



The Place-Based Intelligence Model Technical Appendix



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Technical Appendix: The Place-Based Intelligence Model

1. Introduction

This technical appendix sets out the methodological approach underpinning the Good Growth Barometer: The Place-Based Intelligence Model. It is intended to provide the rationale behind the approach, as well as transparency on the methods, assumptions and analytical choices adopted.

1.1 The Rationale

Traditional measures of economic performance, such as Gross Domestic Product (GDP), Gross Value Added (GVA) and other measures of local output, provide an indication of the scale and pace of economic activity within a region. However, these measures present three well-recognised limitations when used to assess the feed-through of growth to citizens and their lived experience:

1. **Growth takes time to reach households.** There is often a lag between increases in local output and any corresponding improvement in household incomes and living standards.
2. **Growth affects both income and costs.** Economic expansion can drive up housing costs, energy prices and other local cost pressures, meaning that households may not feel better off even where headline growth is strong. As a result, increases in output or nominal incomes may not translate into equivalent improvements in households' real purchasing power. The impact on living standards will depend on how these cost pressures are distributed across households, as set out below.
3. **The benefits of growth are not evenly distributed.** Lower-income households tend to have a higher marginal propensity to consume and spend a larger share of their income on essentials. As they are also more likely to rent, inflationary increases in rent and other living costs can offset income gains, leaving some households facing a disproportionate squeeze on living standards.

Beyond these traditional economic limitations, GDP and GVA do not capture wider outcomes such as household wellbeing, health, environmental quality or access to opportunity. This means that areas with strong economic growth can still experience high levels of deprivation, poor wellbeing and limited improvements in day-to-day living conditions.

The Place-Based Intelligence Model, the analytical model that underpins the Good Growth Barometer, has therefore been designed to move beyond a broad focus on macroeconomic output by incorporating both market and non-market outcomes into a single, HM Treasury (HMT) Green Book-aligned, measure of good growth: a place-based Public Value Score.

The model's output is the Public Value Score (PVS); this is a composite metric comprising two components: 1) a Social Value Score (SVS), which quantifies the value citizens derive from social and environmental factors such as financial resilience, access to green space, community safety and health outcomes;¹ and 2) an Economic Value Score (EVS), which captures actual household living standards through income net of household taxes and key costs. Together, these components provide a comprehensive, place-based view of good growth that enables direct comparison between local authorities (LAs), benchmarking against regional and national averages, and tracking of progress over time.

Beyond the ability to directly compare LAs on their PVS, the analysis reveals the key driving factors behind each LA's individual score. Critically, the analysis also reveals the relative importance of each driving factor to citizens through the wellbeing valuation method (see Section 3.4). This enables targeted policy and investment decisions by revealing precisely where the greatest opportunities for improvement could lie in each LA.

¹ For full detail on how the SVS and EVS are estimated, see Sections 3 and 4 respectively.

The remainder of this Appendix covers:

- Data Validation and cleaning
- Social Value Score
- Economic Value Score
- Public Value Score
- Technical validation
- Additional econometric modelling for the Good Growth Barometer

2. Data Validation and Cleaning

2.1 Data Selection Process

The Place-Based Intelligence Model draws on a combination of large-scale survey datasets, administrative sources and spatial data to capture the economic, social and environmental dimensions of good growth at a localised level. Datasets were selected based on a) their relevance to the framework's outcome and explanatory variables, b) their geographic coverage and granularity, c) their consistency with HMT Green Book guidance, and d) their suitability for econometric modelling.

2.2 Data Usage

The framework primarily draws on the Office for National Statistics' (ONS) and UK Data Service (UKDS) ² microdata and other nationally representative survey datasets, which provide individual-level observations on income, employment, health, wellbeing, demographics and social behaviours. These sources provide the granularity required to assess how the determinants of good growth vary across places and populations. An overview of the datasets used in the analysis, including their coverage, geographic granularity, role within the framework and key limitations, is provided in Table 1.

Prior to modelling, all datasets underwent a structured data cleaning process to improve the accuracy and reliability of the analysis. This included:

- removal of duplicate observations;
- removal of missing or incomplete responses;
- standardisation of variable definitions;
- alignment of geographic identifiers;
- conversion of categorical variables into grouped or binary indicators where required; and
- removal of outliers and implausible values.

² This work was partially undertaken in the Office for National Statistics Secure Research Service using data from ONS and other owners and does not imply the endorsement of the ONS or other data owners. This work also used data from the UK Data Service (UKDS) and other owners, and does not imply the endorsement of data creators, funders and UKDS regarding our analysis or interpretation.

Table 1: Overview of utilised datasets

Secondary Data Source	Frequency of Collection	Geographic Granularity	Spatial Coverage	Approximate Sample Size	Number of Indicators	Purpose of use
Understanding Society	Each participant is interviewed once per wave (roughly once a year)	Source UKDS: Lower Layer Super Output Area (LSOA) Source ONS: Postcode	United Kingdom	c. 40,000 individuals	22	- Includes detailed household- and individual-level data on income, employment, health, wellbeing, demographics, social behaviours and environmental perceptions - Supports econometric analysis of how economic, social and environmental conditions affect wellbeing and living standards beyond aggregate measures of growth
Annual Population Survey	Interview data are collected continuously throughout the year, with data combined into quarterly rolling and annual datasets	Postcode	United Kingdom	c. 175,000 individuals	7	- Includes large-scale data on employment, economic inactivity, occupation, qualifications, demographics and local labour market characteristics across the UK population. Labour Force Survey data also feeds directly into datasets produced by this survey - Supports regression analysis of good growth outcomes and consistent tracking of labour market trends at local level across a broad range of indicators
Crime Survey for England & Wales (CSEW)	Interview data are collected throughout the year, with data combined into quarterly rolling and annual datasets	LSOA	England and Wales	c. 31,000 adults	8	- Includes data on crime victimisation, perceptions of crime and personal safety - Enables assessment of safety and security as key components of quality of life
People and Nature Survey for England	Collected throughout the year through online surveys, with data reported four times a year	LA	England	c. 25,000 adults	2	- Captures access to and use of green space, including quality, proximity and accessibility - Enables modelling of how natural environment factors contribute to wellbeing outcomes
Police Data UK	Recorded throughout the year, with data published through monthly releases	LSOA	England, Wales and Northern Ireland	N/A	12	- Provides objective, geographically granular measures of recorded crime and anti-social behaviour across LSOAs - Supports modelling of how crime and perceptions of safety influence wellbeing, place quality and wider inclusive growth outcomes

Secondary Data Source	Frequency of Collection	Geographic Granularity	Spatial Coverage	Approximate Sample Size	Number of Indicators	Purpose of use
ONS Regional Gross Value Added	Annually	International Territory Level 1 (ITL1)	United Kingdom	N/A	N/A	- Includes measures of total economic output and industry structure at regional and sub-regional levels - Provides the core measure for the economic model of where and how economic activity is generated, forming the basis for assessing local growth
Defra Modelling of Ambient Air Quality (MAAQ)	Annually	1km x 1km grid	United Kingdom	N/A	1	- Provides an objective, spatially granular measure of ambient air pollution and environmental quality - Supports modelling of how exposure to air pollution is associated with wellbeing and wider growth outcomes

3. Social Value Score

This section sets out the analytical steps taken to estimate the Social Value Score (SVS).

The SVS is derived from 42 regressions that estimate how local conditions influence citizens' subjective wellbeing, measured through life satisfaction, in line with OECD and HMT Green Book guidance.^{3,4}

The Wellbeing Valuation technique, as described in the HMT Green Book and Supplementary Guidance on Wellbeing,⁵ uses life satisfaction as the closest available proxy for notional utility. Since the Social Value Act, this measure has been collected in all nationally representative survey microdata, such as Understanding Society and the Annual Population Survey.

Using life satisfaction as the dependent variable, we can therefore use econometric techniques to isolate the impact of economic, social and environmental conditions on people's actual lived experience.

To build the analysis underpinning the Social Value Score we followed five steps:

1. Variable selection
2. Estimate the relationship between determinants and life satisfaction
3. Scale the coefficients where required
4. Monetise the coefficients
5. Calculate the regional and local authority values

3.1 Variable selection

Variables were selected to support the development of a holistic and HMT Green Book-aligned measure of good growth, capturing how local economic growth translates into household lived experiences through wider social and environmental outcomes. The selection process was designed to ensure that variables were theoretically grounded, supported by robust evidence, and suitable for econometric modelling at both household and local geographic level.

Variables included in the analysis fall into three categories:

- The outcome variable
- Variables of interest
- Controls

3.1.1 Outcome variable

The SVS is a measure of citizen subjective wellbeing in a Local Authority (LA) as compared to other LAs across Great Britain. This measure captures individuals' reported life satisfaction, which represents 'the closest measure to the economist's notion of utility'.⁶

The use of life satisfaction allows the SVS to capture a broader concept of social value than is reflected in conventional economic indicators alone. Measures such as income, employment and economic output remain important determinants of living standards, but they do not fully capture how people experience their lives. Subjective wellbeing reflects the combined influence of a wider range of market and non-market factors, including physical and mental health, job quality, financial security, housing conditions, social relationships, community cohesion, personal safety, access to services and the quality of the local environment.

³ OECD (2013), OECD Guidelines on Measuring Subjective Well-being. OECD Publishing.

⁴ HM Treasury (2026), The Green Book: UK Government Guidance on Appraisal.

⁵ HM Treasury (2021), Wellbeing Guidance for Appraisal: Supplementary Green Book Guidance.

⁶ Department for Work and Pensions, and HM Treasury (2011). Valuation Techniques for Social Cost-Benefit Analysis: Stated Preference, Revealed Preference and Subjective Well-Being Approaches. London: HM Treasury.

The SVS therefore provides a measure of the extent to which the characteristics of a place contribute to residents' overall quality of life. This supports a more holistic assessment of good growth by considering not only whether an area is generating economic prosperity, but also whether that prosperity and the wider conditions of the area are contributing to citizens' lived experiences.

3.1.2 Variables of interest

Variables of interest were assessed using a structured selection framework and assigned a Red Amber Green (RAG) rating based on their overall suitability for inclusion within the final modelling framework. The assessment criteria included:

- alignment with HMT Green Book guidance, the Cabinet Office Social Value Model, and government policy priorities;
- sufficient sample size to support econometric analysis;
- geographic granularity;
- consistency and comparability over time; and
- theoretical alignment with good growth outcomes and suitability for integration within a repeatable analytical framework.

Red-rated variables, where data quality, conceptual overlap or methodological limitations reduced their suitability for inclusion, were excluded from the final framework; amber-rated variables were retained subject to further review or refinement.

Selected examples of variables that were reviewed and subsequently excluded include:

- **Alcohol consumption** was excluded due to concerns regarding measurement validity, as self-reported drinking behaviour is vulnerable to response bias, with heavier drinkers particularly likely to under-report their consumption;
- **Substance use** was excluded because the relevant questions in Understanding Society were asked only of respondents aged 16 to 21, meaning that the resulting measure would not be representative of the wider population;
- The **standard of public transport** was also considered, but no sufficiently reliable and consistently available data source was identified that could be incorporated into the econometric analysis; and
- **Sleep quality** was excluded despite its established relationship with productivity and mental health because it is inherently subjective and was considered likely to overlap with health outcomes already captured through the SF-12 measure.

This process resulted in a final set of 54 variables that capture the economic, social and environmental dimensions of good growth in a way that is robust, policy-relevant and consistent with HMT appraisal guidance.

Selected variables

This section describes the variables of interest used to assess the potential drivers of the SVS, categorised into eight domains.

Financial resilience

- **Debt (non-mortgage):** Included to test whether holding non-mortgage debt is associated with life satisfaction through repayment obligations, financial uncertainty and stress.
- **Financial comfort:** Included to test whether individuals' perceptions of how well they are managing financially are associated with life satisfaction beyond the effect of measured household income.⁷

⁷ The use of a subjective measure is supported by wider literature with a systematic review and meta-analysis by Ngamaba et al. (2020) finding that financial satisfaction is consistently and positively associated with subjective wellbeing across countries, suggesting that individuals' perceptions of their financial situation are an important determinant of life satisfaction.

- Ability to save regularly: Included to test whether the capacity to build financial reserves and prepare for unexpected expenditure is associated with higher life satisfaction.
- Problems paying household bills: Included to test whether difficulty meeting routine financial commitments is associated with lower life satisfaction through financial pressure and uncertainty.
- Private pension contributions: Included to test whether engagement in long-term financial planning and greater perceived retirement security are associated with life satisfaction.
- Contents insurance: Included to test whether protection against unexpected household losses and the ability to afford insurance are associated with life satisfaction.
- Total household utility costs: Included to test whether essential household expenditure is associated with life satisfaction by reducing disposable resources and increasing financial pressure.

Jobs

- Employment status: Included to test whether being employed, unemployed or inactive is associated with life satisfaction.
- Involuntary redundancy: Included to test whether involuntary job loss is associated with lower life satisfaction through reduced security, disrupted routines and psychological distress, independently of household income.
- Perceived job security: Included to test whether anticipated job loss and uncertainty about future employment are associated with lower life satisfaction even where employment continues.
- Job satisfaction: Included to test whether individuals' evaluations of their working conditions, autonomy, relationships and opportunities are associated with their overall life satisfaction.
- Working from home: Included to test whether home working is associated with life satisfaction through reduced commuting and greater flexibility, balanced against possible isolation and blurred work-home boundaries.
- Second job: Included to test whether holding an additional job is associated with life satisfaction through higher income or career opportunities, offset by longer hours and reduced leisure.
- Total hours worked: Included to test the potentially non-linear relationship between working intensity and life satisfaction through earnings, fatigue and work-life balance.
- Commuting time: Included to test whether the duration of an individual's usual journey from home to work is associated with life satisfaction through time costs, fatigue and reduced leisure.

Skills, education & training

- Age of completing continuous full-time education: Included to test whether the age at which an individual completed continuous full-time education is associated with life satisfaction through its influence on employment opportunities, earnings potential and broader life outcomes.
- Highest qualification: Included to test whether the level of an individual's highest qualification is associated with life satisfaction through employment opportunities, earnings potential and broader social participation.

Housing

- Household size: Included to test whether the number of people in the household is associated with life satisfaction through social contact, resource sharing, household responsibilities or crowding.
- Housing affordability: Included to test whether increasing financial arrears are associated with lower life satisfaction through greater financial stress and difficulty meeting routine commitments.

- Household ownership type: Included to test whether housing ownership or tenure, as a proxy for housing security, influences subjective wellbeing through differences in stability, affordability and long-term financial security beyond income alone.⁸
- Landlord type: Included to test whether differences in housing security, maintenance, affordability and landlord service across rental arrangements are associated with life satisfaction.⁹

Health

- Mental health: Included to test whether self-reported mental health status is associated with life satisfaction through its effect on daily functioning, emotional wellbeing and the capacity to engage in work and social activities.
- Physical health: Included to test whether self-reported physical health status is associated with life satisfaction through its effect on mobility, independence, pain and the ability to carry out everyday activities.
- Participation in moderate sport: Included to test whether moderate physical activity is associated with life satisfaction through enjoyment, social interaction and physical and mental health.
- Participation in vigorous sport: Included to test whether more intensive physical activity is associated with life satisfaction independently of participation in moderate sport.
- Smoking: Included to test whether the number of cigarettes smoked is associated with life satisfaction through dependence, financial cost, health and stress-related behaviour.

Safety

- Anti-social behaviour (objective): Included to test whether area-level rates of anti-social behaviour are associated with lower life satisfaction through reduced neighbourhood quality and personal security.
- Bicycle theft (objective): Included to test whether area-level rates of bicycle theft are associated with lower life satisfaction through reduced personal security and property loss.
- Burglary (objective): Included to test whether area-level rates of burglary are associated with lower life satisfaction through fear of victimisation and reduced security in the home.
- Criminal damage and arson (objective): Included to test whether area-level rates of criminal damage and arson are associated with lower life satisfaction through reduced neighbourhood quality and safety.
- Drug offences (objective): Included to test whether area-level rates of drug offences are associated with lower life satisfaction through reduced neighbourhood quality and perceived safety.
- Possession of weapons (objective): Included to test whether area-level rates of weapons possession are associated with lower life satisfaction through fear of violence and reduced personal security.
- Public order offences (objective): Included to test whether area-level rates of public order offences are associated with lower life satisfaction through disorder and reduced neighbourhood amenity.
- Robbery (objective): Included to test whether area-level rates of robbery are associated with lower life satisfaction through fear of victimisation and reduced personal security.
- Shoplifting (objective): Included to test whether area-level rates of shoplifting are associated with lower life satisfaction through reduced local amenity and neighbourhood quality.

⁸ Housing ownership or tenure acts as a proxy for broader aspects of housing security, reflecting differences in stability, affordability and long-term financial security. These factors can influence wellbeing beyond the direct effects of income alone. This is consistent with the wider literature, which finds that homeowners tend to report higher levels of wellbeing than individuals living in rented accommodation, reflecting underlying socioeconomic differences (Tennant et al., 2007).

⁹ Using GIS-linked survey data for Ireland, Brereton et al. (2008) find that individuals living in public (social) housing report lower life satisfaction than those in other housing tenures, even after controlling for income and a comprehensive set of socioeconomic and environmental characteristics. While this does not imply that landlord type itself causes differences in wellbeing, it suggests that housing tenure captures important dimensions of living conditions that extend beyond income alone.

- Theft from the person (objective): Included to test whether area-level rates of theft from the person are associated with lower life satisfaction through fear of victimisation and reduced personal security.
- Vehicle crime (objective): Included to test whether area-level rates of vehicle crime are associated with lower life satisfaction through property loss and reduced security.
- Violence and sexual offences (objective): Included to test whether area-level rates of violence and sexual offences are associated with lower life satisfaction through fear of harm and reduced personal safety.
- Other crime (objective): Included to test whether area-level rates of other recorded crime are associated with lower life satisfaction through reduced neighbourhood quality and security.
- Noisy neighbours or loud parties (subjective): Included to test whether perceived problems with noisy neighbours are associated with lower life satisfaction through annoyance, sleep disruption and reduced privacy.
- Teenagers hanging around (subjective): Included to test whether perceived problems with teenagers hanging around are associated with lower life satisfaction through feelings of intimidation and reduced neighbourhood safety.
- Rubbish or litter (subjective): Included to test whether perceived problems with rubbish or litter are associated with lower life satisfaction through reduced neighbourhood amenity and environmental quality.
- Vandalism and graffiti (subjective): Included to test whether perceived problems with vandalism and graffiti are associated with lower life satisfaction through reduced neighbourhood quality and feelings of disorder.
- People using or dealing drugs (subjective): Included to test whether perceived problems with drug use or dealing are associated with lower life satisfaction through fear, reduced safety and neighbourhood decline.
- People being drunk or rowdy (subjective): Included to test whether perceived problems with drunkenness or rowdy behaviour are associated with lower life satisfaction through intimidation, noise and reduced personal safety.
- Abandoned or burnt-out cars (subjective): Included to test whether perceived problems with abandoned or burnt-out cars are associated with lower life satisfaction through visual blight and signals of neighbourhood neglect.
- Anti-social behaviour in local area (subjective): Included to test whether perceived problems with general anti-social behaviour are associated with lower life satisfaction through reduced feelings of safety and neighbourhood quality.

Social connectivity

- Lives with partner: Included to test whether living with a partner is associated with life satisfaction through companionship, emotional support, shared resources and household stability.
- Household internet connectivity: Included to test whether access to the internet is associated with life satisfaction through employment, education, services, information, entertainment and social contact.
- Unpaid caring hours: Included to test whether the intensity of caring responsibilities is associated with life satisfaction through time pressure, emotional demands and constraints on employment and leisure.

Environment & Green Space

- Outdoor space at home: Included to test whether access to a garden, balcony or other outdoor area is associated with life satisfaction through recreation, relaxation and contact with nature.
- Frequency of green-space visits: Included to test whether engagement with green and natural spaces is associated with life satisfaction through physical activity, social interaction and psychological restoration.
- Improvement in local green space quality: Included to test whether perceived improvements in the attractiveness, usability and maintenance of nearby green spaces are associated with life satisfaction.

- Air pollution: Included to test whether exposure to fine particulate air pollution is associated with lower life satisfaction through environmental concern, reduced local amenity and adverse health-related pathways.

3.2 Estimate the relationship between determinants and life satisfaction

The strength and direction of the relationship between each determinant and life satisfaction was estimated. The SVS draws on 54 variables across eight outcome domains (as set out in Section 3.1.2).

A common modelling framework was applied across the different data sources. However, the exact specification varies according to the explanatory variable. The sections below set out the general model specification and the control variables used. Section 3.2.3 dives into the individual specifications for each of the variables of interest.

3.2.1 Model specification

The following specification estimates the relationship between life satisfaction and each variable of interest:

$$SW_i = \beta_0 + f(Q_i)\beta_Q + \sum_{g=1}^G \sum_{h=1}^{H_g} \mu_{gh} PP_{hi}^g + Z_i\beta + u_i$$

Where:

SW_i – Represents subjective wellbeing, measured using individual life satisfaction scores for observation i . This is the dependent variable within the social and environmental model.

β_0 – Represents the intercept for subjective wellbeing: the expected value when all numerical variables are equal to zero and categorical variables are at their reference category. Where a categorical variable is the variable of interest, we exclude the intercept to improve interpretability.

$f(Q_i)\beta_Q$ – Represents the variable of interest, Q_i , and its associated estimated coefficient, β_Q . The coefficient captures the direction and magnitude of the relationship between the variable of interest and life satisfaction for individual i , holding the other variables in the model constant.

$\sum_{g=1}^G \sum_{h=1}^{H_g} \mu_{gh} PP_{hi}^g$ – Represents the ONS pen-portrait quasi-fixed effects as set out in detail later in this section. PP_{hi}^g is an indicator identifying whether individual i resides in an area assigned to pen-portrait category h within higher-level group g . The coefficient μ_{gh} captures the average difference in life satisfaction associated with that category, relative to the omitted reference category.

$Z_i\beta$ – Represents the vector of individual household and other control variables included in the model, Z_i , together with their associated estimated coefficients, β . These controls account for observable characteristics that may be associated with life satisfaction and the variable of interest.

u_i – Represents the error term, capturing unobserved factors affecting subjective wellbeing that are not explicitly included in the model.

i – Denotes the individual respondent included within the dataset.

3.2.2 Control variables

The regressions include individual and household controls to reduce the risk that the estimated relationship between a determinant and life satisfaction is not confounded by other factors that also influence subjective wellbeing.

The analysis selects controls to capture relevant characteristics without unnecessarily absorbing the relationship it intends to measure. Particular care is taken where a potential control could itself be affected by the determinant, as controlling for such a variable could exclude part of the pathway through which the determinant associates with life satisfaction. The analysis therefore considers the appropriate treatment of these variables in the context of each determinant, and minor adjustments are made between specifications for each regression in the analysis.

Understanding Society (USoc) provides the most complete control set as it contains detailed and consistently measured information across the main health, demographic, household and socioeconomic domains. In particular,

it includes the SF-12, a standardised health measure that provides continuous summary scores for both physical and mental health. This allows the analysis to control for variation in underlying health status more comprehensively and consistently than would be possible using individual categorical health indicators alone. The USoc control specification is therefore used as the benchmark framework for the analysis, with the other datasets using controls covering the same underlying concepts as far as possible.

Maintaining a common conceptual control set is important for comparability. It reduces the likelihood that differences between estimates are driven by arbitrary differences in model specification rather than by the determinants or populations being studied. It also provides a consistent basis for interpreting the results across datasets. However, exact harmonisation is not always possible because the surveys differ in their questionnaires, variable coverage and level of measurement.

Understanding Society (USoc)

For the regressions estimated using USoc data, the regressions control for:

- Physical health status and mental health status measured using the SF-12 Physical and Mental Component Summary scores, together with their squared terms. The SF-12 provides standardised, continuous measures of physical and mental health, allowing the model to control for variation in health status across respondents while also capturing potential non-linear relationships between health and life satisfaction.
- Age and age squared, reflecting the well-established U-shaped relationship between age and both income and life satisfaction. Life satisfaction is typically relatively high in youth and early adulthood, declines through middle age to a low point between the late-40s and mid-50s, and then rises again later in life, often remaining high into old age before potentially declining among the very elderly.
- Gender, caring responsibilities, household relationship status and employment status, covering both unemployment and retirement, to account for demographic and socioeconomic differences that influence both economic living standards and subjective wellbeing independently of the variables of interest.
- Log net equivalised household disposable income (NEDHI) is included to isolate the effect of non-market factors on life satisfaction from the direct influence of financial resources.

This specification provides the starting point for the control sets used in the remaining datasets.

Annual Population Survey (APS)

The APS specification follows the USoc benchmark as closely as the available information permits. It includes:

- General health and general health squared. In APS, general health is a self-reported, subjective measure of overall health, used in place of the separate standardised physical- and mental-health measures available in USoc through the SF-12. The squared term allows for a non-linear relationship between reported health and life satisfaction.
- Age and age squared, to allow for a non-linear age profile.
- Gender.
- Hourly pay, entered in logarithmic form, to account for differences in earnings while allowing for a diminishing marginal association between pay and life satisfaction.
- Marital status, as the available measure of household relationship circumstances.
- Employment status, as the principal control for labour-market circumstances.

The default APS specification includes employment status, but the relevant employment-related specifications remove it. This prevents the model from controlling directly for the characteristic whose association is being estimated or for a factor that may form part of the pathway of interest.

Crime Survey for England and Wales (CSEW)

The CSEW specification contains a narrower set of controls, reflecting the information available in that dataset. It includes:

- General health status and general health squared, using the same subjective, self-reported measure of overall health as in the APS.
- Age and age squared, to capture non-linear age-related differences.
- Income, to account for differences in financial resources.
- Employment status, to account for labour-market circumstances that may be associated with both the determinant of interest and life satisfaction.

Cohabitation status was considered during the development of the specification but was removed from the final CSEW control set due to the question having a very low sample size.

People and Nature Survey (PaNS)

The PaNS control set follows the same broad conceptual framework, although several characteristics are available in banded or categorical form. It includes:

- Age band. As age is recorded in categories rather than as a continuous measure, it is entered categorically and an age-squared term cannot be constructed.
- Sex.
- Income band. Income is likewise entered categorically because the underlying continuous amount is not available. It therefore cannot be transformed into logarithmic form in the same way as household income in USoc or hourly pay in the APS.
- Unemployment status, to capture labour-market circumstances.
- Whether the respondent is married or living with a partner, as the available measure of household relationship status.
- Long-term illness, as the available control for underlying health circumstances.
- Ethnicity. Ethnicity is included directly because the separate pen portrait information used elsewhere could not be linked to the PaNS data.

The use of banded age and income means that the functional form of these controls differs from the benchmark specification. Nevertheless, their inclusion preserves the underlying conceptual coverage of demographic and financial circumstances as far as the structure of the PaNS data allows.

Geographic pen portrait controls

To account for characteristics that may influence life satisfaction but are not fully captured by the observed individual- and household-level variables, the regressions that feed into the SVS calculations include geographic pen portrait controls. These are derived from the Geographic Data Service's 2021/2 UK Output Area Classification (OAC), developed in partnership with the Office for National Statistics (ONS). The OAC is a hierarchical geodemographic classification that identifies areas with similar demographic, socioeconomic and built-environment characteristics. It comprises 52 Subgroups nested within 21 Groups, which are in turn nested within eight Supergroups.

The classification links to the analytical datasets using the respondent's LSOA identifier. Each respondent is assigned to the OAC Subgroup associated with the area in which they live, and a set of categorical Subgroup indicators is included in the regression as control variables.

These indicators act as quasi-fixed effects. Unlike conventional geographic fixed effects, which would control separately for each individual geographic area, the OAC controls group together areas with similar observable characteristics and allow the model to account for average differences in life satisfaction across these neighbourhood types. They are therefore intended to capture otherwise unobserved sociodemographic and neighbourhood-level heterogeneity associated with the type of area in which a respondent lives, rather than to assume that every resident shares the individual characteristics described by the corresponding pen portrait.

Once linked, the model treats the Subgroup indicators in the same way as other controls in the model. They absorb average differences in life satisfaction between neighbourhood types that are not explained by the other observed variables, helping to reduce omitted-variable bias in the estimated coefficients.

For example, suppose smoking is more prevalent in one Subgroup than another and residents of that Subgroup also experience unobserved neighbourhood conditions that independently reduce life satisfaction. Without a geographic control, part of the association between this unobserved sociodemographic heterogeneity and life satisfaction could be incorrectly attributed to smoking, potentially biasing the estimated magnitude or direction of the smoking coefficient. Including the pen portrait controls helps account for this otherwise unobserved heterogeneity, reducing the risk that systematic differences between the types of areas in which respondents live are conflated with the estimated association between smoking and life satisfaction.

3.2.3 Indicator-specific estimations

This section sets out the indicator specific estimations that underpin the model.

The analysis regresses each indicator on subjective wellbeing, measured through life satisfaction, to estimate its association with individual wellbeing. Unless stated otherwise, every indicator follows the standard specification and control set outlined in Section 3.2.1, ensuring that estimates are directly comparable across indicators and that each coefficient reflects the association between the indicator and subjective wellbeing after accounting for the same underlying set of individual and household characteristics. Where an indicator departs from this common approach, the nature of and rationale for that departure is described explicitly.

Financial resilience

The following variables are used as proxies for financial resilience.

Debt

This indicator captures the value to individuals of not being heavily burdened with debt.

The key variable of interest is derived from survey questions in USoc capturing both whether an individual holds any non-mortgage debt and, if so, the total amount owed. In relation to the latter, respondents must answer the following question:

How much in total is owed?

A number of alternative specifications were tested in this estimation, including:

- A binary indicator of whether the individual holds any debt, estimated both with and without an intercept term.
- The log of total debt (Indebt), with additional controls for debt type (e.g. credit card debt, personal loans, hire purchase agreements, and other forms of borrowing) and an interaction between debt type and whether the individual is behind on bills.
- A decomposition of debt into "good debt", "bad debt" and "other debt" categories, each entered separately.
- A combined specification including both the binary debt indicator and the log of total debt.

The final specification includes both the binary debt indicator and the log of the total amount of debt held as covariates, estimated with an intercept term alongside the standard control set. This approach allows the model to capture both the extensive margin (whether an individual holds any debt at all) and the intensive margin (the scale of indebtedness among those with debt). The log transformation of debt accounts for diminishing marginal effects. This means that a given increase in debt has a proportionally larger impact on subjective wellbeing for those with lower levels of debt than for those who are already heavily indebted.

Financial comfort

This indicator captures an individual's subjective financial situation and uses a survey question from USoc, where respondents must answer the following question:

How well would you say you yourself are managing financially these days?

1. Living comfortably
2. Doing alright
3. Just about getting by
4. Finding it quite difficult
5. Finding it very difficult

Able to save regularly

This indicator captures the value of individuals being able to save on a regular basis, as compared to those who save only from time to time or do not save at all. The key variable of interest uses a survey question from USoc, where respondents must answer the following question:

Do you save on a regular basis or just from time to time when you can?

1. Regular basis
2. From time to time
3. Other

In USoc, this question is only asked to those who have previously reported that they do save.

Problem paying bills

This indicator captures whether an individual is behind on paying household bills and uses a survey question from USoc, where respondents must answer the following question:

Sometimes people are not able to pay every household bill when it falls due. May we ask, are you up to date with all your household bills such as electricity, gas, water rates, telephone and other bills or are you behind with any of them?

1. Up to date with all bills
2. Behind with some bills
3. Behind with all bills

Contributes to private pension

This indicator captures the value associated with contributing to a private pension and uses a survey question from USoc, where respondents must answer the following question:

Other than your main employer pension scheme, are you currently a member of any personal pension scheme or do you currently contribute to any personal pension scheme? Please include any Additional Voluntary Contribution scheme you may belong to.

1. Yes
2. No

This variable was also tested in a combined financial-inclusion specification which included pension contributions, late housing payments, bill arrears and saving behaviour; however, the standalone pension model is the specification carried into the final model. This is because it provided a clearer estimate of the relationship between private pension contributions and life satisfaction, without conditioning on other closely related financial behaviours.

Therefore, the specification follows the standard control set adopted throughout, with no additional interaction terms included. The resulting coefficient captures the difference in average life satisfaction between those who contribute to a private pension and those who do not, after controlling for the other variables in the model.

Contents insurance

This indicator captures the value associated with having household contents insurance and uses a survey question from USoc, where respondents must answer the following question:

Household contents insurance?

1. I/We have this
2. I/We would like to have this but can't afford it
3. I/We do not want/need this at the moment

Household utilities

This indicator captures the value associated with the total cost of a household's utilities.

The key variable of interest uses a survey question from USoc, where respondents must answer the following question:

In the last year how much has your household spent on gas and electricity combined?

The regression specification includes the total utilities cost and its log transformation.

The model includes both variables together, allowing the linear and log forms to jointly capture the shape of the relationship between utilities cost and life satisfaction. The log transformation accounts for diminishing marginal effects, such that a given change in utilities cost has a proportionally larger impact on subjective wellbeing for households facing lower costs than for those already facing high costs.

Jobs

Employment status

This indicator captures the value associated with an individual's current economic activity status, as defined by the International Labour Organisation (ILO). This indicator is estimated using data from the APS.

The key variable of interest classifies all respondents into one of four categories based on their basic economic activity:

1. In employment
2. ILO unemployed
3. Inactive
4. Under 16

The ILO unemployment rate is calculated as the number of ILO unemployed expressed as a percentage of the economically active population.

Involuntary unemployment

This indicator captures the value to an individual of not having lost their job to redundancy. This indicator is estimated using data from the APS, where respondents must answer the following question:

Could you tell me the reason you left your last job?

1. You were dismissed
2. You were made redundant
3. You took voluntary redundancy
4. It was a temporary job which came to an end
5. You resigned
6. You gave up work for health reasons
7. You took early retirement
8. You retired (at or after State Pension age)
9. You gave up work for family or personal reasons
10. Education or training
11. You left for some other reason

This question applies to respondents who are working and left a paid job in the last three months.

The specification excludes both employment status and log hourly pay from the control variables. Employment status is excluded because it is closely related to the variable of interest. Involuntary redundancy can directly change an individual's employment status, so controlling for current employment could absorb part of the effect of redundancy that the analysis is seeking to estimate. Log hourly pay is excluded for a related but distinct reason. Current pay may itself be affected by redundancy, for example where an individual subsequently moves into lower-paid work, and may therefore form part of the mechanism through which redundancy affects life satisfaction. In addition, the wage-curve literature identifies a structural relationship between wages and labour-market conditions, creating further potential for collinearity between employment and wages when estimating the relationship across the labour force.¹⁰ Excluding these variables therefore allows the coefficient to capture more fully the association between experiencing involuntary redundancy in the previous three months and life satisfaction, conditional on the remaining controls.

Job security

This indicator captures an individual's perceived job security over the next 12 months and uses a survey question from USoc, asked only of respondents who are an employee in their main job, where respondents must answer the following question:

I would like you to think about your employment prospects over the next 12 months. Thinking about losing your job by being sacked, laid-off, made redundant or not having your contract renewed, how likely do you think it is that you will lose your job during the next 12 months? Is it...

1. Very likely
2. Likely
3. Unlikely
4. Very unlikely

¹⁰ Blanchflower and Oswald (2005): The Wage Curve Reloaded; identify a systematic relationship between wages and labour-market conditions, finding that higher local unemployment is associated with lower real wages. This 'wage curve' indicates that wages and employment conditions are structurally linked, creating potential overlap between employment-related controls and pay when estimating relationships across the labour force.

Job satisfaction

This indicator captures the value associated with an individual's level of satisfaction with their job, using data from USoc, where respondents must answer the following question:

On a scale of 1 to 7 where 1 means 'Completely dissatisfied' and 7 means 'Completely satisfied', how dissatisfied or satisfied are you with your present job overall?

1. Completely satisfied
2. Mostly satisfied
3. Somewhat satisfied
4. Neither satisfied nor dissatisfied
5. Somewhat dissatisfied
6. Mostly dissatisfied
7. Completely dissatisfied

Working from home

This indicator captures the value to an individual of working from home. This indicator is estimated using data from APS.

The key variable of interest uses a survey question, where respondents must answer the following question:

(In your main job) do you work mainly...

1. In your own home
2. In the same grounds or buildings as your home
3. In different places using home as a base
4. Or somewhere quite separate from home

Second job

This indicator captures the value to an individual of having a second job. This indicator is estimated using data from the APS.

The key variable of interest uses a survey question capturing whether an individual had a second job in the reference week.

1. Yes
2. No

This question applies to all respondents who are employees, self-employed, or on government schemes, but excludes those doing paid work in addition to that done on a New Deal scheme. Casual or small jobs are included, provided the job was paid.

Unemployment status was excluded as a control variable because the second-job analysis is restricted to employed respondents, meaning unemployment does not vary within the estimation sample and therefore cannot be separately controlled for.

Hours worked

This outcome captures the value to an individual of the number of hours they work. This outcome is estimated using data from the APS.

The key variable of interest is the total number of hours worked in main and second jobs, using the derived variable SUMHRS, which is available from Spring 1995 onwards and is preferred over the alternative derived variable, TOTHRs, as it is considered a more reliable measure. Derived variables are used in preference to the underlying component variables as they include all respondents, whereas second job hours information is only available for actual hours including overtime.

The key variable of interest is specified as a log-transformed continuous variable. This specification allows the relationship between working hours and subjective wellbeing to be non-linear. In particular, it reflects the expectation that an additional hour of work may have a larger effect on wellbeing for someone working relatively few hours than for someone already working a long week. The specification otherwise follows the standard control set adopted throughout. The log transformation accounts for diminishing marginal effects, such that a given change in hours worked has a proportionally larger impact on wellbeing for those working fewer hours than for those already working long hours.

Commuting time

This indicator captures the value associated with the time an individual usually spends travelling from home to work.

The key variable of interest uses a survey question from the APS, where respondents must answer the following question:

What is your usual home to work travel time in minutes?

Time was recorded in minutes, with travel times exceeding three hours recorded as 180 minutes. Those working outside the UK were recorded as zero. This question applied to all respondents in employment, excluding those on government schemes and those working from home or using their home as a working base.

The specification follows the standard control set adopted throughout, with the exception that the unemployment control was excluded. This is because mode of commute is only observed for individuals in employment who travel to work, meaning there is no variation in employment status within the relevant estimation sample.

Skills, education & training

Across the skills, education and training indicators tested, the analysis did not identify a consistent, statistically significant direct association with life satisfaction. This does not imply that skills investment has no value; rather, many of its benefits are likely to be realised through traditional economic channels such as higher earnings, improved employment prospects and greater productivity, which are already captured through control variables.

Age of completing continuous full-time education

This indicator captures the value associated with the age at which an individual completed their continuous full-time education. This indicator is estimated using data from the APS.

The key variable of interest uses a survey question from the APS, where respondents must answer the following question:

How old were you when you finished your continuous full-time education?

Responses are entered as an age, with additional codes used for those still in continuous education and those who never had continuous education.

Job-related training or education

This indicator captures the value associated with having participated in job-related training or education in the previous three months. This indicator is estimated using data from the APS. The variable records whether respondents participated in job-related education or training over this period. Responses are coded as:

1. Yes
2. No

The variable is available quarterly and applies to respondents aged 16-69 who are either in employment or receiving education or training. The indicator therefore provides a measure of recent participation in skills development or work-related learning, complementing the measures of formal educational attainment and apprenticeship level considered elsewhere in the analysis.

Highest qualification

This indicator captures the value associated with an individual's highest qualification. This indicator is estimated using data from the APS.

The key variable of interest uses a survey question from the APS, where respondents must indicate their highest qualification from a detailed list of options spanning higher degrees and postgraduate qualifications through to entry-level and no qualifications. Responses are coded across a range of academic, vocational, and professional qualifications, including degrees, apprenticeships, A levels and equivalents, GCSEs and equivalents, and trade certificates, as well as a category for those with no qualifications.

The estimation sample was restricted to respondents aged 25 to 65, ensuring that most individuals had completed their education and had not yet reached retirement age. The specification follows the standard control set adopted throughout, with the exception that the control for the number of dependent children was excluded. This control was excluded because educational attainment may influence when people have children and form families, meaning that including the number of dependent children could distort the estimated relationship between qualification level and the outcome of interest (Geruso and Royer, 2018).

Apprenticeship level

This indicator captures the value associated with the level of apprenticeship an individual has achieved or is currently undertaking. This indicator is estimated using data from the APS, where respondents must answer the following question:

What level is your apprenticeship?

1. Apprenticeship (Level 2) or Intermediate Apprenticeship
2. Advanced Apprenticeship (Level 3)
3. Higher Apprenticeship (Level 4 or 5)
4. Don't know

This question applied to respondents who started their apprenticeship in the year 2000 or later. The estimated coefficients for apprenticeship level were not statistically significant, and therefore the analysis did not identify a robust direct association between apprenticeship level and life satisfaction

Housing

Number of people in a household

The key variable of interest uses a survey question from the APS, where respondents must answer the following question:

Number of people in household?

This indicator captures the value associated with the number of people living in an individual's household. This variable is asked of all respondents and may include absent household members.

Housing affordability

This indicator captures the ability of an individual to pay for their accommodation, as compared to those that have struggled.

The key variable of interest uses a survey question from USoc, where respondents must answer the following question:

In the last 12 months, have you ever found yourself behind with your rent/mortgage?

1. Yes
2. No

This indicator assigns value to respondents having answered "No".

Housing ownership type

This indicator captures the value associated with an individual's housing ownership or tenure status.

The key variable of interest uses a survey question from USoc, where respondents must answer the following question:

Does your household own this accommodation outright, is it being bought with a mortgage, is it rented or does it come rent-free?

1. Owned outright
2. Owned/being bought on mortgage
3. Shared ownership (part-owned part-rented)
4. Rented
5. Rent free
6. Other

Landlord type

This indicator captures the value associated with the type of landlord an individual rents their accommodation from.

The key variable of interest uses a survey question from USoc, where respondents must answer the following question:

Who is the accommodation rented from or provided by?

1. Local Authority/Council (or equivalent regional housing body)
2. New Town Commission or Corporation
3. Property company
4. Scottish Homes/Communities Scotland Scottish Special Housing Association (Scotland only)
5. Other housing association, co-op or charitable trust
6. Employer (organisation)
7. Other organisation
8. Relative
9. Employer (individual)
10. Other individual

In this estimation, we look more closely at the following categories: Local Authority, Private landlord, Housing association, co-op or charitable trust, Employer, and Relative.

Alongside the standard control set, the model includes an additional control for household housing costs. Housing costs are likely to vary systematically across landlord types and may themselves have a direct effect on life satisfaction through their impact on disposable income and financial pressure. Including this control helps distinguish the association with the wider characteristics of the landlord or tenure arrangement from the effect of the amount the household pays for its accommodation. The landlord-type coefficients should therefore be interpreted as capturing differences between tenure arrangements conditional on household housing costs, rather than the total effect of landlord type, including any affordability advantage or disadvantage.

Noise from neighbours

This indicator captures the value of an individual not experiencing problems with noise from their neighbours.

The key variable of interest uses a survey question from USoc, where respondents must answer the following question:

Does your accommodation experience noise from neighbours?

1. Yes
2. No

Health

SF-12 Physical Component

This indicator captures the value associated with an individual's physical health functioning, using the SF-12 Physical Component Summary (PCS) score derived from Understanding Society (USoc).

The key variable of interest is a derived continuous variable from the USoc individual respondent file. The SF-12 PCS converts valid answers to twelve questions covering general health, physical functioning, role limitations due to physical health, bodily pain, vitality, social functioning, role limitations due to emotional problems, and mental health into a single physical functioning score, resulting in a continuous scale ranging from 0 (low functioning) to 100 (high functioning).

While SF-12 is generally a control variable, it is important to measure the effects of physical health on wellbeing, as such this regression treats it as a variable of interest.

SF-12 Mental Component Summary

This indicator captures the value associated with an individual's mental health functioning, using the SF-12 Mental Component Summary (MCS) score derived from Understanding Society (USoc).

The key variable of interest is a derived continuous variable from the USoc individual respondent file. The SF-12 MCS converts valid answers to the same twelve questions as the Physical Component Summary, covering general health, physical functioning, role limitations due to physical health, bodily pain, vitality, social functioning, role limitations due to emotional problems, and mental health, into a single mental functioning score, resulting in a continuous scale ranging from 0 (low functioning) to 100 (high functioning). The weighting applied to each question differs from the PCS, placing greater emphasis on items related to mental and emotional wellbeing.

While SF-12 is generally a control variable, it is important to measure the effects of mental health on wellbeing, as such this regression treats it as a variable of interest.

Nutritious diet

This indicator captures the value associated with an individual having access to an adequate and nutritious diet, using measures of food insecurity.

The key variable of interest uses two survey questions from USoc, where respondents must answer the following questions:

(During the last 12 months was there a time when you or others in your household...) Were unable to eat healthy and nutritious food because of a lack of money or other resources?

1. Yes
2. No

(During the last 12 months was there a time when you or others in your household...) Were hungry but did not eat because there was not enough money or other resources for food?

1. Yes
2. No

Alternative specifications are tested using measures of being unable to eat healthy and nutritious food and of food insufficiency separately. The final regression includes both measures jointly alongside the standard USoc control set. This allows the association with being unable to afford healthy and nutritious food to be estimated while accounting for the related experience of food insufficiency.

Moderate and vigorous sport

This indicator captures the value of an individual participating in moderate and vigorous sport.

The key variables of interest are two binary variables capturing whether an individual participates in moderate sport and whether an individual participates in vigorous sport, using data from USoc. Each variable was initially tested separately; however, the final specification adopted includes both variables together as covariates. This ensures that any subjective wellbeing value attributable to participation in moderate sport is not misattributed to participation in vigorous sport, and vice versa.

Obesity

This indicator captures the value of an individual not being obese.

The key variable of interest uses a survey question in USoc, where respondents are asked to indicate which, if any, health conditions they have from a list. Obesity is captured as one of the response options within this question:

Health condition: Very overweight (a BMI of 40 or above)

Low sample size meant the regression did not produce robust results. Therefore, this regression was not carried forward into further analysis.

Smoking

This indicator captures the value of an individual no longer smoking, as measured by the number of cigarettes smoked.

The key variable of interest uses a survey question from USoc, asked only of respondents who smoke cigarettes, where respondents must answer the following question:

Approximately how many cigarettes a day do you usually smoke, including those you roll yourself?

The regression incorporates the log of the number of cigarettes smoked, with an interaction term included between smoker status and mental health (SF-12). This interaction allows the relationship between smoking and life satisfaction to vary according to an individual's mental health. As the variable of interest is a log-transformed continuous variable, the model is estimated with an intercept term. The log transformation accounts for diminishing marginal effects, such that a given change in the number of cigarettes smoked has a proportionally larger impact on subjective wellbeing for lighter smokers than for heavier smokers. This outcome is estimated using a single specification.

Long-term health condition

This indicator captures the value of an individual not having a long-term health problem or disability.

The key variable of interest uses a survey question from APS, where respondents must answer the following question:

Any other past health problems or disabilities that have lasted longer than a year?

1. Yes
2. No

Low sample size meant the regression did not produce robust results, and was therefore not carried forward into further analysis.

Social connectivity

Lives with partner

This indicator captures the value associated with an individual living with a partner. The key variable of interest is a binary measure identifying whether the respondent lives with a partner, using data from USoc, where respondents are provided two answer options:

3. Yes
4. No

Caring hours

This indicator captures the number of hours per week an individual spends providing unpaid care or help to others, whether living with them or not, and uses a survey question from USoc, asked only of respondents who report caring for or helping someone resident or non-resident in their household, where respondents must answer the following question:

Now thinking about everyone who you look after or provide help for, both those living with you and not living with you - in total, how many hours do you spend each week looking after or helping them?

Responses were grouped into four bands: 0-9 hours, 10-34 hours, 35-99 hours, and 100+ hours per week. Treating caring hours categorically allows the association between caring commitments and life satisfaction to differ across the four bands, rather than imposing a constant effect for every additional hour of care.

Alternative control specifications were tested. The initial model included both retirement status and whether the respondent lived with a partner. Removing retirement status had little effect on the results. Removing living with a partner status made the estimated negative coefficients on caring hours less pronounced, due to collinearity between caring responsibilities and household or partnership circumstances. The final specification therefore excludes both retirement status and living with a partner status.

Active in social groups

This outcome captures the value of an individual participating in organisations, such as social, civic, political, leisure, faith-based, service, or care-related groups.

The key variable of interest uses a survey question from USoc, where respondents must indicate which, if any, of the following organisations they belong to or take part in:

1. Political party
2. Trade union
3. Environmental group
4. Parents'/school association
5. Tenants'/residents' group

6. Religious/church organisation
7. Voluntary services group
8. Pensioners' group/organisation
9. Scouts/Guides organisation
10. Professional organisation
11. Other community group
12. Social/working men's club
13. Sports club
14. WI/Townswomen's Guild
15. Women's group/feminist organisation
16. Other
17. None of these

A less granular specification was also tested, decomposing organisation participation into three categories:

- civic and political
- social/leisure/faith
- Service/care organisations

Neither variation was significant, and neither were therefore not carried forward into the final set of outcomes.

Internet connectivity

This indicator captures the value associated with having an internet connection and uses a survey question from USoc, where respondents must answer the following question:

Does your household have access to the internet from home?

1. Yes
2. No

This indicator serves as a proxy for digital inclusion, as internet access supports participation in employment and education, access to services and information, and social contact.

Safety

The analysis includes both objective crime rates and subjective perceptions because the two do not necessarily move together and capture different dimensions of the relationship between crime and wellbeing. Objective rates measure actual local exposure, the effects of which can extend well beyond direct victims through anxiety, behavioural constraint, and reduced freedom of movement. Subjective perceptions capture how individuals interpret and respond to disorder, a channel that may be shaped by personal characteristics or media coverage, and which policy cannot target as directly as crime rates themselves. Including both therefore allows the analysis to distinguish between the wellbeing effects associated with actual local crime and those associated with perceived disorder.¹¹

¹¹ Dustmann and Fasani (2013): The Effect of Local Area Crime on Mental Health; show that local crime affects wellbeing through channels beyond direct victimisation, including fear and anxiety, behavioural constraints and changes to daily routines. They also highlight that perceptions of crime do not necessarily track actual crime rates and may be amplified by individual characteristics or wider information sources, while reductions in actual crime are more directly amenable to policy intervention.

Objective crime rates

The analysis tests a number of alternative specifications capturing the relationship between local crime and life satisfaction. These include total crime, broader groupings of crime relating to violence and personal safety, property crime and public order or anti-social behaviour, as well as more granular crime categories.

The final specification includes the logged rates of anti-social behaviour, bicycle theft, burglary, criminal damage and arson, drug offences, possession of weapons, public order offences, robbery, shoplifting, theft from the person, vehicle crime, violence and sexual offences, and unknown crime simultaneously. Urban-rural classification is also included in the regression. The model uses the standard individual and household controls for physical and mental health, household income, age, sex, retirement status and whether the individual lives with a partner, but excludes the geographic subgroup control.

Estimating the individual crime categories jointly means each crime coefficient estimates the association between that specific category of crime and life satisfaction, holding constant the other crime categories, urban-rural classification and the individual and household characteristics included in the model. The use of logged crime rates allows the coefficients to capture the association with proportional, rather than absolute, differences in local crime rates.

Subjective crime perceptions

The analysis considers eight distinct measures of perceived local crime and anti-social behaviour. Rather than combining these into a single composite measure of perceived crime, each is included within the same regression specification. The final specification therefore includes all eight perception variables simultaneously, alongside the standard control set.

Each coefficient captures the association between the perceived severity of that particular issue and life satisfaction, holding constant perceptions of the other seven issues and the individual and household characteristics included in the model. Although the coefficients are estimated jointly, each perception variable is retained as a separate driver in the subsequent analysis, allowing the wellbeing impact of changes in each specific type of perceived crime or anti-social behaviour to be assessed independently.

The analysis uses eight survey questions from the Crime Survey for England and Wales (CSEW), where respondents must answer the following questions:

How much of a problem are noisy neighbours or loud parties?

1. Very big problem
2. Fairly big problem
3. Not a very big problem
4. Not a problem at all

How much of a problem are teenagers hanging around?

1. Very big problem
2. Fairly big problem
3. Not a very big problem
4. Not a problem at all

How much of a problem is rubbish or litter?

1. Very big problem
2. Fairly big problem
3. Not a very big problem
4. Not a problem at all

How much of a problem is vandalism, graffiti etc.?

1. Very big problem
2. Fairly big problem
3. Not a very big problem
4. Not a problem at all

How much of a problem are people using or dealing drugs?

1. Very big problem
2. Fairly big problem
3. Not a very big problem
4. Not a problem at all

How much of a problem are people being drunk or rowdy?

1. Very big problem
2. Fairly big problem
3. Not a very big problem
4. Not a problem at all

How much of a problem are abandoned or burnt out cars?

1. Very big problem
2. Fairly big problem
3. Not a very big problem
4. Not a problem at all

How much of a problem is anti-social behaviour in your local area?

1. Very big problem
2. Fairly big problem
3. Not a very big problem
4. Not a problem at all

The final specification includes all eight perception variables simultaneously as covariates, alongside the standard control set. Estimating the variables jointly means that each coefficient captures the association between the perceived severity of that specific type of crime and life satisfaction, holding constant the perceived severity of the other seven types and the individual and household characteristics included in the model. This approach avoids attributing the subjective wellbeing effect of one form of perceived disorder to another where the two are correlated in practice.

Environment & Green Space

Outdoor space at home

This indicator captures the value of an individual having access to a private outdoor space at their home, such as a garden.

The key variable of interest uses a survey question from USoc, where respondents must answer the following question:

Does your current accommodation have outdoor space that you can use?

1. Private garden
2. Shared garden
3. Balcony
4. Rooftop garden or terrace
5. No garden or outdoor space
6. Other outdoor space

Frequency of green space visits

This indicator captures the value associated with the frequency with which an individual visited green spaces over the past 14 days.

The key variable of interest uses a survey question from PaNS, where respondents must answer the following question:

How many times, if at all, did you make this type of visit to green and natural spaces in the last 14 days?

The variable of interest is specified as a log-transformed continuous variable, enabling diminishing marginal effects to be accounted for. This refers to a given increase in the number of visits having a proportionally larger impact on subjective wellbeing for those visiting less frequently than for those already visiting often.

Improvement in the quality of local green space (over the last 5 years)

This indicator captures the value associated with a perceived improvement in the quality of local green spaces over the last 5 years.

The key variable of interest uses a survey question from PaNS, where respondents must answer the following question:

Thinking of the green and natural spaces close to where you live, have they improved or reduced in the last 5 years, or have they not changed? The quality has...

1. Improved a lot in the last 5 years
2. Improved a little in the last 5 years
3. Reduced a little in the last 5 years
4. Reduced a lot in the last 5 years
5. Not changed

Walk time to nearest green space

This indicator captures the value associated with the time taken to walk to an individual's nearest green space, with the default reference category being 5 minutes or less.

The key variable of interest uses a survey question from PaNS, where respondents must answer the following question:

How long does it take you to walk to your nearest local green and natural space?

1. 5 minutes or less
2. Between 6 minutes and 15 minutes
3. Between 16 minutes and 30 minutes
4. Between 31 minutes and 45 minutes
5. More than 45 minutes
6. I never walk to my nearest local green space

The regression was tested as part of the analysis but was not carried forward into the final set of modelled indicators because the result was not statistically significant.

Duration of visit

This indicator captures the value associated with the total duration of an individual's most recent visit to a green or natural space, including the time spent travelling to and from the location.

The key variable of interest uses a survey question from PaNS, where respondents must answer the following question:

How long did this visit last altogether? This includes the journey: it is from the time you left home, or wherever you started from, to when you returned.

1. Up to 30 minutes
2. Over 30 minutes and up to an hour
3. Over 1 hour and up to 2 hours
4. Over 2 hours and up to 3 hours
5. Over 3 hours and up to 5 hours
6. Over 5 hours

This indicator serves as a proxy for the intensity of an individual's engagement with the natural environment, as longer visits may provide greater opportunities for physical activity, social interaction and psychological restoration. However, the regression analysis did not identify a statistically significant relationship between visit duration and subjective wellbeing after controlling for relevant individual and household characteristics. There is therefore insufficient evidence from the analysis to conclude that the duration of a visit has an independent effect on wellbeing, and this outcome has not been taken forward for valuation.

Pollution

This indicator captures the association between local air pollution and individual life satisfaction using LSOA-level measures of pollutant concentrations.

A standalone specification using PM2.5 was initially tested. The final regression estimated, however, includes PM2.5 jointly with PM10, benzene, ozone, sulphur dioxide, nitrogen dioxide and other nitrogen oxides, alongside the standard USoc control set. Of the pollutants included in this joint specification, only PM2.5 was statistically significant.

The PM2.5 coefficient carried forward into the results is therefore estimated conditional on the other pollution measures included in this joint specification. It should consequently be interpreted as the association between PM2.5 and life satisfaction holding the other measured pollutants constant.

3.3 Scale the coefficients where required

As the subjective wellbeing valuation coefficients are derived from datasets that use different life satisfaction scales, the estimated coefficients must be standardised to ensure they are comparable. Understanding Society (USoc) measures life satisfaction on a 1-7 scale, whereas the People and Nature Survey (PaNS), the Annual Population Survey (APS), and the Crime Survey for England and Wales (CSEW) use a 0-10 scale.

Objective crime data published by Police UK and air pollution measures sourced from the MAAQ are estimated within the USoc regression framework, using the same life satisfaction outcome and standard control set as the other USoc indicators. Although the underlying indicator data are drawn from external sources, the resulting subjective wellbeing coefficients are therefore estimated on the 1-7 life satisfaction scale and therefore scaled in the same way as USoc data.

Standardising the coefficients is consistent with HMT Green Book Wellbeing Guidance. The guidance primarily expresses life satisfaction effects on a 0-10 scale and demonstrates how a coefficient estimated on a 1-7 scale can be converted by multiplying it by 11/7. Therefore, all coefficients produced using USoc data are scaled in this analysis.

This adjustment places the coefficients on a common response scale, making it easier to compare the estimated wellbeing effects and associated monetary valuations across datasets. As with any rescaling, it assumes that the relationship between the two scales is broadly proportional. Differences in question wording, response labels, survey design, sample composition and model specification may still influence the results. Nevertheless, the adjustment provides a clear and practical basis for improving comparability across the datasets and is consistent with HMT Green Book guidance.

3.4 Monetise the coefficients

To estimate the monetary value of the model's variable of interest on individuals, we apply the wellbeing valuation method, as set out in HMT Green Book and Supplementary Guidance on Wellbeing. The approach enables non-market effects to be expressed in monetary terms through identifying the equivalent income change associated with the subjective wellbeing impact of the explanatory variable. The estimated relationships between wellbeing, income and each explanatory variable are used to derive the income equivalent of a marginal change in the variable. This provides a monetary valuation expressed as the marginal rate of substitution (MRS) between income and the variable of interest.

There are two well-established ways of measuring the monetary equivalent of an outcome, and the choice between them shapes how the calculation itself is framed.

The first is Equivalent Surplus (ES). This represents the willingness to pay (WTP) to avoid the negative impact of the variable of interest. This is calculated as the amount of income that would need to be taken away from an individual who does not experience the adverse outcomes to reduce their subjective wellbeing to the same level as if they had experienced the change in the variable.

The relationship can be expressed as follows:

$$u(q^1, X, y) = u(q^0, X, y + ES)$$

Where:

- q = quantity or quality of non-market good (variable of interest)
- y = income
- X = other factors that affect utility besides income and the variable of interest
- ES = Equivalent Surplus

However, ES takes the no-change state as the reference point, valuing the outcome relative to an individual who has not experienced the adverse change rather than relative to the position of those actually affected.

The second method is Compensating Surplus (CS). Unlike ES, which considers the amount of income an unaffected individual would be willing to forgo to avoid an adverse outcome, CS considers the compensation required for an individual who experiences that outcome. It represents the willingness to accept (WTA) the negative impacts of the variable of interest and is calculated as the amount of income that would need to be provided to the affected individual to restore their subjective wellbeing to the level they would have achieved in the absence of the outcome.

The relationship can be expressed as follows:

$$u(q^0, X, y) = u(q^1, X, y - CS)$$

Where:

- q = quantity or quality of non-market good (variable of interest)
- y = income
- X = other factors that affect utility besides income and the variable of interest
- CS = Compensating Surplus

CS was selected as the method for monetisation, given that the analysis uses survey data that captures individuals' reported subjective wellbeing alongside their observed experience of the variable of interest. The valuation is therefore framed from the perspective of those who experience the outcome, rather than from the perspective of unaffected individuals considering how much they would pay to avoid it. CS takes the individual's initial welfare position as the reference point and estimates the income adjustment required following an adverse change to restore that initial level of subjective wellbeing. This is consistent with the assumption that individuals have an entitlement to the status quo and that adverse changes should be valued according to the compensation required in the post-change position. The resulting measure therefore captures the monetary compensation required to offset the estimated subjective wellbeing loss identified in the survey data.

After establishing CS as the appropriate welfare measure, the analysis calculates the monetary valuation using the estimated coefficients from the subjective wellbeing regression. Specifically, the wellbeing effect of the variable of interest is compared with the wellbeing effect of income to estimate the level of compensation required to offset a change in wellbeing. Where income is specified in logarithmic form, the CS for a change in the variable of interest is calculated as:

$$CS = M^0 - e^{[\ln(M^0) - \frac{g'Q}{f'M}]}$$

Where:

- M^0 = reference household income (median UK household income)
- Q = magnitude of the change in the variable of interest
- $g'Q$ = estimated change in wellbeing associated with the change in the variable
- $f'M$ = marginal utility of log income, assumed to be 1.1 in line with the HMT Green Book Wellbeing Guidance

The median UK household income is used as the reference income when calculating CS. The median was selected in preference to the mean because household income is typically positively skewed, with a relatively small number of high-income households increasing the average. As a result, the median provides a more representative measure of the income of a typical household and is less sensitive to extreme values.

The estimated CS values represent the annual monetary value associated with a one-unit change in each variable of interest for an individual.

Only coefficients that are statistically significant are carried forward into the monetisation stage, as outlined in Section 6.2. This approach ensures that the monetary valuations are based on estimated relationships for which there is sufficient statistical evidence of an association with subjective wellbeing.

3.5 Calculate regional and local authority values

To estimate local impacts, the nationally estimated coefficients are applied to LA-level and regional mean prevalence values for each indicator, and the resulting area-level social value is then benchmarked against the corresponding UK mean. The SVS therefore represents the relative subjective wellbeing position of each area, expressed as a deviation from the national average, rather than an absolute total of individual factor contributions. Decomposing the SVS into its constituent factor valuations allows users to identify the determinants that are most influential within a given area. This supports locally informed interpretation of the national estimates and enables consistent comparisons across LAs and regions.

4. Economic Value Score

The second component of the Public Value Score is the Economic Value Score (EVS), which is derived from Net Equivalised Disposable Household Income (NEDHI). Area-level NEDHI estimates form the basis of the EVS, providing a consistent measure of the extent to which local economic activity translates into household spending power. NEDHI captures the financial resources available to households after accounting for taxes, government transfers, housing costs and household composition. It therefore provides a more direct measure of residents' material living standards, or spending power, than gross earnings or economic output alone.

NEDHI comprises three components:

- **Net income:** Total net household income is derived from gross household income by deducting taxes and adding government transfers, capturing what households receive rather than gross earnings alone.
- **Minus housing costs:** Housing costs are deducted to approximate disposable income net of what is, for most households, the largest fixed expenditure. This ensures the measure captures what households have available to spend, not simply what they earn.
- **Equivalised:** The resulting figure is divided by a factor that adjusts for household size and composition using the modified Organisation for Economic Co-operation and Development (OECD) equivalence scale, assigning a weight of 1.0 to the first adult, 0.5 to each additional adult, and 0.3 to each child.¹²

The formal definition of NEDHI is set out in the equations below:

$$NEHDI_h = \frac{Net\ Household\ Income_h - Housing\ Costs_h}{1 + 0.5(Number\ of\ Adults_h - 1) + 0.3(Number\ of\ Children_h)}$$

Where:

$$Net\ Household\ Income_h = (Gross\ Income_h - Direct\ Tax_h + Transfer\ Payments_h)$$

- h - denotes household h

This produces a comparable measure of household spending power across households of different sizes and compositions.

¹² The UK uses two main equivalence scales for household income. The Modified OECD scale, which assigns weights of 1.0 to the first adult, 0.5 to additional adults and 0.3 to children, is used in this analysis. An alternative, the Companion scale, is designed for after-housing-cost income and applies weights of 1.0, 0.72 and 0.34 respectively. The Modified OECD scale was selected over the Companion scale because the housing cost adjustment used in this analysis captures only rent payments and the interest component of mortgage payments. Given this is narrower than the housing cost measure underpinning the Companion scale, adjusted household income in this analysis remains more closely aligned with the Modified OECD approach.

5. Public Value Score

The Economic Value Score and Social Value Score form the two foundational components of the framework, capturing economic outcomes and social and environmental outcomes, respectively. This section sets out how these two components are combined into a single composite measure, the Public Value Score (PVS).

The HMT Green Book requires that appraisal considers economic, social and environmental outcomes together, rather than in isolation. The PVS meets this requirement by combining the monetary value of the EVS and the SVS into a single figure:

$$\text{Public Value Score (£)} = \text{Economic Value Score (£)} + \text{Social Value Score (£)}$$

Where:

- **Economic Value Score:** The monetary value of household economic outcomes (Net Equivalised Disposable Household Income), capturing what households actually have available to live on after tax, transfers and housing costs (see Section 4).
- **Social Value Score:** The monetary value of social and environmental outcomes, derived by monetising the wellbeing gap between the local authority and the UK average (mean) (see Section 3).

This produces a single monetary figure for each local authority (LA) that captures both the economic and non-economic dimensions of how growth is experienced by citizens in that area.

The analysis calculates the PVS at the LA level because that level balances geographic detail, statistical robustness, and policy relevance. Regional and national averages can conceal important differences between places, while more granular geographies such as LSOAs are often too detailed for consistent analysis across all indicators. At LSOA level, sample sizes may be small, data availability uneven and estimates more sensitive to sampling variation.

LAs also align more closely with the level at which many relevant policy, investment and service-delivery decisions are made. Calculating the PVS at this level therefore supports meaningful benchmarking while ensuring that the results remain sufficiently robust and actionable.

For the purposes of the PBIM, the PVS supports two forms of analysis:

1. **Benchmarking of individual determinants.** For each contributing component of the PVS, the LA mean can be compared against the national or regional mean, identifying specific dimensions where the area over- or under-performs relative to comparable geographies.
2. **Identification of high-impact determinants.** Applying the monetised coefficients from the wellbeing valuation model to LA averages highlights the relative contribution of each factor to the overall score, supporting the identification of priority intervention areas.

Finally, because the PVS can be constructed consistently over time, it also supports longitudinal tracking, showing whether good growth is improving or weakening in a given LA.

6. Technical Validation

As with any econometric framework based on observational survey and administrative data, the analysis is subject to methodological limitations. These limitations do not invalidate the results, but they affect how the estimated relationships and area-level scores should be interpreted. The framework uses careful variable selection, control variables, sensitivity testing, data harmonisation, external benchmarking and statistical significance testing to manage these risks. However, no single analytical approach can eliminate all sources of uncertainty.

6.1 Limitations and mitigations

Causality: The framework estimates statistically robust relationships between determinant variables and outcomes, and while these should not be interpreted as fully causal in all cases, the analysis has been designed to move as close as possible towards causal inference.

The inclusion of a broad set of control variables across each dataset isolates the relationships of interest from other possible influential characteristics. Additionally, robustness testing, including sensitivity to alternative specifications and lag structures, provides assurance that estimated relationships are stable. Results are further benchmarked against established academic and policy literature to confirm that estimated coefficients fall within a plausible range.

A vector of ONS pen portrait dummies is used to capture unobserved heterogeneity in sociodemographic factors that have potential to be correlated with both wellbeing and the variable of interest. These pen portraits, outlined in Section 3.2.1, are designed by ONS to group areas with similar demographic, socioeconomic and built-environment characteristics into a consistent classification. Whilst we do not have a hierarchical data structure, these in effect function as ‘quasi’ fixed effects in that they vary the constant term grouped by socioeconomic group. Pen portraits vary at LSOA level; pen portrait dummies are preferred to LSOA dummies because (a) they are designed to reliably capture local area characteristics, and (b) within-LSOA sample size is low per time period.

Geographic coverage: Some datasets do not provide consistent coverage across all nations of Great Britain, for example, the People and Nature Survey is available for England only. This does not impact the economic and social value scores. It does, however, impact the driver analysis that sits below the Public Value Score (PVS). Where data is not available, drivers are not included. Due to data inconsistencies, Northern Ireland has been excluded from the main analysis (see Northern Ireland section below).

Local Area Representativeness: The microdata sources used in the analysis are designed to be representative at a national level, and therefore may not be fully representative at local authority level. We have addressed this in three ways:

- Statistical weights are applied, accounting for the differences in sampling probability according to demographic factors.
- In the production of social and economic value scores, observations are pooled across years (the most recent 2.5 years) to increase the effective sample size.
- Furthermore, the model does not present standalone descriptive statistics for each local authority; rather, we conduct a series of t-tests to establish whether each local authority is performing differently from others in terms of each metric. Where this is the case, the overall size of the difference is represented graphically, but we do not present the number to avoid over-interpretation (see Section 6.2 for more information).

Northern Ireland: While it was possible to estimate an overall Social and Economic Value score for Northern Ireland, the decision was taken not to include these numbers in the main rankings due to uncertainty around the extent of comparability with the other numbers produced by this analysis. Whilst the methodology underpinning the Understanding Society (USoc) data used to calculate the overall Economic and Social Value scores is comparable with that in Great Britain, there are differences in the Annual Population Survey (APS) methodology, and the Crime Survey for England and Wales (CSEW) and People and Nature Survey (PaNS) data are not present for Northern Ireland. In Great Britain, APS pools responses from the main ONS LFS with additional booster samples designed to improve the precision of estimates for smaller geographic areas and, in turn, population subgroups within those areas, including by age, sex, ethnicity, disability and education. By contrast, the Northern Ireland Statistics and Research Agency (NISRA) collects a single LFS sample, which has been permanently boosted for inclusion in APS since 2018. Whilst this is helpful in the production of statistics at a national level, because the Northern Ireland booster sample is not structured in the same way as the ONS local-area boosts, additional robustness testing would be required to ensure place-based results for Northern Ireland are sufficiently comparable with Great Britain.

The goal is to further develop the Place-Based Intelligence Model (PBIM) for future iterations of the Good Growth Barometer, such that the drivers of economic and social value in Northern Ireland may be included.

Data consistency over time: Differences in collection frequency and sampling methodologies across datasets may affect consistency and comparability over time, particularly where surveys change their methodology between waves. The framework addresses this through careful variable selection, ensuring that only variables with consistent definitions and sufficient time-series availability are included, and through the standardisation of variable definitions during the data cleaning process. This ensures that the framework remains repeatable and comparable across periods.

External validity: The framework estimates a single set of coefficients for each variable across the whole of the UK. In practice, the effect of a particular indicator may differ between areas due to differences in local context, economic structure, demographics or institutional arrangements. The framework manages this by applying the nationally estimated coefficients to LA averages when constructing area-level scores, meaning that local variation in conditions is still captured even where the estimated relationships are held constant. The decomposition of the PVS also allows users to identify which determinants are most material in their area, supporting locally informed interpretation of the national estimates.

Self-reported data: A large proportion of variables rely on self-reported measures, which may be influenced by individual perception, temporary mood or response bias rather than reflecting objective conditions. In many cases, this is a deliberate strength of the framework. This is due to subjective measures such as perceived safety, financial stress or neighbourhood quality being included because the framework seeks to capture people's lived experience, not only objective conditions. Where self-reported data could introduce bias, the framework combines objective indicators, such as spatial data and recorded crime rates, alongside subjective indicators, allowing the model to capture both actual conditions and how those conditions are experienced by individuals.

Sample size: Some variables or geographic areas may have smaller sample sizes, which could reduce the precision of estimated coefficients at finer geographic levels. The framework mitigates this by drawing on large-scale nationally representative surveys, such as the APS with approximately 175,000 respondents per year and USoc with approximately 30,000 households, and by applying statistical significance testing (t-tests) at the LA level to ensure that only meaningful differences are reported.

Double counting: Where variables capture overlapping dimensions of the same underlying concept, there is a risk of double counting within the model. The variable selection process is designed to minimise this risk by assessing conceptual overlap as part of the structured Red Amber Green (RAG) rating framework, excluding variables where substantial duplication with stronger indicators already included was identified.

Survey non-response bias: Non-response in household surveys may be systematically related to the outcomes of interest, for example, individuals with very low wellbeing or high levels of deprivation may be less likely to participate in voluntary surveys. This could lead to estimated relationships that do not fully reflect the experiences of the most disadvantaged groups. The framework draws on nationally representative survey datasets with established sampling designs and weighting methodologies, including USoc, the APS and the CSEW, which are designed to account for differential non-response and support the production of population-representative estimates.

Reverse causality: For some relationships estimated within the framework, the direction of causation may run in both directions. For example, smoking may decrease life satisfaction, but individuals with lower life satisfaction may also be more likely to smoke. While reverse causality cannot be fully ruled out in observational data, to mitigate this risk, the analysis controls for a comprehensive set of demographic, socioeconomic and health characteristics, helping to isolate the relationship between the variable of interest and subjective wellbeing. It is acknowledged that this could potentially be improved through the use of instrumental variables, however this was not possible in the available timeframe.

Lag structure assumptions (economic model): The appropriate lag length is subject to uncertainty, as the transmission of local economic growth to household outcomes may vary across areas and over time. Bell et al (2022) and Key and Lenney (2024) suggest that GDP growth affects household incomes and house prices with an approximate one-year lag, while changes in incomes and house prices may influence one another with a further lag of around one year. More generally, the effects of economic growth can take several years to fully materialise. To mitigate the risk of mis-specifying these transmission dynamics, the model incorporates lagged GDP effects informed by the empirical evidence and economic theory.

Subjectivity of the dependent variable (social and environmental model): Life satisfaction is inherently subjective and may be influenced by factors such as temporary mood, personality traits, cultural norms or recent life events that are not captured by the model. However, life satisfaction is widely used within wellbeing valuation literature as the closest available proxy for individual utility or overall welfare, and its use as the core outcome variable is consistent with established wellbeing economics literature and HMT wellbeing guidance. The large sample sizes drawn from nationally representative surveys help to average out individual-level noise, meaning that systematic patterns in the data are reliably identified.

Robustness checks: The PBIM examines a broad range of relationships between local conditions and citizen outcomes, many of which are novel and have not previously been estimated within a single integrated model of this kind.

Robustness testing has therefore been carried out in two parts. First, testing of the direction of relationships has been undertaken alongside each corresponding indicator, with the detail set out alongside the relevant indicator in Section 3.2.3. Second, to provide assurance that the model specifications are sensible and to build confidence in the broader modelling approach, a subset of more established relationships has been benchmarked against findings from the existing academic and policy literature.

This included benchmarking the estimated wellbeing effect of unemployment against HMT supplementary Green Book guidance, which reports that unemployment is associated with around 0.46 reduction in life satisfaction on a ten-point scale, independently of income effects.¹³ The consistency in direction and broad magnitude provides an external sense-check on the specification and supports confidence in the wider modelling, while retaining the distinct and proprietary nature of the PBIM.

While no observational framework can fully eliminate these constraints, the combination of careful variable selection, control specification, robustness testing and benchmarking means the framework is well placed to produce reliable and policy-relevant findings on the drivers of good growth.

¹³ HM Treasury (2021), *Wellbeing Guidance for Appraisal: Supplementary Green Book Guidance*, pp. 62-64

Social and cultural participation data: The framework does not currently incorporate measures of participation in arts, culture, and other social activities, which represent important dimensions of good growth and citizen wellbeing. The DCMS Participation Survey collects robust, nationally representative data on these outcomes and would materially strengthen the Public Value Score if incorporated. However, the current licensing conditions governing access to the Participation Survey restrict its use to educational purposes, which precludes its inclusion within this analytical framework at present. This represents a notable gap in coverage, particularly given the policy relevance of cultural and social participation to place-based outcomes. We recommend that DCMS consider extending access to the Participation Survey for use in non-educational analysis, in order to maximise the value of this significant data collection investment and enable a more comprehensive assessment of good growth across local areas.

6.2 Statistical significance of area-level differences

A core function of the Place-Based Intelligence Model (PBIM) is enabling each local authority (LA) to benchmark its performance against regional and national averages. However, observed differences between area means may reflect sampling variation rather than genuine differences in underlying conditions, particularly where sample sizes are small or variable distributions are wide. It is therefore necessary to establish whether observed differences are statistically meaningful before drawing policy conclusions from them.

To assess whether the observed differences are statistically meaningful, t-tests are conducted for each LA. For each contributing variable, and for the composite Public Value Score (PVS), the test assesses whether the LA mean is statistically significantly different from the corresponding UK mean.

The null hypothesis is that the LA mean is equal to the UK mean, meaning that any observed difference is attributable to sampling variation. The alternative hypothesis is that the LA mean differs from the UK mean.

Where the null hypothesis is rejected at the 5% significance level, the LA is reported as performing statistically significantly above or below the UK mean, according to the direction of the observed difference. Where the null hypothesis is not rejected, the LA mean is reported as not statistically distinguishable from the UK mean. This does not demonstrate that the LA and UK means are identical; rather, it indicates that there is insufficient statistical evidence to conclude that they differ.

The significance tests therefore provide an additional layer of interpretation alongside the estimated differences. They help distinguish potentially meaningful local variation from differences that may reflect uncertainty in the underlying estimates and reduce the risk of drawing policy conclusions from small or imprecisely estimated gaps.

7. Additional econometric modelling for the Good Growth Barometer: Estimating the relationship between economic output and NEDHI

Using NEDHI, we estimated the extent to which GDP growth translates into household spending power over time. The analysis incorporated established transmission lags and differences in how economic growth affects households across the income distribution.

To model these dynamics, we adapted and extended existing academic approaches linking GDP growth to household earnings. The methodology drew on published academic research, which provided an established framework for estimating the relationship between percentage changes in GDP and percentage changes in household earnings. In particular, empirical evidence from the UK shows a 1% increase in GDP translates into a 0.38% increase in real weekly earnings over a five-quarter time horizon.¹⁴

$$\Delta \log(\text{weekly earning}_i) = \alpha + \beta \Delta \log(\text{GDP})$$

We successfully replicated this result when using real weekly earnings as our variable of interest. This gave us confidence that the model was correctly specified and could be robustly extended to analyse the relationship between GDP growth and NEDHI.

The econometric model estimates how changes in levels of economic output are associated with NEDHI:

$$\Delta \log(\text{NEDHI}_h) = \alpha + \beta \Delta \log(\text{GVA})$$

Where:

$\Delta \log \text{NEDHI}_i$ – Represents the log change in Net Equivalised Disposable Household Income for individuals i at time t . This is the dependent variable within the model and captures household living standards after accounting for taxes, transfers, and adjusting for household size and composition.

α – Represents the constant.

β – Represents the linear relationship between economic growth and NEDHI outcomes. This allows the model to estimate how changes in economic activity translate into changes in household living standards over time.

$\beta \Delta \log(\text{GVA})$ – Represents the log change in UK Gross Value Added (GVA) between the period of the interview and one year prior to the interview. These lagged terms capture how economic growth influences household incomes.

i – Denotes individuals.

h – Denotes households.

Logarithmic transformations are applied to both NEDHI and GVA/GDP to improve model reliability and interpretability. The rationale for this is threefold:

1. **Enabling interpretation as elasticities:** With both the dependent and independent variables in logarithmic form, the model coefficients estimate how percentage changes in GVA are associated with percentage changes in NEDHI. This makes results directly comparable across areas and population groups with different absolute income and output levels.

¹⁴ Bell, B., Bloom, N. and Blundell, J. (2022), Income dynamics in the United Kingdom and the impact of the Covid-19 recession. Quantitative Economics, 13: 1849-1878. <https://doi.org/10.3982/QE1872>

2. **Reducing the influence of extreme values:** Income and economic output data are often unevenly distributed, with a small number of households or regions recording much higher values than the majority. Logging compresses the upper tail of the distribution, ensuring that results are not overly driven by a small number of high-income or high-growth observations.
3. **Capturing non-linear relationships:** The relationship between economic growth and household income is unlikely to be perfectly linear. A £1,000 increase in income has a different marginal effect on a lower-income household compared with a higher-income household. Logging the variables allows the model to reflect these diminishing marginal effects more realistically.

Through this specification, the estimated relationship between GDP growth and household living standards weakened noticeably. Using gross incomes, the academic evidence suggests that a one percent increase in GDP is associated with a roughly 0.4 percent increase in household income. When we substitute in incomes for NEDHI, this coefficient fell to approximately 0.3.

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