Exploring the wellbeing impact of NCS

An interim report

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Contents

About NCS

National Citizen Service (NCS) is a Government-backed initiative that brings together young people aged 15-17 from different backgrounds, giving them the chance to take part in a programme of personal and social development, and community action. Evaluations of NCS to date have measured the experience of participants, as well as four key impact areas:

- Teamwork, communication and leadership.
- Community involvement.
- Transition to adulthood.
- Social mixing.

Key objectives and summary findings of this interim report:

The main NCS 2015 evaluation report from Ipsos MORI[1] states in the summary on page 4:

"The value for money analysis has been undertaken in line with the principles of the HM Treasury Green Book, and seeks to monetise (as far as possible) the resource costs and benefits associated with the scheme. ***NCS has the potential to deliver a number of benefits that are not currently possible to monetise, such as wellbeing****."*

NCS Trust is constantly evaluating the structures, delivery and impacts of the NCS programme on graduates. As part of this ongoing process, NCS wants to explore fully all

[1] Cameron, D., Stannard, J., Leckey, C., Hale, C., & Di Antonio, E. (2017). *National Citizen Service 2015 Evaluation Main report*. Ipsos Mori; Cabinet Office

NCS impacts – particularly the impact on wellbeing – and how these can be monetised as part of the Value for Money (VfM) analysis of the programme.

Jump, working alongside the NCS Trust, has developed a complementary valuation of the NCS 2015 programme in order to quantify the NCS programme's estimated impact on wellbeing and value for money for NCS participants. This is an interim report of the key findings to date.

The Wellbeing Valuation approach taken in this paper, and explained in detail below, evaluates the **entire wellbeing impact** of the NCS programme on NCS participants. As a result, the figures below **include** the benefits estimated in Ipsos MORI's 2015 evaluation as well as values for the wellbeing impacts. **The VfM results from the two reports must not be added together, as this would lead to double-counting.**

In summary, we have found that the NCS 2015 programme produces impacts of between **£3,556** and **£5,748** of value per NCS graduate, depending on the programme season (spring, summer or autumn). This works out to a **benefit-to-cost ratio** of between **2.20** and **4.15**, when the costs of delivering the NCS programme for each graduate are accounted for.

This means that, for every £1 spent on the NCS programme in 2015, there is a return to society of between £2.20 to £4.15, depending on the programme season (spring, summer or autumn).

This Wellbeing Valuation is derived working with the existing data from the IPSOS Mori 2015 Evaluation report (Jump were not able to collect primary data). As a result The Wellbeing Valuation approach taken in this paper, and explained in detail below, evaluates the immediate short term impacts of the NCS programme (experienced 3 months after participation in NCS) on the NCS participant's life satisfaction. This methodology has the advantage of capturing a wide range of immediate, valuable benefits to NCS participants.

These headline impacts are presented in the table below and followed by a more detailed explanation of both the theoretical and technical approach taken. Appendix 2 includes full technical explanation of the methodology and results taken to produce this complementary (VfM) estimate of the NCS programme.

How these short term, immediate wellbeing impacts of the NCS programme combine with the future impacts of the NCS programme will form part of the Jump final report. To this end, the the final report will contain further analysis on the following areas:

1. Exploration of the constituent drivers of life satisfaction from the NCS programme e.g. increased confidence, resilience, leadership skills, trust in other people.
2. Investigation of the medium to long-term impacts of NCS on areas such as movements into higher education, volunteering and improved health.

Work on higher education is ongoing but there are some initial, positive findings on NCS

graduates moving into higher education.

From a comparison of NCS participants with UCAS (University College Admissions Service) data on national UK acceptances; NCS participants appear to have a higher acceptance rate to higher education than non-NCS participants. This impact is seems to be highest (most positive) in graduates from areas of the country that have low participation in higher education.

This is a potentially important finding for the longer term impacts of NCS on social mobility and will add significant new value to the Social Cost-Benefit and VfM analysis of the NCS programme.

The final report will contain a more comprehensive write up and analysis of both these areas of impact and how they combine into a new, complementary VfM estimate for the NCS programme.

Table 1 – VfM assessment (Cost-Benefit Analysis) of the NCS programme at the individual NCS graduate level

NCS programme	Life satisfaction improvement versus control group	Delivered cost of programme (per graduate)*	Value of life satisfaction improvement (per graduate)	Benefit-to-cost ratio (return on investment)
Spring	0.46	£1,520	£5,246	3.45
Summer	0.30	£1,620	£3,556	2.20
Autumn	0.51	£1,385	£5,748	4.15

*All programme costs are taken from the Ipsos MORI NCS 2015 evaluation report.

A technical and theoretical description of the VfM approach taken in this report

The main NCS 2015 evaluation report[2] undertook a comprehensive analysis of the impact of participation in the NCS programme on a wide range of outcomes related to the four key impact areas. The evaluation employed a propensity score matching (PSM) method to assess the impact on outcomes. After controlling for a range of background characteristics at baseline, trends in outcomes were measured for NCS participants against a control group of those expressing interest in the NCS programme, but who did not participate. A large number of outcomes were found to be statistically different between the NCS group and the control group (and the large majority of these showed a positive difference in favour of the NCS participants).

Two of the outcomes were used to perform a value for money (VfM) assessment: (i) the impact on **volunteering behaviour**; and (ii) the impact on **leadership skills**. The 2015 evaluation proceeds to undertake a VfM analysis of these outcomes "*in accordance with the principles of the HM Treasury Green Book, and seeks to monetise (as far as possible) the resource costs and benefits associated with the programme*".

While these are important outcomes to measure and value for VfM analysis, there are limitations to this approach, as the authors of the NCS 2015 evaluation report acknowledge. ("*NCS has the potential to deliver a number of benefits that are not currently possible to monetise, such as wellbeing.*")

This interim report therefore seeks to provide a complementary analysis of VfM by assessing some of the other reported wellbeing outcomes from the 2015 evaluation report with the aim of providing a fuller picture of the VfM of the NCS programme. This is an **interim report** on VfM and the next phase of this work is to understand the constituent drivers of the wellbeing value and to further investigate the longer-term benefits to the graduates themselves and wider society.

[2] Cameron, D., Stannard, J., Leckey, C., Hale, C., & Di Antonio, E. (2017). *National Citizen Service 2015 Evaluation Main report*. Ipsos Mori; Cabinet Office.

The VfM approach taken in this interim report on wellbeing and life satisfaction impact

Measuring wellbeing as a 'non-market impact' for the purposes of Social Cost-Benefit analysis has three approaches recommended by the HM Treasury Green-book[3].

1. Stated preference
2. Revealed preference
3. Subjective wellbeing approach

In order to produce an initial review of wellbeing impact and valuation for this interim report, Jump had to work with the existing data from the Ipsos MORI 2015 Evaluation report and was not able to collect primary survey data. This meant that the life satisfaction approach (approach 3 above) was the only approach possible for this interim report on the 2015 impacts of the NCS programme. A recommendation for the future evaluation of NCS impact and evaluation will be included in the final report. and in future the most effective mix of all three of the approaches above for NCS.

Wellbeing and in particular subjective wellbeing, life satisfaction valuation is an emerging area of policy evaluation. HM Treasury Green Book states:

*subjective wellbeing measurement remains an **evolving methodology** and existing valuations are not sufficiently accepted as robust enough for direct use in Social Cost Benefit Analysis.*

However, an additional paper by HM Treasury on Valuation Techniques for Social Cost-Benefit analysis in 2011[4] states that:

*subjective wellbeing measurement may soon provide a complement to the more traditional economic approaches. And in the meantime it **can play an important role in challenging decision makers to think more carefully about the full range of impacts of their proposed policies. First and foremost, to demonstrate that the valuation of non-market goods, and specifically the measurement of well-being**, is a live research issue across government and academia, and one which Departments should be challenged to pursue further.*

And further recommends:

[3] HM Treasury. (2011). *The Green Book: Appraisal and Evaluation in Central Government* (pp. 1–114). HM Treasury; Organisation for Economic Co-operation and Development (OECD). (2006). *Cost-Benefit Analysis and the Environment: Recent Developments*. Paris, France.

[4] Fujiwara, D., & Campbell, R. (2011). Valuation Techniques for Social Cost-Benefit Analysis: Stated Preference, Revealed Preference and Subjective Well-Being Approaches. A Discussion of the Current Issues (pp. 1–76). London, UK: HM Treasury.

If the decision relates to a multi-billion pound programme or to regulation that will impose costs of similar scale upon industry, it is clearly worth devoting much more resource to ensuring that the valuations of the non-market benefits (and costs) are more accurate than would be appropriate for a smaller scheme.

Given the scale of the UK Government's commitment to NCS, and with the implications across the wider Youth Social Action sector, we believe application of the subjective wellbeing approach is both appropriate and relevant in this case. It is also consistent with the advice in the HM Treasury 2011 report on Social Cost-Benefit analysis.

Monetising the wellbeing impact

As set out in best practice guidelines, such as the HM Treasury Green Book and the OECD Guidelines[5], the valuation of wellbeing outcomes for the purpose of VfM analysis should be conducted using **money metric measures of welfare change.** What this means is that for individuals the value of outcomes should be measured as **compensating surplus** or **equivalent surplus.** In sum, these approaches to money metrics require that values be assessed by looking at the impact of an outcome (*x*) on an individual's welfare (where welfare refers to overall wellbeing and quality of life in the broadest sense) and then to calculate the amount of money that would create the equivalent impact on welfare as an outcome (*x*).

In conducting VfM analysis in line with the Green Book and other best practice guidelines, we are interested in the impact that the outcomes of the NCS programme have on participants' welfare, and then in monetising this impact on welfare. Within this framework, there are two potential ways to approach this:

(i) **Constructed VfM** measures a range of outcomes related to a programme and values each of the outcomes separately by assessing the impact on welfare for individuals. In the final stage, the values of each of the outcomes are aggregated within and across individuals. Both positive and negative outcomes must be included and care must be taken when aggregating to avoid double-counting.

(ii) **Unconstructed VfM** instead measures the impact of the programme as a whole directly on welfare and monetises this impact. The theory and rationale behind this approach is that all impact evaluation is essentially concerned with the impact an outcome has on the individual's welfare. Given this, we can focus directly on welfare impacts as the main measure of interest. Going straight to the final measure of interest (welfare) has a number of benefits. While in unconstructed VfM, it can be difficult to understand which outcomes are contributing to overall VfM, it has the advantage that – provided that we have a robust measure of wellbeing – we do not need to determine and measure all

[5] HM Treasury. (2011). *The Green Book: Appraisal and Evaluation in Central Government* (pp. 1–114). HM Treasury; Organisation for Economic Co-operation and Development (OECD). (2006). *Cost-Benefit Analysis and the Environment: Recent Developments*. Paris, France.

possible outcomes of the programme (the final welfare measure picks up *all* outcomes both positive and negative). It also crucially deals with the issue of double-counting internally (if an outcome is only experienced once by an individual it will only show up once in the improvement of their lives).

It is key to note that both approaches to VfM will, in theory, give the same VfM results if the constructed approach includes every outcome that matters in the analysis. The currently endorsed and employed set of valuation methods in the Green Book and international best practice guidelines (e.g. revealed preference valuation, stated preference valuation, wellbeing valuation, QALY valuation) can be used to conduct either constructed or unconstructed VfM analysis.

The 2015 NCS evaluation is a constructed approach to VfM. **Our contribution in this addendum is to conduct an unconstructed VfM assessment of the NCS programme**. We are able to conduct an unconstructed VfM thanks to the inclusion of a number of wellbeing outcomes (happiness, anxiety, purpose and life satisfaction) in the original evaluation. These are four measures of wellbeing with a rich history of research (Deaton 2008; Kahneman et al. 2003; Richard Layard 2009; O'Donnell et al. 2014), and which are endorsed by the UK Wellbeing Programme and used by the ONS (Office of National Statistics). In this methodology we therefore take the outcomes as having a natural ordering or hierarchy; the four wellbeing measures sit at the top of a pyramid in that they have intrinsic value, with all of the other NCS outcomes sitting underneath with instrumental value.

Over the past 15 years economists have developed methods for valuing happiness and life satisfaction (the Wellbeing Valuation method) in a manner consistent with compensating and equivalent surplus money metric methods (Fujiwara 2013; Layard et al. 2008; Welsch 2007). The Wellbeing Valuation (WV) method is now recognised as a method for making relative assessments of VfM in the HMT Green Book and as an alternative method for valuation by the OECD (2013 & 2017). It has been used in research and VfM analysis by the UK Government (e.g. Department for Culture, Media and Sport (DCMS), Department for Work and Pensions (DWP), Cabinet Office)[6], and the Government of Canada (Public Health Agency Canada[7]), and has featured in over 80 academic publications in economics.

We focus on life satisfaction in this analysis based on the assumption that life satisfaction is a robust measure of wellbeing (Layard 2009) and that the PSM estimator in the Ipsos MORI

[6] Bakhshi, H., Fujiwara, D., Lawton, R. N., Mourato, S., & Dolan, P. (2015). *Measuring Economic Value in Cultural Institutions* (Cultural Value Project) (p. 103). London, UK: Arts and Humanities Research Council.
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Lawton, R. N., & Fujiwara, D. (2016). Living with aircraft noise: Airport proximity, aviation noise and subjective wellbeing in England. *Transportation Research Part D: Transport and Environment*.
[7] Latif, E. (2012). Monetary valuation of cardiovascular disease in Canada. *Economics and Business Letters*, *1*(1), 46–52. doi:10.17811/ebl.1.1.2012.46-52

2015 evaluation provides a robust estimate of the impact of the NCS programme on life satisfaction. Under these two key assumptions, the unconstructed VfM analysis will provide a full assessment of VfM accounting for *all* of the wellbeing impacts of the NCS programme for participants and dealing with the issue of double-counting. There may well be additional impacts to other groups in society, such as businesses and government, and these form part of our ongoing work.

Performing the unconstructed VfM requires an estimate of the impact of the NCS programme on life satisfaction (which comes from the 2015 evaluation) and an impact of money on life satisfaction for the same sample group (this allows us to measure the amount of money that has the equivalent impact on life satisfaction as the NCS programme in order to derive the money metric value). The latter requires estimating separately because it was not part of the 2015 evaluation.

In theory, the estimate of the impact of money on life satisfaction should come from the same group of individuals as in the NCS sample (or should be representative of them). We can derive this estimate from a national data set that contains data on money and wellbeing. We use the British Household Panel Survey (BHPS) which contains data on lottery wins and wellbeing. Lottery wins allows us to derive a robust causal estimate of the impact of money on life satisfaction because lottery winnings are, by law, randomly assigned [8]. It is possible to focus only on a sample of 15-17 year olds in the analysis of the BHPS, but this sample is too small to derive statistically significant results. By using a sample comprised of 15-25 year-olds there is enough sample size in the BHPS to derive statistically significant results. We, therefore, use the results from the 15-25 year-old sample.

The following caveats apply. This sample now includes people in age groups that are not representative of the NCS programme participants, which may imply that our estimate of the impact of money on life satisfaction is not representative of 15-17 year-olds. However, models conducted using a younger age group (e.g. 15-18; 15-20; 15-23 etc) broadly showed similar results to the 15-25 year group, although the results were not statistically significant. Therefore, we can be reasonably confident that the results for the 15-25 year group provide a good proxy for the impact of money on life satisfaction for 15-17 year-olds (the NCS core group).

Therefore, the unconstructed VfM results presented here should be seen as providing a first-order estimate of the full VfM for participants of the NCS programme and future research should be aimed at improving these estimates.

[8] For a full description of the methodology see Fujiwara and Dolan (2016). Our method here uses the same model as in this paper but restricted to 15-25 year-olds. Dolan, P., & Fujiwara, D. (2016). Happiness-Based Policy Analysis. In M. D. Adler & M. Fleurbaey (Eds.), The Oxford Handbook of Well-Being and Public Policy.

Unconstructed VfM results

The NCS 2015 programme produces between £3,556 and £5,748 of value per NCS graduate. This works out to a benefit-to-cost ratio of between 2.20 and 4.15 when costs of running the NCS programme are accounted for. This means that for every £1 spent on the NCS programme in 2015 there is a return to society of £2.20 to £4.15.

The 2015 evaluation found that the impact on life satisfaction varied depending on the season of the programme with the autumn cohort having the highest impact and the summer cohort having the lowest impact on life satisfaction. The headline impacts are presented in the tables below. A full, technical explanation of the methodology and results taken to produce this new VfM assessment of the NCS programme can be found in Appendix 2 and will be included in more depth in the final report.

Table 1 – Value for Money assessment (Cost-Benefit Analysis) of the NCS programme at the individual NCS graduate level

NCS programme	Life satisfaction improvement versus control group	Delivered cost of programme	Value of life satisfaction improvement (per graduate)	Benefit-to-cost ratio (return on investment)
Spring	0.46	£1,520	£5,246	3.45
Summer	0.30	£1,620	£3,556	2.20
Autumn	0.51	£1,385	£5,748	4.15

Note: We calculate lower and upper bounds (using the 95% confidence intervals) on the valuations, and find that the NCS programme breaks even at the lowest lower bound (a cost-benefit ratio of 1.06 for summer) and gives a return of 5.64 using the highest upper bound (for the autumn programme).

The interpretation of these results is key and they differ in meaning to the VfM results in the 2015 evaluation in a number of respects. As stated above, these results represent an unconstructed VfM assessment of the NCS programme. By assessing and valuing the impact on individuals' wellbeing directly, we circumvent the need to value each of the outcomes separately; the unconstructed approach allows us to sweep up all of the outcomes that are important for individuals (both positive and negative) in one calculation. The two outcomes included in the VfM assessment in the 2015 evaluation (volunteering and leadership skills) are therefore both included in the unconstructed VfM.

This is one main reason why the benefit-cost ratios in the 2015 evaluation are lower than the benefit-cost ratios presented here, since many more positive impacts (in addition to volunteering and leadership skills) have been included in this study. A key implication of this is, therefore, that the results of the VfM analysis here and the VfM analysis in the 2015 evaluation **should not be added together** since this would lead to double-counting.

At the individual level, we find that the benefit-cost ratios increase by about 97% (a near doubling of the ratio) on average across the three programmes once the full set of outcomes has been accounted for in the unconstructed VfM analysis.

For the interpretation of the results there is an important question about what the life satisfaction question picks up. The life satisfaction question has been validated in many studies and it has been found to be highly responsive to many life circumstances, events and episodes (see Fujiwara and Campbell (2001) and Fujiwara and Dolan (2016) for a full discussion). The underlying assumption would therefore be that the life satisfaction responses and the unconstructed VfM analysis will have picked up all of the impacts of the NCS programme, including outcomes that were not included in the 2015 evaluation.

In the NCS 2 Years On (2YO) report, the life satisfaction improvement and impact does not seem to endure beyond the year participants take part in NCS. This does not mean that the value is lost as it is real and valuable experience for participants. However, it does lead to an important question about the long-term impacts of NCS.

If life satisfaction is a truly all-encompassing, comprehensive measure of wellbeing, then future outcomes such as impacts on higher education, employment and health will potentially have been internalised in individuals' responses to the life satisfaction questions. However, this would only be the case if people could accurately predict the future, longer-term effects of the NCS programme and also if they care about them now.

Both of these assumptions are questionable and may indicate that all future outcomes are not fully incorporated into the life satisfaction responses, and by extension into the VfM assessment. Therefore, while the unconstructed approach provides the mechanism for conducting a full VfM analysis, it may be that in the present context, it is only a full analysis of the short to mid-term impacts of the NCS programme.

If this is the case, then subsequent VfM calculations of the NCS programme would need to add the value of future impacts to the VfM values estimated here. These would capture, for example, movements into higher education, employment, volunteering and improved health.

This issue will be explored in more depth in the final report but at this stage we have been able to take an initial and indicative look at key areas:

1. Exploration of the constituent drivers of life satisfaction from the NCS programme e.g. increased confidence, resilience, leadership skills, trust in other people.
2. Investigation of the medium to long-term impacts on areas such as movements into higher education, volunteering and improved health.

Longer term impacts - work in progress on higher education

We hope that we have been able to demonstrate in this interim report the main benefits and limitations of this complementary VfM. The Wellbeing Valuation method has built on the Ipsos MORI report with an estimate of the immediate (3 months after participation) wellbeing impacts of the NCS programme on participants.

Work is continuing on the final report. However, an initial look at the longer term impact of NCS on movement of participants into higher education is showing positive results. The findings so far are:

- NCS participants seem to have a higher acceptance rate on average to higher education than non-NCS participants.

- The effect of NCS is highest (most positive) in quintiles 1 and 2 which are the areas of low participation in higher education. This is a potentially important finding for the longer term impacts of NCS on social mobility.

- There is potential to add significant value to the Social Cost-Benefit and VfM analysis of the NCS programme. We propose to monetise participation in the NCS by multiplying the average treatment effect of NCS participation on acceptance rate into higher education by the annualised earning premia and by the exchequer contributions (Walker & Zhu, 2013)[9] .

It is important to emphasise at this point that these are early findings and that this is an interim report. Further work will be undertaken for the final report to fully validate these findings and also to establish how much of this potential value from movement into higher education is additive to the life satisfaction and wellbeing valuation included in this report.

[9] Walker, I. & Zhu, Y. Department for Business, Innovation & Skills. (2013). *The impact of university degrees on the lifecycle of earnings: some further analysis.* (Research paper number 112). London.

In summary

This analysis builds on the 2015 NCS evaluation by Ipsos MORI by conducting an unconstructed VfM analysis using the results for the impacts of the NCS programme on life satisfaction.

- **We find that the NCS 2015 programme produces between £3,556 and £5,748 of value per NCS graduate.**
- **This works out to a benefit-to-cost ratio of between 2.20 and 4.15 when costs of running the NCS programme are accounted for.**
- **This means that for every £1 spent on the NCS programme in 2015 there is a return to society of £2.20 to £4.15.**

Since this is an unconstructed VfM assessment, it is a comprehensive assessment of the VfM of the NCS programme which includes the two outcomes that were included in the VfM assessment in the 2015 evaluation from Ipsos MORI (volunteering behaviour and leadership skills). This is partly why the benefit-cost ratios are larger in this report.

There are questions related to whether the VfM assessment here is able to pick up long-term impacts of the NCS programme, such as impacts on higher education, employment and health in later life, and it needs to be stressed that the results are contingent on the assumption that the models used to derive the impact of money on life satisfaction from a sample of 15-25 year-olds are representative of the NCS cohort. Whilst, on the latter we find no evidence to the contrary, future research should explore these issues in more depth.

This interim report on VfM will be accompanied by a final report published in due course. The additional work for the full report will focus on two key areas:

1. Exploration of the constituent drivers of life satisfaction from the NCS programme e.g. increased confidence, resilience, leadership skills, trust in other people.

2. Further and more comprehensive investigation of the medium to long-term impacts on areas such as movements into higher education, volunteering and improved health.

Initial work on higher education impacts seems to indicate that NCS participants have a higher acceptance rate to higher education than non-NCS participants. There is potential to monetise this impact and add significant value to the Social Cost-Benefit and VfM analysis of the NCS programme.

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Appendix 2: Full technical methodology of the wellbeing valuation approach

Wellbeing valuation derives robust value estimates in line with the welfare economic theory on valuation and now features as part of a number of guidelines such as the HM Treasury Green Book guidance and the OECD guidelines on measuring wellbeing (Fujiwara and Campbell, 2011; Green Book, 2011; OECD 2013, 2014).

The wellbeing valuation approach uses self-reported measures of wellbeing (subjective wellbeing) to measure an individual's welfare, using measures such as life satisfaction. The approach assesses the impacts of an outcome (e.g. participation in the NCS), and of income, on subjective wellbeing (SWB) and estimates a monetary value for that outcome. This reveals the amount of money that has the equivalent (exact same) impact on SWB as the outcome being valued and so represents the monetary value of the outcome. The Wellbeing Valuation method adheres to the welfare economic theory of valuation that underpins cost-benefit analysis (CBA) (Hicks and Allen, 1934) where the monetary value of a change in an individual's utility or wellbeing due to experiencing or consuming the good is measured as compensating surplus (CS) or equivalent surplus (ES) (Bockstael and McConnell 1980).

SWB questions are widely included in national surveys across the OECD with the UK being at the forefront where key wellbeing questions are now included in over 20 national surveys.[1] The wellbeing valuation method can be used to analyse data from these large national datasets and derive values for a wide range of different policy areas. Improvement in the life satisfaction score is taken as a proxy for wellbeing in line with best practice guidelines (Dolan and Fujiwara 2016; Layard 2009).

The main technical issue involved in estimating CS is that we have a robust estimate of the *causal effect* of income and the non-market good on life satisfaction. The impact of the NCS on life satisfaction has been estimated in the 2015 evaluation and will not be covered here, where we focus on the income variable. The income variable in life satisfaction models suffers from endogeneity due to reverse causality, selection bias and measurement error, which all tend to lead to *downward* bias in the income coefficient. To nullify this bias we use an instrumental variable (IV) approach, which eliminates the correlation between the error term and the income variable due to endogeneity. We apply a robust IV for income using lottery wins amongst lottery players. Lottery wins have been used in the SWB literature before by Lindahl (2002), Apouey and Clark (2009), Fujiwara (2013b) and Gardner and Oswald (2007) and here we closely follow Fujiwara (2013b).

[1] http://www.ons.gov.uk/ons/guide-method/method-quality/specific/social-and-welfare-methodology/subjective-wellbeing-survey-user-guide/subjective-well-being-frequently-asked-questions--faq-s-.html#13

The British Household Panel Survey (BHPS) provides extensive data on lottery playing in the UK and we use this data to conduct the IV model using the control function rather than the more traditional two-stage least squares (2SLS) estimation. The control function has the benefit that it can estimate causal effects with higher degrees of external validity than 2SLS. That is, for income we can estimate the causal effect for the sample population rather than the local average effect for the complier population, which is an unobservable population group. Under the control function we estimate a correlated random coefficient (CRC) model using lottery wins as an IV (Z) for household income and controlling for previous lottery wins. For previous wins, I sum annual lottery wins over all years in which the respondent was present in the data up to and including $t-1$. The model is set up as follows (dropping the time and individual subscripts for simplicity):

(1) $$LS = \pi + \beta_1 \ln(M) + \beta_2 X + \varepsilon$$

(2) $$\beta_1 = \alpha_1 + \vartheta_1$$

(3) $$\ln(M) = \pi + \gamma Z + \vartheta_2$$

so that,

(4) $$LS = \pi + \alpha_1 \ln(M) + \beta_2 X + \vartheta_1 \cdot \ln(M) + \varepsilon$$

Here the impact of income on life satisfaction is made up of a constant term and an individually unique term (ϑ_1). This is the unobserved heterogeneity and in essence, the term $\vartheta_1 \cdot \ln(M)$ in (4) removes the complier effect so that $E(\beta_1) = \alpha$ = the average effect of income for the sample. Equation (3) is equivalent to the first stage in 2SLS as it shows the relationship between the instrument (lottery wins) and income. Since M is endogenous in (1), ε and ϑ_2 are correlated, and under the assumption of heterogenous treatment effects ϑ_1 and ϑ_2 are also correlated. Therefore, ϑ_1 and ε in (4) are estimable from the error term from equation (3): $E(\vartheta_1|X, M) = \theta_1 \vartheta_2,\ E(\varepsilon|X, M) = \rho_1 \vartheta_2$. Equation (4) then becomes:

(5) $$LS = \pi + \alpha_1 \ln(M) + \beta_2 X + \theta_1 \hat{\vartheta}_2 \cdot \ln(M) + \rho_1 \hat{\vartheta}_2$$

where $\hat{\vartheta}_2$ is the predicted error term from (3).

α_1 in (5) represents the causal effect of a log-point change in household income on life satisfaction for the average person in the sample. We restrict the sample to 15-25 year olds in the BHPS.

We find that for this sample group α_1 = 1.28.

As derived in Fujiwara (2013) the value (compensating surplus) of the NCS is estimated as:

(6) $$CS = M^0 - e^{\left[\ln\left(M^0 - \frac{\beta_{NCS}}{\alpha_1}\right)\right]}$$

Where β_{NCS} = the impact of the NCS on life satisfaction which comes from the 2015 evaluation, and where α_1 = 1.28 (from the control function model in (5)) and M^0 = sample median household income which is £25,700 for 15-25 year olds in the BHPS. Equation (6) provides the results for the Spring, Summer and Autumn NCS programmes (using the estimated β_{NCS} for each programme – note that the estimate of β_{NCS} differs across the programmes) set out in Table 1 of the report.

Table 1 – Value for Money assessment (Cost-Benefit Analysis) of the NCS programme at the individual NCS graduate level

NCS programme	Life satisfaction improvement versus control group	Delivered cost of programme	Value of life satisfaction improvement (per graduate)	Benefit-to-cost ratio (return on investment)
Spring	0.46	£1,520	£5,246	3.45
Summer	0.30	£1,620	£3,556	2.20
Autumn	0.51	£1,385	£5,748	4.15

Note: We calculate lower and upper bounds (using the 95% confidence intervals) on the valuations, and find that the NCS programme breaks even at the lowest lower bound (a cost-benefit ratio of 1.06 for summer) and gives a return of 5.64 using the highest upper bound (for the autumn programme).