HM Treasury

SITF Social Impacts Task Force

Wellbeing discussion paper: monetisation of life satisfaction effect sizes

A review of approaches and proposed approach

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Written by: Sara MacLennan (Department for Environment, Food and Rural Affairs) and Iven Stead (in previous capacity as economist within Department for Transport), with editorial input from Amanda Rowlatt (Department for Transport Chief Analyst and Chair of the Social Impacts Task Force).

A number of academics and practitioners have provided significant input and advice through a number of workshops from 2018-2021 and written review. This includes: Paul Frijters, London School of Economics Centre for Economic Performance; Andrew Oswald, Warwick University; Daniel Fujiwara, London School of Economics; Carol Graham, Brookings University; Kelsey O'Connor, STATEC Research and IZA; John Henderson, health economist, former Department for Health and Social Care; Jan DeNeve, University of Oxford; Paul Dolan, London School of Economics; Gus O'Donnell; Catherine Connolly, Economicsense; Will Watt, State of Life; Nancy Hey, What Works Centre for Wellbeing; *members of Defra's Economic Advisory Panel*: Rob Fraser; Susan Chilton; Brian J Revell; Bhaskar Vira; Ian Hodge; Lucy O'Shea; David Harvey; Tim Lloyd; Steve McCorriston and Jacopo Torriti; *members of the Government Economics Service*: Michael Zand (HSE), Phil Ball (DCMS), Allan Little (DfE), Kenneth Low (HO), Craig Lindsay (DWP), Omar Idriss (HMT-DHSC), Joseph Lowe (HMT).

This guidance is however a technical review document and should not be considered a reflection of any contributor's views in full.

Executive summary

This paper is based on the expertise and input from a range of experts in social cost benefit analysis, non-market valuation and wellbeing economics. Input has been gathered from the Treasury - What Works Centre for Wellbeing roundtable in June 2018[1], peer review of the What Works Centre for Wellbeing Economics-Wellbeing Publications 2018-2020[2], the DEFRA Economics Advisory Panel Meeting in November 2020[3], and the academic and government economics review of the Wellbeing Green Book supplementary guidance[4]. Experts who have inputted their comments include those with a range of academia and practical expertise, from those within and beyond the wellbeing economics specialism.

Overview

There are many different approaches which have been proposed for incorporating robust life satisfaction impacts into the economic analysis used to inform policy decision-making. This paper sets out the range of approaches considered, alongside the pros and cons which have been raised through academic review.

The preferred approach seeks to incorporate **robust, causal estimates of wellbeing**[5] within the existing structures of social cost benefit analysis (SCBA) – i.e. translating wellbeing impacts into equivalent monetary values, which can be incorporated directly into SCBA.

An approach is sought to monetising these causal estimates which:

i. can achieve **approximate consistency with existing government values** that are accepted and used (e.g, the Value of a Statistical Life Year (SLY) and the value of a Quality Adjusted Life Year (QALY))
ii. fits within the **existing theoretical framework of values used within SCBA**
iii. can be **practically applied** and is easy to adopt
iv. is consistent with **evidence on the link between wellbeing and income**
v. is **robust and based on published papers**
vi. does not lead to any **unintended consequences** or disadvantage for certain groups

These are the key criteria against which the options have been assessed.

Based on the discussion and expert reviews which have informed this paper, on balance, the recommended approach is to use a linear conversion from wellbeing to money, using a range of values rather than a single point estimate. The lower bound of this range is set to be as consistent as possible with the existing Green Book recommended QALY value, while the upper bound is based on direct academic evidence on the estimated willingness to pay for changes in life satisfaction. **The resulting central value is £13,000 per one-point change in life satisfaction per year on a 0-10 scale (i.e. per 'WELLBY'), with a low-high range of £10,000 to £16,000 (all**

[1] With contributions and discussions from Academics: Richard Layard, Andrew Oswald, Paul Dolan, Paul Frijters, George McKerron, Christian Krekel; Daniel Fujiwara; Members of GES: Michael Zand (HSE), Phil Ball (DCMS), Iven Stead (DfT), Sara MacLennan (WWCW), Alastair Johnson (DEFRA), Allan Little (DfE), John Henderson (DHSC), Kenneth Low (HO), Craig Lindsay (DWP), Omar Idriss (HMT-DHSC), Joseph Lowe (HMT); Social Impacts Task Force and the What Works Centre for Wellbeing: Amanda Rowlatt (Chair, DfT), Nancy Hey

[2] Including regular and special meetings of the Social Impacts Task Force during the drafting and finalisation of the What Works Centre for Wellbeing publications on wellbeing economics (2019-2020)

[3] EAP Members: Academic experts in Government Economics and non-monetary valuation: Rob Fraser (Chairman); Susan Chilton; Brian J Revell; Bhaskar Vira; Ian Hodge; Lucy O'Shea; David Harvey; Tim Lloyd; Steve McCorriston and Jacopo Torriti

[4] September and December 2020 draft. Including review from Carol Graham; Jan DeNeve; Gus O'Donnell; John Henderson; Kelsey O'Connor; Paul Dolan; Will Watt; Daniel Fujiwara; Government Economic Service members across government

[5] i.e. this does not include simply regression analysis: see Annex 3 below

in 2019 prices). This paper describes the background and the steps leading to this point. This recommended approach will be published as part of the wellbeing guidance in July 2021.

Background and context

This paper – and the focus on ***monetising subjective wellbeing effect sizes*** *- is one aspect of incorporating wellbeing in advice for policymaking. The fuller description of where wellbeing is relevant at the research stage, for the strategic case and long listing stage is described in the Wellbeing Green Book supplementary guidance. In addition, at the appraisal stage, wellbeing impacts may be important non-monetised impacts. "Wellbeing impacts", in their broadest sense, are already monetised using a range of existing monetisation approaches, including stated and revealed preferences. This paper focuses only on the smaller and specific question of the approach and value to take for* ***monetising subjective wellbeing effect sizes****, where these effect sizes are robust and causal in nature.*

Wellbeing, in its broadest sense, is already at the core of Social Cost Benefit Analysis.[6] Many 'wellbeing impacts' are already sufficiently and robustly monetised and incorporated in Social Cost Benefit Analysis[7]: there are a number of existing methods available for monetising or valuing impacts to welfare, including stated preference methods and revealed preference methods.[8]

However, there are relevant policy states and changes for which there is an absence of monetised values, but evidence is clear they are important for wellbeing – such as loneliness, community or social relations, trust, and resilience. Where there are robust, causal estimates of the wellbeing impact, subjective wellbeing evidence can support analysts to incorporate this evidence in SCBA. Subjective wellbeing evidence also provides an alternative method of valuation, which in some cases can be less biased than alternative valuation methods (such as stated preference techniques) which specifically ask people how much they are willing to pay for a certain change: using the subjective wellbeing approach allows us to assess the impact of changes without overly drawing attention to the change.[9]

There are many different approaches which have been proposed for incorporating wellbeing more completely into relevant economic analysis for decision-making – and specifically, incorporating **robust, causal estimates** of **subjective wellbeing[10] impacts**.

Some recent approaches (e.g. Clark *et al.* 2018, DeNeve *et al.*, 2020) propose making wellbeing the "common currency" in the economic analysis which inform policy decisions. Other academics propose that wellbeing cannot be quantified in a common currency, nor monetised - and decisions should be weighed up on a case by case basis. Other approaches (e.g. Clark and Oswald (2002); Dolan *et al.* (2016); Huang *et al.* (2018); Frijters *et al.* (2020)) propose methods

[6] And as such, is already aimed to be incorporated in the economic analysis developed inform policy decisions

[7] As set out in HM Treasury's *Green Book*: "*Social Cost Benefit Analysis (CBA) assesses the impact of different options on social welfare. All relevant costs and benefits are valued in monetary terms, unless it is not proportionate or possible to do so. Social Cost Benefit Analysis (CBA) is the recommended approach for detailed comparison of the short-list of options.*" (Paragraph 5.2 and 5.3, The Green Book 2020, HM Treasury). Social Cost Benefit Analysis seeks to express the full costs and benefits of a project in monetary terms by looking at the impact on people's wellbeing, often referred to as 'welfare'.

[8] See the HMT Green Book for further information. Choosing the most appropriate approach requires understanding of the strengths and weaknesses of different non-market valuation techniques. Table 2 in the Wellbeing Green Book Supplementary Guidance sets out where the different approaches may be more appropriate.

[9] The discussion of where different approaches may be more robust and more appropriate is covered in the wider Wellbeing Supplementary Green Book Guidance.

[10] Note that the ONS uses the term of "personal wellbeing" when describing the quantification and measurement of subjective wellbeing. To ensure clarity – that the focus is on personal, subjective, wellbeing - we use the term subjective wellbeing in this paper. As discussed later in the paper, life satisfaction is the most commonly used, holistic, measure of subjective wellbeing.

to 'translate' robust wellbeing effect sizes into equivalent income – in order to compare other impacts with money as the common currency for social cost benefit analysis.

This paper sets out the range of approaches. For completeness these full range of approaches are covered:[11]

Part A: Approaches which propose new structures for economic decision-making, or shifting the focus from Social Cost Benefit Analysis

- taking a common currency based on Life Satisfaction: using wellbeing Cost Effectiveness Analysis (CEA) across all aspects of government decision making
- no monetisation – relying on non-monetised impacts only
- no monetisation – describing and using a range of wellbeing measures

Part B: Approaches which fit within the existing structure of social cost benefit analysis

The approaches in part B are all similar in their focus on **translating a change in life satisfaction to a robust monetary value which can be used as part of SCBA**, but differ in their proposed form for functional form of the translation – as well as the value used to convert life satisfaction changes into equivalent monetary values.

The guide sets out the proposed approaches for the **value** for the income translation, using either:

- a range of monetised values and different approaches from published studies
- an income coefficient from cross-sectional regression
- an income coefficient which seeks to identify the exogenous impact of income
- willingness-to-pay (WTP) for wellbeing changes from stated preference surveys
- the value of a QALY

Alongside the different approaches for **functional form**:

- linear relationship between income and wellbeing
- applying a log translation to income to account for diminishing marginal utility

These approaches are drawn together into three 'headline' options for comparison:

- I. drawing on existing 'off the shelf' monetised values from published studies
- II. using a log transformation of income and drawing on robust estimates of the causal, exogenous impact of income on wellbeing (the so-called 'Three Stage Approach for Wellbeing Valuation')
- III. assuming a linear relationship between income and wellbeing, based on the existing Green Book QALY value and individuals' WTP for wellbeing changes

A summary of these approaches is in the table in Annex II, with more detail examined within section A and B. The 'headline', combined options have been compared in Table 1 against the criteria for an effective monetisation approach set out above.

[11] However the key focus of this paper is **on approaches which monetise subjective wellbeing impacts**, given the existing framework of the HMT Green Book, where SCBA is generally used to inform decisions

Table 1: Combined, key options, assessed against criteria for preferred monetisation approach

	Consistent with existing government values used in CBA	Fit within the theoretical framework of values in CBA	Practical and easy to adopt / apply	Fits with wellbeing evidence	Based on published papers/robust background	Unintended consequences	Conclusion
Approach I: Using **monetised wellbeing values from published papers**	Depends on study: would need to be considered on a case-by-case basis. Many are from other contexts and are unlikely to be directly comparable with existing appraisal values such as the Green Book QALY value	Depends on study, would need to be considered on a case-by-case basis.	Value from each study would need to be adjusted to fit UK context (i.e. value transfer). There is likely to be some inconsistency.	Depends on study. Approach can be different across studies.	Yes – as default, only published papers would be drawn from. However, the monetisation approach is often in the discussion section of paper and not always clearly explained.	Possible inconsistency across values used for wellbeing changes across different policy changes, driven by different treatment of income which can yield wildly different implied monetary values of wellbeing.	Potential inconsistency in monetary values, both across studies and compared with existing government values (e.g. the QALY value).
Approach II: Using a log transformation of income and a **coefficient representing the exogenous income on wellbeing**[12] (selected values range from **0.35 – 1.96).**	Depends on the value used. Lower coefficients would result in inconsistency and implausibly high monetary values given existing frameworks used in CBA, while higher coefficients yield values more in line with the current Green Book QALY value.	Depends on the study. Figures based on lifecycle model and estimates using large lottery wins *may* not estimate the same concept which underpins WTP used for policy analysis.	Fairly straightforward but requires interpretation and specific calculations for each appraisal to reflect the logarithmic functional form.	Broadly speaking the logarithmic function leads to bigger WTA than WTP values[13] due to diminishing marginal utility of income and the income constraint. However, this approach leads to a greater than linear monetary valuation of larger losses and a smaller than linear monetary valuation of	Depends on the study. A coefficient of 0.35-0.50 for ln(income) is considered most robust estimate of long-run exogenous impact of income on wellbeing.[15] The paper[16] setting out calculation of behind coefficient of 1.7 (on a 0-10 scale) has not been published in a peer	Non- linear monetary value associated with changes in wellbeing, which may not match with government aims nor society's preferences. For example, a decrease in wellbeing of 0.7 for one person would have greater monetary value than a decrease of 0.1 for 7 people.	Potentially more challenging to apply in practice. Approach *could* be applied as sensitivity, where wellbeing effects exceed0.5 (LS

[12] this assumes life satisfaction = a + b ln (Income) +other factors, where the value of the income coefficient (b) is used to monetise life satisfaction changes
[13] losses of the same amount are 'valued' more than gains of the same amount
[15] Lindqvist et al (2020)
[16] See Fujiwara (2013)

Using life satisfaction on a 0-10 scale and ONS median incomes as income in equation	For example, using a log income coefficient of 0.35 would mean a 1-point change in life satisfaction for one year is valued as around £80k, which is higher than the ~£70k for an (entire) 'life year' (2019 prices). Towards the other end of the spectrum, Fujiwara (2020) uses a log income coefficient of 1.7 (for LS on a 0-10 scale), the value calculated from his 2013 paper, arrives at value of a life year of around £58k, broadly consistent with existing values used for QALYs.			larger gains. It is less clear at a social level that we would be valuing decreases in LS as more important than gains.[14]	reviewed journal, only a peer reviewed-book chapter referring to the approach.[17] A new study[18] setting out ln(income) of 1.96 (on a 0-10 scale) is in process of publication.		on a 0-10 scale)
Approach III: Assuming a **linear relationship** between income and wellbeing, **using range between value of a statistical life year and willingness to**	Yes. Pivots off the Green Book QALY standard value which is also used consistently across government, for example by DfT, Defra and DHSC.	Yes, using WTP figures, both from the wellbeing literature and via the QALY value – which is ultimately derived on the WTP-based value of a statistical life.	Yes. No need to understand the "reference point"[20] - same value applied regardless of size or sign of change.	Yes. Frijters and Krekel (2021) draw on existing research to suggest that individual consider the 0-10 scale to have equal 'steps. Behavioural economics evidence that shows that a loss is greater than a	Yes. Frijters and Krekel (2021) and other academics use the concept of a WELLBY and a linear conversion. Values corroborated by figures from Huang *et al.* (2018)	No obvious unintended consequences. Note that under this approach a wellbeing increase for those with lower wellbeing has the same value as a wellbeing	Preferred approach, mainly for enabling consistency, but may be conservative. Values would need to be

[14] Where 'importance' is assessed as the monetary value placed on this given appraisal impact
[17] Although the valuation methodology itself has been used to value non-market goods in peer-reviewed journals. For example, Lawton et al. (2020).
[18] Fujiwara (2021)
[20] i.e. each individuals' starting point of wellbeing and income, prior to the policy intervention

pay for wellbeing change[19]				gain should be incorporated in the *wellbeing effect sizes*, rather than the monetisation of those effect sizes. There is some uncertainty around the minimum and maximum levels on the 0-10 scale used to derive the monetary value from the QALY (discussed below). This approach may be an underestimate compared to wider wellbeing literature:[21]	which looked at the life satisfaction impact of highly noticeable income losses.	increase for those with a higher starting point of wellbeing.	reviewed in light of anticipated future updates to the QALY and SLY values.

[19] In general, WTP (rather than WTA) valuation is appropriate for government interventions – given the appropriateness of a principle of parsimony in attribution of entitlement to government services, a principle that is necessary to allow optimisation of service deployment (see e.g. Franklin (2015))

[21] wellbeing benefits from employment have been shown to more than outweigh the salary benefits. See e.g. Winkelmann and Winkelmann (2003). This approach would give a value of only ~£7k for moving into employment, demonstrating a monetised value much lower than the wage benefits and a potentially underestimated appraisal value compared to published literature.

Part A: Alternative approaches which shift the focus away from social cost benefit analysis

1. Taking a common currency based on Life Satisfaction: using wellbeing Cost Effectiveness Analysis across policy decisions

Summary

- This approach proposes that the positive and negative impacts of all government policies should all be assessed against their net impact on subjective wellbeing – and specifically, the impact on total life satisfaction years (or 'WELLBYs').
- The net impact of each proposal would be compared to the costs of the proposal, to evaluate the impact on wellbeing per pound of expenditure (or '£s per WELLBY' gained).
- There may also be a case to give special weight to those who score lowest on the wellbeing score.
- This would be used to prioritise expenditure on decisions which have the greatest impact on wellbeing.
- The marginally funded policy under this approach would reveal society's 'threshold' value per WELLBY, as the ratio of £s to WELLBYs for that policy. This is conceptually similar to the use of a cost-effectiveness QALY threshold value by NICE.
- Even income changes would be assessed by their impact on wellbeing, with a varying impact relating to who receives the income and how it is spent.

Using wellbeing as a common currency for policy-making has been strongly advocated by Lord Richard Layard, Professor of Economics at LSE (see e.g. Frijters *et al*., 2020; Clark *et al.,* 2018; De Neve *et al*., 2020; Layard 2016) and has been developed as a workable concept by Paul Frijters and Christian Krekel (see Frijters and Krekel, 2021). The use of the term 'WELLBY' was developed by the LSE Centre for Economic Performance (LSE-CEP) with the first published use in Frijters *et al.,* 2020. The concept of wellbeing as a common currency supported by Jan-Emmanuel de Neve, Professor of Economics at Oxford University (see e.g. DeNeve *et al.*, 2020), by Gus O'Donnell, former head of the Civil Service and Cabinet Secretary to three Prime Ministers (ibid. plus e.g. IFS Annual Lecture[22]), among others.

Other academics outside of the wellbeing sphere with expertise in policy analysis and non-market valuation also support the concept that wellbeing should be central to policy advice (and decision-making), without supporting or suggesting this *specific* approach of using wellbeing cost effectiveness analysis with life satisfaction as the 'common currency'.

Discussion and conclusion

This proposal has had much publicity, including in the wake of the policy responses to Covid-19. In some form, the approach could be workable, in a similar manner to how QALYs are used to inform health cost-effective funding decisions. However, there are several challenges:

- incorporating proposals which lack sufficient wellbeing evidence (the authors advocate mass rollouts of wellbeing evaluations)
- allocating a set 'budget' for interventions to improve wellbeing (the approach proposes this would be the whole Government budget)
- most importantly, this proposal of assigning the entire budget depending on wellbeing requires a fundamental change to the process of funding allocation, which is not the aim of this paper – nor the Green Book guidance which this paper informs

[22] *The Covid Tragedy: following the science or the sciences?* https://www.ifs.org.uk/publications/15042

Given that the focus of the Wellbeing Green Book Supplementary Guidance is to **incorporate wellbeing within the existing structures used for UK government appraisal (i.e. the HMT Green Book)**, this approach of allocating the entire budget via wellbeing has been discounted.

However, the principles of assessing wellbeing robustly, consistently and coherently are important principles which are discussed across the proposals below.

In the future, this approach may become an important tool and a consideration in areas of government spending, where there is sufficient wellbeing evidence. The broad approach can already be applied in specific areas of government spending where wellbeing captures all the outcomes affected by a proposal: as set out in the Green Book, Social Cost-Effectiveness Analysis (CEA) is a variant of Social CBA which compares the costs of alternative ways of producing the same or similar outputs. [23]

The approach has important merits **for the purposes incorporating wellbeing in Social Cost Benefit Analysis and monetising wellbeing** and, alternative approaches need to be considered.

2. No monetisation of wellbeing impacts – relying on description of non-monetised impacts

Summary

- This approach proposes that wellbeing impacts cannot credibly be monetised.
- Wellbeing impacts should instead be described, quantified where possible and communicated alongside the costs of policies, to make a decision on the preferred option for policy implementation.

This challenge to monetisation of non-market impacts is not unique to wellbeing and has been raised for several issues, including the monetisation of health and the environment.

Discussion and conclusion

The challenge of meaningful monetisation is already reflected in part in the Green Book and applied by analysts. Non-monetised impacts which are disproportionate to quantify or monetise are already incorporated within the Green Book's recommended approach to SCBA and are described qualitatively to complement the information provided to decision-makers.

At the same time, part of the rationale for social cost benefit analysis is to compare diverse, market and non-market impacts: non-monetised impacts are challenging to compare to monetised impacts.

Taking an approach where wellbeing impacts were **only** considered as (non-monetised) wellbeing measurements, and not incorporated in valuation, would actually reduce the list of benefits and costs which can currently be monetised within SCBA. Many important wellbeing impacts are already quantified and monetised through existing techniques, such as stated and revealed preference. Excluding these impacts which are already monetised and restricting the monetisation of impacts only to market prices, would lead to a more imperfect measure of full welfare (or wellbeing) impacts of policy interventions, and could undermine the relevance and impact of **social** cost benefit analysis. It would not permit monetisation of subjective wellbeing

[23] Social CEA may sometimes be appropriate where: wider social costs or benefits will remain broadly unchanged or for the delivery of a public good; or the output may not be proportionately quantified. It is not appropriate where there are further material benefits beyond the outcome variable. However, in certain circumstances, subjective wellbeing may be a relevant outcome variable for Social CEA where it fully captures all the outcomes affected by a proposal.
Wellbeing-based social CEA can also be performed using other outcomes that don't use personal wellbeing for example in health the use of EQ5D based QALYs.

impacts, even where there are robust, causal effect sizes. **We propose that we would continue to clearly describe and compare non-monetised impacts across policy options, to complement SCBA where we do not have sufficient confidence in wellbeing effect sizes to support monetisation.**

One important challenge to monetisation raised by this approach is that econometric estimates of the wellbeing effects of income may fail to address on "spill overs"[24], which may in turn influence the estimated income effect size used for monetisation. This is an important point, which has been incorporated in the methodology described below for estimating coefficients for the causal effect of income on wellbeing.

3. No monetisation of wellbeing impacts – assessing a range of wellbeing dimensions

Summary

- This approach is similar to the above, since it proposes that wellbeing impacts cannot credibly be monetised. However, this approach also argues that it is also not possible to reduce wellbeing to a single 'subjective wellbeing' figure.
- Wellbeing impacts should instead be quantified *where possible*, using a range of dimensions and a range of measures where relevant.
- Some practitioners / academics propose a matrix approach or similar.

A multi-dimensional approach is used for example at a local authority level, to assess priorities.[25] It is also proposed as an approach to evaluate impacts of wellbeing in rural areas.[26] Publications have also proposed matrix approaches such as the 'Inclusive Economy Matrix' for assessing potential policy options (see e.g. Pouw and McGregor, 2014).

Discussion and conclusion

Wellbeing is consistently viewed by several disciplines as a multidimensional concept, which *could* be considered problematic to condense and measure as a single-dimensional figure (i.e. life satisfaction), whether monetised or not. There are different implications in different contexts. For one single policy change, there are likely to be various dimensions moving: the inter-dimensional relationships are important to consider. In addition, a single figure such as life satisfaction alone may not adequately describe ***why*** wellbeing may be low or high.

This means that, alongside a single, evaluative measure such as life satisfaction, it can be important to assess these different dimensions in order to understand the specific needs for different groups in different contexts. This can help to evaluate the effectiveness of policies and in turn help to assess where and what type of interventions may be most effective.

Taking a multi-dimensional or matrix approach can be an important analytical tool, and particularly important for early policy research as well as evaluation. However, as above, this approach does not necessarily lend itself to the existing structure of SCBA and cannot replace the existing approaches.

[24] i.e. it is challenging to describe independent variables as 'independent' since many are interrelated. Correlation between explanatory variables makes it difficult to isolate the impacts of the different drivers on wellbeing.
[25] See e.g. Local Government Association: https://www.local.gov.uk/health-and-wellbeing
[26] Forthcoming research

Conclusion: Part A

These three broad approaches are considered important for future development, in particular for policy development research, evaluation, and early assessment. In defined areas, there may also be a role for consistently comparing the wellbeing impacts across policies or approaches, with a consistent measure of wellbeing as the outcome variable (i.e. a cost-effectiveness analysis).

Part B: Approaches for monetisation of subjective wellbeing which fit within a SCBA framework

We assume under this approach that measures of life satisfaction and other subjective wellbeing measures are good proxies of an individual's underlying utility.

If policy change X leads to Y change in wellbeing[27] *and* Y change in wellbeing can be valued as £Z (through using an appropriate, evidenced based conversion value and functional form) then *policy change Y leads to a change of wellbeing valued as £Z.*

Under this approach, monetising subjective wellbeing estimates relies on the combination of three aspects:

i. evidence of robust, causal wellbeing impacts
ii. a robust conversion value from wellbeing impact to income / money
iii. a sensible and empirically founded functional form for this conversion

Options for each of these aspects are set out below, followed by three, combined options.

I. Ensuring robust, causal wellbeing impacts

The last 50 years have seen an explosion in research and analysis of the wellbeing effects of different changes, many of which are relevant for policy. As is set out in Annex A3 of the Wellbeing Supplementary Green Book Guidance and Annex 3 below, it can be difficult to determine whether a given factor that shows an association with wellbeing actually contributes to the feelings that are reported. It should be clear that this challenge of demonstrating causality applies across all social sciences. There is no a priori reason to think it is either more or less difficult within the field of wellbeing economics.

Part of the difficulty is that much of the evidence about wellbeing comes from regression analyses of cross-sectional data. Investigators compare groups that display different levels of wellbeing and seek to understand how much of the variation between them is explained by factors whose influence on wellbeing is generally known (for example, age, gender, socioeconomic characteristics, where someone lives), as well as by an additional factor of interest.

Nevertheless, cross-sectional regression analyses can be critical for identifying factors that could potentially affect wellbeing and are often the precursor for research that can help to establish causality. We have confidence in some **cross-sectional regressions** where the effect is backed up with theories or evidence from wider social or medical science **and** this holds across regions, time and multiple studies[28].

Certain econometric techniques, such as *individual fixed effects* and *area-specific fixed effects analyses*, improve opportunities to identify causal channels leading from a factor of interest to a change in wellbeing. Among the research approaches that can help to establish causality are

[27] Measured e.g. as point changes in life satisfaction on a 0-10 scale. We use the term 'WELLBY' to describe one point change in life satisfaction for one year

[28] The most famous example of this is the early evidence on smoking and lung cancer, published by Richard Doll in the British Medical Journal in 1950. Statistical purists objected at the time because the results were cross-sectional. Confidence grew with lung dissections, demonstrating the theory of why this could be the case alongside the cross-sectional evidence.

longitudinal panel studies. These are studies which observe changes over long periods of time in the same people.

Natural experiments can also help to establish causality. In these cases, something occurs that happens to affect groups differently, such as when those born after a certain date are subject to a different education or health policy than those born earlier. In an ideal natural experiment, the groups that were subject to different policies would be formed randomly, meaning that any overall difference in wellbeing between the groups is likely to stem from the policy changes rather than from differences in individual characteristics and / or self-selection into the 'treatment group'.

Experiments that randomly assign people to an intervention or a control group (or 'randomised control trials') are another tool for helping to establish causality.[29] They are used widely in medical research and are becoming more common in social science. They are not always silver bullets, however. While random allocation makes it easier to identify what causes a particular change, at the same time it isolates the effects of that intervention from real-world contextual factors that are often critical to how an intervention actually works and why. Investigators who want to replicate the findings from earlier trials often have difficulty doing so and in retrospect it is not always possible to identify which aspect of an intervention was most important in producing differences between a control group and the volunteers who received an intervention (Deaton and Cartwright, 2018).

There are other approaches to create an appropriate control group or counterfactual, such as regression discontinuity and propensity score matching.[30] The Magenta Book provides guidance on where these approaches may be most effectively used.

The recommendation is that **only evidence with a sufficiently convincing causal wellbeing impact should be considered for monetisation.** The Wellbeing Green Book supplementary guidance Annex A2 highlights a selection of values and studies where there is confidence in the causal wellbeing impact for the group in question.

Wellbeing-money conversion: Quantifying wellbeing impact

In the text below, we are mainly quantifying subjective wellbeing through changes in 'life satisfaction' on a 0 – 10 scale. Life satisfaction has become fairly standardised in policy and economic studies due to the availability of the measure in many data sets and its use in numerous studies, which makes it easier to compare effects consistently.[31]

However, depending on the policy, wellbeing may best be measured and quantified in other ways, including mental health scales or momentary measures. See Appendix A1 in the Green Book Wellbeing Supplementary Guidance for more information on alternatives.

A one-point change in life satisfaction per year on a 0-10 scale is defined as one 'WELLBY'[32].

[29] Since they help to estimate what would happen in the absence of the intervention
[30] See section 3.5 of the Magenta Book: https://www.gov.uk/government/publications/the-magenta-book
[31] Life satisfaction is also preferred by many analysts as it is seen as being made up of a balance of affect (positive and negative emotions) together with a cognitive assessment of how well one's life measures up to aspirations, goals and the achievements of others (Kahneman and Krueger, 2006; Diener, 1984), which means it provides a more holistic view of wellbeing than momentary measures.
[32] Taking the term used by the LSE-CEP and developed by Paul Frijters among others

II. Wellbeing - Money conversions

For all of the options below, the starting point is a robust impact on wellbeing, as set out in Annex 3.[33] The next stage is assessing how much income (or money) to associate with this same change in wellbeing.

There are a range of estimates in the literature for the impact of income on subjective wellbeing (SWB).[34] Clark *et al.,* (2018) find a coefficient on ln(income)[35] of 0.13, based on panel data analysis of the changes in SWB between the ages of 34 and 42 in the British Cohort Survey. Murtin *et al.*, (2017) using Gallup data from across the world find an average coefficient of 0.48 and for Europe, Brenig & Proeger (2016) find an average coefficient of 0.49. However, it should be noted that the income variable in these analyses is likely to be endogenous.[36] The following studies use exogenous changes in income. Lindqvist *et al.,* (2020) find a long-run ln(income) coefficient of 0.35-0.50 from analysing the long-run life satisfaction effect of Swedish lottery winners. Frijters *et al*., (2004) find a ln(income) coefficient of 0.5 from panel data analysis of the large changes in income in East Germany following re-unification. Fujiwara (2013), referenced in Fujiwara and Dolan (2016), finds a coefficient of 1.7 based on instrumental variable analysis of UK lottery winners in the British Household Panel Survey.[37] Fujiwara (2021) find a coefficient of 2.0[38] based on individuals' willingness to pay (WTP). Willingness to pay has also been estimated for a change in health states (measured by QALYs), which can be considered to reflect a subset of what aspects of life matter to individuals when they assess their wellbeing.

These wide-ranging estimates are driven differences in estimation methodologies as well as the data and underline the challenge and complexity in estimating robust income effects. Key sources of this uncertainty include endogeneity in the statistical model, how aware individuals are of the changes to their income, whether the effect is short or long run and whether gains or losses in income are considered. There are a range of options which were considered for the robust conversion value from wellbeing to income in the approaches described below.

The three key approaches considered include:

1. Using estimates of the effect of income on wellbeing
2. Using estimates of the willingness to pay for changes in wellbeing
3. Aligning with the value of a statistical life

These are discussed below.

1. Using estimates of the effect of income on wellbeing

Summary

- This approach would use an average or the range of coefficients on ln(income) as described above, or a sub-set, focusing only on British data, only on short or long term effects, or only on studies which specifically draw out the exogenous impact of income on wellbeing. Specifically, this is studied by looking at the wellbeing changes of lottery winners.

[33] (usually estimated in life satisfaction years, due to the data available and the rationale discussed above and in the Green Book supplementary guidance)
[34] All reported estimates are based on life satisfaction, in all cases converted to a 0-10 scale, for equivalence
[35] A log-point change in income
[36] This is confirmed by studies showing that happier people earn higher wages in the future, see Oswald and DeNeve (2012)
[37] A coefficient of ln(income) of 1.1 on a 1-7 scale, as measured in the British Household Panel Survey.
[38] For life satisfaction on a 0-10 scale, a coefficient on ln(income) of 1.25 on a 1-7 scale.

- With a given estimate for the robust, causal wellbeing impact, we estimate the amount of income which would need to be gained or lost to generate the same change in wellbeing.

Discussion

The general approach, of using wellbeing equations to produce monetary estimates of the value of events and phenomena that affect human wellbeing, has been applied in DiTella, Maculloch and Oswald (2001), Clark and Oswald (2002), Blanchflower and Oswald (2004)[39] alongside a range of further published papers covering a wide spectrum of themes: all estimating wellbeing impacts and seeking to translate them into monetary estimates.

As per the overview above, there are different studies which can be used to include in these equations for the impact of income on wellbeing. This includes:

a. Cross sectional regressions
b. Estimates of the effect of an exogenous change in income – in the long run
c. Estimates of the effect of an exogenous change in income – in the short run

These are described and compared in more detail below.

a. Cross sectional regressions

- British data has demonstrated a value between **0.1-0.2** (see e.g. Clark *et al.*, 2018).
- This conversion using the value of the cross-sectional regression of ln(income) on wellbeing has been proposed e.g. by Richard Layard among others.

Discussion and conclusion

Although approaches based upon cross-sectional regressions of wellbeing aim to account for the impact of income on wellbeing after controlling for health, opportunities, living situation and other confounding factors, they are still likely to overstate the effect of income on wellbeing, due to potential remaining endogeneity in income variable. For example, higher life satisfaction may drive attained earnings (simultaneity bias) or underlying factors (such as intelligence) may affect both (omitted variable bias).

In addition, these studies do not single out income changes that are necessarily noticeable by the individual, so valuations are likely biased upwards compared to true willingness to pay values. As a result, the monetised wellbeing values achieved are much higher than 'traditional' values achieved through revealed preference, stated preference and other methods aiming to estimate WTP.

b. Estimates of the exogenous change in income in the long run

- This approach aims to address the endogeneity in the wellbeing impacts of income – specifically, using the wellbeing changes of lottery winners.
- Lottery wins are arguably comparable to a large-scale randomised controlled trial where some people are given money and others are not.
- Drawing from the most recent, high quality study using Swedish data[40] (assessing the long-run effects) would suggest a coefficient of **0.35-0.50** on ln(income) (LS on a 0-10 scale) is the estimate with the most confidence.

[39] This paper was presented at the LSE 1993 conference by Blanchflower, yet only published 11 years later in 2004.
[40] Lindqvist *et al.* (2020)

Discussion and conclusion

Addressing the likely endogeneity in the effects of income can give us more confidence in the scale of effect.

However, there are issues to be aware of with this approach. Firstly, income won through a lottery is likely to have a different effect on wellbeing than changes in household income, the latter of which is what we ideally need to use to value non-market goods. With income won through a lottery, there is no "choice situation" where an individual needs to make trade-offs. Related to this, lottery wins can be effectively understood as willingness-to-accept figures, in the sense that the income changes assessed are all positive. There is significant evidence from behavioural economics of gain-loss asymmetry, with losses typically valued much more highly than gains. We would expect to see significantly higher income effect sizes, and correspondingly lower monetised wellbeing values, if losses in income were used to derive the income coefficient as opposed to gains.

Secondly, the approach of assessing the **long-run effects** may not capture the same type of value which we are aiming to use in cost benefit analysis. For willingness to pay estimates, we are effectively seeking to understand the **immediate** amount of income an individual is willing to forgo, rather than any longer term impacts which may arise through changes in spending over the long run or as individuals adapt to new levels of income. In essence, we wish to focus on the trade-offs between money and non-market goods individuals themselves would voluntarily choose to make *if* markets existed. Thus, valuations based on the long-term impact of income on wellbeing are likely to be understated for the purposes of non-market valuation.

Thirdly, the Lindqvist et al. (2020) study looked at **large wins** (over $100,000), whereas in non-market valuation we are generally interested in **marginal** changes in wellbeing and income.

c. Estimates of the exogenous change in income in the short run

- Similarly, this approach aims to address the endogeneity in the wellbeing impacts of income by using the wellbeing changes of lottery winners.
- If relying solely on British data, and assessing the **short term impact** of income on wellbeing, Fujiwara's 2013 paper estimating a coefficient of ln (income) of 1.1 (0-7 scale) could be applied, which would be the equivalent of ~**1.7** on a 0-10 scale.[41]

Discussion and conclusion

There are several points to note with respect to this study. Firstly, this estimate uses an instrumental variable approach with a control function, whereby household income is instrumented by lottery wins. This means that the estimate relates to the impact of household income rather than lottery wins per se. Secondly, through use of the control function approach this study is able to estimate the average partial effect (APE) of income on wellbeing. This is the effect of income on wellbeing for anyone in the UK population. Other lottery win studies have not used a control function and therefore the income impact estimates are valid only for the population of lottery players in the country and hence cannot be extrapolated for the purposes of non-market valuation. Thirdly, different to the above, this study estimates the **short term change** from an increase in income, rather than longer term changes in spending and

[41] Fujiwara, D. 2013. "A General Method for Valuing Non-market Goods Using Wellbeing Data: Three-Stage Wellbeing Valuation." CEP Discussion Paper No. 1233.
Referred to in Dolan and Fujiwara (2016)

behaviour, which may better capture the value which we are aiming to use within cost benefit analysis.

For policy analysis, we are seeking to understand the trade-offs between money and non-market goods individuals themselves would voluntarily choose to make *if* markets existed, i.e. using an understanding of the immediate compensation or payment to make up for this change rather than the long term impact of income on wellbeing. Finally, this study looks at small lottery wins which makes the data particularly relevant for the context of policy analysis, where the changes which are likely to come about tend to be smaller in nature.

However, it should be noted that this study was published in a book chapter rather than a journal (although the valuation methodology itself has been used to value non-market goods in peer-reviewed journals).[42] The study relies on self-identified 'lottery winners' in the British Household Panel Study, and the data in the study is now quite old (2002) as the BHPS stopped collecting data on lottery wins from 2008. As above, lottery wins can be broadly understood to be willingness to accept figures. As set out in Franklin (2015), willingness to pay figures can be argued to be the appropriate figures we are seeking to use for assessing changes in health (and by association, wellbeing).

To address these challenges, Fujiwara has recently completed a further study, using an alternative approach of choice experiment and WTP. This study aims to address these challenges (see below, WTP for wellbeing changes) and provides a similar, but slightly higher, value for the effect of income on wellbeing (leading to lower monetised wellbeing values).

Discussion and conclusion for Approach 1 (a-c)

This approach enables the use of wellbeing equations to produce monetary estimates of the value of events and phenomena – and through this, is a potential option for incorporating monetised impacts of life satisfaction in social cost benefit analysis.

Initial values from this approach were considered to be unrealistically high compared to market values[43] and inconsistent with existing 'benchmarks' used in CBA. This can relate to two aspects:

- the lack of confidence in some wellbeing impacts assessed. For example, some one-off or infrequent events may have been overstated in some regressions used. [The recommended approaches for achieving confidence in wellbeing effect sizes are discussed in (i) above.]
- the difference in the 'type' of wellbeing assessed and valued. This is in two parts.
    - Ex-ante vs ex-post: Firstly, using panel data and relying on exogenous changes in income with the effects over a longer time period aims to draw out individuals' longer-term, experienced utility or wellbeing relating to income changes. In comparison, willingness to pay estimates often rest upon an individual's prediction of how something will impact their life, whether this is from stated or revealed preferences. However, individuals tend to systematically and materially mis-predict utility when stating preferences in advance, or through revealed behaviour.[44] It can be argued that experienced utility could be considered to be a 'truer' reflection of the wellbeing associated with changes in income. However, where studies show a lower impact of income on wellbeing, as is the case in these longer term panel studies of lottery wins, this leads to a higher associated monetary value per change

[42] Lawton *et al*. (2021)
[43] For example, ~£50 per visit to the cinema
[44] E.g. Daniel Gilbert, Stumbling on Happiness; and Odermatt, R., Stutzer, A., 2019; both challenge stated preferences and evidence that people don't predict their own happiness changes well

in wellbeing and unrealistic values for non-market goods which are many times higher than values estimated from stated preference or revealed preference methods.

- WTP vs WTA: Furthermore, lottery wins could be considered to be willingness to accept valuations. Behavioural economics demonstrates that losing something is 'valued' higher than gaining the same. As a result, the associated monetary impact is higher. However, as is set out in Franklin (2015), WTP values can be more closely associated with the monetary values we are aiming to represent for policy analytical purposes.

As is stated in the introduction, two of the key principles we are seeking through this approach are approximate consistency with existing government values and consistency within the existing framework of Cost Benefit Analysis. Consistency with valuation is essential: in order to be able to apply social CBA, we rely on the assumption that the social gain produced is sufficient to compensate for any resulting loss – i.e. sufficient confidence that when we monetise a 'gain' it can be commensurate with the monetisation of a 'loss'. This consistency *may* not apply when using this approach: using experienced utility associated with income could be considered to capture a different category of value than is generally estimated through CBA, which may lead to inconsistency with existing values used in CBA. For example, current values of SLY are derived from WTP evidence.

Of all the sub-options (a)-(c) above, relying on short term impacts of (exogenous) income on wellbeing (i.e. the coefficient of 1.7 on ln(income)) may be considered to be theoretically closer to what we are aiming to capture for marginal policy changes. Since the coefficient is higher it will also produce more conservative values for outcomes which have been shown to be in line with stated preference values. Where appropriate methods are followed to have confidence in the wellbeing effect size, the resulting monetary values are broadly in line with the types of estimates we would apply for WTP.[45] This ln(income) coefficient of 1.7 leads to a value of a life year of £58,000 (Fujiwara *et al.*, 2020), which is broadly in line with the Green Book QALY value of £60,000.

This consistency with existing government values should be continually reviewed. If and when any government figures for the value of a statistical life year update - including the methods and approaches taken for this valuation - the comparison with wellbeing values will need to be revisited.

2. Using estimates of willingness to pay for wellbeing changes

Summary

- This approach uses estimates of the **willingness to pay** for changes in wellbeing, to ensure consistency with the WTP values currently used in SCBA.
- This is based on a discrete choice experiment (Fujiwara, 2021) carried out to estimate the causal effect of household income on life satisfaction in the UK.[46]
- This arrives at an estimate of 1.96 for the coefficient on ln(income) when life satisfaction is converted to a 0-10 scale.

[45] These conclusions are based on empirical triangulation alongside consideration of theoretical differences – see the supplementary guidance for an example valuing flooding impacts under the different approaches.

[46] This study included 282 legitimate responses as the final sample size, which generated 2,820 separate choices in the data since each respondent made 10 different binary choices. Quotas on age, gender, income and region in the UK were set to make the sample nationally representative.

Discussion and conclusion

Values from this approach do not suffer from the endogeneity challenges discussed under option 1a. In addition, this approach can be considered to be theoretically consistent with the WTP values as conventionally applied in SCBA. **This is one of the preferred approaches and provides the upper bound for the recommended WELLBY value range as discussed below.**

3. Aligning with Value of Statistical Life Year

Summary

- This approach focuses on achieving consistency with existing valuations used in Government. It is based on Frijters & Krekel (2021) and applies the monetised value of a QALY, derived from the Value of a Statistical Life Year[47], to the appropriate number of WELLBYs. As described above, a WELLBY is defined as a one-point change in life satisfaction for one year.
- To determine the number of WELLBYs equivalent to one life year, we need to consider what is incorporated in the relative measures. As is described in Brazier *et al.*'s (2016) paper for the Department of Health, a QALY is a sub-set of what is captured within life satisfaction. A QALY, when measured with the EQ-5D, represents the value of an additional life year lived with no problems with mobility, self-care or usual activities, no pain or discomfort, and no anxiety or depression.[48] Brazier *et al.*'s research sponsored by NICE emphasises that there are additional dimensions to wellbeing (and wellbeing as measured by Life Satisfaction) which are not captured within these dimensions of the QALY.
- We can broadly align life satisfaction scores with the upper and lower bound of a QALY based on research and papers from Frijters *et al.* (1999, 2021) as well as data from the ONS. Frijters & Krekel (2021) note that the average life satisfaction of someone with no health problems is around 8 (on a 0-10 scale).[49] **There are different assumptions which can be taken for the bottom end of the range**. There are QALY states worse than 0 – i.e. negative QALYs, yet the bottom end of the life satisfaction range is 0. **Very little is known about individuals who answer 0 on a QALY and 0-2 on a life satisfaction scale.[50] Frijters (1999) look at the life satisfaction point at which individuals become indifferent between continuing to live or not. Peasgood *et al.,* (2018) implemented a very similar idea on UK respondents and found the zero-point to be around 2.[51]**
- **However, this may be an overestimation of the point of indifference, when comparing with observed behaviour (in this case, committing suicide): approximately 0.01 take their own lives, yet a higher proportion of ONS respondents give 2 or lower on a life satisfaction score. In the other direction, ONS data shows that the average Life Satisfaction of those self-reporting their**

[47] In turn estimated through Carthy et al. (1999) willingness to pay values
[48] The highest level of health which can be expected
[49] Previous ONS data from 2014/15 Personal well-being estimates personal characteristics - Office for National Statistics (ons.gov.uk) shows that the mean life satisfaction of individuals reporting 'very good' health is over 8 on a 0-10 scale. Recent data from ONS Coronavirus personal and economic well-being impacts - Office for National Statistics (ons.gov.uk) shows that those reporting that they do not have specific health conditions report a mean life satisfaction of over 8 (See Row 120, tab 'changes for parts of population').
[50] Respondents in Peasgood et al. (2018) found lower ends of the life satisfaction scale difficult to imagine
[51] With a small sample: further research is encouraged.

health to be 'very bad' is around 5.[52] Based on the limited data available, the point of indifference with a QALY of 0 is considered to align with a life satisfaction score of greater than 0, which we assume is a score of 1 (on a 0-10 scale).

- One QALY is then associated with a 7- point change in life satisfaction (from someone with no health problems, to as bad as death: 8-to-1).
- Given a QALY is worth £60,000 (2014 prices and values) as per HMT Green Book guidance, or £70,158 in 2019 prices and values,[53] one WELLBY would have a value of £70,158/(8-1) = £10,023.

As corroboration of this number, Huang *et al.* (2018) find, using an instrumental variables approach which ensures 'noticeability' of the income change, that a one-off loss of income of approximately £9,000 reduced life satisfaction by 1 point for 1 year. The value of a WELLBY under this approach would therefore be £9,000 in 2015 prices, or £10,246 in 2019 prices. This provides further corroboration for a WELLBY value in this order of magnitude, but we rely on the QALY based derivation as it is based on established existing approaches to valuing life and health impacts in the Green Book.

Table 2 below lays out the comparison of the concepts of a WELLBY, a QALY and the Value of a Statistical Life (VSL), as is currently applied to a QALY for monetising QALYs within the Green Book.

Table 2: comparison of WELLBY, QALY and valuation method used for QALYs

	WELLBY (Change in life satisfaction, per year)	QALY (Quality Adjusted Life Year)	Value of a Statistical Life Year
What are we measuring through valuing these concepts?	Value associated with an improvement in (quality of) life, as assessed by the person themselves,[54] considering their life as a whole.	Value associated with an improvement in quality of life, assessed by individuals themselves[55]	Calculated by Carthy *et al.* (1999) Willingness to pay to return to normal health. Wider costs to society (e.g. health, lost productivity) are **not** included in this figure.
What does the top of	Completely satisfied with life (self-assessed) for one year	No health problems for one year[56]	Normal health

[52] Personal well-being estimates personal characteristics - Office for National Statistics (ons.gov.uk) Note that 'very bad' health is considered higher than a 0 QALY

[53] Uplifted to 2019 prices using GDP deflator growth (ONS series MNF2), and real GDP per capita growth (ONS series IHXW) in conjunction with the marginal utility of income elasticity parameter of 1.3 as recommended in the main text.

[54] When used in calculations / looking at impacts, change in WELLBYs are based on averages across individuals for a defined change. Although people's answers are likely coloured by their expectations (based on their age, circumstances, etc), this applies across WELLBYs, QALYs and the WTP figures used to assess the value of a statistical life – i.e. across the columns

[55] This is assessed by individuals, but when used in calculations, change in QALYs are based on averages across individuals for a defined change.
For EQ5D, this is assessed on 5 dimensions: mobility, self-care, usual activities, pain and discomfort, and anxiety and depression.

[56] Specifically, when calculating QALYs from EQ5D: "no problems with mobility, self-care or usual activities, no pain or discomfort, and no anxiety or depression".

range represent			
What does the bottom of range represent	Not at all satisfied with life (self-assessed) for one year	Dead. Note in some cases it is possible to assign negative QALYs to states deemed worse than dead.	From Carthy *et al.* (1999) – various health states. From WTP for risk reduction: Fatality
Conversion in concept	Both WELLBYs and QALYs assess a broad concept of quality of life. QALYs are valued at £60k, based on a conversion from the VSL estimated by Carthy *et al.* (1999). [57] There are of course many assumptions required for transferring across from the VSL into a WTP-QALY, and, to enable consistency, we applying the same imperfect assumptions to WELLBYs. As the work on VOSL continues and the approach to be used for QALYs is updated / improved, the same figure would be applied for WELLBYs.		
Comparison in coverage:	Life satisfaction considers how individuals feel life is going as a whole, whereas QALYs are measuring 5 key components which may exclude some areas considered when individuals judge their own life satisfaction. Based on this, 0-1 of a QALY covers *less* than 0-to-10 of Life satisfaction. This is partially addressed through capping the top end of the range (below).		
Conversion in ranges:	1 for a QALY is "no health problems" – this could be roughly assigned to an 8 of life satisfaction (based on ONS data[58], Frijters and Krekel, 2021) There is limited evidence for the bottom end of the scale. There are QALY states worse than 0 – i.e. negative QALYs, yet the bottom end of the life satisfaction range is 0. Frijters and Krekel (2021) estimate that a 0 on life satisfaction is equal to a state worse than death, with a tipping point is 2.[59] However, this could be considered to be too high, given that 0.01% of people commit suicide and a much higher % answer 2 or below on the ONS questions. Given the existence of negative QALY values, we assume the indifference point between living and dying sits at 1 on the 0-10 life satisfaction scale; however there is uncertainty surrounding this assumption and it remains an important area for future research.		

Although people's answers are likely coloured by their expectations (based on their age, circumstances, etc), this applies across the columns – for WELLBYs, QALYs and the WTP figures used to assess the value of a statistical life

[57] But note this is a different concept from the willingness to pay for an avoided fatality, which assesses WTP to reduce risk.

[58] Previous ONS data from 2014/15 Personal well-being estimates personal characteristics - Office for National Statistics (ons.gov.uk) shows that the mean life satisfaction of individuals reporting 'very good' health is over 8 on a 0-10 scale. Recent data from ONS Coronavirus personal and economic well-being impacts - Office for National Statistics (ons.gov.uk) shows that those reporting that they do not have specific health conditions report a mean life satisfaction of over 8 (See Row 120, tab 'changes for parts of population'). Previous APS data shows that individuals

[59] This is based on Frijters (1999) who look at the life satisfaction point at which individuals become indifferent between continuing to live or not. Peasgood et al. (2018) implemented a very similar idea on UK respondents and found the zero-point to be around 2.

Discussion and conclusion

As described above, SCBA is ultimately seeking to find a way to compare apples and oranges –a range of benefits and a range of costs are converted to monetary values in order to have one consistent unit (money) for comparison. This allows us to calculate whether the social gains of policies offset the social costs, and by how much.

This aim of SCBA means that **consistency is essential**. This single unit of comparison would not achieve its purpose if one aspect of measuring welfare of a life well-lived were monetised with a certain value and another approach were monetised with a different value. This approach aims to achieve this consistency. Reflecting the ongoing research and cross-government discussions on VSL and QALY values, **the WELLBY value derived under this approach would be updated in future, once the work on valuing life and health impacts has reached a conclusion**.

It should be noted that this conversion relies on several assumptions, but these assumptions can be considered logical, given the evidence available. In addition, this *broad* magnitude of the WELLBY is corroborated by research by Huang *et al.* (2018), which uses an instrumental variables approach that ensures 'noticeability' of the income change[60].

This is the second of our preferred approaches, and provides the lower bound for the recommended WELLBY value range as discussed below.

Conclusion: Part B (II) Value for wellbeing – monetisation conversion

The preference is for **theoretical robustness** (values where the **exogenous** impact of income on wellbeing has been estimated, where WTP/WTA has been drawn out) and for **consistency** with existing values of a statistical life year. There are several uncertainties in the estimates and assumptions, but approach 3 and 4 are considered to be well justified and academically supported. As a result of these uncertainties, we propose a range between approach 3 and 4, described in approach III below.

III. Functional form: linear vs. log

Once we calculate the 'translation value' from wellbeing to income, or the coefficient which is used for this translation, the next question is how this calculation is operationalised by analysts for a range of wellbeing changes, for a range of individuals with different incomes and initial wellbeing. Two options are discussed in this section.

1. Log transformation applied to income

Summary

- Literature is clear that there is a declining marginal utility effect of income: additional income has a smaller impact on wellbeing where the receiving individual has more to begin with.
- This approach would reflect this relationship when estimating the relationship between wellbeing and income, meaning that for larger decreases in wellbeing, there is a *larger* associated per-unit monetary value than smaller decreases; whereas for larger increases in wellbeing there is a *smaller* associated per-unit monetary value.

[6060] These authors find that a one-off loss of income of approximately £9,000 reduced life satisfaction by 1 point for 1 year. The value of a WELLBY under this approach would therefore be £9,000, or £10,246 in 2019 prices. This provides further corroboration for a WELLBY value in this order of magnitude, but we rely on the QALY based derivation as it is based on established existing approaches to valuing life and health impacts in the Green Book.

- This is applied separately for deriving WTP and WTA values (see further detail below).

Discussion and conclusion

The economic literature is clear that income has a diminishing marginal impact on wellbeing, but it is not necessarily theoretically grounded that a greater decrease in wellbeing should be associated with a greater than proportional increase in monetary value, or that larger (negative) changes in wellbeing are assessed and valued by society as more important. To give an example, this approach means that a decrease in wellbeing of 0.7 for one person would have greater monetary value than a decrease of 0.1 for 7 people. In the other direction, an increase in wellbeing of 0.7 for one person would have a smaller monetary value than an increase of 0.1 for 7 people. These differences are driven solely by the diminishing marginal utility of income – the wellbeing effect sizes to which monetisation is applied are constant (linear). Since we are using monetary value as a proxy for welfare or public value in SCBA, this means that we would imply that larger decreases in wellbeing had greater than proportionate negative "public value" and larger increases in wellbeing larger than proportionate "public value".

This approach naturally shows bigger WTA than WTP values[61] due to diminishing marginal utility of income, and the income constraint. However, behavioural economics evidence would suggest that there is a *discontinuity* in the utility function at the origin, rather than a smooth curve. This in turn would imply a much greater divergence between WTP and WTA values than would be implied by income effects alone.

A key challenge with this approach is the ability for analysts to correctly interpret the evidence and calculate the estimates based on robust values: specific interpretation and calculations are required.

A further challenge with this approach (as below) is that it does not place extra emphasis or weighting on those with a lower starting wellbeing. However, this is partially (and qualitatively) addressed in other ways through appraisal and the Green Book.[62]

2. Linear functional form

Summary

- This approach would calculate the monetised value per 1 point change in life satisfaction, using the steps described above, then apply this amount linearly to life satisfaction: applying the same value per change in wellbeing across individuals, irrespective of the scale of the change and irrespective of individuals' initial wellbeing levels.

Discussion and conclusion

Taking a linear conversion (rather than a log conversion) is pragmatic – it can be practically applied and is easy to adopt. Policy values are 'reference independent' which is desirable as there is not always an obvious reference point against which individual policy impact can be classified in terms of size and sign. Moreover, where effects may accumulate over time or across policies, it becomes challenging to ensure a consistent 'adding up' of effects across policies where each appraisal is sensitive to a reference point and, therefore, to the (arguably arbitrary) order in which interacting policies are assessed.

The linear approach is also equitable – the 'value' of the wellbeing change is the same, no matter the income and no matter the reference point. The same WELLBY value should be

[61] losses of the same amount are 'valued' more than gains of the same amount

[62] Mainly qualitatively, through descriptions of impacts on different groups. This difference is not quantitatively accounted for in Green Book Appraisal: distributional weights only address the different impact of income on groups with lower starting income

applied to all individuals regardless of income and represents a population average willingness to pay. This is justified on equity grounds, a per the approach taken for valuing life and health impacts in the Green Book.[63]

As the WELLBY is a constant unit value, losses and gains are valued equally. While the behavioural economics literature suggests losses are often valued more highly than equivalent gains (beyond what can be explained by diminishing marginal utility of income), this difference can be captured in the scale of the wellbeing effect size as opposed to the monetisation approach: well-conducted experiments and studies may show where there is a difference in wellbeing impact associated with a gain compared with a loss, which can be directly translated across into the monetary value using the linear conversion.

As above, a challenge with this approach is that it does not place extra emphasis or weighting on those with a lower starting wellbeing. However, as above, this is partially addressed in other ways through appraisal and the Green Book (and would be a challenge to put into practice).

Overall, using the same per-unit value for all wellbeing impacts[64] has the benefit of being transparent and easy to apply. Furthermore, it is in line with the existing Green Book approach to valuing life and health impacts.

This is the preferred functional form.

Due to the greater differences for larger wellbeing changes (see annex I), it is suggested that the log functional form be applied as sensitivity, for wellbeing changes greater than 0.5 LS point (0-10 scale).

Conclusion: Part B (III) Functional form

The preference is for an approach which is **practical** to apply, can fit with the existing literature to be considered sufficiently robust, is equitable and **does not lead to unintended consequences** and is **consistent** with existing approaches used for e.g. QALYs.

As a result, a linear conversion (i.e. a constant unit value per WELLBY) is the preferred approach.

[63] See Green Book annex A1.

[64] Noting that, as above, the wellbeing effect sizes themselves may be estimated to reflect asymmetry between losses and gains, which would be reflected in the LS changes to be monetised, as opposed to the monetary values *per point change in LS*.

Part C: Combined options

A combination of these factors on income conversion and functional form has been drawn together to create three headline options:

I. Income effects from published studies

Summary

- There are a selection of wellbeing impacts that have been monetised using the 'wellbeing valuation' method and published in peer-reviewed academic journals: the impacts available depend on where natural experiments have occurred, or situations where it has been possible to draw out a causal effect
- This approach would involve analysts using these monetised values which have been published in peer-reviewed academic journals:
- These figures would be adjusted using GDP deflator and real income growth as needed.
- Where further studies have identified a robust, causal wellbeing impact (for example, through an RCT) but have not monetised this impact, these wellbeing impacts would not be monetised.

Discussion and conclusion

This approach would enable robust effect sizes to be incorporated in the existing structures of SCBA and the Green Book. Since only peer reviewed studies would be included, the judgement of robustness would already have been taken through academic peer review.

However, this would lead to inconsistency: slightly different methodologies for an income conversion are likely to have been applied across each study. The monetary values are highly sensitive to income coefficients, which would effectively be different across each study. Furthermore, under this approach, where we only have an LS effect size without the published study translating to monetised effects (for example, from a RCT estimating the wellbeing effects of a change) analysts cannot monetise wellbeing changes. Such results, which may be the most robust, cannot be included in key SCBA metrics such as the BCR and NPV.

II. Logarithmic functional form based on exogenous change in income and WTP evidence

Summary

- This is the combination of the approaches described in ii (1), often referred to as the '3 stage approach', whereby the change in wellbeing is estimated then monetised using an independently derived coefficient for the causal effect of (log) income.
- There are a range of values which could be used for the ln(income) coefficient on wellbeing[65]: selected estimates focusing on the exogenous impact range from 0.38 to 1.96 (life satisfaction on a 0-10 scale)
- Where analysis focuses on a specific group, the income level of this group could be applied to the equations. However, when being used for national analysis, national average incomes should be used. This is described in more detail in Annex I.

Discussion and conclusion

As described in Table 1 above, this approach is backed up by economic theory.

Some of the higher estimates for the coefficient of ln(income) can be backed up with triangulation[66] and considered consistent with values currently used in SCBA in the UK. Other,

[65] this assumes Wellbeing = a + b Log of Income +c Vector of Other Variables That Influence Wellbeing and we are particularly interested in the size of the coefficient *b*

[66] E.g. for the QALY, see Fujiwara (2020)

lower estimates are considered inconsistent with **current** appraisal values used e.g. for the value of a statistical life year.

However, as described above, while this approach is workable, it requires interpretation and specific calculations for each policy appraisal application.

III. Linear conversion with a range of values, based on the QALY and WTP evidence

Summary

- This approach recognises the inherent uncertainty in the conversion of wellbeing effect sizes to income, as well as the importance of consistency with existing values used in government. It takes two approaches for this conversion and proposes a range across these two approaches.
- It rests upon having robust estimates of a change in life satisfaction and the duration of the change. This change in life satisfaction per year is **converted to a monetary value by multiplying by £13,000** [Low: £10,000, High £16,000]. This is the recommended standard value of one wellbeing adjusted life year - a 'WELLBY'[67] - in 2019 prices and values. The value of WELLBY derived in this way can then be applied linearly to any change in life satisfaction.
- Where the change in life satisfaction is greater than 0.5 points of life satisfaction per person per year, analysts should also carry out a sensitivity test, using an additional approach to apply compensating surplus, reflecting the diminishing marginal utility of income on wellbeing.

Derivation of the recommended WELLBY value and low-high range

There are two main approaches to estimating the monetary value of a WELLBY, defined as one statistical unit of life-satisfaction on a 0-10 scale for one person for one year. Both are aiming to estimate the Willingness to Pay for changes in Life Satisfaction.

Approach 1: Pivoting off the Green Book value of a QALY

- The first approach focuses on achieving consistency with existing valuations used in Government, as is described in (II) 3 above. It is based on Frijters & Krekel (2021) and applies the monetised value of a QALY, derived from the Value of a Statistical Life Year[68], to the appropriate number of WELLBYs. As described above, a WELLBY is defined as a one-point change in life satisfaction for one year.
- One QALY is associated with a 7- point change in life satisfaction (from someone with no health problems, having LS of 8, to being indifferent to death, which we assume corresponds to LS of 1).
- Given a QALY is worth £60,000 as per HMT Green Book guidance (2014 prices and values), or £70,158 in 2019 prices and values,[69] one WELLBY would have a value of £70,158/(8-1) = £10,023.

[67] See Frijters & Krekel ,2021.
[68] In turn estimated through Carthy et al. (1999) willingness to pay values
[69] Uplifted to 2019 prices using GDP deflator growth (ONS series MNF2), and real GDP per capita growth (ONS series IHXW) in conjunction with the marginal utility of income elasticity parameter of 1.3 as recommended in the main text.

This conversion relies on a number of assumptions, but these assumptions can be considered logical, given the evidence available. In addition, this *broad* magnitude of the WELLBY is corroborated by research by Huang *et al.* (2018), which uses an instrumental variables approach that ensures 'noticeability' of the income change[70]. We choose to rely on the QALY based derivation as it is based on established existing approaches to valuing life and health impacts in the Green Book.

This consistency with existing government values should be continually reviewed. If and when any updates to the Green Book QALY and VSL values are made, including the methods and approaches used for deriving these values, the comparison with wellbeing values will need to be revisited.

Approach 2: Calculating the willingness to pay for life satisfaction changes

The second approach is described under (II) 3 above.

Fujiwara (2021) finds the coefficient on ln(income) is 1.25 (with life satisfaction measured on a 1-7 scale). We can define a WELLBY in this context as the aggregation of WTP for many infinitesimally small individual gains in life satisfaction which sum to 1 point of life satisfaction for one year (i.e. 1 WELLBY).[71] If life satisfaction us related to ln(income), this can be computed as the inverse of the marginal utility of income:

$$WTP - WELLBY = \left[\frac{f'(\ln(M))}{M}\right]^{-1} = \frac{M}{\beta_Y}$$

This expression is simply the marginal rate of substitution between income and life satisfaction. In this expression β_Y is the coefficient on ln(income), converted to a 0-10 scale. Given we are using a ln(income) coefficient of 1.25 on a 1-7 scale, this needs multiplying by 11/7 to be expressed on a 0-10 scale. Then, we have:

$$\beta_Y = \frac{11}{7}(1.25) = 1.96$$

We can then calculate the WTP per WELLBY with reference to average earnings based on ONS data, which were £30,673 in 2019 as follows:

$$WTP\ (WELLBY) = \frac{£30{,}673}{1.96} = £15{,}615.$$

For simplicity this is rounded to £16,000.

Deriving the central recommended WELLBY value

Summarising, we have derived two estimates of the monetary equivalent value of a WELLBY, £10,023, and £15,649 (both in 2019 prices and values). We treat these as the upper and lower

[7070] These authors find that a one-off loss of income of approximately £9,000 reduced life satisfaction by 1 point for 1 year (2015 prices). The value of a WELLBY under this approach would therefore be £10,246 in 2019 prices – aiding comparability.

[71] This is analogous to the definition of the Value of a Life Year and Value of a Prevented Fatality. See https://www.gov.uk/government/publications/valuation-of-risks-to-life-and-health-monetary-value-of-a-life-year-voly/a-scoping-study-on-the-valuation-of-risks-to-life-and-health-the-monetary-value-of-a-life-year-voly.

bound, and take the mid-point as the recommended central estimate of the WTP-per-WELLBY, which is then:

$$WTP\ (WELLBY) = \frac{10{,}000 + 16{,}000}{2} = £13{,}000.$$

Therefore, the recommended value of a WELLBY, alongside the low-high range recommended for sensitivity testing, is given in the below table.

Table 3: Low, Central and High WELLBY value

	WELLBY value (2019 prices and values)	Source
Low	£10,000	Based on QALY value, broadly using approach in Frijters and Krekel (2021) but adapting to reflect wider academic comment on the life satisfaction indifference point between life and death
Central	£13,000	Midpoint of low and high
High	£16,000	Based on ln(income) coefficient of 1.96[72] from Fujiwara (2021)

Discussion and conclusion

This approach provides a range, addressing the suggestion of interval estimates[73] and the concern that monetisation gives the deception of accuracy.

This is an approach which can achieve broad consistency with existing government values which are accepted and used;[74] gives us 'plausible' values within the framework of Cost Benefit Analysis; is in line with published research and does not lead to any unintended consequences or disadvantage for certain groups.

Taking a linear conversion (rather than a log conversion) is pragmatic – it can be can be practically applied and is easy to adopt; the linear approach is also equitable – the 'value' of the wellbeing change is the same, no matter the income and no matter the reference point. The same WELLBY value should be applied to all individuals regardless of income and represents a population average willingness to pay. This is justified on equity grounds, a per the approach taken for valuing life and health impacts in the Green Book.[75]

One challenge with this approach is that it does not place extra emphasis or weighting on those with a lower starting wellbeing. However, this is addressed in other ways through appraisal and the Green Book (and would be a challenge to put into practice).

As the WELLBY is a constant unit value, losses and gains are valued equally. While the behavioural economics literature suggests losses are often valued more highly than equivalent gains (beyond what can be explained by diminishing marginal utility of income), using the same per-unit value for all wellbeing impacts has the benefit of being transparent and easy to apply.

[72] On a 0-10 scale, original study based on 1-7 scale and noted coefficient of 1.25
[73] Raised by a range of academic reviewers, including Tim Lloyd, Professor of Economics in the Faculty of Management, Bournemouth University
[74] For example, for the Value of a Statistical Life Year and value of a Quality Adjusted Life Year as set out in the Green Book.
[75] See Green Book annex A1.

Furthermore, it is in line with the existing Green Book approach to valuing life and health impacts.

The ln(income) coefficient of 1.96 (on a 0-10 scale) is backed up by recent UK stated preference data and therefore controls appropriately for potential confounding effects in the relationship between SWB and income. Using this coefficient also means that values form wellbeing valuation correspond most closely to traditional WTP values (Fujiwara, 2021). This is higher than some of the other estimates reported in the literature, but the resulting values should be broadly in line with what individuals themselves would themselves be willing to pay to obtain SWB benefits, on the assumption that they are highly aware of both the change in income and the impact of the change in non-market good being valued.

In addition, since the focus of this approach has been to achieve consistency, values applied should be updated as and when the figures for the VSL and / or QALY are updated.

Annex 1: Monetising wellbeing impacts for non-marginal changes using the ln(income) approach

For large changes in life satisfaction (greater than 0.5 points of life satisfaction) it may be important to consider the impact of diminishing marginal utility of income on valuations, which is not reflected in the WELLBY approach. This means the monetary equivalent value will not be a linear function of the size of the change (as under the WELLBY approach) but the slope will increase (decrease) as the required gain (loss) in income to offset the life satisfaction change increases. This follows directly from diminishing marginal utility of income and the concavity of the utility function. For small changes in life satisfaction this makes little difference to appraisal values.

Drawing on standard welfare economics, there are two possible ways of measuring the monetary equivalent of a given change in life satisfaction. The formulae given below are based on the ln(income) approach described above and are taken from Fujiwara (2013).

i. **Compensating Surplus (CS)** calculates the amount of money, paid or received, that will leave the agent in his/her initial welfare position following a change from the status quo.

   The formula for calculating the CS of a change in outcome Q (i.e. the wellbeing value of Q) is:

$$CS = M\left[1 - \exp\left(-\frac{\beta_Q \Delta Q}{\beta_Y}\right)\right]$$

ii. **Equivalent Surplus (ES)** is the amount of money, to be paid or received, that will leave the agent in his/her subsequent welfare position in the absence of a change from the status quo.

   The formula for calculating the ES of a change in outcome Q is:

$$ES = M\left[\exp\left(\frac{\beta_Q \Delta Q}{\beta_Y}\right) - 1\right]$$

where

M = average net personal income;

β_Y = the coefficient of log income (1.96)[76], from Fujiwara (2021);

β_Q = the coefficient on the good/outcome (Q) being valued.

[76] For life satisfaction on a 0-10 scale

$\Delta Q =$ change in the good/outcome being valued.

Note, in most wellbeing appraisal applications, $\beta_Q \Delta Q$ will simply be the total life satisfaction effect size (per person per year) for the policy impact being appraised, denoted ΔLS in the main text.

For changes in Q which **increase** wellbeing, CS represents the income loss individuals would be willing to sustain to secure Q (similar to the notion of WTP), whereas ES represents the gain in income which is as good as the impact of Q on SWB (similar to the notion of WTA). In this case, ES will always exceed CS and both will be positive.

For changes in Q which **decrease** wellbeing, CS represents the income gain which would compensate individuals for the loss in wellbeing (similar to the notion of WTA), whereas ES represents the amount of income people would be willing to forgo to avoid the loss in wellbeing (similar to the notion of WTP). In this case, the absolute CS will always exceed absolute ES, but both will be negative. Therefore, the sign needs to be flipped positive if the appraisal values are to be reported as 'costs'. For example, an ES of -£1000 effectively corresponds to a willingness to pay £1,000 to avoid the decrease in wellbeing.

The table below summarises the relationships between CS, ES, WTP and WTA.

Table 4: Willingness to Pay, Willingness to Accept, Compensating Surplus, Equivalent Surplus and Life Satisfaction changes

Change in life satisfaction is…	Compensating surplus	Equivalent surplus
Positive	WTP to obtain increase	WTA to forego gain
Negative	WTA to tolerate decrease	WTP to avoid loss

In general, CS is the preferred measure for appraisal, which corresponds with the idea that individuals have a 'right' to the status quo situation, so we ought to look at the income change needed in the new (post-policy situation) to offset the change, not how much we would need to change income by in the pre-policy situation to equal the change.

For changes in excess of around 0.5 points of life satisfaction per person per year, analysts may wish to carry out a sensitivity test using the following formula for the compensating surplus given above. Note that this will give alternative sensitivity values aligned to the **high** end of the range (but accounting for non-linearity arising due to diminishing marginal utility of income), and not the central value of £13,000/WELLBY.

Figure 1 and table 5 illustrate the relative values under the WELLBY and 3-stager approaches. As can be seen, the value are fairly close (comparing the 'compensating surplus' and 'WELLBY – high columns) for life satisfaction changes less than 0.5 (0-10 scale).

Figure 1: WTP/WTA values (compensating surplus) versus upper-end WELLBY monetary values (i.e. where 1 WELLBY=£16k), plotted against change in life satisfaction

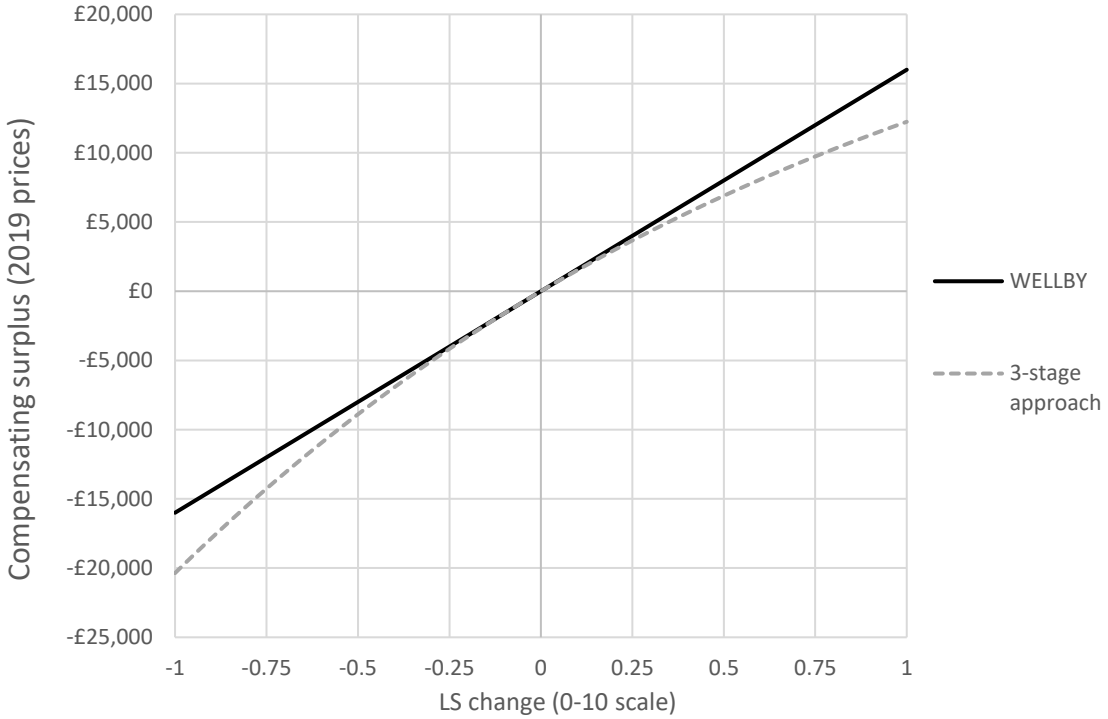

Table 5: Summary of monetary values of specified life satisfaction changes under the WELLBY (linear) and 3-stage (linear-log) approaches

		WELLBY values		
Change in life satisfaction (0-10 scale)	**Compensating surplus**	**Low**	**Central**	**High**
-1.00	-£20,360	-£10,000	-£13,000	-£16,000
-0.50	-£8,891	-£5,000	-£6,500	-£8,000
-0.40	-£6,928	-£4,000	-£5,200	-£6,400
-0.30	-£5,061	-£3,000	-£3,900	-£4,800
-0.20	-£3,288	-£2,000	-£2,600	-£3,200
-0.10	-£1,602	-£1,000	-£1,300	-£1,600
-0.05	-£791	-£500	-£650	-£800
0.05	£771	£500	£650	£800
0.10	£1,522	£1,000	£1,300	£1,600
0.20	£2,969	£2,000	£2,600	£3,200
0.30	£4,344	£3,000	£3,900	£4,800
0.40	£5,651	£4,000	£5,200	£6,400
0.50	£6,893	£5,000	£6,500	£8,000
1.00	£12,237	£10,000	£13,000	£16,000

Annex 2: summary of approaches

Table 6: Summary of approaches with pros and cons

	Approach	Pros	Cons	Conclusion
	Alternative approaches			
	Taking a common currency based on Life Satisfaction: using wellbeing Cost Effectiveness Analysis across government decision-making	Enables all policy changes to be compared against their impacts on wellbeing	Does not fit with existing structure of the Green Book and economic decision-making	May be considered in for some areas where cost-effectiveness of wellbeing outcomes is relevant. Does not fit into existing structure.
	No monetisation	Already considered to a certain degree – with non-monetised impacts a greater focus of the revised Green Book	Does not allow impacts to be incorporated in monetisation where we have robust, causal effects	Continue to use where we do not have full confidence in size or causal effect of the impact. Does not need to be considered for monetisation of wellbeing.
	Incorporating subjective wellbeing in social cost benefit analysis			
Options for income conversion	Take income effects published in journals[77]:	-Considers only peer reviewed studies from high quality journals, meaning that peer reviewers have taken the judgement of robustness -Enables robust effect sizes to be incorporated in the existing structures of SCBA and the Green Book	-Inconsistency: slightly different methodology likely to be applied across each study. Value is sensitive to income effect which will be different across all studies. -Where we only have a subjective wellbeing effect size without the published study translating to monetised effects (for example, from a RCT estimating the wellbeing effects of a change) analysts cannot monetise. Such results, which may be the most	Discounted.

[77] Analysts use only the specific monetised values which have been published in a peer-reviewed academic journal. We would communicate these with the price year they are in, leaving analysts to adjust using GDP deflator and real income growth as needed.

			robust, cannot be included in key CBA metrics such as BCR and NPV.	
	Using a coefficient on income based on cross-sectional regressions	-Enables robust effect sizes to be incorporated in the existing structures of SCBA and the Green Book	-Likely to overstate effect of income, since likely to be endogeneity in income effect.	Discounted.
	Using a coefficient on income based on exogenous change in income – in the long run (lottery wins data over lifetime)	-Aims to address endogeneity in income estimate	-Lottery wins considered to be WTA values, so valuations are likely biased upwards compared to WTP values which tends to be used in analysis. - As a result, values achieved are much higher than 'traditional' values achieved through RP, SP and other methods aiming to estimate WTP. Values implausibly high within the SCBA framework.	Discounted.
	Using a coefficient on income based on exogenous impact of income – in the short run (lottery wins data in short run)	-Aims to address endogeneity in income estimate	-Questions around the generalisability of the lottery wins variable and the data is now quite old (2002) as the BHPS stopped collecting data on lottery wins.	Discounted.
	Using a coefficient on income based on WTP	-Aims to address endogeneity in income estimate -Assess noticeable changes in income and WTP -Consistent with theoretical approach of other values used in SCBA	-Coefficient on income is at the highest end of coefficients in the literature	Included in range for value.
	Using QALY value	-Consistency with existing values used in Government – and will be updated to continue consistency as these are updated	-Will need to be updated as research and discussions on the VSL and QALY values are completed over the coming years.	Included in range for value.

Functional form	Using a log functional form for the conversion to income	-Fits with functional form demonstrating the declining marginal rate of substitution of income	-This functional form may not apply in reverse: unit monetary values sensitive to size of wellbeing effect, which may not reflect society's preferences.	Recommended approach for sensitivity, where life satisfaction changes are >0.5 (0-10 scale).
	Using a linear functional form	-Simple and transparent – always the same approach so easily applied across appraisal. -Policy values are 'reference independent': there is not always an obvious pivot point for whether effects are positive or negative, and where effects may accumulate over time/policies.	-Plenty of evidence that losses hurt more than gains, and that noticeability/visibility matter, which a single figure obscures. -However, the asymmetric impacts of a gains and losses can still be captured in the wellbeing effect sizes, to which the monetisation approach is then applied.	Recommended approach.

Annex 3: Robust estimates of wellbeing impact[78]

This text appears as Box 6 in the Wellbeing Supplementary Green Book guidance

To draw out the causal impact on any outcome, there are several general principles which apply, summarised below and in Annex A3. These are an important consideration for all robust evaluation. There are additional considerations when using subjective wellbeing evidence.[79]

General principles for robust, causal estimates:

In general, our confidence tends to be highest:

- in estimates from **well-designed randomised control trials** where wellbeing has been measured;
- where there are **naturally occurring conditions** that replicate randomisation such as a natural experiment, randomised encouragement (instrumental variable approach), threshold randomisation (regression discontinuity approach). This often requires longitudinal data, but this is not always the case (e.g. instrumental variables). For example, expansion in education, lottery wins, stock market crashes, opening up Norwegian tax records, regulatory changes.

There is only a small number of these, however the data is becoming more readily available. Annex A2 draws out a number of studies where estimates have been drawn from well-designed randomised control trials or 'natural experiments'.

In the large majority of cases, we don't have data from randomised control trials or natural experiments: in most policy settings, the change in question is endogenous. In these cases, we have relatively more confidence in:

- Techniques using **believable sources of random variation similar to the policy intervention in mind** (prevalent techniques usually centred around an argued random source of variation include Dif-in-Dif, Regression Discontinuity, IV-estimation, exclusion restriction estimation). The better studies allow us to control for the impact of exogenous individual unobserved factors that have caused the treatment of interest (including hereditary factors), or exogenous area specific factors when using geographic information. In all cases though, judgments about the causal structure will be involved.
- As discussed in section 4.3 above, this would need to be backed up with a clear logic, consistent with theories from social science in general; and ideally where it is possible to triangulate with other estimates, including e.g. market prices, and across sources of variation (within-person, between-person, across regions, across countries, across time, across similar changes in slightly differently worded variables).

We have confidence in some **cross-sectional regressions** only where the effect is backed up with theories or evidence from wider social or medical science **and** this holds across regions, time, etc – as above. This should be reasonably judged.

We have less confidence in:

- a one-off **cross-sectional** analysis of choices which are deliberated, including for example, diet, choices of purchases.

[78] Principles developed from HMT, Social Impacts Task Force and What Works Centre for Wellbeing Roundtable on Wellbeing Appraisal (2018).
[79] See OECD Guidelines on measuring subjective wellbeing http://dx.doi.org/10.1787/9789264191655-en

- estimates of a change in a global measure such as life satisfaction where the change is marginal (e.g. additional trips to a cinema) rather than a change in state or frequent visits.

We have almost no confidence *in* very small trials on relatively trivial interventions using measures with high measurement errors.

Caution should be applied when interpreting studies:
- Selection bias may occur where the policy variable is correlated with unobserved factors about the individual;
- Reverse causality (leading to bias) will occur if happier people select into policy programme rather than the other way around.

Principles for robust, non-biased estimates in wellbeing studies:
- Consider measurement error: subjective wellbeing and policy variables need to be measured accurately or else will lead to bias;
- Marginal changes (e.g. one-off visits and events) are less likely to produce realistic figures for evaluative wellbeing;
- Appropriate controls. This will depend on the factor of interest, but most likely include the key drivers of wellbeing: permanent factors not caused by the factor we are interested in or transient factors which in theory could be caused by the factor of interest as long as it is measured before.[80] Fixed effects should be used where possible.

[80] Note that multicollinear variables will reduce accuracy of our estimates (increased standard errors)

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