Macroeconomic Shocks, Job Security and Health: Evidence from the Mining Industry

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Abstract

How do exogenous changes in the macroeconomic environment affect workers' perceived job security, and consequently, their mental and physical health? To answer this question, we exploit variation in world commodity prices over the period 2001-17 and analyse panel data that includes detailed classifications of mining workers. We find that commodity price increases cause increases in perceived job security, which in turn, significantly and substantively improve the mental health of workers. In contrast, we find no effects on physical health. Our results imply that the estimated welfare costs of recessions are much larger when the effects of job insecurity, and not only unemployment, are considered.

Keywords: Job Security, Health, Commodity Prices, Mining

JEL Codes: I10, J60, C23

1. Introduction

Research shows that economic recessions are harmful for mental health. Deleterious effects have been detected for self-reported symptoms of poor mental health (McInerney et al., 2013), mental health-related hospitalisations (Engelberg and Parsons, 2013), prescriptions for anti-anxiety and anti-depressant medications (Bradford and Lastrapes, 2014), searches on the Internet for 'depression' and 'anxiety' (Tefft, 2011), and suicide rates (Ruhm, 2000; Phillips and Nugent, 2014; Breuer, 2015; Mattei and Pistoresi, 2019). It has also been found that recessions reduce life satisfaction (Di Tella et al., 2003; Luechinger et al., 2010). These findings are complementary to studies that have shown that at the individual-level, losing your job adversely affects health and mortality (Winkelmann and Winkelmann, 1998; Eliason and Storrie, 2009; Kassenboehmer and Haisken-DeNew, 2009; Sullivan and Von Wachter, 2009; Browning and Heinesen, 2012; Black et al., 2015; Bloemen et al., 2018).

But whose mental health suffers most during economic downturns? Changes in the macroeconomic environment have larger effects on mental health than can be explained by increased distress of the newly unemployed, or the reduced labour market opportunities of the long-term unemployed. One argument proposed in the literature is that economic downturns breed greater job insecurity among the much larger numbers of employed, and that this wider insecurity is the main driving force of the observed aggregate worsening in mental health (for example, Di Tella et al., 2003; Luechinger et al., 2010; Green, 2011; Caroli and Godard, 2016). In other words, individuals may care about increases in the unemployment rate, even when they themselves are not unemployed (Luechinger et al., 2010). As Di Tella et al. (2003) explain, "… an increase in joblessness can affect well-being through at least two channels. One is the direct effect: some people become unhappy because they lose their jobs. The second is that, perhaps because of fear, a rise in the unemployment rate may reduce well-being even among those who are in work or looking after the home." Within a theory of social comparisons, Clark et al. (2010) similarly note that, "The social norm of unemployment suggests that aggregate unemployment reduces the well-being of the employed, but has a far smaller effect on the unemployed." In fact, it has been argued more broadly that the anticipation of a stressful event represents an equally important, and perhaps even greater, source of anxiety than the occurrence of an actual event (Lazarus and Folkman, 1984; Burgard et al., 2009).[1]

These arguments and findings are important, because they imply that the welfare costs of economic downturns might be substantially larger if the effects of job insecurity on wellbeing are considered in addition to the impacts on the newly unemployed. While this is an appealing hypothesis, few studies have provided causal evidence on how macroeconomic conditions affect job insecurity, and in-turn, mental and physical health.

For a number of reasons, providing causal estimates is difficult in this context. First, changes in general macroeconomic conditions, as proxied by changes in unemployment or stock markets for example, often impact upon multiple aspects of people's lives, not only their job security (Frijters et al., 2015). Second, individuals likely self-select into jobs that differ in their underlying security. Researchers can readily control for observable characteristics that partly determine such selection; but characteristics and preferences, such as the level of risk aversion, and cognitive

[1] There is some evidence that job insecurity can impact the mental health of family members (Carlson, 2015; Bünnings et al., 2017). Increased job insecurity also has been found to cause households to increase savings (Carroll et al., 2003) and to reduce or defer consumption (Benito, 2006). A recent paper identified a link between a measure of daily flunctions in economic uncertainty and suicides in England and Wales (Vandoros et al., 2019).

and non-cognitive skills, are only partially measured in surveys. Third, there is the potential for reverse causality: health shocks, which can reduce productivity, may also increase workers' fears that they will be fired or made redundant. Fourth, there is the possibility of measurement error in workers' reports of their job security, as well as in their self-reported health.

To overcome these identification challenges, one must find a source of exogenous variation in macroeconomic conditions that impacts health through its effect on job security. In particular, an exogenous shock that impacts certain workers and not others, or the same worker at different times. It is also important that workers not be able to foresee this shock, and thus adjust their economic decision-making in advance. Few studies have been able to overcome these identification challenges.

In this paper, we aim to shed additional light on why changes in the macroeconomic environment have a major impact on health, by identifying the causal effect of economic conditions on feelings of job insecurity, and mental and physical health. To do this, we employ an uncommon identification approach. Using detailed Australian panel data for the years 2001-17, we focus on a sample of individuals working in specific mining subindustries (e.g. iron ore, gold, coal), and explore how their perceived job insecurity varies with world commodity prices.[2] While the mining sector in Australia only accounts for around 2% of the workforce, it is of prime importance for the economy, accounting for 8.5% of GDP, and half of total export earnings (Garnett, 2015).

[2] Green and Leeves (2013) and Rohde et al. (2016) also use Australian panel data to study the relationship between insecurity and mental health. While both papers contribute to the literature by applying individual fixed effects models, neither use exogenous variation to allow for causal identification.

Our main regression specification controls for individual-employment spell fixed-effects and month-year fixed-effects. This implies that identification is driven by differential variation in commodity prices across time faced by a worker during their employment in a particular mining subindustry. During our sample period, there was substantial variation in commodity prices because of strong demand growth from China, India and other industrialising economies, and the collapse in global economic growth associated with the Global Financial Crisis (GFC). This price variation differentially shocked the profitability of different mining subindustries, affecting perceived demand for labour.

The most similar study we are aware of is Goldberg et al. (1999), which estimated the effect of industry-specific export and import real exchange rates on employment stability in the US, as represented by individual-level job-changes and industry-switches. They found no overall effect of exchange rate changes on job instability. Using a similar identification strategy, Kaiser and Siegenthaler (2016) use a sample of Swiss manufacturing firms to estimate the effects of industry-specific exchange rates on employment.[3] Exchange rate changes are found to have only small impacts on total employment, but to significantly alter the skill mix of employees within firms.

Contributing to the broader job security literature, Caroli and Godard (2016) fit a model of individual-level health outcomes using European data, with perceived job security instrumented by country-specific employment protection legislation interacted with industry-specific dismissal rates. Their conclusions are that job insecurity significantly increases the probability of individuals suffering from skin

[3] In a study unrelated to employment outcomes or job insecurity, Berman et al. (2017) exploit exogenous variation in world commodity prices to identify the impact of mining on conflicts in Africa.

problems and headaches or eyestrain, but does not affect depression or anxiety. Reichert and Tauchmann (2017) estimate the effects of company-level workforce reductions on private sector workers in Germany. Results from their individual-level fixed-effects models suggest that the fear of job loss, measured by workforce reductions, negatively affects employee psychological health and job security. Finally, Bratberg and Monstad (2015) exploit a natural experiment in which some Norwegian municipalities were affected by a financial shock. They find that the financial shock reduced municipality workers' sickness absence, which they argue is the consequence of reduced job security.[4]

The remainder of this paper is organised as follows. In Section 2 we describe the HILDA survey and our main data items. Next, in section 3, we outline our main methodological approaches. We present results for the job security and health outcomes in Sections 4 and 5, respectively. Section 6 includes a comparison of mining workers with other workers. Finally, we conclude in Section 7.

[4] We note that there is a substantive literature in psychology and public health that has focused on the link between job insecurity and health (see De Witte, 1999; Sverke et al., 2002; Virtanen et al., 2013; Fiori et al., 2016; Urbanaviciute et al., 2019), and a number of studies have used panel data to better address this relationship (see De Witte et al., 2016). The results from these studies are mixed, but tend to find that there is a significant association between job insecurity and poorer health outcomes, with the strength of the relationship being greater for mental than physical health. While the use of longitudinal data improves temporal identification, this literature has not tended to use exogenous variation in job security to better identify health effects. One of the most highly cited papers is Ferrie et al. (2002), who analysed prospective cohort data from the Whitehall II study. The study found that a loss of job security for white-collar workers in the British Civil Service was associated with worse self-reported health and increased psychiatric morbidity. Interestingly, these adverse effects did not fully disappear when the threat of job loss was removed.

2. Data

2.1. HILDA Survey Data

Data come from the Household, Income and Labour Dynamics in Australia (HILDA) survey. HILDA is an ongoing longitudinal study that began in 2001 with a nationally representative sample of Australian households. We use waves 1 to 17 (2001-2017) of the unconfidentialised version of HILDA, which contains detailed industry codes (4-digit Australian and New Zealand Standard Industrial Classification (ANZSIC) 2006) of the respondents. We use these codes to identify our sample of individuals who work in different types of mines (e.g. gold, iron ore, coal) within the mining industry. Columns (1) and (2) of Appendix Table A provide the full list of mining subindustries and related ANZSIC 2006 codes.[5]

The sample in our main analysis is formed of individuals who were employed in the mining industry at the time of a HILDA survey for at least two consecutive years (1,521 individual-year observations); this sample restriction is implemented because we use within individual-employment spell fixed-effects. Most of these observations are from coal mining (52.3%), followed by iron ore mining (15.3%), oil and gas extraction (9.7%), and gold ore mining (8.5%), as shown in column (3) of Appendix Table A. Figure 1 is a map of currently operating mines of all commodities within Australia; it shows that these mines are spread across all Australian states. Appendix Table B shows that, compared to national averages for

[5] Several industry codes cannot be matched to commodity price data because the codes are not specific enough or because price information is not available. These codes are: metal ore mining; mineral sand mining; other metal ore mining; non-metallic mineral mining; and quarrying, gravel and sand quarrying, and other construction material mining. However, this excludes only a small number of observations, given that few individuals work in these industries.

all employees, mining workers in our sample are more likely to reside in Queensland (32.5% versus 20.8%) and Western Australia or Northern Territory (28.0% versus 10.2%), and in regional and remote areas (67.6% versus 35.6%). Clearly mining is a male-dominated industry (89%), but mining workers are of similar average age to workers from other industries (39 versus 40). Given the nature of the industry, mining workers also are more likely to have had a vocational education (50.2% versus 33.6%), and correspondingly are less likely to have a university-level education (15.5% versus 29.0%). We discuss the external validity of our results in Section 6.

2.2. Measuring Job Security and Health

Perceived job security is a key variable for the analysis. We construct this variable based on individuals' responses to seven questions about their satisfaction with job security and employment opportunities, their perceived likelihood of losing and leaving job, and future job security. The full text of the questions can be found in Appendix C. Some of these questions are asked in a personal interview (Personal Questionnaire) conducted face-to-face with the majority of respondents in HILDA. The remaining questions are asked in a confidential paper questionnaire (Self-Completion Questionnaire). Appendix D show the mean values of these variables for all employees in HILDA, and for mining workers, respectively. Mining workers report lower satisfaction with their job security (7.4 versus 7.9 on a 10 point scale), even though their satisfaction with employment opportunities is higher (7.7 versus 7.4). They also think that there is a higher percentage chance of them losing their job in the next 12 months (15.1% versus 10.6%) compared to all workers, and thus are more worried about the future of their jobs (3.4 versus 2.9 on a seven point scale). However, although higher, job insecurity in the mining industry is not dramatically greater than for the wider workforce, with most miners feeling secure in their jobs (4.8 versus 5.0).

We use principal component factor analysis to reduce the number of job security variables, which we perform using all available HILDA observations for employed individuals.[6] Only one factor has an eigenvalue greater than 1, which loads on all seven questions. The scoring coefficients on the individual job security questions are shown in Appendix D. Satisfaction with job security and perceived secure future in one's job have the highest scoring coefficients. The expected likelihood of leaving your current job has the lowest scoring coefficient. The job security factor has a mean of -0.19, indicating that our mining sample on average feels less secure than the general working population (0.19 standard deviations lower).

We measure worker health using the SF-36 multi-attribute health instrument, which has been widely used in the economics literature (see, for example, Brazier et al., 2002; and Cornaglia et al., 2014). It consists of a series of questions about mental and physical wellbeing and functioning in eight domains: Vitality, Social-Functioning, Role-Emotional, Mental Health, Physical Functioning, Role-Physical, Bodily Pain, and General Health. Within each domain, the answers are scored and summed to produce an index. We perform a principal component factor analysis on these indices; as expected, it produces two factors (with eigenvalues greater than 1).

[6] Factors with eigenvalues greater than one are retained. Factor loadings are estimated using the variance-covariance matrix of the job security questions. The factor loadings are then rotated using orthogonal varimax method to simplify factor structure; with orthogonal rotation factors are uncorrelated with each other. Finally, we use regression methods to obtain scoring coefficients and construct the job security factor by summing the standardized job security questions weighted by the corresponding scoring coefficients. The job security factor has mean equal to zero and variance equal to one in the sample of all employed individuals in the HILDA.

One factor primarily loads heavily on psychological domains (Mental Health, Vitality, Role-Emotional) and the other on physical domains (Physical Functioning, Role-Physical, Bodily Pain). We refer to the first factor as 'Mental Health' and the second factor as 'Physical Health'.

2.3. Commodity Prices

We link the HILDA data to monthly worldwide commodity prices obtained from the International Monetary Fund (IMF) Primary Commodity Prices database.[7] The price variable is constructed as follows: first, we select the relevant price series for each of the mining subindustries. Next, we convert the commodity prices to Australian dollars using historical USD/AUD exchange rate information from the Reserve Bank of Australia (RBA) to take into account exchange rate fluctuations. Finally, we create subindustry-specific price indices using the average 2005 price as the base price (so that the average 2005 price in AUD = 1).[8] For oil and gas extraction and silver-lead-zinc ore mining, there is more than one relevant price; for those subindustries, we calculate a weighted average price index, where the weights are relative industry shares used by the RBA in their calculation of the Index of Commodity Prices.[9] Appendix A lists the specific price series and weights used in

[7] Where possible price series come from IMF Primary Commodity Prices database. Gold and silver prices were obtained from World Bank (WB) Global Economic Monitor Commodities database.

[8] We normalize the commodity prices with respect to the 2005 average following the IMF. Using other year averages or an average price across all years (2001-17) produces comparable results. Comparable results are also generated when using commodity prices expressed in USD.

[9] See http://www.rba.gov.au/statistics/frequency/weights-icp.html

the calculations. In most specifications, the price is measured in the month prior to the survey interview.

Figure 2 depicts the subindustry-specific price indices for the years covered by HILDA and included in our analysis. It also shows the correspondence of price movements with the timing of the annual sampling of HILDA (shaded in grey), where the majority of survey respondents are interviewed in the last quarter in each year. From 2001 to 2006, mining commodity prices were relatively stable. After 2006 the variation in prices for most commodities increased substantially, with iron ore, gold and coal being especially volatile. In fact, the price of iron ore increased dramatically between 2007 and 2011 and varied substantially afterwards. During this period, commodity demand shocks were the primary cause of price increases. Exceptionally strong demand growth from the industrialising economies, particularly China and India, caused inventories of many commodities to fall to historically low levels, raising prices significantly (Devlin et al., 2011).

Figure 3 highlights the level of correlation between aggregate world commodity prices and mining employment levels. Specifically, it presents the IMF metals price index from 2000 to 2016 (2005 = 100), along with Australian Bureau of Statistics (ABS) Labour Force Survey data on the number of full-time employed persons working in the metal ore mining industry.[10] We can see that prices and employment are strongly correlated, as expected. Also, changes in commodity prices tend to lead to changes in mining employment. For example, employment changes lag by approximately two years the increase in price in 2003 and the decrease in

[10] The metals price index is constructed from copper, aluminium, iron ore, tin, nickel, zinc, lead, and uranium price indices.

price in 2011. Given this relationship, it is reasonable to think that mining workers would relate changes in commodity prices to job security.[11]

3. Methods

To determine the relationship between perceived job security (js_{ict}) and commodity prices in the past month (p_{ct}), we estimate the following linear regression:

$$js_{ict} = \alpha_{ic} + \delta_t + \beta_1 p_{ct} + \boldsymbol{X}'_{\boldsymbol{ict}}\boldsymbol{\beta_2} + u_{ict} \qquad (1)$$

where i indexes individuals, c indexes mining commodities, and t indexes time (month-year). Individual-employment spell fixed-effects α_{ic} imply that the effect of commodity prices on job security (β_1) is identified from changes in prices across time experienced by a mining worker while in an employment spell with a particular mining sub-industry (e.g. changes in iron-ore prices while working in an iron-ore mine). These individual-employment spell fixed-effects control for differences in job security across mining subindustries, and for changes in workforce composition over time.

Multiple observations from different workers in each month allow for the estimation of month-by-year time fixed effects δ_t. These time fixed effects control

[11] Labour market features of the Australian mining industry include: subcontracting out of on-site activities, workforce mobility through fly-in/fly-out positions, (skilled) labour shortages, and employee attraction and retention (Tonts, 2010). The latter two features have meant that during periods of rising commodity prices mining companies have found it difficult to attract staff, leading to the prolific use of foreign skilled labour (Dickie and Dwyer, 2011). These labour shortages mean that employment changes may be 'sticky' with respect to commodity price movements in the short-term.

for aggregate monthly shocks across commodities, such as global macroeconomic shocks, and for any general Australian mining shocks or policy changes that may jointly impact upon world commodity prices and job security. They also control for seasonality. Vector $\boldsymbol{X}'_{ict}$ includes time-varying demographic and socio-economic characteristics: gender, age, quadratic function in age, marital status, number of children, education, state of residence, and remoteness of residence. The random error term u_{ict} includes any unobserved determinants of job security that vary across individuals, commodities, and time.

The clear link between movements in world commodity prices and real employment outcomes shown in Figure 3 suggests that $\beta_1 > 0$. In essence, decreases in price eventually reduce company revenues and restrict labour demand in affected mining businesses. Therefore, sustained price decreases are expected to eventually lead to layoffs. Price decreases also may work through labour supply, influencing workers to voluntarily leave their job for another. Both of these labour supply and labour demand channels imply that, in the short-term, decreases (increases) in world commodity prices will decrease (increase) perceived job security.[12]

An assumption underlying equation (1) is that world commodity prices are not determined by decisions of mining companies with regards to their Australian-based operations. Indeed, it would be problematic for our identification if a company's

[12] Importantly, there is evidence that mining workers are cognisant of recent movements in commodity prices. For example, there are multiple periodicals produced specifically for mining workers (such as 'Australian Mining' and 'Mining Monthly') that regularly contain articles on commodity price movements and their likely impacts, such as on mine expansions or closures. As a specific example, a recent article titled 'Coal price soars, sees mines reopen', begins with "The current surge in coal prices has signalled positivity in the resources sector, leading to announcements of mines reopening both in Australia and overseas" (Masige, 2016).

decision to lower production at an Australian mine, and consequently to reduce the mine's workforce, caused changes in world commodity prices. That example is plausible only for iron ore and coal, given that Australia's shares of world exports in those commodities are large. Importantly, our main results are robust to re-estimating the models with coal or iron ore omitted.[13]

Another assumption is that mining workers are aware of changes in the price of their mine's commodity, and that this affects their perceived job security. The results that we will show in Section 4.1 suggest that this is the case. However, we also test whether these job security perceptions are meaningful, in the sense that they predict actual changes in employment status. In the top section (A) of Appendix E we present estimates from individual fixed-effects regressions that relate employment changes to one-year lagged perceived job security. The estimates provide evidence that perceived job security predicts future outcomes: a one standard deviation increase in job security increases the probability of being employed in the same mining subindustry (commodity type), and reduces the probability of changing jobs (voluntarily or involuntarily).

The speed with which price movements affect perceived job security is less clear, and will depend largely upon information flows within the general mining industry and within each specific mining company. We empirically investigated this issue by systematically constructing a series of weighted mean prices, using prices over the 12 months prior to the survey, essentially representing different lag structures. Then, we estimated equation (1) using these different price variables and

[13] The estimated effects of commodity prices on job security, β_1 in equation (1), equals 0.140 when coal is omitted and equals 0.205 when iron is omitted.

evaluated the goodness-of-fit of each. The weights come from the probability distribution function of the log normal distribution, which was chosen for its ability to provide a sufficiently wide range of different weighting patterns. Our results suggest that goodness-of-fit is maximised when a high proportion of weight is given to recent prices, especially the price last month. Therefore, throughout the rest of the paper we use price-last-month. The results using this more straightforward approach are very similar to those using the weighted price that maximises goodness-of-fit.

To model the impact of commodity prices on health, different mental and physical health outcomes are substituted for job security in equation (1). This reduced-form model provides estimates of how industry-specific macroeconomic conditions (represented by commodity prices) affect health. Given the documented mental health effects of worsening labour market and stock market conditions (e.g. McInerney et al., 2013; Reichert and Tauchmann, 2017), it is expected that decreases in world commodity prices will significantly decrease mental health ($\alpha_1 > 0$). It is also possible that physical health is affected in the short run; through an effect on workplace accidents, for example.

The results presented in Section 4.2 suggest that perceived job security is the main pathway through which commodity prices affect health. Supplementary regression results demonstrate that commodity prices are not significantly related to: job changes; promotions; satisfaction with pay, the work itself, hours worked, and job flexibility; and satisfaction with financial situation, amount of free time, home in which you live and neighbourhood. We therefore interpret the reduced form commodity price effects on health as evidence of a causal effect of job insecurity on health.

In all regressions we cluster errors at the commodity level to allow for correlation between errors over time for workers in a given mining sub-industry. Since the standard cluster-robust variance estimator is biased (usually downwards) when the number of clusters is small as in our case, we use wild cluster bootstrap-*t* procedure. This procedure involves (1) generating a large number of pseudo-samples from the original sample, where the sampling unit in our case is the commodity; (2) for each pseudo-sample calculating the *t*-statistic with errors clustered at the commodity level; and (3) using the distribution of this *t*-statistic across all the pseudo-samples to make inference about the parameter of interest (Cameron et al, 2008). In Monte Carlo simulations, Cameron et al (2008) find that wild cluster bootstrap-*t* performs best compared to other alternative methods. In the tables, we present *p*-values obtained from this wild cluster bootstrap-*t* procedure (Roodman et al., 2019).

4. Perceived Job Security Results

4.1. Main Job Security Effects

Panel A in Table 1 displays the estimated effect of world commodity prices on our main measure of job security, a standardised variable derived from our factor analysis on the seven listed job security measures available in the HILDA data (see Appendix C). This estimate indicates that price increases experienced by miners while working in a particular subindustry leads to a substantive improvement in their perceived job security: a doubling of 2005 prices, which is well within our observed price movements, is estimated to increase reported job security by 0.102 standard deviations. The additional coefficient estimates from the regression of job security can be found in column (3) of Appendix B. These estimates suggest that within individual-employment spell variation across time in individual characteristics, such as household demographics, educational attainment, and location of residence, are not strong predictors of job insecurity.

Importantly, Section B of Appendix E presents estimated effects of commodity prices on employment stability measured in the next wave (i.e. roughly 12 months after commodity prices are measured) from individual fixed-effects regressions. The estimates are relatively small and statistically insignificant, suggesting that the large effects on perceived job security in the short-term (shown in Table 1) do not convert in to large effects on 'real' employment stability. This divergence between perceived job insecurity and any eventuated job loss suggests that there may be scope for interventions designed to alleviate the health effects of job insecurity.

The remaining panels in Table 1 provide the results from several alternatively specified models, but still using our main composite measure of perceived job security as the outcome. First, we test for asymmetries in the relationship between commodity prices and job security by disaggregating the price variable into two components: price last month if prices are trending upwards, and price last month if prices are trending downwards. The variables have been generated such that the coefficients on each have the same interpretation: the effect on job insecurity from a one-unit increase in price. The results in panel B suggest that workers respond similarly to increases in prices regardless of whether prices are trending upwards or downwards. Second, we test whether volatility in prices is important for job insecurity. The finding in panel C suggests that perceived job security may be negatively related to the variance of prices; but the coefficient estimate is imprecisely estimated. Third, panel D indicates whether the linear specification we use in Table 1 is sufficient by allowing for a quadratic relationship. The coefficient on price squared is economically small and statistically insignificant, indicating that our linear approximation is sufficient.

Finally, in panel E we conduct a placebo test by estimating whether commodity prices are associated with perceived job security among ex-mining workers. We assign ex-miners the current price of the commodity that was mined in their former job. We find that former mining workers are unaffected by current commodity prices, with the estimated price coefficient being 5 times smaller than the estimated price coefficient for current miners.

We also explore the potential for a heterogeneous relationship between commodity prices and job security by using the unconditional quantile regression approach. This approach, developed by Firpo et al. (2009), allows us to estimate the effects of commodity prices across the entire distribution of job security. We find that the effect of commodity prices on job security is largest at lower quantiles. Appendix Table F shows that the estimated price effects at the 10th and 25th unconditional quantiles equal 0.387 and 0.422, respectively, and are several times larger than the mean effect shown in Table 1 (0.102), and the effects at all the 50th, 75th and 90th quantiles (0.093, 0.125, 0.058). These estimates indicate that a doubling of 2005 prices increases job security by around 0.4 standard deviations for workers with low job security. Together, these results indicate that workers with low perceived job security are more affected by changes in profitability are than workers with high perceived job security.

4.2. Additional Effects

Before presenting the result of our models of mental and physical health, we investigate whether commodity prices affect known determinants of health status other than perceived job security. These results help us to interpret the reduced-form health estimates. Specifically, in Table 2 we test whether changes in commodity prices affect other job attributes (Panel A) and investment income outcomes (Panel B). These two sets of variables are those a priori most likely to be affected by changes in prices (other than job security).

The results in Panel A indicate that the commodity price does not have a substantive effect on any of the additional job attributes. Specifically, price has a relatively small and statistically insignificant impact upon wages, hours worked in past week, satisfaction with total pay, the work itself (work content), hours worked, and flexibility to balance work and non-work commitments. In addition, price is not strongly related to whether workers feel their job is stressful or complex, and whether they have freedom over what, how and when they work. Therefore, it appears that the only measured job-related attribute that is affected significantly by changes in commodity prices – at least in the short run – is perceived job security.

In panel B we test the possibility that mining workers financially gain from increases in world commodity prices because of their higher tendency to have mining-related investments. For example, mining workers may be more likely to own shares in mining companies, leading to higher dividends following commodity price increases. Or mining workers may be more likely to rent-out properties located in mining towns, which expand or contract in mining booms and busts. Specifically, we estimate fixed-effect regressions of the amount of income received from: (1) dividends from shares, managed funds; (2) interest from banks, bonds, trusts, financial institutions; (3) rent from properties owned; (4) royalties; and (5) total income from investments. The results indicate that commodity prices are not a significant determinant of investment income.

Overall, the results so far indicate that increases in world commodity prices have: (a) a large positive effect on how secure workers feel about the security of their job; (b) statistically insignificant effects on other aspects of work; and (c) statistically insignificant effects on income from investments. These findings provide some support to the conjecture that commodity prices affect health primarily through the impact on perceived job security.

5. Health Results

5.1. Main Health Effects

Table 3 presents the reduced-form estimated effects of world commodity prices on mental and physical health. These estimates suggest that prices are significantly related to our overall mental health measure: a doubling of 2005 prices is estimated to increase the mental health of mining workers by 0.117 standard deviations. Prices are also significantly related to general health, which reflects both physical and mental health dimensions (Au and Johnston, 2014). In contrast, commodity prices has a smaller and statistically insignificant effect on overall physical health (-0.050).

To help us better understand how mental health is affected by prices, Panel B presents the estimated effects on the three SF-36 dimensions that most strongly correlate with the overall measure: mental health, vitality, and role emotional.[14] The estimates show that a doubling of 2005 prices increases the mental health dimension by 0.123 standard deviations and the vitality dimension by 0.128 standard deviations (significant at 5% and 10% level respectively). The role emotional dimension, which

[14] The mental health dimension reflects whether the individual has been feeling: nervous, so down in the dumps that nothing could cheer them up, calm and peaceful, down, and happy. The vitality dimension reflects whether the individual has been feeling: full of life, a lot of energy, worn out, and tired. The role emotional dimension reflects whether emotional problems have meant the individual has: cut down amount of time spent on work or other activities, accomplished less, and did not do work or other activities carefully.

reflects whether emotional problems limit day-to-day and social activities, is not affected by prices. Panel C presents the price effects for the main dimensions of physical health, representing mobility, pain and reductions in normal activities. In-line with the overall physical health effect, prices are not strongly related with any of the three physical health dimensions.

Naturally, some workers may be more vulnerable to price movements than others, and therefore there may be heterogeneity in the effect of commodity prices on health. Repeating the analysis from 4.1, we first explore this possibility by using the fixed-effects unconditional quantile regression approach. Appendix F (Panel B) shows that the effects of commodity prices on mental health are similar across the 50th, 75th and 90th quantiles (0.077, 0.074 and 0.076). The estimated price effects at the 10th and 25th quantiles are larger, equalling 0.191 and 0.157, respectively. These estimates are less precisely estimated than those from the fixed-effects linear regressions shown earlier, however they provide suggestive evidence that workers with poor mental health are more strongly affected by changes in global commodity prices than are workers with good mental health. This is in-line with the finding that prices more strongly affect workers with low job security (who have lower mental health on average).

We additionally explore heterogeneity by estimating price effects separately for subgroups of workers. We compare the effects for workers: (1) with and without a university degree level education; (2) employed in a managerial position or not; (3) employed with their firm for more or less than 4 years; (4) on a permanent employment contract or being on a casual (flexible) or fixed-term contract; and (5) working in a large (with more than 5,000 employees) or small (less than 5,000 employees) firm. Our a priori expectation was that workers with less education, employed in a non-managerial position, having fewer years of tenure with the firm, being employed on a more casual basis, and working for smaller firms will be the most vulnerable to perceived changes in job security. The results are shown in Table 4. In contrast to these expectations, the results are not indicative of strong differences by sub-groups. The largest difference is for the manager / non-manager comparison, with the coefficient estimates suggesting that managers' mental health is more strongly affected by changes in prices (0.153 compared to 0.097). This finding may be due to managers being more cognisant of changes in world business conditions. It may also be due to managers internalising their employees' job insecurity and worsening mental health. Importantly, however, the pair-wise differences in coefficient estimates for this and all other comparisons are not statistically significant.

Collectively, the findings discussed in this sub-section indicate that increased prices affect job security, which in-turn affect the mental health of workers. In particular, feeling secure with your employment situation appears to decrease the propensity for workers to feel nervous, down in the dumps, worn out, and tired. These effects are particularly strong for workers who had pre-existing low levels of job security and mental health.

5.2. Spouse and Partner Health Effects

Many studies have shown that the health of spouses/partners are inter-related, with a health shock or a change in health behaviours to one having spill-over effects on the other (Fletcher, 2009; Fletcher and Marksteiner, 2017). Studies also show that labour market shocks can have negative spillover effects on spouses' health; particularly, spouses' mental health (Marcus, 2013). It is therefore plausible that business conditions affecting worker job security and mental health, have spill-over effects on spouses' health outcomes. The HILDA survey includes health information on all household members aged 15 years and over, allowing us to test this possibility. Specifically, we re-estimate all the mental and physical health regressions displayed in Table 3 using spouse health outcomes rather than worker health outcomes (omitting any spouses who also work in the mining industry).

The coefficient estimates from the spouse regressions are presented in Table 5, and show that world commodity prices are not a statistically significant predictor of any of the ten spouse health outcomes. In fact, the point estimates for the overall mental health index and the mental health dimensions are all negative, which is opposite in sign to the worker effects in Table 3. We do not therefore find evidence of household spill over health effects stemming from increased job insecurity.

6. External Validity

One important strength of our study is the tight matching of exogenously driven economic conditions within sub-sectors of one industry (mining), implying strong internal validity. From the various model estimates, we are confident that we are capturing the true effect of commodity price movements by sub-sector of the mining industry on the perceived job security of workers. The underlying causal mechanism we have assumed is that mining workers are cognisant of price changes in their specific sector; our analyses clearly suggest that this is the case.

While mining is an industry where employment prospects are closely aligned to world commodity price movements, it is also the case that workers in many industries and occupations will not have such explicit and readily identifiable real-time information about their employment prospects. This means that finding corresponding exogenous variation for a variety of industries is difficult. Thus, we recognise that the strength of our results comes at the potential cost of uncertain external validity: that is, the extent to which our results can be generalised to other workers and industries. The mining industry is male dominated, and many jobs are in rural areas. Moreover, the nature of some jobs in the mining industry might mean that mining workers differ in key economic preferences and characteristics. For example, they may differ by time and risk preferences. If, for example, mining workers are less risk averse, and they select into mining because they are willing to accept more employment uncertainty for higher wages, then our estimates of the effect of job security on health might be smaller than what would be found for other industries. Similarly, those selecting into the mining industry might have different levels of physical and mental health, which might mean that the effects of shocks to job security could have different impacts on health for workers in other industries.

To inform on this issue, we provide in the top panel (A) of Appendix Table G descriptive information about health and proxies for time and risk preferences for mining workers, compared to other jobs that could reasonably be viewed as substitute work options. Therefore, we compare mining workers to those in construction and manufacturing, but also provide the statistics for workers in all industries. Given that mining is male-dominated, these statistics are provided for males only to avoid any gender differences in health or economic preferences.[15] Importantly, looking at the means and standard deviations there are no large or statistically significant differences in the level of mental health or physical health between mining and construction workers, and only a slightly lower level for those in manufacturing and other industries. With regards to our proxies for time and risk preferences, there is no significant difference between miners and all of the other industries in attitudes to risk, but some differences in planning horizon, with

[15] The average standard mental and physical health measures are above zero because these statistics are for males only, whereas the standardised is based on males and females.

construction workers being 11 percentage points more likely to report that the most important time period for planning saving and spending is either in the next week or next few months.

To further inform on the likely external validity of our results, the bottom panel (B) in Appendix Table G provides estimates of the coefficient on the lag of perceived job security on employment for miners and each of the comparison industries. The estimated association is similar for miners and construction workers, but the association is somewhat larger for manufacturing workers and all other workers. The final row provides estimates of the relationship between job security and mental health by industry. Again, the magnitude of the estimates is similar for miners, construction and manufacturing workers. Although only indicative, these results suggest that the main conclusions regarding the strong link between job security and mental health that we have found for mining workers may be relevant for other workers, particularly for workers in the construction industry. However, we realise that this analysis provides only suggestive evidence.

7. Conclusion

In this paper, we provide new evidence on how changes in the macroeconomic environment affect workers' perceived job security, and consequently, their mental and physical health. For identification, we exploit exogenous variation in world commodity prices over the period 2001-17. In particular, we study how the perceived job security of workers in the mining industry in Australia, is affected by changes in subindustry world prices for commodities. We use this as a source of exogenous variation in the expected labour demand in the industry. It is clear that employment in the mining industry is closely aligned to changes in commodity prices, and our results suggest that mining workers are highly cognisant of price changes.

Our findings shed light on the wider costs of recessions and economic slowdowns on health. Many studies have documented a sizeable aggregate decline in mental health in times of high unemployment in many countries. When thinking about those most affected by recessions, it is natural to first consider the costs incurred by those who are made unemployed. However, a wide body of literature has found that job insecurity is strongly associated with worse health for workers. Therefore, the extent to which recessions increase perceived job insecurity, and in turn how this affects health, is an important issue to study further. Even at the highest point of unemployment following the GFC, the numbers of unemployed are many times lower than the number of employed. Therefore, even a relatively small decline in worker health due to greater job insecurity can dominate aggregate health costs.

We also contribute to the broader economics and industrial relations literatures on the causes and potential harmful consequences of job insecurity. This is an important issue given that recent economic recessions, increasing global competition, rapid advancements in technology and automation, and labour market deregulation, have led to greater job insecurity for workers (Ferrie, 2001; Sverke and Hellgren, 2002; Blinder, 2009; Burgard et al., 2009; Kalleberg, 2009; Virtanen et al., 2013; ILO, 2014; Caroli and Godard, 2016; Shoss, 2017). Furthermore, austerity measures in the wake of the GFC have been aimed at cutting the size of the public-sector workforce (Hodges and Lapsley, 2016), which has meant that many traditionally secure jobs can no longer be relied upon for long-term financial stability. More generally, changes in the nature of employment have meant that there are fewer “jobs for life”, and there has been a growing reliance by private-sector firms on temporary, casual, and zero-hour contracts (Lewchuk, 2017). Consequently, job insecurity is now a salient feature of both the private and public sectors.

The estimated effects from our main and robustness regression specifications indicate that in response to an increase in world commodity prices, the perceived job security of workers increases substantially: a doubling of 2005-level prices is estimated to increase perceived job security by around one-tenth of a standard deviation. Interestingly, there is no equivalent changes in employment, wages, work hours, or other dimensions of job satisfaction (e.g. pay, hours, flexibility, content); in the short-term. This finding is broadly in-line with previous studies. For example, Goldberg et al. (1999) find that appreciations in industry-specific export and import real exchange rates are associated with small inconsistent effects on job instability (as measured by job changes and industry switches).

Importantly, using reduced-form models we find that higher commodity prices improve mental health: a doubling of 2005-level prices is estimated to increase our broad mental health index by around one-tenth of a standard deviation. More specifically, higher commodity prices, and consequently greater job security, significantly decreases the propensity for workers to feel nervous, down in the dumps, worn out, and tired. These effects are particularly strong for workers who had pre-existing low levels of mental health. There was no corresponding effects for any physical health outcomes.

Overall, we find robust evidence that: (1) exogenous changes in macroeconomic conditions affect the perceived job security of workers; and (2) that shocks to perceived job security substantively affects workers' mental health, but not their physical health. In line with the hypothesis of Di Tella et al. (2003), our results suggest that the fear of losing a job generates a significant drop in the wellbeing of those who work, and that this is likely to be the key driver in the observed worsening in mental health and wellbeing found in times of recession.

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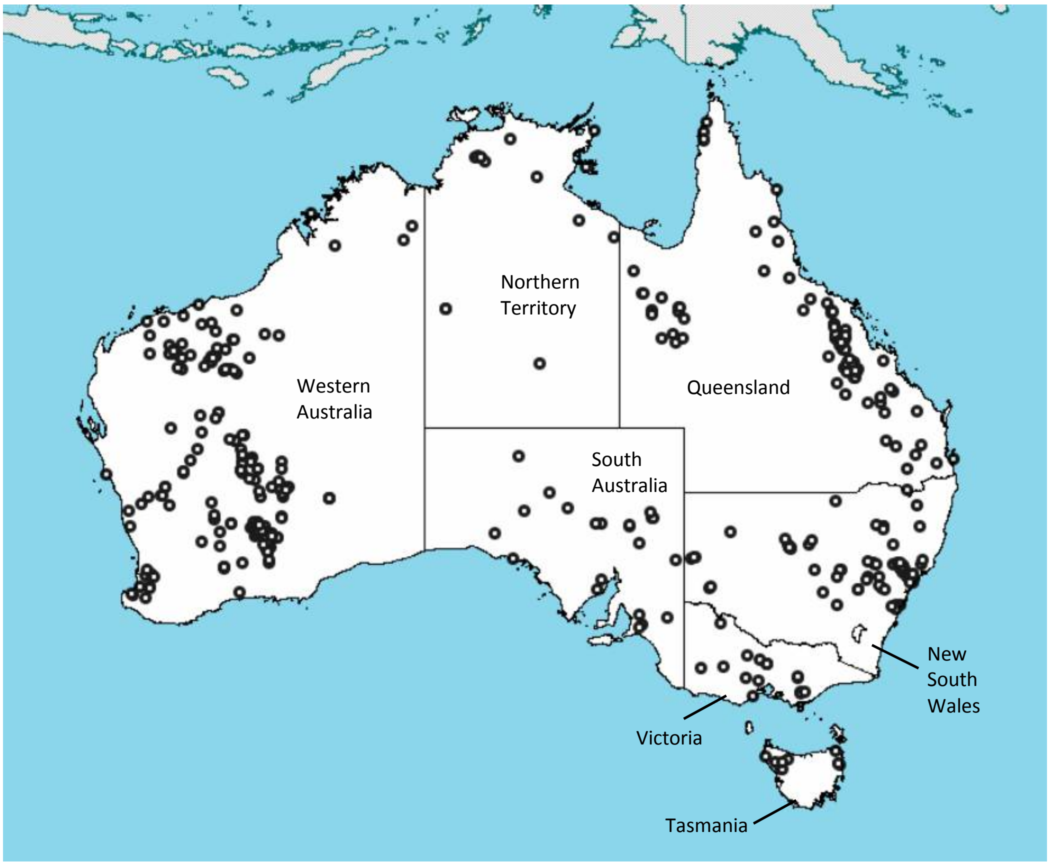
Figure 1: Map of Operating Australian Mines of all Commodities



Source: Geoscience Australia's Australian Mines Atlas:
http://www.australianminesatlas.gov.au/

Figure 2. Commodity Prices, and HILDA Sampling (in grey shade)

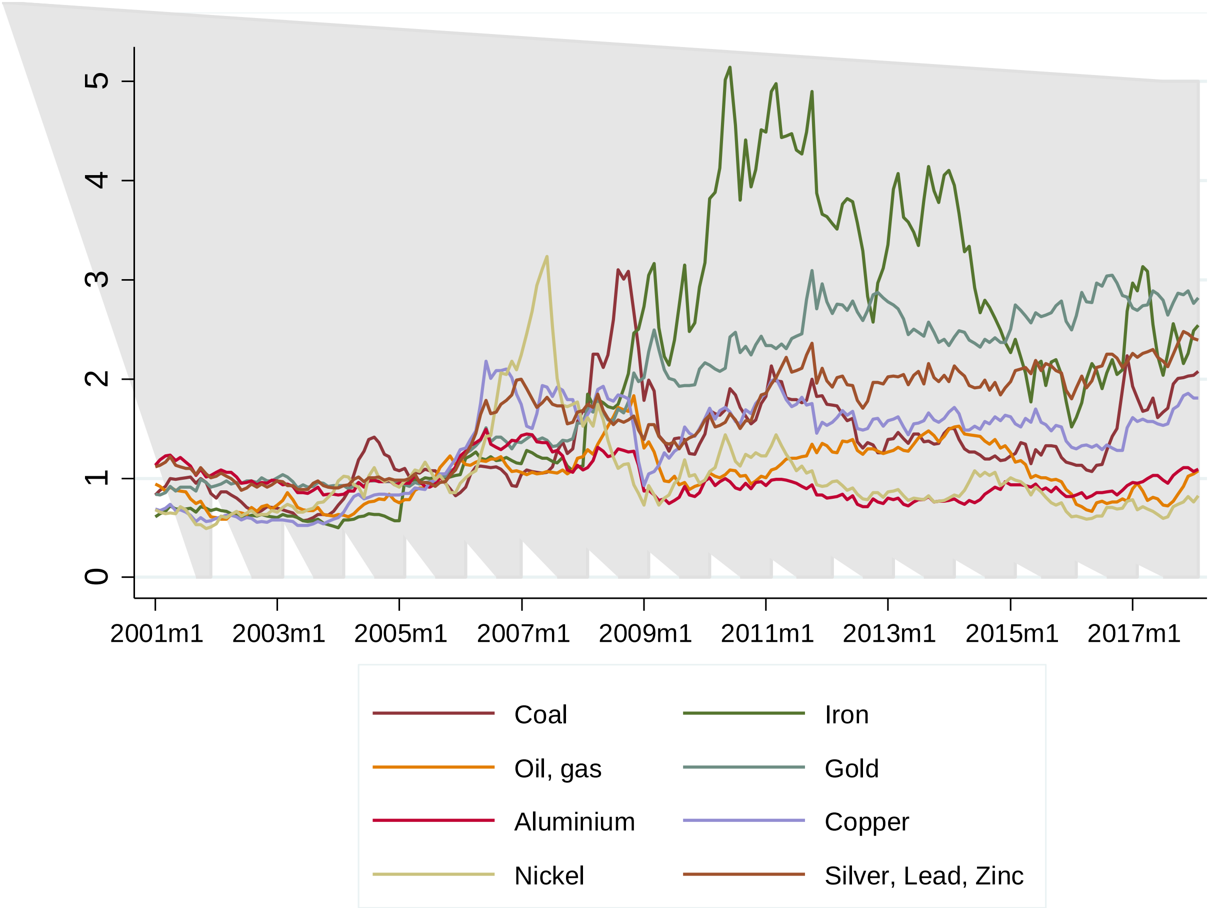


Figure 3. Employment Levels in the Metal Ore Mining Industry and Metal Price Index over time

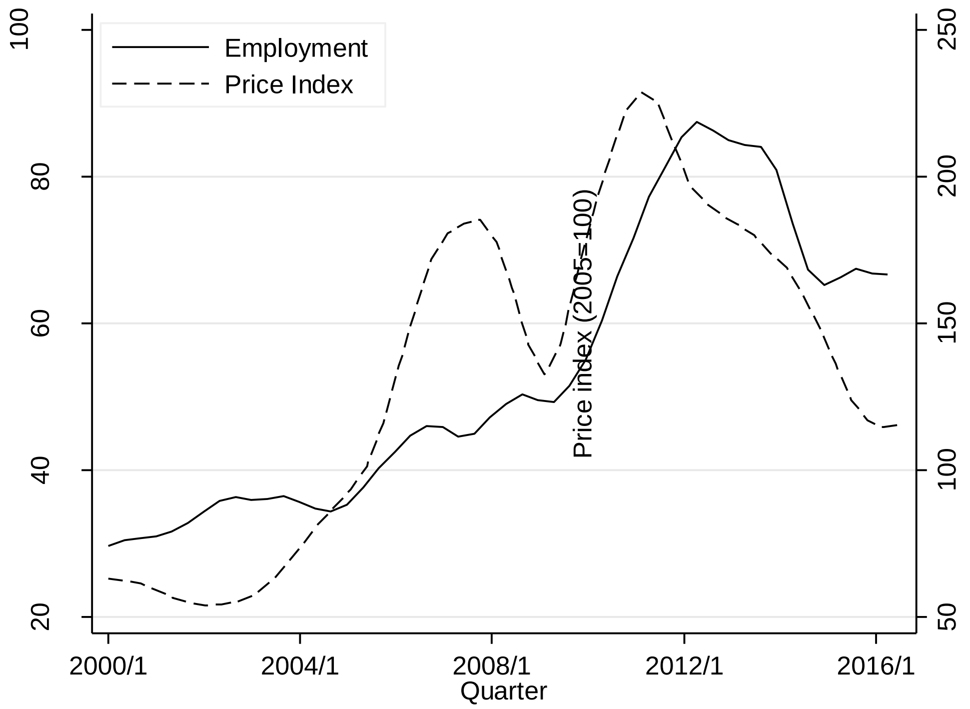


Table 1: Estimated Effects of Commodity Prices on Job Security

	Price coefficient	
A. Main effect		
Price last month	0.102**	[0.033]
B. Testing for asymmetric price effects		
Price last month if higher	0.101**	[0.039]
Price last month if lower	0.108**	[0.039]
C. Testing for price volatility effects		
Price last month	0.121*	[0.095]
Standard deviation last 12 months	-0.131	[0.459]
D. Testing for non-linear price effects		
Price last month	0.540**	[0.035]
Price last month squared	-0.084	[0.163]
E. Placebo test using past mining workers		
Price last month	0.020	[0.557]

Notes: Results presented in panels A-E come from separate regressions; within each panel, all variables are included simultaneously in one regression. In panels A-D, sample size is 1,521 person-year observations. In panel E, sample size is 3,732. P-values based on wild cluster bootstrap with 9,999 replications at commodity level are presented in brackets. All regressions control for quadratic function in age, marital status, number of dependent children, education, state, remoteness, individual-employment spell fixed-effects, and month-year fixed-effects. *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 level, respectively.

Table 2: Estimated Effects of Commodity Prices on Job and Employment Outcomes

	Sample mean	Price coefficient	
A. Job attributes:			
Log real weekly wages & salary	7.415	0.117	[0.491]
Hours work per week	49.48	-0.588	[0.479]
Satisfaction with total pay (std)	0.437	-0.024	[0.455]
Satisfaction with the work itself (std)	-0.036	-0.004	[0.808]
Satisfaction with hours you work (std)	-0.003	0.032	[0.635]
Satisfaction with flexibility (std)	-0.318	0.032	[0.431]
Job quality factor: high stress and low pay (std)	-0.227	-0.050	[0.259]
Job quality factor: high control/autonomy (std)	-0.319	0.049	[0.323]
Job quality factor: high complexity (std)	0.233	0.083*	[0.072]
B. Income received from investments ($`000s)			
Dividends from shares, managed funds	0.293	-0.067	[0.547]
Interest from banks, bonds, trusts, financial institutions	0.789	-0.109	[0.794]
Rent from properties owned	0.003	-0.001	[0.480]
Royalties	1.505	0.751	[0.683]
Total investment income	2.648	-0.274	[0.712]

Notes: Presented figures are coefficients on an index of last month subindustry-specific commodity price (2005 = 1.00). In panel B, all outcomes measure total income received in the financial year. The estimates in each row come from separate models. P-values based on wild cluster bootstrap with 9,999 replications at commodity level are presented in brackets. All regressions control for quadratic function in age, marital status, number of dependent children, education, state, remoteness, individual-employment spell fixed-effects, and month-year effects. *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 level, respectively.

Table 3: Estimated Effects of Commodity Prices on Health and Wellbeing

	Sample	Price coefficient	
A. Summary Measures			
Mental health (factor)	1298	0.117**	[0.034]
Physical health (factor)	1298	-0.050	[0.404]
General health (std)	1312	0.032**	[0.022]
B. Mental Health Dimensions			
Mental health (std)	1317	0.123**	[0.039]
Vitality (std)	1317	0.128*	[0.055]
Role emotional (std)	1312	0.019	[0.774]
C. Physical Health Dimensions			
Physical health (std)	1313	-0.076	[0.343]
Bodily pain (std)	1319	0.026	[0.687]
Role physical (std)	1314	0.012	[0.874]

Notes: Commodity price variable is an index of last month subindustry-specific commodity price (2005 = 1.00). P-values based on wild cluster bootstrap with 9,999 replications at commodity level are presented in brackets. All regressions control for quadratic function in age, marital status, number of dependent children, education, state, remoteness, individual-employment spell fixed-effects, and month-year effects. *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 level, respectively.

Table 4: Estimated Effects of Commodity Prices on Mental Health for Subgroups

		Sample	Price Coefficient	
i.	University degree	214	0.117	[0.373]
	No university degree	1084	0.116**	[0.034]
ii.	Manager	607	0.153***	[0.026]
	Not a manager	691	0.097*	[0.034]
iii.	Tenure ≥ 4 years	669	0.103*	[0.051]
	Tenure < 4 years	629	0.131**	[0.047]
iv.	Permanent employment contract	1026	0.114**	[0.042]
	Casual or fixed-term contract	248	0.080	[0.094]
v.	Firm size ≥ 5000 employees	594	0.147**	[0.041]
	Firm size < 5000 employees	470	0.169**	[0.034]

Notes: The estimates in each panel come from separate models. Presented figures are coefficients on an index of subindustry-specific last month commodity price (2005 = 1.00). Two price variables are included in a model: each of them is equal to the original price variable for the observations with the respective characteristic and zero otherwise; no constant is included. P-values based on wild cluster bootstrap with 9,999 replications at commodity level are presented in brackets. All regressions control for gender, quadratic function in age, marital status, number of dependent children, education, country of birth, state, remoteness, commodity fixed-effects, and month-year effects. *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 level, respectively.

Table 5: Estimated Effects of Commodity Prices on Spouse/Partner's Health

	Sample	Price coefficient	
A. Summary Measures			
Mental health (factor)	932	-0.082	[0.931]
Physical health (factor)	932	0.067	[0.507]
General health (std)	940	0.028	[0.626]
B. Mental Health Dimensions			
Mental health (std)	947	-0.051	[0.912]
Vitality (std)	947	-0.066	[0.806]
Role emotional (std)	941	-0.089	[0.616]
C. Physical Health Dimensions			
Physical health (std)	944	0.034	[0.807]
Bodily pain (std)	943	-0.029	[0.657]
Role physical (std)	943	-0.012	[0.906]

Notes: The sample consists of partners of mining workers; partners who themselves work in mining are excluded. Commodity price variable is an index of last month subindustry-specific commodity price (2005 = 1.00). P-values based on wild cluster bootstrap with 9,999 replications at commodity level are presented in square brackets. All regressions control for quadratic function in age, marital status, number of dependent children, education, state, remoteness, individual-employment spell fixed-effects, and month-year effects. *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 level, respectively.

APPENDIX

Appendix Table A. Mining related ANZSIC 2006 codes and prices series

(1) Industry	(2) ANZSIC 2006 code	(3) Sample proportion	(4) Price series	(5) Weight
Coal Mining	600	0.523	Coal, Australian thermal coal, 12,000-btu/pound, less than 1% sulfur, 14% ash, FOB Newcastle/Port Kembla, US$ per metric ton	n/a
Oil and Gas Extraction	700	0.097	Crude Oil (petroleum), simple average of three spot prices: Dated Brent, West Texas Intermediate, and the Dubai Fateh;	0.4
			Natural Gas, simple average of three prices: Russian Natural Gas border price in Germany, Indonesian Liquefied Natural Gas in Japan, and Natural Gas spot price at the Henry Hub terminal in Louisiana	0.6
Iron Ore Mining	801	0.153	China import Iron Ore Fines 62% FE spot (CFR Tianjin port), US dollars per metric ton	n/a
Bauxite Mining	802	0.062	Aluminium, 99.5% minimum purity, LME spot price, CIF UK ports, US$ per metric ton	n/a
Copper Ore Mining	803	0.038	Copper, grade A cathode, LME spot price, CIF European ports, US$ per metric ton	n/a
Gold Ore Mining	804	0.085	Gold (UK), 99.5% fine, London afternoon fixing, average of daily rates	n/a
Nickel Ore Mining	806	0.021	Nickel, melting grade, LME spot price, CIF European ports, US$ per metric ton	n/a
Silver-Lead-Zinc Ore Mining	807	0.021	Silver (Handy & Harman), 99.9% grade refined, New York	0.33
			Lead, 99.97% pure, LME spot price, CIF European Ports, US$ per metric ton	0.33
			Zinc, high grade 98% pure, US$ per metric ton	0.33

Appendix Table B: Estimated Coefficients of Individual-Level Covariates on Job Security

	All Mean	Sample Mean	Estimated coefficient	
Price last month	-	1.560	0.102**	[0.033]
Age	40.027	38.906	-0.296***	[0.251]
Age-squared/100		-	0.118**	[0.011]
Male	0.523	0.897		
Married/Cohabitating	0.686	0.762	-0.039	[0.623]
Number of children under 15 years	0.597	0.753	0.023	[0.736]
High School	0.173	0.128	-0.230	[0.559]
Vocational education	0.336	0.502	-0.304	[0.699]
University degree	0.290	0.155	-0.418	[0.618]
VIC/SA/TAS	0.396	0.100	0.056	[0.877]
QLD	0.208	0.325	-0.156	[0.647]
WA/NT	0.102	0.280	0.020	[0.895]
Inner Regional Australia	0.231	0.341	-0.134	[0.368]
Outer Regional Australia	0.105	0.244	-0.004	[0.961]
Remote/Very remote Australia	0.020	0.091	-0.419*	[0.014]

Notes: Sample size equals 1,521. Means for all employed adults in HILDA (n=154,382) are presented in column. Commodity price variable is an index of subindustry-specific last month commodity price (2005 = 1.00). Standard errors robust to clustering at individual level are presented in parentheses. P-values based on wild cluster bootstrap with 9,999 replications at commodity level are presented in square brackets. Omitted categories for education, state, and remoteness are Less than high school, New South Wales (NSW), and Major cities of Australia. VIC stands for Victoria, SA for South Australia, TAS for Tasmania, QLD for Queensland, WA for Western Australia, and NT for Northern Territory. Regression controls for individual-employment spell fixed-effects and month-year effects. *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 level, respectively.

Appendix C: Job Security Questions in HILDA

Personal Questionnaire:

1. Looking at [showcard], please pick a number between 0 and 10 to indicate how satisfied or dissatisfied you are with the following aspects of your job. Your job security?
2. I am going to read out a list of different aspects of life and, using the scale [showcard], I want you to pick a number between 0 and 10 that indicates your level of satisfaction with each. Your employment opportunities?
3. What do you think is the per cent chance that you will lose your job during the next 12 months? (That is, get retrenched or fired or not have your contract renewed.)
4. What do you think is the per cent chance that you will leave your job voluntarily (that is, quit or retire) during the next 12 months?

Self-Completion Questionnaire:

5. The following statements are about your current (main) job. Please indicate, by crossing one box on each line, how strongly you agree or disagree with each. The more you agree, the higher the number of the box you should cross. The more you disagree, the lower the number of the box you should cross. (on 7-point scale):
    a. The company I work for will still be in business 5 years from now.
    b. I have a secure future in my job.
    c. I worry about the future of my job.

Appendix D: Sample Means and Scoring Coefficients for Job Security Index Items

	Mean for all industries	Mean for mining industry	Index scoring coefficients
Satisfaction with job security (0-10)	7.874	7.393	0.273
Satisfaction with employment opportunities (0-10)	7.443	7.677	0.197
Percentage chance of losing job (0-100)	10.603	15.123	-0.225
Percentage chance of leaving job (0-100)	22.833	16.918	-0.099
Agree that company still in business in 5 years (1-7)	5.824	5.755	0.180
Agree that I have a secure future in my job (1-7)	5.000	4.799	0.271
Agree that I worry about future of my job (1-7)	2.933	3.374	-0.216

Notes: Column (1) presents the means for all employed adults in HILDA (n=145,515). Column (2) presents the means for mining workers who worked with a given commodity for at least two consecutive years (n=1,521). Column (3) presents the scoring coefficients used to construct the job security factor.

Appendix E: Effects of Job Security and Commodity Prices on Future Employment Outcomes

A. Estimated coefficients of job security in regressions of:		
Employment	0.007	[0.648]
Employment in mining industry	0.022	[0.086]
Employment in same mining subindustry	0.029**	[0.038]
Fired in last 12 months	-0.028	[0.450]
Changed jobs in last 12 months	-0.076**	[0.028]
B. Estimated coefficients of commodity prices in regressions of:		
Employment	0.015	[0.323]
Employment in mining industry	0.006	[0.828]
Employment in same mining subindustry	-0.003	[0.927]
Fired in last 12 months	-0.022	[0.597]
Changed jobs in last 12 months	-0.011	[0.530]

Notes: Presented figures are coefficients on the job security factor in the top panel and commodity prices in the bottom panel. All employment outcomes are measured in the next wave. The estimates in each row come from separate models. P-values based on wild cluster bootstrap with 9,999 replications at commodity level are presented in square brackets. All regressions control for gender, quadratic function in age, marital status, number of dependent children, education, country of birth, state, remoteness, individual fixed-effects, commodity fixed-effects, and month-year fixed-effects. *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 level, respectively.

Appendix F: Estimated Effects of Commodity Prices on Job Security and Mental Health from Unconditional Quantile Regressions

	Quantile				
	10th	25th	50th	75th	90th
A. Job Security					
Price last month	0.387***	0.422***	0.093	0.125**	0.058
	(0.120)	(0.091)	(0.069)	(0.062)	(0.052)
B. Mental health					
Price last month	0.191	0.157*	0.077*	0.074*	0.076*
	(0.139)	(0.089)	(0.047)	(0.040)	(0.042)

Notes: Sample size equals 1,521 in panel A and 1,298 in panel B. Commodity price variable is an index of last month subindustry-specific price (2005 = 1.00). Standard errors are presented in parentheses. All regressions control for gender, quadratic function in age, marital status, number of dependent children, education, country of birth, state, remoteness, commodity fixed-effects, and month-year effects. *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 level, respectively.

Appendix G: Summary Statistics by Industry Classification

	Mining	Construction	Manufacturing	All Others
A. Means and standard deviations				
Mental health	0.22	0.15	0.04	0.06
	[0.82]	[0.90]	[0.93]	[0.97]
Physical health	0.08	0.02	0.02	0.07
	[0.90]	[0.93]	[0.92]	[0.92]
Short planning horizon	0.44	0.55	0.52	0.46
	[0.50]	[0.50]	[0.50]	[0.50]
Takes above average risks	0.13	0.14	0.12	0.15
	[0.34]	[0.34]	[0.33]	[0.36]
B. Regressions				
Lag job security on employment	0.003	0.005	0.026***	0.019***
	(0.008)	(0.004)	(0.004)	(0.002)
Job security on mental health	0.091***	0.123***	0.105***	0.137***
	(0.027)	(0.012)	(0.014)	(0.007)
Sample size	1383	8537	8322	43142

Note: The sample consists of male employed adults. In the top panel, standard deviations are presented in brackets; other figures are sample means. The variable short planning horizon indicates that the most important time period for planning saving and spending is either in the next week or next few months (rather than in the next year, next 2-4 years, next 5-10 years, >10 years ahead). The takes above average financial risks variable indicates that the willingness to take either substantial financial risks or above average financial risks (rather than average financial risks or no financial risks). In the bottom panel, standard errors robust to clustering at individual level are presented in parentheses.; other figures are coefficient estimates. All regressions control for quadratic function in age, marital status, number of dependent children, education, state, remoteness, individual fixed-effects and month-year effects.