

The Unintended Consequences of Flexicurity: The Health Consequences of Flexible Employment

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Abstract

While atypical employment contracts offer flexibility in the labour market, these kinds of contracts are inherently insecure and may generate stress among affected workers. This study examines the impact of atypical forms of employment on workers' health. Using discrete time proportional hazards models methodology the study shows that, other things equal, the longer percent of time spent inflexible employment contracts increases the odds of falling into ill health for a variety of health conditions. The results are robust to controlling for the endogeneity in the relationship.

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Abstract

While atypical employment contracts offer flexibility in the labour market, these kinds of contracts are inherently insecure and may generate stress among affected workers. This study examines the impact of atypical forms of employment on workers' health. Survival analysis after controlling for frailty and the endogeneity in the relationship shows that other things equal, the longer percent of time spent inflexible employment contracts increases the odds of falling into ill health for a variety of health conditions.

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1. Introduction

In Europe, flexible employment contracts have come to the forefront of the economic policy debate as the European Commission promoted the concept of ‘flexicurity’. Although it is not clear that the pace of structural change has increased over time, the process of globalisation, increased European integration and technological development has provided a perception of a need for labour market flexibility enabling employers to respond to market pressures in order to respond to changing circumstances and to retain a competitive advantage in the face of global market pressures. Thus, the European Commission published in June 2007 a communication as a response to a call from the European Council (Presidency Conclusions 2006, 2007) focusing on exploring “the development of a set of common principles on flexicurity” (European Commission 2007, p. 4). The Commission highlighted “the need to achieve the objectives of the renewed Lisbon Strategy, in particular more and better jobs, and at the same time to modernise the European social models”. Within this communication flexicurity is defined “as an integrated strategy to enhance, at the same time, flexibility and security in the labour market” (p. 4).

Although any policies towards offering to the individuals exposed to these processes of change either more security or adequate income protection have been stifled, a large segment of the labour market now offers unstable forms of employment, with those individuals in temporary jobs facing far shorter job durations and greater job instability compared to those in full-time permanent jobs (Gregg and Wadsworth 1995, 1996).

Although increased labour market flexibility is allegedly expected to improve the employment and labour force participation rates, the shift to non-standard contracts and the deregulation of the institutional framework that traditionally supported vulnerable groups of the working population is associated with lower income, greater job and financial insecurity and, thus, potentially a reduced quality of life. This idea forms the basis of this paper, examining the link between flexible contracts and the health of workers. The problem is addressed by estimating the effect of flexible employment on the *duration* of a spell of good health using the longitudinal element of the British Household Panel Survey dataset. The study employs a self-assessed measure of health and a number of relatively

objective measures, namely heart or blood pressure problems; stomach or digestion problems; anxiety, depression and other psychological problems; breathing or chest problems; migraines; skin conditions and allergies; or ‘other’ health conditions.

However, the study of this issue encounters a number of methodological challenges:

First, failure to account for effects of unobserved heterogeneity or frailty that is, personal or family characteristics or other unobserved factors which decrease (increase) the probabilities of exiting a spell of good health may bias the results in favour of a negative (positive) duration dependence (Heckman and Borjas 1990; Lancaster 1979). The influence of socioeconomic and individual characteristics on the length of time an individual remains in good health is estimated using the approach proposed by Jenkins (2005), which allows for covariates to vary across time, and is able to accommodate the issues described above.

Second, it is not clear *a priori* whether the effects of precarious employment, such as the sense of work ethic or confidence associated with unstable employment cause poor health or whether poor health is a factor that restricts the individual’s opportunities to obtain and retain a secure or a permanent employment contact. This issue of endogeneity and the associated causality plagues any estimated effects unless it is suitably controlled for or circumvented. The issue of endogeneity/causality in the precarious employment – health duration relationship is addressed by recording the cumulative time that an individual, healthy at the start of the observation period, spends in precarious employment until the time that his or her good health comes to an end. The probability of exit from a spell of good health is estimated over the whole time that the individual is healthy. Thus, by design, lower health status cannot cause precarious employment. This methodology of estimating the effect of an event on the health of individuals by restricting the sample to those individuals who exhibit good health at the start of the survey in order to avoid endogeneity or causality problems is well documented in applied research (Lynch et al, 1997; Buckley et al, 2004).

Thus, this paper will develop methodologies to overcome these two statistical complications in the investigation of the relationship between health and precarious employment. After a brief literature review to put the problem in context, details are given on the estimation strategies and the data used to

estimate the relationship. Results are discussed and placed in the context of the literature and a final section concludes.

2. A Brief Literature Review of the Effects of Flexible Employment on Health

In the 20th Century, many firms relied on long-term and stable employer-employee relationships as a means of human resource management. Employers relied heavily on an ‘invisible handshake’ as opposed to the ‘invisible hand’ that cannot operate effectively in the labour market when employment contracts cannot perfectly foresee future contingencies (Okun, 1980). These ideas were formalised in the theoretical framework of the ‘Implicit Contract’ theory (e.g., Baily, 1974; Gordon, 1974; Azariadis, 1975; Azariadis and Stiglitz, 1983) which in its simplest form can be described as an employment contract over two states of nature; a good state when demand is high and the worker’s marginal revenue product (MRP) is high and in adverse states, when demand is low and the value of the marginal revenue product is low. The main idea is that the individual worker is more risk averse than the individual employer, due to significant differences in wealth. In addition, employers and executives have greater experience in financial affairs and, thus, are more able to counter financial risks than an average employee. Hence, the worker has much lower ability to bear risks and values a wage-employment contract that reduces risk over the two states of nature. Thus, since workers dislike income uncertainty and dislike being jobless, firms find a profitable employment strategy to maximise profits, and to attract and retain workers, by providing a contract that reduces the risk to the worker over good and adverse states of the economy. This enables firms to attract and retain a high quality pool of workers, eliminate information asymmetries about their ability and productivity, foster specific training skills, while employees were likely to reciprocate to their employer’s loyalty by exerting greater effort (Akerlof, 1982).

Yet, recently these attitudes are increasingly seen as obsolete in the advanced economies, as the notion of a ‘job for life’ has ceased to exist. Current attitudes to human resource management and employment tend to shift the burden of the risk to the worker. The stability of the wage level over good and adverse states can be retained only via a corresponding variation of employment or,

alternatively, any decrease in demand would be accompanied with variations in wages. Hence, currently there is a marked labour market trend towards an increase in the use of precarious or 'atypical' forms of employment and an increasing burden of risk on the workforce. These forms of employment include fixed term contracts, temporary or casual contracts, temporary-help agency work and the like. The labour market trend towards precarious employment is illustrated by the growth of 'zero-hour' contracts, an extreme form of temporary employment. Zero-hour contracts imply that workers are employed without any guarantee about the amount of work they will gain. The Financial Times (April 7, 2013) reports that according to government estimates, 23% of employers now use zero-hour contracts. The total number of employees on zero-hours contracts rose 25 per cent over the course of 2012 and more than 150 per cent since the autumn of 2005. Since 2005, the yearly number of zero-hour contracts has increased from 50,000 to 200,000. Interestingly a recent report by the University and College Union showed that two-thirds of universities in the UK use zero-hour contracts (UCU, 2013).

However, as the risk has been transferred from the firm to worker, economists and policymakers have become increasingly interested in investigating the effects of precarious forms of employment on individuals' well-being, quality of life and health. A detailed review of the evidence is beyond the scope of this study, particularly given the broad reviews on the association between temporary employment and health status by Virtanen *et al.* (2005) and De Cuyper *et al.*(2008). Reviewing the literature, these studies conclude that an association between temporary/flexible employment and psychological morbidity and that the health risk may depend on instability of temporary employment and the context. Economists have typically attempted to estimate the utility cost of moving towards such precarious modes of work. Thus, although they find evidence that fixed-term contracts function as effective stepping-stones towards permanent jobs, especially for women, Booth *et al.* (2002) show that temporary jobs in the UK are not desirable as a means of long-term careers. Such jobs typically pay less than corresponding permanent jobs and are associated with lower levels of job satisfaction and poorer work-related training, *ceteris paribus*.

The above results are corroborated by evidence from a number of epidemiological studies that show a close association between precarious types of employment and low psychological wellbeing or mental distress (e.g. Benavides *et al.*, 2000; Aronsson *et al.* 2002; Virtanen *et al.* 2002; Waenerlund *et al.* 2011; Sirviö *et al.* 2012). Furthermore, Pouliakas and Theodossiou (2005) find that temporary, part-time workers in eleven European labour markets are strongly dissatisfied compared to those on permanent, full-time contracts. In a further study, they demonstrated (Pouliakas and Theodossiou, 2010) that other things equal the anticipated psychological ‘costs’ of moving from a riskless permanent contract to the insecurity of flexible employment or no work at all appear to be very significant.

However, De Cuyper *et al.* (2008) point out that some of the empirical evidence on health and psychological impact of precarious types of work suffers from a number of shortcomings stemming from the heterogeneity of precarious workforce (fixed-term, part-time, temporary, irregular, atypical, casual jobs, non-standard working etc.) and the inconsistent definitions of precarious type of work. Furthermore, results may be biased due to methodological limitations relating to non-random selection into inflexible employment and the effects of confounding factors in regression models.

Although the previous literature identifies a linkage between (particularly psychological or subjective wellbeing) health and flexible contracts using either small scale surveys for specific groups or cross section survey data, to the knowledge of the authors, none has examined the potential link between precarious contracts and physical health over a long period of time using large scale survey data. While data limitations are a partial cause of the lack of research, there are strong reasons to expect that such a link is real and significant.

Rose and Marmot (1981), Bosma *et al.* (1997), Sapolsky (2005), Vitetta *et al.* (2005) and Wilkinson and Pickett (2006, 2009) offer wide and convincing epidemiological and medical evidence indicating that increased stress, and in particular, long-term ‘low grade’ stress, can lead to ill health. Importantly, the long term effects of employment uncertainty on individual functioning are clearly implied in Leombruni *et al.* (2013) since they find that workers exposed to the stress and uncertainty of job loss due to firm closure exhibit a large and significant risk of workplace injury after

reemployment. By their nature atypical employment, namely fixed-term, part-time, temporary, irregular, atypical, casual jobs, non-standard working contracts, increase uncertainty about the future. This increased uncertainty explains at least some of the reduced job satisfaction and increased psychological stress shown by those in such inflexible contracts. To the knowledge of the authors this is the first study that examines this link between precarious employment and health.

3. Econometric Methodology

Because the medical linkage between stress and ill health is not instantaneous, time is a key element in the analysis. Hence, this study models the effects of precarious employment in a duration framework, to examine the effect of the increasing amount of time spent in atypical/temporary employment contracts on health. Although the Cox (1972) hazard model approach is employed as a starting point, the methodology used in the paper follows Jenkins (1995), Stewart (1996) and Meyer (1990) which builds on Prentice-Gloeckler (1978).

The variable to be explained is the duration of an individual's good health. Only continuous spells of good health are considered and once an individual exits the panel re-entry is not allowed. Each individual is observed once per year hence time intervals are of one year of length. The interval boundaries are one year of length $t = 1, 2, 3, \dots$ and the interval t is $(t-1, t]$. The end of a spell of good health can either be observed before the end of the survey period thus it is considered complete ($c_i = 1$) or it cannot be observed thus it is a right censored observation ($c_i = 0$).

A complete spell i in the t th interval adds to the likelihood a discrete time density function,

$$P(t-1 < T_i < t) = S(t-1) - S(t) = \frac{h_{it}}{1 - h_{it}} \prod_{k=1}^t (1 - h_{ik}) \quad (1)$$

A censored spell of good health i with length t intervals adds to the likelihood function the discrete time survivor function,

$$S_i(t) = P(T_i > t) = \prod_{k=1}^t (1 - h_{ik}) \quad (2)$$

where $T_i = \min\{T_i^*, C_i^*\}$ where T_i^* is a latent failure time and C_i^* a latent censoring time for spell i , and the discrete hazard is $h_{ik} = P(k-1 < T_i \leq k | T_i \geq k-1)$.

Hence the log-likelihood is,

$$\log L = \sum_{i=1}^n c_i \log\left(\frac{h_{it}}{(1-h_{it})}\right) + \sum_{i=1}^n \sum_{k=1}^t \log(1-h_{ik}). \quad (3)$$

Jenkins (1995, 2005) shows that this implies that a log likelihood function of a binary dependent variable y_{ik} can be formulated as

$$\log L = \sum_{i=1}^n \sum_{k=1}^t [y_{ik} \log h_{ik} + (1-y_{ik}) \log(1-h_{ik})] \quad (4)$$

where $y_{ik} = 1$ if spell i ends in year t and $y_{ik} = 0$ otherwise.

Furthermore, Prentice and Gloeckler (1978) show that the complementary log-log function

$$\begin{aligned} c \log \log[1-h_t(X_{it})] &\equiv \log(-\log[1-h_t(X_{it})]) = \beta_0 + X_{it}\beta + \gamma_t \\ \Rightarrow h_t(X_{it}) &= 1 - \exp(-\exp(\beta_0 + X_{it}\beta + \gamma_t)) \end{aligned} \quad (5)$$

is the appropriate form for such grouped-interval data, where γ_t is the interval baseline hazard and X_{it} are covariates that may be time-varying but are constant within intervals.

Estimating the effects of employment precariousness on health with this type of models faces an important issue identified by De Cruyter *et al.* (2008) regarding the potential problems of individual heterogeneity on the estimates. This concern echoes Heckman and Borjas (1990) and Lancaster (1979) who have pointed out that unobservable heterogeneity (or frailty) can significantly bias the results in a hazard estimation framework. The frailty arises when unobserved personal characteristics or other relevant factors are not controlled for. However, Jenkins (2005) shows that a discrete mixture model can describe adequately the unobserved heterogeneity between individuals, and Vaupel *et al.* (1979), Hanagal (2011) and Wienkle (2011) show the ability of frailty term to capture the unobservable random effects shared by individuals with similar (unmeasured) risks affecting the exit rates.

An approach to account for an arbitrary nonparametric distribution for individual heterogeneity is suggested by Heckman and Singer (1984). They assume that each individual belongs to one of a number of different types (mass points), $z = 1, \dots, z$, where membership of each type is unobserved. They, then, allow the intercept term in the hazard function to differ across the types. In view of this, the hazard becomes

$$h_{tz}(\mathbf{X}_{it}) = 1 - \exp\left[-\exp\left[m_z + \beta_0 + X_{it}\beta + \gamma_t\right]\right] \quad (6)$$

where m_z describes the nonparametric distribution of the individual heterogeneity component, and m_1 is normalised to zero. This approach can be readily implemented by using the “hshaz” subroutine available in STATA (Jenkins, 2005) where the log-log specification is used that converges to a proportional hazard model as the hazard rate tends to zero. In most applications the hazard rate is sufficiently small so that the log-log specification converges to

$$\left|\frac{h_{tz}}{1-h_{tz}}\right| = \exp\{m_z + \beta_0 + X_{it}\beta + \gamma_t\} \quad (7)$$

The exponentials of the estimated coefficients β are the odds ratios.

Notwithstanding the use of the above approach to control for the effects of unobserved heterogeneity this study, by design, retains some homogeneity in the sample using the methodology of Marmot *et al.*, (1978a), Marmot *et al.*, (1978b), Marmot *et al.*, (1991) and Marmot and Davey Smith (1997) by restricting the sample to individuals employed for the whole observation period. Hence, factors such as unemployment and absolute poverty cannot affect the findings because everybody in the study is in paid employment (either inflexible or permanent contracts) for each year that they are in the sample.

Furthermore, the methodology adopted in this paper establishes the likely direction of causality purging by construction the possibility of endogeneity. In particular, the sample consists of individuals who have reported good health at the start of the observation period and are in work. When the individual exits good health, his or her socioeconomic status is recorded. By design, this

procedure ensures that the direction of causality is from paid employment (temporary or permanent contract) to health. The individual who enjoys good health is first observed to exit good health on the account of the advancing share of the flexible or permanent paid employment, *ceteris paribus*. Notwithstanding the clear establishment of the direction of the effect, one may argue that endogeneity may still be an issue since approaching, but not manifested, ill health may be associated with the likelihood of someone being observed in temporary employment rather than permanent contract at the initial period. Ordinarily, this issue should not be of concern because the unobserved heterogeneity term should account for this. Nevertheless, to more directly control for this potential issue, an augmented model is re-estimated by introducing a control for the past health of the individual in the main formulation. As a further robustness check to identify any possible endogeneity, the sample is further restricted to individuals who are in good health and in permanent employment at the initial period so any move to temporary employment and to ill health takes place only within the observation period.

4. Data

The data for this study come from 17 waves of the British Household Panel Survey (BHPS), a nationally representative survey of British residents. In order to implement the strategy described above, healthy workers are selected and are followed until they either experience a worsening of their health condition or they are not observed anymore (and thereby, become censored observations). The total length of time in good health is recorded for each individual.

Several different health measures are employed in this study. Subjective health is derived by the information provided by the respondents regarding how their health has been over the past 12 months. Those who state that it was excellent or very good are classified as those who are healthy while other responses suggest ill health. Furthermore, the BHPS has a variety of other, more objective, health problems, namely heart or blood pressure problems; stomach or digestion problems; anxiety, depression and other psychological problems; breathing or chest problems; migraines; skin conditions

and allergies; or ‘other’ health conditions. Workers are considered to be in good health if the specific health condition was not mentioned while ill health was specified when the condition was mentioned.

The key independent variable is the percentage of time spent in a flexible employment. For the first eight waves of the BHPS, respondents are asked to identify if their current job was permanent, seasonal/temporary job or a fixed time contract. For the remaining nine waves the respondents are asked to first identify whether their job is permanent or non-permanent and in a follow-up question to identify the kind of non-permanent job they do. This study combines the responses in two groups permanent and flexible employment contracts.¹ A set of standard demographic variables – gender, education, race, splines of age, marital status, region, and current smoking status – are also included in the regressions as control variables. However, it should be noted that this study takes into account any unobserved heterogeneity (omitted factors/variables) through an arbitrary nonparametric distribution of individual heterogeneity.

5. Empirical Results

5.1 Kaplan-Meier non parametric survival plots

To obtain some view of the raw data, the Kaplan-Meier non parametric survival plots are shown in Figures 1-8 for the subjective and objective health measures. In these figures, a dummy variable is used to indicate when a worker has been in flexible employment for at least 50 percent of the time that they are observed. Figure 1 indicates the survival plots for the subjective health measure, with the dotted line as the survival plot for those in flexible employment for more than 50 per cent of the time. As can be seen, the survival plot drops much more quickly for the group who have long exposure to flexible contracts. Indeed, the hazard of falling out of good health is always much higher for those with long exposure to flexible employment contracts for the entire range of objective health measures.

5.2 Hazard function Regressions using the whole sample

¹ This includes the self-employed who also answer this question on whether their job is permanent or temporary, although the results are robust to their exclusion from the sample. Registered disabled are excluded from the sample in order to preserve some homogeneity of the sample.

In this section, the results from a series of hazard regressions are discussed to identify the correlation between flexicurity provisions such as flexible employment contracts on health. Table 1 contains the results of three sets of regressions for subjective health. The first column reports the results from a standard Cox hazard model. The key variable of interest is the percentage of time spent in flexible employment.² The results for this variable are found in the first row and indicate that an increase in the time spent inflexible employment increases the odds of going into bad health, relative to time spent in a permanent job. Although the point estimate is small, it is important to note that this is for a one percentage point increase in the amount of time spent inflexible employment. To get a better idea of the magnitude of the effect, if one increases the time spent in flexible employment by one standard deviation (about 14.6 percentage points), it would increase the odds of falling into bad health by 1.091.

The second and third columns of Table 1 exhibit results using the Prentice-Gloeckler method as modelled by Jenkins. The second column allows for discrete time periods. However, allowing for discreteness does not diminish the statistical significance of the effect of flexible employment contract – indeed the point estimate is slightly larger than in the Cox regression. When the effects of unobserved heterogeneity (frailty) are taken into account in the last column the odds ratio now increases to 1.013 (or 1.208 for a one standard deviation increase in the per cent of time inflexible employment).

Table 2 reports a set of odds ratios for different hazard regressions for each of the objective health measures. Each cell in the table represents selected results from a different regression, but all are the odds ratio of increasing the percentage of time spent on a flexible contract. While the point estimates of the increase in the odds ratio does differ slightly across illness measure and regression methodology, the results are remarkably consistent. All odds ratios are significant at the five per cent level (at least) and all fall into the range of 1.008 to 1.018 for a one percentage point increase in time

² The other covariates generally confirm intuitive relationships between the variables and ill health. Compared to white workers, non-white workers are more likely to fall into bad health. Married workers are somewhat more likely to fall into ill health, as are workers in London (compared to other parts of England). There is little effect of education, except for higher odds from those without secondary schooling degrees. As expected a decrease in household income increase the hazard of falling into bad health. Smoking has a similar effect.

spent inflexible jobs relative to permanent jobs (or 1.123 to 1.286 increase for a one standard deviation change). As with subjective health, the results are also robust with respect to hazard estimation methodology, with the point estimates increasing even when frailty is controlled for. Thus, this implies robust and consistent evidence that continued exposure to the stress of flexible employment increases the risk of bad health.

5.3 Hazard function Regressions disaggregating by gender and income level

Although the results above are indicative of the full sample, two further sets of regressions are estimated to evaluate if these results are consistent across subgroups in the population. First, separate regressions for males and females are estimated, in view of the evidence that health and employment patterns are different across genders. Second, it may be that there are compensating differentials paid for the uncertainty of flexible employment (at least at the hourly level). Since previous research shows that health increases with income, one would expect that under compensating differentials, the increased income would mitigate the effects of flexible employment on health.

The results of this exercise are found in Table 3. There are some interesting differences across illnesses and samples. For example for subjective health, while both males and females experience higher odds of falling into ill health with an increase in the percent of time in flexible employment, the effect seems to be larger for males. Likewise, rather than mitigating the detrimental effects of flexible employment on health, the odds of ill health are much higher for those whose household income is above the median.³

Looking at the objective measures of health, this pattern of larger effects for males in both heart and breathing illness is found. There seems to be little difference between genders for stomach health and skin allergies, while flexible work affects women more for anxiety/depression, migraines and ‘other’ health conditions. The odds of ill health are much higher for those whose household income is

³ However, the results of this should be viewed with caution since household income is used rather than earned income. So any compensating differential effects may be mitigated because of the income of the other members of the household.

above the median in the case of heart, stomach, and breathing, while the ‘other’ health conditions are more prevalent among poorer workers.

Overall, the above results confirm that although there is some heterogeneity across different subsamples, the longer exposure to flexible employment contracts is correlated with ill health.

5.4 Robustness Checks

In this section a number of specifications are used to evaluate the robustness of the results discussed above:

Sample sensitivity

A potential issue that may arise concerns the selectivity of the results to the construction of the sample. As discussed above, the sample consists of people who are in good health in the first wave of the BHPS and then followed until they either fall into bad health or drop out of the sample (i.e. the censored group). Once this sample is set, then the percentage of time spent in permanent or flexible jobs is calculated. However, for those in the sample for only a few waves, these percentages are quite discrete with little variation. To evaluate the sensitivity of the results to these possible influential observations the regressions are re-estimated including in the sample only those who are observed for at least five waves. Results from this exercise are found in Table 4. Except for the cases of heart and anxiety/depression health, the results are still statistically significant, and indeed, the statistically significant odds ratios are generally larger once the sample is restricted to those in the sample the longest times.

The second robustness check relates to the sample homogeneity. The results reported above are based on a sample in line with the literature (e.g. the ‘Whitehall’ studies of Marmot and others cited above), which shows that it is desirable to focus on a sample of individuals who are always in employment. This provides a homogeneous group of individuals who have continual exposure to work and so factors such as unemployment and absolute poverty cannot affect the findings because all those included in the study are in paid employment, throughout the period of observation. Nevertheless, those on flexible contracts are likely to spend some time in non-employment. Thus, the

sample is expanded to allow for individuals who may be out of work, either due to unemployment or being out of the labour force (although each individual spends at least one wave in a flexible or permanent job so all individuals have had the opportunity to experience an employment spell). Table 5 shows the results from this estimation. In general, expanding the sample to allow for different labour market statuses confirms the main conclusion of this study, namely an increase in the percentage of time in flexible contracts relative to the percentage of time spent in a permanent job increases the odds of falling into ill health. This is consistent across all health types except for heart and 'other' illnesses which, while positive, are now statistically insignificant.

Endogeneity Issues

An augmented model is re-estimated by introducing a control for the past health of the individual in the main formulation in order to evaluate the possible effects of endogeneity on the estimated results. Although one would expect that the frailty correction purges such individual level effects, it is worth confirming this by estimating the main regression on a sample that provides a control for past health. In doing so, the sample uses the BHPS wave 5 onwards. Thus, healthy workers are identified in Wave 5 and followed through until they experience a spell of bad health or are censored. The waves 1 to 4 are utilised to identify if the worker had experienced any bad spell of health in this period. If there is a spell of bad health an additional dummy variable to indicate this spell is created.

Table 6 contains the results from this robustness check. In the Table, for reference the 'All Waves' row repeats the results from Table 1 or Table 2 (for the respective illness). The row with 'Last 13 Waves' contains the odds ratio for the percent of time spent in a flexible contract, but without any control for past health. By comparing these two rows one is able to assess if there is any substantive difference in the coefficients when the panel starts in Wave 1 ('All Waves') or starts in Wave 5 ('Last 13 Waves'). In general, it turns out that there is very little difference. If anything the odds ratios tend to be somewhat higher for the latter sample, and all are statistically significant and indicate higher hazards. The final row for each health outcome includes the past ill health dummy variable. In general, the odds ratios decrease by a small amount but remain statistically significant in

all regressions. Thus, the results from earlier are robust to the inclusion of this variable with the odds ratios little changed from the ‘Last 13 Waves’ row.

In view of the importance of the issue of endogeneity a further robustness check is employed since one could argue that approaching ill health that has not yet manifested itself may be associated with the likelihood of someone being observed in temporary rather than permanent contract in the initial period. One way to investigate this is to restrict the sample at the initial period to include individuals who are in good health and in permanent employment. Thus any moves to temporary employment are observed within the observation period. In this case one should expect that the direction of causality is clearly from paid employment to health. The individual enjoys good health in permanent employment at the start and he or she is observed to exit good health on the account of the advancing share of the flexible or permanent paid employment within the observation period, *ceteris paribus*. However, in performing this set up it was found that the number of observations of workers who experience employment in a temporary contract falls dramatically (to between 40 to 60 individuals depending on the measure of health). In view of this, any multivariate regression estimates are not estimated with much precision. However, non-parametric Kaplan-Meier plots for each of the health measures consistently demonstrate⁴ that the risk of health deterioration is higher for those with high percentages of temporary contract experience even though at the initial period they were employed in a permanent contract. Although the above results constitute an illustration of the insignificant effect of the endogeneity, they are salutary since along with the corrections of the frailty heterogeneity and the initial selection of workers in good health, these survival plots suggest that the problem of endogeneity may not be important in this paper.

6. The effect of flexible contracts on objective health - the possible pathways

Although the results reported in this study show that the use of flexible contracts increase the incidence of ill health, it would be useful to know the pathway of this outcome. It is not likely that there is a direct and immediate link between the onset of a flexible contract to heart problems, for

⁴ Figures are available from the authors on request.

example. However, as suggested above, the linkage may be through the increased stress suffered by the worker as he or she bears the risk of precarious employment contracts. While the BHPS does not contain any biomarkers that would medically indicate stress, there are a series of questions from the General Health Questionnaire (GHQ) that do involve stress – problems with sleep, problems with decision making, feeling under strain, problems overcoming difficulties, loss of confidence and loss of happiness. Using the same methodology as above with the health indicators, each of these problems is investigated in turn – starting with a sample of workers who do not express the stress indicator. They are followed over time until they signal a problem with that stress measure or are censored. The same set of regressors are included in the regression as before, including the key variable of the percent of time in flexible contracts.

Table 7 reports the results from these regressions with the odds ratios on the percent of time in flexible contracts for the three sets of duration models and for the various samples examined earlier. In each of the full sample regressions, there are higher odds of having stress as the percent of time in flexible employment increases, all in the 1.004 to 1.015 range, indicating that an increase in time in flexible employment is correlated with higher stress levels as measured by loss of sleep, difficulty in decision making, etc. As above, the frailty corrected models have the largest point estimates of the odds ratios.

As with the health measures, there is more heterogeneity among the samples. The effect of flexible employment on sleep and problems overcoming difficulties affect women more than men, while men on flexible contracts are more likely to have problems decision making or lose confidence. Except for sleep problems, the odds ratios are significant for both income groups and tend to be higher for the more highly paid. In general, the central point is that the increased exposure to forms of ‘atypical’ or flexible contracts causes higher odds of feeling stress for nearly all subsamples.

7. Conclusions

Flexible employment contracts are thought to offer flexibility in the labour market and promote higher employment levels. However, flexible employment contracts are inherently insecure since precarious

employment induces uncertainty and hence stress among the affected workers. This study examines the impact of flexible employment contracts on workers' psychological health. Using a discrete time proportional hazards models methodology after controlling for unobserved heterogeneity and by design circumventing endogeneity, it is shown that the longer the amount of time spent in flexible employment contracts increases the odds of falling into ill health for a variety of health conditions, *ceteris paribus*. The results are robust to variations of the sample, to further controlling for the effects of past health.

Precarious employment contracts are associated with higher risk and less control one has over his/her own life and income as well as the level of participation in the society. Individuals with long spells of 'atypical' or precarious employment have higher levels of stress due to their inability to control their lives. Indeed this study shows that such contacts are associated with a higher hazard of exhibiting high levels of stress indicators. Flexible employment contracts have severe negative externalities and, very uncertain employment or labour market career gains for a growing part of the workforce. Thus, by investigating and understanding the effect of casualization of the employment relationship on the health and psychological well-being of employees, policy makers may obtain a wider understanding of how to assess the impact of socio-economic policies on individual wellbeing, thus informing the design of a socially cohesive welfare policy.

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Table 1. Subjective Health Hazard Models

Variable	Cox	Prentice-Gloeckler (hshaz)	
		without frailty	with frailty
% time in flexible employment	1.006*** (3.59)	1.008*** (4.20)	1.013*** (4.55)
Male	0.956 (-0.77)	0.949 (-0.90)	0.952 (-0.56)
Nonwhite race	1.406** (2.27)	1.503*** (2.70)	1.486 (1.56)
Age 15-25	4.477*** (11.74)	6.276*** (14.13)	9.430*** (10.41)
Age 26-35	3.133*** (11.85)	4.067*** (14.49)	7.173*** (13.01)
Age 36-45	1.896*** (7.22)	2.164*** (8.70)	2.873*** (7.71)
Age 46-55	1.441*** (4.17)	1.546*** (4.97)	1.799*** (4.34)
Married	1.113 (1.58)	1.150** (2.05)	1.231** (2.05)
London	1.210** (2.03)	1.276** (2.59)	1.466** (2.36)
Wales	0.940 (-0.53)	0.927 (-0.66)	0.996 (-0.03)
Scotland	1.103 (1.06)	1.138 (1.40)	1.086 (0.54)
University degree	0.868 (-0.79)	0.858 (-0.85)	0.958 (-0.15)
Secondary sch. degree	0.843 (-0.98)	0.816 (-1.17)	0.913 (-0.33)
No secondary sch. degree	1.394* (1.84)	1.483** (2.18)	2.330*** (2.94)
HH income in 1 st quartile	2.200*** (8.46)	2.566*** (10.04)	4.194*** (9.82)
HH income in 2 nd quartile	1.746*** (6.55)	1.950*** (7.84)	2.726*** (7.62)
HH income in 3 rd quartile	1.374*** (3.89)	1.441*** (4.45)	1.885*** (5.05)
Current smoker	1.216*** (3.19)	1.279*** (4.00)	1.485*** (4.09)
ln(time)	NA	1.489*** (11.26)	3.678*** (16.24)

Notes: Numbers in parentheses are asymptotic z-statistics. All coefficients have been converted to odds ratios. *, **, and *** indicate 10%, 5%, and 1% significance, respectively. The excluded variables are age greater than 55, non London England, postgraduate degree and the top quartile of household income.

Table 2. Odds Ratios on Percent of Time Spent on a Flexible Contract Hazard Regressions for the Objective Health Measures

Sample	Cox	Prentice-Gloeckler (hshaz)	
		without frailty	with frailty
Heart Health	1.008** (2.02)	1.008** (2.16)	1.011** (1.96)
Stomach Health	1.012*** (3.96)	1.013*** (4.24)	1.018*** (4.05)
Anxiety/Depression Health	1.010*** (3.05)	1.010*** (3.32)	1.014*** (3.11)
Breathing Health	1.008** (2.52)	1.009*** (2.63)	1.010** (2.35)
Migraine Health	1.008*** (2.84)	1.009*** (3.21)	1.009*** (3.21)
Skin/Allergy Health	1.009*** (3.24)	1.010*** (3.58)	1.018*** (4.12)
‘Other’ Health Conditions	1.008** (2.42)	1.009*** (2.65)	1.015*** (3.20)

Notes: Numbers in parentheses are asymptotic z-statistics. All coefficients have been converted to odds ratios. ** and *** indicate 5% and 1% significance, respectively. All regressions include the covariates in Table 1.

Table 3. Odds Ratios on Percent of Time Spent on a Flexible Contract Hazard Regressions for the Objective Health Measures by Subsample

Health Illness and Sample	Cox	Prentice-Gloeckler (hshaz)	
		without frailty	with frailty
<i>Subjective Health</i>			
Female	1.005* (1.94)	1.006** (2.32)	1.010*** (3.01)
Male	1.008*** (3.00)	1.010*** (3.45)	1.016*** (3.56)
Income below median	1.005** (2.55)	1.007*** (3.25)	1.010*** (2.71)
Income above median	1.012*** (3.58)	1.015*** (4.06)	1.030*** (4.26)
<i>Heart Health</i>			
Female	1.004 (0.67)	1.004 (0.73)	1.002 (0.25)
Male	1.012** (2.34)	1.013** (2.50)	1.022*** (2.96)
Income below median	1.004 (0.98)	1.005 (1.13)	1.008 (1.36)
Income above median	1.019** (2.52)	1.020*** (2.59)	1.040*** (3.46)
<i>Stomach Health</i>			
Female	1.013*** (3.37)	1.014*** (3.62)	1.020*** (3.84)
Male	1.011** (1.98)	1.012** (2.19)	1.016* (1.93)
Income below median	1.010*** (2.90)	1.011*** (3.08)	1.023*** (4.23)
Income above median	1.017*** (2.66)	1.018*** (2.81)	1.033*** (4.47)
<i>Anxiety/Depression Health</i>			
Female	1.011*** (3.00)	1.012*** (3.34)	1.016*** (3.02)
Male	1.006 (0.89)	1.006 (0.89)	1.018* (1.90)
Income below median	1.010*** (3.13)	1.012*** (3.50)	1.021*** (3.68)
Income above median	1.005 (0.55)	1.006 (0.65)	1.002 (0.18)

Breathing Health

Female	1.007 (1.53)	1.008 (1.61)	1.020** (2.22)
Male	1.010** (1.99)	1.010** (2.08)	1.022*** (3.16)
Income below median	1.006 (1.57)	1.007* (1.67)	1.005 (1.11)
Income above median	1.015** (2.43)	1.016** (2.58)	1.018** (2.25)

Migraine Health

Female	1.008*** (2.62)	1.010*** (3.11)	1.011*** (2.71)
Male	1.007 (0.99)	1.006 (0.88)	1.011 (0.93)
Income below median	1.008*** (2.75)	1.010*** (3.16)	1.012*** (3.44)
Income above median	1.009 (1.15)	1.009 (1.17)	1.005 (0.52)

Skin/Allergy Health

Female	1.010*** (3.01)	1.012*** (3.55)	1.020*** (4.09)
Male	1.007 (1.36)	1.008 (1.45)	1.019** (2.49)
Income below median	1.010*** (3.29)	1.012*** (3.68)	1.022*** (4.46)
Income above median	1.008 (1.11)	1.008 (1.22)	1.018 (1.32)

'Other' Health Conditions

Female	1.009** (2.56)	1.010*** (2.71)	1.020*** (4.38)
Male	1.001 (0.15)	1.002 (0.28)	0.999 (-0.12)
Income below median	1.009** (2.49)	1.010*** (2.60)	1.018*** (3.21)
Income above median	1.005 (0.63)	1.006 (0.77)	1.007 (0.78)

Notes: Numbers in parentheses are asymptotic z-statistics. All coefficients have been converted to odds ratios. *, ** and *** indicate 10%, 5% and 1% significance, respectively. All regressions include the covariates in Table 1.

Table 4. Odds Ratio for Percent of Time Spent on Flexible Employment for those in Sample for at Least Five Waves

Sample	Cox	Prentice-Gloeckler (hshaz)	
		without frailty	with frailty
Subjective Health	1.012*** (3.04)	1.014*** (4.68)	1.025*** (3.14)
Heart Health	1.006 (0.69)	1.008 (0.94)	0.987 (-0.80)
Stomach Health	1.019*** (3.22)	1.021*** (3.61)	1.035*** (4.36)
Anxiety/Depression Health	1.006 (0.64)	1.008 (0.92)	0.996 (-0.22)
Breathing Health	1.019*** (3.70)	1.013*** (2.69)	1.029*** (4.25)
Migraine Health	1.016* (1.76)	1.021** (2.48)	1.032*** (2.99)
Skin/Allergy Health	1.011 (1.50)	1.016** (2.35)	1.020* (1.91)
'Other' Health Conditions	1.018*** (3.80)	1.020*** (4.31)	1.034*** (4.18)

Numbers in parentheses are asymptotic z-statistics. All coefficients have been converted to odds ratios. *, ** and *** indicate 10%, 5% and 1% significance, respectively. All regressions include the covariates in Table 1.

Table 5. Odds Ratios for Regressions Allowing for Nonwork

Sample and Variable	Cox	Prentice-Gloeckler (hshaz)	
		without frailty	with frailty
<i>Subjective Health</i>			
% of time in flexible employment	1.005*** (3.40)	1.005*** (3.80)	1.008*** (3.77)
% of time in nonwork	0.991*** (-9.22)	0.990*** (-10.17)	0.984*** (-10.19)
<i>Heart Health</i>			
% of time in flexible employment	1.004* (1.50)	1.004 (1.59)	1.004 (1.20)
% of time in nonwork	0.995*** (-4.07)	0.995*** (-4.13)	0.990*** (-4.88)
<i>Stomach Health</i>			
% of time in flexible employment	1.014*** (6.26)	1.014*** (6.48)	1.017*** (4.30)
% of time in nonwork	0.994*** (-3.66)	0.994*** (-3.76)	0.990*** (-4.75)
<i>Anxiety/Depression Health</i>			
% of time in flexible employment	1.007*** (3.04)	1.008*** (3.20)	1.009*** (2.65)
% of time in nonwork	0.993*** (-4.88)	0.993*** (-4.96)	0.989*** (-5.23)
<i>Breathing Health</i>			
% of time in flexible employment	1.006** (2.17)	1.006** (2.21)	1.010** (2.47)
% of time in nonwork	0.991*** (-5.70)	0.991*** (-5.79)	0.986*** (-5.84)
<i>Migraine Health</i>			
% of time in flexible employment	1.006** (2.25)	1.006** (2.25)	1.007** (2.51)
% of time in nonwork	0.986*** (-8.05)	0.985*** (-8.30)	0.983*** (-7.92)
<i>Skin/Allergy Health</i>			
% of time in flexible employment	1.007*** (2.96)	1.007*** (3.09)	1.011*** (3.37)
% of time in nonwork	0.990*** (-7.10)	0.989*** (-7.38)	0.981*** (-7.49)
<i>'Other' Health Conditions</i>			
% of time in flexible employment	1.004 (1.36)	1.004 (1.44)	1.004 (1.08)
% of time in nonwork	0.988*** (-7.78)	0.988*** (-7.98)	0.983*** (-7.61)

Numbers in parentheses are asymptotic z-statistics. All coefficients have been converted to odds ratios. ** and *** indicate 5% and 1% significance, respectively. All regressions include the covariates in Table 1.

Table 6. Odds Ratios on Percent of Time Spent on a Flexible Contract Hazard Regressions for the Objective Health Measures Robustness Check Including Past Health

Sample	Cox	Prentice-Gloeckler (hshaz)	
		without frailty	with frailty
<i>Subjective Health</i>			
All Waves	1.006*** (3.59)	1.008*** (4.20)	1.013*** (4.55)
Last 13 Waves	1.009** (2.55)	1.011*** (2.99)	1.012*** (2.75)
With past health	1.010*** (2.67)	0.984*** (-9.01)	1.011*** (3.06)
<i>Heart Health</i>			
All Waves	1.008** (2.02)	1.008** (2.16)	1.011** (1.96)
Last 13 Waves	1.015*** (4.53)	1.017*** (4.95)	1.031*** (4.26)
With past health	1.015*** (4.33)	1.017*** (4.88)	1.029*** (4.14)
<i>Stomach Health</i>			
All Waves	1.012*** (3.96)	1.013*** (4.24)	1.018*** (4.05)
Last 13 Waves	1.020*** (7.83)	1.021*** (8.29)	1.032*** (7.16)
With past health	1.020*** (7.89)	1.019*** (7.28)	1.026*** (5.93)
<i>Anxiety/Depression Health</i>			
All Waves	1.010*** (3.05)	1.010*** (3.32)	1.014*** (3.11)
Last 13 Waves	1.016*** (5.91)	1.017*** (6.50)	1.030*** (5.79)
With past health	1.016*** (5.85)	1.012*** (4.51)	1.014*** (3.39)
<i>Breathing Health</i>			
All Waves	1.008** (2.52)	1.009*** (2.63)	1.010** (2.35)
Last 13 Waves	1.019*** (6.89)	1.020*** (7.37)	1.033*** (7.63)
With past health	1.019*** (6.80)	1.016*** (5.71)	1.025*** (4.55)
<i>Migraine Health</i>			
All Waves	1.008*** (2.84)	1.009*** (3.21)	1.009*** (3.21)
Last 13 Waves	1.010*** (3.40)	1.011*** (3.84)	1.012*** (3.25)
With past health	1.010*** (3.45)	1.009*** (2.89)	1.007* (1.75)

Skin/Allergy Health

All Waves	1.009*** (3.24)	1.010*** (3.58)	1.018*** (4.12)
Last 13 Waves	1.013*** (5.55)	1.015*** (6.28)	1.023*** (6.24)
With past health	1.013*** (5.50)	1.013*** (5.43)	1.018*** (5.76)

'Other' Health Conditions

All Waves	1.008** (2.42)	1.009*** (2.65)	1.015*** (3.20)
Last 13 Waves	1.018*** (5.52)	1.019*** (6.07)	1.031*** (5.59)
With past health	1.019*** (5.95)	1.021*** (6.41)	1.032*** (4.83)

Notes: Numbers in parentheses are asymptotic z-statistics. All coefficients have been converted to odds ratios. ** and *** indicate 5% and 1% significance, respectively. All regressions include the covariates in Table 1. 'With Past Health' regression includes a dummy if ill health (specific to the illness) in the first four waves of the BHPS.

Table 7. Odds Ratios on Percent of Time Spent on a Flexible Contract Hazard Regressions for the GHQ Stress Measures by Subsample

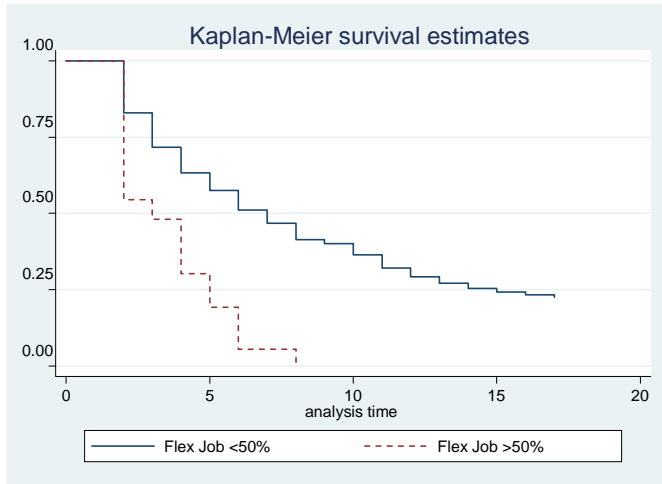
Health Illness and Sample	Cox	Prentice-Gloeckler (hshaz)	
		without frailty	with frailty
<i>Sleep (n=2,718)</i>			
Full sample	1.005*** (3.02)	1.006*** (3.76)	1.008*** (3.28)
Female	1.006*** (2.89)	1.008*** (3.65)	1.010*** (3.42)
Male	1.003 (1.04)	1.004 (1.33)	1.006 (0.85)
Income below median	1.007*** (3.52)	1.008*** (4.55)	1.010*** (3.82)
Income above median	0.999 (-0.21)	1.000 (-0.10)	1.002 (0.34)
<i>Decision Making (n=2,608)</i>			
Full Sample	1.007*** (2.94)	1.007*** (3.14)	1.013*** (3.61)
Female	1.000 (0.11)	1.001 (0.19)	1.003 (0.53)
Male	1.023*** (4.27)	1.013*** (4.52)	1.024*** (5.10)
Income below median	1.005* (1.87)	1.006** (2.12)	1.011*** (3.00)
Income above median	1.011** (2.56)	1.012*** (2.75)	1.022*** (4.09)
<i>Under Strain (n=2,504)</i>			
Full Sample	1.004** (2.58)	1.005*** (3.30)	1.006*** (2.71)
Female	1.004* (1.91)	1.005** (2.30)	1.008** (2.58)
Male	1.005** (1.96)	1.006*** (2.63)	1.009* (1.69)
Income below median	1.004* (1.91)	1.005** (2.50)	1.009*** (2.68)
Income above median	1.005* (1.75)	1.006** (2.37)	1.004 (1.22)
<i>Overcome Difficulties (n=2,668)</i>			
Full Sample	1.008*** (5.13)	1.009*** (5.84)	1.015*** (4.63)
Female	1.010*** (4.91)	1.012*** (5.63)	1.018*** (4.74)
Male	1.006** (2.41)	1.007*** (2.75)	1.008 (1.57)
Income below median	1.008*** (4.34)	1.009*** (5.09)	1.014*** (3.86)
Income above median	1.010*** (2.83)	1.011*** (3.21)	1.021*** (4.49)

<i>Lose Confidence (n=2,620)</i>			
Full Sample	1.007*** (3.50)	1.007*** (3.84)	1.011*** (3.96)
Female	1.005** (2.04)	1.006** (2.29)	1.008 (1.43)
Male	1.009*** (3.04)	1.010*** (3.30)	1.015*** (3.44)
Income below median	1.005** (2.16)	1.006** (2.46)	1.009** (2.15)
Income above median	1.012*** (3.53)	1.013*** (3.91)	1.018*** (4.34)
<i>Happiness (n=2,663)</i>			
Full Sample	1.006*** (3.42)	1.007*** (3.99)	1.011*** (4.00)
Female	1.006** (2.55)	1.006*** (3.03)	1.011*** (2.67)
Male	1.007*** (2.61)	1.008*** (3.10)	1.012** (2.57)
Income below median	1.005** (2.49)	1.006*** (2.99)	1.009*** (2.92)
Income above median	1.008** (2.53)	1.009*** (3.05)	1.019*** (4.42)

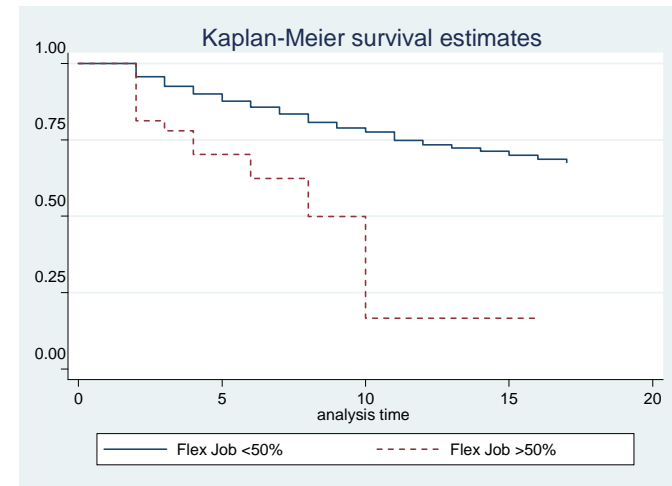
Notes: Numbers in parentheses are asymptotic z-statistics. All coefficients have been converted to odds ratios. *, ** and *** indicate 10%, 5% and 1% significance, respectively. All regressions include the covariates in Table 1.

Figure 1: Survival Plot for Health Measures

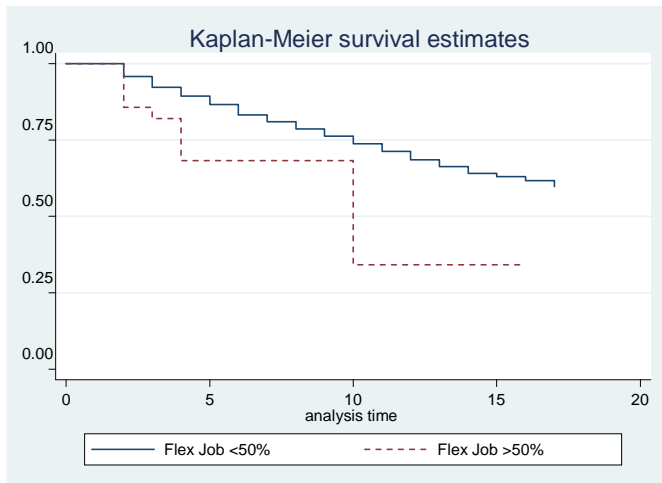
Subjective Health



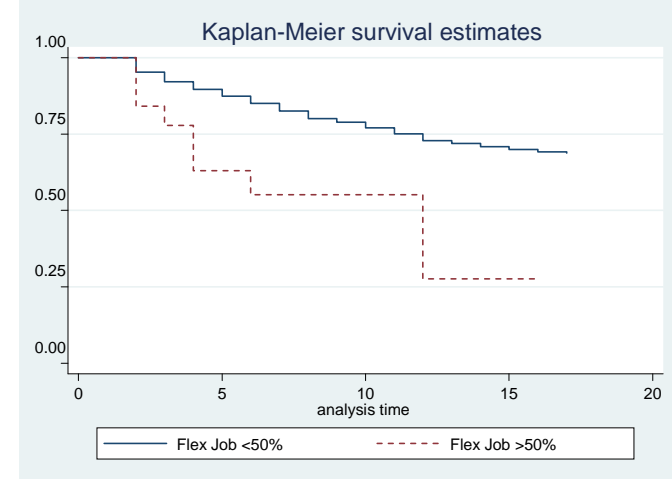
Stomach Health



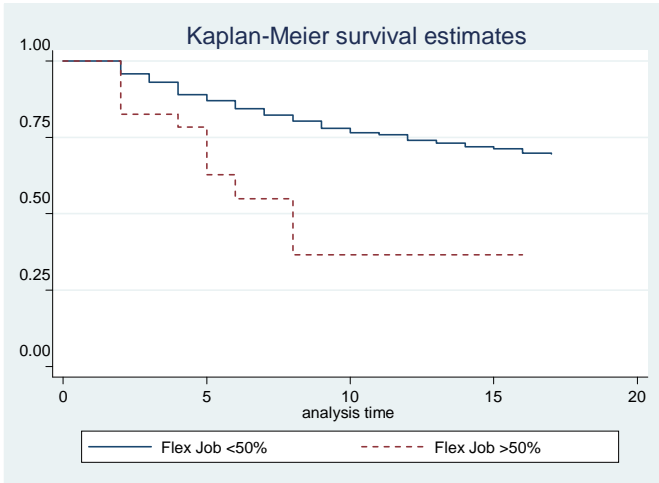
Heart Health



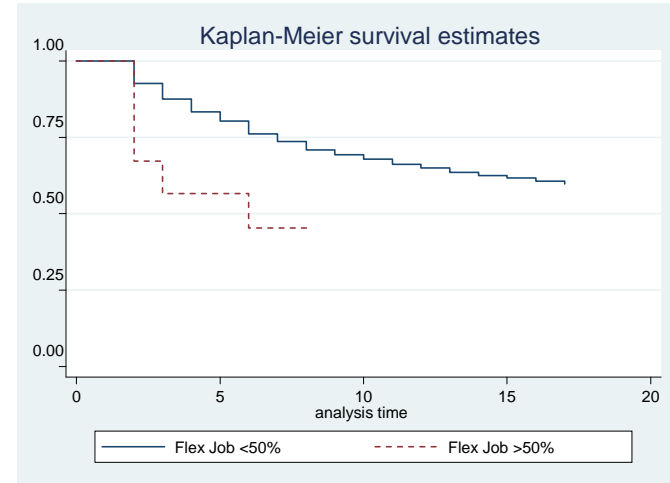
Anxiety/Depression Health



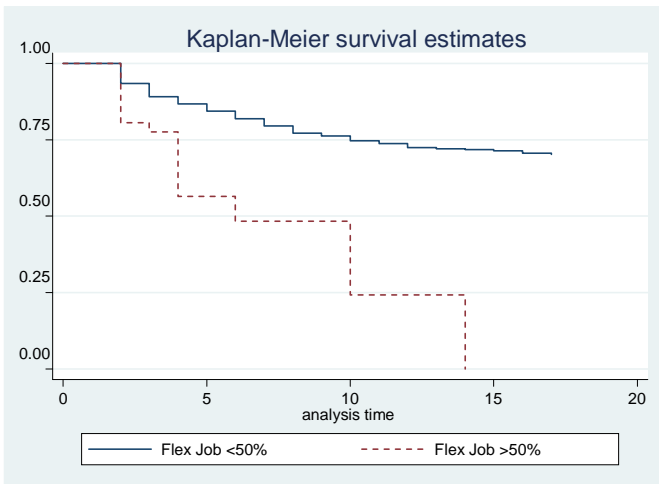
Breathing Health



Skin/Allergy Health



Migraine Health



'Other' Health Conditions

