Economic Insecurity as a Socioeconomic Determinant of Mental Health

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Abstract:

Economic insecurity has been the topic of an emerging body of literature that is increasingly relevant to the labour markets of developed economies. This paper uses data from the British Household Panel Survey to assess the causal effect of various aspects of economic insecurity on mental health in the UK. The results support the idea that economic insecurity is an emerging socioeconomic determinant of mental health, although the size of the effect varies across measures. In particular, it appears that perceived future risks are more damaging to mental health than realised volatility.

1. Introduction

The mental health of the working age population is an issue that is justifiably receiving increasing attention. At the individual level, mental health is often regarded as the single biggest contributor to life satisfaction, more so than physical health, unemployment, and income (Layard et al., 2013). Mental health also has significant economic consequences at both the employer and national level. The Centre for Mental Health (2010) estimates that the cost of lost output due to mental health issues for England in 2009/10 amounted to at least £30 billion. National-level health and social care costs will obviously increase this figure substantially. Despite these costs, mental health continues to inhibit a significant proportion of many populations. The most common problems, anxiety and depression, are particularly concentrated amongst the working age population (Layard et al., 2013). Therefore, any evidence that supports or enhances our knowledge of the roots of mental health issues can potentially result in effective policy responses by both governments and employers.

Using data from the British Household Panel Survey (BHPS) (Institute for Social and Economic Research, 2010) the aim of this paper is to investigate the impact of one potential source of psychological distress for the working-age population of the UK: economic insecurity.

Economic insecurity can be defined as "the anxiety[1] produced by the possible exposure to adverse economic events and by the anticipation of the difficulty to recover from them" (Bossert and D'Ambrosio, 2013, p.1018). There are many potential sources of such insecurity. One particular form of economic insecurity may arise from a fear of unemployment. It is also the case that economic insecurity may result from an expectation of a worsening financial situation that is unrelated to an individual's employment. A key feature of these forms of economic insecurity is that they are both subjective and future-orientated. Such characteristics may present a challenge when looking to conduct cross-country policy analysis. Consequently, a number of objective measures of economic insecurity have been proposed. One such measure, is the Economic Security Index (ESI) (Hacker et al., 2014) which focusses on realised volatility in household income.

The analysis in this paper aims to identify the causal impact of economic insecurity on mental health, using a range of measures of economic insecurity. While also capturing

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[1] A wider focus on psychological distress may be more appropriate within the definition of economic insecurity, particularly in a mental health context where anxiety can relate to specific disorders.

various aspects of economic insecurity, we control for factors that are closely related to economic insecurity, both unemployment scarring (Clark et al., 2001) and anticipation of unemployment (Clark and Georgellis, 2013). Furthermore, potential simultaneity bias is addressed using fluctuations in the economic environment as exogenous instruments (Rohde et al., 2014b). By confirming theoretical priors outlined in Geishecker (2012) regarding the direction of simultaneity bias within the mental health-insecurity relationship, it has been possible to identify a lower bound for the causal effect of economic insecurity on mental health.

Our analysis suggests that the extent to which the mental health of an individual is affected by economic insecurity varies across measures. For males, the largest effect comes from insecurity related to their employment. For females, the effect from work-related economic insecurity and concerns regarding the future financial situation are largely equal. For both sexes it is the case that subjective measures have a larger negative effect than objective measures based on realised income volatility. Consequently, the results support a range of existing evidence identifying economic insecurity – particularly work-related economic insecurity – as an emerging socioeconomic determinant of health (Benach et al., 2014).

The rest of the paper is organised as follows. Section 2 provides a brief overview of the key related literature. Section 3 covers methodological issues, including the construction of the ESI (Hacker et al., 2014) using the BHPS dataset. The main results are given in Section 4. This section includes a comparison of trends across the measures of economic insecurity, and discussion of the regression results. Section 5 concludes the paper.

2. Related Literature

A body of empirical evidence has provided robust support for the negative impact on health from exposure to downside economic risks, particularly those related to employment relationships. The consistency of these findings has led to this form of economic insecurity being identified as an emerging socioeconomic determinant of health (Benach et al., 2014). This work-related economic insecurity can be conceptualised as consisting of three principal elements (Anderson and Pontusson, 2007): a cognitive assessment of the likelihood of job loss (job insecurity), an evaluation of the probability of finding equivalent employment (employment insecurity), and the likelihood of experiencing financial problems (financial insecurity). These elements can occur separately or in combinations, and each may have a

different impact on mental health. Interactions between current perceptions, past experiences, and future outcomes may also influence any effect.

Clark et al. (2001) show that unemployment experience continues to negatively affect subjective wellbeing despite an individual finding alternative employment. However, using the same data, Knabe and Rätzel (2011) find that this effect is not observed when current concerns regarding job security are controlled for. They suggest that past unemployment experience impacts on current wellbeing by influencing perceptions of future unemployment risk. In addition to finding a negative effect from past unemployment, Clark and Georgellis (2013) also find a negative effect on both subjective wellbeing and mental health prior to unemployment being experienced. However, current economic insecurity is not controlled for, and it is unclear how this will differ from anticipation of unemployment. In each of these papers, clear differences are found between males and females.

In addition to the effects of unemployment, a few recent papers examine the specific effect of economic insecurity. They key distinction is that economic insecurity can have a negative impact on health regardless of any objective event occurring. For example, an individual may correctly perceive a low chance of job loss, but be concerned about large costs associated with this low probability event. Despite not suffering from employment volatility, this may result in a welfare loss associated with this psychological distress.

Using Canadian data, Watson (2015) shows that work-related economic insecurity is associated with a decline in mental health for both males and females. However, when the sample is restricted to only respondents with children under the age of 18, the result is only statistically significant for males. Rohde et al. (2014c) find negative effects on both physical and mental health across a range of measures of economic insecurity using data from Australia. The negative effects on mental health are much larger than the impact on physical health. A further difference is that the mental health effects are not influenced by the income of the sufferer, while a higher income significantly reduces the negative effects on physical health.

The existing evidence presented illustrates the consistency of the finding that economic insecurity has a significant negative effect on health and wellbeing. However, these papers do not control for potential simultaneity in the relationship. Although an estimation strategy that controls for time-invariant individual heterogeneity will remove some sources of endogeneity, it remains the case that other time-varying sources may remain. For example,

the onset of mental health difficulties may lead to an individual being concerned about their future income and employment outcomes. Geishecker (2012) provides a theoretical foundation (supported empirically) for expectations regarding the direction of such simultaneity bias. He shows that in cases where economic insecurity has a negative effect on mental health, and the size of this effect is increasing in the potential utility cost of employment volatility, then the negative effect of economic insecurity on mental health will be biased upwards. Consequently, the negative effects found in models that do not control for simultaneity will underestimate the damaging effect of insecurity on mental health.

Only one existing study has attempted to deal with endogeneity in the economic insecurity and mental health relationship. Using Australian data, Rohde et al. (2014b) instrument for economic insecurity using the mean levels of unemployment by age, financial satisfaction by education level, and insecurity by region. Although the instruments appear to be sufficiently strong to identify the relationships for a range of economic insecurity measures, the results are mixed. The estimate of the negative effect of job insecurity on mental health is larger in the instrumental variables regression compared to the equivalent fixed effects estimate. However, the IV result fails to reach any conventional level of statistical significance. Likewise, for financial insecurity the coefficient is only significant at the 10% level. In this instance the IV estimate is smaller than the corresponding FE estimate. However, it is the case that most of the estimates have the expected negative effect on mental health.

Utilising the combined contributions of this existing literature, we analyse the effect of economic insecurity on mental health within a model that controls for both past and future unemployment experience. An attempt is also made to replicate, using data from the UK, the finding in Rohde et al. (2014c) that the negative effect of insecurity is experienced equally throughout the income distribution. In addition to controlling for unemployment experiences, the analysis will build on the findings of Rohde et al. (2014c) by also allowing for differences between genders, and selecting the sample such that individuals experience involuntary insecurity first hand. Lastly, the analysis will test the theoretical predictions of Geishecker (2012) regarding the direction of potential simultaneity bias within the insecurity-mental health relationship. The overall aim is to use a fixed effects model to identify a lower bound for the negative effect of economic insecurity on mental health within the working age population of the UK.

3. Methodology

3.1 Data and Selection of Sample

The data used within the analysis comes from the BHPS (Institute for Social and Economic Research, 2010). All eighteen waves of data are used, although the main sample period covers 1993-2007 such that unemployment experience from the past 3 years can be included, in addition to employment outcomes one year in the future. The focus for the main analysis is working-age (16-64) sample members.

A number of additional sample restrictions are imposed in order to allow for a distinct effect of economic insecurity on health to be identified. Firstly, sample members must be part of the 'primary' labour force – that is employed on a permanent full-time contract. This restriction is imposed to remove the possibility of individuals voluntarily or knowingly selecting into insecure employment. Additionally, the sample is limited to individuals either without a partner or whose partner is not suffering from either work-related or financial insecurity. Although intra-household transmission of economic insecurity is an interesting aspect that has not been thoroughly investigated to date, the aim of the current analysis is to accurately identify the health effect of economic insecurity on the immediate sufferer of insecurity.

The initial analysis of trends across measures of economic insecurity does not impose these sample restrictions as the aim is to observe nationally representative trends in the working age population. BHPS cross-sectional weights are used to correct for unequal sampling probabilities. As a result, the sample for Northern Ireland is not included in the overall trend due to a different sampling strategy being employed. Consequently, the analysis of trends covers only Great Britain, while the regression analysis includes all of the UK. The sample used for the comparison of trends is balanced within each wave, such that sample members have provided valid responses to the subjective measures which are asked to all survey participants, and have also provided sufficient information to allow the ESI to be formed.

3.2 Objective Measurement of Economic Insecurity

The Economic Security Index (ESI) proposed by Hacker et al. (2014) is a household-level index that aims to combine multiple dimensions of economic security. Three sources of

hardship are identified and enter the index with equal weight: downward income volatility, non-discretionary expenditures, and inadequate financial wealth to smooth consumption in the event of downward income volatility. The index was designed to enable cross-country policy analysis. By combining dimensions of economic insecurity, and focussing exclusively on objective data that are largely available within household panel surveys, the ESI offers a measure that is potentially comparable across countries.

In this paper we construct and use the Economic Security Index for Great Britain (ESIGB) which is obtained by applying the original ESI method proposed by Hacker et al. (2014) to data from the UK. Although not a new index, the ESIGB incorporates small methodological changes.

As in Hacker et al. (2014) the final index is formed by finding the proportion (weighted or unweighted) of the population that suffers a qualifying income loss in each period *t*:

$$ESIGB_t = \frac{\sum_{i=1}^{n_t} L_{it}^{GB}}{n_t}$$

For an individual to be within a household that has suffered a qualifying income loss, all three conditions within the expression L_{it}^{GB} must hold. A qualifying loss is defined as:

$$L_{it}^{GB} = \begin{cases} 1 \ if \left(\frac{y_{it} - D_{it}}{e_{it}} < \left(\frac{3}{4} \right) \frac{y_{it-1} - D_{it-1}}{e_{it-1}} \right) \cap (W_{it} < W*_{it}) \cap (R_{it} = R_{it-1}) \\ 0 \ otherwise \end{cases}$$

where *y* is real household income; *D* is real non-discretionary household costs; *e* is the modified OECD household equivalence scale; *W* is the real household liquid financial wealth; *W** is the typical cumulative income loss over median recovery time; and *R* is the retirement status dummy.

The household income figure is adjusted to account for differences in household size and composition using the modified OECD scale (Hagenaars et al., 1994). This equivalence scale assigns a value of 1 to the household head, 0.5 to each additional adult member, and 0.3 to

each child. It should be noted that this equivalence differs from that used within Hacker et al. (2014). All items concerning income and wealth have been converted to real values. Gross income has been used to form the index. However, it is possible to form the index using net income. Results comparing both net and gross income, in addition to a more detailed discussion of the ESIGB methodology, are available in Kopasker (2016).

Departures from the original ESI methodology result from data issues, differing priorities as to what the index should capture, and sometimes a combination of these two. Beyond these changes, the general approach differs slightly in that the focus is on forming the index using data from a single data source, rather than using other datasets to estimate missing data.

A key change to the original ESI method (Hacker et al., 2014) is to slightly alter the definition of a qualifying loss such that deductions for non-discretionary spending focus on housing costs, rather than the costs associated with servicing unsecured debt. Housing costs are an essential expense that offer limited flexibility regarding the payment schedule, and may be secured against the primary residence of individuals and families. Consequently, difficulty meeting such expenses is highly likely to result in a level of psychological distress. For this reason, housing costs are included as a non-discretionary expenditure within the ESIGB.

Although debt service costs have not been estimated within the ESIGB, ideally they would be included in addition to housing costs as items of non-discretionary spending. The main barrier to their inclusion is the lack of available data on either debt payments or household debt holdings. Data on the level of debt holdings are only available in the three waves of the BHPS where the wealth module is included. Therefore, it would be possible to estimate debt service costs based upon the method outlined in Hacker et al. (2010), which assumes a 9% interest rate and 5 year repayment term. Furthermore, it may be possible to form an estimate of debt levels for the periods between the BHPS wealth module being conducted. However, doing this would introduce a degree of measurement error into an element of the index that can otherwise be formed entirely from observed data. Given that the estimation of wealth within the ESIGB relies on interpolation of values between periods where the BHPS wealth module was conducted, the decision was made to omit estimates of debt service costs in the first instance. The main benefit of this decision is that the qualifying loss element within the ESIGB can be calculated for years where information on wealth and debt are not available. As will be shown within the next section, this appears to provide a reliable indicator of the

trend in the full index. However, it remains the case that the impact of debt service costs on the ESIGB should be investigated in any future development of the ESIGB methodology.

A less significant change is the fact that we do not include the deduction for medical expenditures, which was present in the ESI, as this is considered to be insignificant given the public provision of health services within the UK.

From a practical perspective, building the Economic Security Index from existing household panels is a data-intensive task. Even within the original construction (Hacker et al., 2014), multiple data sources are used to overcome issues of data availability. Despite the periodic availability of wealth data within the BHPS, including a measure of an adequate private financial safety net is the most challenging aspect in constructing the ESIGB. In particular, forming a measure of wealth at the household level is problematic. Additionally, constructing an annual measure of the ESI between the years were data on wealth is available is a further challenge.

Within the BHPS a module of questions regarding personal savings was conducted in 1995, 2000, and 2005, and this is the basis for the liquid financial wealth measures used within the ESIGB. Liquid financial wealth is defined as being financial assets that can be readily accessed. The available data from the BHPS limits this to amounts held in savings accounts and investments. The measure is not assets net of debt, as in Hacker et al. (2014).

In order to obtain a measure of household wealth from the constituent personal wealth measures, the bounding approach within Banks et al. (2003) was used. The central issue here is that each respondent within the BHPS is asked the questions within the wealth module, and it is not always possible to identify whom the jointly held assets are shared with and the relative split of the asset among household members. Following Banks et al. (2003), an upper and lower bound of personal financial asset holdings was formed. Whereas the upper bound treats all jointly held assets as being held solely by the respondent, the lower bound assumes that any jointly held asset is split evenly amongst the adults within the household. Therefore, to form the measure of household wealth at both the lower and upper bound, the value of personal wealth for all respondents within the household is summed. Only results for the lower bound are presented here since the decision has little impact on the results.

To enable calculation of the ESI between years when the wealth module was asked, it was assumed that changes between periods occurred linearly at the personal level. The decision to

apply linear interpolation in these periods was made for both simplicity and to ensure that estimates were based on the wealth data that are available. Consequently, no estimate of household wealth has been made for individuals that do not answer the wealth module questions in either waves 5 and 10 or waves 10 and 15. For example, if an individual provides wealth data in wave 5, but is not present in wave 10, then it will not be possible to carry out the linear interpolation to allow them to be included in waves 6, 7, 8 and 9. However, they will be included in wave 5. The impact of this variability is minimal. The results within the next section show that the level of the ESIGB does not differ greatly in years where information on wealth was available to years where linear interpolation is used.

The final element of the wealth calculation involves estimating the adequacy of household wealth to meet income shortfalls. To do this, measurement is made of the median time taken for individuals to fully recover from a drop of 25% or more in household income. Group-specific medians are calculated based on income drop size (25-35%, 35-50%, and 50%+), age groups (18-34, 35-44, 45-64), and pre-drop income quintiles. Only those with the necessary data throughout the period to complete recovery are included, since any assumptions made during non-constant presence may bias the estimates. A recovery is deemed to have been completed on the first occasion that the individual's household income returns to the pre-drop level. Multiple qualifying income drops within a recovery period, occurring before income has returned to the level prior to the first drop are ignored. Additionally, recovery periods are truncated at 6 years to limit the impact of outliers.

The simplifying assumption is made that the level of post-drop income is sustained throughout the recovery period, i.e. income does not return to pre-drop levels incrementally. Again this is a departure from the original method (Hacker et al., 2014) which calculates the average sum of losses. However, since median recovery times are very short (maximum 3 years) in the GB data, the effect of this assumption on the resultant levels of economic insecurity will be negligible.

An indicator of an individual suffering from a qualifying loss of household income (as defined within the ESIGB) is included in the main analysis. This has been done to ensure consistency of the sample for years where no wealth data is available, while also maximising the sample size to be used within the instrumental variables analysis.

3.3 Subjective Measurement of Economic Insecurity

Two measures of subjective economic insecurity are included in the main analysis. The first comes from a question asking for individuals' level of satisfaction with their current job security. Responses are given on a 7-point scale. These have been recoded into a binary variable such that those expressing any dissatisfaction with their current level of job security are coded as 1. This question is only asked of survey participants that are employed at the time of interview, and has not been used to balance the sample for the analysis of trends. This subset of economic insecurity has been termed work-related economic insecurity.

The second subjective measure is formed using expectations about individuals' financial situation over the next twelve months. Original responses are given on a 3-point scale. For this analysis, individuals indicating that they expect their financial situation to worsen are coded as 1, while others are coded as zero. This subjective measure is called financial insecurity.

An additional subjective measure is included when comparing trends in insecurity. This measure results from a question asking respondents to assess their current financial situation on a 5-point scale. Responses expressing difficulty arising from individuals' current financial situation are coded as 1. This measure was included to resemble a subjective equivalent to the ESIGB, since it captures current material hardship. This measure is termed current income insecurity.

The dependent variable in the main analysis comes from responses to the 12-item General Health Questionnaire (GHQ-12), which has been validated as a screening tool for psychological distress (Goldberg et al., 1997). The questions cover aspects of mental functioning and emotional difficulties. Responses to the individual questions within the GHQ-12 are scored on a scale ranging from 0 (substantial decrease in symptoms) to 3 (substantial increase in symptoms). The twelve scores are then summed to form a Likert scale from 0 to 36 capturing a single dimension of mental wellbeing[2]. In keeping with the relevant literature, this score has been reversed for such that the scale is increasing in mental wellbeing. Additionally, the scale has been standardised to allow coefficients to be interpreted as standard deviations from the mean.

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[2] This unidimensional structure of GHQ-12 is supported by Hankins (2008), although higher dimension models have also been suggested (Graetz, 1991; Martin and Newell, 2005) which potentially offer further opportunities for analysis.

3.4 Model Specification

The specification used to identify a lower bound for the effects of economic insecurity on mental health takes the form:

$$H_{it} = \beta_0 I_{it} + \beta_1 P_{it} + \beta_2 F_{it} + X_{it}'\gamma + \alpha_i + \eta_t + \varepsilon_{it}$$

where H_{it} is the GHQ-12 score (0-36) for individual i at time t, I is the dummy variable indicating exposure to economic insecurity, P is unemployment experience in the past 3 years, and F is unemployment experience in the next 12 months. X is a vector of standard controls. The individual-specific intercept is given by α, η is the time dummy, and ε represents the idiosyncratic error.

The model above is estimated using the standard fixed effects (FE) estimator. Such an approach assumes that the dependent variable is cardinal in nature, which is evidently not the case when using the GHQ-12 score, despite the large number of categories available. However, it was considered more important to control for individual unobserved heterogeneity than for the ordinal nature of the dependent variable (Ferrer-i-Carbonell and Frijters, 2004). A further benefit of this strategy is that results are readily comparable to those produced by the instrumental variables (IV) estimation[3].

All standard errors are clustered at the individual level such that they are robust to arbitrary heteroscedasticity and within-subject autocorrelation.

As outlined earlier, there are potential time-varying ways by which mental health and economic insecurity may be simultaneously determined. To enable IV estimation, variations in individuals' economic environment (Rohde et al., 2014b) are used. Rather than using variables at the individual level, these instruments come at the level of occupation (17 categories), industry (25 categories), and region (12 categories). In each case, the mean level of the relevant form of economic insecurity is used, based upon a minimum number of observations per category (industry=80, occupation=30, and region=140). Instruments at this level of aggregation were shown to be exogenous.

The rationale behind these instruments is that changes at the regional-, industry-, or occupational-level will only impact on individuals' mental health by altering expectations about their own employment or financial situation – i.e. individuals will form expectations by

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[3] Performed in Stata using XTIVREG2 (Schaffer, 2015)

taking cues from their economic environment. Importantly, awareness of the mean levels of insecurity will not impact on individuals' mental wellbeing directly - that is without altering their level of concern for their own situation. For example, where a particular industry is threatened by overseas competitors, this will only have an effect on the individuals' mental health if they believe that this represents a threat to their own current economic situation. Consequently, instruments such as these fulfil the requirement of only influencing the dependent variable of mental health indirectly through their effect on economic insecurity. A test of this indirect effect, where the instruments are shown to be jointly and individually insignificant in a regression on GHQ-12 score, was carried out.

4. Results and Discussion

Sub-section 4.1 offers a comparison of trends in the ESIGB with trends of alternative subjective measures of economic insecurity using the full BHPS sample. Sub-section 4.2 gives the results of the FE regression using the restricted sample, while sub-section 4.3 gives equivalent results from the IV regression.

4.1 Comparison of Trends

Given the difficulty of capturing economic insecurity within a single measure, and the multiple elements that make up the concept of economic insecurity, it is important to examine a range of indicators.

An objective measure of economic insecurity is desirable as it may enable robust cross-country analysis in the future. However, the subjective nature of economic insecurity makes objective measurement difficult. For an objective measure to be comparable, it should on average correspond to equivalent subjective measures. For example, if the ESIGB captures anxiety associated with realised downward income volatility, then it should be reflected in subjective responses about individuals' current financial situation. However, similar comparisons are not as apparent for the other measures employed. For instance, although a central aspect of work-related economic insecurity may be the loss of labour income, this does not mean that the probability of that loss is high. Therefore, individuals may feel insecure, but not expect their financial situation to worsen.

Great Britain only (original sample members aged 16-64)
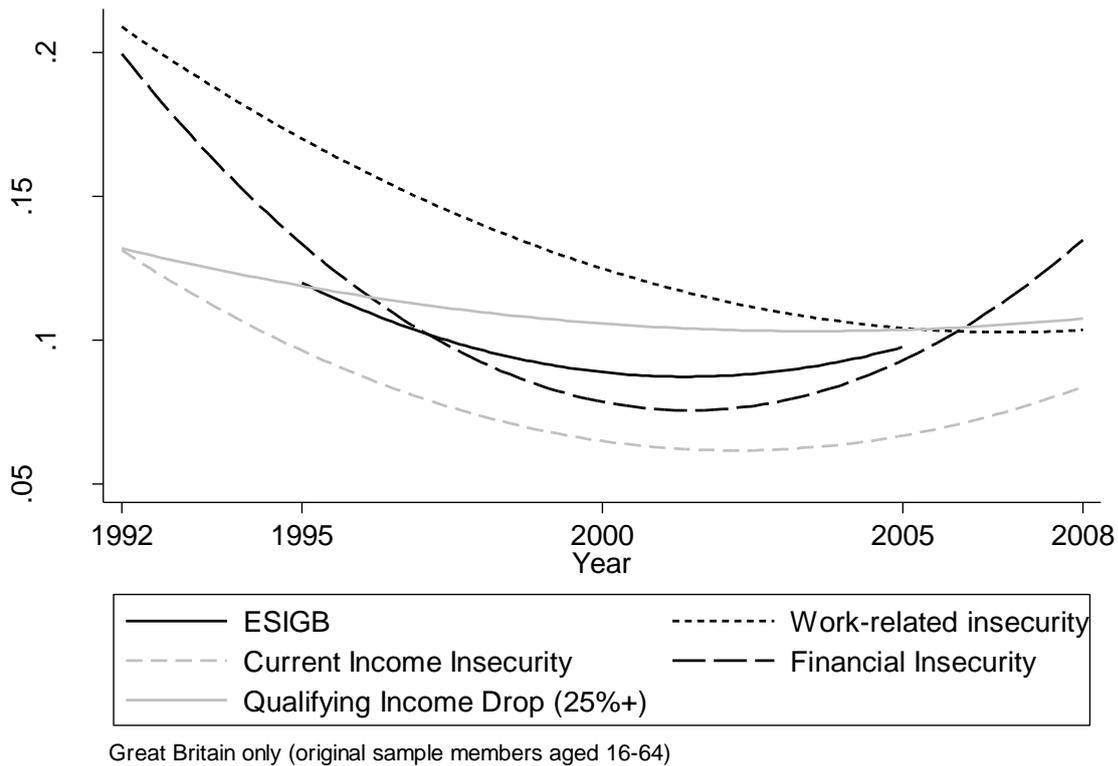
Figure 1. Weighted Trends in ESIGB and Subjective Measures of Economic Insecurity

Figure 1 illustrates the trend in each of the measures of economic insecurity. The vertical axis gives the proportion of the sample that is suffering from economic insecurity. This figure has been weighted to be nationally representative. What is apparent is that all measures show a decline in the level of economic insecurity until around 2001. Beyond this period the trends differ. The full ESIGB and qualifying income drops show a slight increase, while both current income insecurity and financial insecurity display a more pronounced increase. The only measure that does not display any clear increase is the measure of work-related insecurity. The trend in this measure declines steadily throughout the period, despite a perception that employment has become more insecure. However, work-related insecurity appears to affect the greatest proportion of the sample over the majority of the sample period.

After fitting trends to each measure, there is a slight difference between the full ESIGB and the measure based only on qualifying income drops. In the latter case the trend appears to be relatively flat throughout the slightly longer period for which data is available. Consequently, Figure 1 raises doubts about the reliability of qualifying income drops as a predictor of the full ESIGB, although these are shown to be unfounded in Figure 2 below.

14
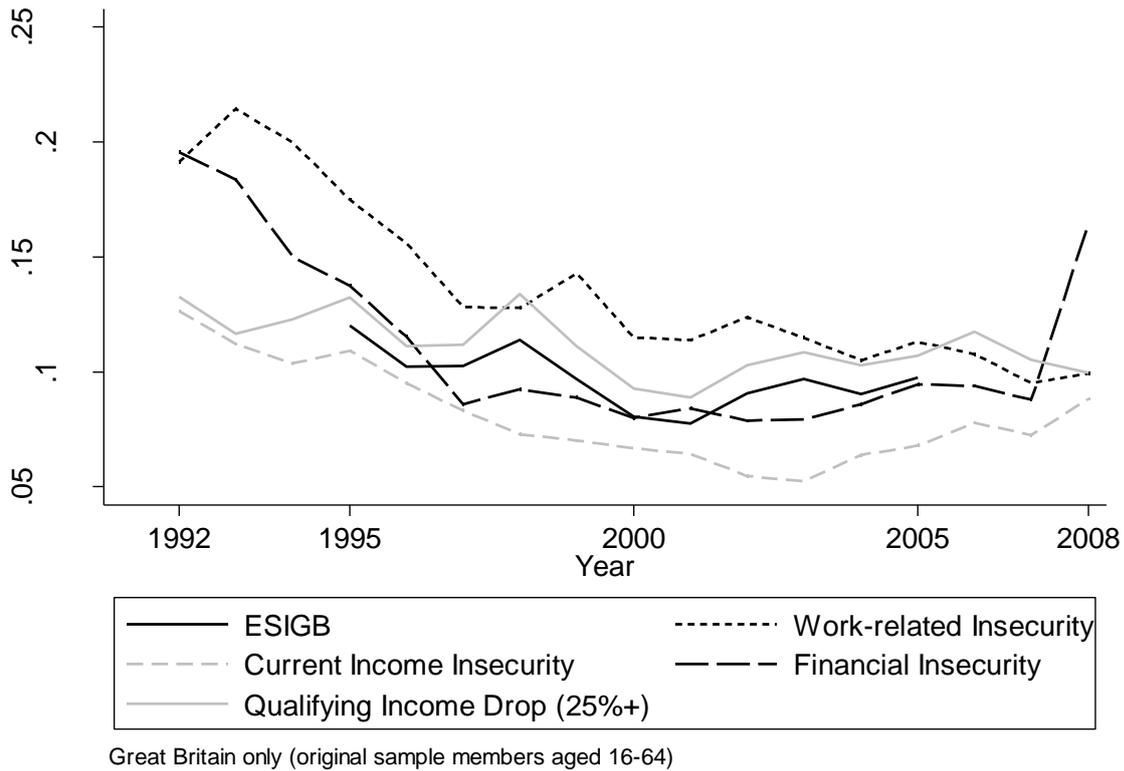
Figure 2. Weighted Mean Levels of ESIGB and Subjective Measures of Economic Insecurity.

Figure 2 presents equivalent data to Figure 1, but uses the weighted mean level of insecurity for each measure. Although Figure 2 is less clear, it does reveal additional information. Most striking is the large increase in expected income insecurity at the beginning of the financial crisis. Between 2007 and 2008 financial expectations worsened significantly. However, no other measure of insecurity had such a large change. There was a slight increase in individuals with current income insecurity, although this was not reflected in the mean level of qualifying income drops. A further point of note is that the level of the ESIGB is higher than current income insecurity at all points. This is unexpected since it was thought that the cut-off point of 25% for a qualifying income drop within the ESI method was very conservative, and that a number of individuals would experience financial distress due to lower levels of drops in household income. However, this discrepancy raises doubts about using a measure of uninsured income instability to capture economic insecurity.

In contrast to Figure 1, it is apparent from Figure 2 that the rate of qualifying income drops provides a very close approximation to the full ESIGB. This suggests that decisions made regarding the measurement of household wealth have limited impact on the index. The

reason for this is that amongst individuals within households that are identified as suffering from economic insecurity, the (weighted) median level of liquid household wealth is £10, while the 75th percentile is only £1143. Amongst the full sample the (weighted) 75th percentile is much higher at £7402. The (weighted) median level of household wealth is also higher within the full sample at £787. This suggests that from a methodological perspective household wealth is relatively unimportant within the ESIGB since the majority of household at risk of economic insecurity have relatively low wealth holdings. However, the more substantive finding is that sufferers of economic insecurity are more likely to have little or no protection from household income volatility. Therefore, asset poverty potentially becomes a major risk factor associated with the ESIGB.

	ESIGB	Income drop	Work- related	Current income	Financial
ESIGB	1				
Income drop	0.939	1			
Work-related	0.013	0.014	1		
Current income	0.057	0.051	0.056	1	
Financial	-0.022	-0.014	0.089	0.041	1

Table 1. Correlations between Measures of Economic Insecurity

Table 1 above summarises the correlations between all the measures of economic insecurity that are employed within this analysis. In many cases, the correlations are much lower than expected. The high correlation between the ESIGB and the qualifying income drops is expected due to the fairly negligible effect of household wealth in absorbing income drops. However, it would be expected that individuals within households that suffer income drops of 25% or more would indicate that they are currently struggling financially. This is especially the case given the extent of asset poverty amongst households suffering a qualifying income drop.

Given how low the correlation is between the ESIGB (or qualifying income drops) and the current income insecurity measure, it appears that the measures are capturing very different things. For reasons that are not immediately apparent, realised income volatility does not correlate highly with perceptions about current economic circumstances. This may be due to income volatility being measured at the household level and perceptions being taken at the individual level. This would also account for the ESIGB having an unexpectedly higher trend than comparable subjective measures. It may also be that a number of the income drops captured by the ESI are planned or expected, and consequently less stressful. A further

explanation could be that the experience of past income drops hardens individuals to the anxiety associated with such a loss. However, it is not possible at this stage to identify which of the candidate explanations is most likely. Intra-household transmission of insecurity, the effects of asset poverty on insecurity, and the impact of chronic economic insecurity are all promising areas for future research.

Low correlations between measures of economic insecurity were also found by Rohde et al. (2014b) using equivalent data from Australia. They find that a 25% drop in household income has a correlation with financial dissatisfaction of only 0.095. While the correlation between a 25% income drop and job insecurity is 0.043. Unlike the GB data, Rohde et al. (2014b) report a higher correlation between job insecurity and financial dissatisfaction at 0.252.

4.2 Fixed Effect Regression

Table 2 below gives the results from the FE regressions for each measure of economic insecurity. It is clear that both future orientated measures of economic insecurity result in a significant negative effect on mental health in both males and females. For males, being dissatisfied with current levels of job security reduces mental wellbeing by 0.317 of a standard deviation from the mean; the equivalent figure for females is 0.170. An individual's expectation that their financial situation will worsen within the next year reduces mental health by roughly the same amount for females. Unlike the case of work-related economic insecurity, there is not a large difference between males and females in terms of the negative impact of future income insecurity. This suggests that there is something regarding work-related insecurity that negatively affects males beyond a fear of financial misfortune.

Gender differences in the effect of work-related economic insecurity have been found within the existing literature. Using Canadian data, Watson (2015) finds a negative effect on male mental health of 0.14 standard deviations from the mean, and 0.9 for females. This difference in the size of the coefficients between the UK and Canada encourages future research looking at how the institutional setting impacts on levels of economic insecurity. However, more pertinent to the current analysis is a test of "breadwinner hypothesis" conducted by Watson (2015). After controlling for whether or not the individual is a parent, Watson (2015) finds no statistically significant effect of work-related economic insecurity on mental health for females, while the coefficient for males becomes larger and remains

significant. An alternative test of this breadwinner hypothesis was carried out in the current analysis by limiting the sample to only those identified within the BHPS as being legally or financially responsible for the household. As with Watson (2015), this resulted in the coefficient for work-related economic insecurity becoming insignificant for females at the 5% significance level, while the equivalent coefficient for males became larger and is statistically significant. Additional checks showed little difference in the proportion of household income being provided by male and female household heads. As such, it may not be the "breadwinner" role in itself that causes the gender differences that are observed in many studies of job insecurity, although it cannot be ruled out that the responsibilities of this role impact differently on males and females.

Watson (2015) posits that a possible explanation is that the "breadwinner" role may be more important to the male identity than to females. The results in this analysis support the suggestion that the source of this difference between genders involves more than financial aspects. Strandh et al. (2013) show that differing societal expectations regarding labour force participation of males and females can alter the negative impact on wellbeing resulting from unemployment. It may also be the case that such societal expectations influence the extent of psychological distress resulting from a fear of unemployment.

One gender difference shown in Table 2 that is not supported within existing literature is that anticipation of unemployment has a large and statistically significant negative effect on males, but no effect on females. This result is apparent across all measures of economic insecurity that are used within the analysis. The comparison for this result comes from Clark and Georgellis (2013). They show a negative impact on GHQ scores for both males and females who suffer unemployment within the next 12 months. Furthermore, this effect is larger for females. Some difference in comparison to Clark and Georgellis (2013) were expected due to differences in model specification. In particular, the inclusion of current work-related economic insecurity would be expected to capture a similar effect to anticipation of unemployment. Work-related economic insecurity as conceptualised here includes a cognitive assessment of the probability of job loss. Therefore, it was expected that there would be no separate effect from anticipating unemployment. This presents a difficulty in interpreting what this separate effect of anticipation involves.

Dependent variable: GHQ-12 score	Work-related Male	Work-related Female	Financial Male	Financial Female	Income Drop Male	Income drop Female	ESI Male	ESI Female
Economic Insecurity	-0.317***	-0.170***	-0.180***	-0.174***	-0.074**	0.005	-0.102**	0.001
	(-9.69)	(-3.94)	(-5.00)	(-3.19)	(-2.12)	(0.11)	(-2.30)	(0.02)
Past 3 years unemployment	0.264	-0.327	0.281	-0.354	0.280	-0.345	0.265	-0.184
	(1.35)	(-0.98)	(1.45)	(-1.07)	(1.46)	(-1.05)	(1.07)	(-0.56)
Unemployed within 12 months	-0.204**	0.005	-0.262***	-0.013	-0.266***	-0.035	-0.255***	0.002
	(-2.56)	(0.04)	(-3.26)	(-0.08)	(-3.32)	(-0.23)	(-2.73)	(0.01)
2nd income quintile	-0.108*	-0.175**	-0.107*	-0.178**	-0.129**	-0.181**	-0.168**	-0.175*
	(-1.91)	(-2.05)	(-1.89)	(-2.09)	(-2.22)	(-2.08)	(-2.42)	(-1.66)
Middle income quintile	-0.130**	-0.129	-0.123**	-0.130	-0.158**	-0.132	-0.208***	-0.219*
	(-2.12)	(-1.41)	(-1.98)	(-1.42)	(-2.46)	(-1.41)	(-2.68)	(-1.95)
4th income quintile	-0.131**	-0.142	-0.127**	-0.148	-0.169**	-0.150	-0.235***	-0.210*
	(-2.06)	(-1.50)	(-1.99)	(-1.56)	(-2.51)	(-1.52)	(-2.88)	(-1.78)
Top income quintile	-0.154**	-0.168*	-0.143**	-0.174*	-0.198***	-0.174*	-0.266***	-0.258**
	(-2.20)	(-1.68)	(-2.03)	(-1.75)	(-2.65)	(-1.67)	(-2.98)	(-2.04)
Other controls (except interactions)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	13186	7650	13186	7650	13186	7650	10085	5779
n	2499	1690	2499	1690	2499	1690	2408	1589
R^2	0.0371	0.0239	0.0265	0.0231	0.0243	0.0207	0.0272	0.0239

Notes

t statistics in parentheses   * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Other controls include education, age, marital status, number of children, existing health problems, industry of employment, hours worked, employer size.

Table 2. The Effect of Economic Insecurity on Standardised GHQ-12 score (Fixed Effect Regression)

In order to investigate this difference, an alternative variable that captured involuntary termination of the current employment relationship was used. In this case there was no statistically significant effect that was separate from work-related economic insecurity. This suggests that anticipation of unemployment may be capturing individuals who are voluntarily entering into unemployment. Such planned transitions may be related to dissatisfaction with some aspect of the employment relationship other than security. Additionally, individuals may hold some private information that makes them aware that finding equivalent employment may be difficult. Although it is not possible to test this conjecture within the current study, there are previous studies that highlight the mitigating effect of employability on job insecurity, most notably Green (2011).

In line with expectations, there is no separate negative impact on mental health from the proportion of time spent unemployed within the last 3 years when current insecurity is controlled for. Knabe and Rätzel (2011) suggest that past unemployment experience influences perceptions of future unemployment risk, and this leads to the scarring effect of unemployment which has previously been supported (Clark et al., 2001). Their main finding was that when current perceptions of unemployment risk are controlled for, the effect of past unemployment experience will become insignificant, a result that is supported in Table 2. However, it is surprising that this result is consistent across all measures of economic insecurity. One possibility is that each measure of economic insecurity is influenced by past unemployment experience, such that the mechanism suggested by Knabe and Rätzel (2011) operates within all of them. In the case of the objective measures it may be that past income loss, most probably due to employment volatility, does inform perceptions of future employment risk. The validity of the ESI as a measure of future-orientated insecurity is based on this idea (Hacker et al., 2014). However, the determinants of each measure of economic insecurity have yet to be reliable tested within the literature. One effort in this direction (Rohde et al., 2014a) found differences in the determinants of income instability and subjective economic insecurity.

A further interesting result in Table 2 is that subjective elements of economic insecurity have a stronger negative impact on mental health than the objective measures employed within this study. There are no statistically significant effects for females experiencing a 25% or more decrease in household income. For males experiencing a qualifying income loss there is a negative effect on mental health of 0.074 standard deviations from the mean. The figure rises to 0.1 when using the full ESIGB index, although the loss of 3000 observations makes

this comparison somewhat unreliable. For both males and females, it appears that exposure to perceived risk is more harmful than the realisation of risks. This is an important point since individuals may suffer a larger negative effect on mental health from a perceived risk than from a realised risk. Additionally, Table 3 below shows that the negative effects of all forms of economic insecurity are unaffected by unemployment experience within the next 12 months. Therefore, these results suggest that the negative effects of economic insecurity may be hidden from conventional measurement.

   The final point of note from Table 2 is that mental health is negatively related to an individual's position in the household income distribution. Recall that household income is equivalised and in real values. The position in the household income distribution is given in comparison to the full BHPS sample. As the sub-sample used within this analysis includes only those in full time permanent employment the result has limited relevance to the full population. Due to the sample being used, there are relatively few observations within the base category (lowest quintile). Furthermore, for each model reported in Table 2, we fail to reject the joint hypothesis that the coefficients on household income are all equal relative to the base category. Therefore, the results suggest that earning a level of income above the lowest quintile results in a negative effect on mental health for the primary workforce of the UK. This finding does not agree with the majority of existing literature that employs household income as a determinant of mental health. For example, Jones and Wildman (2008) show that higher levels of equivalised household income are associated with higher psychological wellbeing in women, although the effect is small. For men there is no statistically significant effect.   Jones and Wildman (2008) also point out that no clear consensus emerges from existing studies that use both the GHQ-12 and the BHPS in models that control for individual unobserved heterogeneity. However, it is the case that existing studies find small or weak effects, if any. Therefore, it is likely that the result in this table is capturing something about increased psychological burden associated with moving from the lowest income quintile to a higher income level. This may be related to a strain from increased financial independence as some means tested in-work benefits are removed (Jones and Wildman, 2008). It should also be noted that inclusion of the (log) level of household income, rather than the position in the income distribution, results in there being no statistically significant effect on mental health from household income.

   Table 3 below provides results from additional regressions that interacts the economic insecurity variables with income, unemployment experience, and unemployment outcomes

within the next 12 months. As can be seen, very few of these individual interactions are statistically significant, and in every case the interactions are jointly insignificant. Furthermore, their inclusion affects the economic insecurity coefficients in most cases, and makes estimation of the model using IV more difficult. Therefore, the decision was made to exclude these interactions from the main results.

The lack of statistically significant interactions may still be informative. However, it should be noted that the interpretation of the economic insecurity variables are based only on the base category of every interaction. For example, the economic insecurity variable in the first column refers to a male in the bottom income quintile with no unemployment experience in the last 3 years, and that does not become unemployed in the next 12 months.

The negative effects of work-related economic insecurity on male mental health do not appear to change depending on the sufferer's position within the household income distribution. The same appears to be true for females, although the lack of a statistically significant coefficient on the economic insecurity variable casts some doubt on this. Such a finding is consistent with results using equivalent Australian data reported by Rohde et al. (2014c). However, Rohde et al. (2014c) are able to report this result across a range of indicators of economic insecurity. Within Table 3 this result cannot be reliably reported for the other measures of economic insecurity due to the effect that including insignificant interaction terms has on the other variables of interest. One exception is male financial insecurity, which appears to have a far larger negative effect for sufferers in the lowest quintile of the household income distribution.

Dependent variable: GHQ-12 score	Work-related Male	Work-related Female	Financial Male	Financial Female	Income drop Males	Income drop Female	ESI Male	ESI Female
Economic Insecurity	-0.395***	-0.241	-0.768***	0.028	0.023	-0.052	0.077	0.059
	(-3.03)	(-0.65)	(-5.11)	(0.08)	(0.24)	(-0.36)	(0.66)	(0.30)
Past 3 years unemployment	0.226	-0.446	0.256	-0.317	0.297	-0.253	0.285	-0.184
	(1.10)	(-1.23)	(1.33)	(-0.96)	(1.42)	(-0.71)	(1.08)	(-0.52)
Insecurity * Past unemployment	0.225	0.791	0.558	-3.697**	-0.090	-0.271	-0.009	0.189
	(0.42)	(1.53)	(0.73)	(-2.05)	(-0.22)	(-0.42)	(-0.02)	(0.25)
Unemployed within 12 months	-0.216**	0.018	-0.266***	0.036	-0.265***	-0.105	-0.254***	-0.111
	(-2.18)	(0.09)	(-3.07)	(0.26)	(-3.23)	(-0.65)	(-2.76)	(-0.63)
Insecurity * Unemployed within 12 months	0.038	-0.031	0.027	-0.240	0.004	0.676	0.009	0.980*
	(0.24)	(-0.10)	(0.13)	(-0.46)	(0.01)	(1.48)	(0.02)	(1.68)
Insecurity * 2nd income quintile	0.098	0.174	0.593***	-0.313	-0.127	0.084	-0.180	-0.033
	(0.72)	(0.46)	(3.52)	(-0.79)	(-1.20)	(0.49)	(-1.36)	(-0.15)
Insecurity * middle income quintile	0.081	-0.074	0.556***	-0.272	-0.096	0.236	-0.171	0.061
	(0.57)	(-0.20)	(3.33)	(-0.73)	(-0.76)	(1.39)	(-1.09)	(0.28)
Insecurity * 4th income quintile	0.148	0.130	0.656***	-0.134	-0.079	-0.032	-0.222	-0.252
	(1.05)	(0.35)	(4.00)	(-0.36)	(-0.67)	(-0.17)	(-1.43)	(-1.04)
Insecurity * top income quintile	-0.006	0.076	0.603***	-0.133	-0.148	-0.180	-0.386**	-0.208
	(-0.05)	(0.20)	(3.69)	(-0.36)	(-1.19)	(-0.84)	(-2.32)	(-0.77)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	13186	7650	13186	7650	13186	7650	10085	5779
n	2499	1690	2499	1690	2499	1690	2408	1589
R^2	0.0377	0.0251	0.0277	0.0247	0.0245	0.0227	0.0279	0.0264

Notes
t statistics in parentheses   * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Other controls include education, income, age, marital status, number of children, existing health problems, industry of employment, hours worked, employer size.

Table 3. The Effect of Interactions with Economic Insecurity on Standardised GHQ-12 score (Fixed Effect Regression)

4.3 Instrumental Variables Regression

Table 4 below reports the results of the IV estimation. This model is directly comparable with Table 2 as no interaction terms are included. The purpose of this stage of analysis is to test the hypothesis that the coefficients on the economic insecurity variables from the FE analysis (see Table 2) underestimate the effects of economic insecurity on mental health due to simultaneity bias. This hypothesis is based upon the theoretical predictions outlined in Geishecker (2012) which showed that when job insecurity and subjective wellbeing are simultaneously determined the coefficient on insecurity will be upward biased, such that any negative effect will be underestimated. This prediction can be readily applied to work-related economic insecurity. In the case of financial insecurity this is less clear as the source of the insecurity is not known, although this could conceivably result from an expectation of employment volatility. The two objective measures are included for completeness despite simultaneity bias being less likely in these cases.

For males the hypothesis that the FE results understate the negative effects of work-related economic insecurity on mental health is broadly supported. The coefficient is almost 3 times larger in the IV regression compared to the FE results. Diagnostics tests show that the model is overidentified and the instruments are sufficiently strong. The only doubt comes from the endogeneity test which suggests that work-related economic insecurity may not be endogenous. However, the result of this test is close to the 5% significance level and is sensitive to changes in the sample, for example only including household heads. Therefore, on balance it is likely that this relationship does suffer from simultaneity bias. The results for the other measures of economic insecurity for males indicate that the estimates in Table 2 are not suffering from simultaneity bias since the diagnostic tests reject endogeneity. Such a finding is only partially surprising for the financial insecurity measure and suggests that the source of insecurity may not be concerns regarding employment volatility. This creates the possibility that planned transitions, or the burden of debt holdings may create feelings of financial insecurity. As mentioned earlier, further study of the determinants of each form of economic insecurity is something that would develop this literature.

Dependent variable: GHQ-12 score	Work-related Male	Work-related Female	Financial Male	Financial Female	Income drop Male	Income drop Female	ESI Male	ESI Female
Economic Insecurity	-0.880***	0.002	-0.188	0.574	0.050	-0.735	0.378	-0.679
	(-2.88)	(0.01)	(-0.46)	(1.06)	(0.11)	(-1.42)	(0.64)	(-1.21)
Past 3 years unemployment	0.211	-0.346	0.280	-0.319	0.303	-0.369	0.376	-0.315
	(1.01)	(-1.05)	(1.44)	(-0.96)	(1.44)	(-1.08)	(1.32)	(-0.87)
Unemployed within 12 months	-0.096	-0.036	-0.262***	-0.108	-0.263***	-0.015	-0.261***	0.010
	(-0.94)	(-0.19)	(-3.27)	(-0.62)	(-3.24)	(-0.09)	(-2.79)	(0.06)
2nd income quintile	-0.106*	-0.183**	-0.107*	-0.196**	-0.096	-0.371**	-0.0319	-0.341*
	(-1.85)	(-2.09)	(-1.89)	(-2.25)	(-0.75)	(-2.31)	(-0.18)	(-1.89)
Middle income quintile	-0.138**	-0.135	-0.123**	-0.151	-0.105	-0.466*	0.002	-0.507*
	(-2.19)	(-1.46)	(-1.97)	(-1.63)	(-0.54)	(-1.86)	(0.01)	(-1.88)
4th income quintile	-0.134**	-0.153	-0.127**	-0.169*	-0.102	-0.578*	0.0208	-0.573*
	(-2.08)	(-1.57)	(-1.99)	(-1.77)	(-0.41)	(-1.84)	(0.06)	(-1.74)
Top income quintile	-0.162**	-0.178*	-0.143**	-0.189*	-0.116	-0.685*	0.039	-0.689*
	(-2.28)	(-1.75)	(-1.97)	(-1.89)	(-0.39)	(-1.86)	(0.10)	(-1.79)
Other controls (except interactions)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	13186	7650	13186	7650	13186	7650	9845	5565
n	2499	1690	2499	1690	2499	1690	2168	1375
LM Underidentification test stat	70.385	35.920	51.601	30.743	52.854	40.507	32.333	42.011
Underidentification p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
K-P Weak Identification F stat	24.846	12.993	18.500	10.388	18.442	14.780	10.930	15.049
Endogeneity C test stat	3.631	0.193	0.002	2.020	0.071	2.345	0.622	1.633
Endogeneity p-value	0.057	0.661	0.968	0.155	0.789	0.126	0.430	0.201

Notes

t statistics in parentheses   * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Other controls include education, age, marital status, number of children, existing health problems, industry of employment, hours worked, employer size.

Table 4. The Effect of Economic Insecurity on Standardised GHQ-12 score (Instrumental Variables Regression)

For females the results for work-related economic insecurity appear to be affected by weak instruments. Although endogeneity is rejected, this result is unreliable due to the other diagnostic test results. The problem of weak instruments appears in all the female IV results. Consequently, the only tentative conclusion would be to assume that female results with sufficiently strong instruments would reflect any simultaneity bias identified by the results for males. Therefore, the results within Table 2 may be valid, with the particular case of work-related economic insecurity being a lower bound estimate of the true effect.

5. Conclusions

This paper has added to an emerging body of evidence showing the negative effects of economic insecurity on mental health. A range of measures of economic insecurity were presented, and although trends in the measures were shown to be broadly similar across the majority of the sample period there is little correlation between the measures. This becomes most pertinent when comparing one proposed objective measure, the Economic Security Index (Hacker et al., 2014), to subjective measures that could reasonably be expected to capture similar aspects of insecurity. It remains the case that a range of measures are always beneficial when conducting analysis. In this respect the ESI certainly contributes by providing an objective measure of realised downside income volatility which can be readily applied to panel data, and may enable cross-country policy analysis. However, the more interesting immediate challenge is to understand the reasons why the relationship between objective and subjective measures do not match prior expectations, especially as this difference is also apparent in the effects on mental health. It seems that greater psychological distress is caused by perceived exposure to downside risk than by realised downside volatility.

The results also suggest that any negative effect of economic insecurity on mental health is experienced regardless of the level of household income and of unemployment outcomes. The income results largely support those first presented in Rohde et al. (2014c). However, the result in this paper is not as conclusive since inclusion of irrelevant interactions often resulted in the main effect also becoming insignificant. Despite this, it appears that one key feature of economic insecurity is that it can be experienced across the income distribution. Furthermore, the negative effects may be experienced without any objective event occurring. Consequently, economic insecurity may result in a largely hidden welfare loss resulting from psychological distress that can affect any member of the population.

In the instrumental variables regressions it appears that endogeneity is only an issue for work-related economic insecurity. In this respect, theoretical predictions from Geishecker (2012) regarding the direction of the bias were supported in the case of male employees. Consequently, the fixed effect regression results can be considered as a lower bound for the negative impact of economic insecurity on mental health. The IV results for females were less conclusive, although it is likely that the FE results are the most relevant.

With the exception of financial insecurity, there is a clear pattern of economic insecurity having greater negative impact on males than females. This is particularly the case for work-related economic insecurity. Analysis of trends in economic insecurity showed work-related insecurity as consistently having the highest rate within the population. When coupled with the large gender difference, this makes work-related economic insecurity a particularly significant factor for male mental health. Although it is clear that the employment relationship is the source of this insecurity, further research is needed to understand the particular characteristics of the employment relationship that result in insecurity. Existing research in this area has tended to focus on the role of global economic integration, for example Scheve and Slaughter (2004) and Geishecker et al. (2012). Further research is required to identify the broader socioeconomic factors determining economic insecurity.

The analysis in this paper encourages cross-country analysis of how labour market institutions, employer characteristics, and management practices mitigate the negative impact of economic insecurity on mental health. The use of an objective measure such as the ESI may enable such analysis, although the use of comparable subjective measures may offer greater insight.

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