

RESILIENCE BAROMETER: METHODOLOGY DOCUMENT

JULY 2022

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1. INTRODUCTION

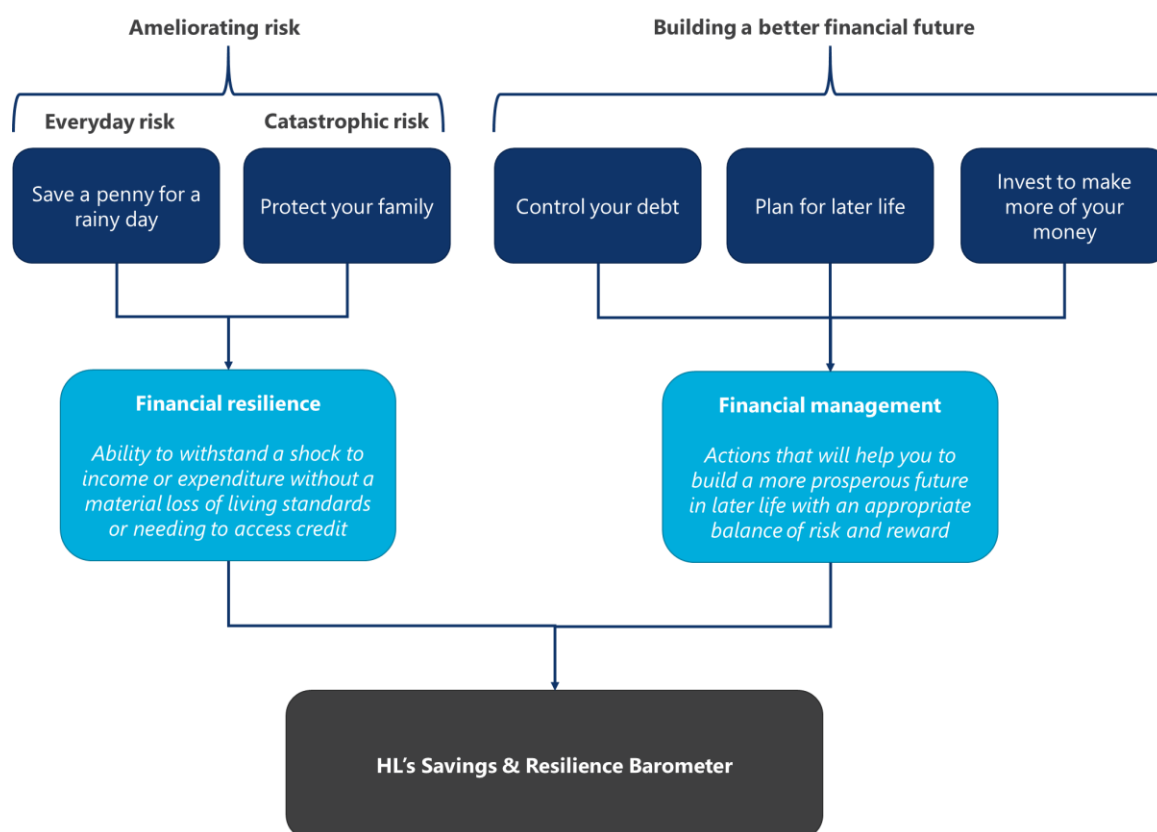
1.1 OVERVIEW

A barometer has been developed to measure the financial resilience of households within Britain. The following document sits alongside the barometer results report to provide a detailed explanation of the methodology underpinning them. This document outlines how the historical dataset has been constructed as well as the development of the barometer indicators. Furthermore, the forecast and scenario model methodology are described, highlighting how the barometer results have been projected in the short-run.

Financial resilience is conventionally defined as a household's ability to withstand an unexpected shock to their income or expenditure. Being able to cope with such everyday risk is undoubtedly of crucial importance. However, solely focusing on this aspect would neglect choices and behaviours that influence the financial wellbeing of households around the country. In shaping the barometer to Hargreaves Lansdown's 'five to thrive' model¹, we have sought to develop a holistic measure that can produce a comprehensive tool to monitor financial resilience. The barometer is structured around five pillars as illustrated in Fig. 1:

- **Control your debt:** it is not that debt is inherently a bad thing for consumers. Indeed, there are very sound reasons why households need and do take on debt, for example to finance educational courses or a house purchase. However, ensuring that debt repayments are sustainable is a crucial first step to successful financial management.
- **Protect your family:** once debt is under control, ensuring that there is an adequate safety net to guarantee the financial future of dependants in the event of catastrophe should be a priority for households.
- **Save a penny for a rainy day:** having access to a pool of savings that can help to mitigate the consequences of an unexpected shock to income or spending is a prerequisite of sound financial planning.
- **Plan for later life:** planning for the associated drop in income during retirement is integral to preserving purchasing power during this period. Ensuring adequate pension contributions through the working life and more actively managing funds closer to retirement are important in this respect.
- **Invest to make more of your money:** finally, once households have accomplished the above, they have the freedom to invest any excess savings into assets that can help to build a better financial future.

¹ <https://www.hl.co.uk/features/5-to-thrive>

Fig. 1. Savings and Resilience Barometer: conceptual structure

1.2 MAPPING THESE TO INDIVIDUAL INDICATORS

In collaboration with Hargreaves Lansdown, Oxford Economics mapped each of these pillars to a set of concepts that could be measured by specific indicators. The data underpinning the indicators is a household panel dataset—effectively a database of households which provides a representative sample to derive conclusions about both the state of the nation and how conditions vary across households with different socioeconomic characteristics. The original source for our panel dataset is the Wealth and Assets Survey (WAS) conducted by the Office for National Statistics (ONS) on a biennial basis. The WAS is the most detailed financial survey run in the UK with information on all aspects of households' balance sheets together with demographic information such as the age of household members, whether residents own or rent their home, and the household's region.

Despite such exceptional detail, the WAS did not contain all the information we wished to use when constructing measures of financial resilience. We therefore imputed additional variables, exploiting the correlation between these indicators and household characteristics evident from other survey data. For example, we used the Financial Lives Survey (FLS) conducted by the Financial Conduct Authority to model the likelihood of households being covered by income protection policies dependent on key characteristics. This was then matched based on common characteristics to the households in the WAS dataset. Other sources used for imputation include the Living Costs and Food Survey (LCFS) and the Labour Force Survey (LFS).

The major downside of the WAS compared to other data sources is that it is published with a very long reporting lag meaning that the data are not timely. At the time of modelling, the latest WAS

dataset was based on interviews conducted between 2018 and 2020. To bring this up to date, we have extrapolated it forward through to 2021 Q4 using a wide range of macroeconomic and survey data and different modelling techniques.

With the underlying data in place, the final step in our analysis was to transform these data into a barometer measure as structured in Fig. 1. A barometer is simply an analytical tool that allows indicators measured in different units to be combined. Therefore, it is often used to measure multi-faceted concepts, such as financial resilience, where it is advantageous to synthesise information from a wide range of variables.

To understand how household financial resilience is expected to change in the short run, baseline forecast for the following year will be presented, leveraging projections from Oxford's Global Economic Model (GEM). Furthermore, this method will also provide us with a platform to evaluate the consequences of salient risks for UK households via scenario analysis, using the barometer to develop more granular insights than afforded by macroeconomic indicators.

1.3 DEFINITION OF A HOUSEHOLD

The barometer describes financial conditions for households in Britain as defined by individuals that are living together and related or dependant². As our measure of financial resilience is at the household level, individuals who are not related or dependant on each other cannot be assumed to financially support each other and therefore are treated as a separate household in the barometer. Furthermore, the final dataset only includes households which have an average age below 68 and the main earner in the household is not retired.

The following sections in this document provide more in-depth detail on the following:

1. Variables selected and historical imputation
2. Extrapolation methodology
3. Indicator thresholds
4. Forecast and scenario methodology

² This differs from the WAS definition of a household as this is based on individuals living together. Where indicators are only available at the household level as defined by the WAS, they have been split between the new definition of households based on the number of adults. These variables include the value and debt of the property they live in.

2. VARIABLES SELECTED

In this section we describe the process used to identify concepts that were relevant to each of the five pillars we sought to capture using the barometer and how these were mapped to individual metrics. These indicators are calculated for each household enabling detailed analysis of the metrics by household type³.

2.1 CONTROLLING YOUR DEBT

Controlling debt is about keeping debt repayments manageable and affordable. This involves distinguishing between productive debt and problematic debt as well as identifying the potential burden it can place on a household.

2.1.1 Affordability of future debt repayments

Liabilities obligate households to make a future stream of payments—how affordable these are in the near-term compared to current income will capture their affordability. This is measured by the following variable:

- Monthly debt repayments as a share of total monthly household income.

Monthly debt repayments including credit cards, store cards, overdrafts, and hire purchase are taken from the WAS. Households will also need to cover the mortgage repayments on their primary residence. Household income will be used to evaluate the affordability of these debt repayments. In this measure, household income excludes income from rental properties as monthly mortgage payments for these properties are not included in the debt repayment variable. The WAS only collects total debt for these properties and does not ask about the monthly repayments.

2.1.2 Uncertainty of future repayments

A household can better plan and is more financially secure if it is certain about the value of debt it will have to repay in the future. Therefore, taking on debt with a variable rate exposes a household to greater financial risk. The size of this risk is captured by the following variable:

- Share of household debt with a variable interest rate.

Within the WAS, respondents are asked whether their mortgage is on a variable rate. This is added to their credit card debt to identify the size of their liabilities that have a variable rate. Other types of loans are assumed to have fixed interest rates. Total liabilities are combined with mortgage on the main home to calculate the size of this debt as a proportion of the total.

³ In the publicly available databases only the Government office regions are available. In order to calculate the indicators at a more granular regional level, the probability of each household being in these regions was estimated. See appendix for more details.

2.1.3 Use of debt

The type of debt taken out by a household is important when considering whether it strengthens or weakens its financial resilience. Debt can be used to acquire assets and build financial resilience in the future. Examples of this type of debt are mortgages or loans used to finance home upgrades which increase an individual's potential wealth. Debt can also be used to finance a household's consumption that it cannot afford, given current income. To measure the size of households' usage of 'good' debt we created the following variable:

- Share of debt that is used to finance capital consumption.

The WAS's section on debt has questions relating to reasons for taking out loans and hire purchase. Debt which has been taken out to cover home improvement, business, main residence, and second home purchases are classed as financing capital consumption. The size of this is used to calculate its proportion out of total debt.

2.1.4 Existence and severity of arrears

Existence of arrears is evidence that a household is behind on its debt repayments and severe arrears is a sign that a household's debt may be spiralling out of control. This concept is measured using the following variable:

- Whether a household is in arrears or not.

The WAS is used to identify the households that are in arrears. Arrears in the survey includes credit cards, loans, and bills.

2.1.5 Subjective evaluation of debt position

Personal evaluation of a household's debt can support the other variables collected in judging a household's control of debt. This concept is measured using the following variable:

- Whether a household has debt issues.

The two questions that have been identified in the WAS are shown in Fig. 2. These questions identify whether the household finds its bills and credit commitments a burden and whether it is keeping up with repayments. If the household find its bills and credit commitments to be a heavy burden or somewhat of a burden—as well as falling behind with some or many of its bills—it is identified as having debt issues.

Fig. 2. Variables chosen for the subjective evaluation of debt position

Concept	WAS Question	Problem debt response
Subjective evaluation of debt position	To what extent is keeping up with the repayment of your bills and credit commitments and any interest payments a financial burden to you?	A heavy burden and somewhat of a burden
	Which one of the following statements best describes how well you are keeping up with bills and credit commitments?	Falling behind with some of them and having real financial problems and have fallen behind with many of them

2.2 PROTECT YOUR FAMILY

The Protect Your Family section of the barometer assesses how well a household is prepared for the sudden and possibly long-term loss of earnings. A family can be protected from unexpected circumstances through insurance policies (life, critical illness, and income protection) and having a balanced split of income between earners within the household.

2.2.1 Adequacy of life insurance

Life insurance is an important part of protecting a family's financial strength and resilience in the event of a death. The rationale behind this is that the larger the insurance pay-out as well as assets accumulated by the household, the more comfortable and supported a family will be in the long-term. The variable is only calculated for households with dependants and the concept is measured by this variable:

- Value of insurance and assets minus liabilities and dependant costs, where a dependant is a child under 18.

The WAS survey response detailing a household's life insurance value is combined with their financial assets to provide an understanding of a household's coverage in the event of a death. For this measure, household financial assets exclude primary residence and business value as these should not need to be sold in the event of death.

Household liabilities need to be settled before dependants can benefit from the life insurance pay-out or assets. The liabilities included in the measure are highlighted in Fig. 3.

Households with younger families will need to have adequate protection to support them until there are 18. Dependency costs have been calculated by multiplying the number of years until the children are 18 by an average annual cost of a child. The average annual cost of a child has been calculated based on the 2020 basic cost of raising a child over 18 years as published by the Child Poverty Action Group⁴. The average cost per year of dependency has been estimated as £4,183 and is calculated using the weighted average costs of the couple and lone parent⁵.

⁴ https://cpag.org.uk/sites/default/files/files/policypost/CostofaChild2020_web.pdf

⁵ Weights based on the proportion of lone and couple parents from the 2020 ONS Families and households in the UK data. Lone parents face a cost of £97,862 to raise their child until they are 18 and account for 14% of the of families in the UK. Families who are couple have costs of £71,611 to raise their child until they are 18.

<https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/families/bulletins/familiesandhouseholds/2020>

Fig. 3. Liabilities included in the Wealth and Asset Survey

Measure	Liabilities included
Liabilities	Total outstanding credit/store/charge card balance
	Total outstanding on mail order
	Total outstanding on Hire Purchase accounts
	Total amount of formal and informal loans
	Total value of overdrawn current accounts
	Total value of arrears
	Total value of remaining mortgage on primary residence

2.2.2 Critical illness coverage

If a main earner loses their job or is unable to work due to a critical accident or sickness, critical illness coverage will provide a lump sum to their household. This is measured using the following variable:

- Whether a household has critical illness coverage or not.

The FCA's Financial Lives Survey (FLS) is used to determine whether a household has critical illness insurance. The FLS directly asks whether an interviewee has critical illness which is unavailable in the WAS. Correlations between the presence of cover and characteristics of households in the FLS—including whether there are multiple adults or children in the household, the work status of the main earner, the household's income, age, education, and whether the residents own their own home—are used to predict the likelihood of households in the WAS being protected. Critical illness coverage is then imputed by choosing the households which are most likely to be covered. Further information can be found in the appendix.

2.2.3 Income protection coverage

Similarly, income protection coverage will provide income support to a household in the event of an accident or sickness. This is measured using the following variable:

- Whether a household has coverage or not.

The FLS is also used to determine whether a household has income protection insurance. In the same way as critical illness coverage, the correlations between the presence of cover and characteristics of households in the FLS are used to predict the likelihood of households in the WAS being protected. Critical illness cover is then imputed by choosing the households that are most likely to be covered. See appendix for more detail.

2.2.4 Number of earners and balance of earnings

Having a balanced split of earnings in a household is conducive to building financial resilience. This is because such households are not solely reliant on a single income and are better prepared if the income of an earner is lost. To measure this concept, the following variable is used:

- Share of employment earnings generated by the primary earner.

Earnings data from employment information of the primary earner and their partner from the WAS are used to measure the share of their earnings out of the combined employment earnings.

2.3 SAVE A PENNY FOR A RAINY DAY

The save a penny for a rainy day barometer category assesses the financial resilience of households in the short term and measures how well households have built a cash buffer for unexpected emergencies. Within this category, variables capturing the adequacy of liquid assets, the ability to save (in the form of surplus income), and support offered by an employer in the event of sickness or redundancy are constructed.

2.3.1 Surplus income

Households with a higher savings rate are better prepared to absorb a temporary financial shock. To measure this, the following variable is calculated:

- Total expenditure as a proportion of household income.

Total income is net of taxes and include income from all sources such as employment, investment, benefits, and other regular income.

Total expenditure captures all household outgoings such as rent and mortgage payments, council tax, debt repayments, and expenditure on all goods and services. Household expenditure is taken from the Living Costs and Food Survey (LCFS). The correlation between expenditure indicators and household characteristics are used to impute the house expenditure of the households in the WAS panel. The characteristics used to impute household expenditure include income decile, family size, number of children, vehicle ownership, and housing tenure. For more information, see appendix.

2.3.2 Adequacy of liquid assets

When experiencing a temporary financial shock, most households will immediately react by drawing upon their stock of liquid assets. Therefore, measuring the adequacy of this stock is an important aspect of the barometer category. To measure the adequacy of a household's stock, the following variable is calculated:

- The number of months of essential expenditure covered by drawing upon liquid assets.

The value of liquid assets held by a household is taken from the WAS and includes current accounts, joint accounts, cash ISAs, savings accounts and national savings products, see appendix for more details.

Essential household expenditure is under pinned by the LCFS. This uses non-discretionary spending classifications, based on those used by the Australian Bureau of Statistics (ABS)⁶, to calculate a household's essential expenditure. The average household spending of the essential spending categories is calculated by income decile group and applied to the expenditure categories which have been imputed on to the WAS households. Further detail of the used classification has been provided in the appendix

⁶ <https://www.abs.gov.au/articles/measuring-non-discretionary-and-discretionary-inflation>

2.3.3 Eligibility for and generosity of sick pay

Eligibility for, and generosity of sick pay will determine how well a household is supported by an employer in the event of sickness that prevents a household earner from working. The variable only covers households that include an earner and is measured by:

- The number of months of essential expenditure covered by the value of household sick pay.

In order to be eligible for Statutory Sick Pay (SSP), a person has to be employed and earning an average of £120 per week. For the eligible earner, they receive a minimum of £96.35/ week for 28 weeks from their employer as SSP.

Many employers pay more than SSP, with studies highlighting length of service, occupation, contract type, and company size as important factors in determining who receives sick pay above SSP. Based on these factors, sick pay for the individuals who are working in the household are estimated using a combination of sources. The individual sick pay is then aggregated to provide a household measure of sick pay coverage. For more details, see appendix.

2.3.4 Eligibility for and generosity of redundancy

Similar to SSP, employers are required to pay a minimum level of compensation when making an employee redundant. Furthermore, this may be above the minimum, providing further support to the employee. This only covers working households and is captured with the following variable:

- The number of months of essential expenditure covered by the value of household redundancy pay.

The minimum compensation is determined by several factors. If an employee has been working for an employer for more than two years, when made redundant, they will receive:

- half a week's pay for each full year they were aged under 22;
- a week's pay for each full year they were aged between 22 and 41; and
- a week and a half's pay for each full year they were older than 41.

Length of service is capped at 20 years. Using responses from the WAS, the statutory minimum amount of redundancy pay can be calculated using status of employment to exclude ineligible workers (self-employed and temporary workers), year started job, respondent age group, and gross annual income from main job.

2.4 PLAN FOR LATER LIFE

This section looks at whether a household is prepared for life after retirement and whether it can support itself financially. A large emphasis is placed upon the value of a household's pension as this is the primary source of income for retirees. Furthermore, home ownership gives a household the options of equity release and down-sizing as well lower housing costs as they are not renting in their retirement. This generates increased flexibility and financial resilience upon retirement. Beyond the stream of income provided by a pension, other financial assets and liabilities are valued to create a more complete representation of financial strength.

2.4.1 Value of pension

Pensions are the primary source of income for retirees. The size and type of the pension will determine their income once they retire. How this will cover living costs in retirement is evaluated with reference to the expected costs in retirement. The variable that captures this concept is:

- Value of total pension compared to retirement costs.

The WAS's pension survey responses are used to calculate a household's pension value. This includes: defined contribution schemes, defined benefit schemes, self-invested personal pensions, and retained rights pensions.

Retirement costs are based on the Pension and Lifetime Saving Association's estimate of a moderate living standard⁷. Its latest study suggests that a household will need to spend £20,800 for a single person and £30,600 if in a couple each year to have a moderate standard of living. As this is above the state pension, the extra costs will need to be met by pension savings. An age specific saving target has been calculated to take into account the distribution of earnings over a person's lifetime. With earnings and employment rates differing by age, a household will need to ensure its pension savings reflect their lifetime earnings. See appendix for more detail.

2.4.2 Home ownership in retirement

If a household owns a large amount of home equity, it will be able to release this via downsizing or selling part of their property. Furthermore, housing costs will be lower as they are not renting in retirement if a household owns its own home. The following variable measures this concept:

- Value of home equity

The value of the home equity owned by the household is captured by the value of the main residence minus the remaining mortgage on it from the WAS. To account for the strong correlation between home equity and age, the size of the home equity is divided by the average home equity within the household's 10-year age band. Households who have more home equity than the average will have a value greater than 100, while household with less than the average will have a value smaller than 100. If a household does not own a home, it gets a value of 0.

2.4.3 Other financial assets and liabilities

Beyond the stream of income payments that are derived from a pension, retired households can also support their consumption from other financial assets that they have accrued during their working life. Conversely, they would also have their living standards compromised by any liabilities which require future payments. To measure this concept the following variable is used:

- Long-term assets minus all liabilities (excluding student loans).

⁷ <https://www.retirementlivingstandards.org.uk/>

Household estimates of long-term assets are available through the WAS and these are captured by financial assets that provide a return. Business assets and second homes are also included as they can provide revenue for later life.

Similar to home equity, there is a strong correlation between the value of long-term assets and age. Therefore, the size of a household's long-term assets is divided by the average long-term assets within the household's 10-year age band. Households who have more long-term assets than the average will have a value greater than 100, while households with less than the average will have a value smaller than 100. If a household does not own any long-term assets, it gets a value of 0.

2.5 INVEST TO MAKE MORE OF YOUR MONEY

A household can further improve its financial position by investing income to build wealth in the long term. This barometer category will capture this by investigating if a household has set aside income to invest.

2.5.1 Investment intensity

A household's appetite for investment can be measured by looking at how it allocates its surplus income between liquid and less liquid assets. Whilst liquid assets provide security in the short-term, the less liquid assets can improve wealth in the long term through investment. The investment intensity of the household will be measured only for those with more than 3 months of essential spending as these households will be resilient in the adequacy of liquid assets indicator and any excess money can be invested. The variable used is:

- Share of less liquid assets from total assets for those with more than 3 months of essential spending.

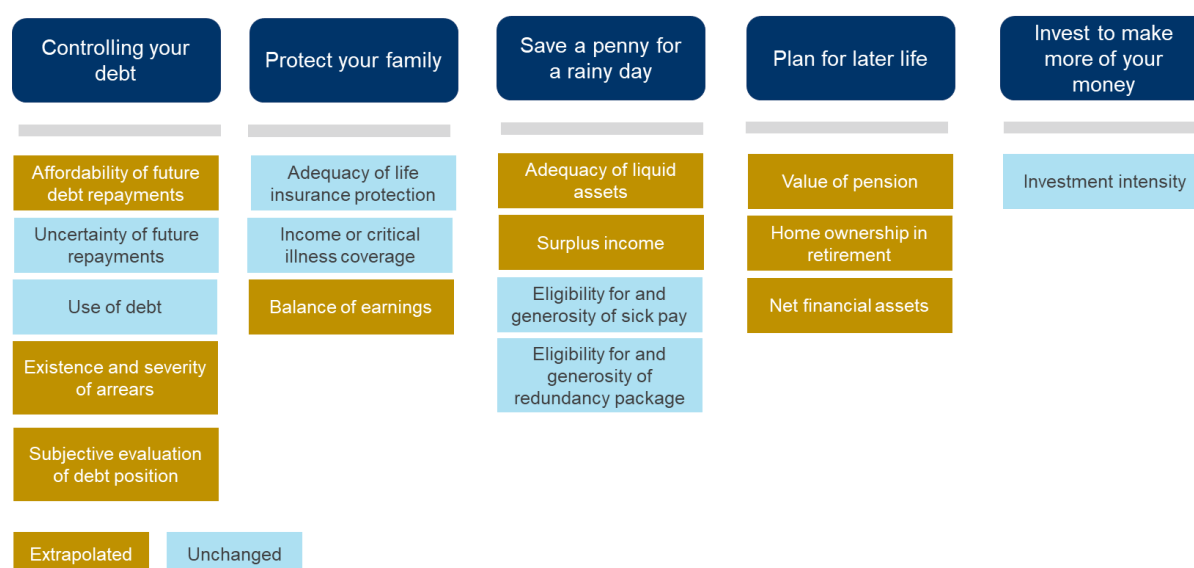
The value of less liquid assets is taken from the WAS, see appendix for the asset classification.

3. EXTRAPOLATING THE DATASET

3.1 EXTRAPOLATION OVERVIEW

At the time of modelling, the latest WAS dataset was based on interviews conducted between 2018 and 2020. To make the data more timely we have extrapolated the variables to 2021 Q4 using a wide range of macroeconomic and survey data and different modelling techniques. Fig. 4 illustrates those variables which were modelled to have changed and those which were assumed to have remained unchanged.

Fig. 4. Extrapolated variables



Four key models were developed to extrapolate the dataset:

1. Asset model including cash, savings accounts, and investment assets.
2. Home equity and second homes.
3. Pension values.
4. Arrears and debt burden.

The following section provides more detail on the macroeconomic and survey data used to extrapolate the indicators.

3.2 ASSET MODEL

The asset model is underpinned by extrapolating household income and consumption up to 2021 Q4 to estimate their value of cash, savings, and investment assets. Depending on income and consumption, households accumulate or draw down on savings each quarter. Furthermore, the modelling also factors in known changes in asset prices.

3.2.1 Household income

Household income has been extrapolated based on households' sources of income. This includes employee and self-employed earnings from work, benefits, investments, and other regular sources of

income. Each component has been individually extrapolated to provide a detailed prediction of how household income evolved up to 2021 Q4. Several of these variables have been grown in-line with the components of UK personal disposable expenditure in the Oxford Economics Global Economic Model (GEM) (see appendix for more detail on the model). This ensures the extrapolated data are consistent with macroeconomic trends as well as the forecast and scenario models which are underpinned by the GEM.

Earnings from employment and self-employment have a separate methodology based on pre-pandemic earnings and earnings since the pandemic started. Up to and including 2019Q4, earnings from work have been extrapolated based on the seasonally adjusted average weekly earnings (AWE) by industry published by the ONS⁸. The earnings of the primary earner and their partner have been individually extrapolated based on the industry they work in to capture any impact this may have on the balance of earnings in the household. Other household work-based earnings are extrapolated in line with the primary earner. Work-based household earnings will therefore differ depending on the industries the households are working in.

The pandemic had a significant impact on the labour market from 2020. As such separate models have been estimated to capture the impact of the change in earnings while in work as well as employment changes. These include:

- **Earnings while in work:** Many employees were put on the furlough scheme during this period as business were forced to close or had a reduction in demand for their services. Whether workers were put on furlough or not is not evenly distributed, with certain workers more likely to be put onto the scheme than others. To incorporate this, the probability of being put on furlough was estimated based on the LFS. This model took into account the industry, education, age, full time/part time status, and managerial status of the worker to provide a probability that they were put on furlough (see appendix for more detail). As the furlough scheme paid 80% of wages, the probability of being on furlough was multiplied by this wage reduction to provide a detailed earnings dataset that was used to extrapolate employee earnings while working. After this, average earnings were constrained to match changes in seasonally adjusted average weekly earnings by industry. A separate model is used to extrapolate self-employed earnings while in work. These earnings were based on the seasonally adjusted average weekly earnings by industry which will capture the key industrial impact the pandemic had on workers' earnings.
- **Employment:** With the pandemic hitting certain industries harder than others, the industrial quarterly change in employment has been used to capture work-based earning falls attributed to job losses. These trends have been based on the seasonally adjusted LFS number of people who are employees and self-employed in each quarter by industry. This adjustment to individuals' income is only applied while a particular industry's employment is below 2019Q4 levels.

⁸ Average weekly earnings (AWE) by 16 NACE industries published by the ONS and seasonally adjusted.

Similarly, the earnings of the primary earner and their partner have been individually extrapolated based on their characteristics to capture any impact to the balance of earnings in the household. Again, other household work-based earnings are extrapolated in line with the primary earner.

Benefits are an important source of income for many households. In particular, Universal Credit and work-related benefits increased during the pandemic, which helped support many households. Household benefits have been extrapolated in two stages, as initially household benefits are extrapolated based on the change in Universal Credit or other work-related benefit and other benefits. This has then been constrained to ensure overall benefits follow the national change in benefits. For the initial extrapolation, if the household has indicated it is not on Universal Credit or other work-related benefits, its income from benefits has increased in line with CPI inflation. Where it is identified as being on Universal Credit and work-related benefits, its benefits were increased by £260 in 2020 Q2 as the government raised weekly benefits by £20. In order to ensure the change in benefits is in line with national figures, the total household change in benefits is constrained to grow in line with the quarterly change in personal sector transfers from central government according to the GEM.

Other regular household income and income from investment have been extrapolated using the quarterly change of other income from the GEM. This income component will include income from many sources with the change in other income expected to capture the general change in these variables.

3.2.2 Household expenditure

Household consumption is underpinned by household-specific saving ratios, national trends in consumer spending by product, and household-specific changes in debt repayments. Bank of England data were used to model saving rates during the pandemic. These ratios were combined with household income to estimate total household consumption before being constrained to match the national consumption trends from the GEM. Seasonally adjusted COICOP data released by the ONS was then used to have to extrapolate household consumption of the difference consumption categories while a survey by the Bank of England has been used to extrapolate monthly debt repayments.

Given the impact of the pandemic there has been further modelling to assess the impact on transport service expenditure and tourism.

- **Transport expenditure:** As the pandemic has particularly impacted commuting patterns, spending on transport services trends is differentiated based on Google mobility data⁹ and changes in homeworking by industry¹⁰. Google mobility data show the change in travel to work as well as general travel compared to pre-pandemic levels. Furthermore, the homeworking data show more people working for business services-based industries have been able to work from home compared to workers in industries such as manufacturing or accommodation and food services where the opportunity to work from home is more limited. If the household is working, the initial estimate of its expenditure on transport services

⁹ <https://www.google.com/covid19/mobility/>

¹⁰ ONS annual Population Survey for homeworking in the UK 2020 and 2019

changes in line with the industry of the primary earner. Where a household is not working, the initial expenditure estimate change is consistent with the general change in travel shown by the Google mobility data. This initial estimate of quarterly change on transport expenditure is then constrained to ensure the aggregate expenditure of the households is consistent with the national trend.

- **Tourism:** The pandemic has meant many households have been unable to travel abroad. Trends in net consumer expenditure on tourism have been used to extrapolate spending abroad for the households while the rest of the expenditure in this COICOP category follows the restaurants and hotels national expenditure trend.
- **Families:** For households with children, the pandemic has meant they have spent more time at home, increasing expenditure for families during the lockdowns. Assumptions based on survey information have been used to estimate the increase in family spending associated to the pandemic lockdowns¹¹.

Debt repayments have significantly changed during the pandemic due to both less consumer credit being used to support consumption, and more being paid off. While pre-pandemic debt repayments were extrapolated based on overall credit growth from the GEM, Bank of England data were used to model monthly debt repayments during the pandemic. These models were based on arrears, income, age, employment status, education, region, homeownership, and family size and were used to predict debt repayments for each household in the WAS. Annual predictions were linearly interpolated to quarterly predictions, then the resulting predicted quarter on quarter growth rates were applied to the monthly debt repayments in the WAS. Finally, overall debt repayments in the economy were constrained to match total credit growth, taken from the GEM. More details are available in the appendix.

3.2.3 Change in assets

Each quarter, households will accumulate or draw down on their assets based on their extrapolated income and consumption. Initially, the change in assets is based on the historical proportion of assets they held during the WAS period. Overall liquid assets have then been constrained to match personal sector savings from the GEM. Savings of less liquid assets have been changed for each household to ensure all their surplus income is captured. As well as this, the current stock of household asset will have changed in value. Observed financial data are used to change the household's current stock of assets. Fig. 5 shows the associated financial indicators used.

¹¹ <https://www.resolutionfoundation.org/app/uploads/2021/01/Pandemic-pressures.pdf>

Fig. 5. Financial indicators used

Asset	Linked financial variable
Household value of current accounts	Interest rate on bank deposits, GEM
Household value of savings accounts	Interest rate on bank deposits, GEM
Household value of cash ISAs	Interest rate on bank deposits, GEM
Household value of stocks and shares ISAs	MSCI World TR
Household value of National Savings certificates and bonds	Direct Saver interest rate
Household value of UK shares	FTSE All-Share Index TR
Household value of insurance products	No change
Household value of fixed term bonds	10 year gilt, GEM
Household value of employee shares and share options	FTSE All-Share Index TR
Household value of Unit/Investment trusts	MSCI World TR
Household value of Overseas shares	MSCI World ex UK TR
Household value of UK bonds/gilts	10 year gilt, GEM
Household value of overseas bonds or gilts	Barclays Aggregate Global Bond Index
Household value of informal financial assets	No change

3.3 HOME EQUITY AND SECOND HOMES

For homeowners, the value of their house is extrapolated based on the UK House Price Index published by the Land Registry¹². The house price of the main residence is extrapolated based on the Government Office Region and house type or flat¹³. As there is less information available for the other properties the household owns, they have been extrapolated using the national overall average UK House Price Index. The extrapolated home price is based on the quarter in which the household answered the survey.

Household mortgages are extrapolated based on the average mortgage size during the extrapolation period¹⁴. Other property values and their associated debt such as land and business remain unchanged due to limited information. Home equity and net property have been estimated by calculating the difference between property values and property debt in 2021 Q4.

3.4 PENSION WEALTH

Household pension values have been extrapolated based on the pension type. Defined contribution pensions have been extrapolated based on household contributions as well as asset growth. The percentage of earnings households contribute to their pensions is captured in the WAS. This is combined with the extrapolated employment and self-employment earnings data to calculate the quarterly increase in their pension. Their current pension value increases each quarter based on the global equity prices and interest from UK long run bonds¹⁵. It is assumed that households hold 70% of

¹² <https://landregistry.data.gov.uk/app/ukhpi>

¹³ The WAS includes information on house type including; detached, semi-detached, terraced.

¹⁴ The average has been calculated based on the total number of mortgages outstanding and the total mortgage liabilities from the GEM

¹⁵ Equity prices are measured using MSCI World TR and long run gilts are measured by 10 year government debt.

their assets as equity and 30% as bonds if the primary earner is below 60 while the split is assumed to be 50:50 when they are 60 and above.

The total value of additional voluntary contribution (AVCs) pension schemes follows a similar methodology. The value increases in line with equity and bond prices with the ratio based on the age of the primary earner. This scheme however does not increase with any contributions. CPI is used to extrapolate the value of other pensions households may have¹⁶.

As households have aged during the extrapolation period, the retirement costs are based on their age during 2021 Q4.

3.5 ARREARS AND DEBT BURDEN

Arrears and household debt have been extrapolated based on macroeconomic data on consumer and credit and using Bank of England survey data to estimate variation across household groups.

3.5.1 Arrears

The WAS contains information on whether households were in arrears during the survey period. In order to extrapolate this variable forward, we used Bank of England data to model the likelihood of individual households being in arrears in any given year. Since the Bank of England survey is not fully a panel—some households drop out of and come into the sample—it was not straightforward to model the likelihood of a household entering or exiting arrears from one year to the next. Instead, we fit independent models for each wave of the survey.

Logistic regressions were fitted for each of 2019, 2020 and 2021. The variables used to model whether a household was likely to be in arrears included income, age, employment status, whether the respondent had a degree, region, whether the respondent owns their own home, the number of children, and the number of adults in the household. These models were used to predict the likelihood of households in the WAS being in arrears in each year. More details are available in the appendix.

3.5.2 Debt burden

The process for modelling the subjective burden of debt was similar to that for arrears. An ordered logistic regression was fitted for each of 2019, 2020 and 2021, with the same covariates as the arrears models, where the dependent variable was an ordered variable describing whether debt was no burden at all, something of a burden, or a heavy burden. These models were then used to predict the burden of debt for each household in the WAS in each of those years. This is mapped onto a binary variable classifying households by whether they find debt a burden or not. More details are available in the appendix.

¹⁶ Defined benefit schemes were extrapolated using CPI due the limited data available to evaluate the change in their value.

4. DATA NORMALISATION AND WEIGHTS

4.1 BAROMETER OVERVIEW

The purpose of this barometer is to measure financial resilience: a level of financial security and good management that ensures unexpected storms can be weathered and a comfortable retirement is within reach. As such we want to use the barometer as a tool to track and monitor what proportion of households are meeting acceptable standards in the various aspects of their financial management e.g., adequately saving for retirement, putting aside enough cash reserves for a rainy day etc.

In this context, we decided that it was most appropriate to normalise the data using a linear scaling approach but with maximum values defined, where appropriate, by a theoretical reference value that represented a point at which it was deemed resilience had been achieved.

For that reason, we applied thresholds to each of the indicators. The maximum possible score for each indicator is 100, and the value of the underlying measure that corresponds to 100 is set with reference to resilience rather than wealth. For example, a household scored full marks on the 'adequacy of liquid assets' indicator if they have enough liquid wealth to cover three months' essential expenditure. Households with higher rates of savings coverage did not receive a higher score on this indicator.

4.2 THRESHOLDS

There are a number of ways that thresholds have been chosen. In some cases, external sources of information and expertise have been used to set thresholds at an appropriate level. Sometimes, the underlying variable natural ranges between 0 and 100 so no transformation is needed. And in other cases, the threshold has been set with reference to the distribution of values in the household-level dataset that has been used to calculate scores. In these cases, often the 10th or 90th percentile has been chosen in order to allow for the range of situations that most households find themselves in while excluding outliers that might skew the results. See the appendix for a detailed description of the thresholds used and the rationale behind those choices.

4.3 WEIGHTS

Weights have been used for aggregating the factors into the final barometer. This includes a within pillar weight as well as across pillar weight. Subjective weights have been used as alternative methods will not find appropriate weights. These weights are based on Hargreaves Lansdown's view of importance in financial resilience.

Fig. 6. Pillar weights

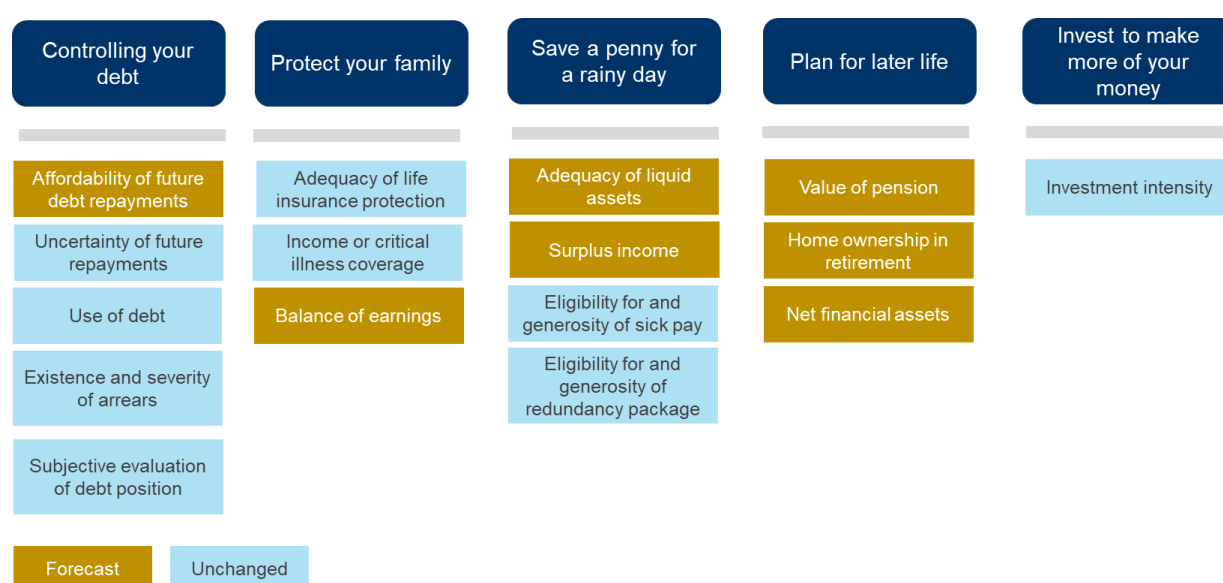
Pillar	Concept	Within-Pillar Weight	Pillar Weight
Control Your Debt	Affordability of future debt repayments	44%	22%
	Uncertainty of future debt repayments	22%	
	Use of debt	11%	
	Arrears	11%	
	Subjective evaluation of debt position	11%	
Protect Your Family	Life insurance	67%	22%
	Critical illness insurance	8%	
	Income protection insurance	8%	
	Balance of earnings	17%	
Save a penny for a rainy day	Adequacy of liquid assets	50%	22%
	Surplus income	13%	
	Sick pay	25%	
	Redundancy pay	13%	
Plan for Later Life	Value of pension	50%	22%
	Home ownership	25%	
	Other assets	25%	
Invest	Investment intensity	-	11%

5. FORECAST AND SCENARIO

5.1 OVERVIEW

For each iteration of the barometer, we will present a baseline forecast for the following year, leveraging projections from Oxford's Global Economic Model (GEM). Furthermore, this method will also provide us with a platform to evaluate the consequences of salient risks for UK households via scenario analysis, using the barometer to develop more granular insights than afforded by macroeconomic indicators. Fig. 7 illustrates those variables which were modelled to have changed and those which were assumed to have remained unchanged.

Fig. 7. Forecast and scenario variables



Forecasts from the GEM have been used to forecast the following financial characteristics of households':

1. Surplus income.
2. Household assets including cash, savings accounts, investment assets and home equity.
3. Pension values.

5.2 SURPLUS INCOME

Surplus income has been forecast in two stages. Initially, income and consumption are projected at the level of individual households, from which household-specific surplus income can be calculated. This initial forecast is then constrained to ensure that the overall change from the households is in line with the change in personal sector savings from the GEM. Household income and consumption are initially forecast using the following methodology:

- **Household income** has been forecast based on households' sources of income. This includes earnings from work, benefits, investments, and other regular sources of income. Each component has been individually forecast based on the relevant components of UK personal

disposable expenditure on Oxford Economics Global Economic Model (GEM) (see appendix for more detail on the model).

- **Household consumption** is underpinned by CPI and consumption trends as well as changes in debt repayments. CPI trends in food, energy, fuel and core inflation are combined with overall real consumption changes from the GEM to provide COICOP specific consumption forecasts for each household. Personal sector debt interest payments from the GEM underpin the forecast of monthly debt repayments.

5.3 HOUSEHOLD ASSETS

5.3.1 Cash, savings account, investment assets

Assets are forecast according to the portfolio of assets held by individual households, with growth in each asset class underpinned by the relevant forecast in the GEM. The assets have been split into three groups; liquid assets, financial products, and bonds. While the GEM does not forecast the value of every asset that households might hold, indicators are used to capture the macroeconomic trends in these three groups.

Liquid assets are projected forward based on the personal sector liquid assets stock. Financial products, which include all types of share holdings¹⁷, grow inline with personal sector holdings of companies securities. Both these projected macroeconomic series capture the expected change in value and as well as the amount of the assets held by the personal sector. Finally, government bonds and gilts are forecast based on changes in personal sector stock of government debt as well as the interest rate earned on their current stock of bonds as measured by the 10 year gilt projections. Outside of these three groups, the value of household's current stock of NS&I increases by the interest rate¹⁸ while insurance products and informal financial assets remain unchanged.

5.3.2 Home equity and second homes

For homeowners, the value of their house is forecast based on UK Average House Price growth from the GEM. Similarly, the value of other properties the household owns has been projected using the same series.

Household mortgages are forecast based on the projected mortgage liabilities of the household sector. Home equity and net property have been estimated by calculating the difference between property values and property debt.

5.4 PENSION WEALTH

Household pension values have been forecast based on the pension type. Using a similar methodology to the extrapolation model, defined contribution pensions have been forecast based on household contributions as well as asset growth. The percentage of earnings households contribute to

¹⁷ Share holdings include UK and overseas shares, investment and unknown ISA, unit investment trusts and employee shares and options.

¹⁸ This is calculated as the central policy rate plus an adjustment factor to account for the latest historical spread between policy rates and direct saver interest rate.

their pensions is combined with the forecast of earnings to calculate the quarterly increase in their pension. Their current pension value increases each quarter based on global equity prices¹⁹ and interest from UK long run bonds as forecast in the GEM. It is assumed that households hold 70% of their assets as equity and 30% as bonds if the primary earner is below 60 while the split is assumed to be 50:50 when they are 60 and above.

The total value of additional voluntary contribution (AVCs) pension schemes follows a similar methodology. The value increases in line with equity and bond prices with the ratio based on the age of the primary earner. This scheme however does not increase with any contributions. CPI is used to extrapolate the value of other pensions households may have.

Retirement costs and state pension are forecast to update the pension value benchmark. Retirement costs have been forecast based on CPI and wage growth while the state pension forecast based on the "triple lock" policy, see the appendix for more details. The household age is based on their age during the forecast period.

¹⁹ Based on the world share price total return index as estimated within the GEM

6. APPENDIX

ASSET OVERVIEW

The wealth and asset survey includes the household value of several assets. These have been categorised into two groups as shown in Fig. 8. The most liquid assets include cash held in current accounts, ISA's, savings accounts and national saving products. Assets that are deemed less liquid are held in financial products and accounts outside of these four cash-based accounts.

Fig. 8. Household assets groups²⁰

Asset grouping	Asset type
Liquid assets	Household value of net current accounts
	Household value of cash ISA
	Household value of savings accounts
	Household value of national savings products
Less liquid assets	Household value of fixed term investment bonds
	Household value of unit investment trusts
	Household value of employee shares and options
	Household value of overseas bonds and gilts
	Household value of UK bonds and gilts
	Household value of informal financial assets
	Household value of tax-exempt savings plans
	Household value of investment and unknown ISA
	Household value of all other property, excluding main property
	Value of business assets, after deducting outstanding debts*

CONSUMER SPENDING

Household expenditure is based on the Living Costs and Food Survey (LCFS). This survey is used to impute total household expenditure, COICOP based expenditure as well as essential expenditure for the households in the Wealth and Asset Survey (WAS). The 2018-2019 and 2019-2020 LCFS have been combined to provide a consistent estimate of expenditure with the latest wave of the WAS.

Expenditure models

COICOP expenditure categories from the LCFS have been aggregated into the general, vehicle, children specific, housing costs and housing goods and services. Nursery, crèche, playschools, and childcare payments were removed from miscellaneous goods & services and combined with child specific expenditure. Furthermore, vehicle insurance and taxation were added to purchase and operation of vehicles. Lastly, housing expenditure was split between key housing costs, which include rent, mortgage repayments (interest and capital), council tax, fuel and power, and other housing costs

²⁰ Value of business assets, after deducting outstanding debts is only include in the net financial asset indicator. It is excluded from the investment intensity indicator

which are based on furnishings, household equipment, and services. These groupings are summarised in Fig. 9.

Fig. 9. Expenditure groups

Expenditure group	LCFS Expenditure category
General expenditure	Food and non-alcoholic beverages
	Alcohol and tobacco
	Clothing and footwear
	Health
	Transport services
	Communication
	Recreation and culture
	Restaurants & hotels
	Miscellaneous goods & services excluding nursery, crèche, playschools and childcare payments
	Education
Education and child specific expenditure	Nursery, crèche, playschools and childcare payments
Vehicle expenditure	Purchase of vehicles
	Operation of personal transport
	Vehicle insurance and taxation
Housing expenditure	Housing costs <i>including: rent, mortgage repayments, council tax, fuel and power</i>
	Household goods and services <i>including Furnishings, household equipment and services</i>

Initially, we imputed total consumer expenditure for the households in the WAS by estimating of regressions on the LCFS data. In the model total expenditure as a share of net income is regressed on number of adults and children, income decile²¹, vehicle ownership, and tenure. The income quintile thresholds are based on the WAS survey to ensure consistency when imputing the expenditure estimates onto the WAS households. Then we predicted total expenditure by multiplying the predicted share and net household income.

²¹ The first income decile was split to provide greater accuracy for those households who have zero or negative savings rates.

Fig. 10. Expenditure share model results

VARIABLES	Total expenditure share
Number of adults	0.0263***
Number of children	0.0260***
Number of vehicles	0.0728***
Household Decile (base category is bottom half of first decile)	
Top half of first decile	-0.177***
2	-0.245***
3	-0.255***
4	-0.337***
5	-0.364***
6	-0.431***
7	-0.485***
8	-0.535***
9	-0.614***
10	-0.657***
Tenure (base category is owner)	
Own with a mortgage	0.0848***
Renter	0.0231***
Age (base category is 24 and under)	
24 - 44	-0.0215***
45-64	-0.0357***
65 and over	-0.0851***
Employment status (base category is employed)	
Unemployed	-0.00528***
Self-employed	-0.00413***
Retired	-0.0429***
Constant	1.114***

Expenditure share for the broad COICOP categories were then calculated. Fig. 11 shows the results of the quantile regressions fit on the LCFS household survey data to model the shares of expenditure on the items for each household. The number of vehicles and young children were significant and shown to increase expenditure in their respective expenditure categories. Expenditure on housing is higher for those renting or with a mortgage, while expenditure on household goods and services is higher for those who own their own home. The predicted expenditure shares from these models have been multiplied by gross household income to calculate household expenditure for these categories.

Fig. 11. Expenditure share model results

Variable	General expenditure	Vehicle expenditure	Education and child specific expenditure	Housing Costs	Household goods and services
Number of adults	0.028***	-0.001***	-0.001***	-0.014***	0.002***
Number of children	0.006***	0.000	0.006***	-0.01***	0.002***
Number of vehicles	-0.026***	0.066***	-0.001***	-0.026***	0.001***
Household Quintile					
2	-0.017***	0.001***	0.001***	-0.006***	0.004***
3	0.004***	0.005***	0.001***	-0.028***	0.004***
4	0.028***	-0.003***	0.006***	-0.039***	0.003***
5	0.047***	-0.027***	0.01***	-0.042***	0.004***
Age (base category is 24 and under)					
24 - 44	0.038***	0.008***	-0.016***	-0.04***	0.004***
45-64	0.075***	0.000	-0.021***	-0.062***	0.006***
65 and over	0.053***	0.000	-0.02***	-0.032***	0.008***
Tenure (base category is owner)					
Own with a mortgage	-0.116***	-0.01***	-0.001***	0.153***	-0.002***
Renter	-0.121***	-0.001***	0.000	0.161***	-0.008***
Employment status (base category is employed)					
Unemployed	0.000	-0.018***	0.000	-0.004***	-0.001***
Self-employed	-0.02***	0.01***	-0.002***	-0.002***	-0.001***
Retired	0.062***	-0.018***	-0.002***	-0.039***	0.007***
Constant	0.506***	0.02***	0.022***	0.316***	0.011***

To ensure household saving is consistent with the national saving rate of 4.9%²², an additional expenditure category was calculated²³. Firstly, the ratio between the household weighted average savings rate from the panel and the national saving rate. This difference was used to calculate the additional individual household expenditure needed for the average saving rates to be consistent. The size of the additional category is based on their initial savings ratio.

Detailed expenditure

The detailed expenditure for the households in the WAS has been estimated by splitting out the general expenditure category into more detailed expenditure categories. The split was created so the

²² Based on the average saving ratio between 2018 Q2 and 2020 Q1 published by the ONS - United Kingdom Economic Accounts: Quarter 2 (Apr to June) 2021.

²³ This category will partly capture other expenditure items such as purchase or alteration of dwellings as well as any data differences between sources.

household expenditure broadly follows the 12-digit COICOP classification. However, additional detail was included for transport services and restaurants & hotels to capture the impact of the pandemic. In particular, commuting has seen a significant fall, which will be seen in the transport services data, while traveling abroad has been limited, so impacting spending on holidays abroad in accommodation services. As households have different spending patterns based on wealth, these additional spending categories have been calculated based on the average household expenditure by decile. The final expenditure categories are the following:

Fig. 12. Expenditure categories

Expenditure category
Food and non-alcoholic beverages
Alcohol and tobacco
Clothing and footwear
Housing <i>including: rent, mortgage repayments, council tax, fuel and power</i>
Household goods and services
Health
Purchase of vehicles and operation of personal transport equipment
Transport services
Communication
Recreation and culture
Education and child specific expenditure
Restaurants & hotels domestic spending
Restaurants & hotels spending abroad
Miscellaneous goods & services

Essential expenditure

The essential expenditure classification is underpinned by an Australian Bureau of Statistics study into inflation of discretionary and non-discretionary spending. These categories are focused on key items that households need to consume and are summarised in Fig. 13.

Fig. 13. Essential spending classification

Expenditure group	Essential spending
Food and non-alcoholic beverages	Bread, rice and cereals, Pasta products, Beef (fresh, chilled or frozen), Pork (fresh, chilled or frozen), Lamb (fresh, chilled or frozen), Poultry (fresh, chilled or frozen), Bacon and ham, Other meat and meat preparations, Fish and fish products, Milk, Cheese and curd, Eggs, Other milk products, Butter, Margarine, other vegetable fats and peanut butter, Cooking oils and fats, Fresh fruit, Other fresh, chilled or frozen fruits, Dried fruit and nuts, Preserved fruit and fruit based products, Fresh vegetables, Dried vegetables, Other preserved or processed vegetables, Potatoes, Other tubers and products of tuber vegetables, Jams, marmalades, coffee, tea, cocoa and powdered chocolate
Housing	Rents, mortgage repayments, Maintenance and repair of the dwelling, Water supply and miscellaneous services relating to the dwelling, Electricity, Gas and other household fuels, Goods and services for routine household maintenance
Health	Medical products, appliances and equipment and Hospital services
Transport	Operation of personal transport and Transport services
Communication	Postal services, Telephone and telefax equipment, Telephone and telefax services, Internet subscription fees (ex. combined packages) and Combined telecom services
Recreation and culture	Pets & pet food and TV, video, satellite rental, cable subscriptions and TV licences
Education and child care expenditure	Education fees, Payments for school trips, other ad-hoc expenditure, Nursery, crèche, playschools and Child care payments
Miscellaneous goods & services	Personal care products, social protection (excl child care expenditure), insurance

All of health, communication, education, and child specific expenditure are included in a household's essential expenditure. Not all of the expenditure items are included in the other categories. In these cases, the average share of essential items by decile is calculated and applied to the household's expenditure of that category.

SICK PAY

Eligibility and generosity of sick pay determines how well a household is supported by an employer in the event of sickness, preventing a household earner from working. While the government provides Statutory Sick Pay (SSP), many employers pay more than SSP. Studies have highlighted that length of service, occupation, contract type, and company size play a significant role in determining who receives sick pay above SSP.

Several sources of information have been combined to estimate the extra pay individuals may get on sick leave as well as their eligibility for SSP. Where an individual may be entitled to more than the SSP, the value of sick pay is calculated as the weeks of coverage times their gross weekly employment earnings plus any remaining SSP entitlement. As the SSP covers 28 weeks, many individuals will first get their enhanced sick pay before getting only the SSP. The individual estimates have then been aggregated to provide a household measure of sick pay coverage.

The number of weeks an individual will have sick pay coverage has been calculated using company benchmark data which provides the median number of sick pay weeks by broad industry group and

length of service²⁴. This information has been enhanced by multiplying the median by the proportion of businesses that provide above sick pay by size and contract type to estimate the number of extra weeks sick pay an individual may get depending on their industry, length of service, size of company, and contract type²⁵. The number of weeks covered in the public sector and higher & further education only differ based on industry and length of service.

Fig. 14. Estimated number of weeks sick pay above SSP

	Small Company			Medium Company			Large Company		
	1 year	2 years	5 years	1 year	2 years	5 years	1 year	2 years	5 years
Private production permanent	2.0	2.3	3.1	3.6	4.1	5.6	5.9	6.8	9.2
Private production temporary	1.3	1.5	2.0	2.4	2.7	3.7	3.9	4.5	6.1
Private production no contract	1.2	1.3	1.8	2.1	2.4	3.3	2.1	2.4	3.3
Private services permanent	2.0	4.7	5.1	3.6	8.6	9.2	5.9	14.1	15.1
Private services temporary	1.3	3.1	3.4	2.4	5.7	6.1	3.9	9.3	10.0
Private services no contract	1.2	2.8	3.0	2.1	5.0	5.4	3.5	8.2	8.8
Public sector	16	32	52	16	32	52	16	32	52
Higher and further education	21	32	52	21	32	52	21	32	52

RETIREMENT COSTS

Retirement costs are based on the Pension and Lifetime Saving Association's estimate of a moderate living standard. They calculate an individual will need to spend £20,800 if single or £15,300²⁶ if in a couple each year to have this standard of living. As the relationship status of a household at retirement is not known, an average cost for an individual has been calculated based on a weighted average of these two costs. The weighting used has been estimated based on the proportion of individuals who are single or in a couple for the age cohort 65-69²⁷. This data shows there is a higher proportion of households that are living in a couple compared to being alone. Furthermore, there is a slightly higher probability of an individual being alone if they are currently single. This is due to some individuals not currently living in a couple in this age cohort and have never been in a couple which does not apply to an individual who is currently in a couple. As shown below, this leads a cost per adult to be £16,835 if single in the WAS dataset and £16,577 if in a couple.

Fig. 15 Annual weighted average cost of retirement

Variable	Couple	Single
Weight on couple cost	78%	72%
Weight on single cost	22%	28%
Retirement Cost of living	£16,577	£16,835

²⁴ <https://www.unison.org.uk/content/uploads/2017/03/Sickness-absence-benchmarks.pdf>

²⁵ As published by the Department of Health & Social Care in their Health in the workplace and Sickness absence and health in the workplace studies.

²⁶ As calculated by half the £30,600 needed for the couple.

²⁷ 2019 marital status and living arrangements data published by the ONS.

Households will also need to cover any income tax that must be paid. Individuals currently get £12,570 tax free allowance so an individual will need to pay tax on the income needed above this threshold (£4,007 if in a couple and £4,265 if single). With income taxed at 20%, an individual who is in a couple will be required to pay £801 and £853 if they are currently single.

These costs will need to be met by the state pension and pension savings. It is assumed that the state pension is available to all the individuals and equals £9,412 annually²⁸. Individuals will need to cover the remaining expenses with pension savings which is £7,966 if in a couple and £8,276 if single. Based on a 4% annual draw down, an individual who is in a couple will therefore need £199,154 in pension savings and £206,900 if they are currently single to afford a moderate lifestyle in retirement.

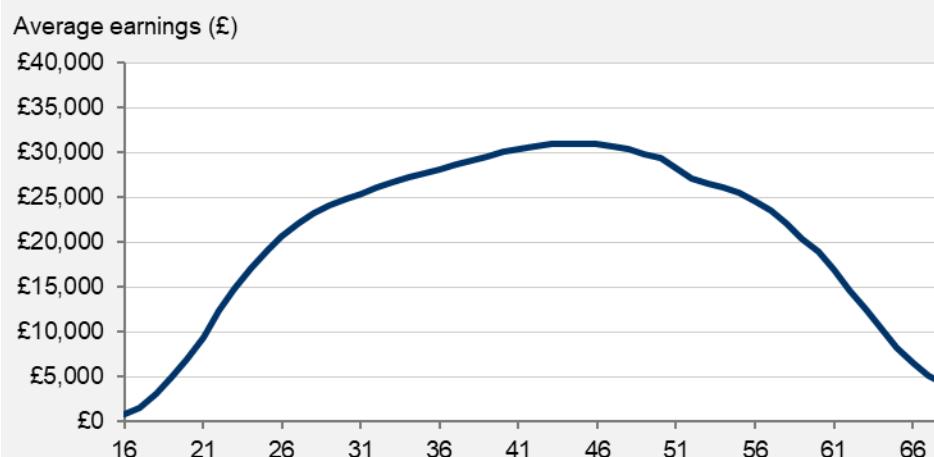
Fig. 16 Total cost of retirement

Variable	Couple	Single
Retirement Cost of living	£16,577	£16,835
Annual income tax (£12,570 tax free)	£853	£853
State pension	£9,412	£9,412
Annual cost above state pension	£7,966	£8,276
Total saving required for retirement	£206,900	£206,900

To evaluate how well households are doing in terms of their pension savings, this retirement cost has been distributed over the working life of the individuals within the household. Pre-pandemic data²⁹ shows that, in general, average earnings and employment rates peak for individual in their mid-40's, declining thereafter. Individual's pension savings should therefore follow a similar pattern and the savings needed to finance a moderate cost of living has been distributed based on the average lifetime earnings. Lifetime earnings has been calculated by multiplying the average earnings by the employment rate at each age. As shown below, average earnings and employment rates are expected to be lower for older individuals which will reduce their ability to save into their pension.

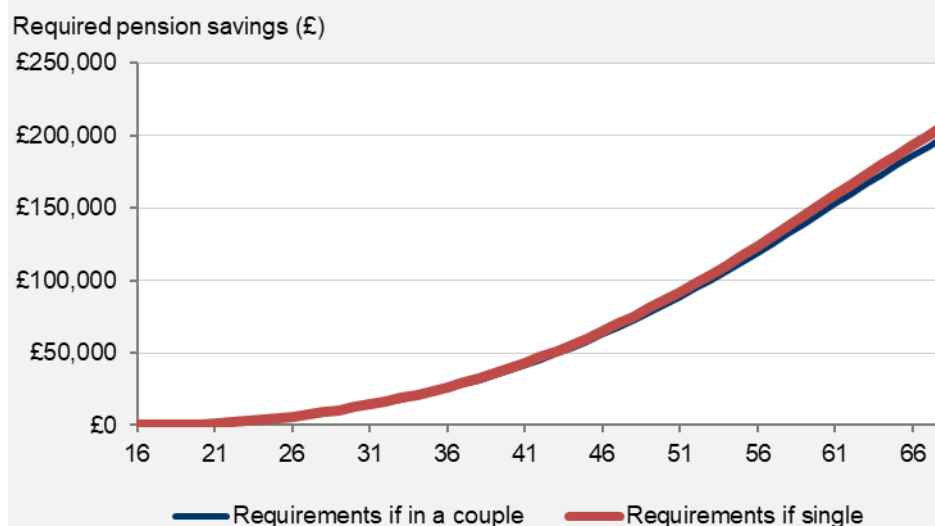
²⁸ Based on the 2019 to 2020 median state pension income of £181 per week published by the ONS Pensioners incomes.

²⁹ Based on 2019 labour force survey data interpolated by individual age.

Fig. 17. Average earnings by age (Retiring at 68)

Source: Oxford Economics

Once the required saving has been calculated by age, a discount rate of 3% per year until retirement has been applied to account for the real investment return. As the retirement age is increasing, separate costs by age have been calculated based on when an individual can access their state pension. Where an individual can retire earlier, they will need to have saved more money quicker as they are working few years. The cumulative savings required for an individual retiring at 68 is shown in Fig. 18.

Fig. 18. Pension savings required by age (Retiring at 68)

Source: Oxford Economics

FORECAST RETIREMENT COSTS

Retirement costs are based on the latest Pension and Lifetime Saving Association's estimate of a moderate living standard. As these retirement costs are based on the cost required in 2021/22, these costs have been forecast based on CPI and wage growth to provide a relevant cost during the forecast

period. Based on assumptions from Hargreaves Lansdown, the costs increase by the CPI plus half the difference between wage and CPI growth. This will take into account the rising costs faced by the households as well as some of the general improvement in living standards. Furthermore, the state pension forecast based on the “triple lock” policy. Each year, the state pension is increase based on the highest of these three measures every year: A flat 2.5% rise, average earnings growth in the second quarter of the previous year or inflation in the third quarter of the previous year. The forecasts of earning and inflation are based projections from Oxford’s Global Economic Model (GEM). These retirement costs have been distributed over the working life of the individuals within the household, the methodology for more details. The age of the individuals in the household increases each year to ensure the correct cost is used.

PENSION CONTRIBUTIONS

Each household participant in the Wealth and Assets Survey (WAS) provides data on the value of their pension contributions (from both employer and employee), and type of scheme. However, it has two deficiencies for our modelling. These are:

1. **Pensionable pay:** while the WAS identifies those on a defined contribution scheme, it does not include information on the pensionable salary their contributions are based on. An employee’s pensionable salary could be basic earnings, qualifying earnings, or total earnings depending on the scheme they are on.
2. **Representativeness of the data:** the distribution of pension contributions does not match that of the more reliable, employer-provided, Annual Survey of Hours and Earnings (ASHE).

Pensionable pay

Several steps were taken to identify the employee’s pensionable earnings and hence an individual’s method of auto-enrolment pension contributions. Employees are allocated to one of three schemes which have different pensionable pay and minimum contributions (Fig. 10).

Fig. 19. Pensionable pay and minimum contribution by defined contribution scheme

Type	Pensionable pay	Minimum employer contribution	Minimum employee contribution	Minimum total contribution
Total pay	Total pay	3.0%	4.0%	7.0%
Qualifying earnings	£6,240 and £50,270 of total pay	3.0%	5.0%	8.0%
Basic pay	Pay excl bonus, holiday pay etc	4.0%	5.0%	9.0%

In the WAS survey, no information is collected on the method of contributions. Pension contributions are expressed as either a reported percentage or a calculated percentage given the individual’s pension contribution and their basic pay depending on the question answered by the interviewees. Furthermore, other household datasets do not include questions on the type of scheme households are on. While the ASHE includes information on each employee’s pensionable pay, this may include earnings below the lower earnings limit or above the upper earnings limit as highlighted by the Department for Work & Pensions and, therefore, does not identify whether qualifying earnings should be used. To identify the employee’s pensionable pay and type of scheme, we made the following assumptions:

Total pay

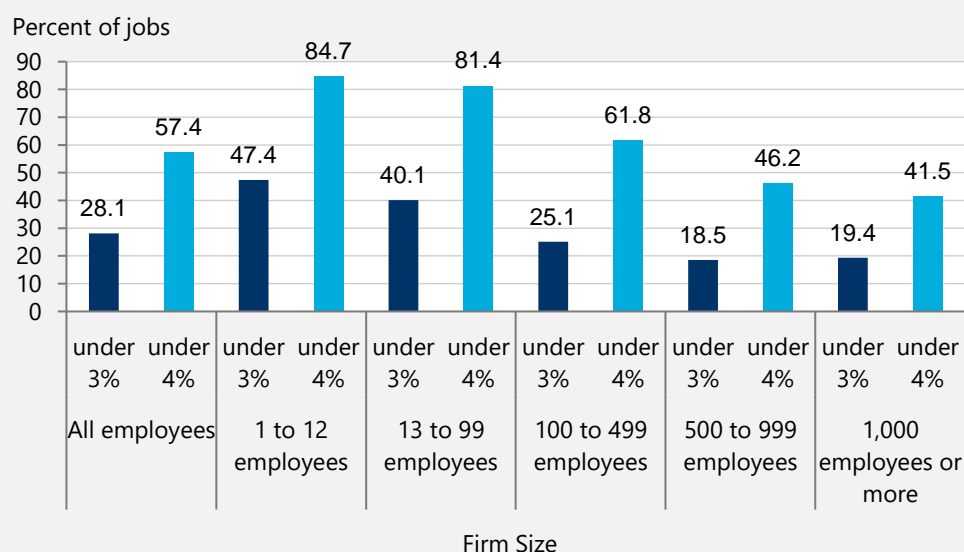
Total earnings schemes require employees to contribute only 4%, compared to 5% for those on either the basic or qualifying earnings schemes. As such, we assume that all those employees contributing exactly 4% were on a total earnings scheme. This is only identifiable for employees that provided percentage answers in the WAS as calculated pension percentages require an assumption on their pensionable pay.

Qualifying and basic earnings

We use employer contributions to distinguish between those on basic earnings and qualifying earnings. Basic earnings schemes require that employers contribute 4%, while qualifying earnings schemes require that they contribute only 3%. As such, we assume that all those individuals whose employers are contributing less than 4% are on qualifying earnings, and hence the rest are on basic earnings. In the analysis, we are only able to identify those on minimum qualifying earnings.

When compared to ASHE, the distribution of employee contributions from the WAS suggests a higher proportion of employees on a basic earnings pension scheme. As data from ASHE are provided by employers rather than employees, it is believed to be more accurate. Within the ASHE data, 57.4 percent of employees have a pension contribution of under 4% and 21.2 percent of employees between 4% and 8%, while the WAS has 45.7 percent of employees under 4% and 34.8 percent of employees between 4% and 8%. Therefore, we adjust the employer contributions in the WAS data so that they are in line with the aggregated distributions from the ASHE dataset. In particular, we focus the analysis on identifying those paying less than 4% which will enable the identification of those on minimum qualifying earnings.

At the firm size level, the published 2021 ASHE data identify clear trends in the proportion of employees where the employer contributes less than 4%. This data show that smaller firms were significantly more likely to contribute less than 4% when compared to larger firms. As employers contributing less than 4% could mean an employee is on either a total or qualifying earnings scheme, employer pension contributions under 3% were also assessed. Where an employer has provided total pay as their pensionable pay and their contributions are based on qualifying earnings, the calculated percentage will be less than 3% and below the minimum. As shown in Fig. 11, a higher proportion of individuals with employers contributing under 3% is found in smaller firms. While this trend is in line with industry expectations, a difference of 29.3% for all employees is larger than expected. Based on Hargreaves Lansdown knowledge of pension schemes, the number of employees using qualifying earnings schemes is significantly larger than those on total salary schemes. The reason for this result could be due to some employers taking into account the fact that the employees are on qualifying earnings while others do not. As a result, an average of the proportions was calculated by firm size.

Fig. 20. Proportion of jobs by employer contribution share by firm size

Source: ASHE 2021

In order to match the proportion by firm size of those we believe to be on qualifying earnings, we adjust the pension contributions of individuals in the WAS. Individuals who had a pension contribution between 4% and 8% were shifted onto qualifying earnings based on their previously reported employer pension contribution, firm size, and sector of the economy they worked in. This will mean those individuals that reported lower pension employer contributions and worked in firms more likely to have employees on qualifying earnings were adjusted first until the proportion on qualifying earnings match the ASHE data.

Distribution of employee pension contribution

We adjust employee contributions to match the ASHE distribution of contributions for each band of employer contributions. This is done by ranking individuals by their reported employee contributions, and then adjusting those marginal individuals across employee contribution bands to match the ASHE distribution while minimising the deviations from their reported contributions.

Having adjusted the distribution of contributions and mapped each individual to a scheme, we change the employee contributions of those individuals contributing less than the minimum required by their scheme. This ensures that total contributions are greater than 8% for those on qualifying earnings, 7% for those on total earnings, and greater than 9% for those on basic earnings.

INCOME PROTECTION AND CRITICAL ILLNESS COVER

Income protection and critical illness cover are imputed from the 2020 Financial Lives Survey (FLS), conducted by the Financial Conduct Authority (FCA). For both types of cover, the survey reports whether the respondent does or does not have the cover. Other characteristics of the respondent and their household are used to model the likelihood of particular households having each type of cover.

Modelling income protection and critical illness cover

In both cases, the outcome variable modelled is binary (1 in the presence of cover, 0 otherwise) and as such logistic regressions were fitted on the FLS data. All covariates used were available in, or could be

calculated from the WAS dataset. As with expenditure, the income decile thresholds are based on the WAS to ensure consistency when imputing cover for WAS households. Fig. 21 shows the results of these regressions, where the coefficients are interpreted as the effect on the log odds of the outcome variable, holding other covariates constant.

These models were then used to predict the probability of each household in the WAS having each type of cover. The households with the highest probability of having a given type of cover in the WAS were assigned that type of cover, such that the overall share of households with cover matched the share in the FLS.

Fig. 21. Critical illness cover and income protection model results

Variable	Critical illness cover	Income protection
Household type (base category single adult, no children)		
Single adult with children	0.57***	-0.01***
Multiple adults, no children	-0.09***	-0.64***
Multiple adults with children	0.26***	-0.49***
Work type (base category not employed)		
Employed full-time	0.92***	0.57***
Employed part-time	0.54***	0.05***
Self-employed full-time	0.29***	0.00
Self-employed part-time	0.76***	-0.01
Household income decile		
2	-0.17***	0.63***
3	0.15***	0.70***
5	0.39***	0.87***
6	-0.26***	0.18***
7	0.50***	1.15***
8	0.59***	1.50***
9	0.72***	1.51***
10	0.90***	1.79***
Age (base category 16-24)		
24-34	1.00***	0.55***
34-44	0.97***	0.68***
44-54	0.91***	0.33***
54-64	0.37***	-0.03***
64-70	-0.23***	-0.87***
70+	-1.17***	-3.68***
Degree	-0.04***	0.27***
Homeowner (base category own home outright)		
Own home with mortgage	0.91***	0.83***
Rent home	-0.69***	-0.62***
Constant	-3.93***	-4.58***

In the case of both types of cover, homeowners with a mortgage are more likely to be protected than those who own their homes outright, who are in turn likelier to be covered than renters. Those of prime working age, 24-54, are generally the likeliest to be covered in both cases. Both employees and self-employed workers are more likely to have critical illness cover than those who are not working, but only employees are more likely to have income protection than those who are not working. In both cases, broadly speaking, households with higher incomes are more likely to be covered. Single adult households are the most likely to have income protection policies, while households with children are the most likely to have critical illness cover. Having a degree makes income protection more likely, but critical illness cover slightly less likely.

PENSIONS INCLUDED IN THE WAS

The WAS includes the following pensions:

Fig. 22. Pensions included

Variable label
Total value of defined benefit occupational scheme
Total value of current defined contribution pension wealth
Total value of AVCs scheme
Total value of current personal pension scheme
Value of total retained DB pension wealth ¹
Total value of retained rights in DC scheme
Total value of retained rights for drawdown
Value of pensions in payment
Value of pensions expected from former spouse/partner

As noted in their user guides, the wealth for each of these components was calculated as describe below.

Current defined benefit occupational pension scheme wealth

Individuals could report up to two current defined benefit pensions. The wealth in each of these schemes was calculated separately (as described below) and then summed to derive total wealth in current defined benefit (DB) occupational schemes³⁰.

Wealth in these schemes was defined as:

$$W_i = \frac{A_R Y_i^p + L_i}{(1 + r)^{R-a}}$$

Where:

³⁰ Since these are individual, not household, pension wealth measures, and due to the complexity of the calculations and the information that would have been required from respondents, survivor benefits are not modelled. In practice, this would lead to an underreporting of pension wealth for women, since the expected future survivor's benefits that they will receive when they (on average) outlive their husbands will not be measured. To the extent these survivors' benefits will be sometime in the future for most women, their omission will have only a small effect on the calculations.

- A_R is the age- and sex-specific annuity factor at normal pension age, R , based on (single life) annuity rates quoted by the Financial Services Authority, assuming average age- and sex- specific life-expectancies (as estimated by the Government Actuary's Department) and a discount rate of 3 per cent.
- Y_i^p is annual pension income, defined as $Y_i^p = \alpha_i n_i s_i$
- α_i is the accrual fraction in the individual's scheme
- n_i is the individual's tenure in the scheme.
- s_i is the individual's gross pay at the time of interview.
- L_i is the lump sum that the individual expects to receive at retirement r is the real investment return (assumed to be 3 per cent per annum)
- R is the normal pension age in the pension scheme.
- a is the individual's age at interview.

Definition of wealth from Additional Voluntary Contributions (AVCs)

Individuals who reported being members of an occupational DB scheme were asked whether they had made any AVCs and, if so, what the value of their AVC fund was at the time of interview. Therefore, current AVC wealth is simply defined as the fund value reported by the respondent at the time of the interview.

Definition of current defined contribution occupational pension

Individuals could report up to two current defined contribution pensions. The wealth in each of these schemes was calculated separately (as described below) and then summed to derive total wealth in current defined contribution (DC) occupational schemes. This procedure was also followed for those who reported that their employer-provided scheme was a hybrid scheme or that they did not know the type of scheme.

Individuals were asked to report the value of their fund at the time of the interview and were encouraged to consult recent statements where available. Current occupational DC pension wealth is, therefore, simply defined as the fund value reported by the respondent at the time of the interview.

Definition of current personal pension wealth

Individuals could report up to two current personal pensions; current being defined as schemes to which the individual was (or could have been) contributing at the time of interview. The wealth in each of these schemes was calculated separately (as described below) and then summed to derive total wealth in personal pensions.

Individuals were asked to report the value of their fund at the time of the interview and were encouraged to consult recent statements where available. Current personal pension wealth is, therefore, simply defined as the fund value reported by the respondent at the time of the interview.

Retained rights in defined benefit occupational pension scheme

Individuals could report up to three pensions in which rights have been retained. These could be either DB or DC schemes. The wealth in each DB retained scheme was calculated separately (in much the same way as for current DB schemes described above) and then summed to derive total wealth held as retained rights in defined benefit (DB) occupational schemes.

Retained rights in defined contribution occupational pension

The wealth in each DC retained scheme was calculated separately as described in above and then summed to derive total wealth held as retained rights in DC schemes. Specifically, individuals were asked to report the value (at the time of interview) of their retained DC fund.

Rights retained in schemes which individuals are drawing down

Individuals could also report that they were already drawing down assets from a retained pension scheme. In these cases, individuals were asked to report what the remaining fund value for their scheme was at the time of interview. The wealth in each of these schemes was then summed to derive total wealth held in schemes of this type.

Pensions expected in future from former spouse/partner

Individuals were asked to report in total how much they expected to receive in the future from private pensions from a former spouse or partner. Respondents were given the choice to report this either as a lump sum wealth figure, or as an expected annual income. Two slightly different approaches were followed, depending on how the respondent answered.

For those who reported a total lump sum value, this figure was taken as the relevant wealth measure and discounted back to the time of the interview. For those who reported an expected future annual income, wealth was calculated in much the same way as for DB schemes described above:

$$W_i = \frac{A_R Y_i^p + L_i}{(1 + r)^{R-a}}$$

Where:

- A_R is the age- and sex-specific annuity factor at retirement age, R (see above)
- Y_i^p is expected annual pension
- r is the real investment return (assumed to be 3 per cent a year)
- R is assumed to be 65, or the individual's current age if he/she was already aged over 65
- a is the individual's age at interview

Definition of wealth from pensions in payment

In order to calculate the value of the future stream of income provided by pensions from which the individual was already receiving an income, the lump sum which the individual would have needed at the time of interview to buy that future income stream from a pension provider was calculated. Wealth from pensions in payment was therefore defined as:

$$W_i = \frac{A_R Y_i^p}{(1 + r)^{R-a}}$$

Where:

- A_R is the age- and sex-specific annuity factor based on respondent's current age, a
- Y_i^p is reported current annual private pension income

For those age groups for whom no market annuity factor was available (ages 75 and over), the ONS predicted a hypothetical annuity factor based on the information from those ages where annuity prices were available.

EXTRAPOLATING EARNINGS BASED ON FURLOUGH LIKELIHOOD

Fig. 23. LFS furlough models

Variable	2020 Q2	2020 Q3	2020 Q4	2021 Q1	2021 Q2	2022 Q3
Education (base category degree)						
Other qualification	0.41***	0.44***	0.29***	0.44***	0.61***	0.47**
No qualification	0.17	0.18	0.38*	0.48***	0.56**	0.30
NACE industry (base category agriculture, forestry and fishing)						
Mining and quarrying; Electricity, gas, air cond supply; Water supply, sewerage, waste	0.74	0.28	1.27	-0.61	0.68	1.55
Manufacturing	1.53***	0.83*	2.67**	0.50	1.09	2.20*
Construction	1.63***	0.75	2.44*	0.36	0.98	2.04*
Wholesale, retail, repair of vehicles	1.57***	0.61	2.86**	1.06	1.46*	1.96
Transport and storage	1.35***	1.12**	3.12**	0.85	1.79*	2.73**
Accommodation and food services	2.61***	1.74***	4.62***	2.82***	3.28***	3.77***
Information and communication	0.63	0.39	2.18*	-0.09	1.05	1.92
Financial and insurance activities	-0.07	-0.41	0.93	-1.38*	0.01	0.70
Real estate activities	1.51***	0.50	1.96	-0.13	0.88	1.31
Prof, scientific, technical activ.	1.31***	1.00*	2.33*	-0.17	0.83	2.00
Admin and support services	1.51***	1.21**	3.15**	1.02	1.72*	2.60*
Public admin and defence	-0.93*	-1.22**	0.43	-1.85**	-0.62	0.27
Education	0.26	0.01	1.29	-0.41	0.27	1.12
Health and social work	0.10	-0.28	1.66	-0.52	0.06	1.19
Other	1.86***	1.50***	3.59***	1.93**	2.52***	2.46*
Age (base category 16-24)						
24-34	-0.13	0.23	0.14	-0.10	0.07	0.54*
34-44	-0.28***	0.20	-0.07	-0.27**	-0.02	0.24
44-54	-0.36***	0.32*	0.03	-0.28**	0.06	0.68**
54-64	0.01	0.43***	0.06	-0.11	0.21	0.78***
64-70	0.36**	0.64***	0.58***	0.26	0.49**	1.34***
70+	0.81**	1.19***	0.20	0.93***	0.67*	1.54***
Part-time	0.18***	0.44***	0.51***	0.63***	0.43***	0.22
Manager (base category not a manager)						
Manager	-0.15**	-0.21*	0.19*	0.22**	0.21*	0.07
Foreman or supervisor	0.08	-0.02	0.19	0.23*	0.19	0.09
Constant	-3.33***	-4.16***	-6.12***	-3.74***	-5.38***	-7.50***

In order to model changes in earnings (as separate from employment) during the pandemic, we focussed on the likelihood of particular workers being furloughed. Logistic regression models were fit

on data from the Labour Force Survey, where the dependent variable is a binary variable encoding whether the respondent was on furlough at the time of interview.

These models were used to predict the likelihood of workers being furloughed in the WAS: this was done separately for the reference member of the household and (where relevant) their partner. Individual workers' earnings were first reduced by the predicted likelihood of being on furlough in each quarter multiplied by 20%, since furlough payments typically covered 80% of income. After this, average earnings were constrained to match changes in average earnings by NACE industry from the AWE.

ARREAR EXTRAPOLATION**Fig. 24. Bank of England arrears models**

Variable	2018	2019	2020	2021
Household income decile				
2	-0.80***	-0.30	-0.18	-1.02**
3	-1.09***	-0.68**	-1.38***	-0.69**
4	-1.82***	-1.65***	-1.49***	-0.88***
5	-1.41***	-1.92***	-2.02***	-1.41***
6	-1.84***	-1.25***	-1.35***	-1.24***
7	-1.68***	-1.95***	-1.96***	-1.54***
8	-1.53***	-1.52***	-1.75***	-1.70***
9	-1.63***	-1.49***	-2.06***	-1.27***
10	-0.92***	-0.95***	-1.50***	-0.63**
Age (base category 16-24)				
24-34	-0.77***	0.12	-0.13	-0.08
34-44	-0.83***	-0.10	-0.52*	-0.08
44-54	-1.74***	-0.21	-0.59**	-0.94***
54-64	-2.42***	-0.76**	-1.63***	-1.01***
64+	-3.28***	-1.77***	-1.55***	-2.84***
Main earner employed	0.37	-0.46	-0.25	-0.28
	-0.25	-0.16	-0.31	-0.28
Degree	0.10	-0.20	0.18	-0.16
Region (base category North East & Yorkshire and the Humber)				
North West	0.29	0.21	0.50	0.11
Midlands	-0.24	0.03	0.14	-0.14
South East	-0.21	-0.29	0.18	0.13
East of England	-0.76**	0.02	0.33	0.34
South West	-0.81**	-0.49	0.41	0.01
Wales	-0.18	-0.34	-0.09	0.42
London	0.51**	0.53*	1.05***	0.78***
Scotland	-0.20	0.16	0.33	0.32
Homeowner (base category own home outright)				
Own home with mortgage	-0.92***	-0.84***	0.06	-0.38**
Rent home	-0.09	0.27	0.67**	0.01
ln(Number of children)	0.83***	0.84***	0.70***	0.62***
ln(Number of adults)	0.76***	0.09	0.69*	0.47
Constant	-0.47	-1.30**	-2.36***	-1.38**

Fig. 24 shows the results of the logistic regressions fitted on Bank of England household survey data to model whether households are in arrears. Coefficients are interpreted as the effect on the log odds of being in arrears, holding other covariates constant. For all models, the likelihood of being in arrears broadly decreases as income and age increase. A greater number of children increases the likelihood of being in arrears. In 2018 and 2019 Londoners were more likely to be in arrears than those from other regions.

These models were used to predict the likelihood of being in arrears for all households in the WAS. Once the predictions had been made, households were classified as being burdened or not in the following way:

- The percentage change π in the share of households that were in arrears from one year to the next was calculated from the Bank of England survey data
- If the share increases from year t to year $t + 1$:
 - All those households which are in arrears in year t are assumed to continue to be in arrears in year $t + 1$
 - The households with the highest predicted probability of being in arrears from among those who were not in arrears in year t are assumed to be in arrears in year $t + 1$, such that the overall percentage change equals π
- If the share decreases from year t to year $t + 1$:
 - All those households which are not in arrears in year t are assumed to continue not to be in arrears in year $t + 1$
 - The households with the lowest predicted probability of being in arrears from among those who were in arrears in year t are assumed not to be in arrears in year $t + 1$, such that the overall percentage change equals π

DEBT BURDEN**Fig. 25 Bank of England debt burden models**

Variable	2018	2019	2020	2021
Household income decile				
2	-0.36*	-0.26	0.20	-0.11
3	-0.24	-0.41**	-0.37*	-0.58***
4	-0.80***	-0.62***	-0.45**	-0.77***
5	-0.57***	-0.97***	-0.65***	-0.92***
6	-1.12***	-0.99***	-0.71***	-1.13***
7	-1.17***	-1.18***	-0.91***	-1.13***
8	-1.25***	-1.21***	-1.06***	-1.33***
9	-1.37***	-1.50***	-1.21***	-1.02***
10	-1.29***	-1.31***	-1.27***	-1.27***
Age (base category 16-24)				
24-34	-0.37**	0.04	-0.09	0.21
34-44	-0.50***	0.03	-0.18	-0.03
44-54	-0.76***	-0.15	0.07	-0.17
54-64	-1.28***	-0.43**	-0.44**	-0.30
64+	-1.70***	-0.72***	-0.86***	-0.94***
Employment status (base category employed)				
Self-employed	0.09	0.06	-0.13	-0.19
Unemployed	-0.20*	-0.19	-0.04	-0.27**
Degree	0.03	-0.07	0.07	-0.02
Region (base category North East & Yorkshire and the Humber)				
North West	0.58***	0.07	0.36*	-0.14
Midlands	0.21	0.21	0.29*	0.00
South East	0.40**	0.14	0.24	0.04
East of England	0.36**	0.07	0.38*	0.28
South West	0.46**	0.05	0.38*	0.16
Wales	0.42**	0.15	0.05	0.28
London	0.71***	0.27*	0.58***	0.50***
Scotland	0.43**	0.04	0.22	-0.03
Homeowner (base category own home outright)				
Own home with mortgage	0.20	0.35***	0.64***	0.56***
Rent home	0.60***	0.79***	1.00***	0.80***
ln(Number of children)	0.48***	0.55***	0.72***	0.42***
ln(Number of adults)	0.79***	0.71***	0.18	0.56**
Cuts				
Cut 1	0.19	0.63*	0.31	0.12
Cut 2	2.12***	2.69***	2.34***	2.08***

Fig. 25 shows the results of the ordered logistic regressions fitted on Bank of England household survey data to model the burden of debt for each household. Coefficients are interpreted as the effect on the log odds of the latent response variable, holding other covariates constant. For all models, debt burden broadly decreases as income and age increase. Homeowners with a mortgage find debt a greater burden than those who own their homes outright, and renters find debt a greater burden still. A greater number of children increases the debt burden. In 2018 and 2019 Londoners were more burdened by debt than those from most other regions, and in 2020 households with more adults found debt a greater burden.

These models were used to predict the burden of debt for all households in the WAS. Once the predictions had been made, households were classified as being burdened or not in the following way:

- The percentage change π in the share of households that felt debt was a burden from one year to the next was calculated from the Bank of England survey data
- If the share increases from year t to year $t + 1$:
 - All those households which find debt a burden in year t are assumed to continue to find debt a burden in year $t + 1$
 - The households with the highest predicted burden from among those who did not find debt a burden in year t are assumed to find debt a burden in year $t + 1$, such that the overall percentage change equals π
- If the share decreases from year t to year $t + 1$:
 - All those households which did not find debt a burden in year t are assumed to continue not to find debt a burden in year $t + 1$
 - The households with the lowest predicted burden from among those who did find debt a burden in year t are assumed not to find debt a burden in year $t + 1$, such that the overall percentage change equals π

MONTHLY DEBT REPAYMENTS

Fig. 26 Bank of England monthly debt repayment models

Variable	2018	2019	2020	2021
Household income decile				
2	-0.35	0.14	0.39	0.56**
3	0.20	0.61***	0.76***	0.67***
4	0.24	0.52**	1.06***	1.02***
5	0.52***	0.89***	1.20***	0.66***
6	0.20	0.87***	1.04***	0.96***
7	0.59***	0.61***	1.41***	1.04***
8	0.58***	0.70***	1.34***	0.77***
9	0.86***	0.99***	1.41***	1.34***
10	1.23***	1.18***	1.68***	1.85***
Age (base category 16-24)				
24-34	-0.36*	0.10	0.40	0.70**
34-44	-0.38*	0.06	0.39	0.41
44-54	-0.56***	0.20	0.59**	0.47*
54-64	-0.21	0.28	0.77***	0.75***
64+	0.39	0.89***	1.25***	1.11***
Employment status (base category employed)				
Self-employed	-0.08	-0.32	-0.22	0.17
Unemployed	-0.49***	-0.48***	-0.45***	-0.45***
Degree				
	0.04	-0.08	-0.23**	-0.06
Region (base category North East & Yorkshire and the Humber)				
North West	0.36*	-0.08	-0.23	-0.19
Midlands	0.05	0.12	-0.23	-0.18
South East	0.17	0.09	-0.20	-0.16
East of England	0.14	-0.14	-0.07	-0.09
South West	0.21	0.02	-0.42**	-0.20
Wales	0.18	-0.01	-0.66**	0.19
London	0.51***	-0.13	-0.11	0.45**
Scotland	0.39**	-0.16	0.16	0.30
Homeowner (base category own home outright)				
Own home with mortgage	0.09	0.29**	0.10	-0.21
Rent home	-0.14	-0.08	-0.09	-0.24*
ln(Number of children)				
	0.88***	0.44***	0.54***	0.58***
ln(Number of adults)				
	0.01	0.19	-0.27	0.20
Constant				
	4.59***	3.78***	3.99***	3.42***

Fig. 26 shows the results of weighted least squares regressions, fitted on Bank of England data where the dependent variable is the logarithm of monthly debt repayments. The process for using these project debt repayments forward is as follows:

- The models are used to predict annual figures for monthly debt repayment.
- The annual predictions are linearly interpolated to a quarterly frequency, and predictions for quarterly repayment growth are derived from these.
- Quarterly repayment growth predictions are applied in a chained manner to monthly debt repayments from the WAS.

Aggregate repayment growth quarter-on-quarter is constrained to match total UK credit growth from Oxford Economics' Global Economic Model, by scaling all households' repayments up or down by the same factor.

MONTHLY SAVINGS

Fig. 27 Bank of England savings ratio models

Variable	2018	2019	2020	2021
Household income decile				
2	-0.13	0.15	0.19	0.22
3	0.04	0.25*	0.26	0.27
4	0.24	0.61***	0.69***	0.52***
5	0.44***	0.71***	0.80***	0.59***
6	0.25	0.78***	0.84***	0.67***
7	0.82***	0.83***	0.87***	0.79***
8	0.80***	1.24***	1.34***	0.86***
9	1.21***	1.09***	1.39***	0.99***
10	1.19***	1.58***	1.60***	1.21***
Age (base category 16-24)				
24-34	-0.45**	-0.38**	-0.53**	-0.22
34-44	-0.40**	-0.65***	-0.78***	-0.29
44-54	-0.56***	-0.71***	-0.87***	-0.40**
54-64	0.20	-0.49***	-0.26	0.11
64+	0.64***	0.36*	0.42*	0.60***
Employment status (base category employed)				
Self-employed	0.21	-0.34*	0.01	0.07
Unemployed	-0.63***	-0.45***	-0.20*	-0.43***
Degree				
	0.44***	0.39***	0.46***	0.39***
Region (base category North East & Yorkshire and the Humber)				
North West	0.15	0.08	0.05	0.14
Midlands	0.38**	0.20	0.03	0.02
South East	0.12	0.10	-0.06	-0.01
East of England	0.15	0.52***	0.00	-0.11
South West	0.29	0.18	-0.05	-0.16
Wales	0.12	-0.13	-0.28	0.28
London	0.47***	0.26	0.06	0.41**
Scotland	0.30	0.34*	-0.38**	-0.24
Homeowner (base category own home outright)				
Own home with mortgage	-0.64***	-0.60***	-0.60***	-0.77***
Rent home	-1.43***	-1.11***	-1.30***	-1.56***
ln(Number of children)				
	-0.05	-0.27***	-0.26**	-0.04
ln(Number of adults)				
	0.07	-0.19	-0.29	-0.04
Constant				
	1.90***	1.95***	2.28***	1.84***

Fig. 27 shows the results of weighted least squares regressions, fitted on Bank of England data where the dependent variable is the saving ratio. The saving ratio has been calculated base on the monthly saving of households and their income. The process for predicting the saving ratio is as follows:

- The models are used to predict annual figures for savings ratios.
- The annual predictions are linearly interpolated to a quarterly frequency, and predictions for quarterly differences in savings ratios are derived from these.
- Quarterly savings ratio difference predictions are applied in a chained manner to the pre-pandemic savings ratios from the WAS.

PREDICTING GRANULAR REGIONAL DATA

In the publicly available dataset, the WAS reports the location of households at Government Office regions³¹ (e.g. Scotland, Wales, North East of England, South East of England and so on), but does not provide more granular locational data. In order to calculate financial resilience results at NUTS2 / ITL2 level, we modelled the probability of each household in the dataset being in any given NUTS2 / ITL2 region. For example, for each household in the North East of England, we modelled the probability of being in either Tees Valley & Durham or Northumberland and Tyne & Wear. The probability of being in any other NUTS2 / ITL2 region is zero, since these are the only two in the North East of England. Once probabilities were assigned to each household, statistics at NUTS2 region were calculated using these probabilities as weights (multiplied by the sample weights from the original WAS).

In order to assign probabilities, we used a random forest classifier model for each NUTS1 / ITL1 region, trained on the 2020 Financial Lives Survey, which does report location at the NUTS2 / ITL2 region. Features used in the model included: the average age of adults in the household; the number of adults and children in the household; the household's employment status and education level; gross household income; whether the household receives income from each of work, a pension, investments, benefits or other sources; whether anyone in the household is a manager; whether the house is rented, owned with a mortgage, or owned outright; whether the household is in arrears or finds debt a burden; the value of the house and the value of any outstanding mortgage; and the household's stock of liquid assets and investments. For each WAS household in a given NUTS1 / ITL1 region, these models are able to assign a probability of being in any given NUTS2 / ITL2 region.

OXFORD ECONOMICS GLOBAL ECONOMIC MODEL (GEM)

Oxford Economics' Global Economic Model (GEM) provides a rigorous and consistent structure for forecasting and testing scenarios. A globally integrated economic model covering 85 countries, it can be used to address questions on a wide range of economic topics such as the impact of oil price changes, or the effects of slower economic growth. Furthermore, individual country models are fully linked through global assumptions about trade volume and prices, competitiveness, capital flows, interest and exchange rates, and commodity prices.

Data included in the GEM is collected from a variety of sources. For the UK model, the primary data sources for the statistics used in the barometer include the ONS and the Bank of England. Where

³¹ These regions are in-line with the NUTS1 / ITL1 geographic definition.

world data is used, such as the world share price total return index, the relevant series of several countries have been weighted together within the GEM.

SUMMARY OF THRESHOLDS

Pillar	Indicator	Lower Threshold	Upper Threshold	Rationale
Save a penny for a rainy day	Adequacy of liquid assets	0 = no liquid assets	100 = liquid assets covering at least three months' essential expenditure	According to the Money Advice Service, "[a] good rule of thumb to give yourself a solid financial cushion is to have three months' essential outgoings available in an instant access savings account". ³²
	Surplus income	0 = no (or negative) surplus income	100 = surplus income at least 9% of net income	The Resolution Foundation has found that, for many people, income can be volatile from month to month ³³ , with the size of the fluctuation being broadly proportional to income. Surplus income of 9% of net income is the 90 th percentile of the distribution in the WAS.
	Sick pay	0 = no sick pay	100 = sick pay covering at least three months' essential expenditure	At sick pay covering three months' essential expenditure, full resilience is calibrated to match the period covered by the 'adequacy of liquid assets' indicator.
	Redundancy pay	0 = no redundancy pay	100 = redundancy pay covering at least 1.3 months' essential expenditure	A study by Glassdoor has found that the average time it takes to interview for a job in the UK is 27.5 days. ³⁴ Assuming an additional two weeks to find and apply for a job, the upper threshold was set at redundancy pay covering 1.3 months' essential expenditure.
Protect Your Family	Life insurance	0 = (assets + life insurance) covers mortgage, other	100 = (assets + life insurance) covers mortgage, other	When (assets + life insurance) – (mortgage + other liabilities + dependants' living costs) was calculated

³² <https://www.moneyadviceservice.org.uk/en/articles/emergency-savings-how-much-is-enough>

³³ <https://www.resolutionfoundation.org/app/uploads/2018/10/Irregular-payments-RF-REPORT.pdf>

³⁴ <https://www.glassdoor.com/research/time-to-hire-in-25-countries/>

Pillar	Indicator	Lower Threshold	Upper Threshold	Rationale
		liabilities and dependants' living costs with a shortfall of £163,831 or more	liabilities and dependants' living costs fully	for the WAS, the 10 th percentile of the distribution was a shortfall of £163,831.
	Critical illness cover	0 = no critical illness cover	100 = critical illness cover	The underlying data used to model this cover only state whether the respondent is covered or not.
	Income protection	0 = no income protection	100 = income protection	The underlying data used to model this protection only state whether the respondent is protected or not.
	Balance of earnings	0 = main earner earns all household income	100 = main earner earns 60% or less of household income ³⁵	The share of earnings from the main earner ranges from 50% to 100%. The threshold was set at the 20 th percentile of the distribution which was that the main earner earns 60% or less of household income.
Control Your Debt	Affordability of future debt repayments	0 = debt repayments are 45% or more of net income for those with a mortgage; or 19% or more of net income after rent for those without a mortgage ³⁶	100 = no debt repayments	The affordability of debt repayments depends on how those repayments relate to net income. Since mortgage repayments are included—but are not per se bad since they typically replace rent payments—different thresholds were used for those who are repaying mortgages and those who are not. These thresholds were set at the 90 th percentiles for each population, which are 45% and 19% of income respectively.
	Uncertainty of future debt repayments	0 = all debt is variable rate	100 = no debt is variable rate	Since the share of debt that is variable rate ranges from 0% to 100%, these formed natural thresholds without the need to transform the underlying variable.

³⁵ 60% is the 90th percentiles of the populations with the WAS

³⁶ 45% and 19% are the 90th percentiles of the populations with and without a mortgage respectively

Pillar	Indicator	Lower Threshold	Upper Threshold	Rationale
	Use of debt	0 = all debt is used for current consumption (e.g. holiday, leisure) and none for investment or capital consumption (e.g. mortgage or home improvements)	100 = all debt is used for investment or capital consumption	Since the share of debt that is used for investment or capital consumption ranges from 0% to 100%, these formed natural thresholds without the need to transform the underlying variable.
	Arrears	0 = in arrears (excluding mortgage)	100 = not in arrears (excluding mortgage)	Being in arrears to any extent is prima facie evidence that a household is not managing its finances successfully, so the maximum penalty (i.e. a score of 0) is applied however great or small the value of arrears.
	Subjective evaluation of debt position	0 = debt is a burden	100 = debt is not a burden	Finding debt a burden to any extent is prima facie evidence that a household is not managing its finances successfully, so the maximum penalty (i.e. a score of 0) is applied whether the household finds debt somewhat of a burden or a great burden.
Plan for Later Life	Value of pension	0 = no pension accumulated	100 = accumulated pension is on track to provide a moderate standard of living in retirement ³⁷	Resilience on this pillar is scored according to the calculated rate at which households would need to accumulate a pension pot in order to have a moderate standard of living in retirement. If a household is on track, that household is considered fully resilient.
	Home ownership	0 = no housing equity	100 = housing equity at or above the national age-adjusted mean	One reason to accumulate housing equity is to have somewhere to live in later life without needing to pay rent. Since house prices change substantially over time, rather than tying this equity

³⁷ See the section on pensions for more details

Pillar	Indicator	Lower Threshold	Upper Threshold	Rationale
				to a specific cash value, households are considered fully resilient if they are doing as well as or better than the average household in the same age category.
	Other assets	0 = no (net) assets other than pension or housing equity	100 = (net) assets other than pension or housing equity at or above the national age-adjusted mean	Assets other than pensions or housing equity can help support a comfortable retirement by providing an income or a source of emergency funds. Since having enough pension to cover a moderate standard of living in retirement is covered by the 'value of pension' indicator, the upper threshold for this indicator is set distributionally. However, in order to measure resilience rather than simply wealth, a cap of the age-adjusted mean was chosen, rather than the 90 th percentile.
Invest	Investment intensity	0 = no savings are invested in less liquid assets	100 = all savings are invested in less liquid assets	Since the share of savings that is invested ranges from 0% to 100%, these formed natural thresholds without the need to transform the underlying variable.

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