time structure of the data.

Methods

Matching approach

As discussed in the literature review, previous research has raised concerns about the validity of comparing mental and wellbeing between entrepreneurs and non-entrepreneurs in light of the possibility of healthy individuals self-select into self-employment (Baron, Franklin and Hmieleski 2016; Rietveld et al., 2015). In order to address the concern of selection bias and to answer our first research question, we used Propensity Score Matching (PSM) to create comparable groups of the self-employed and employees. In essence, matching models simulate the conditions of an experiment in which individuals in treatment group (the self-employed) and control group (employees) are randomly assigned, allowing for the identification of a causal link between the career choice and outcome variables (Rosenbaum and Rubin, 1985).

To match the 174 self-employed individuals with a comparable group of employees, we first estimated a logit model to calculate the propensity score or the conditional probability of a person switching from employment to self-employment, using ten matching covariates – age, gender, education, marital status, income, region, mental and physical health (t_0), and anxiety and depression work stress (t_0). We then used the propensity scores to generate a sample consisting of the self-employed and their matched paid employees. We used three different matching algorithms to identify a matching set of employees: (1) Nearest neighbour, (2) Genetic matching, and (3) Subclassification matching. The nearest neighbour method is the most commonly used approach. It consists of matching each treated individual with the control individual that has the closest propensity score. We used nearest neighbor matching

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3 with the ratio 1:1. Genetic matching is a method of multivariate matching that uses an
4 evolutionary search algorithm to determine the weight each covariate is given (Diamond and
5 Sekhon 2013). It matches covariates to identify employees who are most similar to the self-
6 employed people in our sample. The goal of subclassification is to form subclasses, such that
7 in each the distribution (rather than the exact values) of covariates for the treated and control
8 groups are as similar as possible (Stuart, King, Imai & Ho, 2011).
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15 After matching, we conducted propensity score balance test to ensure the equality of means
16 of observed characteristics in the treatment and control groups. We followed the following
17 common balance test procedure: (1) a two-sample t -test: after matching, there should be no
18 significant differences. (2) comparison of the pseudo R^2 and p -values of the likelihood ratio
19 test of the joint insignificance of all the regressors obtained from the logit analysis before and
20 after matching the samples: The pseudo- R^2 should be lower and the joint significance of
21 covariates should be rejected (or the p -values of the likelihood ratio should be insignificant)
22 (Sianesi, 2004). (3) checking mean absolute standardized bias (MASB) between the self-
23 employed and employees as suggested by Rosenbaum and Rubin (1985), in which they
24 recommend that a standardized difference of greater than 20% should be considered too large,
25 indicating that the matching process has failed.
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36 After propensity score balance test, we used average treatment effect (ATT) and difference in
37 difference (DiD) to test our first two hypotheses: Self-employed individuals experience better
38 (or worse) health (mental and physical) than individuals in wage work (H1a, H1b, H2). We
39 compared the differences of health status between the self-employed and employees at
40 different time points. We also used the genetic and subgroup methods to validate our results.
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46 *Mediation analysis*

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48 Our third and fourth hypotheses (H3, H4) focus on the mediating role of work-related strain
49 (job anxiety and job depression) in the relationship between self-employment and health.
50 Traditionally, such mediation models are tested using Baron and Kenny's (1986) classic four-
51 step approach. According to this approach, a mediation effect exists if (1) self-employment is
52 a significant predictor of health (c path; i.e., overall relationship), (2) self-employment is a
53 significant predictor of the mediator (job anxiety or job depression) (a path), (3) the mediator
54 is a significant predictor of health when controlling for self-employment (b path), and (4) the
55 effect of self-employment on health becomes significantly smaller or non-significant when
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controlling for the mediator (c' path, or “direct effect”). However, there are shortcomings inherent in the Baron and Kenny method (see Holmbeck, 2002). Preacher and Hayes (2004) thus suggested that tests of mediation should be based on a significance test of the indirect effect ab , that is, the product of the a and b paths. The indirect effect is the proportion of the relationship between self-employment and health that is mediated by work-related strain.

To test our mediation model, we applied Sobel’s (1982) often-used method to assess the significance of the indirect effect that runs through the mediator variables (Hessels et al., 2017). We estimated the indirect effects by assessing the reduction of the coefficient of self-employment as mentioned in step 4 above. If the addition of mediator renders the coefficient of self-employment insignificant, full mediation takes place; if the coefficient of self-employment is reduced but is still significantly different from zero, partial mediation is present (MacKinnon, Lockwood, Hoffman, West & Sheets, 2002).

Moderation analysis

Our fifth hypothesis (H5) focuses on the moderating effect of gender on the relationship between self-employment and work-related strain and between self-employment and health. Since gender is a time invariant variable, we used pooled OLS regressions to estimate the role of gender in moderating the relationship between self-employment and work-related strain and between self-employment and health.

Results

Demographic characteristics

Descriptive statistics before matching-means, standard deviations and t -test are presented in Table 1 for individuals in wage work ($N=9696$) and in self-employment ($N=174$). As can be observed in Table 1, the self-employed (43.49) are on average older than employees (41.78) ($p<0.05$). Moreover, the self-employed (63%) are more likely to be male than employees (45%) ($p<0.001$). They are more likely to be in densely-populated regions ($p<0.05$), and earn less than their wage-paid counterparts after entering into self-employment ($p<0.05$).

Table 1 inserted about here

Propensity score matching and balance test

In the first step of the PSM, the logit model was estimated in order to analyze the factors that

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3 affect occupational change, and to calculate the propensity to transit into self-employment for
4 each individual. The results in Table 2 show that those with lower mental health are more
5 likely to become self-employed (-0.02, $p < 0.04$). Older people are more likely to transit into
6 self-employed compared to staying in paid employment (0.02, $p < 0.001$). Men have a higher
7 likelihood of moving into self-employment (0.87, $p < 0.001$). People from London have much
8 higher chance to transition into self-employed than those from the Northwest (-0.27, $p < 0.05$),
9 West Midlands (-0.68, $p < 0.01$), Northeast (-0.47, $p < 0.1$), Scotland (-0.82, $p < 0.01$) and
10 Northern Ireland (-0.29, $p < 0.1$).
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22 Results of balance test are presented in Appendix 2 and Appendix 3. First, after matching the
23 bias between the treatment group and control group is largely reduced. That is, the t -test
24 significance of group differences for any of the covariates disappears while the p -value
25 increased (Appendix 2). Second, the pseudo R^2 of the estimated logit model is high before
26 matching, and low afterwards (Appendix 3). Similarly, the p -values of the likelihood ratio
27 test are all insignificant after matching, indicating that no systematic differences remain in the
28 distribution of covariates between the two groups. The joint significant effect of the
29 covariates on occupational change, as expressed by the significant Chi^2 , cannot be rejected
30 before matching but is rejected after matching in all three matching algorithms. Third, the
31 mean and median bias are all below 20% as required, and are all even below 10%, indicating
32 a very good match (see last two columns Appendix 3). Note that the subclass method
33 conducts matching via producing weights. Hence the observant stays the same as original
34 dataset, which explains the mean and median bias is the same before and after matching
35 (Appendix 3). In this case, we abandon the subclass matching algorithms in the average
36 treatment effect (ATT) on the treated test. Results of balance test can also be assessed by
37 checking the overlap in the range of propensity scores across treatment and comparison
38 groups (called “common support”)(Garrido et al., 2014). Common support is subjectively
39 assessed by examining a graph of propensity scores across self-employment and employment
40 groups (Appendix 4). We found the extent of overlap to be satisfactory.
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56 *Hypotheses*

57 In Hypotheses H1a and H1b, we posit that self-employed individuals experience better
58 mental health than individuals in wage work in the shorter term (i.e. two-years) after entering
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3 self-employment and that the mental health benefits of self-employment are not sustained
4 over the longer term (four years after entering self-employment). In Table 3, the results show
5 that individuals transiting from employment into self-employment experience better mental
6 health in the next 2 years (at t_1). Results from both nearest neighbor and Genetic matching
7 algorithms also corroborate this upswing in mental health at t_1 (NNM: ATT: 2.11, $p < 0.02$;
8 GEN: ATT: 2.87, $p < 0.01$). However, after two further years, the positive effect of self-
9 employment on mental health at t_2 disappears. The group difference on mental health is
10 insignificant at t_2 (NNM: ATT: 0.75, $p > 0.10$; GEN: ATT: 1.54, $p > 0.10$). The results support
11 Hypotheses H1a and H1b. In Hypothesis H2, we posit that self-employed individuals
12 experience poorer physical health than individuals in wage work in the longer term. Results
13 in Table 3 indicate that the group differences in physical health at t_1 and t_2 are insignificant
14 ($p > 0.10$), suggesting that those entering self-employment neither experience poorer physical
15 health in the shorter term (two-years after occupational change) nor in the longer term (four
16 years after becoming self-employed) than individuals in paid employment. Thus, Hypothesis
17 H2 is rejected.

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31 In Hypothesis 3, we postulate that self-employed individuals experience less work-related
32 strain than individuals in wage employment in the shorter term (H3a) and that self-employed
33 individuals experience more work-related strain than individuals in wage employment in the
34 longer term (H3b). For the two indicators we used to measure work-related strain, results in
35 Table 3 show that self-employed individuals experience less job anxiety (NNM: ATT: -0.59,
36 $p < 0.001$; GEN: ATT: -0.59, $p < 0.01$) and job depression (NNM: ATT: -0.84, $p < 0.001$; GEN:
37 ATT: -0.78, $p < 0.001$) than individuals in wage employment at t_1 , thereby confirming
38 Hypothesis H3a. Contrary to our expectations, results in Table 3 show that self-employed
39 individuals continue to experience significantly less job depression (NNM: ATT: -0.55,
40 $p < 0.001$; GEN: ATT: -0.68, $p < 0.001$) than individuals in wage employment at t_2 . They also
41 experience relatively less job anxiety t_2 but the average treatment effect on job anxiety at t_2 is
42 not significant (NNM: ATT: -0.21, $p > 0.10$; GEN: ATT: -0.40, $p > 0.10$). Taken the results
43 together, Hypothesis H3b is not supported. The temporal changes of health and work-related
44 strain are also depicted in Figure 3.

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57 Table 3 and Figure 3 inserted about here

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60 In Hypothesis 4, we propose that the effects of self-employment on mental health (H4a) and

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3 physical health (H4b) are mediated by work-related strain. Before testing Hypothesis 4, we
4 checked multicollinearity. Table 4 presents the correlation matrix of variables. Job anxiety
5 and job depression are shown to be highly correlated (0.65, $p < 0.001$). We then conducted a
6 diagnostic test of multicollinearity by analyzing the variance inflation factors (VIFs) of all
7 variables. The test results show that all VIFs are lower than 10. Although there is no general
8 cut-off point for VIFs, most researchers believe that the issue of multicollinearity is not a
9 concern if VIF is lower than 10 (Hair, Anderson, Tatham, & Black, 1995; Kennedy, 1992).
10 Hence, our diagnosis test suggests that the issue of multicollinearity should be of no concern
11 in our regressions.
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24 We also conducted a Hausman test to choose between a fixed effects model and a random
25 effects model. The null hypothesis is that the preferred model is random effects. Consistent
26 with Hausman (1978), we rejected the null hypothesis and applied fixed effects regressions
27 since the p -value of our Hausman test is small (< 0.05).
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32 To test the mediating effect of work-related strain on the relationship between self-
33 employment and mental health, we added the mediator (job anxiety and job depression) into
34 regressions in column 2 and column 3 of Table 5. This renders the coefficient for self-
35 employment insignificant, suggesting that the relationship between self-employment and
36 mental health is fully mediated by job anxiety and job depression. We then applied Sobel's
37 (1982) method to assess the significance of the indirect effect that runs through the mediator
38 variables. Table 5 (see bottom part of Table 5) presents the indirect effect, and the proportion
39 of the relationship between self-employment and health mediated by job anxiety and job
40 depression. The indirect effects in columns 2-3 indicate that job anxiety and job depression
41 fully mediate the relationship between self-employment and mental health. The percentage
42 mediated by job anxiety is 32.9% ($p < 0.1$) and the percentage mediated by job depression is
43 84.9% ($p < 0.001$). The indirect effects in columns 2-3 suggest that job depression plays a
44 larger mediating role. When job anxiety and job depression are added simultaneously in
45 column 4, the coefficient for self-employment also becomes insignificant, confirming that the
46 relationship between self-employment and mental health is fully mediated by job anxiety and
47 job depression. This supports Hypothesis H4a.
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3 To test the mediating effect of work-related strain on the relationship between self-
4 employment and physical health, we carried out the same procedure. The effect of self-
5 employment on physical health in columns 5 of Table 5 is insignificant, implying that the
6 pre-condition of mediating effect on physical health is not satisfied. In this case, there is no
7 mediating relationship of work-related strain between self-employment and physical health.
8 Thus, Hypothesis H4b is rejected.
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19 In Hypothesis 5, we posit that self-employed women compared to self-employed men
20 experience more work-related strain (H5a) as well as lower mental health (H5b) and physical
21 health (H5c) after entering self-employment. To test the hypotheses regarding the moderating
22 effect of gender, we conducted pooled OLS regressions for work-related strain and health.
23 The results in Table 6 confirm gender's role in moderating the relationship between self-
24 employment and job anxiety (-0.020 , $p < 0.01$) and between self-employment and job
25 depression (-0.046 , $p < 0.01$), suggesting that self-employed women compared to self-employed
26 men experience more work-related strain after entering self-employment. Hence, H5a is
27 supported. The results in Table 6 also confirm that self-employed women compared to self-
28 employed men experience lower mental health after entering self-employment (-2.16 ,
29 $p < 0.001$). Thus, H5b is supported. However, results in Table 6 do not suggest that self-
30 employed women compared to self-employed men experience lower physical health after
31 entering self-employment (0.13 , $p > 0.05$). Thus, H5c is not supported. We plot the interaction
32 of self-employment and gender on work-related strain in Figure 4 and the interaction of self-
33 employment and gender on health in Figure 5.
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46 Table 6, Figures 4 & 5 inserted about here
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50 *Robustness checks*

51 To check the robustness of findings for Hypothesis 1 for mental health, we carried out two
52 additional analyses. First, we followed Becker and Ichino (2002) and conducted Rosenbaum
53 bounds sensitivity analysis to test if the PSM results are sensitive to hidden bias (unobserved
54 selection). This is because the PSM method is unable to capture selection bias based on
55 unobserved covariates (Rubin, 1977). The results of sensitivity analysis are reported in
56 Appendix 5. The bounds under the assumption that the true treatment effect is underestimated
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(sig-) reveal that the results are largely insensitive to unobserved covariates. The odds of differential assignment of treatment due to unobserved factors (γ) would have to increase by a factor of 1.3 and 1.4 respectively to change the inference on the effect of self-employment on mental health both at t_1 and t_2 .

Second, we the used difference in difference approach to check results from ATT. As shown in Appendix 6, from t_0 to t_1 , we find the DiD (difference in difference) on mental health is significant (3.13, $p < 0.05$), while from t_0 to t_2 , we find the DiD is insignificant (0.85, $p > 0.05$). Concerning physical health, no DiD is significant. The results are consistent with what we conclude from ATT analysis.

We also conducted a pooled OLS regression to check the robustness of findings for Hypothesis 3. The pooled regressions exploit all available variation in the data (both across and within individuals), whereas the fixed-effects regressions have the advantage of focusing on the variation within individuals (over time) and standard errors are clustered on the individual level (Hessels et al., 2017). Results in Appendix 7 verify the mediating effect of job anxiety and job depression between self-employment and mental health (Job anxiety: percentage mediated is 46.1%, $p < 0.001$; Job depression: percentage mediated is 86.68%, $p < 0.001$). In addition, no mediation relationship has found in terms of physical health.

Discussion

This study advances new insights on the health consequences of changing from employment to self-employment. We integrate the Stressor-Strain-Outcome model with research on challenge stress and allostatic load to offer new explanations for the causal mechanisms through which self-employment affects mental and physical health. Through employing a sophisticated matching methodology in combination with difference-in-difference analyses of longitudinal data in the UK, we identify the unique temporal patterns of the impact of self-employment on health. We also clarify who self-selects into self-employment. In light of heterogeneity in entrepreneurship, we introduce gender as an important source of heterogeneity to understand the conditions under which self-employment affects health. Our research thus contributes new insights to, and plus gaps in, the thriving literature of entrepreneurship and health.

New insights into self-selection and health

Despite a growing awareness that self-selection into self-employment might bias estimates of the health benefits of self-employment (Baron et al., 2016), few studies have empirically accounted for such bias in research on self-employment and health and the nature and direction of self-selection is either debated or not commented on. Utilizing a sophisticated matching methodology and difference-in-difference analyses, we consider counterfactual cases and offer insight into the nature of self-selection for the debate on whether healthier individuals (Baron et al 2016; Rietveld et al., 2015) or those with health issues (Wiklund et al., 2018, 2020) are more likely to become self-employed.

We find that those with poorer mental health (although not physical health) are more likely to change from employment into self-employment. This novel evidence on self-selection based on a population representative sample of opportunity (not necessity) self-employed is important as previous research is scarce and rarely based on population-representative samples (see Wiklund et al., 2018 for an overview). We note that our findings are opposite to those by Rietveld et al. (2015) who find that healthier individuals self-select into self-employment. The key difference between theirs and the present study is the sample. Rietveld et al. (2015) use the U.S Health and Retirement Study which includes individuals over 50 years of age only; whereas our study is based on a representative sample of the UK working-age population. Intuitively it makes sense that in later life only those that feel energetic and healthy enough engage in self-employment as in Rietveld et al. (2015). Yet our study allows us to identify a more general trend across the entire working-age population. Notably, our findings are aligned with research that, although not explicitly testing for self-selection, suggests that those with disability (Pagan, 2009) and certain mental health disorders (Verheul et al., 2016; Wiklund, Yu, Tucker and Marino, 2017; Wolfe and Patel, 2017) may be more likely to engage in self-employment and entrepreneurship.

Our study points to the need for more research on the nature and direction of self-selection in entrepreneurship. For example, finding a self-selection effect for necessity entrepreneurs could paint a bleak picture where discrimination in the labor market forces those with mental health issues to find alternative options for employment and to become reluctant entrepreneurs. However, finding, as we did, that those with lower mental health self-select out of wage employment into self-employment suggests that it is the flexibility that self-employment offers to tailor work arounds one's individual needs and to craft one's own job

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3 that creates a positive pull into self-employment (Wiklund et al., 2018). Put differently,
4 individuals with lower health capital proactively seek out the nonpecuniary benefits of self-
5 employment. In sum, our findings advance the debate on the role of health-based self-
6 employment. In sum, our findings advance the debate on the role of health-based self-
7 selection into self-employment (Rietveld et al.; 2015; Wiklund et al., 2018).
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10 11 *Advancing the understanding of timing and temporality of health outcomes*

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13 In response to recent calls to take time and temporal processes seriously in entrepreneurship
14 research (Levesque and Stephan, 2019) and research on entrepreneurs' well-being and health
15 (Stephan, 2018), we consider time in our framework integrating the Stressor-Strain-Outcome
16 model, challenge stress and allostatic load. This allows us to develop theoretical explanations
17 of 'when' self-employment will impact mental as opposed to physical health and *how*
18 (through work-related strain).
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26 Our specific findings reveal an uplift in mental health due to lower work-related strain in the
27 short term after individuals enter self-employment. This effect is consistent with a
28 honeymoon effect and consistent with challenge stressors such as those that are inherent in
29 self-employment creating positive emotions, motivational and performance enhancements in
30 the shorter term but which wear off over time (in our study they were over after four years).
31 Notably our findings do not suggest that there is no stress in self-employment, but rather they
32 are consistent with a pattern of 'positive' or challenge stress that lifts negative affective
33 reactions (i.e. lowering job-related depressive affect and anxiety). Thus, we confirm strain as
34 the mechanism that mediates the impact of self-employment on mental health in line with the
35 Stressor-Strain-Outcome model (Koeske and Koeske, 1993), while the direction of effects is
36 consistent with research on challenge stress (e.g., Cavanaugh et al., 2000). The newly self-
37 employed will have a sense of thriving, due to ongoing learning and grappling with the
38 complexities of being responsible for everything in their work. Yet this uplift in emotions and
39 performance can only be maintain for a shorter time period, which is why we see at the end
40 of our study period after four years that stress levels rise again (relative to the two-year
41 measurement point) and the mental health uplift subsides back to pre-self-employment levels.
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55 Considering the temporality of effects also offers an explanation (in addition to self-selection)
56 as to why past research on strain finds mixed evidence on whether the self-employed
57 experience more or less strain than their organizationally employed counterparts (Cardon and
58 Patel, 2015; Hessels et al., 2017). Unfortunately, past research typically pools longitudinal
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3 data over time⁶ and not all studies account for self-selection (Hessels et al., 2017). Based on
4 our theoretical framework and empirical findings we suggest that future research should ask
5 *when* (and not whether) the self-employed experience better mental and physical health and
6 that such research should pay attention to temporality to differentiate short-term challenge
7 stress from longer-term aggregated strain.
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13 We find that self-employment has no short-term or long-term effect on physical health. This
14 finding is consistent with some past studies (e.g., Perry and Rosen, 2001) but not others
15 including studies that like ours account for self-selection (e.g., Nikolova, 2019; Stephan &
16 Roesler, 2010; Rietveld et al., 2015). We suggest that a possible answer lies in considering
17 temporality and especially long-term effects. Some research indicates that the effect of work-
18 related stressors on the physiological stress processes (allostatic load) that underpin poor
19 physical health can take considerable time to unfold (for instance, five years, Hammar,
20 Alfredsson and Theorell, 1994; Stephan and Roesler, 2010). Yet for the most part the
21 temporality of such effects is not considered. Our findings show that both considering time
22 and treating mental and physical health as distinct outcomes is essential in disentangling the
23 effect of self-employment on health. This calls for future research on self-employment, stress
24 and health to take temporality seriously and to extend, if possible, the investigation over time
25 horizons beyond four years. Such research will allow to ascertain the longer-term effect of
26 self-employment on mental health and physical health. Certainly, we are aware that
27 substantial resources are needed to address drop-outs (see limitations below). Furthermore,
28 our findings call for dedicated theorizing on mental and physical health as related but also
29 distinct outcomes.
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45 *New insights into heterogeneity of self-employment and health: Gendered stress and health*

46 Our theoretical framework and findings extend research on the gendered nature of self-
47 employment which typically investigates entry (e.g. Minniti, 2009), firm performance and
48 access to finance (Marlow and McAdam, 2013; Marlow and Patton, 2005) to the rapidly
49 growing research on self-employment, stress and health (Stephan, 2018; Wiklund et al.,
50 2019). We find that the uplift in mental health driven by lower work-related strain is only
51 experienced by self-employed men, not by self-employed women. This complements
52 research by Parslow et al. (2004) who found self-employed women suffered worse physical
53 health compared to self-employed men (We discussed above temporality as a reason for our
54 lack of findings with regard to physical health). Our theory on the gender-based sources of
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3 strain in self-employment also complements existing work which has identified work-life
4 balance and interference as one source of stress for self-employed women (see Stephan, 2018,
5 p.304 for an overview) by highlighting gendered stress and health effects in a study on a
6 population representative sample and a research and analytical design that allows to draw
7 causal conclusions. Moreover, we also suggest that in addition to stresses arising from work-
8 life interference, the gendered nature of household and care work, further stresses arise from
9 the stereotypical view of self-employment as a male career that likely disadvantages self-
10 employed women more indirectly yet still profoundly (e.g., when suppliers or customers
11 prefer to contract with self-employed men rather than women).

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21 Considering that our sample were opportunity self-employed, our findings also add to the
22 body of research on heterogeneity in the health and well-being benefits of self-employment
23 and call for gender to be included as a key aspect of heterogeneity that is often overlooked.
24 To date extant research has focussed on contrasting opportunity and necessity entrepreneurs
25 (also Stephan, 2018 for a review), while our study showcases important gender-based
26 heterogeneity among opportunity self-employed. Our findings are made starker by the fact
27 that our setting is the UK i.e. a developed economy that embraces gender equality. If we
28 identify gendered stress and health effects to the disadvantage of women in this setting, it is
29 likely that such effects are even more dramatic in countries with less commitment to gender
30 equality and patriarchal societies and where women find it often more difficult to enter self-
31 employment in the first place (Bhuiyan and Ivlevs, 2019; Estrin and Mickiewicz, 2011).
32 Future research is needed to understand how self-employed women can experience the health
33 and well-being benefits of self-employment and the contexts that enabling these outcomes to
34 happen.

35 36 37 38 39 40 41 42 43 44 45 46 **Conclusion**

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48 In this paper, we apply a non-parametric propensity score matching approach to examining
49 the relationship between self-employment and health. Our research design allows us to
50 account for selection bias and establish a causal effect of self-employment on health. We
51 offer novel evidence to the emerging research on health-based self-selection into self-
52 employment. We find those with lower mental health are more likely to self-select into self-
53 employment. Furthermore, our research draws new attention to the timing of health and well-
54 being benefits in self-employment and offers insights on causal processes related to work-
55 related strain that past research often mentions but rarely investigates. Compared to those
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3 who stay in paid employment, after becoming self-employed, the self-employed experience a
4 short-term uplift in mental health which is explained by lower job-related strain. This uplift is
5 however not sustained over the longer-term (four years in our study) and chiefly occurs for
6 self-employed men rather than women. There is also no relationship of self-employment with
7 physical health.
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13 *Practical implications*

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15 Our findings, accounting for self-selection and tracing a population-representative sample of
16 newly self-employed and of wage employees over four years, suggest that the health benefits
17 of self-employment may have been exaggerated in past research. This is important
18 knowledge for educators and policy makers who wish to encourage self-employment. They
19 should not present self-employment as the 'healthy occupation' even though some self-
20 employed (men) will experience an uplift in mental health initially. It is also important
21 knowledge for those supporting the self-employed be it mentors, coaches and business
22 advisors who should prepare the self-employed for the long-term by helping them to manage
23 their strain levels. Equally investors and lenders should have an interest to council the self-
24 employed about the potential long-term strain and health risks as a way of protecting their
25 investments.
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36 Our findings on the gendered nature of stress and health in self-employment to the
37 disadvantage of self-employed women suggest on the one hand that self-employed women
38 might benefit from dedicated support and training in coping strategies to maintain their well-
39 being. Yet we believe these findings call for broader interventions such as promoting greater
40 acceptance of self-employed women and women entrepreneurs through positive role models,
41 in education and media campaigns to help overturn the stereotype that self-employment and
42 entrepreneurship are a 'men's game'. Moreover, it is likely that the widespread provision of
43 longer hours of child care and promoting gender equality in care work would go a long way
44 of alleviating the gendered nature of stress and health in self-employment.
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53 *Limitations and future research*

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55 This study has a number of limitations. First, our research identifies variation in stress and
56 mental health levels over time. Yet, we are not able to investigate longer-term trends beyond
57 four years. It may be that the often cited stressful nature of work only reflects in the
58 experience of the self-employed after four years. Moreover, it may only be at later time
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3 points that the physiological stress response builds up (as set out in research on allostatic
4 load, e.g., Patel et al., 2018). The Understanding Society survey in the UK is ongoing and
5 will enable analysis of longer time periods as new waves of data are made available. At the
6 same time, the already small sample of self-employed can be expected to shrink further as
7 some previous respondents drop out of the survey, which is a common problem in
8 longitudinal research. In order to have a more nuanced understanding of the temporal effect
9 of self-employment on health, future research needs to explore other data sources at the
10 population level (see Toivanen et al., 2015 and Goncalves and Martins, 2018) for examples.
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19 Second, addressing self-selection into self-employment is empirically challenging
20 (Goncalves, & Martins, 2018; Nikolova, 2019). The measurement error in choice into self-
21 employment is much higher than choice into employment. This measurement error is further
22 exacerbated when health is a selection factor into a highly heterogeneous and episodic
23 outcome – self-employment. Many factors can create identification challenges. The PSM
24 approach we used in this paper can help address some concerns about self-selection bias but
25 not without caveats. In her recent paper, Nikolova (2019) used entropy balancing with
26 difference in difference (DID) to tackle self-selection and time-invariant unobserved
27 heterogeneity. While entropy balancing has a number of advantages over matching and
28 propensity score methods, Hainmueller (2012) has pointed out that entropy balancing
29 provides no safeguard against bias from unmeasured confounds that are often a vexing
30 problem in observational studies. Thus, other problems that are commonly associated with
31 preprocessing methods still apply. Future research will need to continue to find innovative
32 methodology to tackle empirical challenges to the identification of the effect of self-
33 employment on health.
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46 Third, similar to Goncalves, & Martins (2018), Nikolova (2019), and Stephan & Roesler
47 (2010), in this research, we have not measured job characteristics directly. Therefore, our
48 interpretations rest on an assumption that the self-employed work in a job situation
49 characterized by autonomy but also considerable stressors (in line with arguments and
50 research by Cardon and Patel, 2015; Rauch et al., 2018; and others). Future research should
51 measure stressors as well as job resources in studies on self-employment and health.
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58 Fourth, in acknowledgement of considerable differences between different types of self-
59 employment, research indeed needs to disentangle the idiosyncrasies of self-employment
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(Burke, 2015; Dvouletý, 2018). Unfortunately, since we used a longitudinal cohort sample to investigate the temporal nature of the impact of self-employment on health, we were constrained by the sample size to account for the idiosyncratic nature of self-employment. We acknowledge this as a limitation and important area for future research. Nonetheless, past research has used prior employment status (employed vs. unemployed) of the self-employed to capture opportunity vs. necessity entrepreneurship (Nikolova 2019; Binder & Coad, 2016). Note however that there are typically very few individuals moving from unemployment into both employment and self-employment (also Binder & Coad, 2016). Hence our focus is on those self-employed that have been employed before. In this sense we are already investigating a particular type of the self-employment i.e. opportunity entrepreneurs. As is common in advanced economies such as the UK, opportunity self-employment is the dominant form of self-employment.

¹ Strain results from exposure to stressor (or work demands) and is the resulting negative experience, which is colloquially expressed as ‘feeling stressed’.

² Cardon and Patel (2015) is an exception and measures both stress and health, but their study focusses on health behaviors (e.g. drinking, smoking, weight gain) instead of illness itself.

³ Binder and Coad (2016) investigate life satisfaction but not mental or physical health over the first three years of self-employment.

⁴ Preamble to the Constitution of WHO as adopted by the International Health Conference, New York, 19 June - 22 July 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of WHO, no. 2, p. 100) and entered into force on 7 April 1948.

⁵ For instance, the inconsistent findings may also be related to the differences in the measures used. However, even studies using similar objective and physiological measures still yield different results (e.g., Stephan and Roesler, 2010 better objective health of self-employed vs. Patel et al., 2019 worse objective health).

⁶ Some studies consider job tenure, which can help proxy time-effects. Yet tenure is typically a control for the overall sample, rather than examined in interaction with self-employment. The overall effect of tenure is typically positive suggesting rising stress levels with longer (self-)employment (e.g., Hessels et al., 2017).

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Table 1 Variables description

	Employees N=9696		Self-employed N=174		Differences	Pr(> z)
	Mean	SD	Mean	SD		
Mental health t ₀	50.46	8.25	49.64	9.91	0.82	0.26
Mental health t ₁	49.88	8.78	52.63	7.76	-2.75	0.001
Mental health t ₂	50.17	8.71	51.51	8.73	-1.34	0.13
Physical health t ₀	53.66	7.3	54.6	6.76	-0.94	0.47
Physical health t ₁	53.31	7.76	54.01	6.12	-0.7	0.17
Physical health t ₂	52.91	8.16	53.59	7.54	-0.68	0.51
Job Anxiety t ₀	4.13	2.51	4.16	2.62	-0.03	0.91
Job Anxiety t ₁	4.07	2.59	3.33	2.04	0.74	0.001
Job Anxiety t ₂	4.03	2.61	3.71	2.54	0.32	0.09
Job Depression t ₀	2.66	2.34	1.61	2.57	0.09	0.62
Job Depression t ₁	2.66	2.4	1.76	1.56	0.90	0.001
Job Depression t ₂	2.64	2.41	2.01	2.04	0.63	0.001
Age	41.78	10.58	43.49	11.24	-1.71	0.05
Gender	0.45	0.5	0.63	0.49	-0.18	0.001
Marital status	0.26	0.44	0.23	0.42	0.03	0.41
Education	4.34	1.46	4.41	1.45	-0.07	0.21
Regions	6.18	3.5	5.98	3.41	0.2	0.03
Income t ₀	2091.4	1470.76	2454	2588	-362.96	0.69
Income t ₁	2218.44	1553.16	1991	2496	227.87	0.03
Income t ₂	2400.85	1736.59	2391	2909	9.67	0.55

Table 2 Estimation of the logit model on the propensity to transit into self-employment

		Estimate	Std. Error	Pr(> z)	
Mental Health t_0		-0.02	0.01	0.04	*
Physical Health t_0		-0.02	0.01	0.15	
job anxiety t_0		0.03	0.04	0.07	^
job depression t_0		0.05	0.04	0.84	
Age		0.02	0.01	0.001	***
Gender		0.87	0.16	0.001	***
Marital status		-0.04	0.17	0.95	
Education	No qualification				
	Other qualification	0.07	0.46	0.83	
	GCSE	0.01	0.42	0.94	
	A-level	0.36	0.42	0.64	
	Other higher degree	0.01	0.43	0.48	
	Degree	0.42	0.42	0.77	
Regions	London				
	North west	-0.27	0.32	0.03	*
	South east	-0.22	0.27	0.24	
	West Midlands	-0.68	0.41	0.01	**
	Yorkshire and the Humber	-0.54	0.31	0.37	
	East of England	-0.54	0.29	0.56	
	North East	-0.47	0.49	0.08	^
	East Midlands	0.16	0.28	0.90	
	South West	-0.03	0.29	0.59	
	Wales	-0.54	0.35	0.12	
	Scotland	-0.82	0.34	0.01	*
	Northern Ireland	-0.65	0.39	0.10	^
Income t_0		-0.29	0.00	0.67	
Number of observations	9870				
LR Chi ² (26)	64.124				
Prob > Chi ²	0.00				
Pseudo R ²	0.04				
Log likelihood	857.31				

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, ^ $p < 0.1$

Table 3 Mean differences and ATT before and after matching

Outcome Variable	Matching Algorithm	Self-employed	Employees	ATT	SE	t-test
		Mean	Mean			
Mental health at t ₁						
	Before Matching	52.63	49.88			0.01
	NNM	52.63	50.98	2.11	0.58	0.02
	GEN	52.63	50.30	2.87	0.59	0.01
Mental health at t ₂						
	Before Matching	51.51	50.17			0.04
	NNM	51.51	51.24	0.75	0.59	0.77
	GEN	51.51	50.39	1.54	0.62	0.24
Physical health at t ₁						
	Before Matching	54.01	53.31			0.13
	NNM	54.01	54.15	-0.12	0.45	0.84
	GEN	54.01	53.57	0.01	0.42	0.54
Physical health at t ₂						
	Before Matching	53.59	52.91			0.24
	NNM	53.59	52.90	0.67	0.54	0.41
	GEN	53.59	53.51	-0.35	0.49	0.92
Job anxiety at t ₁						
	Before Matching	3.33	4.07			0.001
	NNM	3.33	3.97	-0.59	0.08	0.001
	GEN	3.33	3.94	-0.59	0.17	0.01
Job anxiety at t ₂						
	Before Matching	3.71	4.03			0.09
	NNM	3.71	3.94	-0.21	0.09	0.25
	GEN	3.71	4.13	-0.40	0.20	0.13
Job depression at t ₁						
	Before Matching	1.76	2.66			0.001
	NNM	1.76	2.61	-0.84	0.07	0.001
	GEN	1.76	2.54	-0.78	0.14	0.001
Job depression at t ₂						
	Before Matching	2.01	2.64			0.001
	NNM	2.01	2.56	-0.55	0.07	0.001
	GEN	2.01	2.69	-0.68	0.16	0.001

Table 4 Correlation matrix

		1	2	3	4	5	6	7	8	9	10	11
1	Self-employment	1.00										
2	Mental Health	0.07*	1.00									
3	Physical Health	-0.02	-0.26***	1.00								
4	Job Anxiety	-0.09**	-0.47***	-0.11***	1.00							
5	Job Depression	-0.13***	-0.51***	-0.10***	0.65***	1.00						
6	Age	0.08**	0.15***	-0.15***	-0.07*	-0.09**	1.00					
7	Gender	0.29***	0.04	-0.09**	-0.03	-0.04	0.08**	1.00				
8	Marital status	-0.02	-0.06	0	0.06*	0.05	-0.13***	0.02	1.00			
9	Education	-0.02	-0.06	0.11***	0.13***	0.04	0.03	0.02	0.09**	1.00		
10	Regions	-0.01	-0.02	0.01	-0.05	-0.01	0.07*	-0.01	-0.12***	-0.15***	1.00	
11	Income	-0.26***	0.02	0.09**	0.11***	0.05	0.04	-0.14***	0.02	0.25***	-0.05	1.00

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, ^ $p < 0.1$

Table 5 Linear fixed-effects regression results with health as dependent variable

	Mental Health				Physical Health			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Added Mediators		+Job Anxiety	+Job depression	+Job Anxiety & Job Depression		+Job Anxiety	+Job depression	+Job Anxiety & Job Depression
Self-employment (Base: wage workers)	1.76 [^] (0.94)	1.18 (0.79)	0.22 (0.81)	0.53 (0.78)	0.19 (0.75)	0.27 (0.75)	0.40 (0.76)	0.36 (0.76)
Mediators								
Job Anxiety		-1.93*** (0.17)		-1.22*** (0.22)		0.26 [^] (0.16)		0.17 (0.22)
Job Depression			-2.10*** (0.19)	-1.17*** (0.25)			0.29 [^] (0.18)	0.16 (0.24)
Control Variables								
Age	0.09* (0.04)	0.08* (0.04)	0.06 [^] (0.04)	0.07* (0.03)	-0.09** (0.03)	-0.09** (0.03)	-0.09** (0.03)	-0.09** (0.03)
Gender	0.08 (0.97)	0.81 (0.82)	-0.15 (0.83)	0.42 (0.80)	-1.54* (0.77)	-1.64* (0.77)	-1.51 [^] (0.77)	-1.58 [^] (0.05)
Marital status	-1.70 (1.11)	-1.40 (0.93)	-1.42 (0.94)	-1.35 (0.91)	0.33 (0.88)	0.29 (0.87)	0.29 (0.87)	0.28 (0.87)
Income	0.07 (0.30)	0.34 (0.25)	0.05 (0.25)	0.23 (0.24)	0.42 [^] (0.24)	0.39 [^] (0.24)	0.43 [^] (0.23)	0.40 [^] (0.24)
Other qualification	-1.89 (4.05)	-1.09 (3.41)	-1.71 (3.45)	-1.28 (3.31)	3.83 (3.25)	3.72 (3.24)	3.81 (3.24)	3.75 (3.24)
GCSE etc	-2.36 (3.83)	-1.20 (3.23)	-2.64 (3.27)	-1.78 (3.13)	2.26 (3.07)	2.10 (3.06)	2.30 (3.06)	2.18 (3.06)
A-level etc	-3.83 (3.80)	-2.28 (3.21)	-3.69 (3.24)	-2.77 (3.11)	3.89 (3.04)	3.68 (3.04)	3.87 (3.03)	3.74 (3.03)
Other higher degree	-3.48 (3.87)	-1.22 (3.27)	-3.23 (3.30)	-1.92 (3.17)	2.80 (3.10)	2.49 (3.10)	2.76 (3.09)	2.58 (3.09)
Degree	-3.22 (3.76)	-1.05 (3.18)	-2.83 (3.21)	-1.63 (3.08)	4.40 (3.02)	4.10 (3.02)	4.34 (3.01)	4.18 (3.01)
North west	1.40 (2.02)	0.66 (1.70)	-0.73 (1.73)	-0.26 (1.66)	-1.92 (1.62)	-1.82 (1.62)	-1.63 (1.62)	-1.69 (1.62)
South east	0.95 (1.78)	0.30 (1.50)	-1.15 (1.53)	-0.64 (1.47)	-1.20 (1.42)	-1.11 (1.42)	-0.91 (1.43)	-0.98 (1.43)
West Midlands	2.33 (2.20)	2.28 (1.85)	1.35 (1.88)	1.75 (1.80)	-1.61 (1.77)	-1.60 (1.76)	-1.48 (1.76)	-1.53 (1.76)
Yorkshire and the Humber	2.61 (2.11)	0.35 (1.79)	0.44 (1.81)	-0.03 (1.74)	0.44 (1.70)	0.75 (1.70)	0.74 (1.70)	0.81 (1.70)
East of England	-1.73 (1.88)	-0.64 (1.59)	-2.51 (1.61)	-1.48 (1.54)	1.23 (1.50)	1.08 (1.50)	1.33 (1.50)	1.19 (1.50)
North East	-0.87 (2.80)	-2.48 (2.37)	-2.17 (2.40)	-2.61 (2.30)	2.27 (2.26)	2.49 (2.26)	2.45 (2.25)	2.51 (1.25)
East Midlands	-0.78 (1.93)	-1.20 (1.63)	-1.78 (1.65)	-1.60 (1.58)	-1.31 (1.54)	-1.25 (1.54)	-1.17 (1.54)	-1.19 (1.54)
South West	1.54 (1.90)	0.77 (1.60)	0.60 (1.63)	-0.14 (1.57)	0.20 (1.53)	0.30 (1.52)	0.49 (1.53)	0.43 (1.53)
Wales	-1.46 (2.33)	-1.41 (1.97)	-1.14 (1.99)	-1.07 (1.91)	-0.28 (1.87)	-0.32 (1.87)	-0.32 (1.87)	-0.33 (1.87)
Scotland	-1.51 (2.09)	0.25 (1.76)	-1.70 (1.78)	-1.55 (1.71)	1.54 (1.68)	1.53 (1.68)	1.57 (1.67)	1.55 (1.68)
Northern Ireland	2.51 (2.31)	0.43 (1.96)	0.17 (1.98)	-0.22 (1.90)	0.04 (1.87)	0.35 (1.86)	0.36 (1.86)	0.42 (1.86)
Indirect effects								
via job anxiety		0.59 [^] (32.9%)		0.32 [^] (22%)		-0.08 (-0.29%)		-0.06 (0.32%)
via job depression			1.56*** (84.9%)	0.84*** (55.1%)			-0.22 (-9.22%)	-0.14 (1.68%)
F	1.28	7.76	7.78	9.45	1.80	1.86	1.85	1.79
R ²	0.08	0.34	0.32	0.38	0.10	0.11	0.11	0.11
p-value	0.018	0.001	0.001	0.001	0.001	0.001	0.001	0.001

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, [^] $p < 0.1$ (two-sided). Regression coefficients are displayed with standard errors between parentheses. Standard errors are clustered on the individual level. Proportion of total relationship mediated by job anxiety or job depression is shown in brackets.

Table 6 Pooled OLS regressions on work-related strain and health with moderating test of gender

	Job anxiety		Job depression		Mental health		Physical health	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Added Moderator		+SE* Gender		+SE* Gender		+SE* Gender		+SE* Gender
Self-employment (Base: wage workers)	-0.13** (0.12)	-0.09** (0.25)	-0.43*** (0.11)	-0.09 (0.22)	1.57*** (0.42)	2.03*** (0.41)	0.36 (0.33)	-0.53 (0.33)
Control Variables								
Age	-0.02*** (0.001)	-0.02*** (0.001)	-0.02*** (0.001)	-0.02*** (0.001)	0.08*** (0.01)	0.09*** (0.01)	-0.10*** (0.01)	-0.10*** (0.01)
Marital status	-0.10 (0.10)	-0.10 (0.10)	0.10 (0.09)	0.10 (0.09)	-1.64*** (0.37)	-1.34*** (0.37)	0.19 (0.29)	0.15 (0.29)
Income	0.26*** (0.05)	0.26*** (0.05)	0.05 (0.05)	0.03 (0.05)	0.32^ (0.18)	0.02 (0.18)	0.58*** (0.14)	0.60*** (0.14)
Other qualification	-0.03 (0.15)	-0.04 (0.15)	0.15 (0.13)	0.13 (0.13)	0.15 (0.53)	0.33 (0.53)	-1.65*** (0.41)	-1.77*** (0.42)
GCSE etc	-0.30* (0.13)	-0.30* (0.13)	0.06 (0.12)	0.06 (0.12)	0.33 (0.46)	0.33 (0.47)	-1.30*** (0.36)	-1.43*** (0.37)
A-level etc	-0.34* (0.13)	-0.34* (0.13)	0.17 (0.12)	0.16 (0.12)	0.69 (0.47)	0.71 (0.48)	-1.63*** (0.37)	-1.82*** (0.38)
Other higher degree	0.04 (0.17)	0.04 (0.17)	0.13 (0.15)	0.13 (0.15)	0.24 (0.60)	0.40 (0.62)	-0.74 (0.47)	-1.00* (0.49)
Degree	0.38* (0.16)	0.38* (0.16)	0.05 (0.14)	0.04 (0.14)	-0.48 (0.56)	-0.31 (0.65)	0.16 (0.44)	0.40 (0.51)
North West	0.49* (0.23)	0.49* (0.23)	0.08 (0.20)	0.08 (0.20)	0.40 (0.81)	0.29 (0.81)	-0.57 (0.64)	-0.54 (0.64)
South East	0.02 (0.23)	0.03 (0.23)	-0.09 (0.20)	-0.08 (0.20)	0.35 (0.81)	0.42 (0.81)	-0.22 (0.64)	-0.24 (0.64)
West Midlands	0.23 (0.24)	0.24 (0.24)	0.23 (0.22)	0.24 (0.22)	-0.06 (0.87)	-0.07 (0.87)	-1.03 (0.68)	-1.01 (0.68)
Yorkshire and the Humber	0.41^ (0.25)	0.41^ (0.25)	0.33 (0.22)	0.32 (0.22)	0.59 (0.88)	0.56 (0.87)	-0.91 (0.69)	-0.90 (0.69)
East of England	0.13 (0.23)	0.13 (0.23)	-0.14 (0.20)	-0.13 (0.20)	0.58 (0.81)	0.68 (0.81)	-0.35 (0.63)	-0.33 (0.63)
North East	0.42^ (0.24)	0.42^ (0.24)	0.08 (0.22)	0.09 (0.22)	0.56 (0.86)	0.58 (0.86)	0.08 (0.67)	0.16 (0.67)
East Midlands	0.27 (0.22)	0.27 (0.22)	-0.13 (0.20)	-0.13 (0.20)	0.36 (0.79)	0.42 (0.78)	-0.36 (0.62)	-0.29 (0.62)
South West	-0.06 (0.23)	-0.06 (0.23)	-0.13 (0.20)	-0.12 (0.20)	0.64 (0.80)	0.55 (0.80)	0.64 (0.63)	0.68 (0.63)
Wales	-0.20 (0.26)	-0.20 (0.26)	-0.19 (0.23)	-0.19 (0.23)	0.27 (0.92)	0.20 (0.91)	-0.11 (0.72)	-0.08 (0.72)
Scotland	0.14 (0.24)	0.14 (0.24)	-0.02 (0.22)	-0.02 (0.22)	-0.38 (0.87)	-0.37 (0.86)	0.50 (0.68)	0.53 (0.68)
Northern Ireland	-0.04 (0.25)	-0.04 (0.25)	-0.08 (0.23)	-0.08 (0.23)	0.72 (0.90)	0.81 (0.90)	-2.40*** (0.71)	-2.40*** (0.71)
Moderators								
Gender	0.13* (0.08)	0.17* (0.08)	0.01 (0.07)	0.08 (0.08)	0.12 (0.28)	2.62*** (0.49)	-0.13 (0.22)	-0.03 (0.39)
Interaction effects								
Self-employment* Gender		-0.20** (0.20)		-0.46** (0.18)		-2.16*** (0.34)		0.13 (0.27)
F	5.88	5.66	2.96	3.14	3.86	4.95	9.52	9.26
R ²	0.04	0.04	0.02	0.02	0.02	0.03	0.06	0.06
p-value	0.001	0.001	0.001	0.001	0.02	0.03	0.001	0.001

*** p < 0.001, ** p < 0.01, * p < 0.05, ^ p < 0.1 (two-sided). Regression coefficients are displayed with standard errors between parentheses.

Figure 1. Hypothesized relationships among self-employment, work-related strain, gender, and health

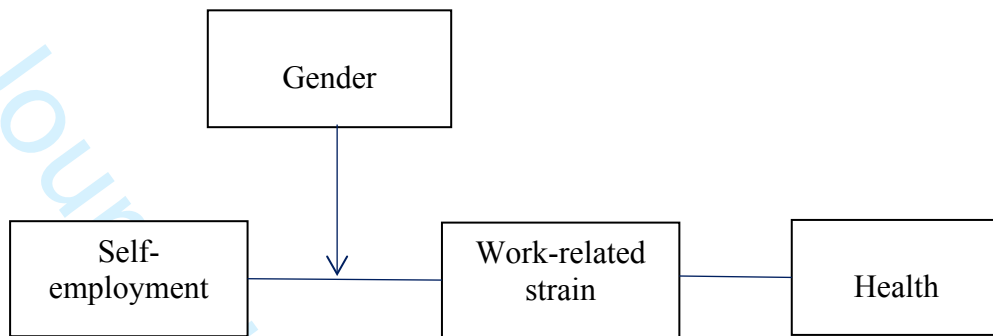


Figure 2. Hypothesized time-related effects of self-employment on health

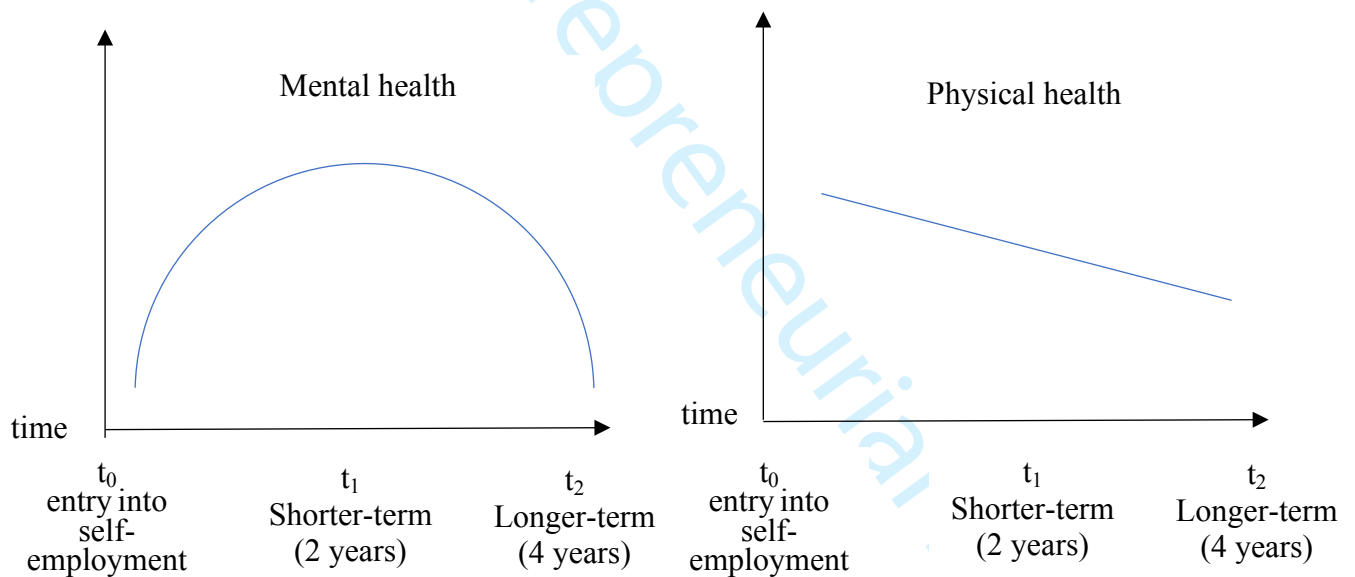


Figure 3 Temporal features of health and work-related strain

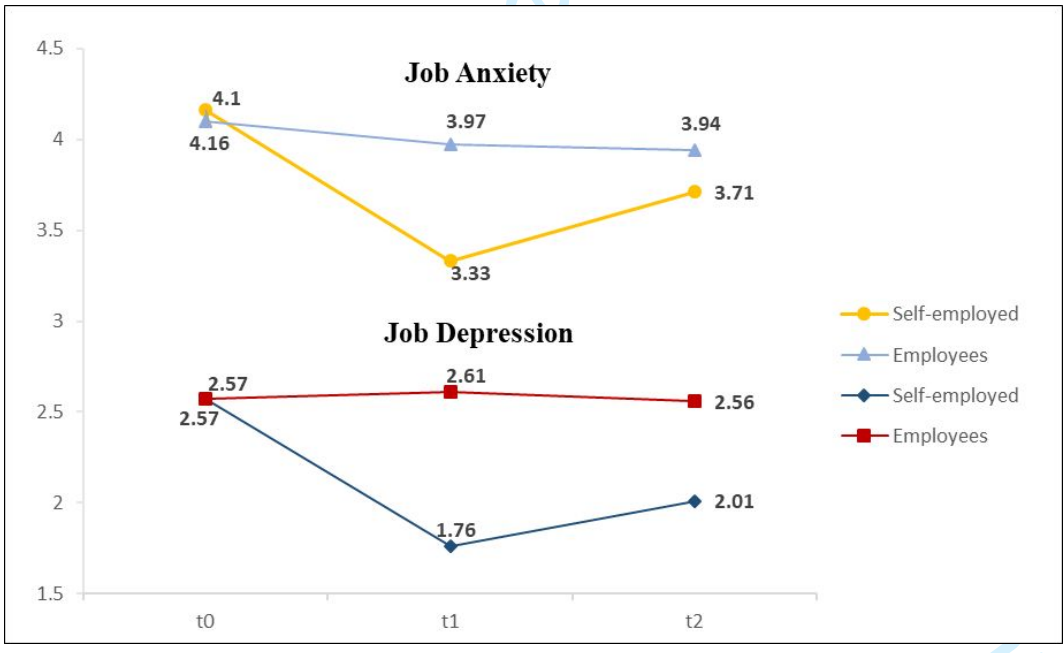
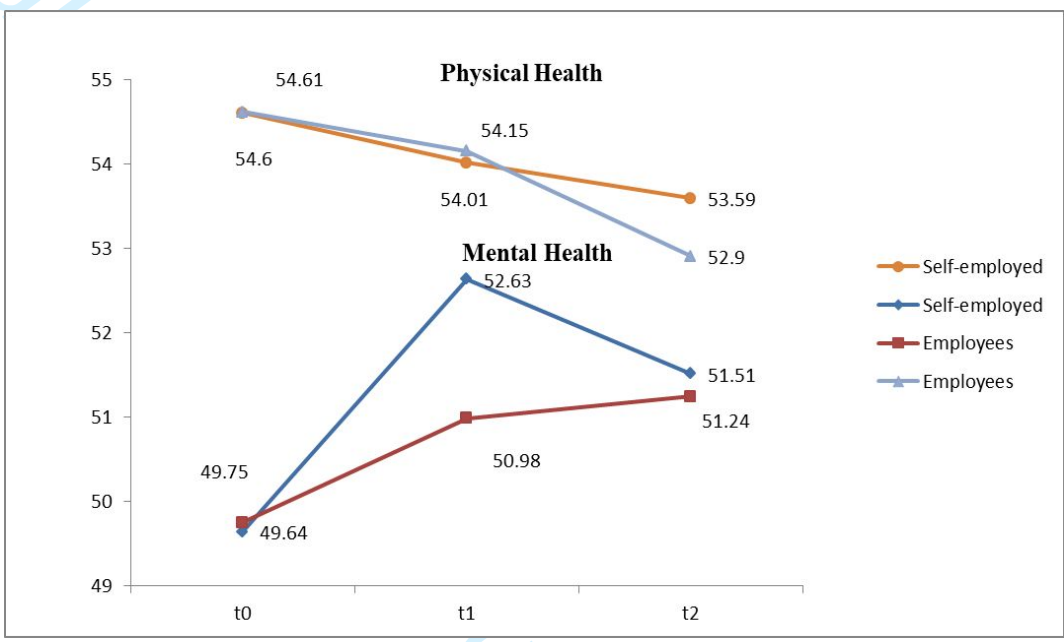


Figure 4 Interaction of self-employment and gender on work-related strain

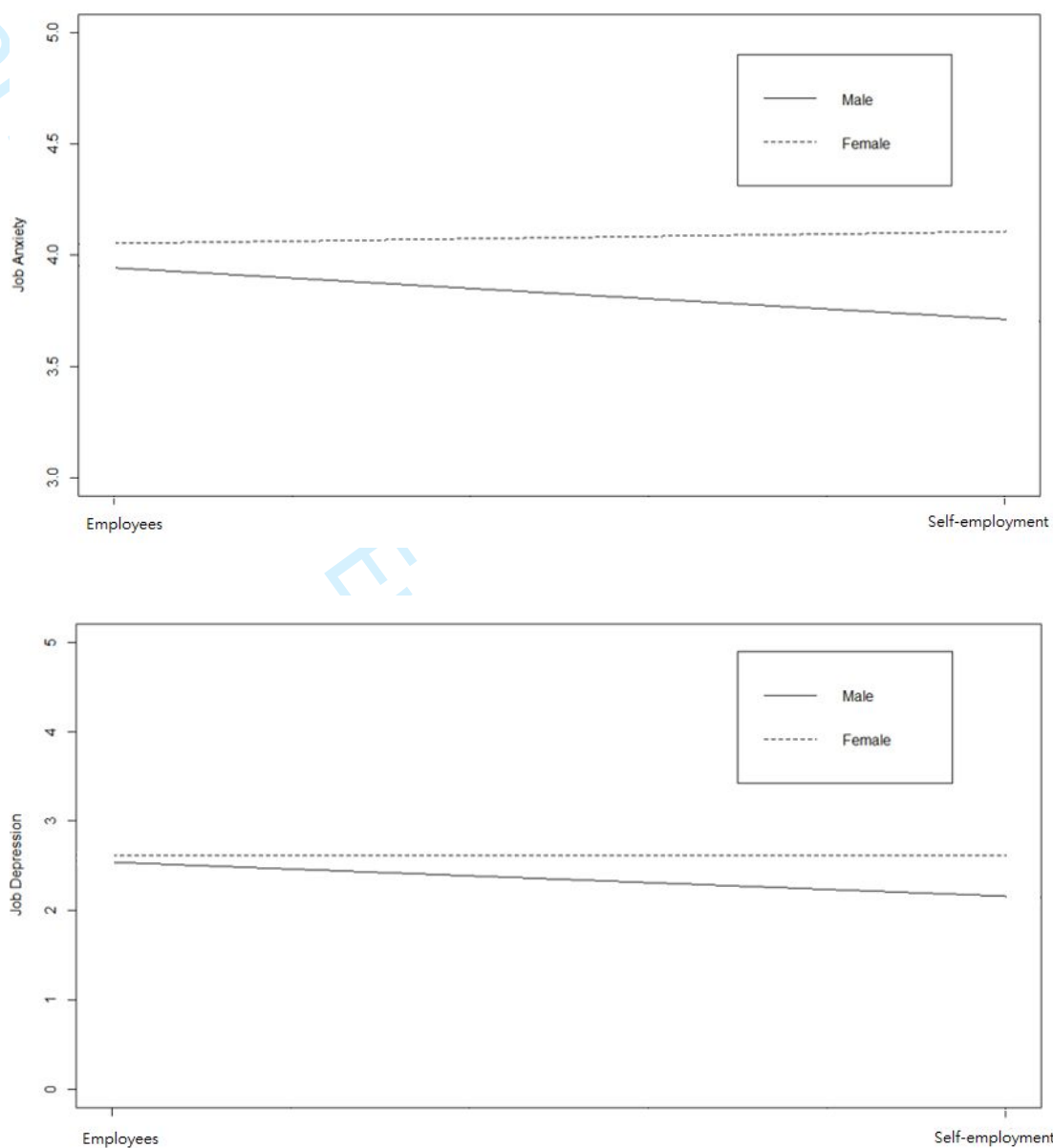
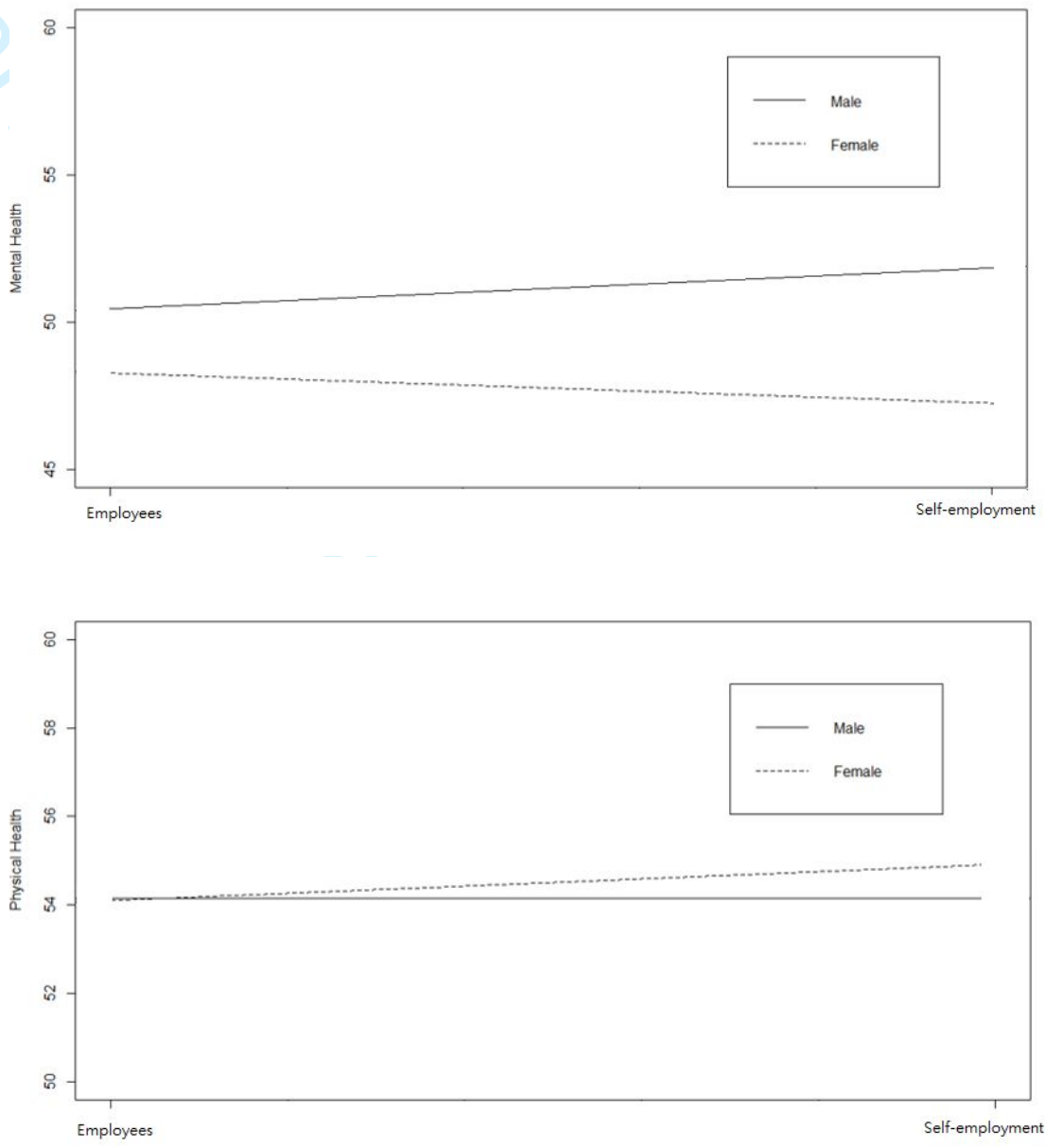


Figure 5 Interaction of self-employment and gender on health



Appendix 1 Overview of research on self-employment and health

Study	Sample	Health measure(s)	Method(s)		Significant relation: Self-employment and health	
			Procedures	Endogenous selection control	Mental health	Physical health
Eden (1975)	183 self-employed individuals and 1092 salary workers in the USA in 1969	An index containing 21 items measured undesirable symptoms: somatic complaints, depression, and performance debilitation. One-item measure of positive mental health	Means comparison	No	No	N/A
Lewin-Epstein & Yuchtman-Yaar (1991)	131 self-employed individuals and 434 salaried workers from two cities of Holon and Bat-Yam, Israel	9-item measure of health (diastolic BP, Serum cholesterol, Triglycerides, HDL (%), HDL (mg), Perceived health, Somatic complaints, Physician visits, and Disability days)	Multivariate analysis	No	N/A	(-) (greater risk of cardiovascular disease)
Jamal (1997)	70 self-employed individuals and 165 wage workers from a city of Canada	Measures of psychosomatic health problems from Michigan studies of workers' health, and 22-item mental health scale	One-way ANOVA	No	N/A	(-) (in psychosomatic health problems)
Benavides et al. (2000)	1836 sole traders and 13310 people in other types of employment from 2 nd European Survey on Working Conditions Surveys in 15 EU countries (1995)	Three self-reported health indicators - overall fatigue, backache, and muscular pain	Logistic regressions	No	(-)	(-)
Tetrick et al. (2000)	75 self-employed individuals and 82 wage workers from Michigan, USA	9-item emotional exhaustion scale	MANOVA	No	(+)	N/A
Perry and Rosen (2001)	1086 self-employed individuals and 7898 wage-workers from the United State (1996 Medical Expenditure Panel Survey, MEPS)	Subjective measure of general physical and mental health status; objective measure of physical limitations and a variety of medical conditions (e.g. cancer, cardiac problem)	Means comparison	Partially by employing two different dataset to examine transitions from wage-earning to self-employment	No	No
Dolinsky & Caputo (2003)	1412 self-employed, wage-earning, and non-employed women from the United State (1976-1995 Mature Women's Cohort of the National Longitudinal Survey of Labor Market Experience (NLSLME))	One-item measure of self-reported health status	Multivariate regressions	No	No	N/A
Benach et al. (2004)	4289 sole traders and 30262 people in other types of employment from 2 nd and 3 rd European Survey on Working Conditions Surveys in 15 EU countries (1995 and 2000)	Two self-reported health indicators: fatigue and backache	Logistic regressions	No	(-)	(-)
Parslow et al. (2004)	324 self-employed individuals and 1951 wage workers from Australia (PATH Through Life Project)	12-item physical health scale, scores on Goldberg's depression and anxiety scales	Hierarchical regressions	No	No	(-) for self-employed women
Andersson (2008)	149 self-employed individuals and 1849 wage workers from Sweden (1991 and 2000 Swedish Level-of Living Survey)	Mental health dummy	Multivariate regression (fixed-effects)	No	(-)	N/A

Stephan & Roesler (2010)	149 self-employed individuals and 149 wage workers from the German National Health Survey 1998	Blood pressure, somatic diseases, mental disorders, and behavioural health indicators	Multivariate regressions	Yes, case control design	(+)	(+)
Yoon and Bernell (2013)	1481 self-employed individuals and 11954 wage workers from the household component of the 2007 Medical Expenditure Panel Survey (MEPS), USA	Perceived physical and mental health status; Physical Health Composite Scores derived from the Short-Form 12 Version 2 (SF-12v2); Mental Health Composite Scores calculated from the SF-12v2 and the Kessler Index of non-specific psychological distress); and a set of medical conditions (stroke, diabetes, asthma, high blood pressure, high cholesterol, emphysema, joint pain, and arthritis).	Multivariate regressions	Yes, instrumental variables	No	(+)
Cardon and Patel (2015)	688 self-employed, 688 employed from NHANES I Epidemiologic Follow-up Study (NHEFS I), USA, 1982-84, outcomes measured in 1987	Stress (three measures of blood pressure and three items of general self-reported life stress) Health measure combines alcohol use, smoking, physical activity, weight gain, and subjective health	Path analysis	Yes, propensity score matching and instrumental variables	N/A	(-) indirect via stress
Rietveld, Bailey, Hessels and van der Zwan (2016)	1276 business owners and 3279 wage-workers from 2013 Global Entrepreneurship Monitor (GEM) Survey with the EQ-5D-5L Self-Reported Health Instrument in four Caribbean Basin countries	EuroQol EQ-5D-5L Self Reported Health instrument	Binary logit regressions	No	(+)	(+)
Rietveld, Kippersluis, H., & Thurik (2016)	3050 self-employed individuals and 10399 wage workers from the United States (1992-2010 Health and Retirement Study)	Three health indicators (number of health conditions, self-reported health and mental health)	Pooled regressions and longitudinal regressions	Yes. Uses the selection on observable variables as an indication for the potential selection on unobservable variables	(-)	(-)
Toivanen et al. (2016)	A cohort of the total working population (4 776 135 individuals; 7.2% self-employed; 18–100 years of age at baseline 2003) in Sweden	mortality (all-cause, CVD, neoplasms and suicide)	Cox proportional hazards models	No	N/A	(+/-) mortality is lower among those self-employed who run a limited liability Company, but mortality is higher those self-employed operating as sole proprietors, mortality is higher in trade and transportation
Lee & Kim (2017)	2501 self-employed individuals and 3289 people in other types of employment from 2005-2013 Korean Retirement and Income Study	Subjective physical health measured by a single survey question: "In general, how would you estimate that your physical health is?" on a 5-point scale	Pooled cross-sectional model and fixed effect models	No	N/A	(-)
Goncalves & Martins (2018)	132,000 self-employed individuals and wage workers over a period of up to 84 months between January 2005 and December 2011 from administrative social security records representative of the active population in Portugal	Hospital admissions	Pooled OLS models and fixed-effects panel data models	Yes, control for individual time-invariant heterogeneity through individual fixed effects	N/A	(+)

Nikolova (2019)	German longitudinal data for the period 2002–2014	the Short Form (SF)-12 questionnaire (physical health in four domains - bodily pain, general health, role physical, and physical functioning; the mental health in four domains - vitality, role emotional, mental health, and social functioning)	Binary logit regressions	Yes, difference-in-differences (DID) applied after entropy balancing	necessity entrepreneurs (+); opportunity entrepreneurs (+)	opportunity entrepreneurs (+)
Patel et al. (2019)	194 self-employed and 1511 employed individuals	Allostatic load	generalized structural equation model	No	No	(-)

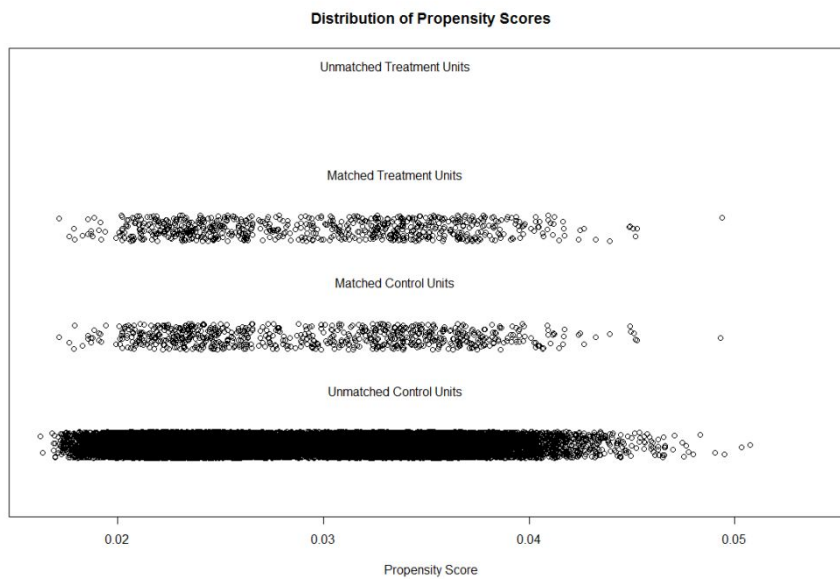
Appendix 2 Tests for selection bias after matching

	Matched Sample		Bias		<i>t</i> -test
	Treated	Control			
	N=174	N=174	Bias	Bias reduction	<i>p</i> -value
Physical health at t_0	54.60	54.61	0.001	0.13	0.99
Mental health at t_0	49.64	49.75	0.01	0.08	0.91
Job anxiety at t_0	4.16	4.10	0.08	0.05	0.58
Job depression at t_0	2.57	2.56	0.03	0.01	0.52
Age	43.49	42.95	0.02	0.11	0.65
Gender	0.63	0.61	0.04	0.33	0.83
Marital status	0.23	0.24	0.00	0.03	0.80
Education	4.41	4.55	0.06	0.04	0.36
Regions	5.98	6.02	0.01	0.05	0.91
Income t_0	2454.36	2597.20	0.09	0.11	0.59

Appendix 3 Statistical tests to evaluate the matching

Matching Method	Pseudo R^2	Likelihood Ratio χ^2	$p > \chi^2$	Mean bias	Median bias
Before Matching	0.29	1031.56	0.00	0.11	0.06
NNM	0.02	241.22	0.79	0.05	0.04
Genetic	0.00	241.30	1.00	0.01	0.01
SUBCLASS	0.00	872.93	0.94	0.11	0.06

Appendix 4 Distribution of Propensity Scores

Appendix 5 Sensitivity Analysis at t_1 and t_2

Gamma	Mental health at t_1		Physical health at t_1		Mental health at t_2		Physical health at t_2	
	sig-	sig+	sig-	sig+	sig-	sig+	sig-	sig+
1	0.0241	0.0241	0.2761	0.2761	0.3646	0.3646	0.3762	0.3762
1.1	0.0059	0.0756	0.1294	0.4758	0.1879	0.5763	0.1959	0.589
1.2	0.0013	0.1722	0.0526	0.665	0.0838	0.7532	0.0882	0.7638
1.3	0.0002	0.3099	0.019	0.8092	0.0331	0.8725	0.0351	0.8798
1.4	0	0.4678	0.0063	0.9018	0.0118	0.9407	0.0126	0.9449
1.5	0	0.62	0.0019	0.9536	0.0039	0.9747	0.0042	0.9769
1.6	0	0.7477	0.0005	0.9797	0.0012	0.99	0.0013	0.991
1.7	0	0.8432	0.0001	0.9916	0.0003	0.9963	0.0004	0.9967
1.8	0	0.9082	0	0.9967	0.0001	0.9987	0.0001	0.9989
1.9	0	0.949	0	0.9988	0	0.9996	0	0.9996
2	0	0.973	0	0.9996	0	0.9999	0	0.9999
2.1	0	0.9862	0	0.9999	0	1	0	1
2.2	0	0.9932	0	1	0	1	0	1
2.3	0	0.9968	0	1	0	1	0	1
2.4	0	0.9985	0	1	0	1	0	1
2.5	0	0.9993	0	1	0	1	0	1
2.6	0	0.9997	0	1	0	1	0	1
2.7	0	0.9999	0	1	0	1	0	1
2.8	0	0.9999	0	1	0	1	0	1
2.9	0	1	0	1	0	1	0	1
3	0	1	0	1	0	1	0	1

Gamma – Log odds of differential assignment due to unobserved factors

sig- - Lower bound significant level (underestimation of treatment effect)

sig+ - Upper bound significant level (overestimation of treatment level)

Appendix 6 Difference in Difference Analysis

	Self-employment			Employees			DiD no controls	DiD with controls
	1	2	3 (=2-1)	4	5	6 (=5-4)		
Mental Health (t ₀ , t ₁)	49.64	52.63	2.99	49.75	50.98	1.23	1.76	3.13*
Mental Health (t ₀ , t ₂)	49.64	51.51	1.87	49.75	51.24	1.49	0.38	0.85
Physical Health (t ₀ , t ₁)	54.60	54.01	-0.59	54.61	54.15	-0.46	-0.13	0.01
Physical Health (t ₀ , t ₂)	54.60	53.59	-1.01	54.61	52.90	-1.71	0.70	0.33
Job Anxiety (t ₀ , t ₁)	4.16	3.33	-0.83	4.10	3.97	-0.13	-0.70	-0.43*
Job Anxiety (t ₀ , t ₂)	4.16	3.71	-0.45	4.10	3.94	-0.16	-0.29	-0.09
Job Depression (t ₀ , t ₁)	2.57	1.76	-0.81	2.56	2.61	0.05	-0.86	-0.83**
Job Depression (t ₀ , t ₂)	2.57	2.01	-0.56	2.56	2.56	0	-0.56	-0.27*

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, ^ $p < 0.1$ (two-sided)

Appendix 7 Pooled OLS regression results with health as dependent variable

	Mental Health				Physical Health			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Added Mediators		+Job Anxiety	+Job depression	+Job Anxiety & Job Depression		+Job Anxiety	+Job depression	+Job Anxiety & Job Depression
Self-employment (Base: wage workers)	1.57*** (0.42)	1.35*** (0.37)	0.69* (0.36)	0.85* (0.35)	0.36 (0.33)	0.37 (0.33)	0.40 (0.76)	0.36 (0.76)
Mediators								
Job Anxiety		-1.71*** (0.06)		-1.89*** (0.07)		0.08 (0.05)		0.17 (0.22)
Job Depression			-2.05*** (0.06)	-1.42*** (0.08)			0.29^ (0.18)	0.16 (0.24)
Control Variables								
Age	0.08*** (0.01)	0.05*** (0.01)	0.05*** (0.01)	0.04** (0.01)	-0.10*** (0.01)	-0.10*** (0.01)	-0.10*** (0.01)	-0.10*** (0.01)
Gender	0.12 (0.28)	0.35 (0.24)	0.13 (0.24)	0.25 (0.23)	-0.13 (0.22)	-0.14 (0.22)	-0.13 (0.22)	-0.14 (0.22)
Marital status	-1.64*** (0.37)	-1.80*** (0.32)	-1.43*** (0.31)	-1.58*** (0.31)	0.19 (0.29)	0.20 (0.29)	0.18 (0.29)	0.19 (0.29)
Income	0.32^ (0.18)	0.77*** (0.16)	0.41** (0.15)	0.62*** (0.15)	0.58*** (0.14)	0.56*** (0.14)	0.57*** (0.14)	0.56*** (0.14)
Other qualification	0.15 (0.53)	0.10 (0.46)	0.45 (0.45)	0.33 (0.44)	-1.65*** (0.41)	-1.65*** (0.41)	-1.67*** (0.41)	-1.66*** (0.41)
GCSE etc	0.33 (0.46)	0.18 (0.41)	0.46 (0.40)	0.15 (0.39)	-1.30*** (0.36)	-1.28*** (0.36)	-1.31*** (0.36)	-1.29*** (0.36)
A-level etc	0.69 (0.47)	0.12 (0.42)	1.04* (0.41)	0.64 (0.40)	-1.63*** (0.37)	-1.61*** (0.37)	-1.65*** (0.37)	-1.63*** (0.37)
Other higher degree	0.24 (0.60)	0.30 (0.53)	0.50 (0.52)	0.46 (0.50)	-0.74 (0.47)	-0.74 (0.47)	-0.75 (0.47)	-0.75 (0.47)
Degree	-0.48 (0.56)	-0.17 (0.49)	-0.38 (0.48)	-0.17 (0.47)	0.16 (0.44)	0.13 (0.44)	0.15 (0.44)	0.14 (0.44)
North West	0.40 (0.81)	1.23^ (0.71)	0.56 (0.69)	0.94 (0.68)	-0.57 (0.64)	-0.60 (0.64)	-0.57 (0.64)	-0.59 (0.64)
South East	0.35 (0.81)	0.39 (0.71)	0.17 (0.69)	0.25 (0.68)	-0.22 (0.64)	-0.22 (0.64)	-0.21 (0.64)	-0.22 (0.64)
West Midlands	-0.06 (0.87)	0.33 (0.76)	0.41 (0.74)	0.47 (0.72)	-1.03 (0.68)	-1.05 (0.68)	-1.05 (0.68)	-1.06 (0.68)
Yorkshire and the Humber	0.59 (0.88)	1.29^ (0.77)	1.26^ (0.75)	1.42^ (0.73)	-0.91 (0.69)	-0.95 (0.69)	-0.95 (0.69)	-0.95 (0.69)
East of England	0.58 (0.81)	0.79 (0.71)	0.30 (0.69)	0.50 (0.67)	-0.35 (0.63)	-0.36 (0.63)	-0.34 (0.63)	-0.35 (0.63)
North East	0.56 (0.86)	1.28^ (0.75)	0.72 (0.73)	1.04 (0.72)	0.08 (0.67)	0.05 (0.67)	0.08 (0.67)	0.06 (0.67)
East Midlands	0.36 (0.79)	0.82 (0.69)	0.10 (0.67)	0.42 (0.66)	-0.36 (0.62)	-0.39 (0.62)	-0.35 (0.62)	-0.36 (0.62)
South West	0.64 (0.80)	0.53 (0.70)	0.38 (0.69)	0.40 (0.67)	0.64 (0.63)	0.64 (0.63)	0.65 (0.63)	0.65 (0.63)
Wales	0.27 (0.92)	-0.07 (0.80)	-0.11 (0.78)	-0.17 (0.76)	-0.11 (0.72)	-0.10 (0.72)	-0.10 (0.72)	-0.09 (0.72)
Scotland	-0.38 (0.87)	-0.15 (0.76)	-0.42 (0.74)	-0.28 (0.72)	0.50 (0.68)	0.49 (0.68)	0.51 (0.68)	0.50 (0.68)
Northern Ireland	0.72 (0.90)	0.65 (0.79)	0.55 (0.77)	0.57 (0.75)	-2.40*** (0.71)	-2.40*** (0.71)	-2.40*** (0.71)	-2.40*** (0.71)
Indirect effects								
via job anxiety		-2.31*** (94.67%)		-0.76*** (85.33%)		-0.02 (1.85%)		-0.04 (3.74%)
via job depression			-1.41*** (76.68%)	-1.21*** (73.73%)			-0.12 (10.26%)	-0.08 (6.78%)
F	3.86	48.55	58.97	66.73	9.52	9.20	9.247	8.85
R ²	0.02	0.25	0.29	0.32	0.06	0.06	0.06	0.06
p-value	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

*** p < 0.001, ** p < 0.01, * p < 0.05, ^ p < 0.1 (two-sided). Regression coefficients are displayed with standard errors between parentheses. Standard errors are clustered on the individual level. Proportion of total relationship mediated by job anxiety, job depression or job demand is shown between brackets.