



## **The Tax Education Gap**

Tax knowledge and  
attitudes to tax in the UK

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# Abstract

The tax system is notoriously difficult to navigate, with simplification still a regular topic of conversation across the tax community. HMRC statistics show that over 750,000 people filed their tax returns late in 2018<sup>1</sup>, but an outstanding question is to what degree this is down to lack of understanding among the wider UK populace. Tax affairs aren't covered in state school education, and late or improperly filed returns and notorious complexity suggest a knowledge gap is present for a proportion of the UK general public.

To provide evidence on the extent to which there is a "tax education gap", Deloitte designed a survey questionnaire to objectively measure levels of personal tax knowledge, as well as gain insights on interactions with the UK tax system and attitudes to taxation. Commissioned through polling company YouGov, this survey was then directed to a nationally-representative sample of over 2,000 adults in the UK.

This explanatory note sets out in further detail how the survey questionnaire was designed, and how responses to tax knowledge-focused questions were used to construct an objective measure of tax knowledge: the "Tax Education Score" (TES). It also sets out the full survey results, and documents the econometric analysis which assess whether there is a relationship between tax knowledge and two important attitudes to taxation: perceptions of fairness in the UK tax system, and preferences for tax and spend.

The survey results produced several interesting findings. Firstly, levels of tax knowledge in the UK are generally low, particularly in commonplace topics such as tax codes and the top rate of income tax. Age, income and educational attainment are found to be key drivers behind the level of tax knowledge. Finally, tax knowledge is also found to be robustly and positively associated with perceptions of fairness in the tax system, and willingness to pay more tax.

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<sup>1</sup> HMRC (2018). "On-time Self Assessment returns break the record again". <https://www.gov.uk/government/news/on-time-self-assessment-returns-break-the-record-again>

# Executive Summary

- There is relatively little evidence on levels of tax literacy and knowledge in the UK. To provide evidence, a survey questionnaire was designed by Deloitte to ascertain information on levels of knowledge of tax, interaction with the UK tax system, as well as attitudes to taxation in the UK. The survey was directed towards a nationally representative sample of 2,119 adults aged 18+.
- Only 19% of people reported having a Personal Tax Account (PTA). When compared to official HMRC statistics for the number of PTAs, this low proportion suggests that there is a gap between awareness of PTAs and the reality. However, of those who said they had a PTA, the vast majority of those who did find them either “very helpful” or “somewhat helpful” (81%).
- Responses to survey questions on tax knowledge were used to objectively construct a Tax Education Score (TES). Most people achieved low scores; from a maximum possible score of 30, the weighted average was 10.6, and nearly half (46%) achieved a TES of 10 or under. 18-24 year olds achieved the lowest average TES of 6.9, while over 55s achieved the highest average TES of 12.3.
- An area of strength in tax knowledge was sources of additional income and whether these are taxable. For example, 79% of people correctly answered that £4,000 earned from letting out a second property to holidaymakers (on top of regular employee income) would be taxable. However, knowledge of arguably more important topics – such as tax codes and the top rate of tax – was far poorer. Only 54% correctly identified the meaning of tax code 1250L.
- Respondents were also asked to rate their own knowledge of tax before answering the tax-related questions. Self-rated knowledge was broadly in line with actual knowledge: those rating their knowledge as “Very Good” achieved an average TES of just over 15 (albeit only half of the maximum potential score), while those rating their knowledge as poor achieved an average score of just over 7.
- There were large majorities in favour of increasing tax education. 78% of people either strongly agreed or agreed that in general, people in society do not know enough about tax. 76% of people either strongly agreed or agreed that there should be more tax education in schools.
- Perceptions of fairness in the UK tax system were fairly split; a plurality of people indicated that they held “Neutral” views (30%), with a slightly higher proportion saying that the tax system is “Unfair” (24%) versus “Fair” (16%). 16% responded that they did not know.
- The majority of people would rather keep taxes as they are (43%) rather than increasing them to extend and improve public services (26%), in contrast to previous research on this topic. For the half of people who were asked about their own taxes changing, a greater proportion favoured maintaining taxes (47%) rather than increasing taxes (21%).
- Econometric analysis of the survey results shows that age, gross income, educational attainment and occupation are likely to be key drivers behind tax knowledge, regardless of model specification chosen. Whether a person has recently completed Self Assessment was also found to have a positive effect on tax knowledge.
- Econometric analysis has also provided evidence of a relationship between tax knowledge and attitudes to taxation. A positive association was found between the TES and perceptions of fairness in the UK tax system, and a higher TES was also found to be associated with a greater willingness to pay more tax.

# 1. Research Methods

## 1.1 The Omnibus survey

The dataset used in this study was generated from an Omnibus survey<sup>2</sup> conducted by UK polling company YouGov. A survey questionnaire, designed by Deloitte, was directed towards a nationally representative sample of 2,119 adults aged 18 and over, with fieldwork taking place in late May 2019. To ensure that the survey sample was nationally representative, responses were also weighted by characteristics such as gender, age, education level, occupation and region.

It was anticipated prior to survey fieldwork that responses to questions on a topic such as tax would be significantly affected by respondents' political allegiances and their levels of political engagement.<sup>3</sup> As the survey questionnaire used in the study features questions on taxation, a political Omnibus survey approach was chosen over a standard Omnibus survey. For research and analysis purposes, the results from the political Omnibus survey can be treated in the same manner as those taken from a regular Omnibus. This is because respondents who participated in the political Omnibus are from the same "pool" of people who respond to a standard Omnibus, rather than for example being from a separate group of people who are asked political questions.

In practice, this means that the survey sample was not only weighted to ensure it had the right balance of respondents by characteristics such as age and gender, but was also weighted by the number of people who did and did not vote in the most recent General Election (at the time of writing, the 2017 UK General Election), as well as the right balance of people who are, and are not interested in politics. This weighting also appropriately reflects the shares of people who voted for different political parties, as well as voting for Remain or Leave during the EU Referendum 2016.

## 1.2 Survey design

A survey questionnaire was designed by Deloitte to ascertain information on levels of knowledge of tax, the degree of interaction with the UK tax system, as well as attitudes to taxation in the UK. The survey questionnaire consists of four constituent sections:

- 1) The first section features questions designed to elicit **socio-demographic and other background information**, such as gender, age, socioeconomic group, employment status, marital status, highest level of education achieved, region of residence, and whether the respondent has any children. In addition to the information from these questions being used to ensure a nationally representative sample, the inclusion of these questions has provided a series of natural control variables which are likely in their own right to influence both knowledge of and attitudes to taxation.
- 2) The second section features questions designed to ascertain information on **respondents' direct interactions with the UK tax system**. These include questions on whether respondents have a Personal Tax Account (PTA)<sup>4</sup>, which can then be broadly compared to the official HMRC statistics for the number of PTAs in existence. For those reporting that they do have a PTA, a further question was asked on whether they find their PTA useful. Respondents were also asked whether they have recently submitted a tax return through Self Assessment.

<sup>2</sup> An omnibus survey is a method of quantitative research whereby survey questions on multiple topics are combined, with results collected from multiple participants as part of the same study.

<sup>3</sup> Political engagement in this context refers to the previous decision to vote or not to vote, and the level of interest (or disinterest) in politics. In practice, this means that the survey sample was balanced both by those voting for different political parties, but also balanced by those with different levels of political engagement. For the latter, research from the British Election Study (BES) was used, with different responses to the question "How much attention do you pay to politics?"

<sup>4</sup> The Personal Tax Account (PTA) is an online resource launched in 2015 by Her Majesty's Revenue and Customs (HMRC). It is designed to enable people to view and make changes to their information online, and intended to help people manage their tax affairs through the account rather than telephoning or writing to HMRC.

- 3) The third section consists of a series of questions **designed to elicit respondents' knowledge of taxation and the UK tax system**, with a specific focus on personal taxes.<sup>5</sup> The first question in this section seeks respondents' views on their own knowledge of tax, with the remaining questions designed to test respondents' knowledge of tax. The responses to these questions have then enabled an objective measure of knowledge to be constructed, referred to as the "Tax Education Score" (TES). Knowledge is considered both in terms of general knowledge about UK tax rates and revenues, and specific aspects of tax policy.
- 4) The fourth section consists of a series of questions designed **to elicit respondents' views of and attitudes to tax**. This section consists of four questions: The second and third seek views on the level of tax education, and knowledge of tax in society. Finally, the fourth and fifth questions were designed to elicit perceptions on whether the tax system is fair or otherwise; and views on whether taxes should be increased, maintained or decreased.

### 1.3 The survey questionnaire

#### *Socio-demographic characteristics*

A number of questions on socio-demographic characteristics were included in the survey, both to ensure a nationally-representative sample and to provide control variables used in analysis linking the TES with attitudes to taxation. The chief characteristics captured are listed below;

- **Age**, measured in years. As a person's age increases, the likelihood that they will interact with the tax system increases; all things being equal, it would be expected that this experience would impart a greater level of tax knowledge.
- **Income**, measured by stated annual gross income. Having a higher income could act as a proxy for greater levels of interaction with the tax system, with this greater interaction imparting greater levels of tax knowledge. Income could also influence both attitudes to tax.
- **Education**, measured by the highest level of education achieved and grouped in three categories of Low Education, Medium Education and High Education.<sup>6</sup> The overall level of educational attainment achieved are likely to influence the ability to interact with and understand taxation.
- **Occupation**, using the two social grade<sup>7</sup> groupings of ABC1 and C2DE. Those in professional and managerial occupations might be expected to have higher levels of tax knowledge.

A number of other socio-demographic characteristics were captured through the survey. They include **gender**, **region** and **marital status**. **Employment status** was also captured, as experiences in or outside the labour force might be expected to influence knowledge of tax.

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<sup>5</sup> For this study, "personal tax" in the UK context was treated as Income Tax, National Insurance Contributions (NICs), Inheritance Tax (IHT), Capital Gains Tax (CGT) and Council Tax. The rationale for the focus on personal taxes is that respondents are more likely to have had experience of interacting with taxes such as Income tax and National Insurance Contributions (NICs) rather business taxes, such as Corporation Tax. However, taxes which are levied through businesses but where incidence is commonly perceived to fall on individuals or households, such as Value-Added Tax (VAT), are also considered in some questions.

<sup>6</sup> **Low Education** is grouped as those with no formal qualifications; Youth training certificate/skillseekers; Clerical and commercial; City & Guilds certificate; CSE grades 2-5; CSE grade 1, GCE O level, GCSE, School Certificate; Scottish Ordinary/Lower Certificate. **Medium Education** is grouped as those with Recognised trade apprenticeship completed; City & Guilds certificate – advanced; ONC; GCE A level or Higher Certificate; Scottish Higher Certificate; Nursing qualification (e.g. SEN, SRN, SCM, RGN); Teaching qualification (not degree); University diploma; Other technical, professional or higher qualification. **High Education** is grouped as those with a University or CNA first degree (e.g. BA, BSc and BEd); a University or CNA higher degree (e.g. MSc, PhD).

<sup>7</sup> Social grade is a classification system based on an individual's occupation, or at household-level the occupation of the chief-income earner. The six grade classification system was originally derived from the British National Readership Survey (NRS). The six grades are as follows: A: Upper middle class; B: Middle class; C1: Lower middle class; C2: Skilled working class; D: Working class; and E: non-working. This six grade classification system was originally derived from the British National Readership Survey (NRS).

*Interactions with the UK tax system*

After providing information on their socio-demographic characteristics, respondents were asked up to a maximum of four questions on their interactions with the UK tax system. Two questions focused on **whether the respondent has a Personal Tax Account (PTA)**; it could be thought that having access to a PTA may have the effect of indirectly imparting knowledge of UK taxation and influencing a user's views on the tax system, so it also acts as a useful control variable when assessing the drivers behind levels of tax knowledge. To assess whether the PTA is considered to be a success, respondents who stated that they had a PTA were also asked **how helpful they found the services and accessibility of their PTA**, with responses set on a five-point Likert scale<sup>8</sup>, ranging from "Not at all helpful" to "Very helpful".

An additional two questions focused on whether respondents had **submitted a Self Assessment tax return to HMRC in the past year**. The majority of UK individual taxpayers are typically not required to complete a return each year; this may be because their sole income is generated through a full-time job for which their tax is paid by their employer through the Pay As You Earn (PAYE) system, or due to personal income and investment allowances and exemptions. However, those individuals who have other, sufficiently large sources of income or gains are likely to have had to complete a tax return, becoming more tax-aware in the process; the inclusion of this dummy variable seeks to control for this indirect education effect. Those respondents reporting that they had submitted a return were then asked **why they had submitted a tax return**, with possible responses including making profits through self-employment, or reporting capital gains.

*Knowledge of taxation and the UK tax system*

Following questions capturing their socio-demographic characteristics, and their level of interaction with the tax system, respondents were then presented with a series of questions designed to test their understanding of taxation and the UK tax system. Before this however, respondents were firstly asked to **rate their own understanding of tax**, with responses based on a five-point Likert scale ranging from 'Very Good' to 'Very Poor'; respondents could also indicate not being sure. The inclusion of this self-rated knowledge question has thus enabled direct comparisons between self-rated knowledge and the level of actual knowledge as measured by the TES.

A review of the relatively sparse literature on tax literacy suggests that designing and choosing questions to determine levels of tax knowledge is largely arbitrary; at the same time, putting forward an excessive number of overly-complex questions would have raised the risk of survey fatigue or raised the risk of a disproportionately large number of unenlightening "don't know" responses. In light of this, the survey questionnaire used in this study covers various aspects of personal tax in the UK, reflecting where relevant changes in the tax system resulting from devolution, and utilising a multiple-choice or true or false framework. A full list of the tax-related survey questions can be found in Annex B of this note.

In order to objectively assess the level of tax knowledge held by each respondent, an **overall "Tax Education Score" (TES)** has then been calculated by aggregating the number of correct responses to the individual questions designed to test levels of tax knowledge. More specifically, a correct answer was assigned a score of one, with incorrect answers and "don't know" responses being assigned a score of zero; respondents could ultimately achieve a maximum score of 30. The TES has then been used to firstly objectively assess levels of tax knowledge across the UK, and then secondly to see whether there are any associations between tax knowledge and certain attitudes to tax. For example, whether those with a higher TES are more likely to view the UK tax system as being fair rather than unfair; this is discussed in more detail in the next subsection.

*Views of and attitudes to tax and the UK tax system*

Finally, respondents were presented with a series of questions designed to elicit their views and attitudes to taxation and the UK tax system. These questions can be broadly disaggregated into two groups. The first group concerned attitudes to the **whether the provision of tax education**

<sup>8</sup> The Likert scale is a psychometric scale for which possible response options, either numeric or verbal, cover a range of opinions on a topic. Typically, respondents provide their level of agreement to a particular statement, choosing from a symmetric, pre-populated set of responses.

**should be increased, and whether society in general knew enough about tax.** Respondents were presented with the following statements and then asked the degree to which they agreed or disagreed, with possible responses set on a Likert scale.

- *"There should be greater provision of education on tax in schools."*
- *"In general, people in the UK do not know enough about tax."*

The second group concerned **perceptions of fairness in the UK tax system** and **preferences for tax and spend**. For the former, respondents were presented with the following statement: *"A tax system which is fair will distribute money from rich to poor, treat people and activities on a similar basis, and meet taxpayers' expectations."* How fair would you say the UK tax system is? Respondents were then asked to provide a score for fairness on a scale between 1 and 10, with 1 as "Very Unfair" and 10 as "Very Fair".

For the latter, respondents were firstly asked a question on whether **they would prefer taxes to be increased, reduced or be left as they are**. This question was purposefully worded in a similar manner to a question which features in the annual British Social Attitudes (BSA) survey.<sup>9</sup> Recent BSA findings suggest growing public support for higher taxes in order for government to spend more on health, education and social benefits;<sup>10</sup> the latest version suggested that 60% of respondents supported higher taxes. However, the wording of this particular question has been modified for the survey, by presenting this question either in terms of taxes increasing or decreasing in a *general sense*, or in terms of the respondents' *own taxes* increasing or decreasing. Half of survey respondents randomly received the following question:

- *People have differing views on whether it is more important to reduce taxes or keep up government spending. How about you? Which of these statements come closest to your own view?*
  - o *Taxes should be increased, in order to extend and improve public services*
  - o *Things should be left as they are*
  - o *Taxes should be cut, even if it means some reductions in public services*
  - o *Don't know*

The other half of respondents instead randomly received the following question:

- *People have differing views on whether it is more important to reduce taxes or keep up government spending. How about you? Which of these statements come closest to your own view?*
  - o *I would prefer my taxes to be increased, in order to extend and improve public services*
  - o *I would prefer my taxes to be left as they are*
  - o *I would prefer my taxes to be cut, even if that means some reductions in public services*
  - o *Don't know*

The objective of including these differently-worded versions of the same question was to examine whether the level of support for higher taxes in general remains similar when respondents are presented with the prospect of having to pay a greater amount of tax themselves.

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<sup>9</sup> The British Social Attitudes Survey (BSA) is an annual statistical survey conducted in Great Britain by National Centre for Social Research (NatCen) since 1983. It was not conducted in 1988 or 1992. The survey is directed towards over 3,000 people each year and seeks to generate respondents' views on what it is like to live in Britain and how they think Britain is run.

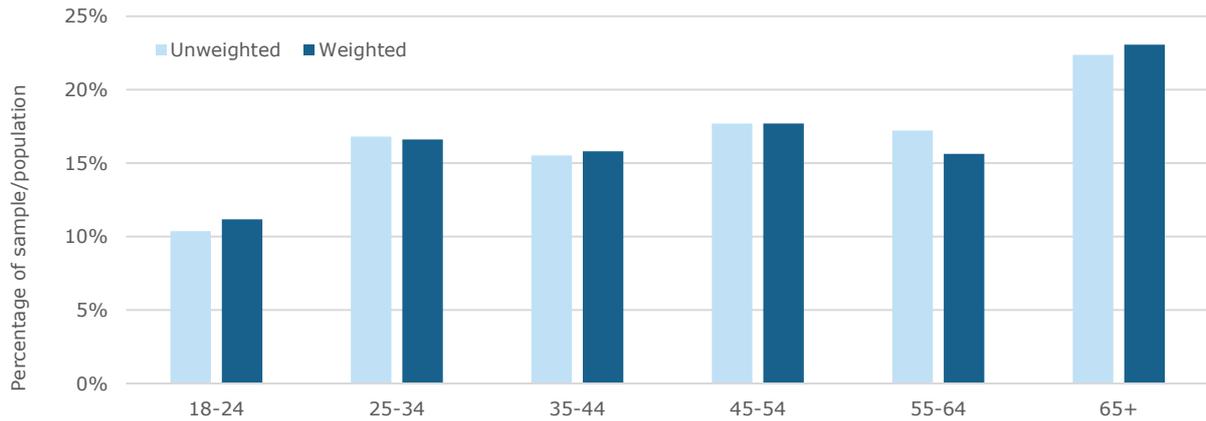
<sup>10</sup> NatCen, Nov 2018. Do people really want to pay more tax? <http://www.natcen.ac.uk/blog/do-people-really-want-to-pay-more-tax>

# 2. Dataset

## 2.1 Descriptive Statistics

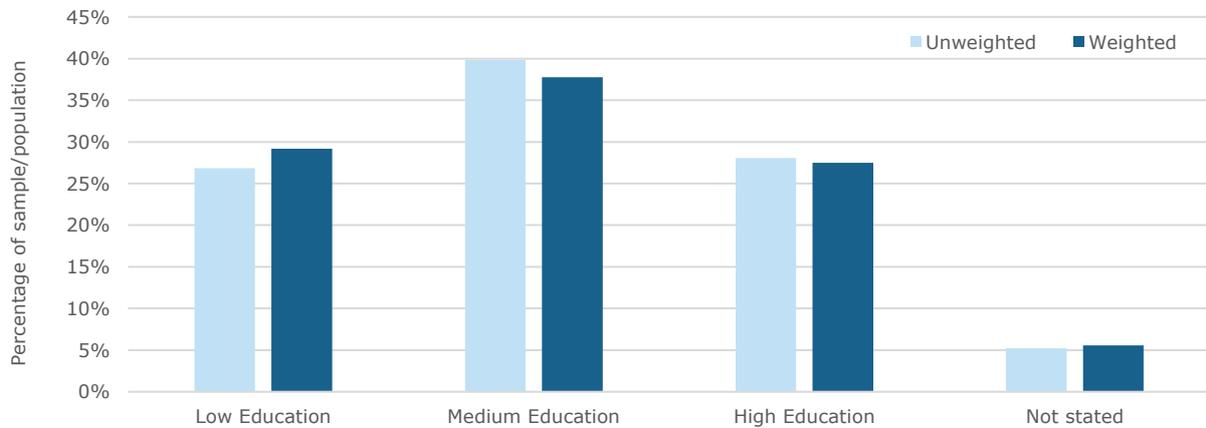
As expected, the dataset generated from the YouGov Omnibus survey is balanced and reflects the UK population in a number of dimensions, including by region, age and gender. The following charts show the unweighted and weighted proportions of the 2,119 respondents by the major characteristics. Distributions for the other captured characteristics can be found in Annex A.

Figure 1: Distribution by age group



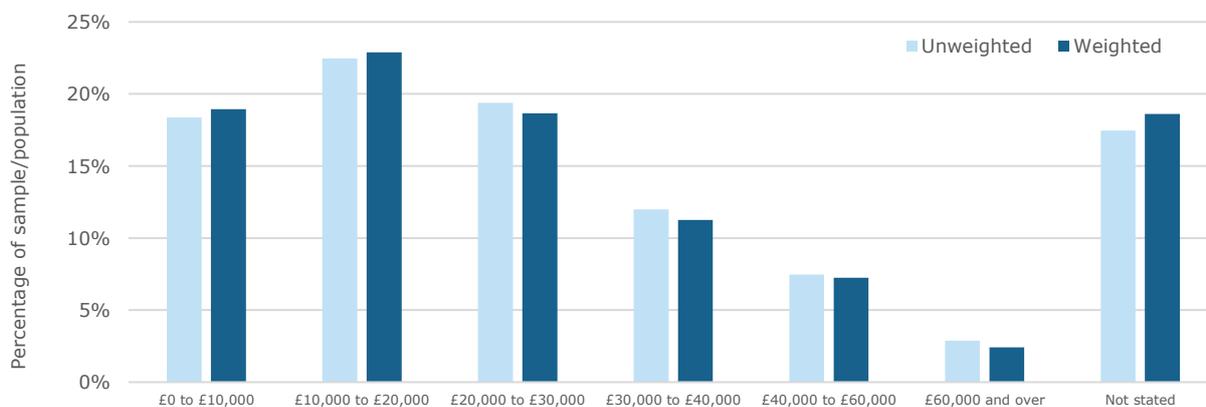
Source: YouGov, Deloitte analysis

Figure 2: Distribution by highest education achieved



Source: YouGov, Deloitte analysis

Figure 3: Distribution by gross income



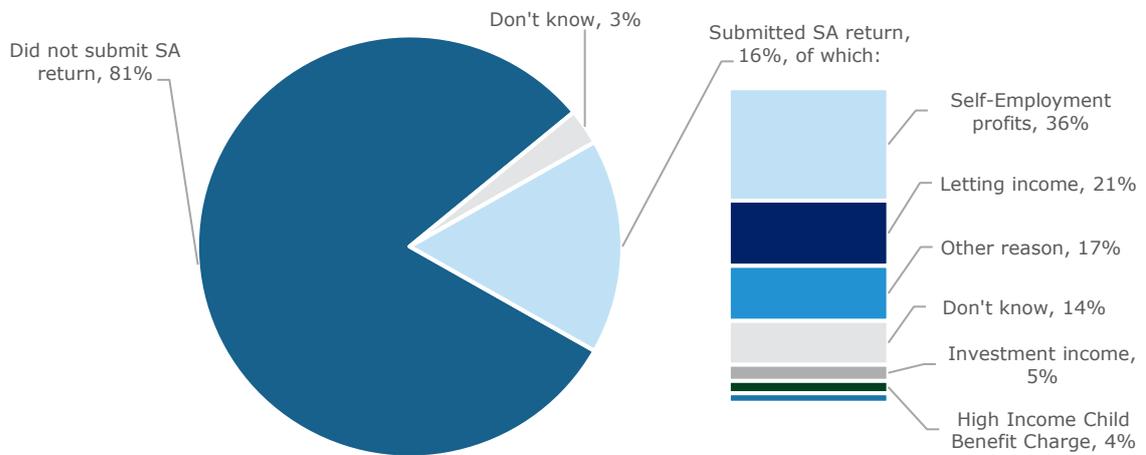
Source: YouGov, Deloitte analysis

# 3. Results

## 3.1 Interactions with the tax system

Figure 4 below shows firstly the (weighted) proportions of people who reported submitting a Self Assessment tax return in the past year, and secondly the stated reasons for why respondents completed Self Assessment. As might be expected, only a minority of people reported completing and submitting a tax return in the past year (16%). From those who did submit a tax return, declaring profits earned through self-employment was the most common reason for doing so (36%); however, a not-insignificant share of people who did submit a return did not know why they had done so (14%).

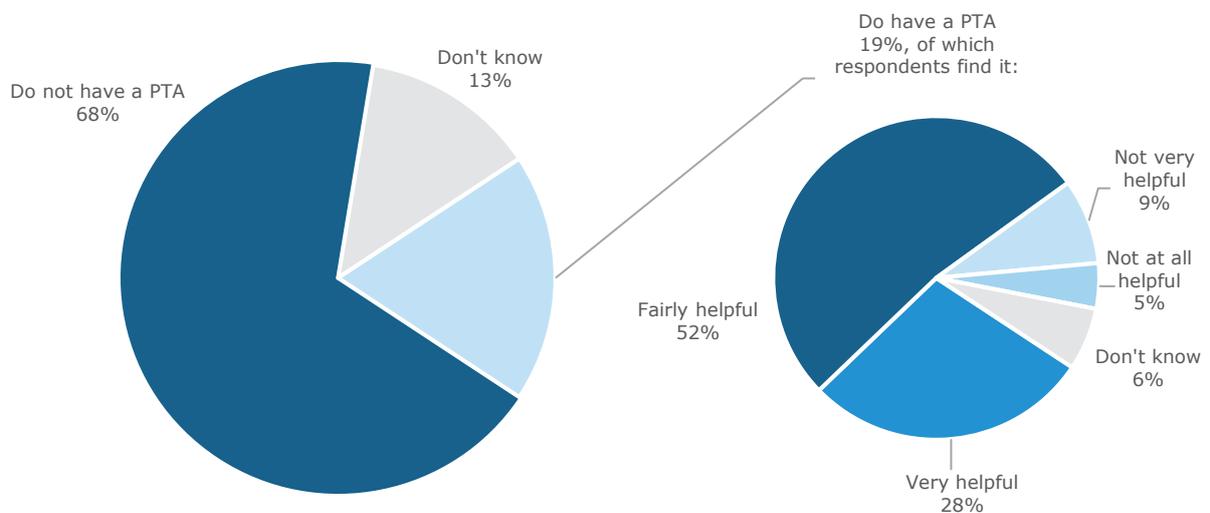
Figure 4: Reported completion of Self Assessment in the past year, and reasons for doing so, weighted



Source: YouGov, Deloitte analysis

Figure 5 below shows the proportion of respondents reporting whether or not they had a Personal Tax Account (PTA), and for those who do, how useful they find their PTA. While only a minority did have a PTA (19%), the vast majority of those who did found them either “very helpful” or “somewhat helpful” (81%).

Figure 5: Completion of Self Assessment in the past year, and reasons for doing so, weighted

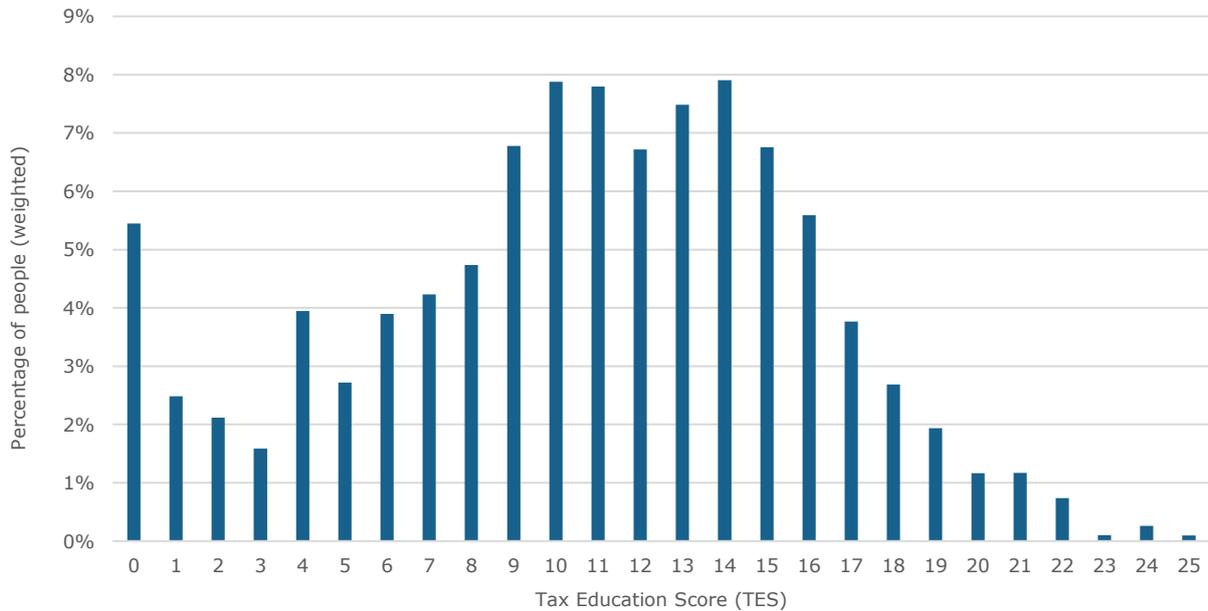


Source: YouGov, Deloitte analysis

### 3.2 Knowledge of taxation and the UK tax system

Figure 6 below shows the distribution of the Tax Education Score (TES) by proportion of the population on a nationally-representative basis; in other words, the proportions of respondents achieving different scores have been weighted. The weighted average TES was 10.6; the maximum score achieved was 25; and just under 83% of people achieved a TES of 15 or under. The distribution is also somewhat skewed by the disproportionate share of people who achieved a score of zero (just over 5%).

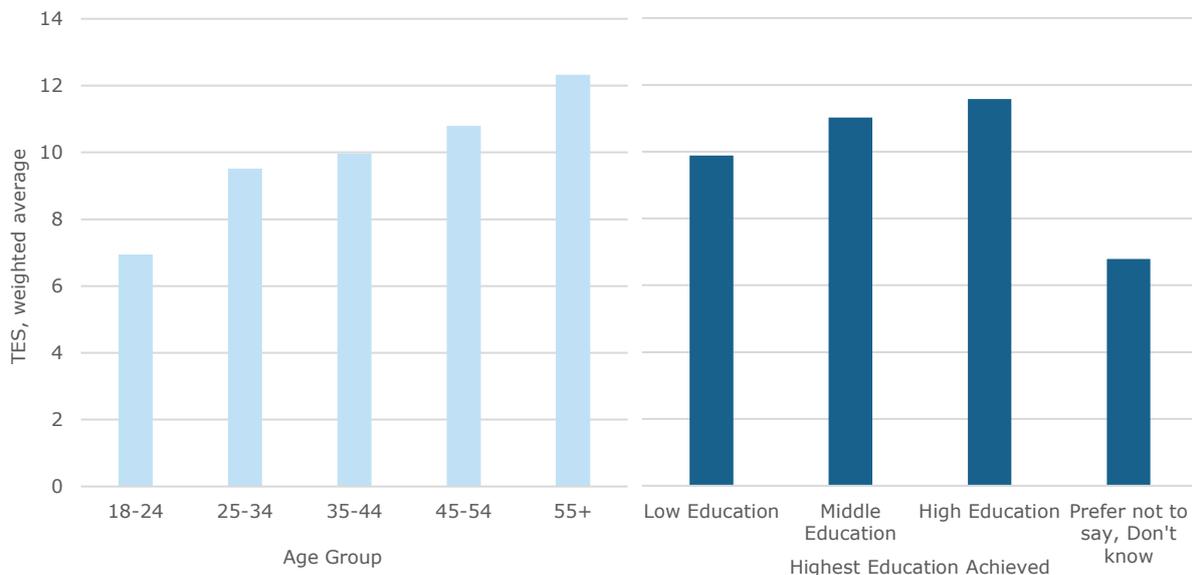
Figure 6: *Distribution of TES, weighted*



Source: YouGov, Deloitte analysis

Before undertaking further analysis, explored in the next section, there appears to be a correlation between the level of tax knowledge and two notable factors: age and education. Figure 7 below shows the weighted average TES by age group and the highest level of education achieved. The weighted average TES for 18-24 year-olds was 6.9; in contrast, those aged 55 and over achieved a weighted average of 12.3. Similarly, those in the Low Education category and those did not know their highest education attainment (or preferred not to say) achieved weighted averages of 9.9 and 6.8 respectively; in contrast, those with a High Education achieved a weighted average of 11.6.

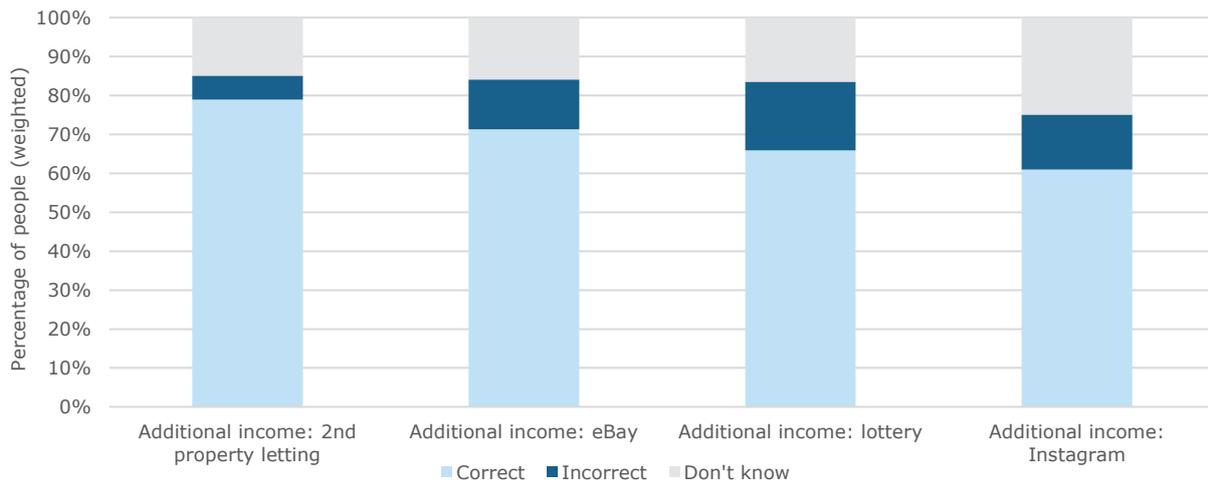
Figure 7: *Weighted average TES by age group and highest level of education achieved*



Source: YouGov, Deloitte analysis

The full list of tax knowledge questions and the breakdown of correct and incorrect responses for each tax knowledge question can be found in Annex B of this paper. However, one notable area of strength in tax knowledge concerned sources of additional income and whether they are taxable. A number of survey questions focused on an individual earning £20,000 per year before tax, earned entirely through a full-time job, and then some additional income that they could earn in any given year. A selected number of additional income sources included income from renting out a spare room on Airbnb; letting income for a second property let out to holidaymakers; income from selling unwanted items on eBay; and advertising income earned from being an influencer on Instagram. Figure 8 below shows the breakdown of responses for these selected questions, for which there was a high share of correct answers.

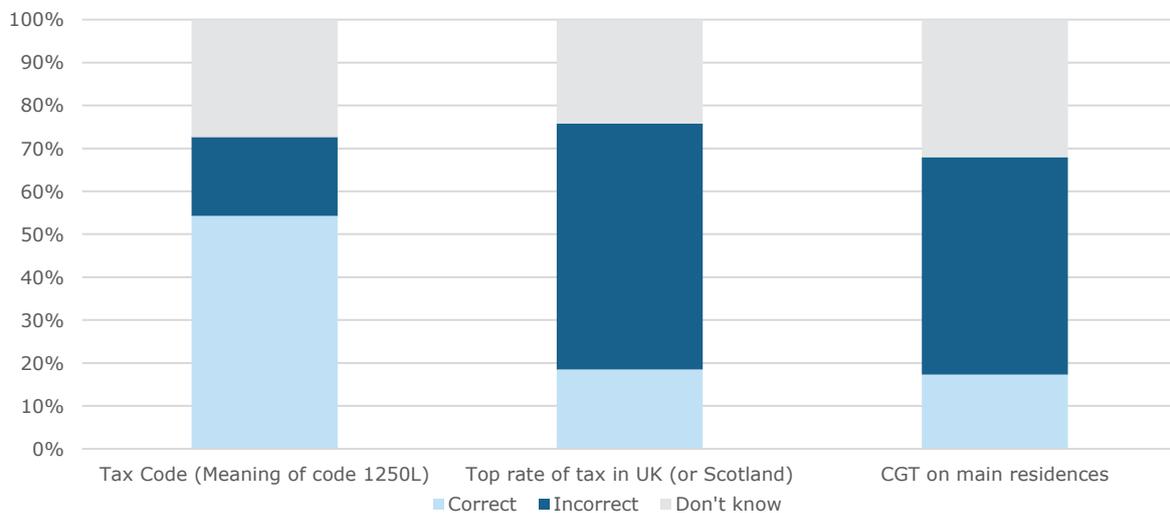
Figure 8: Selected tax knowledge questions on sources of additional income, breakdown of responses



Source: YouGov, Deloitte analysis

In contrast, people performed comparatively poorly on tax knowledge questions focusing on arguably more commonplace and important topics. For example, survey respondents were asked about the meaning of tax code 1250L (S1250L in Scotland, or C1250L in Wales), indicating that the taxpayer has allowances of £12,500 which will be set against their earnings to calculate PAYE tax. Respondents were also asked about the top rate of income tax in the UK (with respondents in Scotland asked about the top rate of tax there instead), and whether Capital Gains Tax (CGT) is due on the sale of a main residence property (if the property sold for more than was paid for it). Figure 9 below shows the breakdown of responses to these questions; only 54% correctly understood the meaning of tax code 1250L.

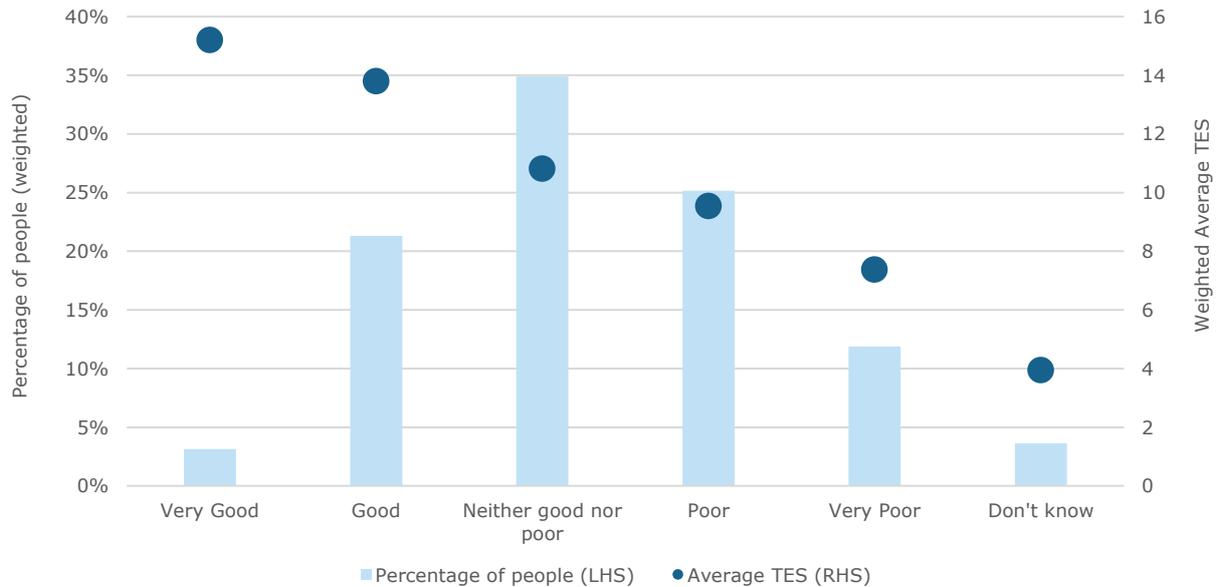
Figure 9: Selected tax knowledge questions on tax code 1250L, the top rate of tax and whether Capital Gains Tax (CGT) is due on a main residence



Source: YouGov, Deloitte analysis

Before answering any tax knowledge questions, respondents were given the opportunity to rate their own knowledge of tax. Figure 10 below shows firstly the proportions of people reporting their own knowledge of tax, ranging from “Very Good” to “Very Poor”, and secondly the weighted average TES achieved by each group. While only 3% reported that their knowledge was “Very Good”, the weighted average score for this group was the highest at just over 15. In contrast, 12% reported their own knowledge as “Very Poor” and they achieved an average score of just over 7. Self-rated knowledge therefore appears to be broadly in alignment with actual knowledge; that being said, even those who believed their knowledge to be “Very Good” only achieved an average score of just over half the maximum total.

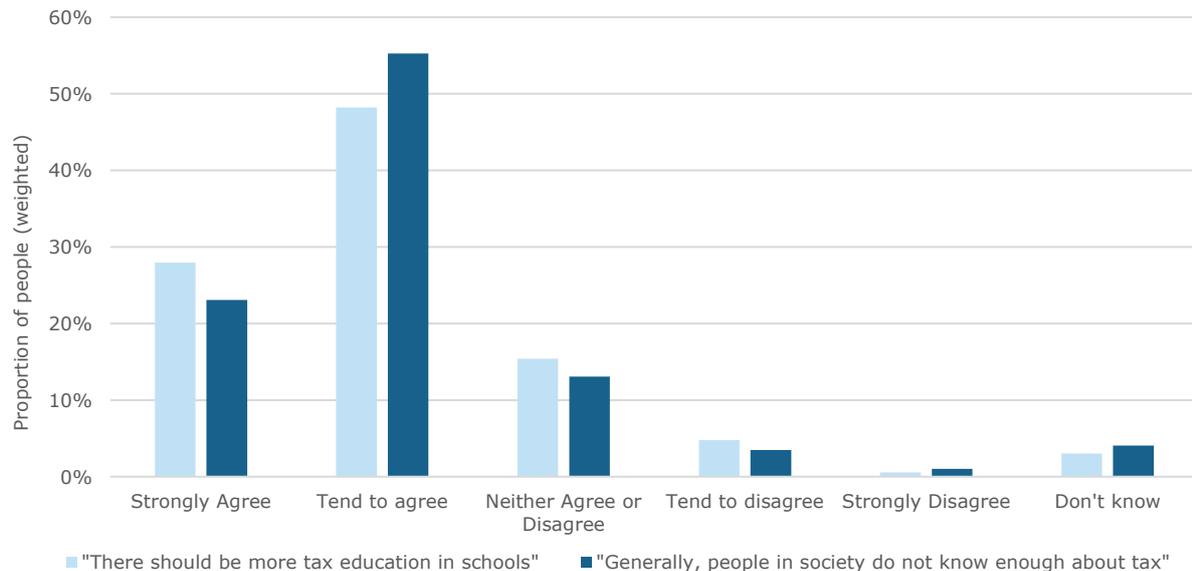
Figure 10: Self-rated knowledge of tax and average TES



Source: YouGov, Deloitte analysis

Figure 11 below shows responses to the two questions focusing on tax education and society. There are clear majorities in favour of increasing tax education in schools, and the notion that people in society do not know enough about tax. 76% of people either “strongly agreed” or “agreed” that there should be more tax education in schools; similarly, 78% of people either “strongly agreed” or “agreed” that generally, people in society did not know enough about tax.

Figure 11: Views on tax education and knowledge of tax in society

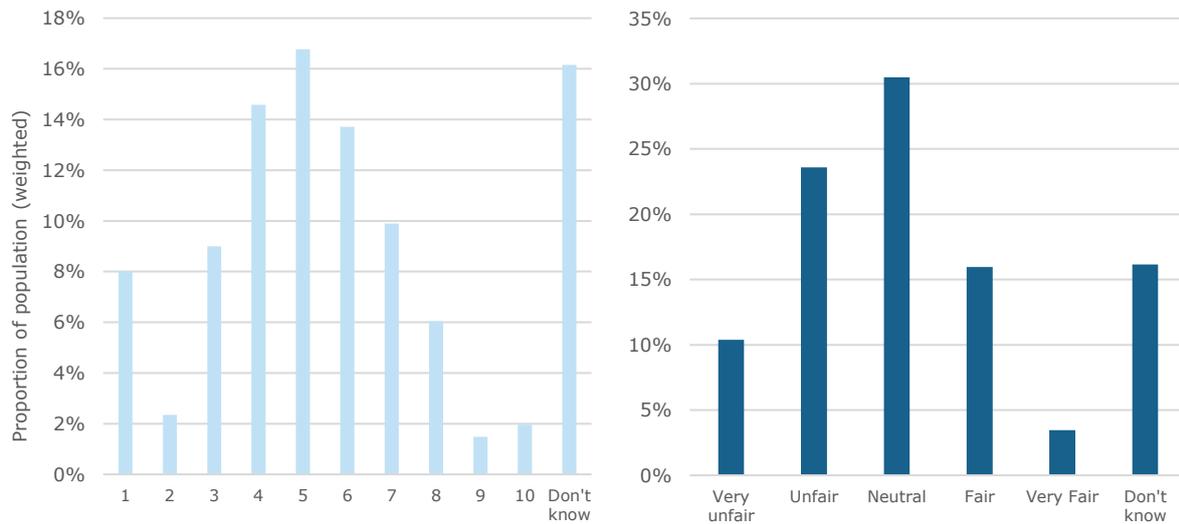


Source: YouGov, Deloitte analysis

### 3.2 Attitudes towards taxation and the UK tax system

Figure 12 below shows the proportions of people reporting their views on the fairness of the UK tax system; in the survey, respondents scored the fairness of the UK tax system with a value between 1 and 10. For further analysis purposes, these scores have been condensed into five categories, as follows: responses of 1 and 2 classed as "Very Unfair"; 3 and 4 were classed as "Unfair"; 5 and 6 classed as "Neutral/Neither fair or unfair"; 7 and 8 classed as "Fair"; and 9 and 10 classed as "Very Fair". A plurality do not view the UK tax system as either fair or unfair (30%), with a slightly greater share viewing the tax system as unfair (24%) rather than fair (16%); in addition, a significant proportion of people responded that they did not know (16%).

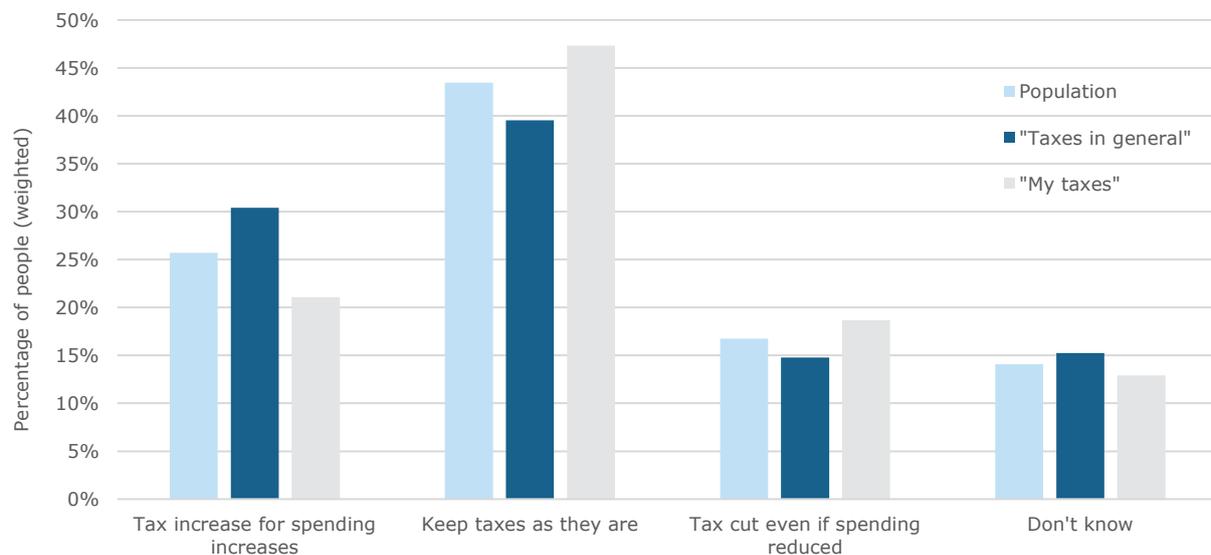
Figure 12: Perceptions of fairness in the UK tax system (original responses and condensed), weighted



Source: YouGov, Deloitte analysis

Finally, Figure 13 below shows the breakdown of different responses to the questions on whether taxes should be reduced, maintained ("should be left as they are") or increased. A plurality of the population stated that they would prefer taxes to be kept as they are (43%), with a slightly higher proportion favouring higher taxes for higher spending (26%) compared to reducing tax even if it meant public spending cuts (17%). However, when these proportions are disaggregated into those who were asked about taxes in general versus "my" taxes, these proportions differ. For example, a smaller proportion of those being asked about their own taxes favoured tax rises (21%) in comparison to those being asked about taxes in general (30%).

Figure 13: Perceptions of fairness in the UK tax system (original responses and condensed), weighted



Source: YouGov, Deloitte analysis

# 4. Model Specifications

## 3.1 Outcomes of interest, the form of the data and choice of models

This project seeks to assess the likely drivers behind the following three outcomes, using results taken from the Tax Education Gap survey questionnaire. The objective is to robustly determine which factors – including tax knowledge but also including other controlling factors such as age, level of education, completion of a Self Assessment return – are likely to influence these outcomes.

- Level of tax knowledge (through the Tax Education Score)
- Perceptions of fairness in the UK tax system
- Preferences for tax and spend

The level of tax knowledge is considered as both an outcome in itself, and as a potential driver behind both perceptions of fairness in the tax system, and preferences for tax and spend. In other words, the TES is identified as a dependent variable in its own econometric model but also acts as an independent variable in econometric models for the other two key outcomes.

All three of these survey outcomes take the form of discrete variables. In other words, these variables can only be represented by a finite number of values – and in the case of the latter two, from a finite set of choices. For example, while it is possible to obtain a TES of any value between 0 and 30, it is impossible for an individual respondent to obtain a score of 20.5. The presence of discrete variables influences the choice of models and specifications used in this study; in this instance there is less of a case to support applying the standard Ordinary Least Squares (OLS) model, as the presence of discrete dependent variables would violate the key OLS assumption that the model's residual errors follow a normal distribution. This assumption implicitly requires that the data be continuous, unbounded, and measured on an interval or ratio scale, as otherwise it is not possible to transform the data to ensure normally-distributed residual errors. In the absence of continuous dependent variables, an alternative set of model or models is therefore needed.

The model for the TES is the first to be considered. The TES calculated for each respondent takes non-negative discrete values of between 0 and 30 inclusive, and each respondent had approximately the same amount of time over the same fieldwork period to answer the survey questionnaire. Rather than being a reflection of a choice or series of choices, or a categorical variable, the TES could instead be considered a count variable. Given this, the application of a Poisson regression model, or the Negative Binomial regression model, is likely to be more appropriate to assess the influence of different driving factors on the TES. For the survey questions on perceptions of fairness in the tax system, and preferences for tax and spend, the responses are represented by ordinal values. In other words, the values can be placed in a clear order or scale. For example, a perception of fairness score of ten, indicating that the respondent believes the tax system to be extremely fair, is higher than a score of five, indicating a view of neutrality. This supports the use of the Ordered Probit and Ordered Logistic models to assess the relationship between the TES and perceptions of fairness, and preferences for tax and spend. Further information on the Poisson, Negative Binomial, Ordered Probit and Ordered Logistic models and why they have been chosen for each outcome variable is provided below.

## 3.2 The Poisson regression model

The Poisson distribution models the probability of a certain number of events occurring within a fixed period of time, following the formula below. Here,  $y$  is the number of events, and  $\mu$  is the incident rate, or the number of times a rare event occurs within a fixed period of time. A further property of this particular distribution is that its arithmetic mean and variance are equal.

$$\Pr(Y = y | \mu) = \frac{e^{-\mu} \mu^y}{y!} \text{ where } y = (0, 1, 2 \dots)$$

(1)

The Poisson regression model assumes that an outcome variable of count data follows the Poisson distribution and assumes that logarithm of its expected value can be modelled using a linear combination of a certain number of unknown parameters. In other words, the Poisson regression model can be used to determine the factors that influence the incident rate  $\mu$ , with  $\mu$  modelled on a series of independent variables, or regressors, alongside an intercept. The Poisson regression model then takes the following form, with  $\beta_1$  as the intercept and a total of  $k$  regressors. In this context, the period of time is universally set as one and therefore not set out explicitly below.

$$\mu = e^{(\beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k)} \tag{2}$$

The model and its coefficients are then solved using the Maximum Likelihood Estimation (MLE) approach. In other words, a likelihood function is derived and then parameters for  $\beta_1, \beta_2$  etc. are chosen so as to maximise this likelihood function. The logged likelihood function is as follows.

$$\ln[L(y, \beta)] = \sum_{i=1}^n y_i \ln[\mu(x'_i \beta)] - \sum_{i=1}^n \mu(x'_i \beta) - \sum_{i=1}^n \ln(y_i!) \tag{3}$$

However, an important caveat is that the Poisson regression model features the restrictive assumption that the variance and mean of the dependent variable are equal. The phenomenon of variance being greater than the mean, referred to as *overdispersion*, indicates either that relevant explanatory variables have been omitted, or that the Poisson model may not be appropriate. Overdispersion can be indicated by a higher sample variance in comparison to the arithmetic mean for the dependent variable – and can be more formally tested for using the Pearson Chi-Squared test.<sup>11</sup> If the model fails the test, this indicates that the model has a significant lack of fit.

### 3.3 The Negative Binomial regression model

Evidence of overdispersion indicates that an alternative specification may be needed. One such alternative is the Negative Binomial regression model, which also models count data but crucially relaxes the assumption that the mean must equal the variance. The Negative Binomial distribution represents a generalised version of the Poisson distribution which incorporates a ‘gamma noise variable’, which captures heterogeneity in the Poisson distribution caused by overdispersion. The distribution then takes the following form, where  $\nu$  is a scale parameter,  $y$  is the number of events and  $\mu$  is the incident rate.

$$\Pr(Y = y_i, \mu | \alpha) = \frac{\Gamma(y_i + \nu)}{\Gamma(y_i + 1) \Gamma(\nu)} \left(\frac{\nu}{\nu + \mu}\right)^\nu \left(\frac{\mu}{\nu + \mu}\right)^{y_i} \text{ where } y = (0,1,2 \dots) \tag{4}$$

The Negative Binomial model then takes the same form as the Poisson regression model, with  $\mu$  expressed as a function of multiple regressors ( $\beta_1, \beta_2, \beta_k$ ). Once again in this context, it is assumed that there is no exposure period, i.e.  $t$  is equal to one. As with the Poisson regression model, the model parameters are then solved using MLE. The logged likelihood function is set out below.

$$\sum_{i=1}^n \{ \ln[\Gamma(y_i + \nu)] - \ln[\Gamma(\nu)] - \ln[\Gamma(y_i + 1)] - \nu \ln \Gamma(1 + \nu^{-1} \mu) - y_i \ln \Gamma(1 + \nu^{-1} \mu) + y_i \ln (\nu^{-1}) + y_i \ln (\mu) \} \tag{5}$$

Both the Poisson regression and Negative Binomial regression models have been applied in this study<sup>12</sup>, with the Pearson Chi-Squared test, Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC) and other tests<sup>13</sup> used to determine which is the more appropriate to model the factors influencing the TES.

<sup>11</sup> The Pearson chi-square is defined as the squared difference between the observed and predicted values divided by the variance of the predicted value summed over all observations in the model; it is one when the variance is equal to the mean.

<sup>12</sup> These models were run in Stata using the *poisson* and *nbrreg* commands respectively.

<sup>13</sup> The Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) are estimators of the relative quality of statistical models for a given set of data. The model with the lowest estimated AIC or BIC is typically preferred.

### 3.4 The Zero-inflated Poisson model, and the Zero-inflated Negative Binomial model

It has already been observed that a slightly disproportionate share of the population achieved a TES of zero, as shown earlier in Figure 6; overdispersion is also likely to be present. Given this outcome, the application of either the Zero-inflated Poisson model or the Zero-inflated Negative Binomial model may be more appropriate. Both of these models are designed to accommodate non-negative, discrete count data which have excess counts of zero, by combining either the conventional Poisson or Negative Binomial distribution with the logit distribution.<sup>14</sup> As with the Poisson or Negative Binomial distribution models, the model coefficients are estimated through Maximum Likelihood Estimation (MLE).

Under both models, each observation follows one of two cases: in the first case, the count ( $j$ ) is zero; in the second case, the count is that predicted by either the Poisson or Negative Binomial model. The first case occurs with probability  $\pi$ , the second case with probability  $1 - \pi$ . Under the zero-inflated Poisson model, the probability distribution of the random variable  $y$ , in this context the TES, is then as follows:

$$\Pr(y_i = j) = \begin{cases} \pi_i + (1 - \pi_i)e^{-\mu_i} & \text{if } j = 0 \\ (1 - \pi_i) \frac{\mu_i^{y_i} e^{-\mu_i}}{y_i!} & \text{if } j > 0 \end{cases} \quad (6)$$

$\mu$  is once more modelled on a series of independent regressors, as previously set out in Equation 2 above. The term  $\pi$  is represented by a logistic link function, defined as per Equation 7 below. The exposure term "t" is set to zero in this context; there are set of  $k$  regressor variables, which may share or be the same as the regressor variables used to model  $\mu$ . Here,  $Z_1$  is also set to equal one to then act as an intercept (constant) term. Those regressors which are found to not produce statistically significant coefficients have been dropped, even if they produce significant coefficients in the main model.

$$\pi_i = \frac{\lambda_i}{1 + \lambda_i}$$

$$\text{where } \lambda_i = e^{(\ln(t_i) + \gamma_1 Z_{1i} + \gamma_2 Z_{2i} + \dots + \gamma_k Z_{ki})} \quad (7)$$

The probability distribution under the zero-inflated Negative Binomial model is similar to that of the Zero-inflated Poisson model. It differs through the inclusion of the Negative Binomial distribution, represented in Equation 8 below by the term  $G$ , which in turn is represented by the aforementioned Equation 4 above.  $\mu$  is again modelled on a series of independent regressors, as set out in Equation 2 above.

$$\Pr(y_i = j) = \begin{cases} \pi_i + (1 - \pi_i)G(y_i = 0) & \text{if } j = 0 \\ (1 - \pi_i)G(y_i) & \text{if } j > 0 \end{cases} \quad (8)$$

Both the Zero-inflated Poisson and Zero-inflated Negative Binomial models have been estimated<sup>15</sup> alongside the conventional Poisson and Negative Binomial regression models, with tests used to determine which provides the best fit for the observed TES distribution and values.

<sup>14</sup> The logit (or logistic) distribution is a continuous probability distribution applied in logistic regression when modelling categorical dependent variables, in this instance the probability of having a count of zero, or a positive non-zero count. The logit distribution resembles the standard normal distribution, with both having properties including being symmetrical and unimodal. The logit distribution has wider "tails" than the normal distribution, and is more appropriate for modelling the likelihood of extreme events.

<sup>15</sup> These models were run in Stata using the *zip* and *zinb* commands respectively.

### 3.5 The Ordered Probit and Ordinal Logistic models

Unlike the TES, which can be considered a count variable, the responses to the questions on perceptions of fairness in the UK tax system and preferences for tax and spend are not only discrete and ordinal in nature, but are limited to a small number of categories. In other words, the responses have a natural, meaningful and sequential order with an increasing value signifying either a perception of increased fairness, or willingness to pay less, the same or increased tax. However, the discrete values themselves hold no intrinsic meaning and it is not clear what true distance separates the different responses; for example, the true distance between the values of 1 ("Very Unfair") and 2 ("Unfair") is not necessarily the same as that between 3 ("Fair") and 4 ("Very Fair"). In addition, while there is an underlying unobserved response – perhaps for instance someone feels that the "true" perception of fairness is actually 3.5 – respondents are forced to choose either a rating of either 3 or 4.

Given this, there is a clear rationale against using a conventional linear Ordinary Least Squares (OLS) model. Alternatively, responses could be treated as separate nominal categories through a multinomial model, but this would involve inefficiently discarding the ranking information available. Moreover, the number of possible responses in both cases exceed two, ruling out the usage of either the standard Probit or Logistic regression models. The Ordered Probit or Ordered Logistic regression models are therefore more likely to be appropriate to assess the relationship between tax knowledge and the two attitudes. In both models, there is a discrete outcome variable  $Y$  which can take  $i$  number of outcomes, alongside an unobserved latent variable  $Y^*$ ; only  $Y$  is measurable, and is a function of  $Y^*$ . Moreover,  $Y^*$  has a series of threshold ("cut-off") points, represented by the  $\kappa$  term, whereupon if  $Y^*$  crosses a particular threshold then the observed  $Y$  takes a particular value. For example, if  $Y$  is represented by three outcomes, there are two cut-off points as follows:

$$\begin{aligned} Y_i &= 1 \text{ if } Y_i^* \leq \kappa_1 \\ Y_i &= 2 \text{ if } \kappa_1 \leq Y_i^* \leq \kappa_2 \\ Y_i &= 3 \text{ if } Y_i^* \geq \kappa_2 \end{aligned} \tag{9}$$

The latent variable  $Y^*$  can be estimated as a linear function of a number of independent variables ( $X_1, X_2, \dots$ ). There are  $k$  independent variables; the independent variables and their coefficients are collectively referred to through the  $Z$  term; there is also an error term  $\varepsilon$  to capture random disturbances. No intercepts are modelled as these are represented by cut-off points where  $Y^*$  is collapsed down to the discrete outcomes captured by  $Y$ . The difference between the two models arises from the differences in the link functions<sup>16</sup> applied, and by extension the distributions of the random disturbances. Probit models use the first link function shown below, where  $\Phi$  is the inverse cumulative distribution function of the normal distribution,  $\mu$  is the mean,  $\beta$  represents a series of coefficients and  $X$  is a vector of predictor variables.

$$\begin{aligned} \text{Probit link function: } g(\mu_i) &= \Phi^{-1}(\mu_i) = X_i' \beta \\ \text{Logit link function: } g(\mu_i) &= \ln\left(\frac{\mu_i}{(1 - \mu_i)}\right) = X_i' \beta \end{aligned} \tag{10}$$

Both models then proceed to model only the  $Z$  component, implicitly accepting that due to the error term,  $Z$  is not a perfect measure of  $Y^*$ . However, the assumption that the error term follows either a Normal or Logit distribution enables the probability of errors to be estimated.

$$\begin{aligned} Y_i^* &= \sum_{k=1}^K \beta_k X_{ki} + \varepsilon_i = Z_i + \varepsilon_i \\ \text{where } Z_i &= \sum_{k=1}^K \beta_k X_{ki} \end{aligned} \tag{11}$$

<sup>16</sup> The link function is used in generalised linear models, such as Probit and Logit models, to transform the probabilities of the levels of a categorical response variable to an unbounded continuous scale. This transformation then enables the responses to then be modelled against the independent (predictor) variables.

The probabilities for each discrete outcome, as well as the threshold points, are then estimated as follows using MLE.

$$\Pr(\text{outcome}_j = i) = \Pr(\kappa_{i-1} < \beta_1 x_{2j} + \beta_2 x_{2j} + \dots + \beta_k x_{ij} + \varepsilon_j \leq \kappa_i) \quad (12)$$

Returning to the aforementioned example of three discrete outcomes, the probability for each of these outcomes can then be expressed through the following equations below.

$$\begin{aligned} P(Y = 1) &= \frac{1}{1 + \exp(Z_i - \kappa_1)} \\ P(Y = 2) &= \frac{1}{1 + \exp(Z_i - \kappa_2)} - \frac{1}{1 + \exp(Z_i - \kappa_1)} \\ P(Y = 3) &= 1 - \frac{1}{1 + \exp(Z_i - \kappa_2)} \end{aligned} \quad (13)$$

A key assumption which applies for both the Ordered Probit and Ordered Logit models is the *proportional odds assumption* (POA), sometimes referred to as the *parallel lines assumption* or *parallel regressions assumption*. The proportional odds assumption has a null hypothesis that states the coefficients in the model are the same across response categories. In other words, the effect of the independent variables on the ordered outcome variable are the same as the outcome value changes. This assumption is often violated in practical settings, which is discussed below.

### 3.6 The Ordered Probit and Ordered Logistic models, when relaxing the proportional odds assumption

Rather than the proportional odds assumption holding in all instances, it is likely that the coefficients for different predictor variables will in actuality vary as the outcome – perception of fairness, or preference for tax and spend – changes. In this case, it is necessary to estimate a less restrictive model which allows some or possibly all coefficients to vary as the outcome value changes. After running the Ordered Logit models, the Brant Test<sup>17</sup> has been run to test whether the proportional odds assumption does in fact hold.

The user-written Stata command *gologit2*<sup>18</sup> has been used to estimate both Ordered Probit and Ordered Logit models in which the proportional odds assumption is relaxed. This command has the major advantage of being able to fit partial proportional odds models, where the proportional odds constraint is relaxed only for those variables where it is not justified.<sup>19</sup> Use of the *gologit2* command also offers the capacity to easily undertake the LR Test<sup>20</sup> for both the Ordered Probit and Ordered Logit models. The results from the Brant and LR Tests, alongside use of the Akaike Information Criteria (AIC) and Bayesian Information Criteria (BIC), have then been used to determine the most appropriate model specification to apply. When the reporting results of Ordered Probit and Ordered Logit models in which the POA is relaxed, the coefficients and associated standard errors are reported for each outcome, with the exception of the top outcome.<sup>21</sup>

<sup>17</sup> The Brant Test is used to test whether the proportional odds assumption holds in the Ordered Logit model, with a significant test statistic indicating that the assumption has been violated. In Stata, it is run using the *brant* command directly after the *ologit* command. The command cannot be run with an Ordered Probit model, for which LR Test is solely used instead.

<sup>18</sup> The *gologit2* command is a user-written program that estimates generalized ordered logit models for ordinal dependent variables. Williams, Richard. 2006. "Generalized Ordered Logit/ Partial Proportional Odds Models for Ordinal Dependent Variables." *The Stata Journal* 6(1):58-82. <http://www.stata-journal.com/article.html?article=st0097>. The author is grateful to Professor Williams for his guidance in using the command.

<sup>19</sup> Using the *gologit2* command, the general relaxation of the proportional odds constraint is achieved using the *autofit* option. Specifying *autofit* enables the Wald Test to be run on each independent variable, to check whether the respective coefficients are significantly different when they are allowed to vary across outcomes. A statistically insignificant test value indicates that the given variable does not violate the proportional assumption. A Wald Test is also run across the entire constrained model.

<sup>20</sup> The LR Test compares two models, one in which no variables are constrained to meet the proportional odds assumption, and one in which all variables are constrained to meet the assumption. A significant test result indicates that at least one variable violates the assumption. It typically yields similar results to that of the Brant Test.

<sup>21</sup> The coefficients are reported separately for each category because they indicate whether it is more or less likely that the respondent will be in a higher response category than the current one. For example, in the preferences for tax and spend model, the coefficients for "Reduce Taxes" contrast the likelihood of choosing "Reduce Taxes" against "Maintain Taxes" and

### 3.7 Chosen model specifications and variables used

Table 1 below summarises which variables have been included in the final model specifications for the three outcomes of interest. Each model has been estimated parsimoniously; in other words, each delivers a desired level of explanation or prediction with as few predictor variables as possible, and ignores those variables for which the associated coefficients are found to be statistically insignificant. All regression models have been run with robust standard errors and population weights, with the latter supplied by YouGov alongside the Tax Education Gap survey results.<sup>22</sup> The next section of this paper sets out the modelling results.

For the two model specifications focusing on attitudes to taxation – perceptions of fairness and preferences for tax and spend – a small but not-insignificant share of respondents did not provide a response, or responded with “don’t know”. Such non-responses cannot be meaningfully assigned an ordinal ranking against the stated responses, so have been discarded from the estimated regression models and ignored thereafter. It is acknowledged that the removal of those submitting non-responses raises the risk of selection bias, as the selection of respondents is no longer randomised and the characteristics of respondents and non-respondents may differ. However, as only 16% and 14% provided “don’t know” to the respective questions, sample selection bias is unlikely to influence the results.<sup>23</sup>

Table 1: *Chosen model specifications and variables*

| Group                | Independent variable / Chosen model specification | Tax Education Score (TES) | Perceptions of fairness of the UK tax system | Preferences for tax and spend |
|----------------------|---|---------------------------|--|-------------------------------|
| Tax                  | Tax Education Score (TES)                         |                           | ✓  | ✓                             |
|                      | Personal Tax Account (PTA)                        | ✓                         | ✓  | ✓                             |
|                      | Completed Self Assessment                         | ✓                         | ✓  | ✓                             |
|                      | Own taxes vs taxes in general                     |                           |  | ✓                             |
| Demographics         | Age   | ✓                         | ✓  | ✓                             |
|                      | Age Squared (Quadratic)                           |                           | ✓  |                               |
|                      | Gender  |                           | ✓  | ✓                             |
|                      | Children  |                           |  | ✓                             |
|                      | Gross Income                                      | ✓                         | ✓  | ✓                             |
|                      | Employment status                                 | ✓                         |  |                               |
|                      | Occupation  | ✓                         | ✓  | ✓                             |
|                      | Education   | ✓                         | ✓  | ✓                             |
|                      | Region  | ✓                         | ✓  | ✓                             |
| Political Engagement | Vote in General Election 2017                     |                           | ✓  | ✓                             |
|                      | Vote in EU Referendum 2016                        |                           |  | ✓                             |

Source: Deloitte analysis

“Increase Taxes”; meanwhile, the coefficients for “Maintain Taxes” contrast the likelihood of choosing “Maintain Taxes” over “Increase Taxes”. Hence there are no reported coefficients for “Increase Taxes” as this is the highest response category.

<sup>22</sup> In Stata, the option *pweight* is used to specify population weights within a regression model. The *pweight* option instructs Stata to use the sampling weight as the number of subjects in the population that each observation represents when computing estimates such as proportions, means, and regressions parameters.

<sup>23</sup> To further test this, a sample selection model for Ordered Probit was separately run using the *heckprobit* command in Stata, with the TES, age and occupation used to model whether a fairness response was provided (the Probit component of the model). The resulting regression coefficients were very similar to that of the applied Ordered Probit model, providing some evidence that sample selection bias is unlikely to be a major problem when modelling perceptions of fairness.

# 5. Results

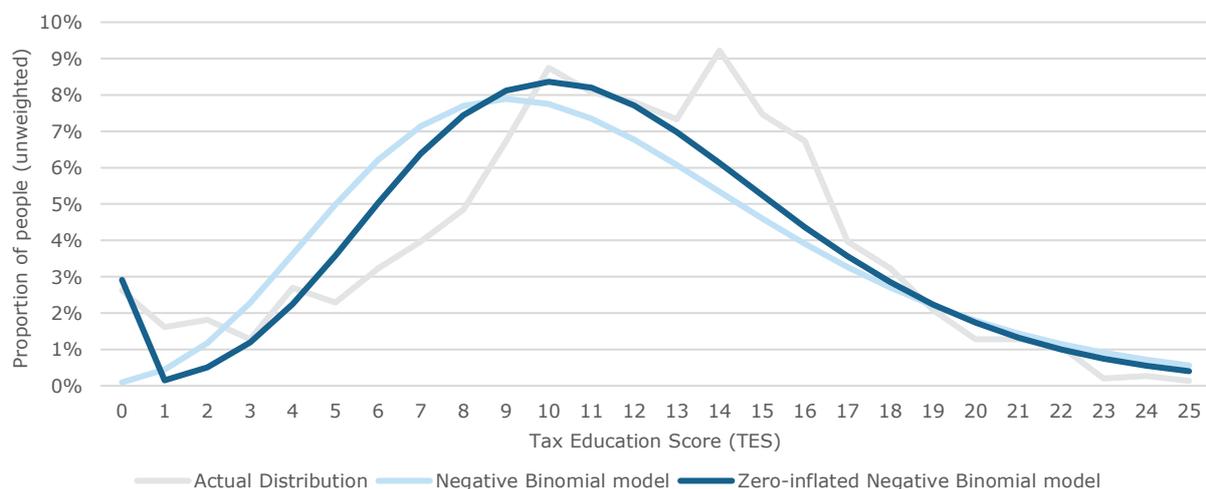
## 5.1 Tax Education Score (TES)

Regardless of the model specification chosen, the likely key determinants for tax knowledge include age, occupation, gross income, and educational attainment. The full modelling results can be found in Annex C. The coefficients associated with all of these variables are found to be positively associated with the TES, and statistically significant at the 1% level. In other words, as a person's age increases, or as they fall into ever-higher education, income or occupation brackets, their TES would be expected to increase as well.

Descriptive analysis and post-estimation tests have then been used to determine the most appropriate model for further analysing the relationship between these factors and the TES. Firstly, there is sizeable difference between the arithmetic mean and variance of the TES counts, overdispersion is likely to be present; there is also a slightly disproportionate share of people who achieved a TES of zero. While the AIC and BIC criterion values suggest that the Poisson model provides a superior fit compared to the Negative Binomial model, the LR test results which accompany the Negative Binomial model results indicate that the dispersion term (the alpha term) is very likely to be non-zero. This is evidenced by the alpha term being found to be statistically-significant at the 1% level. This in turn provides evidence that overdispersion is present, and that the application of the Negative Binomial model would be more appropriate.

The decision to then either use the conventional Negative Binomial model or the Zero-inflated Negative Binomial model is influenced by the fit of both models: in this instance, the distribution of the TES counts predicted by the models against the actual distribution. Figure 14 below shows the actual and predicted distributions; the actual distribution is taken from Figure 6 earlier in this paper. The zero-inflated Negative Binomial model appears to quite accurately predict the proportion of respondents with a TES of zero, although it provides a weaker fit for low, non-zero TES counts. Conversely, the Negative Binomial model performs more strongly when the TES is low. The zero-inflated Negative Binomial model has been chosen as the final model specification.

Figure 14: *Perceptions of fairness in the UK tax system (original responses and condensed), weighted*

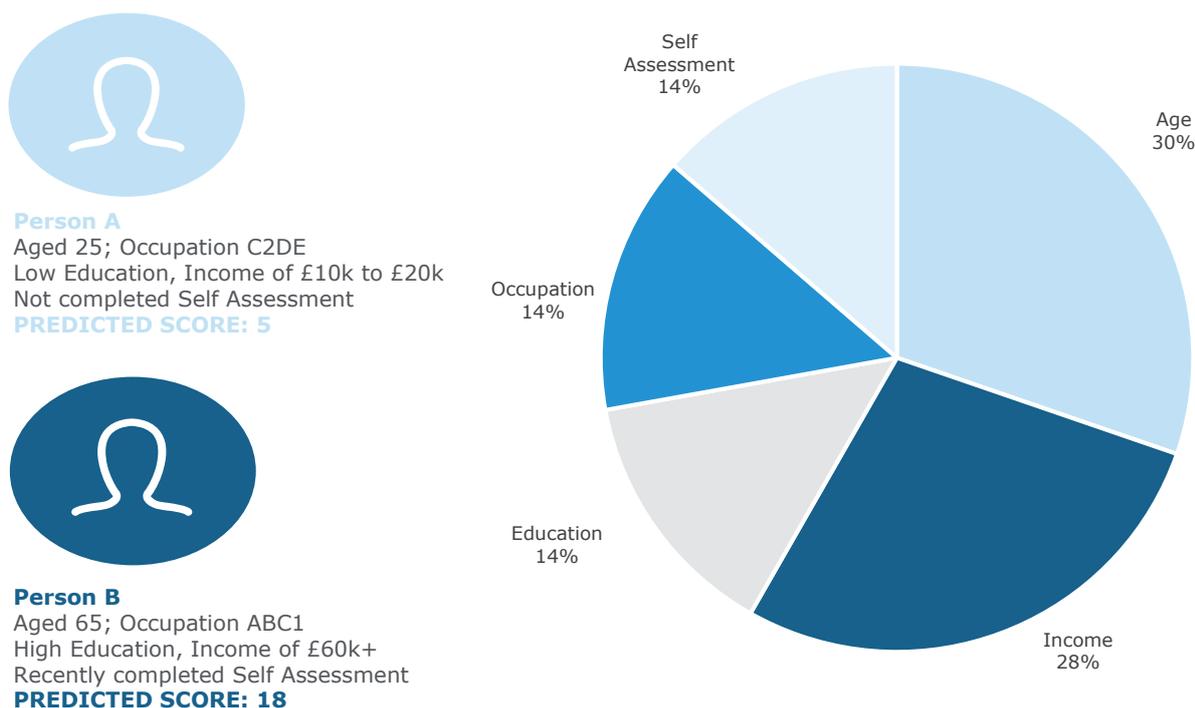


Source: YouGov, Deloitte analysis

Rather than attempting to directly interpret the model coefficients presented in Annex C, the final model specification has been used to predict<sup>24</sup> the TES for two representative individuals, for illustration both of whom are married and living in the South East, but with different ages, occupations, and education and with only one having recently completed Self Assessment. Person B achieves a considerably higher TES, with their higher age and gross income accounting for over half of the difference against Person A's TES.

<sup>24</sup> This has been achieved using the *margins* command in Stata. Margins are statistics calculated from predictions of a previously fit model at fixed values of some covariates and averaging (or otherwise integrating) over the remaining covariates.

Figure 15: Predicted TES for two stylised individuals, and different factors' influence behind the difference



Source: YouGov, Deloitte analysis

## 5.2 Perceptions of fairness of the UK tax system

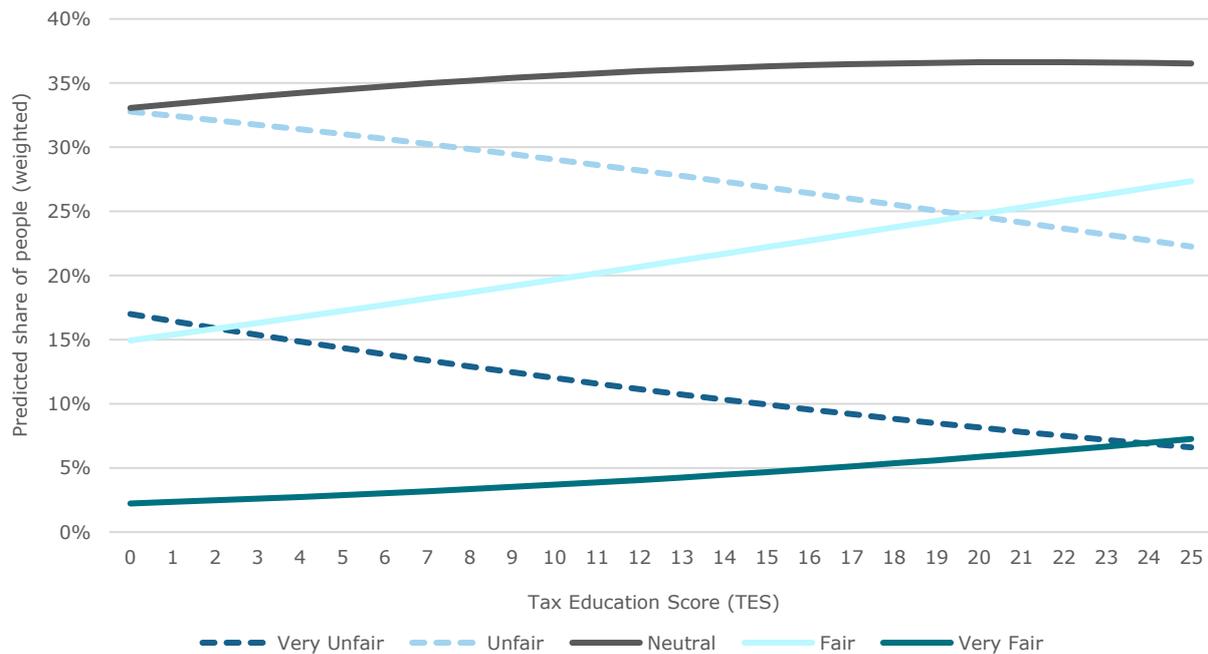
This subsection summarises the model results for the first of the two attitudes to taxation explored: perceptions of fairness in the UK tax system. As discussed earlier, responses to the survey question were condensed into a five-point scale ranging from "Very Unfair" to "Very Fair". The full results and associated post-estimation tests can be found in Annex C of this paper.

The TES is found to be positively associated with perceptions of fairness in all model specifications, with model coefficients found to be statistically significant at the 1% level. So as the TES increases, the likelihood that a person perceives that the tax system is fair increases. Other factors found to be positively associated with perceptions of fairness include age, educational attainment, and political preference, and (less strongly) gross income and occupation. Post-estimation tests have then been used to determine the most appropriate model. Results from both the Brant and LR tests indicate that the null hypothesis of the Proportional Odds Assumption holding is rejected in the Ordered Logit model, as shown by the test statistics. However, the LR test statistic for the Ordered Probit LR Test model is found to be insignificant at the 5% level, suggesting that the null hypothesis holds. The Ordered Probit model is also found to perform best when the AIC and BIC are compared. The Ordered Probit is thus chosen as the chosen final model specification.

Rather than directly interpreting the model coefficients shown in Annex C, the predicted share of people reporting the different perceptions of fairness have been estimated and are shown here, excluding those with "don't know" responses.<sup>25</sup> Figure 16 overleaf shows the predicted shares for the five fairness outcomes as the TES increases; a higher TES is associated with a higher share of the population perceiving the tax system as either "Fair" or "Very Fair", with a commensurate fall in the probability of perceiving the tax system as "Unfair" or "Very Unfair". Hypothetically, if everyone achieved a TES of zero, around 17% of people are predicted to perceive the tax system as "Fair" or "Very Fair", whereas if everyone achieved a TES of 25, this proportion is predicted to increase to around 35%. Conversely, the share of people who perceive the tax system as "Unfair" or "Very Unfair" would fall from around 50% to 29%.

<sup>25</sup> Estimating the predicted population shares is based on the estimation of Average Marginal Effects, achieved using the *margins* command in Stata. The TES variable is allowed to vary while the values of all other independent variables are held at the existing distribution. In effect, different hypothetical populations with the same TES are being compared.

Figure 16: Tax knowledge and perceptions of fairness, predicted population shares (excl. "don't knows")



Source: Deloitte analysis

### 5.3 Preferences for tax and spend

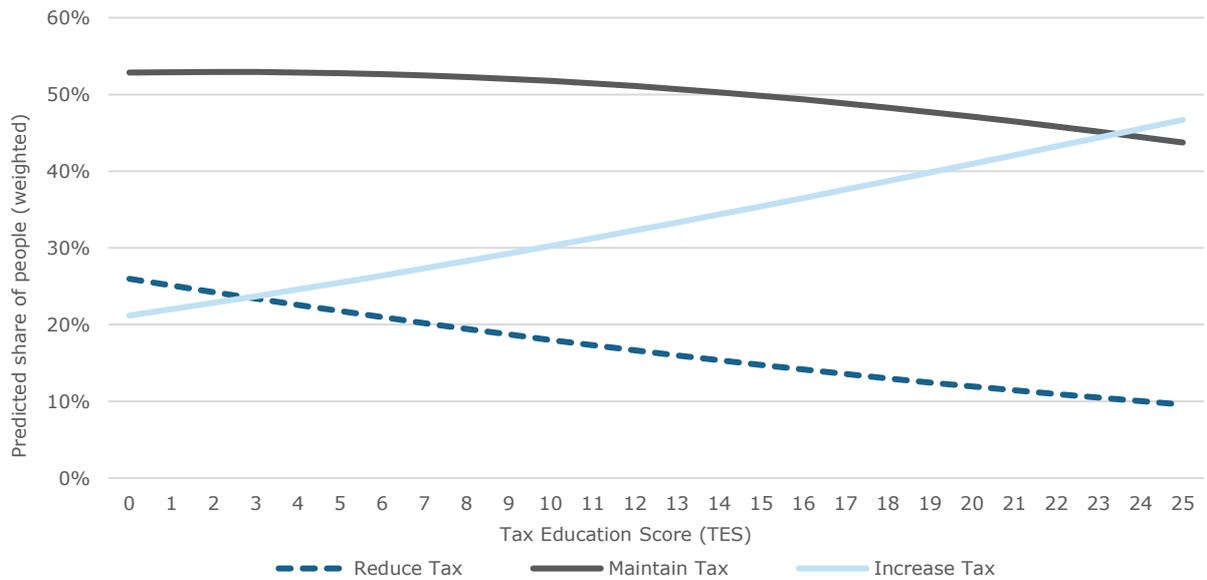
After perceptions of fairness, the second of the two attitudes to taxation examined is preferences for tax and spend. Responses to the associated survey question were condensed into a three-point scale: reduce taxes, maintain taxes or increase taxes. Again, the full results and associated post-estimation tests are not presented here; these can be found in Annex C of this paper.

Regardless of the model, the TES is found to be positively associated with the preferences for tax and spend variable, with coefficients found to be statistically significant at the 1% level. In other words, as the TES increases, the likelihood that a person shifts their preference from reducing to maintaining tax, or from maintaining tax to increasing tax, increases. Other factors found to be positively associated with tax and spend preferences in all models include age, educational attainment, and political preference. In other words, being older and better-educated raises the probability that you will opt for maintaining or increasing taxes, rather than reducing them. Conversely, changing the wording of the question to suggest that respondent's own taxes will be reduced, maintained or increased has a negative impact on preferences, in the sense that it reduces the likelihood that someone will want to either maintain or increase taxes.

Once more, post-estimation tests have then been used to determine the most appropriate model for analysing the relationship between TES and preferences for tax and spend. Results from both the Brant and LR tests indicate that the null hypothesis of the Proportional Odds Assumption (POA) holding is rejected for both the Ordered Logit and Ordered Probit models, as shown by the significant test statistics in both cases for the LR test. Given this, the Ordered Logit and Ordered Probit models with the POA relaxed are considered. The Ordered Logit model with relaxation of the POA is also found to perform best when the AIC and BIC are compared. The Ordered Logit with relaxation of the POA is thus used hereafter as the chosen final model specification.

Using the final model specification, Figure 17 overleaf shows the predicted shares of people choosing the three tax and spend preferences (excluding "Don't know" responses). A higher TES is associated with a greater share of people preferring tax increases, while the shares either preferring taxes to be maintained or reduced fall. If everyone achieved a TES of zero, only around 21% of people are predicted to prefer tax increases, while around 53% and 26% of people would prefer to maintain or reduce taxes respectively. However, if everyone achieved a TES of 25, the share of people preferring tax increases would increase to 47%, while the share of those preferring taxes to be maintained or reduced would fall to around 44% and 10% respectively.

Figure 17: Tax knowledge and preferences for tax and spend, predicted population shares (excluding "don't know" responses)

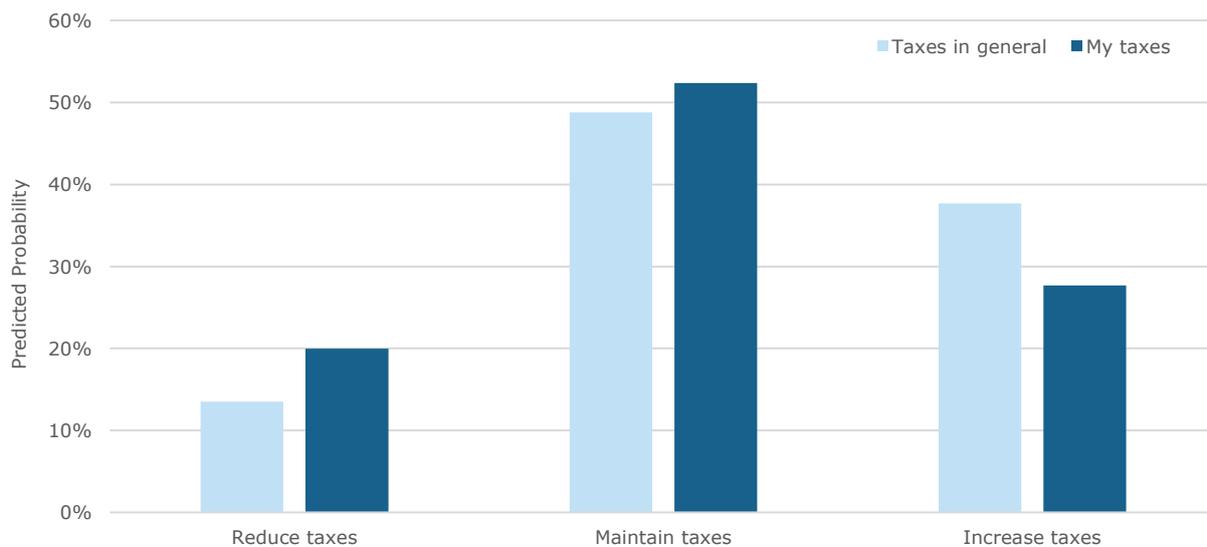


Source: YouGov, Deloitte analysis

Finally, Figure 18 below shows the predicted shares of people choosing the three different tax and spend preferences, disaggregated by the two particular sets of associated question wording received by respondents. Half of respondents received a question concerning their preferences for "taxes in general", whereas the remaining half received a question concerning their preferences for "my taxes".

The final model specification predicts that around 49% of people asked about taxes in general would prefer taxes to be maintained at current levels, while around 38% of these people would prefer tax increases. However, these population shares shift somewhat when compared to those who are instead asked about their own taxes. In this case, the share of people preferring to maintain taxes rises to around 52%, with the share preferring increases in tax falling to 28%. Conversely and perhaps unsurprisingly, the proposition of one's own taxes changing raises the share of people opting for cutting taxes.

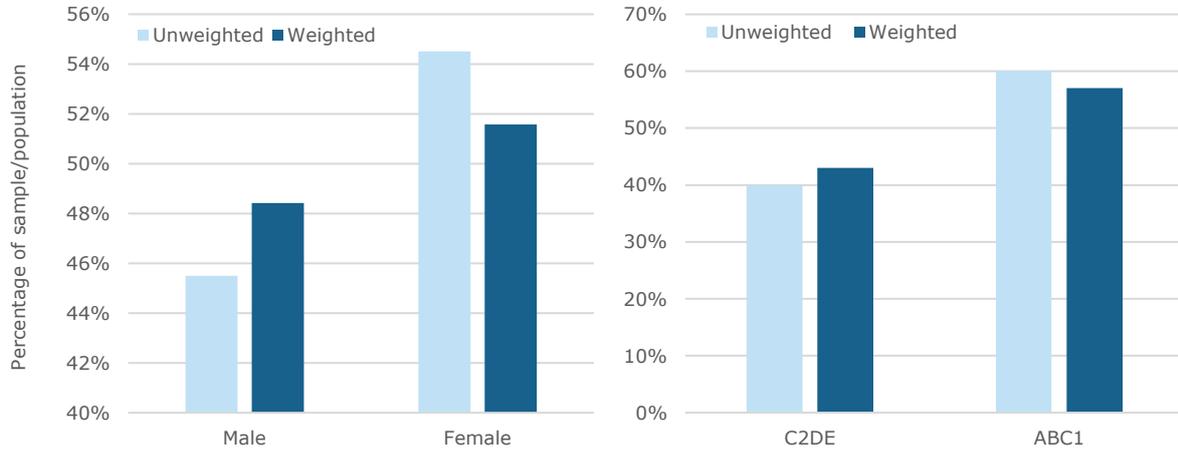
Figure 18: "My taxes" versus "Taxes in general": predicted probabilities, based on the average person



Source: YouGov, Deloitte analysis

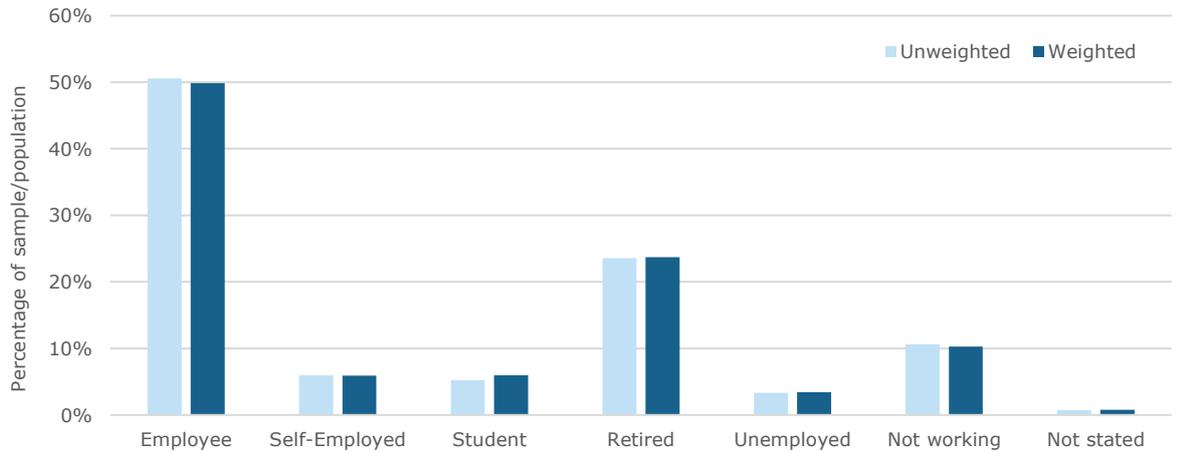
# Annex A: Further Descriptive Statistics

Figure A.1: Distribution of respondents by gender and occupation



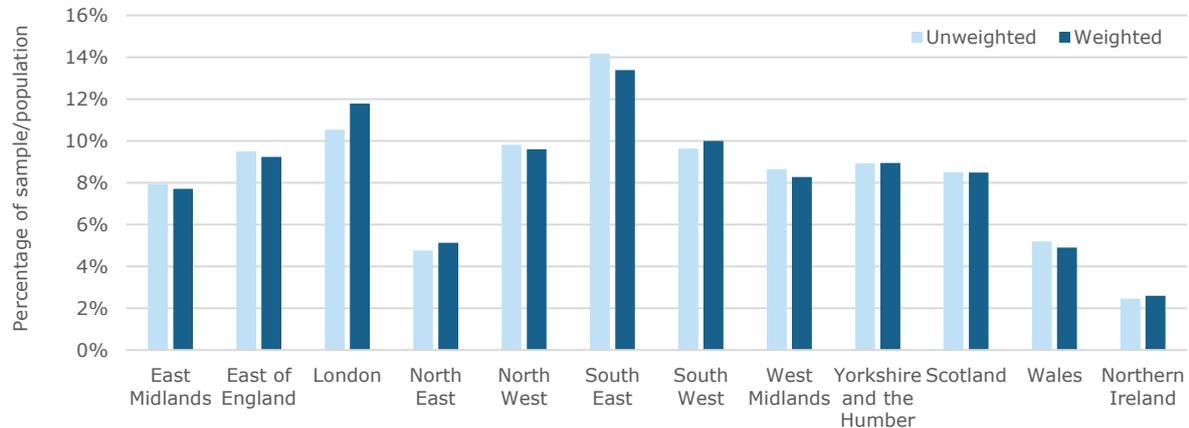
Source: YouGov, Deloitte analysis

Figure A.2: Distribution of respondents by employment status



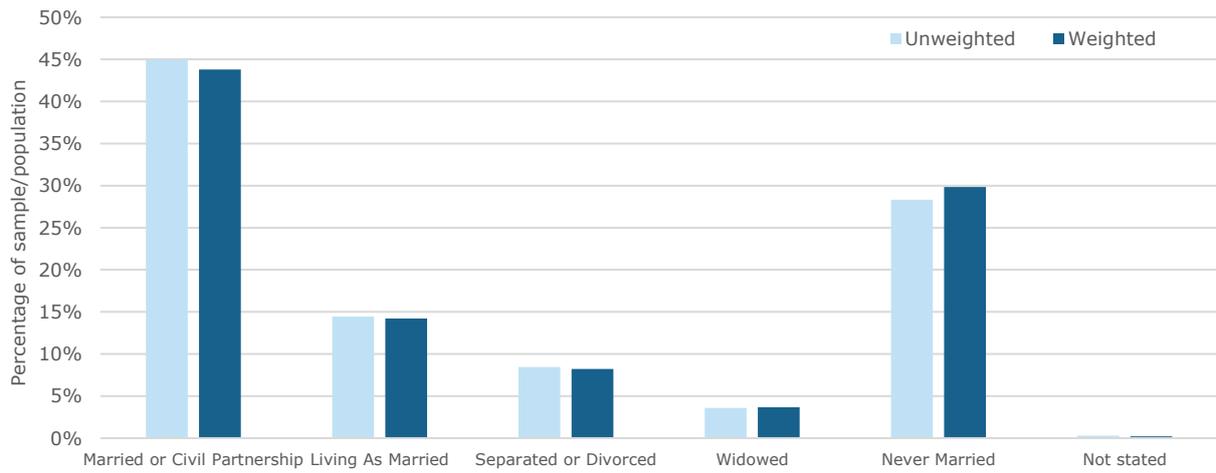
Source: YouGov, Deloitte analysis

Figure A.3: Distribution of respondents by region (former Government Office Regions)



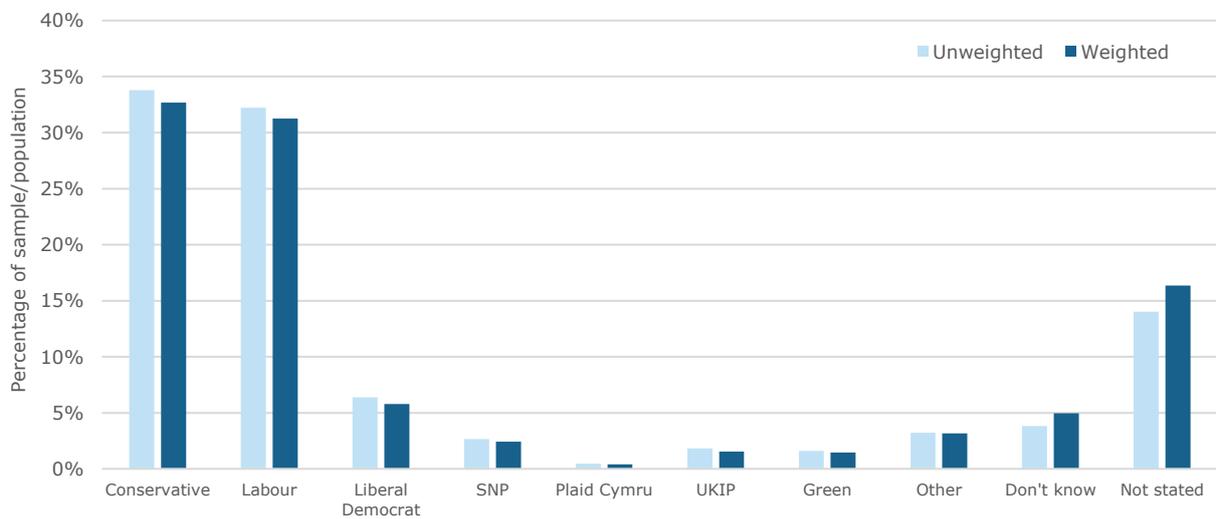
Source: YouGov, Deloitte analysis

Figure A.4: Distribution of respondents by marital status



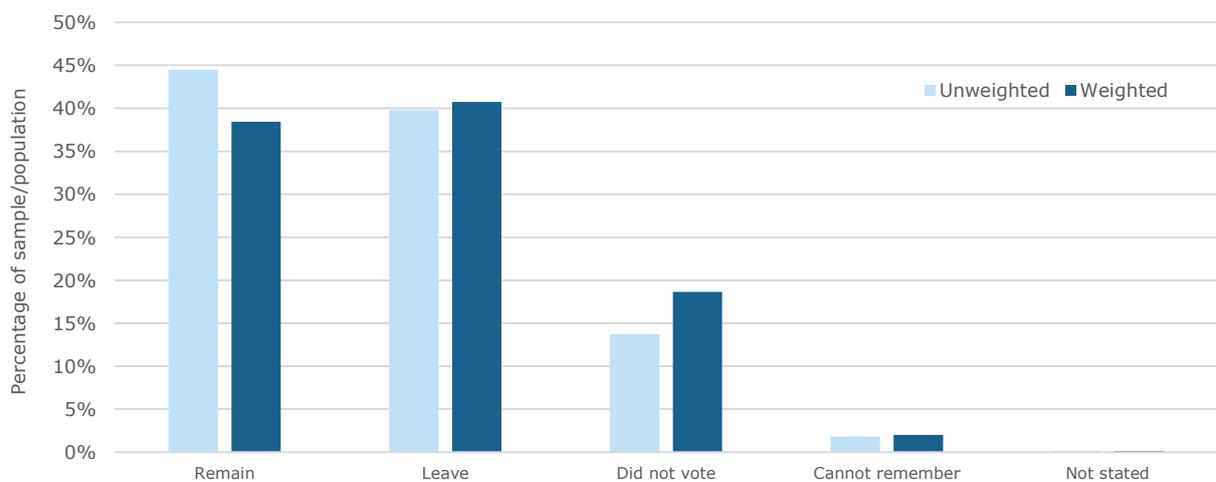
Source: YouGov, Deloitte analysis

Figure A.5: Distribution by vote in General Election 2017



Source: YouGov, Deloitte analysis

Figure A.6: Distribution by vote in EU Referendum 2016



Source: YouGov, Deloitte analysis

# Annex B: Tax-related survey questions

## B.1 Interactions with the UK tax system

- Have you submitted a Self Assessment tax return to HMRC in the past year?
  - Yes
  - No
  - Not sure
- *[Note: If answer to question above is "Yes"; skip if "No" or "Not sure"; this is a multi-choice question].* You stated before that you did submit a tax return. Why did you submit a return? Please tick all that apply.
  - *I made profits through self-employment (including partnership profits)*
  - *I had some letting income*
  - *I was required to pay the High Income Child Benefit charge*
  - *I had some untaxed investment income*
  - *My annual income exceeded £100,000*
  - *I made capital gains through selling an asset or assets*
  - *Other reason (please state)*
  - *Don't know [Note: all other options ruled out if this is selected]*
- We would now like to ask you about the Personal Tax Account (PTA). The Personal Tax Account system is an online resource that Her Majesty's Revenue and Customs (HMRC) launched in 2015 to enable people to view and make changes to their information online. It is intended to help people manage their tax affairs through the account rather than phoning or writing to HMRC. Do you have a Personal Tax Account?
  - Yes
  - No
  - Not sure
- *[If answer to question above is "Yes"; skip if "No" or "Not sure"].* You stated before that you do have a Personal Tax Account. Thinking about the services and accessibility of your Personal Tax Account, how helpful is it?
  - *Extremely helpful*
  - *Very helpful*
  - *Somewhat helpful*
  - *Slightly helpful*
  - *Not at all helpful*
  - *Not sure*

## B.2 Knowledge of tax and the UK tax system

*Note: correct answers emboldened*

- By the "UK tax system", we mean the different types of taxes and rates people and businesses in the UK pay. This includes things such as VAT, Income Tax, National Insurance Contributions (NICs), Corporation Tax, Council Tax, Business rates etc. How would you best describe your own knowledge of how the UK tax system works?
  - *Very Good*
  - *Good*
  - *Fair*
  - *Poor*
  - *Very Poor*
  - *Not sure*
- *[Note: Only shown if respondent lives outside of Scotland].* Outside of Scotland, what is the current top statutory rate of Income Tax on earned income in the UK?
  - 30%
  - 35%
  - 40%
  - **45%**
  - 50%
  - 55%
  - Not sure

[Note: Only shown if respondent lives in Scotland]. In Scotland, what is the current top statutory rate of Income Tax on earned income?

- 30%
  - 40%
  - 45%
  - **46%**
  - 50%
  - 56%
  - 60%
  - Not sure
- Adam is employed, earning £25,000 and pays tax under PAYE. He has just received his notice of coding for 2019-20, which enables his employer to calculate the amount of tax to take off Adam. His note of coding shows a code of 1250L (S1250L in Scotland, or C1250L in Wales). Does this mean that:
    - His tax bill on the earnings will be £1,250
    - He has other income apart from his earnings of £1,250
    - He has allowances of £1,250 which will be set against his earnings to calculate PAYE tax
    - **He has allowances of £12,500 which will be set against his earnings to calculate PAYE tax**
    - Not sure

- Please think about the following statements in relation to an individual earning £20,000 who is going to receive £4,000 of additional income. Ignoring the personal savings allowance, dividend allowance and National Insurance Contributions, consider how the additional income will be taxed. For reference, dividends are amounts paid by a company to its shareholders, taken from company earnings.

|  |            |           |
|--|------------|-----------|
| Bank interest is taxed at the same rate as earnings.         | <b>Yes</b> |           |
| Dividends are taxed at the same rate as earnings.            |            | <b>No</b> |
| Income from a pension is taxed at the same rate as earnings. | <b>Yes</b> |           |

- Please think about the following situation. You earn £20,000 per year before tax, earned entirely through a full-time job. Please think about the following types of additional income that you could earn in any given year. Thinking about these individually and in isolation, which would you have to pay tax on?

|   |            |               |
|---|------------|---------------|
| £2,400 of income from renting out a spare room on Airbnb                  |            | <b>No Tax</b> |
| £4,000 earned from letting out a second property to holidaymakers         | <b>Tax</b> |               |
| £500 of income earned from selling of unwanted items on eBay              |            | <b>No Tax</b> |
| A £15,000 lottery prize   |            | <b>No Tax</b> |
| £2,000 in advertising income earned from being an influencer on Instagram | <b>Tax</b> |               |

- Please think about the following situation. You sponsor a friend to run a marathon on behalf of a charity. When making your sponsorship donation, the charity asks you to sign a Gift Aid confirmation. What does this mean? Please tick all of the following which apply.
  - **The charity can claim 25p back in tax from every £1 that you donate**
  - If you are a Basic Rate taxpayer, you can claim 25p back in tax from every £1 that you donate
  - **If you are a Higher Rate taxpayer, you can claim 25p back in tax from every £1 that you donate**
  - Nothing happens – all charities have to request a Gift Aid confirmation by law
- Please think about the following statements relating to National Insurance (NI).

|   |             |              |
|---|-------------|--------------|
| "The first 25% of your pension is not subject to National Insurance, but the remainder is."           |             | <b>False</b> |
| "Employees pay the same National Insurance rates on their earnings as the self-employed."             |             | <b>False</b> |
| "Employees stop paying National Insurance on their earnings when they reach the State Pension Age."   | <b>True</b> |              |
| "Employers stop paying National Insurance on the earnings of employees at State Pension Age or over." |             | <b>False</b> |

- Please think about the following statement. "You own a property, which you have lived in as your main home throughout the entire period of owning it. You are required by HMRC to pay Capital Gains Tax if you sell the property for more than you paid for it." Is this statement:
  - True
  - False
  - **It depends on other factors, such as the size of the property, or whether you have ever let part of it out**
  - Not sure

- Please consider the following examples of gifts and inheritances. Is Inheritance Tax payable in each case? You may assume that the total value of each is above £325,000.

|   |            |           |
|---|------------|-----------|
| <i>Gifts between spouses more than 7 years before death</i>           |            | <b>No</b> |
| <i>Gifts between spouses less than 7 years before death</i>           |            | <b>No</b> |
| <i>Assets on death left to a spouse</i>                               |            | <b>No</b> |
| <i>Gifts between other individuals more than 7 years before death</i> |            | <b>No</b> |
| <i>Gifts between other individuals less than 7 years before death</i> | <b>Yes</b> |           |
| <i>Assets on death left to a non-spouse</i>                           | <b>Yes</b> |           |

- Thinking further about gifts, everyone in the UK has an annual gift allowance for inheritance tax (IHT), meaning they can make gifts to friends and family without the possibility of being taxed, up to a certain amount in each tax year. How much is this annual gift allowance?
  - £1,000
  - £3,000**
  - £5,000
  - £10,000
  - Not sure
- In addition to the IHT annual gift allowance, everyone in the UK can also make smaller gifts to as many people as they want in any given tax year. What is the maximum amount that can be given to each person in each tax year that can be classified as a small gift?
  - £250**
  - £300
  - £400
  - £500
  - Not sure
- Individuals can save tax-free with Individual Savings Accounts (ISAs). What is the maximum you can currently save tax-free per tax year through an ISA account or accounts?
  - £15,000
  - £20,000**
  - £22,400
  - £25,000
  - £26,400
  - It depends on the number of ISA accounts that you have
  - Not sure
- Please think about the following situation. You have an annual salary of £25,000 from wages, and your only other income is £400 of interest earned through an interest-bearing account at your bank (and not in an ISA). What tax rate would apply to this £400 of interest income?
  - 0%**
  - 5%
  - 10%
  - 20%
  - 40%
  - Not sure
- Please think about the following situation. You and your partner have two children, both aged under 16. In 2018-19, you earned £30,000, while your partner earned £55,000. You received a total of £1,788.80 in Child Benefit. What proportion of your Child Benefit would your partner be required to pay back in tax?
  - 0%
  - 50%**
  - 100%
  - Not sure
- Please think about all of the different taxes in the UK, such as VAT, Income Tax, Corporation Tax, and including National Insurance Contributions (NICs). How much revenue was raised in total tax and National Insurance Contributions in the UK in 2017-18? Please give your best estimate if you are unsure.
  - £150 billion
  - £250 billion
  - £300 billion
  - £400 billion
  - £500 billion
  - £700 billion**
  - £900 billion
  - £1 trillion
  - Not sure

- In the year 2017-18, Income Tax raised just over £180 billion in revenues for the government. After Income Tax, which of these taxes made the largest contribution to UK government revenues?
  - Value Added Tax (VAT)
  - **National Insurance Contributions (NICs)**
  - Fuel Duty
  - Corporation Tax
  - Council Tax
  - Not sure
- Please think about the following major tax reliefs. Which of these do you think these ranks highest in terms of cost for the government to provide?
  - 0% VAT rate on children’s clothing
  - 0% VAT rate on books, newspapers and magazines
  - 0% VAT rate on UK passenger transport
  - Income tax relief on pension contributions
  - Individual Savings Accounts (ISAs)
  - **Exemption from Capital Gains Tax (CGT) on gains on a main residence**
  - Entrepreneurs’ Relief
  - Agricultural and business reliefs in Inheritance Tax

### B.3 Attitudes to taxation

- Which of these statements come closest to your own view? [Presented to half of respondents.]
  - Taxes should be increased, in order to extend and improve public services
  - Things should be left as they are
  - Taxes should be cut, even if it means some reductions in public services
  - Don’t know

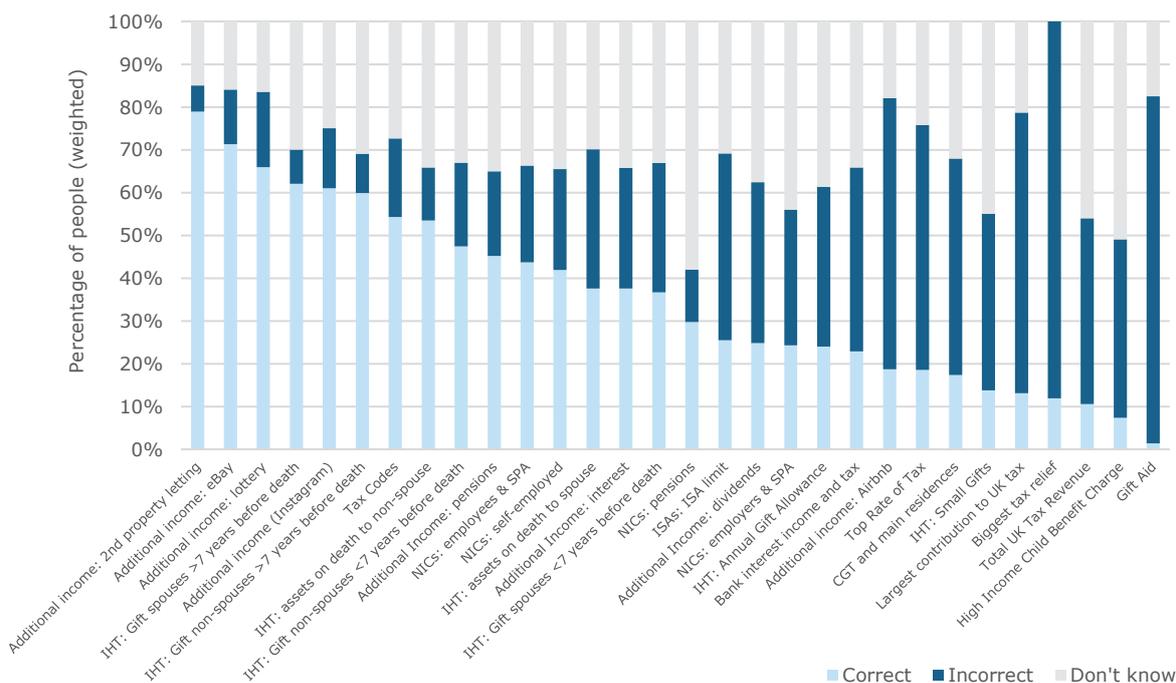
Which of these statements come closest to your own view? [Presented to half of respondents.]

- I would prefer my taxes to be increased, in order to extend and improve public services
- I would prefer my taxes to be left as they are
- I would prefer my taxes to be cut, even if that means some reductions in public services
- Don’t know

"A tax system which is fair will distribute money from rich to poor, treat people and activities on a similar basis, and meet taxpayers’ expectations." Again, by the "UK tax system", we mean the different types of taxes and rates applied to these taxes on people and businesses in the UK. This includes things such as VAT, Income tax, Council tax etc. Based on the statement above, on a scale of 1 to 10, how fair would you say the UK tax system is? Please assign a score between 1 and 10, where 10 = "extremely fair"; 1 = "extremely unfair".

### B.4 Breakdown of responses to tax knowledge questions

Figure B.1: Breakdown of tax knowledge questions by correct, incorrect, and "don't know" responses



Source: YouGov, Deloitte analysis

# Annex C: Full Model Results

Table C.1a: Tax Education Score (TES)

| MODEL  | VARIABLE              | OLS                | Poisson            | Negative Binomial  | Zero-inflated Poisson |                     | Zero-inflated Negative Binomials |                     |
|--|-----------------------|--------------------|--------------------|--------------------|-----------------------|---------------------|----------------------------------|---------------------|
|  |                       |                    |                    |                    | Coefficient           | Inflated            | Coefficient                      | Inflated            |
| Tax  | Self Assessment       | 1.32***<br>(0.39)  | 0.11***<br>(0.03)  | 0.11***<br>(0.03)  | 0.10***<br>(0.03)     |                     | 0.10***<br>(0.03)                |                     |
|  | PTA                   | 0.83**<br>(0.33)   | 0.07***<br>(0.03)  | 0.07**<br>(0.03)   | 0.05**<br>(0.03)      | -1.45**<br>(0.66)   | 0.05*<br>(0.03)                  | -1.47**<br>(0.67)   |
|  | Demographics          | Age                | 0.08***<br>(0.01)  | 0.01***<br>(0.00)  | 0.01***<br>(0.00)     | 0.01***<br>(0.00)   | -0.04**<br>(0.01)                | 0.01***<br>(0.00)   |
|  | Occupation (ABC1)     | 1.33***<br>(0.28)  | 0.12***<br>(0.03)  | 0.12***<br>(0.03)  | 0.12***<br>(0.02)     |                     | 0.12***<br>(0.02)                |                     |
| Gross Income<br>(Base =<br>£0-£10,000)                   | £10,000-£20,000       | 0.41<br>(0.39)     | 0.05<br>(0.04)     | 0.05<br>(0.04)     | 0.04<br>(0.03)        | 0.05<br>(0.40)      | 0.04<br>(0.03)                   | 0.05<br>(0.41)      |
|  | £20,000-£30,000       | 1.51***<br>(0.40)  | 0.15***<br>(0.04)  | 0.15***<br>(0.04)  | 0.12***<br>(0.04)     | -1.10*<br>(0.59)    | 0.12***<br>(0.04)                | -1.10*<br>(0.59)    |
|  | £30,000-£40,000       | 1.63***<br>(0.45)  | 0.16***<br>(0.04)  | 0.17***<br>(0.04)  | 0.13***<br>(0.04)     | -1.52**<br>(0.73)   | 0.13***<br>(0.04)                | -1.52**<br>(0.74)   |
|  | £40,000-£60,000       | 1.91***<br>(0.54)  | 0.18***<br>(0.05)  | 0.18***<br>(0.05)  | 0.16***<br>(0.04)     | -0.69<br>(0.69)     | 0.16***<br>(0.04)                | -0.68<br>(0.70)     |
|  | £60,000+              | 3.80***<br>(0.79)  | 0.31***<br>(0.06)  | 0.32***<br>(0.06)  | 0.26***<br>(0.06)     | -23.85***<br>(0.43) | 0.27***<br>(0.06)                | -17.20***<br>(0.43) |
| Education<br>(Base = Middle)                             | Middle Education      | 1.28***<br>(0.33)  | 0.11***<br>(0.03)  | 0.11***<br>(0.03)  | 0.10***<br>(0.03)     | -0.71<br>(0.45)     | 0.09***<br>(0.03)                | -0.71<br>(0.46)     |
|  | High Education        | 1.75***<br>(0.37)  | 0.16***<br>(0.03)  | 0.16***<br>(0.04)  | 0.13***<br>(0.03)     | -1.09**<br>(0.53)   | 0.13***<br>(0.03)                | -1.09**<br>(0.53)   |
| Marital Status<br>(Base = Married/<br>Civil Partnership) | Living as married     | -0.26<br>(0.39)    | -0.02<br>(0.04)    | -0.02<br>(0.04)    | -0.02<br>(0.03)       | -0.05<br>(0.55)     | -0.02<br>(0.03)                  | -0.05<br>(0.56)     |
|  | Separated/ Divorced   | -0.83*<br>(0.49)   | -0.07<br>(0.04)    | -0.07*<br>(0.04)   | -0.05<br>(0.04)       | 0.81<br>(0.64)      | -0.05<br>(0.04)                  | 0.81<br>(0.64)      |
|  | Widowed               | 0.49<br>(0.62)     | 0.03<br>(0.05)     | 0.05<br>(0.05)     | 0.01<br>(0.05)        | -23.22***<br>(0.57) | 0.02<br>(0.05)                   | -16.61***<br>(0.58) |
|  | Never Married         | -0.93***<br>(0.36) | -0.09***<br>(0.03) | -0.09***<br>(0.03) | -0.09***<br>(0.03)    | -0.08<br>(0.47)     | -0.09***<br>(0.03)               | -0.08<br>(0.48)     |
| Region<br>(Base = London)                                | East Midlands         | 1.45***<br>(0.55)  | 0.12**<br>(0.05)   | 0.13***<br>(0.05)  | 0.07<br>(0.04)        | -2.87***<br>(1.08)  | 0.07<br>(0.05)                   | -2.88***<br>(1.10)  |
|  | East                  | 0.77<br>(0.63)     | 0.07<br>(0.06)     | 0.07<br>(0.06)     | 0.06<br>(0.05)        | -0.45<br>(0.68)     | 0.06<br>(0.05)                   | -0.44<br>(0.69)     |
|  | North East            | 0.79<br>(0.63)     | 0.07<br>(0.06)     | 0.07<br>(0.06)     | 0.02<br>(0.06)        | -2.05*<br>(1.12)    | 0.02<br>(0.06)                   | -2.06*<br>(1.13)    |
|  | North West            | 0.72<br>(0.61)     | 0.06<br>(0.06)     | 0.06<br>(0.06)     | 0.03<br>(0.05)        | -1.11<br>(0.68)     | 0.03<br>(0.05)                   | -1.11<br>(0.68)     |
|  | South East            | 1.47***<br>(0.52)  | 0.12***<br>(0.05)  | 0.12***<br>(0.05)  | 0.10**<br>(0.04)      | -0.87<br>(0.64)     | 0.10**<br>(0.04)                 | -0.87<br>(0.64)     |
|  | South West            | 1.09*<br>(0.59)    | 0.09*<br>(0.05)    | 0.09<br>(0.06)     | 0.03<br>(0.05)        | -24.68***<br>(0.43) | 0.03<br>(0.05)                   | -18.06***<br>(0.43) |
|  | West Midlands         | 0.48<br>(0.62)     | 0.04<br>(0.06)     | 0.04<br>(0.06)     | 0.05<br>(0.05)        | 0.12<br>(0.60)      | 0.05<br>(0.05)                   | 0.12<br>(0.60)      |
|  | York. and Humber      | 0.66<br>(0.57)     | 0.06<br>(0.05)     | 0.07<br>(0.05)     | 0.02<br>(0.05)        | -1.47**<br>(0.72)   | 0.02<br>(0.05)                   | -1.48**<br>(0.72)   |
|  | Scotland              | 0.14<br>(0.55)     | 0.01<br>(0.05)     | 0.01<br>(0.05)     | -0.02<br>(0.05)       | -0.94<br>(0.67)     | -0.02<br>(0.05)                  | -0.94<br>(0.68)     |
|  | Wales                 | 0.86<br>(0.69)     | 0.07<br>(0.06)     | 0.08<br>(0.06)     | 0.05<br>(0.05)        | -0.70<br>(0.89)     | 0.06<br>(0.05)                   | -0.70<br>(0.89)     |
|  | Northern Ireland      | 0.01<br>(0.87)     | -0.00<br>(0.08)    | 0.00<br>(0.08)     | -0.05<br>(0.08)       | -24.10***<br>(0.46) | -0.05<br>(0.08)                  | -17.44***<br>(0.46) |
| Other  | Constant              | 3.54***<br>(0.77)  | 1.71***<br>(0.07)  | 1.69***<br>(0.08)  | 1.84***<br>(0.06)     | 0.15<br>(0.98)      | 1.84***<br>(0.07)                | 0.14<br>(0.98)      |
|  | R-Squared             | 0.23               | -                  | -                  | -                     | -                   | -                                | -                   |
|  | Log-transformed alpha | -                  | -                  | -2.30***<br>(0.14) | -                     | -                   | -2.96***<br>(0.16)               | -                   |
|  | Observations          | 1,499              | 1,499              | 1,499              | 1,499                 | 1,499               | 1,499                            | 1,499               |

Standard errors in parentheses; asterisks indicate significance level (\*\*\*)  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.1$ )

Source: Deloitte

Table C.1b: AIC and BIC results for model fit

| Model                            | Observations | Log-Likelihood (Null) | Log-Likelihood (Model) | Degrees of Freedom | AIC     | BIC     |
|----------------------------------|--------------|-----------------------|------------------------|--------------------|---------|---------|
| Ordinary Least Squares (OLS)     | 1,499        | -4,540.6              | -4,344.7               | 27                 | 8,743.4 | 8,886.8 |
| Poisson                          | 1,499        | -                     | -2.2                   | 27                 | 58.4    | 201.8   |
| Poisson, Zero-inflated           | 1,499        | -2.2                  | -2.1                   | 52                 | 108.1   | 384.4   |
| Negative Binomial                | 1,499        | -2.2                  | -2.1                   | 28                 | 60.2    | 209.0   |
| Negative Binomial, Zero-inflated | 1,499        | -2.1                  | -2.0                   | 53                 | 110.1   | 391.6   |

Table C.2a: Perceptions of fairness in the UK tax system

| CATEGORY                                       | VARIABLE                       | OLS                | Ordered Probit     | Ordered Logit      |
|--|--------------------------------|--------------------|--------------------|--------------------|
| Tax  | TES                            | 0.02***<br>(0.01)  | 0.02***<br>(0.01)  | 0.04***<br>(0.01)  |
|  | Self Assessment                | 0.17*<br>(0.09)    | 0.19**<br>(0.09)   | 0.31**<br>(0.16)   |
| Demographics                                   | Age                            | -0.05***<br>(0.01) | -0.05***<br>(0.01) | -0.08***<br>(0.02) |
|  | Age (Squared)                  | 0.00***<br>(0.00)  | 0.00***<br>(0.00)  | 0.00***<br>(0.00)  |
|  | Female                         | 0.16<br>(0.10)     | 0.18<br>(0.11)     | 0.32*<br>(0.19)    |
|  | Occupation (ABC1)              | 0.18*<br>(0.10)    | 0.20*<br>(0.11)    | 0.35*<br>(0.18)    |
|  | Female, Occupation (ABC1)      | -0.24*<br>(0.13)   | -0.26*<br>(0.14)   | -0.44*<br>(0.24)   |
|  | Gross Income<br>(Base = £60k+) | £0-£10,000         | -0.27*<br>(0.16)   | -0.30*<br>(0.17)   |
| £10,000-£20,000                                |                                | -0.42***<br>(0.16) | -0.46***<br>(0.17) | -0.77***<br>(0.29) |
| £20,000-£30,000                                |                                | -0.19<br>(0.15)    | -0.21<br>(0.16)    | -0.38<br>(0.28)    |
| £30,000-£40,000                                |                                | -0.34**<br>(0.15)  | -0.37**<br>(0.17)  | -0.61**<br>(0.29)  |
| £40,000-£60,000                                |                                | -0.30*<br>(0.18)   | -0.33*<br>(0.19)   | -0.58*<br>(0.33)   |
| Education<br>(Base = Middle Education)         | Low Education                  | 0.01<br>(0.08)     | 0.02<br>(0.09)     | 0.05<br>(0.15)     |
|  | High Education                 | 0.15**<br>(0.07)   | 0.16**<br>(0.08)   | 0.32**<br>(0.13)   |
| Region (Base = England)                        | Scotland                       | -0.10<br>(0.10)    | -0.11<br>(0.11)    | -0.14<br>(0.19)    |
|  | Wales                          | -0.19<br>(0.13)    | -0.19<br>(0.14)    | -0.35<br>(0.22)    |
|  | Northern Ireland               | 0.01<br>(0.23)     | -0.01<br>(0.25)    | 0.10<br>(0.49)     |
| General Election 2017<br>(Base = Conservative) | Labour                         | -0.34***<br>(0.08) | -0.35***<br>(0.08) | -0.64***<br>(0.14) |
|  | Liberal Democrats              | -0.25**<br>(0.12)  | -0.26**<br>(0.12)  | -0.48**<br>(0.22)  |
|  | Other                          | -0.29***<br>(0.11) | -0.31***<br>(0.11) | -0.56***<br>(0.20) |
|  | Don't know                     | -0.72***<br>(0.17) | -0.78***<br>(0.19) | -1.27***<br>(0.35) |
| Miscellaneous                                  | Constant                       | 3.84***<br>(0.36)  | -                  | -                  |
|  | Cut-off point 1                | -                  | -2.40***<br>(0.39) | -4.05***<br>(0.67) |
|  | Cut-off point 2                | -                  | -1.40***<br>(0.38) | -2.35***<br>(0.66) |
|  | Cut-off point 3                | -                  | -0.41<br>(0.38)    | -0.71<br>(0.66)    |
|  | Cut-off point 4                | -                  | 0.70*<br>(0.40)    | 1.40**<br>(0.69)   |
|  | Observations                   | 1,314              | 1,314              | 1,314              |

Standard errors in parentheses; asterisks indicate significance level (\*\*\*)  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.1$ . Source: Deloitte

Table C.2a: Perceptions of fairness in the UK tax system (continued)

| MODEL           | CATEGORY                       | VARIABLE           | Ordered Probit, relaxed POA |                    |                    |                    | Ordered Logit, relaxed POA |                    |                    |                 |
|-----------------|--------------------------------|--------------------|-----------------------------|--------------------|--------------------|--------------------|----------------------------|--------------------|--------------------|-----------------|
|                 |                                |                    | Very Unfair                 | Unfair             | Neutral            | Fair               | Very Unfair                | Unfair             | Neutral            | Fair            |
| Tax             | TES                            | 0.04***<br>(0.01)  | 0.01<br>(0.01)              | 0.03***<br>(0.01)  | 0.01<br>(0.02)     | 0.09***<br>(0.03)  | 0.02<br>(0.02)             | 0.05***<br>(0.02)  | 0.03<br>(0.04)     |                 |
|                 |                                | 0.19**<br>(0.09)   | 0.19**<br>(0.09)            | 0.19**<br>(0.09)   | 0.19**<br>(0.09)   | 0.31**<br>(0.16)   | 0.31**<br>(0.16)           | 0.31**<br>(0.16)   | 0.31**<br>(0.16)   |                 |
| Demographics    | Age                            | -0.05***<br>(0.01) | -0.05***<br>(0.01)          | -0.05***<br>(0.01) | -0.05***<br>(0.01) | -0.08***<br>(0.02) | -0.08***<br>(0.02)         | -0.08***<br>(0.02) | -0.08***<br>(0.02) |                 |
|                 |                                | Age (Squared)      | 0.00***<br>(0.00)           | 0.00***<br>(0.00)  | 0.00***<br>(0.00)  | 0.00***<br>(0.00)  | 0.00***<br>(0.00)          | 0.00***<br>(0.00)  | 0.00***<br>(0.00)  |                 |
|                 | Female                         | 0.18<br>(0.11)     | 0.18<br>(0.11)              | 0.18<br>(0.11)     | 0.18<br>(0.11)     | 0.32*<br>(0.19)    | 0.32*<br>(0.19)            | 0.32*<br>(0.19)    | 0.32*<br>(0.19)    |                 |
|                 | Occupation (ABC1)              | 0.20*<br>(0.11)    | 0.20*<br>(0.11)             | 0.20*<br>(0.11)    | 0.20*<br>(0.11)    | 0.34*<br>(0.18)    | 0.34*<br>(0.18)            | 0.34*<br>(0.18)    | 0.34*<br>(0.18)    |                 |
|                 | Female, Occupation             | -0.26*<br>(0.14)   | -0.26*<br>(0.14)            | -0.26*<br>(0.14)   | -0.26*<br>(0.14)   | -0.45*<br>(0.23)   | -0.45*<br>(0.23)           | -0.45*<br>(0.23)   | -0.45*<br>(0.23)   |                 |
|                 | Gross Income<br>(Base = £60k+) | £0-£10,000         | -0.31*<br>(0.18)            | -0.31*<br>(0.18)   | -0.31*<br>(0.18)   | -0.31*<br>(0.18)   | -0.47<br>(0.30)            | -0.47<br>(0.30)    | -0.47<br>(0.30)    | -0.47<br>(0.30) |
| £10,000-£20,000 |                                | -0.47***<br>(0.17) | -0.47***<br>(0.17)          | -0.47***<br>(0.17) | -0.47***<br>(0.17) | -0.78***<br>(0.29) | -0.78***<br>(0.29)         | -0.78***<br>(0.29) | -0.78***<br>(0.29) |                 |
| £20,000-£30,000 |                                | -0.22<br>(0.16)    | -0.22<br>(0.16)             | -0.22<br>(0.16)    | -0.22<br>(0.16)    | -0.38<br>(0.28)    | -0.38<br>(0.28)            | -0.38<br>(0.28)    | -0.38<br>(0.28)    |                 |
| £30,000-£40,000 |                                | -0.39**<br>(0.17)  | -0.39**<br>(0.17)           | -0.39**<br>(0.17)  | -0.39**<br>(0.17)  | -0.62**<br>(0.29)  | -0.62**<br>(0.29)          | -0.62**<br>(0.29)  | -0.62**<br>(0.29)  |                 |
| £40,000-£60,000 |                                | -0.35*<br>(0.19)   | -0.35*<br>(0.19)            | -0.35*<br>(0.19)   | -0.35*<br>(0.19)   | -0.59*<br>(0.33)   | -0.59*<br>(0.33)           | -0.59*<br>(0.33)   | -0.59*<br>(0.33)   |                 |

|  |                   |                    |                    |                    |                    |                    |                    |                    |                    |
|--|-------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Education                              | Low Education     | 0.02<br>(0.09)     | 0.02<br>(0.09)     | 0.02<br>(0.09)     | 0.02<br>(0.09)     | 0.05<br>(0.15)     | 0.05<br>(0.15)     | 0.05<br>(0.15)     | 0.05<br>(0.15)     |
|  | High Education    | 0.17**<br>(0.08)   | 0.17**<br>(0.08)   | 0.17**<br>(0.08)   | 0.17**<br>(0.08)   | 0.32**<br>(0.13)   | 0.32**<br>(0.13)   | 0.32**<br>(0.13)   | 0.32**<br>(0.13)   |
| Region<br>(Base = England)             | Scotland          | -0.10<br>(0.11)    | -0.10<br>(0.11)    | -0.10<br>(0.11)    | -0.10<br>(0.11)    | -0.14<br>(0.19)    | -0.14<br>(0.19)    | -0.14<br>(0.19)    | -0.14<br>(0.19)    |
|  | Wales             | -0.19<br>(0.14)    | -0.19<br>(0.14)    | -0.19<br>(0.14)    | -0.19<br>(0.14)    | -0.34<br>(0.22)    | -0.34<br>(0.22)    | -0.34<br>(0.22)    | -0.34<br>(0.22)    |
|  | Northern Ireland  | -0.00<br>(0.25)    | -0.00<br>(0.25)    | -0.00<br>(0.25)    | -0.00<br>(0.25)    | 0.10<br>(0.49)     | 0.10<br>(0.49)     | 0.10<br>(0.49)     | 0.10<br>(0.49)     |
| General Election 2017<br>(Base = Cons) | Labour            | -0.36***<br>(0.08) | -0.36***<br>(0.08) | -0.36***<br>(0.08) | -0.36***<br>(0.08) | -0.65***<br>(0.14) | -0.65***<br>(0.14) | -0.65***<br>(0.14) | -0.65***<br>(0.14) |
|  | Liberal Democrats | -0.26**<br>(0.12)  | -0.26**<br>(0.12)  | -0.26**<br>(0.12)  | -0.26**<br>(0.12)  | -0.48**<br>(0.22)  | -0.48**<br>(0.22)  | -0.48**<br>(0.22)  | -0.48**<br>(0.22)  |
|  | Other             | -0.32***<br>(0.11) | -0.32***<br>(0.11) | -0.32***<br>(0.11) | -0.32***<br>(0.11) | -0.57***<br>(0.20) | -0.57***<br>(0.20) | -0.57***<br>(0.20) | -0.57***<br>(0.20) |
|  | Don't know        | -0.77***<br>(0.19) | -0.77***<br>(0.19) | -0.77***<br>(0.19) | -0.77***<br>(0.19) | -1.26***<br>(0.35) | -1.26***<br>(0.35) | -1.26***<br>(0.35) | -1.26***<br>(0.35) |
| Miscellaneous                          | Constant          | 2.18***<br>(0.40)  | 1.56***<br>(0.38)  | 0.35<br>(0.38)     | -0.47<br>(0.47)    | 3.54***<br>(0.71)  | 2.58***<br>(0.66)  | 0.56<br>(0.66)     | -1.23<br>(0.88)    |
|  | Observations      | 1,314              | 1,314              | 1,314              | 1,314              | 1,314              | 1,314              | 1,314              | 1,314              |

Note: POA is the Proportional Odds Assumption. Standard errors in parentheses; asterisks indicate significance level (\*\*\*)  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.1$ . Source: Deloitte

Table C.2b: AIC and BIC results for model fit, LR Tests, and Brant Test for Ordered Logit model

| AIC, BIC                     | Observations | Log-Likelihood (Null) | Log-Likelihood (Model) | Degrees of Freedom | AIC     | BIC     |
|------------------------------|--------------|-----------------------|------------------------|--------------------|---------|---------|
| Ordinary Least Squares (OLS) | 1,314        | -1,906.7              | -1,840.0               | 22                 | 3,724.1 | 3,838.1 |
| Ordered Probit               | 1,314        | -1,858.7              | -1,795.3               | 25                 | 3,640.5 | 3,770.1 |
| Ordered Logit                | 1,314        | -1,858.7              | -1,798.0               | 25                 | 3,645.9 | 3,775.4 |
| Ordered Probit, relaxed POA  | 1,314        | -1,881.4              | -1,807.9               | 28                 | 3,671.9 | 3,817.0 |
| Ordered Logit, relaxed POA   | 1,314        | -1,881.4              | -1,808.1               | 28                 | 3,672.2 | 3,817.3 |

| LR Tests           | Ordered Probit | Ordered Logit |
|--------------------|----------------|---------------|
| LR chi2(63)        | 82.41          | 86.97         |
| Probability > chi2 | 0.051          | 0.024         |

| Brant Test for Ordered Logit model | Chi-Squared | P > Chi-Squared | Degrees of Freedom |
|------------------------------------|-------------|-----------------|--------------------|
| All Variables                      | 69.72       | 0.01            | 42                 |
| Tax Education Score                | 15.09       | 0.00            | 2                  |
| Age                                | 1.22        | 0.54            | 2                  |
| Age (Squared)                      | 2.06        | 0.36            | 2                  |
| Self Assessment                    | 0.23        | 0.89            | 2                  |
| Female                             | 4.96        | 0.08            | 2                  |
| Occupation                         | 0.88        | 0.64            | 2                  |
| Female, Occupation                 | 2.32        | 0.31            | 2                  |
| Under £10,000                      | 4.56        | 0.10            | 2                  |
| £10,000 to £20,000                 | 6.36        | 0.04            | 2                  |
| £20,000 to £30,000                 | 2.33        | 0.31            | 2                  |
| £30,000 to £40,000                 | 1.36        | 0.51            | 2                  |
| £40,000 to £60,000                 | 4.04        | 0.13            | 2                  |
| Low Education                      | 0.30        | 0.86            | 2                  |
| High Education                     | 1.94        | 0.38            | 2                  |
| Scotland                           | 0.27        | 0.87            | 2                  |
| Wales                              | 7.59        | 0.02            | 2                  |
| Northern Ireland                   | 6.54        | 0.04            | 2                  |
| Labour                             | 1.07        | 0.59            | 2                  |
| Liberal Democrats                  | 0.46        | 0.80            | 2                  |
| Other                              | 0.06        | 0.97            | 2                  |
| Don't know                         | 1.52        | 0.47            | 2                  |

Source: Deloitte

Table C.3a: Preferences for tax and spend

| MODEL                                       |                                  | OLS                | Ordered Probit     | Ordered Logit      | Ordered Probit, relaxed POA |                    | Ordered Logit, relaxed POA |                    |
|---|----------------------------------|--------------------|--------------------|--------------------|-----------------------------|--------------------|----------------------------|--------------------|
| CATEGORY                                    | VARIABLE                         | -                  | -                  | -                  | Reduce Tax                  | Maintain Tax       | Reduce Tax                 | Maintain Tax       |
| Tax   | TES                              | 0.02***<br>(0.00)  | 0.03***<br>(0.01)  | 0.05***<br>(0.01)  | 0.03***<br>(0.01)           | 0.03***<br>(0.01)  | 0.05***<br>(0.02)          | 0.05***<br>(0.02)  |
|   | My tax changed                   | -0.17***<br>(0.04) | -0.32***<br>(0.07) | -0.56***<br>(0.12) | -0.31***<br>(0.07)          | -0.31***<br>(0.07) | -0.53***<br>(0.12)         | -0.53***<br>(0.12) |
|   | Self Assessment                  | -0.14**<br>(0.05)  | -0.25**<br>(0.10)  | -0.44***<br>(0.17) | -0.23**<br>(0.10)           | 0.01***<br>(0.00)  | -0.41**<br>(0.17)          | 0.03***<br>(0.01)  |
| Demographics                                | Age                              | 0.01***<br>(0.00)  | 0.02***<br>(0.00)  | 0.03***<br>(0.01)  | 0.02***<br>(0.00)           | -0.31***<br>(0.07) | 0.04***<br>(0.01)          | -0.53***<br>(0.12) |
|   | Female                           | 0.02<br>(0.07)     | 0.04<br>(0.12)     | 0.12<br>(0.20)     | 0.05<br>(0.12)              | 0.05<br>(0.12)     | 0.13<br>(0.20)             | 0.13<br>(0.20)     |
|   | Occupation (ABC1)                | 0.10*<br>(0.06)    | 0.20*<br>(0.11)    | 0.37*<br>(0.20)    | 0.19*<br>(0.11)             | 0.19*<br>(0.11)    | 0.35*<br>(0.19)            | 0.35*<br>(0.19)    |
|   | Female, Occupation               | -0.12<br>(0.08)    | -0.24*<br>(0.14)   | -0.48*<br>(0.25)   | 0.04<br>(0.16)              | -0.42***<br>(0.15) | 0.03<br>(0.29)             | -0.76***<br>(0.26) |
|   | Have children                    | -0.11**<br>(0.05)  | -0.20**<br>(0.09)  | -0.32**<br>(0.16)  | -0.22**<br>(0.09)           | -0.22**<br>(0.09)  | -0.36**<br>(0.15)          | -0.36**<br>(0.15)  |
|   | Employ. Status (Base = Employee) | Self-Employed      | 0.04<br>(0.10)     | 0.07<br>(0.18)     | 0.21<br>(0.31)              | -0.22<br>(0.20)    | 0.28<br>(0.18)             | -0.33<br>(0.35)    |
| Student                                     |                                  | 0.29**<br>(0.14)   | 0.54**<br>(0.25)   | 0.95**<br>(0.44)   | 0.51**<br>(0.25)            | 0.51**<br>(0.25)   | 0.92**<br>(0.44)           | 0.92**<br>(0.44)   |
| Retired                                     |                                  | -0.00<br>(0.06)    | 0.01<br>(0.11)     | 0.01<br>(0.19)     | -0.01<br>(0.11)             | -0.01<br>(0.11)    | -0.00<br>(0.20)            | -0.00<br>(0.20)    |
| Unemployed                                  |                                  | 0.12<br>(0.12)     | 0.21<br>(0.22)     | 0.39<br>(0.39)     | 0.81**<br>(0.39)            | -0.13<br>(0.31)    | 1.65**<br>(0.80)           | -0.20<br>(0.54)    |
| Not working                                 |                                  | 0.15**<br>(0.07)   | 0.29**<br>(0.14)   | 0.53**<br>(0.24)   | 0.27**<br>(0.14)            | 0.27**<br>(0.14)   | 0.48**<br>(0.24)           | 0.48**<br>(0.24)   |
| Gross Income (Base = £60k+)                 | £0-£10,000                       | 0.21*<br>(0.13)    | 0.38*<br>(0.23)    | 0.60<br>(0.40)     | 0.62***<br>(0.24)           | 0.22<br>(0.23)     | 1.01**<br>(0.42)           | 0.32<br>(0.39)     |
|   | £10,000-£20,000                  | 0.24**<br>(0.12)   | 0.44**<br>(0.22)   | 0.74**<br>(0.38)   | 0.40**<br>(0.20)            | 0.40**<br>(0.20)   | 0.66*<br>(0.34)            | 0.66*<br>(0.34)    |
|   | £20,000-£30,000                  | 0.16<br>(0.11)     | 0.29<br>(0.21)     | 0.47<br>(0.37)     | 0.45**<br>(0.21)            | 0.14<br>(0.21)     | 0.72**<br>(0.36)           | 0.21<br>(0.35)     |
|   | £30,000-£40,000                  | 0.13<br>(0.12)     | 0.23<br>(0.22)     | 0.38<br>(0.38)     | 0.41*<br>(0.22)             | 0.07<br>(0.21)     | 0.69*<br>(0.39)            | 0.11<br>(0.36)     |
|   | £40,000-£60,000                  | 0.11<br>(0.13)     | 0.20<br>(0.23)     | 0.34<br>(0.41)     | 0.19<br>(0.21)              | 0.19<br>(0.21)     | 0.32<br>(0.36)             | 0.32<br>(0.36)     |
| General Education (Base = Lower Education)  | Middle Education                 | 0.09*<br>(0.05)    | 0.16*<br>(0.09)    | 0.30*<br>(0.16)    | 0.18*<br>(0.09)             | 0.18*<br>(0.09)    | 0.33**<br>(0.17)           | 0.33**<br>(0.17)   |
|   | High Education                   | 0.13**<br>(0.06)   | 0.24**<br>(0.11)   | 0.42**<br>(0.19)   | 0.25**<br>(0.11)            | 0.25**<br>(0.11)   | 0.43**<br>(0.19)           | 0.43**<br>(0.19)   |
| Region (Base = England)                     | Scotland                         | -0.00<br>(0.08)    | -0.01<br>(0.15)    | -0.04<br>(0.25)    | -0.01<br>(0.14)             | -0.01<br>(0.14)    | -0.05<br>(0.25)            | -0.05<br>(0.25)    |
|   | Wales                            | -0.21***<br>(0.08) | -0.38***<br>(0.14) | -0.66***<br>(0.24) | -0.39***<br>(0.14)          | -0.39***<br>(0.14) | -0.68***<br>(0.24)         | -0.68***<br>(0.24) |
|   | Northern Ireland                 | -0.09<br>(0.14)    | -0.16<br>(0.26)    | -0.29<br>(0.47)    | -0.16<br>(0.24)             | -0.16<br>(0.24)    | -0.30<br>(0.41)            | -0.30<br>(0.41)    |
| General Election 2017 (Base = Conservative) | Labour                           | 0.25***<br>(0.05)  | 0.46***<br>(0.09)  | 0.80***<br>(0.15)  | 0.48***<br>(0.09)           | 0.48***<br>(0.09)  | 0.84***<br>(0.16)          | 0.84***<br>(0.16)  |
|   | Liberal Democrats                | 0.28***<br>(0.07)  | 0.54***<br>(0.14)  | 0.95***<br>(0.23)  | 0.56***<br>(0.14)           | 0.56***<br>(0.14)  | 0.99***<br>(0.24)          | 0.99***<br>(0.24)  |
|   | Other                            | 0.24***<br>(0.08)  | 0.44***<br>(0.14)  | 0.78***<br>(0.25)  | 0.20<br>(0.16)              | 0.59***<br>(0.15)  | 0.35<br>(0.28)             | 1.02***<br>(0.25)  |
|   | Don't know                       | 0.06<br>(0.14)     | 0.13<br>(0.25)     | 0.20<br>(0.45)     | 0.10<br>(0.24)              | 0.10<br>(0.24)     | 0.14<br>(0.44)             | 0.14<br>(0.44)     |
| EU Ref 2016 (Base = Remain)                 | Leave                            | -0.24***<br>(0.05) | -0.45***<br>(0.08) | -0.77***<br>(0.14) | -0.45***<br>(0.08)          | -0.45***<br>(0.08) | -0.77***<br>(0.14)         | -0.77***<br>(0.14) |
|   | Did not vote                     | -0.28***<br>(0.10) | -0.50***<br>(0.18) | -0.85***<br>(0.31) | -0.51***<br>(0.17)          | -0.51***<br>(0.17) | -0.85***<br>(0.31)         | -0.85***<br>(0.31) |
|   | Cannot remember                  | -0.38**<br>(0.17)  | -0.68**<br>(0.31)  | -1.13**<br>(0.54)  | -0.67**<br>(0.32)           | -0.67**<br>(0.32)  | -1.17**<br>(0.56)          | -1.17**<br>(0.56)  |
| Miscellaneous                               | Constant                         | 1.30***<br>(0.17)  | -                  | -                  | -0.92***<br>(0.32)          | -1.87***<br>(0.32) | -1.67***<br>(0.55)         | -3.21***<br>(0.55) |
|   | Cut 1                            | -                  | 0.51<br>(0.31)     | 0.90*<br>(0.54)    | -                           | -                  | -                          | -                  |
|   | Cut 2                            | -                  | 2.10***<br>(0.32)  | 3.60***<br>(0.56)  | -                           | -                  | -                          | -                  |
|   | Observations                     | 1,323              | 1,323              | 1,323              | 1,323                       | 1,323              | 1,323                      | 1,323              |

Note: POA is the Proportional Odds Assumption. Standard errors in parentheses; asterisks indicate significance level (\*\*\*)  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.1$ ). Source: Deloitte

Table C.3b: AIC and BIC results for model fit, LR Tests, and Brant Test for Ordered Logit model

| AIC, BIC                     | Observations | Log-Likelihood (Null) | Log-Likelihood (Model) | Degrees of Freedom | AIC     | BIC     |
|------------------------------|--------------|-----------------------|------------------------|--------------------|---------|---------|
| Ordinary Least Squares (OLS) | 1,314        | -1,906.7              | -1,840.0               | 22                 | 3,724.1 | 3,838.1 |
| Ordered Probit               | 1,323        | -1,329.6              | -1,207.5               | 32                 | 2,479.1 | 2,645.1 |
| Ordered Logit                | 1,323        | -1,329.6              | -1,206.1               | 32                 | 2,476.1 | 2,642.1 |
| Ordered Probit, relaxed POA  | 1,323        | -1,336.5              | -1,185.6               | 40                 | 2,451.3 | 2,658.8 |
| Ordered Logit, relaxed POA   | 1,323        | -1,336.5              | -1,183.3               | 40                 | 2,446.6 | 2,654.1 |

| LR Tests                  | Ordered Probit | Ordered Logit |
|---------------------------|----------------|---------------|
| LR Chi-Squared (30)       | 66.42          | 64.22         |
| Probability > Chi-Squared | 0.000          | 0.000         |

| Brant Test for Ordered Logit model | Chi-Squared | P > Chi-Squared | Degrees of Freedom |
|------------------------------------|-------------|-----------------|--------------------|
| All Variables                      | 69.52       | 0.00            | 30                 |
| TES                                | 0.05        | 0.82            | 1                  |
| My tax changed                     | 3.93        | 0.05            | 1                  |
| Age                                | 0.24        | 0.62            | 1                  |
| Self Assessment                    | 2.35        | 0.13            | 1                  |
| Female                             | 0.39        | 0.53            | 1                  |
| Occupation                         | 0.23        | 0.63            | 1                  |
| Female, Occupation                 | 3.83        | 0.05            | 1                  |
| Child                              | 2.17        | 0.14            | 1                  |
| Self-Employed                      | 4.99        | 0.03            | 1                  |
| Student                            | 0.14        | 0.70            | 1                  |
| Retired                            | 0.00        | 0.97            | 1                  |
| Unemployed                         | 3.60        | 0.06            | 1                  |
| Not working                        | 1.29        | 0.26            | 1                  |
| £0 - £10,000                       | 2.97        | 0.09            | 1                  |
| £10,000 - £20,000                  | 1.73        | 0.19            | 1                  |
| £20,000 - £30,000                  | 5.28        | 0.02            | 1                  |
| £30,000 - £40,000                  | 4.01        | 0.05            | 1                  |
| £40,000 - £60,000                  | 0.54        | 0.46            | 1                  |
| Medium Education                   | 0.72        | 0.40            | 1                  |
| High Education                     | 1.48        | 0.22            | 1                  |
| Scotland                           | 0.60        | 0.44            | 1                  |
| Wales                              | 0.93        | 0.34            | 1                  |
| Northern Ireland                   | 0.34        | 0.56            | 1                  |
| Labour                             | 7.89        | 0.01            | 1                  |
| Liberal Democrats                  | 1.36        | 0.24            | 1                  |
| Other                              | 13.09       | 0.00            | 1                  |
| Don't know                         | 1.65        | 0.20            | 1                  |
| Leave                              | 0.04        | 0.85            | 1                  |
| Did not vote                       | 0.01        | 0.94            | 1                  |
| Cannot remember                    | 0.08        | 0.78            | 1                  |



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