

AN INSTRUMENTAL VARIABLE APPROACH TO UNEMPLOYMENT, PSYCHOLOGICAL HEALTH AND SOCIAL NORM EFFECTS

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ABSTRACT

This empirical study presents estimates of the impact of unemployment on psychological health using UK household panel data. The causal impact of unemployment is established using instrumental variable methods. Psychological health is measured using both the General Household Questionnaire measure and also self-reported data on individual occurrences of anxiety-related conditions. We find evidence for positive selection into unemployment on the basis of poor psychological health. Nevertheless, panel instrumental variable estimates suggest a sizeable causal worsening of psychological health arising from unemployment. We also find evidence that the negative impact of unemployment can be largely mitigated by local labour market conditions: those entering unemployment in localities with higher unemployment rates suffer less deterioration in their psychological health. Copyright © 2012 John Wiley & Sons, Ltd.

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1. INTRODUCTION

It is well known that the unemployed exhibit worse physical and mental health, by a variety of subjective and objective measures, compared with those who are employed (Clark and Oswald, 1994; Blanchflower, 1996; Korpi, 1997; Winkelmann and Winkelmann, 1998; Laporte, 2004; Hamilton *et al.*, 1997). Although it is plausible that unemployment affects an individual's health, a reverse causality might also exist, or both might be co-determined by unobserved factors such as lifestyle, culture or genetics. Studies in the economics literature typically attempt to overcome this reverse causality problem by exploiting exogenous unemployment events, such as mass lay-offs or firm closures (Browning *et al.*, 2006; Bockerman and Ilkka, 2009; Kassenboehmer and Haisken-DeNaw, 2009; Salm, 2009; Schmitz, 2010). Understanding causal links is an important issue as evidence suggests that deterioration in psychological health associated with unemployment leads to worsening health behaviours and even self-harm (Classen and Dunn, 2011; Davalos *et al.*, 2011).

A new literature on the social norms of health and well-being finds that the relationship between unemployment and an individual's psychological health is highly sensitive to the level of unemployment among a reference group, such as the local or household unemployment rate. An individual's unemployment is associated with less deterioration in psychological health where the local unemployment rate is higher (Clark, 2003). Hence, unemployment is a social norm against which an individual's evaluation of his or her psychological health is referenced, in much the same way as the literature on reference points in the labour supply decisions

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(Lindbeck *et al.*, 1999) or consumption choices (Blinder and Pesaran, 1998) find that individual behaviour is dependent upon the behaviour of other agents against which an agent implicitly or explicitly makes comparison. However, studies investigating social norm effects in the unemployment literature do not address the issue of reverse causality.

We make three new contributions. Firstly, we use an instrumental variable approach, whereas existing estimates of social norm effects of unemployment on psychological health in the existing literature might suffer reverse causality, in this study. It is likely that endogeneity is a particular concern in the social norms literature: if unemployment leads to less deterioration in psychological health in contexts of higher reference group unemployment rates, voluntary unemployment will be more likely in contexts where reference group unemployment is more prevalent. The existence of the social norm effect might itself explain individual transitions into unemployment. Using an instrumental variable methodology, we rule out reverse causality by using an instrument for unemployment transitions at the individual level on the basis of exogenous variation in the likelihood of unemployment across individuals (industry unemployment rates). We show that the effects of reference group unemployment on this deterioration in psychological health of approximately the same magnitude of those found in Clark (2003) are robust to the instrumental variable specification. It is estimated that a local unemployment rate of 15% provides a sufficiently high rate of reference group unemployment to offset the impact of involuntary unemployment on psychological health. We choose to define the reference group at a more local level (county) than the regional level used in Clark (2003) to test the sensitivity of the estimated effect to a more locally defined reference group.

Secondly, whereas existing studies using UK data have tended to use the General Health Questionnaire (GHQ) measure of psychological health, we also use an alternative indicator of psychological health: whether the individual is receiving medical treatment for an anxiety-related condition. Suffering anxiety as a medical condition is arguably a more serious and immediate indication of psychological stress than survey-based measures such as the GHQ. We show that most of the patterns in employment transitions and psychological health found using GHQ data are also seen in data on individual anxiety-related medical conditions, although there is weaker evidence for social norm effects in this alternative measure of psychological health.

Thirdly, we provide further evidence on the role of gender and age in the impact of unemployment on individual psychological health. Existing studies find evidence for both effects of unemployment on health: women typically experience less severe deterioration in their psychological health associated with unemployment compared with men (Schmitz, 2010), and older workers closer to retirement age experience milder impacts of unemployment on their psychological health compared with younger workers (for whom an early life unemployment event might lead to worse job prospects over a broader period of their working lives). Results show that there are statistically significant gender and age effects in the consequences of unemployment on psychological health, with middle-age men experiencing the worst psychological health effects of unemployment.

2. DATA AND SUMMARY STATISTICS

The data set used for this study comprises waves 1 to 18 of the British Household Panel Survey (BHPS), waves one to seven of which were used by Clark (2003). The BHPS is a general household survey incorporating approximately 10 000 individuals from 5000 British households interviewed on an annual basis. The panel includes data on a wide range of demographic and socio-economic characteristics including household labour market activity and history, labour and non-labour income plus a variety of subjective health data. From these data, it is possible to construct information on the labour market activity of each member of the household in each wave, as well as their labour market history. Of particular interest to this study is each individual's current labour market status.

We use two measures of psychological health contained in the survey. Firstly, in each wave, the BHPS includes the GHQ. The GHQ comprises series of 12 questions in which individuals are asked to identify how frequently they currently feel, relative to their normal state, depression, anxiety leading to insomnia,

inability to cope and a number of related feelings. Respondents can choose from ‘not at all’, ‘no more than usual’, ‘rather more than usual’ and ‘much more than usual’. The questions included in the GHQ refer to the individual’s current psychological state rather than life-long patterns.

Responses to the GHQ form the ‘GHQ caseness score’, also known as the ‘caseness GHQ’, a well-known measure of psychological health used in the medical and psychological literature and increasingly in the economics literature as a measure of ‘mental’ or ‘psychological’ health or ‘well-being’ (such as Clark, 2003). The GHQ caseness score is calculated by counting the number of cases in which an individual responds ‘rather more than usual’ or ‘much more than usual’ to the negative feelings and ‘rather more than usual’ or ‘much more than usual’ to the positive feelings. Hence, a score of 12 indicates that the individual reported that they feel each of the 12 feelings more (for the negative) or less (for the positive) than usual.

Secondly, in each wave, the BHPS questions respondents on their current medical conditions. In the health module of the survey, all adult respondents in the household are asked to identify the health problems or disabilities that they currently suffer from among those on a list. For our purposes, the most relevant of which for this analysis is ‘Anxiety, depression, bad nerves, psychiatric problems’. Respondents are asked to ignore temporary conditions when answering this question. We use answers to this question to construct an indicator variable that takes a dummy form with a value of 1 for yes and 0 for no.

Summary statistics on the relationship between labour market states and these measures of psychological health from the 18 waves of the BHPS are provided in Tables I and II. As detailed in Table I, of the 107 035 individuals of working age (16–64 years for men and 16–59 years for women) present in at least one of the 18 waves in the sample, a little over two-thirds are observed to be employed and nearly one-in-seven inactive (out of the labour force) and one-in-ten self-employed. The proportion of individuals incapacitated

Table I. Psychological health summary statistics by labour market status

	Proportion of sample (%)	GHQ12 score (0–12)	Suffers anxiety (0/1 dummy)
All individuals of working age	100	1.95 (3.08)	0.08 (0.27)
Employed	68	1.67 (2.80)	0.05 (0.22)
Self-employed	10	1.51 (2.63)	0.04 (0.21)
Inactive	15	2.81 (3.61)	0.16 (0.37)
Incapacitated	3.6	4.32 (4.17)	0.39 (0.49)
Unemployed	3.3	2.97 (3.76)	0.13 (0.33)

Sample: 107 035 individuals of working age present in at least one wave of the BHPS 1991–2009.

Table II. Psychological health summary statistics for employed individuals at time (t) by labour market status at ($t + 1$)

	Proportion of sample (%)	GHQ12 score			Suffers anxiety		
		t	$t + 1$	Change	t	$t + 1$	Change
Employed	93	1.62 (2.73)	1.66 (2.79)	0.04	0.05 (0.21)	0.05 (0.22)	0.00
Self-employed	2	1.58 (2.62)	1.55 (2.67)	–0.03	0.05 (0.22)	0.04 (0.20)	–0.01
Incapacitated	0.8	3.60 (4.02)	4.71 (4.39)	1.11	0.19 (0.40)	0.27 (0.45)	0.08
Inactive	3.3	2.15 (3.15)	2.70 (3.44)	0.55	0.08 (0.27)	0.10 (0.30)	0.02
Unemployed	1.5	2.53 (3.41)	3.65 (4.08)	1.12	0.08 (0.28)	0.13 (0.32)	0.05

Sample: 63 014 employed individuals who are presented in at least two consecutive waves of BHPS 1991–2009. Four percent of individuals who move into unemployment at $t + 1$ subsequently move onto incapacity benefit by $t + 4$.

(reporting they are off-work as a result of long-term sickness) is 3.6%, which is actually higher than the 3.3% of individual reporting they are currently unemployed. Over most of the sample period, the proportion of the working age population out of work due to ill health in the UK exceeded the proportion of the working age population out of work due to unemployment.

Employed or self-employed individuals typically exhibit the lowest caseness GHQ measures, implying they have the highest levels of psychological health. The average caseness GHQ score for an employed individual is 1.67 and for self-employed 1.51, implying that, within these groups, individuals typically report that they experience less than two of the negative feelings surveyed in the GHQ 'rather more than usual' or 'much more than usual'. The average GHQ score for those economically inactive is higher by 1.14 points. The unemployed on average exhibit a score 1.3 units higher than the employed, on average reporting experiencing three of the GHQ feelings 'rather more than usual' or 'much more than usual'. Those individuals who are long-term sick, the incapacitated, exhibit on average the highest GHQ score of 4.32.

Those in employment or self-employment also on average report the lowest rates of suffering anxiety, at 5% and 4%, respectively. In contrast, 39% of those incapacitated report suffering anxiety. The average rate of suffering anxiety among those who are economically inactive is 16%. Among the unemployed, the average rate is 13%. Therefore, those individuals observed to be unemployed exhibit rates of suffering anxiety in excess of twice that among the employed or self-employed. These differences between average psychological health among the working compared with non-working are non-negligible, and in particular, the difference between those employed and unemployed motivates the idea that unemployment might *cause* poor psychological health, whereas it is assumed that incapacity is caused by deterioration in health and inactivity is a self-selected state.

However, a simple analysis of transitions between states indicates positive selection into unemployment on the basis of poor psychological health. Table II provides summary statistics on the psychological health of all employed individuals present in at least one wave of the survey, who remain in the survey in the following year, whether they continue in employment, enter unemployment, self-employment, become incapacitated or leave the labour force. Those individuals who enter unemployment or become incapacitated exhibit worse psychological health whilst employed compared with those households who are observed to remain in employment. The magnitude of positive selection into unemployment is large: those individuals becoming unemployed in the next wave exhibit a GHQ score that is over 50% higher while employed compared with those individuals who remain in employment. In the case of the suffering anxiety indicator, the equivalent value is 60%.

However, accounting for positive selection into unemployment, those entering unemployment nevertheless exhibit a larger deterioration in their (already worse) psychological health measures correlated with the move into unemployment. Whereas those remaining in employment see on average only a very small increase in their GHQ score, those entering unemployment see an increase in their score of approximately 44%. Whereas average rates of suffering anxiety among those remaining in employment are unchanged, among those entering unemployment, the average rate of anxiety increases by 5 percentage points, or 63%. This evidence suggests that, even accounting for positive selection into unemployment on the basis of poor psychological health, there might be a causal link between unemployment and deterioration in psychological health.

These comparisons of year-on-year changes in psychological health scores for the newly unemployed compared with those remaining in unemployment are subject to potential biases arising from selection into attrition on the basis of psychological health or an unemployment event. The year-on-year attrition rate for all individuals present in at least one wave of the BHPS is approximately 7.8%. Of course, the labour market states and transitions of those who attrit the survey are unobserved. However, additional evidence from the survey suggests that the attrition rate might be higher among those who become unemployed. In the 1995 wave, the BHPS included a question on subjective unemployment expectations ('very likely', 'quite likely', 'quite unlikely' and 'very unlikely'). The rate of attrition between 1995 and 1996 for those answering 'very likely' was 20%, compared with 4% for those answering 'very unlikely'. That suggests that attrition is higher among those who become unemployed (assuming the expectations data to a large extent predicts unemployment). Selection into attrition on the basis of unemployment and, we might presume, higher attrition rates for those

who become unemployed and experience the worst psychological health effects will probably bias our results downwards. Consequently, we interpret the magnitudes estimated here as minimum values.

3. ECONOMETRIC MODEL

To investigate the causal impact of unemployment on psychological health in an econometric model that allows for the impact of unemployment on psychological health to vary according to reference (local) level unemployment, controlling for other labour market transitions and a range of demographic and socio-economic control variables, the following econometric model is suggested. For each individual i , observed over two periods, t and $t + 1$, who is in employment in period t , the change in the individual's psychological health score, 'PH' is modelled as Equation (1):

$$\begin{aligned} \Delta PH_{i:t+1,t} = & \alpha + \beta_1 BECUNEMP_{i:t+1,t} + \beta_2 BECSEMP_{i:t+1,t} + \beta_3 BECINACT_{i:t+1,t} \\ & + \beta_4 BECINCAP_{i:t+1,t} + \beta_5 COUN_{i:t+1} + \beta_6 BECUNEMP_{i:t+1,t} * COUN_{i:t+1} \\ & + \beta_7 BECSEMP_{i:t+1,t} * COUN_{i:t+1} + \beta_8 BECINACT_{i:t+1,t} * COUN_{i:t+1} \\ & + \beta_9 BECINCAP_{i:t+1,t} * COUN_{i:t+1} + \gamma_{i:t+1,t} + \varepsilon_{i:t} \end{aligned} \quad (1)$$

where *BECUNEMP*, *BECSEMP*, *BECINACT* and *BECINCAP* are a series of dummy variables that take the value of 1 if in the individual becomes unemployed, self-employed, inactive or incapacitated respectively between periods t and $t + 1$, *COUN* is the unemployment rate measured at time $t + 1$ in the county in which the individual lives, γ is a vector of control variables and ε is the error term. By using the county unemployment rate (across 65 UK counties) as the reference group, we have a more locally defined measure than the regional measure (for 11 UK regions) used by Clark (2003). Hence, the baseline group not included in the various dummy variables for employment transitions are those individuals who remain in employment. Estimating the model in first differences allows for the differencing out of any individual specific time-invariant heterogeneity not captured in the vector of control variables, that is, the so-called 'fixed effect'.

The interaction terms allow for the impact of unemployment on the first difference in the PH score to vary across counties with differing unemployment rates such that the impact of unemployment on the PH score of an individual living in a locality with a particular unemployment rate, relative to the PH score of an employed individual living in the same locality, can be calculated. For example, the impact of unemployment on an individual living in a county with a 10% unemployment rate would be calculated as $\beta_1 + (0.1 \times \beta_5) + (0.1 \times \beta_6)$.

To be confident of estimating the causal effect of unemployment on an individual's PH score, a measure of becoming unemployed in Equation (1) should be used, which rules out the possibility of a reverse causality in which unemployment arises as a result of deterioration in the individual's psychological health, which is a plausible direction of causality. As discussed in Section 1, a variety of instruments are used in the existing literature, such as plant closures or firings, which (at least in the case of the former) are very unlikely to be caused by an individual's physical or psychological health, but have the drawback of being less common events than loss of work due to redundancy or end of contract. The BHPS does not ask unemployed individuals whether their previous job ended because of plant closure, so this strategy cannot be employed here. Instead, an instrumental variable strategy is used whereby a set of instruments correlated with the likelihood of an individual becoming unemployed but exogenous to an individual's psychological health are used to estimate the likelihood of an individual becoming unemployed between waves.

To implement this approach, we use industry-age-year unemployment rates estimated from the UK Labour Force Survey as the instrument in a first-stage model for the individual unemployment event. Industry-age-year unemployment rates are estimated for the 10 top-level Standard Industrial Classification industry groups, using 5-year age bands to define the age groups for each of the 18 waves the BHPS data spans. The advantage of using these estimated unemployment rates as the first-stage instrument is that they are strongly positively

correlated with individual unemployment events observed among BHPS individuals losing their jobs but are exogenous to changes in the health of any individual observed in the survey.

Therefore, Equation (1) is modified with the BECUNEMP dummy variable instrumented by the industry-age-year unemployment rate with the use of the two-stage least squares procedure (with robust standard errors). This modified equation is used to estimate the causal effect of unemployment on the change in an individual's PH score, where the change in the PH score is allowed to vary (linearly) with the unemployment rate in the locality in which the individual lives. We also include industry dummies in the second-stage equation, together with controls for age and year dummies. Hence, the econometric model allows for independent effects of industry group, age and year on individual psychological health.

4. ECONOMETRIC RESULTS

A series of models are estimated to allow for a comparison of the results from the instrumental variable specification with a non-instrumental variable specification and specifications with and without the county-level unemployment interactions that capture the 'social norm' effects. The non-instrumental variable specification should be interpreted as the *association* instead of the *causal link* between labour market transitions and psychological health and is very similar to that estimated in Clark (2003). For each model, we present results for both dependent variables: firstly, the change between waves in the 12-point caseness GHQ score, which takes one of 25 values ranging from -12 to 12 and secondly the change in the 1/0 dummy variable, which indicates that the individual suffers anxiety. For the models with the GHQ score as the dependent variable, we use the ordinary least squares estimator, and for the models with the suffers anxiety indicator as the dependent variable, we use a linear probability model, which allows direct comparison between the results for the uninstrumented regressions and the instrumental variable regressions. As the dependent variable is in each case the change in the psychological health measure (not the level), the coefficients on the independent variables are interpreted as the effect of the variable on the between-year change in an individual's psychological health.

Results from the non-instrumental variable models are presented in Table III. The specification shown in column 1 excludes the county-level unemployment rate-labour market transition interaction terms. The vector of socio-economic and demographic variables included in the specification is detailed in the notes accompanying the table. The coefficients on the variables, which capture labour market transitions, suggest that the impact of movements out of employment into other labour market states has a strong impact on an individual's psychological health. The coefficients on the dummy variables for becoming unemployed (row 1), becoming incapacitated (row 3) and becoming inactive (row 4) are all positive and statistically significant at the 1% level. The respondents in the baseline (omitted) group are those households who remain employed. Therefore, the interpretation of the coefficient on the unemployment variable in column 1 is that, for those becoming unemployed, their GHQ caseness score increases by 1.04 points more than those who remain in employment, and for those becoming incapacitated, the magnitude is 0.97 points. The equivalent magnitudes on the respective coefficients in the model in which the anxiety indicator is the dependent variable (column 3) are 0.04 and 0.06.

With the comparison of these coefficients with the unconditional changes in psychological health scores in Table II, it can be seen that most of the variation in psychological health scores across individual employment transitions in Table II remains in the multivariate model. For example, in the unconditional comparison, those remaining in employment on average see their GHQ score increase by 0.04 points, whereas those moving into unemployment see their GHQ score increase on average by 1.12 points, a difference of 1.08 points. The equivalent coefficient in the ordinary least squares estimates from column 1 is 1.04 points. In the case of the anxiety indicator variable, the change average rates are 0.00 and 0.05 in Table II, respectively, a difference of 0.05. The equivalent coefficient in the linear probability model estimates from column 3 is 0.04. Therefore, the conditional relationship between unemployment and the change in an individual's psychological health from the multivariate model is only very slightly smaller than the unconditional relationship in Table II.

Table III. Employment status transitions and change in psychological health employed individuals at time (t) by labour market status at ($t + 1$)

	GHQ12 score		Suffers anxiety	
	(1)	(2)	(3)	(4)
Labour market status at $t + 1$ (baseline group: employed $t + 1$)				
(1) Unemployed $t + 1$	1.04** (0.10)	1.05** (0.10)	0.04** (0.02)	0.04** (0.02)
(2) Self-employed $t + 1$	-0.07 (0.09)	-0.11 (0.09)	0.01 (0.01)	0.01 (0.01)
(3) Incapacitated $t + 1$	0.97** (0.14)	0.71** (0.15)	0.06** (0.02)	0.05** (0.02)
(4) Inactive $t + 1$	0.46 (0.27)	0.16 (0.14)	0.01 (0.01)	0.01 (0.01)
Interaction with county unemployment rate				
(5) Unemployment rate	-	0.90* (0.45)	-	0.01 (0.01)
(6) Unemployed $t + 1$ * unemployment rate	-	-8.41** (3.21)	-	-29.46** (10.12)
(7) Self-employed $t + 1$ * unemployment rate	-	-3.26 (3.10)	-	-0.08 (0.07)
(8) Incapacitated $t + 1$ * unemployment rate	-	-1.80 (5.98)	-	-0.02 (0.02)
(9) Inactive $t + 1$ * unemployment rate	-	5.84 (4.18)	-	-0.01 (0.02)
Additional controls				
Demographic controls	Yes	Yes	Yes	Yes
Socio-economic controls	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Regression statistics				
N	63 014	63 014	63 014	63 014
F	15.86	11.73	7.85	8.16
Probability > F	0.0000	0.0000	0.0000	0.0000

Note: 63 014 employed individuals who are presented in at least two consecutive waves of BHPS 1991–2009. Additional control variables: age (1/0 dummy variables for 5-year age bracket intervals between age 18 years and state retirement age), 1/0 dummy variables for: male, ethnic minority group, married, divorced, widowed, (baseline single), plus 1/0 dummies for change in marital status), highest educational qualification (degree, a levels or equivalent, o levels or equivalent (baseline no qualifications); household income (£), change in household income; 1/0 dummies for homeownership status (outright owner, mortgaged owner, private renter (baseline social renter); 1/0 dummies for smoker, member of occupational pension; 1/0 dummies for labour market history (unemployed within the past 3 years; self-employed within the past 3 years, incapacitated within the last 3 years, inactive within the last 3 years, baseline in employment for each of the last 3 years).

**denotes significance at 1% level,

*denotes significance at 5% level.

Columns 2 and 4 of Table III include the county-level unemployment–labour market status transition interaction terms. In column 2, the coefficient on the county-level unemployment rate is positive and significant at the 5% level. The coefficient of 0.90 implies that an employed individual who remains employed in the next wave and whose county of residence has an unemployment rate of 10% sees their GHQ score increase by 0.009, a very small magnitude. In column 4, the coefficient on the unemployment rate is not statistically significantly different from zero. Hence, there is little evidence that the level of unemployment in the locality impacts on the between-waves change in the psychological health of employed individuals who remain employed. The interaction terms on the 1/0 dummy variables for becoming self-employed, incapacitated and inactive are also statistically insignificant. These imply that the effect of becoming self-employed, incapacitated or inactive on an individual's psychological health is not dependent upon the unemployment rate in the county of residence.

However, the magnitude of the coefficient on the interaction between becoming unemployed and the local unemployment rate implies that the local unemployment rate impacts greatly upon the between-wave change in

the psychological health of individuals becoming unemployed. For individuals becoming unemployed between waves, the change in their psychological health score can be calculated by adding the coefficient on the dummy variable for becoming unemployed (row 1) to the coefficient on the local unemployment rate (row 5) and the interaction term between the two (row 6).

For example, from the coefficient in column 2, row 6, an individual becoming unemployed in a locality with a 0% unemployment rate would see his or her GHQ score increase by 1.05 points more than an individual remaining employed (for which the implied change in GHQ score is 0). However, an individual becoming unemployed in a county with an unemployment rate of 10% would see his or her GHQ score increase by $1.09 + 0.009 - 0.84$, or a net change of only 0.26 points. Therefore, these results suggest that the association between unemployment and an increase in GHQ score is negatively correlated with the prevailing level of unemployment in the locality in which an individual becomes unemployed. The magnitude of the coefficients suggests that, at a local unemployment rate of 15%, an individual becoming unemployed experiences no statistically significant change in their GHQ score compared with an individual who remains in employment. In column 4, row 6, the equivalent local unemployment rate at which the effects of own unemployment on average rates of suffering anxiety would be offset by the impact of local unemployment on psychological health is 18%. These findings are consistent with that of Clark (2003) who estimated an equivalent value from BHPS wave one to seven data of 20%.

Before moving on to the instrumental variable estimates, Table IV first presents results from alternative models that include gender and age interaction terms. The existing literature suggests that the impact of unemployment on psychological health might be more severe for women (Schmitz, 2010). We investigate variation in the impact of unemployment for women compared with men and across age groups by using a combination of interaction terms. In columns 1 and 2, a gender interaction term is included. For the GHQ score column 1, a negative coefficient of 0.42, statistically significant at the 5% level, suggests that women experience less of a deterioration in the GHQ score upon employment compared with men. In column 2, in which the suffers anxiety indicator is the dependent variable, the coefficient on the gender interaction is not statistically significantly different from zero.

Age interaction terms are incorporated in the model in columns 3 and 4 with the use of a series of 1/0 dummy variables that capture the individual's age in 10-year age brackets. The respondents in the baseline group are those older than 50 years, for which the effect of unemployment on psychological health is given by the coefficient on the unemployment indicator (row 1). Relative to this age group, the pattern in the coefficients on the age bracket interaction terms implies that individuals becoming unemployed in middle age (rows 5 and 6) experience the worse deterioration in their psychological health. These effects are consistent across models for both dependent variables. Therefore, the results show that there are statistically significant gender and age effects in the consequences of unemployment on psychological health, with middle-age men experiencing the worst psychological health effects of unemployment.

Table V provides results from the instrumental variable regressions. The sole instrument in the analysis is the age-industry-year unemployment rate. The null hypothesis that the instrument is insignificant in the first-stage regression can be rejected (F -statistic 7.84, p -value 0.0000). Column 1 again provides results from a specification in which the county unemployment rate–labour market transition interaction terms are omitted. Compared with results from the uninstrumented specifications in Table III, the coefficients on the variables capturing becoming unemployed, becoming incapacitated and becoming inactive are all small in magnitude and generally of weaker significance than before, although they are all still significant at the 1% level.

From these results, the interaction terms portray a very similar relationship to that found in Table III: there is only a very weak relationship between the wave-on-wave change in the psychological health measures and the county-level unemployment rate for those individuals remaining employed; but for those becoming unemployed, the impact of unemployment on the deterioration in the psychological health measure varies greatly depending upon the county unemployment rate. By way of comparison with the earlier estimates, results from this specification imply that an individual becoming unemployed in a county with a 0% unemployment rate would see his or her GHQ score increase by 0.95 points more than an individual remaining employed

Table IV. Employment status transitions and change in psychological health gender and age effects

	Gender interactions		Age interactions	
	GHQ12 score	Suffers anxiety	GHQ12 score	Suffers anxiety
	(1)	(2)	(3)	(4)
Labour market status at $t+1$ (baseline group: employed $t+1$)				
(1) Unemployed $t+1$	1.26** (0.14)	0.02** (0.01)	0.45* (0.23)	-0.03 (0.02)
(2) Unemployed $t+1$ * female	-0.42* (0.20)	-0.02 (0.02)	-	-
(3) Female	0.04 (0.03)	0.01 (0.01)	0.03 (0.02)	0.01 (0.01)
(4) Unemployed $t+1$ * age < 30 years	-	-	0.60* (0.30)	0.01 (0.01)
(5) Unemployed $t+1$ * age 30–39 years	-	-	0.87** (0.30)	0.06** (0.02)
(6) Unemployed $t+1$ * age 40–49 years	-	-	0.82** (0.31)	0.10** (0.02)
(7) Age	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
Additional controls				
Demographic controls	Yes	Yes	Yes	Yes
Socio-economic controls	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Regression statistics				
N	63 014	63 014	63 014	63 014
F	15.22	7.32	13.31	8.46
Probability > F	0.0000	0.0000	0.0000	0.0000

Note: 63 014 employed individuals who are presented in at least two consecutive waves of BHPS 1991–2009. Additional control variables: age (1/0 dummy variables for 5-year age bracket intervals between age 18 years and state retirement age), 1/0 dummy variables for: male, ethnic minority group, married, divorced, widowed, (baseline single), plus 1/0 dummies for change in marital status), highest educational qualification (degree, a-levels or equivalent, o-levels or equivalent (baseline no qualifications); household income (£), change in household income; 1/0 dummies for homeownership status (outright owner, mortgaged owner, private renter (baseline social renter); 1/0 dummies for smoker, member of occupational pension; 1/0 dummies for labour market history (unemployed within the past 3 years; self-employed within the past 3 years, incapacitated within the last 3 years, inactive within the last 3 years, baseline in employment for each of the last 3 years).

**denotes significance at 1% level,

*denotes significance at 5% level.

(for which the implied change in GHQ score is again 0). However, an individual becoming unemployed in a county with an unemployment rate of 10% would see his or her GHQ score increase by $0.95 + 0.008 - 0.74$, or a net change of only 0.22 points. These estimates are very similar in magnitude to those calculated in the non-instrumental variable specification.

Table VI presents estimates from a model in which the reference ‘group’ is defined as the spouse or cohabiting partner of the individual who becomes unemployed. This alternative reference group is suggested by Clark (2003), who found that unemployed individuals with an unemployed partner or spouse exhibit less deterioration in their GHQ score compared with those with an employed partner or spouse. Table VI reveals similar results from the instrumental variable estimates: individuals becoming unemployed on average see a worsening in their psychological health by either measure. However, from the results in column 1, for individuals with a partner or spouse who is unemployed, the increase in GHQ score is much smaller at 0.08 points. Therefore, for individuals with an unemployed partner or spouse, almost all of the deterioration in the GHQ score associated with unemployed is offset by the ‘positive’ effect on psychological health of becoming unemployed in the context of having an unemployed partner or spouse. In column 2, the coefficient on the spouse interaction term is not statistically significantly different from zero, so no reference group effect is discernible.

Table V. Employment status transitions and change in psychological health instrumental variable estimates

	GHQ12 score	Suffers anxiety
	(1)	(2)
Labour market status at $t+1$ (baseline group: employed $t+1$)		
(1) Unemployed $t+1$	0.87** (0.14)	0.03** (0.01)
(2) Self-employed $t+1$	0.02 (0.15)	0.01 (0.01)
(3) Incapacitated $t+1$	0.76** (0.33)	0.04* (0.02)
(4) Inactive $t+1$	0.11 (0.15)	0.01 (0.01)
Interaction with county unemployment rate		
(5) Unemployment rate	0.68** (0.48)	0.01 (0.01)
(6) Unemployed $t+1$ * unemployment rate	-7.01** (2.14)	-24.14** (11.46)
(7) Self-employed $t+1$ * unemployment rate	-3.00 (3.28)	-0.08 (0.07)
(8) Incapacitated $t+1$ * unemployment rate	-2.01 (5.76)	-0.02 (0.02)
(9) Inactive $t+1$ * unemployment rate	4.68 (5.26)	-0.01 (0.02)
Instrument in first-stage model		
(10) Industry-age unemployment rate	0.68** (0.10)	0.57** (0.12)
Additional controls		
Demographic controls	Yes	Yes
Socio-economic controls	Yes	Yes
Industry dummies	Yes	Yes
Year dummies	Yes	Yes
Regression statistics		
N	63 021	63 014
Wald χ^2	212.63	81.26
Probability > χ^2	0.0000	0.0000

Note: 63 014 employed individuals who are presented in at least two consecutive waves of BHPS 1991–2009. Additional control variables: age (1/0 dummy variables for 5-year age bracket intervals between age 18 years and state retirement age), 1/0 dummy variables for: male, ethnic minority group, married, divorced, widowed, (baseline single), plus 1/0 dummies for change in marital status), highest educational qualification (degree, a levels or equivalent, o levels or equivalent (baseline no qualifications); household income (£), change in household income; 1/0 dummies for homeownership status (outright owner, mortgaged owner, private renter (baseline social renter); 1/0 dummies for smoker, member of occupational pension; 1/0 dummies for labour market history (unemployed within the past 3 years; self-employed within the past 3 years, incapacitated within the last 3 years, inactive within the last 3 years, baseline in employment for each of the last 3 years).

**denotes significance at 1% level,

*denotes significance at 5% level.

5. CONCLUSION

This paper has estimated the causal impact of unemployment on individual psychological health with the use of an instrumental variable strategy on UK data. Although those entering unemployment typically exhibited worse psychological health prior to the unemployment event, instrumental variable estimates show that the onset of unemployment leads to a sizeable worsening of individual psychological health, whether measured by the survey-based GHQ score or by self-reported medical conditions data. However, the mitigating impact of the prevalence of local unemployment dampens the impact of unemployment on individual psychological health scores, and this effect is shown to be robust to the instrumental variable specification. A major source of variation is the level of unemployment in a relevant reference group, although age and gender effects also lead to variation in the impact of unemployment across individuals.

Table VI. Employment status transitions and change in psychological health instrumental variable estimates—spousal reference group

	GHQ12 score	Suffers anxiety
	(1)	(2)
Labour market status at $t + 1$ (baseline group: employed $t + 1$)		
(1) Unemployed $t + 1$	0.72** (0.30)	0.03** (0.01)
(2) Self-employed $t + 1$	0.03 (0.10)	0.01 (0.01)
(3) Incapacitated $t + 1$	0.51** (0.14)	0.03 (0.02)
(4) Inactive $t + 1$	0.75 (0.39)	0.01 (0.01)
Interaction with spouse unemployment dummy		
(5) Spouse unemployed	0.03 (0.06)	0.01 (0.01)
(6) Unemployed $t + 1$ * spouse unemployed	-0.64* (0.35)	-0.23 (0.18)
(7) Self-employed $t + 1$ * spouse unemployed	-0.03 (0.16)	-0.01 (0.01)
(8) Incapacitated $t + 1$ * spouse unemployed	-0.50 (0.51)	0.01 (0.01)
(9) Inactive $t + 1$ * spouse unemployed	0.65 (0.53)	0.01 (0.01)
Additional controls		
Demographic controls	Yes	Yes
Socio-economic controls	Yes	Yes
Industry dummies	Yes	Yes
Year dummies	Yes	Yes
Regression statistics		
N	63 014	63 014
Wald Chi ²	212.39	72.46
Probability > Chi ²	0.0000	0.0000

Note: First-stage equation identical to Table V column 1. Additional notes as in Table V.

The public policy implications of these findings are to some extent counterintuitive: as the negative impact on psychological well-being is greater for individuals subject to unemployment in contexts where unemployment is low, targeted government support to help individuals deal with the psychological effect of unemployment might be best directed towards individuals becoming unemployed in low-unemployment areas. The intuition for this is that, in contexts of high unemployment, individuals becoming unemployed receive some form of consolation or peer-group support, either explicit or implicit, from their unemployed peers. For individuals becoming unemployed in contexts of low unemployment, such 'support' or mitigating circumstance is not forthcoming, and hence, there is a stronger rationale for public policy intervention.

We also make a suggestion for future research. Although the findings of this and related studies suggest that the association between unemployment and psychological health appears causal in nature, one limitation of this and related studies is the absence of any consideration of variation in the underlying risk of unemployment facing individuals in the data. Workers evidently differ in the likelihood of becoming unemployed in the near future. In many cases, workers may well anticipate the prospect of unemployment. With the absence of any subjective data on unemployment expectations, studies in the literature typically model the unemployment event taking the sample of those employed as the 'at risk' group. However, anticipated unemployment will most likely be reflected in the psychological health of those employed. One valuable avenue for further research would be to model the differing impacts of anticipated versus unanticipated unemployment on individual psychological health, giving consideration to the possibility that

the worsening of experiencing psychological health by those entering unemployment might plausibly be less severe for those who anticipated the event and *vice versa*.

CONFLICT OF INTEREST

No potential conflicts exist between the author and any interested parties.

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