

TECHNICAL ANNEX

This technical annex sets out our approach, data and methodology that underlie the construction of the Work Foundation's insecure work index. It also briefly discusses the key decisions that were made in the process.

The aim of this document is to make our approach as transparent as possible, so as to inspire challenge from our readership that will lead to further improvements of the index and our forthcoming work, as well as enabling other researchers to re-use and build on what we have done.

Constructing the theoretical framework

The theoretical framework of the Work Foundation insecure work index is underpinned by a rich body of evidence. We analysed a breadth of academic and grey literature, explored domestic and international investigations of insecure work, and a variety of surveys and tools. Then, we narrowed our focus to 'objective' indicators of insecure work that can be measured using social surveys.

Our framework builds on the work of Olsthoorn and Kalleberg in the broad dimensions of insecurity.¹ We then operationalised these dimensions using select survey-based indicators. Throughout this process, we consulted with academics and interested organisations referenced in the acknowledgements section of the report on the theoretical framework, our operationalisation, and our methods.

Data

We compared the advantages and disadvantages of different UK datasets, such as Understanding Society and the Skills and Employment Survey, before selecting the Quarterly Labour Force Survey (LFS).

The LFS is a nationally representative survey of more than 80,000 individuals and nearly 40,000 households run every quarter by the Office for National Statistics. It provides a source of robust data on the labour market, and its longevity allows us both to take a historical look at insecure work, and means we can replicate this work in future.

However, this dataset has important limitations, particularly around earnings information. Due to the structure of the survey, income questions are only asked of a subsample of employees each quarter. Self-employed workers do not provide earnings details. To address this limitation, income for employees and self-employed workers in our dataset was imputed using median hourly pay from the Annual Survey of Hours and Earnings (ASHE) for each occupation at the 4-digit level of the Standard Occupational Classification. More on the considerations and limitations of this approach can be found in the section below: 'note on low pay'.

The sample

We used the same LFS April-June quarter from each year between 2000 and 2021 for consistency and mapped the indicators across time. We coded each job characteristic as a binary variable, with 0 reflecting the absence of a given characteristic, and 1 reflecting its presence. We pruned our sample to retain only those who were in employment, and those who were aged 16-65 in any given quarter. From 2000 to 2021, this generated nearly 1.1 million unweighted observations.



Indicators excluded from the index

The table below provides an overview of the indicators used in the index. Following testing and engagement, we decided to exclude a small number of variables related to insecurity.

Zero-hour contracts and on-call work are often referred to as examples of insecure work. Unfortunately, these indicators are not available before 2011 in the regular version of the LFS. Therefore, we had the option of shortening our time frame for analysis and include zero-hours, or keep our twenty years of data and exclude it. We tried both and compared the results. Including zero-hour contracts and on-call work in the index was not advantageous, as we found that:

- Approximately 70% of those on zero-hour contracts were already being classed as being in severely insecure employment without including this as an indicator. This is due to the higher likelihood of zero-hour contract workers to experience low pay, variable pay, underemployment, involuntary temporary and involuntary part-time employment.
- An additional 23% were categorised as low to moderately insecure, with a minority of about 7% classed as secure.
- This means that people in zero-hour contracts tend to experience several other forms of insecure work simultaneously. Therefore, we feel confident that excluding zero-hours as a separate indicator is justified.

We also decided against including agency work. We were not comfortable with the comparability of agency work variables over time. When testing whether exclusion was justified by comparing an index that included agency work over a shorter timeframe against one that excluded agency work, we found that the number of people involved in agency work is too low for this to make a marked impact on the index scores.

For our third dimension, access to workers' rights, we would have liked to include a time trend analysis of access to sick pay and welfare benefits. However, as the levels of support and eligibility criteria have changed hugely over the past twenty years, we were not able to include reliable indicators for this.

Table 1: Variables used to measure the job characteristics of insecurity, 2000-21

Dimension	Job characteristic	Variables
Contractual	Temporary work	LFS jobtmp & jobtyp
	Involuntary temporary work	LFS whytmp & whytmp6
	Involuntary part-time work	LFS yptjob
Financial	Low pay (<60% of median for employees, <80% for self-employed)	ASHE median hourly pay by 3-digit SOC1992 & 4-digit SOC2010 & 4-digit SOC2020
	Variable hours and pay	LFS varypay99
	Working a second job	LFS secjob
Rights-based	Working for same employer for less than 2 years	LFS emplen (<2 years)
	Self-employed without employees	LFS self1, self2, self3, self4

Note on low pay

We are conscious that being in a low paying occupation is not necessarily the same as being on low overall pay: higher hourly paid occupations in which someone works few hours can still result in low pay.

We imputed earnings data from the Annual Survey of Hours and Earnings (ASHE), as this had the advantage that it could be matched to nearly every LFS respondent who was in work. In comparison, each given quarter of the Labour Force Survey contains earnings information for only about one in five employees in the sample.

Additionally, the LFS does not ask self-employed workers questions about their earnings/income of. As a consequence, this would necessitate excluding self-employed workers from our index on insecure work. As an alternative, we matched ASHE data to self-employed workers.

It is important to acknowledge that this risks underestimating low pay in some areas, while overestimating it in others. Notably, ASHE is a survey of hours and earnings of *employees*, and does not survey self-employed workers, who tend to have much more variable and a higher incidence of low pay than employees.² The Office for National Statistics used surveys and HMRC self-assessment tax data to estimate that in 2016, between 42% and 53% of self-employed workers earned less than £10,000 that year.³

To estimate the prevalence of low pay, we follow the definition of low pay by the Office for National Statistics (ONS), as two-thirds of median pay for employees.⁴ For self-employed workers, we set low pay as less than 80% of median pay. We believe this is justified, as self-employed workers bear the cost of externalities, such as buying and maintaining their own equipment, the cost of insurance, as well as sustaining periods of low, or no work.

We validated our indicator of low pay by comparing it to national sources, and found they matched trends over time. Ultimately, our estimates for low pay remain conservative, placing approximately a quarter of self-employed workers in the low pay category, rather than the half estimated by the ONS. For employees in 2021, approximately 7% had low pay, compared with 14% estimated by the ONS. These differences are due to using the measure of occupational pay, rather than reported earnings. Although providing an important baseline for median pay in a given occupation, individual workers may have higher or lower wages within the same occupation due to different levels of experience, different organisational pay scales, or working different hours.

METHODOLOGY

The Work Foundation UK Insecure Work Index was constructed using Principal Component Analysis (PCA) on the pooled Labour Force Survey from 2000–21. PCA is a technique which reduces the data into fewer components that maintain as much variation as possible. The advantage of this approach is that PCA weights each variable according to its correlation structure, which we broadly interpret as having a lower, or higher, contribution to overall levels of work insecurity.

Due to the binary nature of our indicators, we employed a PCA analysis based on tetrachoric correlations, which we weighted using the LFS provided person weights.

We obtained a correlation matrix, component loadings and a scree plot. This allowed us to determine that the first two components, with eigenvalues of 2.7 and 1.7, were most important in capturing the overall variation. The third component hovered on the edge of 1 eigenvalue and was excluded. Following this, the tetrachoric Principal Component Analysis was repeated, this time retaining only the two main components. From this output, we then used the first, or the principal, component to predict a score of insecure work for each person in our dataset. This continuous score was then split into four parts using Stata's `xtile`

command. In the subsequent analyses, we collapsed the second and third categories into a single one: low to moderate insecurity.

Validating the index

The concern with PCA on a sample stretching over a long period of time is that the component loadings, which are based on the underlying correlation structure between the variables, will be different in one year compared to another. Therefore, we have run PCA on randomly selected quarters of the LFS and compared the correlation matrices. Additionally, we used Confirmatory Factor Analysis on all years. This showed that the correlation structures differed in small ways over the years, for example attributing slightly lower loadings to duration of employment and low pay as time progressed, but were overall broadly consistent.

As a further check, we constructed a 'count index' of insecurity. This uses the same indicators scored 0 to 1, which are simply tallied together for each individual in the dataset. This then shows where people experienced 0, 1, 2, 3 or up to the maximum number of forms of insecurity. The correlation between our PCA index and our count index was high, indicating that where people experienced more forms of insecurity simultaneously in the count index, this was also reflected as higher insecurity scores in the PCA index. This was desirable, as we expect that the more forms of insecure work a person experiences at a given time, the more likely this is to have a negative impact on their financial-, physical- and mental wellbeing and their future employment prospects.

At the same time, it confirmed that our division of the continuous PCA scores into categories was sensible. Those who experienced no forms of insecurity were classed as secure. Those who experienced a single form of insecurity were mainly classed within low to moderate insecurity, with a smaller group of people who experienced two or less commonly, three, lower weighted forms of insecurity also classed as such. The category of severe insecurity then consists of workers who experienced involuntary forms of work, which were weighted relatively heavily, or which combined at least two or more forms of insecurity.

References

- 1 Olsthoorn, M. (2014), Measuring precarious employment: a proposal for two indicators of precarious employment based on set-theory and tested with Dutch labor market data. *Social Indicators Research*, Vol. 119, pp. 421-441; Kalleberg, A., Vallas, S. (2018), Precarious work: Theory, research and politics. *Research in the Sociology of Work*, Vol. 31, pp. 1-30.
- 2 Giupponi, G., Xu, X. (2021), What does the rise of self-employment tell us about the UK labour market? The Institute for Fiscal Studies.
- 3 Office for National Statistics (23 June 2021), Survey and administrative data comparisons of self-employment income, UK: tax years ending 2016 to 2018. Available from: <https://www.ons.gov.uk/peoplepopulationandcommunity/personalandhouseholdfinances/incomeandwealth/articles/surveyandadministrativedatacomparisonsofselfemploymentincomeuk/taxyearsending2016to2018>
- 4 Office for National Statistics (26 October 2021), Low and high pay in the UK: 2021. Available from : <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/bulletins/lowandhighpayuk/2021>