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Employment insecurity and employees' health in Denmark

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1. INTRODUCTION

Over the past two decades, higher foreign competition and institutional reforms aimed at increasing labour market flexibility induced deep firms' restructuring processes that modified the economic environment of many European countries, often resulting in higher levels of perceived employment insecurity (Cappelli *et al*., 1997).

Perceived insecurity is an internal feeling and not an actual event like job loss or unemployment, but an individual worried about losing a job or to be not easily re-employed may experience stress, mental strain and uncertainty for the future due to the anticipation of the consequences of an actual job loss. Often, these circumstances can be as stressful as actual working problems or unemployment episodes (e.g. Dickerson and Green, 2012).

Employment insecurity – as the OECD (2004) defines all job-related perceived uncertainty - has two main domains. The first is job insecurity, related for example to the fear of losing one's job. The second is employability, i.e. the ability of workers to find new jobs if current ones are lost.

In general, a high level of perceived employment insecurity poses key policy challenges as it may *di per se* affect various dimensions of employees' wellbeing, causing higher stress levels, lower mental health and lower productivity (Cottini and Lucifora, 2013; OECD, 2008).

We use register data from Denmark (IDA) merged with the Danish Work Environment Cohort Survey (1995-2000-2005) to estimate the effect of perceived employment insecurity on two dimensions of perceived health: the first is an energy-vitality scale measuring general wellbeing; the second is a mental health scale, which under given thresholds measures severe psychological distress. We measure employment insecurity, first, by a summary index; second, by three dummies that capture job and employability insecurities.

In the literature, job-related insecurity is measured typically in terms of the fear of losing the current job (job tenure insecurity, according to Gallie *et al*., 2016). Many papers find a negative association between job insecurity and mental health or wellbeing (Bugard et al., 2009; Burchell, 1994; Cheng et al., 2005; Ferrie et al., 2001; Ferrie et al., 2005; Laszlo et al., 2010; Nolan et al., 2000). Others found negative effects on physical health (Dooley et al., 1987; Kuhnert et al., 1989), and that perceived job insecurity is a source of low job satisfaction (Origo and Pagani, 2009; Bardasi and Francesconi, 2004, Llena-Nozal, 2009). The negative effect of job worries spans also to spouses' mental health (Bunnings et al. 2017).

Being easily re-employable is positively associated with health and well-being, and negatively with the fear of job loss (Otterbach and Sousa-Poza, 2016; De Cuyper et al., 2008; Berntson and Marklund, 2007). Green (2011) finds that employability strongly moderates the effects of unemployment and of job insecurity on life satisfaction and mental health. Knabe and Ratzel (2010) estimate the effect of job insecurity (among the employed) and perceived reemployment chances (among the unemployed) on life satisfaction. They find future job expectations at least as important as the current employment status.

Another important dimension of job insecurity is internal mobility, i.e. being transferred within the firm to a different position. Because of firm's policies due to e.g. re-organization, outsourcing or takeovers, such job status insecurity was increasing in Europe in the last two decades, but there is little scientific evidence about its effects on workers' health and wellbeing (Gallie *et al*. 2016; Green, 2015; Madsen, 2001, 2013).

We contribute to the literature in two respects. First, we use the OECD definition of employment insecurity, which is a broader than job insecurity and explicitly accounts for employability insecurity. We consider both job status and job tenure insecurity. With employability, they are the main channels through which work-related uncertainty affects

health. Second, we combine alternative empirical approaches, including instrumental variables and fixed effects, to address several endogeneity sources, including reverse causality and omitted variables bias.

Only few papers deal with the endogeneity of employment insecurity. Caroli and Godard (2014) use cross-sectional data on male employees in 22 European countries to estimate the causal effect of job insecurity on health. Their instruments are interactions of employment protection (at the country level) and U.S. aggregate data on dismissal rates (at the industry level). They find that job insecurity negatively affects only a limited subgroup of health outcomes. Overall, instrumental variables estimates are more negative than standard probits.

Using a panel of German workers and fixed effects models, Reichert and Tauchmann (2017) find, first, that objective job insecurity (self-reported staff reduction at the firm level) negatively affects mental health. Second, that objective insecurity has a significant impact on subjective job insecurity. The ratio between the two effects is the instrumental variables estimate of perceived job insecurity on health, with objective insecurity used as instrument for job worries. Being job insecure reduces mental health from the median to the 35th percentile of the health distribution. This effect may not be causal because other mediating channels of objective insecurity may play a role, including employability insecurity.

We use register data on workforce changes at the firm level as a source of exogenous variation for employment insecurity. Unlike self-reported measures of workforce changes, objective ones do not correlate with self-reported health measures, which is key for instruments validity. Because workforce volatility is the only exclusion restriction available, we use instrumental variables only with the employment insecurity index. At the cost of a less detailed analysis, assuming endogeneity of the index is the simplest way to allow for endogeneity in all the three dimensions of insecurity. Further, our instrument may exert an

impact on each of them, which are all potential mediating channels of objective insecurity. This reduces the likelihood of one specific dimension driving results.

Section 2 presents the data. Section 3 introduces the empirical model and discusses estimation methods and identification strategies. Section 4 presents main results and robustness analysis. Section 5 concludes.

2. DATA

We use data from two different sources matched through individual identifiers. First, panel data collected every 5 years from 1990 to 2005 by the National Research Center for the Working Environment that is the 'The Danish Work Environment Cohort Study (DWECS)'. The survey contains information on several aspects of the work environment, including workers' subjective evaluation of employments risks and insecurity, as well as on health outcomes, and other firm and personal characteristics. For our purposes, we focus only on 1995, 2000 and 2005 since the full set of variables for employment insecurity and health is available only for these years.

Second, we use Statistics Denmark Integrated Labour Market Database (IDA), which is the matched employer-employee archive comprising the Danish population of individual and establishment administrative records together with background characteristics. Danish administrative registers record individual annual earnings as well as demographic and firm characteristics, including firm size. Even though IDA comprises the whole population of Danish firms and workers, when matched to the longitudinal component of DWECS the resulting unbalanced panel dataset contains 3,764 employees for 8,992 observations.

Our main outcomes are two health-related variables based on subscales of the Short Form Health Status Survey (36 items, SF-36) (Kristensen *et al*., 2002; Kristensen *et al.*, 2005; Rugulies *et al*., 2006). SF-36 measures perceived health and it is an accepted instrument for

evaluating different dimensions of health (Ware and Gandek, 1998). The DWECS contains two subscales of the SF-36. The first is the energy/vitality scale, constructed adding up the score to the following 4 items: "How much of the time during last month: you felt full of pep/with lot of energy/worn out/tired". The answers range from 1 ('All of the time') to 6 ('none of the time'). We inverted the scoring of the first two variables to measure wellbeing in the positive direction. The resulting score has been normalized to vary between 0 (low health) and 100 (high health). The energy-vitality score is useful to evaluate the overall wellbeing of employees. Low values of our EVI (Energy-Vitality Index) variable measure mental or physical exhaustion and fatigue.

The second is the so-called Mental Health Inventory (MHI-5) subscale, which captures impairment due to mental health problems. A low rate of our Mental Health index (MHI) is associated with high psychological distress and a high rate with low distress. The MHI-5 contains these five questions: 'How much of the time during last month you felt: nervous/down/blue/not happy/not calm and peaceful?'.

The internal consistency (alpha coefficients) of both EVI and MHI scales is good (0.8 for MHI and 0.82 for EVI) and produces reliable Cronbach's alpha values (Bland and Altman, 1997). A number of validation studies for northern European countries (including Denmark) show that a value below or equal the cut-off point 72 (psychological distress) in the MHI is highly correlated with psychological disorders such as anxiety and depression (Thorsen et al. 2013).[1] In the MHI distribution, 72 correspond to the 10th percentile. We estimate a model specification with the psychological distress dummy defined in terms of the 72 cut-off point instead of MHI.

[1]We also experimented with an alternative threshold at 52, which however seems less relevant in the Danish context, but returned very similar results, which are available upon request from the authors.

For the EVI scale, an accepted validation is not available. Nonetheless, we define a dummy for exhaustion that is 1 when EVI scores is below or equal 50, which is the 10th percentile in the EVI distribution and entails an average item score of minimum 3, indicating a severe lack of energy or vitality at least 'a good bit of the time' in the last month. We also estimate a specification with this dummy in place of EVI.

For what concerns perceived employment insecurity, we first distinguish between 'job tenure insecurity', which is a dummy that takes value 1 if the worker mentions to 'worry about losing the current job', and the dummy 'job status insecurity', equal to one if the worker worries about the possibility of being 'Transferred to another work against will'.

We measure insecurity in the labour market by the dummy 'employability insecurity', which is equal to one if the worker declares it would be 'Difficult to find a new job with present qualifications (if the current one was lost)'.

These three measures capture different insecurity dimensions. We investigate on that, and as expected, the correlation between them is positive and statistically significant, but with rather small magnitude: that of job tenure insecurity is about 0.3 with both job status insecurity and employability insecurity. The correlation between the latter two is even smaller (0.17). Collinearity should not be a concern here. Then, we add up the three insecurity dummies to obtain the summary indicator 'employment insecurity index', which is our main key explanatory variable, ordered from 0 to 3, increasing in the number of insecurity dimensions[2].

[2]Using insecurity dimensions as a metric to define this index means that we give the same weight to each additional dimension. Since correlation between the three measures is low, we are confident an increase in the number of dimensions roughly reflects an increase in the level of perceived insecurity. We also experimented with principal component analysis to construct our summary indicator. The first principal component correlates at the 99% with our ordered summary index. Unsurprisingly, main results are qualitatively similar. We also constructed an employment insecurity dummy, equal to 1 if at least one dimension of insecurity out of three is present. The dummy is free from measurement and weighting issues. Also in this case the empirical analysis produces comparable results, that are available upon request from the authors.

We include controls for several job features, such as physical and psychosocial work characteristics (Caroli and Godard, 2014; Green and Mostafa, 2014). The first is measured by exposure to physical hazards; the second by work repetitiveness and social environment (social support from colleagues and supervisors). They also range 0 to 100 by adding up answers to single items. Their inclusion is important to control for changes in the working environment during the large time span between two interviews (five years).

We also control for individual and firm characteristics: gender, marital status, presence of children, educational levels, a set of age dummies, years of tenure and dummies for blue and white collars (that also includes the few managers). We further control for the natural logarithm of individual income, as well as for sector, size, regional and time dummies. A description of the main variables is shown in Table 1.

As suggested by existing studies, Danish employees experience high levels of mental health: the mean of MHI is 85, well above critical values (72) for psychosocial distress, and evidence for other countries (Green, 2011)[3]. The mean of the general wellbeing variable EVI is 73. Its dispersion is higher than MHI. About 15 percent of employees experience job tenure insecurity, which is comparable to the European average and higher than in other countries (Caroli and Godard, 2014; Green, 2011). The 23% of employees is insecure about re-employability.[4] About 63% of employees perceive no employment insecurity at all. For 23% of them insecurity is for one reason, for 9.4% is for two, and only 3.6% of them experience job tenure, job status and employability insecurity.

Table 2 provides unconditional differences in average health between individuals with different employment insecurity levels, over the three waves of the survey. Columns (1) and (3) show that, in any recorded year, average mental health and vitality are lower for

[3] Validation studies for the Danish SF-36: see Bjorner et al. (1998) among others.
[4] In countries like Australia where unlike Denmark there is not a 'flexicurity' system these numbers are higher (35%, see Green, 2011).

employees with higher employment insecurity. Sample differences increases over time, especially after 2000 and for the energy/vitality scale. For what concerns single items, health differences by job tenure insecurity were stable over time, whereas widened for job status insecurity especially in late '90s, and for employability after year 2000. Although of moderate magnitude compared to the sample standard deviation of mental health and vitality, many of these differences are statistically significant, indicating a link between perceived insecurity and health.

3. MODEL AND METHODS

3.1. Model

We assume the following population model for employees' health:

$$H_{it} = \alpha + \beta EI_{it} + \gamma_t + \delta_i + \lambda_{it} + \varepsilon_{it} \quad [1]$$

Hit is health of *i*-th employee at time *t*, EI_{it} is employment insecurity, either the employment insecurity index or the three insecurity dummies. For concreteness, the discussion refers to the employment insecurity index. The parameter of interest is β, which measures the causal effect of *EI* on *H*. We leave implicit conditioning on additional exogenous variables. γ_t captures health time trends. The individual intercepts δ_i control for time-invariant unobservables, omitted from the empirical specification. These include workers' attitudes (ability, risk aversion, intrinsic optimism), lifestyles, characteristics of the family as well as working conditions constant over time. λ_{it} controls for time-varying omitted variables. We may further distinguish between: $\lambda_{it} = \theta_{j(it)} + \phi_{it}$, where $\theta_{j(it)}$ is the fixed effect of the *j*-th firm into which the *i*-th individual is employed at time *t*. For individuals, firm fixed effects control for variability in job-related characteristics due to a firm change. ϕ_{it} captures individual or firm unobservable factors that vary over time.

Subjective employment insecurity may be itself function of health. For example, individuals who suffer from health problems may rate their employability perspectives lower than who is in good health, simply because their health status increases the probability of job losses or not being easily re-employable in the future. We model this relationship adding a second equation for employment insecurity to eq. [1]:

$$EI_{it} = a + bH_{it} + qZ_{it} + d_i + g_t + l_{it} + e_{it} \quad [2]$$

Except *Z* (variables excluded from eq. [1]) we assume identical explanatory variables in both equations. Substituting eq. [1] in eq. [2] we get the reduced form of EI_{it}. Its error term is: $\eta = \pi_0 \varepsilon_{it} + \pi_1 e_{it}$ with $\pi_0 = \frac{b}{1-b\beta}$; $\pi_1 = \frac{1}{1-b\beta}$. The coefficients π_0 and π_1 play an important role for the simultaneity bias, as discussed below.

3.2. Methods

There are three main threads to the identification of β. The first is the omitted variable bias due to time-invariant unobservables. Typical examples of omitted individual traits are risk-aversion and intrinsic pessimism, which would induce employees to report lower health and higher insecurity than the average employee. Further, good quality firms with lower job insecurity may attract employees with on average better health.

The second bias is due to the omission of time variant individual and firm unobservable health determinants that also correlate with perceived insecurity. For example, severe illness in a close relative may decrease employees' well-being and increase stress levels, and simultaneously lead to higher self-perceived job or employability insecurity (e.g. because the relative needs care, leading to higher absenteeism and, hence, higher risks of job lost). Another example is risky working conditions. If they change over time, they may increase job

insecurity and produce high job strain and lower mental health. In all of these circumstances, the bias due to both time-variant and time-invariant omitted variables is likely to be negative.[5]

Reverse causality arises if b in eq. [2] is not zero. Then, EI_{it} is function of ε_{it}. The sign of the simultaneity bias depends on π_0: $cov(EI_{it}, \varepsilon_{it}|\delta_i, \gamma_t, \lambda_{it}) = \pi_0 var(\varepsilon_{it}|\delta_i, \gamma_t, \lambda_{it}) = \frac{b}{1-b\beta}\sigma^2_{\varepsilon|\delta,\gamma,\lambda}$. In general, we expect b and β being both negative. $b < 0$ because a negative health shock reduces current and future work-related prospects, thus increasing perceived insecurity. This implies that the simultaneity bias is positive.[6]

We first estimate the health equations by benchmark OLS. The composite error is: $v_{it} = \delta_i + \lambda_{it} + \varepsilon_{it}$, so that results are affected by all the three sources of bias. We then move to the individual fixed effect (FE) model. Person-specific intercepts δ_i now control for time-invariant heterogeneity and the associated bias. The composite error term is: $\omega_{it} = \lambda_{it} + \varepsilon_{it}$, meaning that FE are biased by reverse causality and correlation between the within individuals components of insecurity and time-variant omitted variables. Purged by the negative time-invariant omitted variables bias, FE estimates of β are likely to be less negative than OLS (smaller coefficient, in absolute terms).

Instrumental variables-fixed effects (IV-FE) tackle the correlation between ω_{it} and EI_{it}. Once time invariant heterogeneity is removed by individual intercepts, instrumental variables are applied to a model with variables transformed in deviations from their individual's means. Instruments can freely correlate with time invariant individual heterogeneity, but need to be exogenous to ω_{it}. The instrumental variables for the endogenous regressor should vary within

[5] Another circumstance that may create a negative bias occurs when cautious employees invest more in health through more healthy lifestyles and sort into firms with less risky working conditions. Instead, the bias may be positive if unhealthy employees sort into more secure firms (e.g. disabled individuals in the public sector) or safer working conditions.

[6] The possibility of a negative bias cannot be completely ruled out, but is seems less plausible, because it requires $b\beta < 1$. This happens if both coefficients are negative but small, or if one of the two is small enough. A tiny b, which may be interpreted as evidence of 'innocuous' or negligible reverse causality, may produce a substantial bias, even changing its direction.

individuals over time. Time-demeaned instruments must correlate with time-demeaned individual insecurity, within individuals. Moving from population to sample moments, this correlation must also be statistically significantly to avoid weak instruments' problems.[7]

Further, we exploit the matched (persons and firm) longitudinal nature of our data, and estimate a FE model with both individual and firm specific intercepts $\theta_{j(it)}$. The error term is: $u_{it} = \phi_{it} + \varepsilon_{it}$, and the model is potentially biased by reverse causality and time-variant unobserved heterogeneity. Cleaning for firm-specific unobserved heterogeneity that is likely to produce a negative bias, individual and firm fixed effects FE estimates may be on average even higher than FE. Firm fixed effects are identified separately only for employees who change firm over time. Adding these effects may be relevant especially in Denmark, where job mobility is higher than in other countries.

We estimate the individual and firm FE model also by instrumental variables. In this case, the instruments can freely correlate also with firm effects. Identification requires enough correlation between *Z* and *EI* at the within individual and within firms level. Depending on the instrument, this may be difficult to achieve since data are such disaggregated that their variability may not be large enough.

3.2.1. Instruments

We use percentage changes in firm's workforce between the survey year and the year before, and use it as exogenous variation for the employment insecurity index. We construct this variable using register data and then attach it to employees interviewed in the survey through the firm identifier.

One caveat is that workforce changes are defined only for firms existing also the year before the survey. For newborn firms - about 8 percent in the sample - this information is

[7] This is equivalent to the two-stage least squares requirement that the first stage exists.

missing. We have 7,634 observations with information on workforce reduction, corresponding to 3,336 employees. IV estimates use this reduced sample, whereas we use the whole sample for OLS and fixed effects estimates. As a robustness check, we will also present OLS and FE results from the reduced sample.

We discretize percentage workforce changes into four categories, which also identifies four binary variables that are our instruments: high increase (larger or equal than +30 percent); low increase (larger or equal than zero and smaller than +30 percent); low decrease (smaller than zero 0 and larger or equal than –30 percent); high decrease (smaller than -30 percent).[8] They account for both positive and negative staff changes, and for the scale of the change (low increases of reductions vs high increases or reductions).[9] This combination guarantees both a reasonable level of detail and a decent number of observations per cell, and ensures enough variability within individuals over time.

To set a threshold for big workforce changes we borrow from papers using mass layoffs, which are defined as employment reductions by 30 percent or more with respect to previous year (see Jacobsen, Lalonde, and Sullivan, 1993; Black et al. 2015). For our purposes, we apply this 30 percent threshold to both positive and negative workforce changes.

Other papers in the literature used similar instruments. Caroli and Godard (2014) look only at average workforce negative changes, computed at the industry level. Reichert and Tauchmann (2017) use a staff reduction dummy, which only considers whether the sign of the change is positive (or zero) vs negative. We consider both the sign (workforce stability or

[8] We create these dummy variables because using the original continuous variable of changes in firms' workforce would imply, first, constant (marginal) effects of workforce changes on insecurity over the whole distribution of the former, which is a restrictive assumption not supported by the data and by the literature on massive layoffs. Second, it would capture insecurity responses of employees to marginal changes in firm's workforce, which are likely to be negligible, as employees are expected to adapt insecurity perceptions mostly to sizeable staff changes.

[9] In our dataset, collapsed at the firm level, only 3.5 percent of firms reduced the workforce by more than 30 percent, around 30 percent between 0 and 30 percent. About half of them kept stable the workforce of increased it less than 30 percent, and the remaining 13 percent increased employees by more than 30 percent.

increase vs reduction) and the size (big vs small) of the change. The latter proxies for workforce volatility, which is also likely to affect insecurity perceptions through higher uncertainty.

With this set of instruments, IV-FE estimates of β are arguably robust to reverse causality. We require that firm-level workforce changes are exogenous from the employee perspective. Even if poor health may reduce individual productivity, possibly resulting in a job loss, we are assuming this does not map into the productivity of co-workers, at least not at a scale that imply sizeable changes in the firm workforce.

Instruments' validity also requires that fixed effects captures all the correlation between workforce changes and health, such that instruments are not correlated with any time-varying omitted health determinants.[10] This would exclude, for example, endogenous firm's selection based on workforce volatility, i.e. that any given employee hurt by a negative health shock would dynamically self-select into another firm with a lower level of workforce volatility. This may be the case for some employees. However, it appears quite implausible that what explains individual mobility are changes in individuals' health correlated with firm workforce changes.[11]

4. RESULTS

[10] Differently from Caroli and Godard (2014), this allows for potentially endogenous sorting by time invariant characteristics, for example that employees on average unhealthy sort into firms with on average lower workforce volatility.

[11] A potential thread to instrument validity is that, at the within-employee level, volatility in workforce changes might affect health through different channels, and not exclusively through (changes in) own employment insecurity (Bünnings et al., 2017). For example, changes in workforce variability may leave employment insecurity of a certain employee unchanged (because he or she knows he will retain his or her job and/or will not be subject to internal mobility), but increase the insecurity of his or her spouse (a less informed party), with negative consequences on employee's health. Another possibility is that large shocks to workforce changes may proxy for deep firm restructuring processes which, from the employee's perspective, may not affect employment insecurity but may imply reductions to other work dimensions relevant for health, for example workplace safety. While we are confident that these are residual cases and that our instruments provide plausibly exogenous variation, to the extent which channels other than employment insecurity are not controlled for by our set of individual, family and job-related attributes, our IV-FE estimates would capture the health effect of an even broader measure of job-related uncertainty than employment insecurity.

4.1. Baseline OLS and individual fixed effects

We first estimate the health equations by standard OLS (Table 3, columns 1 and 2 for MHI; 5 and 6 for EVI) and individual fixed effects (columns 3 and 4 for MHI, 7 and 8 for EVI). The coefficient of the employment insecurity index measures the absolute variation in the health scale induced by an additional insecurity dimension. Variation in health from no insecurity to insecurity in all the three dimensions is obtained multiplying the coefficient by three. To interpret the economic relevance of coefficients we compute the percentile shift they induce in the distribution of the outcome with respect to the median.

Both the summary employment insecurity index and all single indicators of insecurity are negatively associated with both general wellbeing and mental health. Moving from no insecurity to maximum insecurity is associated with a reduction in the mental health by -7.23, which is a sizeable change corresponding to a shift from the median (equal to 88) to the 25th percentile (equal to 80) of MHI.[12] In case of EVI, the cumulated naïve effect implies a median to 25th percentile shift.

Considering single insecurity dimensions, the fear of losing the job (job tenure insecurity) has a lower general wellbeing and, especially, lower mental health coefficient: -2.9 points for MHI versus -1.6 points for EVI. For the latter, job tenure insecurity matters more. Job status insecurity is relevant for both mental health and the general wellbeing of workers as well as employability insecurity.

OLS estimates just provide a general picture and a useful benchmark. Columns (3) – (4) and (7) – (8) of Table 3 present individual fixed effects results, robust to unobserved time invariant heterogeneity, for MHI and EVI, respectively. The point estimates are lower compared to the OLS models and in few cases statistical significance is lost, especially in the

[12] For example, the cumulative effect is calculated multiplying the coefficient by 3 that is -2.41x3 in the case of MHI and -2.85x3 in the case of EVI.

EVI equations. This is what we expect given that, according to the discussion of the previous section, OLS is expected to overestimate (in absolute terms) the true effect.

If we interpreted FE estimates as causal, it would be tempting to attribute the increase in estimated effects to the importance of time-invariant characteristics that, contrary to what expected, shift downward OLS estimates. In fact, it simply reflects that the direction of the bias is not the same across endogeneity sources and that they mix differently depending on the estimator.

4.2. Instrumental variables fixed effects

Individual fixed effects may not properly address time varying factors and reverse causality biases. We deal with this by IV-FE. Results are in Table 4. For the reasons outlined above, we estimate the model using only a specification with the employment insecurity index. Column (1) reports results for the first stage, while estimates for MHI and EVI are in columns (2) and (3) respectively.

First stage results show that variability in workforce changes and employees' perception about employment insecurity are correlated within individuals. This is especially true in cases of low and high increases (excluded category) of the workforce. With respect to the base category, the effect is not statistically significant only in the case of (zero to) low workforce decreases. The F-test on excluded variables is around 12.5, which is sufficient to avoid weak instruments[13]. When instrumenting the employment insecurity index, we find a negative and highly statistically significant coefficient for both MHI and EVI. The coefficient for MHI is -5.03, which implies a shift from the median to the 30th percentile in the MHI distribution when the employment insecurity index increases by one. Moreover, moving from no insecurity to maximum insecurity corresponds to a shift from the median to the 10th

[13] Using Stock-Yogo critical values, this is associated with a 5% maximum relative bias of IV with respect to FE.

percentile, which implied a consistent deterioration in perceived mental health. Similarly for EVI: the coefficient of -7.05 corresponds to a shift from the median to 25th percentile. Again, having maximum insecurity instead of none implies a shift to 10th percentile.

In absolute values, the estimated IV-FE coefficients exceed OLS and FE. As discussed in Section 3, this is consistent with the reverse causality bias being positive. Ignoring reverse causality and time varying unobserved heterogeneity leads to an underestimation of true effects. Similar results appear elsewhere in the literature, but for specific insecurity items not considering, for example, the contribution of employability insecurity (Caroli and Godard, 2014, Reichert and Tauchmann, 2017).

An alternative explanation is interpreting IV-FE results in terms of local average treatment effects. In such case, effects for employment insecurity would refer to individuals for whom workforce change is a key determinant for employment insecurity. They may not be representative of the whole population of Danish employees and more vulnerable to employment insecurity compared to others, but they may be a relevant group for policy makers (Reichert and Tauchmann, 2017).

Based on the comparison between FE and IV-FE results for the insecurity index, our guess is that FE results for the three insecurity dimensions are biased upward, so that true effects of job insecurity and employability may be even bigger (more negative) than in Table 3. We expect that FE results are lower bounds for true effects.

4.3. Psychological distress and Low Energy/Vitality dummies

The use of dummies for severe mental health problems and lack of energy or vitality as dependent variables is convenient because, differently to general MHI and EVI indexes, they capture specific conditions known to be detrimental to employees' well-being, such as severe psychological diseases. Results for OLS, FE and IV-FE are in Table 5, and show that

employment insecurity is positively associated with both severe mental health problems and severe lack of vitality or energy. Overall, individual FE coefficients are smaller than OLS.

All indices of employment insecurity are positively correlated with severe psychological distress (column 4). In this case, estimated coefficients measures the change in the probability of experiencing psychological distress induced by a shift from 0 to 1 in the associated insecurity dimension. Job tenure insecurity shows the highest naïve marginal effect (3.7 percentage points, versus 3.5 percentage points for employability insecurity). In the case of severe lack of energy/vitality, employability insecurity still counts most, with a marginal effect of 5 percentage points (column 9).

Finally, the more robust IV-FE estimations (columns 5 and 10) show that each additional dimension of insecurity increases the probability of developing severe mental health problems by 6.3 percentage points, while for severe lack of energy and vitality the effect is two times larger and is equal to 13.5 percentage points.

The IV-FE results suggest that the mental health and general well-being negative effect of employment insecurity is large enough to shift by a non-negligible amount the probability to develop mental disorders, with high personal and social costs.

4.4 Individual and firm fixed effects.

Before commenting results, few caveats. First, movers represent a substantial share of individuals included in the sample (70 percent), which is key for model identification and estimates precision, but may not be representative of Danish employees.[14] Second, firm-specific intercepts requires at least two movers (at any time) for each firm, and are available only for a limited subset of firms.

[14] Quitters (voluntary mobility) are likely to be positively selected: they are typically high skilled, with better employment prospects, low insecurity and can access firms with better working environments. By converse, selection is likely to be negative for the laid-off (involuntary mobile).

Results are shown in Table 6 and are very similar to those of fixed effects, both with and without instrumental variables. This suggests that standard time individual fixed effect models address with sufficient accuracy also time invariant firm heterogeneity, also in the case of movers. Neglecting the role of firm heterogeneity weakly overstate the effect of employment insecurity especially in the equation for mental health.

For psychological distress, results confirm that all three indicators of employment insecurity do matter, while in the case of general wellbeing only the effect for employability insecurity remains statistically significant.

As for instrumental variables estimates, we are perhaps asking too much to the data, and instruments become rather weak (F Test for weak instruments is below 10). It is likely that time invariant firm unobserved characteristics capture most of the correlation between workforce changes and employment insecurity. Hence, the results are not robust and their interpretation requires particular care. We find a substantial decrease by -6.81 points in the MHI induced by one additional unit of insecurity. Instead, the effect for EVI turns out statistically insignificant.

4.5. Robustness checks

With instrumental variables, we use only observations from individuals employed in firms that were present in registers in the year before the survey. As a robustness check, Table A1 present results obtained re-estimating OLS and FE models using the restricted IV sample. Results are substantially unchanged in terms of magnitude and statistical significance, suggesting that sorting into newborn firms is arguably exogenous in this context.

We also test the sensitivity of IV-FE results to alternative thresholds used to set exclusion restrictions. Instead of the 30 percent splitting rule, we use 25, 20, 15 up to 0 percent. In the latter case, instruments collapse into a single dummy for workforce reduction.

Results are in Table A2 of the Appendix. With the 20 and 25 percent thresholds, estimated effects are similar to our baseline specification (as shown in Table 4). Once getting close to the zero threshold, estimated effects become progressively less up to not statistically significant effects. This is the case of Set 5 when we use a dummy for any change bigger than zero in workforce size.

4. DISCUSSION

We analyse the relationship between perceived employment insecurity and self-reported mental health and general well-being using Danish register data matched with survey data over three waves that cover a period of 15 years. We account for the multidimensionality of employment insecurity, first, by a summary measure, which we use for causal analysis. Second, by three dummies, two for aspects of current job insecurity and one for future employability insecurity.

Based on fixed effects results, job and employability insecurity have a different naïve impact on health: uncertainty associated with the current job is important for mental health and might create a psychological burden for workers who suffer from it. In general, employability has a sizeable and encompassing relationship with health, and is the only insecurity dimension that matters for the energy and vitality scale. Danish employees who fear involuntary firm internal mobility, a dimension never explicitly considered before, experience worse mental health.

Instrumental variables use workforce changes occurred within the firm as exclusion restrictions. Results show that each additional dimension of insecurity causes a shift from the median to the 25th percentile in the mental health scale and to the 30th percentile in that of energy/vitality. Perhaps more importantly, any additional dimension of insecurity increases by about 6 percentage points the probability of experiencing depressive symptoms. Hence, the

cumulative effect of moving from no insecurity to worrying for both the current job and future employment prospects is 18 percentage points. This may be interpreted as the expected cost in terms of individual mental health of being hurt by a large negative economic shock that causes a large exogenous shift in perceived insecurity. Given that the mean of psychological distress is about 10 percent, the implied health reduction is substantial. IV results are in general higher than standard FE, suggesting that ignoring reverse causality may lead to underestimating true effects.

In the Danish system, we expected that flexicurity provided employees with enough insurance, limiting the wellbeing impact of work-related insecurities. Our results suggest that this may not be the case and that employees feel themselves not insured enough by the consequences of employment insecurity, especially of future re-employment prospects. Recent papers show that flexicurity is a source of significant health problems, especially in terms of greater sickness absence and increasing sickness benefits (Afzal et al, 2013). Our results suggest that employment insecurity may be one important mediating channel, through its consequences on psychological distress. Flexicurity may produce more efficient labour force allocations, but with unintended health costs, which impacts should be weighed more carefully in broader economic policy deliberations.

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TABLES

Table 1 – Main variables and descriptive statistics

Variable	Mean	S.D.	min	Max
Dependent variables:				
Mental Health Index MHI	85.69	12.12	0	100
Energy/Vitality Index EVI	73.03	17.19	0	100
Psychological distress (MHI<=72) (§)	0.097			
Lack of energy/vitality (EVI<=50) (#)	0.12			
Key explanatory variable: Employment insecurity index	0.527	0.807	0	3
Insecurity components:				
Job tenure insecurity	0.16			
Job status insecurity	0.14			
Employability insecurity	0.23			
Controls:				
Exposure to physical hazards	12.57	11.04	0	97.62
Repetitive tasks	27.06	19.74	0	100
Lack of social support	18.74	16.35	0	100
Female	0.49			
Low educ	0.20			
Middle educ	0.55			
High educ	0.25			
Age [18, 30)	0.16			
Age [30, 50)	0.60			
Age [50, 65)	0.24			
Has children	0.54			
Widow/separated/divorced	0.09			
Married/couple	0.63			
Single	0.28			
Hourly wage	208.3	65.01	5.55	570
Tenure (years)	6.71	6.96	1	41
If blue collar	0.51			
If white collar (including managers)	0.49			
Year 1995	0.34			
Year 2000	0.37			
Year 2005	0.29			
Resides in CPH region/Central DK	0.66			
Resides in Jutland	0.33			
N. obs	8,992			

Note: To save space, the distribution by sector and size dummies is available upon request. We report the Standard Deviation only for non-binary variables. (§)About 10% of the sample reports values of MHI below or equal 72 (validated threshold for psychological distress). (#) about 10% of the sample report a value of EVI lower than 50 (low general well-being).

Table 2 – Health and perceived insecurity: unadjusted differences and time trends

Dependent variable:	MHI				EVI			
	(1)		(2)		(3)		(4)	
Employment insec.	-1.95	***			-2.53	***		
Employment insec.*2000	-0.76	*			-0.91	*		
Employment insec.*2005	-1.56	***			-2.13	***		
Job tenure insec.			-3.29	***			-2.41	**
Job tenure insec.*2000			-0.87				1.01	
Job tenure insec.*2005			-0.90				-0.79	.
Job status insec.			-1.07	*			-1.83	**
Job status insec.*2000			-2.99	**			-3.26	**
Job status insec.*2005			-1.53				-1.45	
Employability insec.			-1.40	**			-3.14	***
Employability insec.*2000			-0.57				-0.97	
Employability insec.*2005			-2.16	**			-3.79	***

Note. Results from simple OLS regressions. Number of observations: 8,992. All regressions include a constant and year dummies for 2000 and 2005. The coefficients of the non-interacted variables refer to the baseline year (1995); that of interacted variables are deviations from the baseline year. *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.1.

Table 3 – Health (MHI and EVI) estimates by OLS and Individual Fixed Effects (FE)

Dependent variable:	MHI				EVI			
Estimation strategy:	OLS		FE		OLS		FE	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Employment insecurity index	-2.41 ***		-1.39 ***		-2.85 ***		-1.30 ***	
	0.18		0.20		0.24		0.27	
Job tenure insecurity		-2.86 ***		-1.81 ***		-1.61 ***		-0.88
		0.42		0.42		0.55		0.58
Job status insecurity		-1.72 ***		-0.67 *		-1.97 ***		-0.22
		0.42		0.40		0.57		0.59
Employability insecurity		-2.49 ***		-1.61 ***		-4.65 ***		-3.06 ***
		0.35		0.39		0.48		0.53
N. observations	8,992		8,992		8,992		8,992	
N. of individuals			3,764				3,764	

Note: The OLS regression includes controls for individual characteristics (gender, education, age, civil status, presence of children, lifestyles, region), job characteristics (white collar, blue collar, manager, tenure, tenure squared, wage), firm characteristics (sector and size dummies) and time dummies. Standard errors are clustered at the individual level. The FE regressions only include time-varying variables plus individual effects. FE estimates and statistics are from the 'reghdfe' command in Stata. *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.1.

Table 4 – Health (MHI and EVI) estimates by Instrumental Variables - Fixed Effects (IV – FE)

Dependent variable:	Employment insec. index (First stage)		MHI		EVI	
	(1)		(2)		(3)	
Employment insecurity index			-5.03	***	-7.05	***
			2.30		3.41	
Instruments						
Workforce % change:						
Low increase (0% =< change < 30%)	-0.11	***				
	0.03					
Low decrease (-30%=< change < 0%)	-0.02					
	0.03					
High decrease (change < -30%)	0.19	***				
	0.07					
F Test on excluded variables			12.45			
N. observations			7,634			
N. of individuals			3,336			

Note: See Tables 3 for controls included in the estimation. Estimates and statistics are from the 'reghdfe' command in Stata. Robust standard errors in parentheses. *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.1.

Table 5 – Psychological distress dummy (MHI<=72) and Lack of Energy/Vitality dummy (EVI<=50) models by OLS, FE and IV – FE.

Dependent variable:	Psychological distress (MHI<=72)					Lack of energy/vitality (EVI<=50)				
Estimation strategy:	OLS		FE		IV-FE	OLS		FE		IV-FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Employment insec. index	0.048 ***		0.028 ***		0.063 *	0.040 ***		0.020 ***		0.135 **
	0.005		0.005		0.038	0.012		0.006		0.070
Job tenure insecurity		0.061 ***		0.037 ***			0.019 *		0.003	
		0.011		0.011			0.011		0.013	
Job status insecurity		0.031 ***		0.009			0.040 ***		0.01	
		0.011		0.011			0.012		0.013	
Employability insecurity		0.048 ***		0.035 ***			0.077 ***		0.050 ***	
		0.009		0.010			0.01		0.011	
F Test on excluded variables					12.30					12.30
N. observations	8,992		8,992		7,634	8,992		8,992		7,634
N. of individuals			3,764		3,336			3,764		3,336

Note: See Tables 3 for controls included in the estimations. *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.1.

Table 6 –Health (MHI and EVI) estimates by Individual & Firm Fixed Effects

Dependent variable:	MHI			EVI		
Estimation strategy:	FE		IV-FE	FE		IV-FE
	(1)	(2)	(3)	(4)	(5)	(6)
Employment insecurity index	-1.47 ***		-6.81 *	-1.27 ***		-6.5
	0.25		3.89	0.35		4.9
Job tenure insecurity		-1.14 **			-0.05	
		0.57			0.79	
Job status insecurity		-1.33 ***			-0.14	
		0.55			0.76	
Employability insecurity		-1.87 ***			-3.35 ***	
		0.49			0.68	
F Test on excluded variables			4.81			4.81
N. observations	6,136		5,204		6,136	5,204
N. of individuals	2,632		2,327		2,632	2,327
N. of firms	543		351		543	351

Note: FE and IV-FE regressions only include time-varying variables plus individual and firm effects. Estimates and statistics are from the 'reghdfe' command in Stata. As compared to OLS and FE estimates, in the FE model the number of observations is smaller because only movers (individuals who change the firm over time) contribute to the estimates. The number of firms with movers is 1,403, but the number of fix effects is 543 because they can be estimated when there are at least 2 movers per firm. In the case of the IV-FE model, the number of observations is even smaller because, as explained in Table 4 notes, we exclude employees working in new firms, i.e. firms without employees the year before, because information on workforce reduction (which is used as a source of exogenous variation) was not available for them. Robust standard errors in parentheses. *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.1.

APPENDIX

Table A1 – Robustness : Health (MHI and EVI) models by OLS, FE and IV – FE, reduced sample.

Dependent variable:	MHI				EVI			
Estimation strategy:	OLS		FE		OLS		FE	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Employment insecurity index	-2.32 ***		-1.37 ***		-2.75 ***		-1.16 ***	
	0.19		0.21		0.26		0.29	
Job tenure insecurity		-2.55 ***		-1.73 ***		-1.38 ***		-0.55
		0.43		0.45		0.55		0.62
Job status insecurity		-1.81 ***		-0.49		-2.18 ***		-0.16
		0.45		0.47		0.62		0.65
Employability insecurity		-2.47 ***		-1.75 ***		-4.43 ***		-2.91 ***
		0.37		0.42		0.52		0.58
N. observations	7,634		7,634		7,634		7,634	
N. of individuals			3,336				3,764	

Note: See Tables 3 and 4 for controls included in the estimation. *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.1.

Table A2 – Sensitivity analysis of IV-FE results for MHI and EVI to alternative thresholds used to define the set of instruments

Coefficient for:	MHI		EVI		F test of excluded variables
	(1)		(2)		(3)
Alternative Instruments sets:					
Set 1: Workforce % change threshold +/- 25%	-5.36	**	-7.63	***	12.31
Set 2: Workforce change threshold +/- 20%	-3.81	*	-6.35	*	10.40
Set 3: Workforce change threshold +/- 15%	-2.00		-6.47	*	10.09
Set 4: Workforce change thresholds +/- 30% and +/- 15%	-5.36	**	-7.59	**	9.23
Set 5: Dummy for Workforce reduction (threshold +/- 0%)	-2.45		-1.13		15.59

Note: see Table 4 for controls included in the estimation. The different rows refer to different specification where we modified the thresholds used to defined workforce changes and the associated set of instruments as indicated.