

Measuring top income shares in the UK

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Abstract

This paper examines measurement error in the share of income going to the top 1% (and other subgroups) that comes from estimation of the denominator. We compare two approaches: using micro-data, as used to estimate the numerator; and using the National Accounts. Under the former, ‘augmented internal’ approach, the UK top 1% fiscal income share is 2 percentage points higher than under the alternative ‘external’ approach. We set out four principled criteria for selecting between these approaches and argue that the ‘augmented internal’ approach is to be preferred.

Keywords: income inequality, measurement, national accounts, top shares

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1 Introduction

Top income shares – the amount of income held by some fraction of the population, say the top 1%, divided by total income in the population – provide an important insight into the unequal distribution of resources. As well as being a matter of increasing public concern in itself, the share of income captured by the top is also used by economists to understand the dynamics of entrepreneurship, innovation, growth and other macroeconomic outcomes (Gabaix et al., 2016; Jones and Kim, 2018; Aghion et al., 2019). Early work by Atkinson (2005b), later extended to produce the UK top share series in the widely-cited *World Inequality Database* (WID), illustrated how such income inequality in the UK has developed over time. Top shares declined dramatically throughout the 20th Century until the 1980s, rising again to levels seen immediately after the Second World War by the turn of the century. The measured rise in top income shares was halted by the Financial Crisis, though it appears that lately the rise in inequality has resumed.

In this paper, we examine the alternative methods and data sources that can be used to construct the denominator for top income shares, and the quantitative importance of these choices. In particular, we compare the merits of using an augmented internal denominator – using survey data to augment the administrative tax data – to an external denominator based on National Accounts.

In previous studies of top income shares, extensive attention has been paid to measurement of the numerator, i.e. to the accurate quantification of the incomes of the richest (Atkinson, 2005b, 2007; Piketty and Saez, 2003, 2020; Auten and Splinter, 2019). These are poorly measured in survey data, through a combination of lower response rates by the rich and weaker coverage of the types of income sources received by the rich (Burkhauser et al., 2018a,b; Advani et al., 2021a). This has motivated the use of administrative data to replace or augment survey responses.

By contrast, relatively little attention has been paid to measurement issues affecting the denominator, i.e. the corresponding income total for the entire population. This is largely because, in principle, it should be straightforward to measure: once we have a target definition of income, and a way to measure it among top individuals, the same approach can be extended to the rest of the population, creating an ‘internal’ denominator. However, top incomes are best measured in administrative tax data. These exclude very low income individuals who fall below the minimum threshold required to pay tax, known in the UK as the ‘personal allowance’. This “missing income” problem has become more pressing over time as the personal allowance has

increased, tripling over the past 20 years.

Historically, there have been two distinct ways of constructing the denominator for the UK’s fiscal income series – referred to hereafter as the ‘Atkinson series’ – which was developed by Atkinson (2005b) and later extended in a series of updates (Atkinson, 2012, 2013, 2014; Atkinson and Ooms, 2015; Alvaredo, 2017). First, using aggregate income observed from tax records, i.e. an ‘internal’ control, and then augmenting this with other data sources to capture certain types of missing income. We call this the ‘augmented internal’ approach. Second, using the National Accounts to construct the denominator, but with adjustments to target the fiscal income definition. The pivot towards the National Accounts has been partly motivated as a result of the international standardisation of these statistics (Atkinson, 2012).¹

We construct our augmented internal approach by summing the income assessed by tax authorities, obtained from tax data, and adding to this an estimate of total income among the non-taxpaying population using survey data. Our alternative external denominator uses information from the National Accounts, retaining components of national income which have a counterpart in fiscal income.

Our main finding is that denominator choice is quantitatively important: aggregate income is 15% (£119bn) higher on average using the external approach, relative to the augmented internal total. To establish a preference for one methodological approach over another, we define a set of principles that an ideal top share series ought to satisfy, regardless of the income definition being targeted. The four criteria we set out are: (i) comparability between the numerator and denominator; (ii) comparability over time; (iii) international comparability; and (iv) practical considerations. Judging our two fiscal income series against these criteria, we argue that while our augmented internal approach satisfies all but the third criterion, the external approach to constructing a denominator for the fiscal income series satisfies none.

Measurement choices in the denominator affect the level of top share estimates: the share of the top 1% rises by 2 percentage points when an augmented internal income total is used relative to an external total. Along with this higher level, our augmented internal denominator exhibits a smaller drop in top shares following the Financial Crisis relative to the Atkinson series. We find that the top 1% share of pre-tax income rose from 12.2% in 1996-97 to 15.2% in 2007-08. Top shares fell in

¹It is important to emphasise that using National Accounts data for the external control total of a fiscal income series is not the same as the Distributional National Accounts approach to inequality measurement because the latter targets National Income, an income concept that is broader than fiscal income.

the aftermath of the Financial Crisis, and have risen slightly in recent years, with the top 1% receiving 14.3% of pre-tax fiscal income in 2018-19. The 0.8 percentage point post-Crisis rise in our series between 2010-11 and 2014-15 (from 13.5% to 14.3%), compares with a 1.3 percentage point rise (from 12.6% to 13.9%) in the Atkinson series.

The principles and methods we set out are complimentary to the most recent strand of literature on measuring top income inequality, which focuses on measuring top shares using income definitions that are harmonised across countries (Atkinson, 2005a, 2007; Alvaredo et al., 2013, 2016, 2020; Garbinti et al., 2018; Piketty et al., 2018). There are different definitions of income that one could use to measure inequality. Historically, the two most widely-used have been fiscal income – income assessable for tax, typically measured using tax records – and Canberra income – a broader definition of income including all receipts received at annual or more frequent intervals, typically measured using surveys. More recently, the development of ‘Distributional National Accounts’ (DINA) has led to wide adoption of a third income definition based on National Accounts standards. Its appeal lies in consistency with macroeconomic aggregates and the possibility of harmonisation across countries.

However, fiscal income remains an important definition for several reasons: it is consistent with the best data source for measuring the incomes of the richest; it has the longest historical availability; and it continues to be widely used by economists as the foundation for producing inequality series using more comprehensive income definitions, including DINA (Burkhauser et al., 2018b,a; Advani and Summers, 2020; Atkinson and Jenkins, 2019; Jenkins, 2017; Piketty et al., 2018). Despite the addition of DINA series to the WID, fiscal income series continue to be published. The Atkinson series remains the longest running time series for the UK, and has recently been extended based on our ‘augmented internal’ estimates (Advani et al., 2021b). In this paper, we present our arguments for revising the methods used to construct the UK’s fiscal income series, and the principles that ought to guide the estimation of any top share series.

Our approach to selecting between top income series also makes a wider methodological contribution, by providing a principled way to think about the options. The use of National Accounts to construct income control totals for estimating top shares dates back to Kuznets (1953), and has been widely adopted since (Piketty, 2003; Piketty and Saez, 2003). Until 2009, the Atkinson series relied on the augmented internal control method. Internal aggregates were augmented by an adjustment to pension receipts using data on aggregate pension income from the National Accounts.

No adjustment was made to account for individuals with income below the personal allowance. Since 2009, Atkinson switched to using the external control method, using National Accounts data.² This was implemented by summing – in principle – only the components of National Income that are assessable for income tax in the UK, omitting items such as non-taxable benefits. In practice, some non-taxable income sources such as interest payments received by pension funds were also included. This switch passed without much attention, partly because the two approaches produced similar results at the time of the switch. More recently however, delays in producing the series have partly been driven by a need to reconcile the growing gap between the two approaches, as also highlighted by Burkhauser et al. (2018b). By setting out first some clear desiderata against which the alternatives can be compared, we are able to provide a clear rationale for which series should be preferred. These principles can continue to be applied as data availability evolves in the UK, as well as to decisions about denominator choice in other countries’ estimates of top shares.

The remainder of the paper is organised as follows. Section 2 outlines the data sources. Section 3 describes the methodology used to construct our numerator. Section 4 describes the two approaches we use to construct the denominator. Section 5 sets out the four desirable criteria we believe a top share series ought to possess and outlines our reasons for preferring the augmented internal approach. Section 6 presents our updated series for top pre-tax shares in the UK. Section 7 concludes. Throughout the paper, we refer to supplementary tables that can be found in the Online Appendix. These tables and figures are identified by having a letter before their figure number, denoting the relevant Appendix section.

2 Data

Our target measure of income inequality is the share of pre-tax fiscal income that goes to particular top shares of the population, for example the top 1%.³ Fiscal income is defined as income that is taxable under the personal income tax system within a country. In the UK, this includes earned income from employment and self-employment, rental income, interest, dividends, pension income (from private and social security pensions), and certain types of welfare payment.

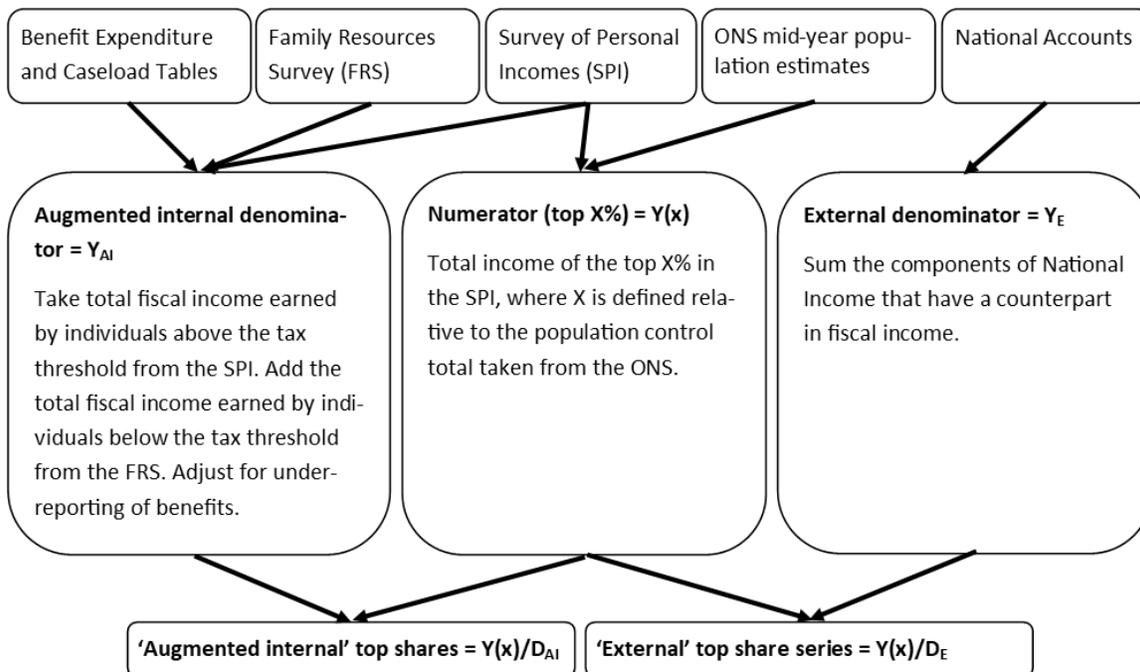
²When this change was implemented, estimates for previous years were *not* revised. The year 2009 is therefore both the year in which the methodology changed, and the year from which the series producing the new methodology commenced.

³In Appendix B we present estimates of *post-tax* top shares, which are constructed by deducting income tax and National Insurance (social security) Contributions from pre-tax fiscal income.

We use individuals as our unit of analysis throughout. From a welfare perspective, it is desirable to measure inequality at the family level, as income-sharing within families means that the living standards of a particular individual are not only determined by his or her income, but also the incomes of other family members. However, unlike in the United States where it is possible to link husbands and wives in administrative tax data (Larrimore et al., 2019), this is not currently possible in the UK.

Figure 1 illustrates the key data sources that are used to construct our top share estimates and how these feed into the different estimates we present. In each series, we use administrative tax microdata combined with external population control totals from the Office for National Statistics (ONS) to construct the numerator (see Section 3). The difference between our top share estimates therefore stems entirely from the methods and data used to construct the denominator. Our ‘augmented internal’ denominator combines the tax data used to construct the numerator – the Survey of Personal Incomes (SPI) (HM Revenue and Customs, KAI Data, Policy and Co-ordination, 2019) – with household survey data from the Family Resources Survey (FRS) (Department for Work and Pensions, Office For National Statistics, NatCen Social Research, 2019). Our ‘external’ denominator draws on the Households sector balance sheet in the UK National Accounts. For further details on how our methodology and series coverage compares to the Atkinson series and to DINA, see Table A1.

Figure 1: **Data and methodology flowchart**



2.1 Survey of Personal Incomes

The SPI Public Use Tapes are released annually by Her Majesty’s Revenue and Customs (HMRC). The data consist of a sample of administrative tax records drawn from the universe of UK income taxpayers, covering the years 1996-97 to 2018-19, though no data were published for 2008-09.⁴ The tax unit is the individual.

The sample size has increased steadily over time, rising from just over 61,000 individuals in 1997 to over 766,000 in 2019. The sampling frame has also changed, due to operational changes in how tax records are maintained by HMRC. HMRC holds individual tax records in three separate computer systems: the National Insurance and Pay-As-You-Earn system (NPS), which covers all employees and occupational pension recipients⁵; the Computerised Environment for Self-Assessment (CESA), which contains tax returns that are filed by individuals who have income on which tax is not automatically withheld (such as self-employment, rental, and untaxed investment income), as well as individuals with earnings above a given threshold; and the Claims

⁴Henceforth, we refer to tax years by the later year, i.e. we refer to 2018-19 as 2019. This is consistent with the terminology practiced by HMRC, but differs from the WID database which refers to the earlier year.

⁵NPS replaced the Computerisation of Pay-As-You-Earn (COP) database which was operational until 2007, and which was used to construct the SPI sampling frame pre-2007

system, which covers a small number of individuals without NPS or CESA records who have had too much tax deducted at source. The SPI samples tax records from each of these databases, using a slightly different sampling strategy for each. The PAYE population from NPS is stratified by gender and pay plus occupational pension income. The sampling probabilities vary across the income distribution and over time, with high income individuals being over-sampled. In 2018-19, PAYE cases accounted for 52% of the sample. Self-assessment tax returns (CESA) are stratified by main income source and range of income and tax due. Again, those with high income or tax due are sampled at a higher rate, and SA cases accounted for just 44% of the sample in 2019. Less than 5% of the sample is derived from Claims cases, which were sampled with varying probabilities over our sample period.

Weights are provided in the SPI microdata, which reflect the sampling probabilities for each stratification group within the sampling frame. In our analysis, we use the sampling probability weights when constructing our estimates of aggregate income, and for allocating sample observations to quantile groups using our external population control total. Further details can be found in Sections 3 and 4.1.

The data contain information on all income assessable for Income Tax. For individuals with incomes exceeding the tax exemption threshold (the standard Pay-As-You-Earn (PAYE) personal allowance, set at £12,500 in 2021), the SPI “provides the most comprehensive and accurate official source of data on personal incomes” (HMRC, 2021). For this reason, we use the SPI as our main source of information on incomes above the personal allowance.

We include individuals with incomes above the personal allowance even if they do not pay income tax. Such individuals are captured in the SPI if their total fiscal income exceeds the personal allowance, but they have no tax liability after deductions and reliefs are taken into account. Were we to omit these individuals from our sample, their incomes would be missing altogether from the resulting income total. This represents a point of departure from the Atkinson methodology which drew on tabulations of SPI data covering the *taxpaying* population. As some of the non-taxpaying population are high earners, it is possible that omitting non-taxpayers affects the numerator in Atkinson’s top share series, as well as the denominator.

The key SPI variable used to compute the total income of those earning above the personal allowance is *total income* (TI).⁶ However, we modify this definition slightly to account for the way in which dividends are recorded in the SPI. Specifically, an

⁶In 2011-12, we deduct PSAV_XS ‘Amount saved towards your pension in excess of the Annual Allowance’ from TI, as this component is not included in TI in other years.

adjustment is applied to the dividends component of total income to account for the notional tax credit which was available on dividends from shares in UK (and some foreign) companies until 2016-17. Until 1999, a 20% tax credit represented the tax already paid on profits made by UK companies under Advanced Corporation Tax (ACT). In 1999, ACT was abolished, but the (now notional) tax credit remained in place at a 10% rate, before being abolished altogether in 2016-17. Until 2016-17, dividends in the SPI have been grossed up by the dividend tax credit amount, though this tax credit amount does not represent any dividends actually received by individuals. To avoid creating an arbitrary discontinuity in 2016-17, we retrospectively remove the notional dividend credit as far back as 1999-00 by reducing the SPI dividend variable by 10%.

2.2 Family Resources Survey

Tax data do not comprehensively capture individuals with incomes below the personal allowance. This presents a growing challenge to the construction of top income *shares*, which require a good estimate of the total personal income in the economy. Historically, the personal allowance was relatively low, so the small amount of income going to people with income below the threshold was ignored in the production of the Atkinson series (Atkinson, 2005b, 2007). However, the personal allowance has risen substantially, tripling over the past 20 years – from £4,195 in 1998-99 to £11,850 in 2018-19. Moreover, as the personal allowance has increased, so has the average income of each individual below the threshold. This means that income totals based only on the taxpaying population miss a growing proportion of total personal income. In 2018-19, 38% of adults had incomes below the personal allowance, covering 8% of total income. Though the SPI does capture a significant number of individuals with income below the personal allowance, HMRC note that “the SPI is not a representative data source for this part of the population” (HMRC, 2021). To capture income below the tax threshold, we supplement our tax data with information drawn from the Family Resources Survey (FRS) Public Use Files, an annual cross-sectional survey of British households.

The sample size has varied over time, ranging from just over 33,000 in 2019 to 51,000 in 2004. The sampling frame consists of addresses of all UK private residences, and excludes individuals living in institutional settings (e.g. prisons, care homes, and student accommodation). The survey uses a stratified clustered probability sample design. The primary sample unit is postcode sectors, which are selected with prob-

ability proportional to size. Each postcode sector is then stratified by region, the socio-economic classification of resident households, the proportion of economically active adults within the region, and the proportion of economically active men who are unemployed. Households are randomly sampled within each stratification group.

In the microdata, weights are provided which account for both the sampling probability of each observation, and differential non-response.⁷ These weights are calculated at both the household- and individual-level. We use individual-level weights in the construction of our aggregate wealth estimates. In principle, when the survey weights are used, the FRS is representative of the whole population. In practice, however, there is known under-coverage at the top of the income distribution (Burkhauser et al., 2018a,b; Jenkins, 2017). Hence, the SPI is a preferable data source for this segment of the population.

Fiscal income is not directly measured in the FRS. However, the Public Use Files contain cleaned and weeklyised income receipts from different sources at an individual level, enabling us to construct a measure of fiscal income which corresponds closely to the tax code. Weekly fiscal income receipts are converted to an annual basis by applying a multiplier of 365/7.⁸ When surveyed, respondents are free to choose the period over which they report their income. These values are then converted to a weekly value prior to the release of the Public Use Files. For individuals who originally reported income on an annual basis, our annualised measure should reflect the income they actually receive over the period of a year. However, there may be some discrepancy between our annualised measure and the actual annual earnings of individuals who report their income on a weekly or monthly basis, especially if their earnings are volatile.

We include all individuals with fiscal income below the standard personal allowance in our sample, regardless of whether they are likely to pay income tax or not (some individuals may pay tax if they are not entitled to the standard personal allowance). We thus use the standard personal allowance as the nominal cutoff for joining our SPI and FRS samples. In Figure A1 we show, for a plausible range of joining thresholds, that this choice makes little difference to the income control total.

⁷For further details on the sampling strategy and grossing methodology, see Department for Work and Pensions (2018).

⁸We use a multiplier of 366/7 in leap years.

2.3 Benefit Expenditure and Caseload Tables

To correct for the under-reporting of benefit income, we use administrative data on benefit expenditure from the UK government’s Benefit Expenditure and Caseload Tables (Spring 2020), which are released with each budget (see Section C.2). Under-coverage and/or under-reporting is a common concern when relying on survey data, and there is known under-reporting of benefit income in the FRS (Corlett et al., 2018). As benefit income is mostly received by those on low incomes, this could lead to the under-estimation of income below the personal allowance if not addressed. Investment income, which is also poorly captured (Ooms, 2019; Advani et al., 2021a), will only have a small impact on our estimates since those with incomes below the personal allowance are likely to receive a minority of total investment income.

2.4 National Accounts

Our external control total is constructed using information contained in the ‘Households’ sector account of the most recent Blue Book publication (2021) – the annual publication of the UK national accounts – which includes disaggregated components of household sector income as far back as 1987.

We draw primarily on the primary and secondary distribution of income accounts of the household sector (Tables 6.2.3 and 6.2.4S). Primary income of the household sector consists of total income from employment (compensation of employees), self employment income (gross mixed income), imputed rent of owner-occupiers (gross operating surplus), and property income received (e.g. interest and dividends) net of interest payments. The secondary distribution of income account contains information on all social contributions and transfers paid and received by the household sector. We supplement this with information contained in the secondary distribution of income account for General Government (Table 5.2.4S), which provides a breakdown of government expenditure on social transfers by benefit type, allowing us to obtain estimates of total expenditure on taxable benefits only. The definitions used to construct the components of National Income do not necessarily correspond to our target definition. In Section 4.2, we discuss this in detail and show that it is a key disadvantage of the external denominator approach.

The National Accounts are published on a calendar year basis. To convert our estimates to fiscal years (as the SPI, and hence our numerator, is published on this basis), we take 3/4 of the total for the earlier calendar year and 1/4 of the total for the later calendar year. This approximates the UK tax year, which runs from the 6th

April to the following 5th April.

2.5 ONS Mid-year population estimates

For our population control we use data from the ONS mid-year population estimates for the UK adult population aged 15 and over (Table A2). This is the same population control as is used to construct the Atkinson series. Unlike the weighted population totals obtained in survey data, which omit individuals living in institutional settings, the ONS mid-year population estimates provide a comprehensive measure of the entire UK resident population.

3 Numerator: Total income held by the top X%

To construct the numerator of our fiscal income series, we use microdata on individual incomes from the SPI. Aggregate income of the top X% is estimated as the total income of the top N individuals whose survey weights sum to approximately X% of P , where P is our population control total. To estimate this, individuals are first ranked according to their total pre-tax fiscal income, y_i^{spi} . Let P_i be the cumulative sum of individual survey weights w_i^{spi} for individuals with income above y_i^{spi} such that $P_i = \sum_{j: y_j^{spi} \geq y_i^{spi}} w_j^{spi}$. Let $\bar{i}(x)$ be the sample individual for whom the cumulative sum of individual survey weights, $P_{\bar{i}(x)}$, is closest to $X \cdot P$,⁹ i.e. the weighted population of individuals with fiscal income above that of individual $\bar{i}(x)$, plus individual $\bar{i}(x)$, is as close as possible to our target population size. We can then estimate the numerator as shown in Equation 1:

$$Y(x) = \sum_{i: y_i^{spi} \geq y_{\bar{i}(x)}^{spi}} w_i^{spi} y_i^{spi} \quad (1)$$

This differs from Atkinson’s approach, which applied Pareto interpolation methods to tabulations of SPI data (Atkinson, 2005b). Given the ready availability of microdata, we can calculate the numerator without needing to make assumptions on the underlying distribution, and without relying on tabulations that only cover those with a positive tax liability.

The magnitude of the numerator depends on the choice of population control, as our combined SPI/FRS sample suffers from population under-coverage particularly

⁹Mathematically, $i = \arg \min_j |P_j - \frac{X}{100} \cdot P|$.

in the early years of our sample, with around 9% of individuals missing in 1997-2003 relative to the ONS population control total. Various factors could give rise to population under-coverage. First, the FRS omits individuals living in institutional settings (see Section 2.2), meaning that there are some individuals below the personal allowance who are not covered in our SPI/FRS sample. A similar outcome could also result from low response rates at the lower end of the income distribution, if this is not properly compensated for in the computed weights. Second, tax evasion could result in some individuals with incomes above the personal allowance being absent from the tax data, or falsely reporting income below the personal allowance.

A priori, it is unclear how population under-coverage impacts top share estimates. If the SPI/FRS sample captures 100% of individuals in the top X% and misses individuals located further down the income distribution, our top shares will be overstated when we use our ‘external’ population control – based on ONS figures. On the other hand, if population under-coverage occurs at the top of the distribution, then whether or not top shares are over- or under-stated depends on the shape of the income distribution. In Appendix C.2 we discuss this issue further and illustrate how top shares differ when an internal population control – taken from the count of individuals in the grossed up data – is used instead. Importantly, the issue of population under-coverage affects top shares regardless of whether an augmented internal or external approach is used for the denominator.

4 Denominator: Total income held by the whole population

4.1 Augmented internal denominator

To augment the internal income control obtained by summing the (weighted) incomes of individuals with income above the personal allowance in the SPI, we sum the fiscal income of those below the personal allowance in the SPI, using FRS survey weights.

This method of augmenting the internal SPI income control differs somewhat from the approach used in the Atkinson series before 2009. The Atkinson method was based on the total income of the *taxpaying* population,¹⁰ obtained from tabulations based on the SPI. This was supplemented with an adjustment for the pension income of non-filers, implemented by scaling up pension income to match the National Accounts

¹⁰Non-taxpayers with income above the personal allowance were excluded, as these individuals were omitted from the tabulated statistics published by HMRC.

total (Atkinson, 2007).¹¹ No systematic adjustment was made to account for those below the tax threshold.

While summing incomes using FRS data may capture a significant proportion of total income below the personal allowance, there is a concern that survey under-coverage and/or under-reporting may result in substantial quantities of missing income. One example of this is the known under-reporting of benefit income in the FRS. Corlett et al. (2018) find a £37 billion gap between total benefit receipts in the FRS and what the the government reported spending. Significant gaps exist particularly for the State Pension (£7.1 billion) and Employment Support Allowance (£6.2 billion) receipts.

Missing benefit income affects the denominator of top income shares, but is unlikely to affect the numerator, as the vast majority of benefit receipts are concentrated at the bottom of the income distribution. In 2018-19, total benefit income below the personal allowance, estimated using the FRS, accounted for 94% of total benefit income using the SPI and FRS combined. The FRS component of the state pension total also represented 40% of the SPI/FRS combined total, whereas the FRS share of the income total overall was only 8%. To avoid under-estimating benefit income, we adjust the augmented internal income total by adding the difference between what the government report spending on taxable benefits (including state pension) according to the Benefit Expenditure and Caseload Tables, and the total amount received according to the SPI and FRS combined.¹² Overall, this adjustment increases the income total slightly (Figure D1), but by less than 1% in recent years.

The formula used for our augmented internal denominator is given in Equation 2:

$$Y_{AI} = \sum_{i:y_i^{spi} > \bar{y}} w_i^{spi} y_i^{spi} + \sum_{j:y_j^{frs} \leq \bar{y}} w_j^{frs} y_j^{frs} + \left(B - \sum_{i:y_i^{spi} > \bar{y}} w_i^{spi} b_i^{spi} - \sum_{j:y_j^{frs} \leq \bar{y}} w_j^{frs} b_j^{frs} \right) \quad (2)$$

¹¹See Appendix D for further details.

¹²We only adjust benefit types which can be directly compared across data sources. Statutory Sick Pay (SSP) and Statutory Maternity Pay (SMP), which are observable in the FRS, are not disaggregated from other income components in the SPI, meaning we cannot compare our total with the expenditure tables. Since entitlement to these benefits is concentrated among individuals with incomes above the tax threshold, under-reporting is not a major source of concern. Corlett et al. (2018) do not list SMP/SSP among the benefit types suffering from significant under-reporting across the FRS as a whole. Meanwhile, Bereavement allowance/Widowed parent’s allowance/Widow’s pension cannot be directly compared with ‘Bereavement related benefits’ in the expenditure tables, which includes a combination of taxable and non-taxable benefits. Our final benefits adjustment is therefore only applied to Carer’s Allowance, Employment Support Allowance (of which contributory), Incapacity Benefit, Jobseeker’s Allowance, and State Pension (excluding State Pension sent overseas).

where y_i^{data} is the fiscal income of individual i in the data, where data may be SPI or FRS; w_i^{data} is the survey weight assigned to individual i in the data; \bar{y} is the personal allowance; b_i^{data} denote total taxable benefits received by individual i in the data; and B denotes aggregate taxable benefits as reported in the Benefit Expenditure and Caseload Tables.

While our top shares account for under-reporting of benefit income, we do not adjust for evasion. Evidence from representative audits finds that evasion as a share of reported income is higher towards the bottom of the reported income distribution, both in the UK (Advani et al., forthcoming; Advani, forthcoming) and US (Johns and Slemrod, 2010; DeBacker et al., 2020). Recent evidence suggests that *offshore* tax evasion specifically – the deliberate under-reporting or hiding of wealth overseas – is highly concentrated among the wealthy (Guyton et al., 2020). It is not clear how well the latter is picked up in representative audits, so the direction of the net effect on top shares is unclear.

4.2 External denominator

We construct our external denominator by retaining the components of National Income that have – in principle – a counterpart in fiscal income. Let F be the subset of components of national income that have a counter part in fiscal income. Then the formula used to construct our external fiscal income total can be written as follows:

$$Y_E = \sum_{c \in F \subset C} NatInc_c \quad (3)$$

where C denotes all components of national income and F is a strict subset. By contrast, the Atkinson series includes some components that do not have a counterpart in fiscal income (i.e. some $c \in C \setminus F$), while DINA estimates include all components of National Income (i.e. all $c \in C$). The set of fiscal income components included in our external denominator are shown in Box 1.

Box 1: components of National Income that have a counterpart in fiscal income

Wages and salaries (Table 6.2.3)

Gross mixed income (self-employment income) (Table 6.2.3)

Interest before FISIM allocation (Table 6.2.3)

Dividends (Table 6.2.3)

Withdrawals from the income of quasi-corporations (Table 6.2.3)

Earnings on property investment (Table 6.2.3)

Rent (from natural resources) (Table 6.2.3)

Social security pension benefits in cash (Table 6.2.4S)

Other social insurance pension benefits (Table 6.2.4S)

Incapacity benefit (Table 5.2.4S)

Carer's allowance (Table 5.2.4S)

JSA (Table 5.2.4S)

Widow's and Guardian's allowance (Table 5.2.4S)

Statutory sick pay (Table 5.2.4S)

Statutory maternity pay (Table 5.2.4S)

Unemployment benefit (Table 5.2.4S)

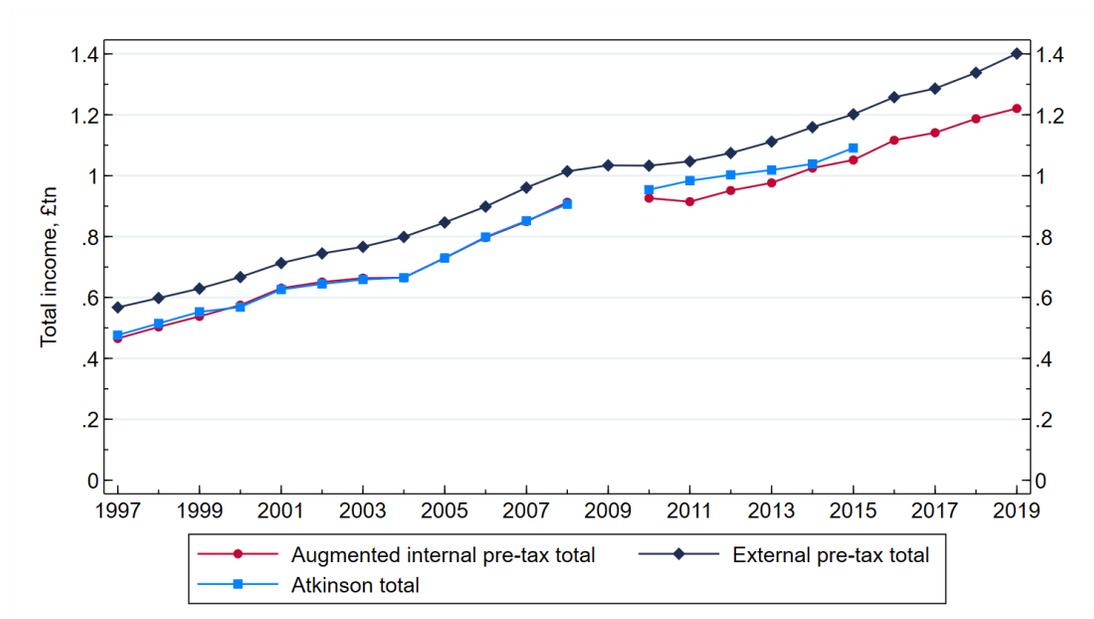
While it is possible to make some progress in aligning National Accounts income components with fiscal income, conceptual differences preclude any attempt to achieve this in full. This is a significant drawback of the National Accounts approach. For example, the National Accounts concept of income from employment makes various adjustments to employment income as measured in the SPI to account for forms of income not subject to taxation, such as rent-free dwellings and meal vouchers provided to employees. Moreover, all income components reported in the National Accounts are subject to a final adjustment during a reconciliation exercise which balances estimates of GDP obtained using the three different approaches (production, expenditure, and income). Conceptual differences between the National Accounts and SPI thus plague all categories of income, even if the income source is assessable for tax in principle.

4.3 Comparing our denominators

Applying the methods described in the previous two sections, we find that the income total obtained via the augmented internal approach is substantially smaller than the

income total obtained using the National Accounts (Figure 2). The difference between our external total and our augmented internal total is primarily a level difference; total income is 15% (£119bn) higher on average over the period using the external measure. However, the two series follow similar time trends.

Figure 2: **Aggregate fiscal income using our augmented internal method, our external method, and the Atkinson series**



Notes: ‘Augmented internal pre-tax total’ is constructed by summing individual incomes above the standard personal allowance (based on the Survey of Personal Incomes (SPI)); individual incomes below the standard personal allowance (based on the Family Resources Survey (FRS)); and an adjustment for under-reported benefit income based on administrative Benefit Expenditure and Caseload Tables (as outlined in Section 4.1). ‘External pre-tax total’ is constructed by summing income components in the ‘Households’ sector of the National Accounts (NA) 2021 Blue Book (as outlined in Section 4.2). ‘Atkinson total’ is the income total developed by Atkinson (2005b) and subsequently extended in Atkinson (2012, 2013, 2014); Atkinson and Ooms (2015); Alvaredo (2017).

Source: Authors’ calculations based on the SPI, FRS, and Benefit Expenditure and Caseload Tables (augmented internal); the UK National Accounts (external); and WID (Atkinson).

Both series diverge from the Atkinson series in the years following Atkinson’s methodological switch (Figure 2). The post-2009 Atkinson method differs from ours in two significant ways.¹³ First, we include only the household sector from the outset, excluding the NPISH sector which had previously been combined with households

¹³Details on how our external approach relates to the Atkinson method can be found in Appendix D.

in the UK National Accounts. In doing so, we avoid making ex-post adjustments of the kind implemented in the Atkinson series as a result of this aggregation. Second, we refine our external income control formula to be as closely aligned as possibly with our target definition of income. The Atkinson method included several income components which have no counterpart in fiscal income, including a deduction for interest payments made by the household sector and many non-taxable benefits. In Appendix D, we discuss how to obtain our external income total using the Atkinson series as the point of departure.

Both our augmented internal and external income controls grow faster than the Atkinson total since 2009, with implications for the growth in top shares. The growth rates of our two denominator series are much more aligned with one another than with the Atkinson series, which we find reassuring given the steps we take to reconcile the National Accounts with the fiscal income definition (see Appendix D).

5 Desirable properties in income share series

To provide a principled approach to selecting between the two approaches, we first set out some key properties a ‘good’ top share series should fulfil. We then compare how our augmented internal and external series compare against these metrics.

5.1 Comparability between numerator and denominator

For top income share measures to be meaningful, the definition of income must be consistent between the numerator and denominator. This is true regardless of which income concept is targeted. If all incomes were reported to a single authority using a consistent definition, top income shares could be constructed by simply taking the share of reported income accruing to the richest X% of those individuals. In practice, no such data exist. While administrative data collected by tax authorities arguably provide the most accurate assessment of fiscal income at the top of the distribution, they miss income at the bottom. This is not only an issue in the UK, where individuals with earnings below the tax exemption threshold do not generally have a tax record, but also in US studies which rely on tax return data. Other sources of data on incomes, such as household surveys, suffer from the opposite problem: poor coverage of income at the top (Burkhauser et al., 2018a,b; Atkinson et al., 2011), and top-coding (Jenkins et al., 2011). Constructing denominators for top share estimates which are representative of the whole population therefore requires combining

multiple sources of data, reconciling income definitions between these data sources as far as possible. Larrimore et al. (forthcoming) show that using administrative ‘information returns’ containing information on the income of non-filers closely replicates survey-based measures of non-filer income in the US. This supports the use of survey-based measures of non-filer income in the UK, where such administrative data are unavailable.

5.2 Comparability over time

While comparability between the numerator and denominator ensures that top income shares are meaningful at a given point in time, much of the value in estimating income inequality comes from observing what happens over time. There are challenges to interpreting dynamic trends in fiscal income shares as changes in income inequality. First, the definition of fiscal income changes naturally as the tax code evolves (Burkhauser et al., 2012, 2015; Splinter, 2018). Variation in which sources of income are included in the tax base may affect the distribution of income assessed for tax purposes, but not the distribution of income measured according to a more comprehensive definition. This issue must be borne in mind by users of top share statistics. For our purposes the goal is not to have an accurate measure of living standards, but to have an accurate measure of the fiscal income series itself, which is then the starting point from which more welfare-relevant income inequality measures can be produced.

However, this property of fiscal income – that the definition changes over time – creates the following measurement issue: data sources and methods used to construct top shares must be sufficiently flexible to definitional changes. This is particularly difficult in light of the fact that top share estimation must draw on multiple sources of data in order to be representative of the whole population.

Income tax data lends itself naturally to the measurement of top income shares according to a fiscal income definition; income measured by the tax authorities automatically follows changes in the tax code. However, any alternative sources of data used to construct the series, such as the National Accounts or survey data, must be sufficiently disaggregated into specific income components in order to construct a measure of income which is closely related to the target definition.

5.3 Comparability across countries

Valuable insight can be gained from comparisons of income inequality across countries and recent work has pushed the frontiers of inequality measurement with a particular focus on international comparability (Piketty et al., 2018; Alvaredo et al., 2016; Piketty et al., 2019; Garbinti et al., 2018). The goal of international comparability has driven the shift towards a National Accounts-based approach to inequality statistics.

In the context of the current exercise, an important question to ask is whether or not it is sensible to compare trends in *fiscal* income inequality at all? What is included in fiscal income varies across countries as tax codes differ. For example, the Netherlands includes the imputed rent of owner occupiers in its Income Tax base and therefore its fiscal income series (Salverda, 2013), whereas the UK does not. Changes in the tax code from one year to the next could affect the relative trends in inequality across countries even if inequality as measured using a more comprehensive income definition remains unchanged. A dramatic change in fiscal income inequality occurred in the the US following the 1986 tax reform which broadened the tax base, and thus the sources of income reported on tax returns (Feenberg and Poterba, 1993, 2000; Gordon and Slemrod, 2000; Piketty and Saez, 2003; Auten and Splinter, 2019). In the UK, changes in dividend tax rates prompted dividend forestalling responses which are reflected in the changes in fiscal inequality observed in the aftermath of the Financial Crisis. Comparisons of such changes in inequality trends across countries must be interpreted with great care.

Fiscal income series can be made comparable across countries to the extent that the methods used to construct them abide by the same principles. However, comparability of the denominator series alone does not ensure the international comparability of the series as a whole, as both the numerator and the tax code remain highly country specific. Thus, no matter what approach one uses to construct the denominator, we argue that this criteria can not be satisfied if the target definition itself is not comparable across countries.

5.4 Practical considerations

Developing a top share series which works well in theory is important, but it also needs to work in practice. We identify two desirable practical criteria. First, the series should be easy to update using the chosen methods and definitions, and in a timely manner. This means that any sources of data used to construct the numerator and denominator must be easy to obtain, clean, and aggregate if the series is to be

sustainable.

Second, the series would ideally be produced and interpreted using data available at a given point in time, without requiring any updating of the past. Neither tax nor survey data, once collected and released, are subject to revisions in general. This means that a fiscal income series which draws only upon these sources of data will be fixed from the point of estimation. In contrast, National Accounts figures are subject to frequent revisions, an outcome of the trade-off between timeliness and accuracy. In the Blue Book, the ONS warn that “expectations of accuracy and reliability in early estimates are often too high” (Office for National Statistics, 2021). A fiscal income series which draws on the National Accounts thus ought to, in the interest of accuracy, be updated as previous Blue Book figures are revised.

5.5 Our Preferred Denominator

We prefer the augmented internal income control total for use in constructing top shares. This approach meets three of the criteria set out in the previous sections: comparability between the numerator and denominator, comparability over time, and practicality. It does not meet the criteria of comparability across countries, which cannot be achieved regardless of the methodology and data sources chosen since the income definition itself is country-specific. The augmented internal series therefore meets each of the criteria that a *fiscal* income series can fulfil – top share series that target alternative definitions of income may meet all four.

By taking the data source used for the numerator as the main data source for our denominator, our augmented internal series satisfies comparability between the numerator and denominator. Though we supplement this with external survey data, the incomes measured in the FRS are sufficiently granular to produce a measure consistent with our target definition. By contrast, external totals from the National Accounts cannot be fully reconciled with fiscal income.

An augmented internal total is also better suited to meeting the criteria of comparability over time. The series presented in this paper covers years since 1997, for which microdata are available. The Atkinson series – produced using SPI-based tabulations which have been in existence for a much longer historical period – covers years since 1990.¹⁴ To produce estimates that can be interpreted as an extension of this

¹⁴Atkinson (2005b) produces fiscal income shares covering years as far back as 1908, though as the tax unit in the UK changed from married couples to individuals in 1990, so too did the unit of analysis used to construct top shares. In the WID, the UK fiscal income series therefore only extends as far back as 1990, over which period the unit of analysis is comparable.

longer-run historical series, it is preferable to use similar data sources and definitions over time. The augmented internal approach can provide this. The second requirement of comparability over time is that the methods and data sources be flexible to changes in the tax code. This is true for the SPI – which automatically evolves with the tax code – but not for the National Accounts. The latter are neither sufficiently disaggregated nor is the procedure for constructing them sufficiently well documented to ensure consistency with tax data definitions.

Neither of our series meet the criteria of international comparability. Given that the income definition we are targetting is highly country-specific, it is not obvious that the use of the National Accounts for measuring total income offers a clear improvement in this regard.

Finally, our ‘augmented internal’ approach ticks more boxes when it comes to practical considerations. In part, this is because we already use the SPI to construct the numerator, and so using this as a data source for the denominator comes at limited additional cost. One argument commonly put forward against using the SPI data in general is that the SPI Public Use Tapes are released with a longer time lag relative to the National Accounts, causing a delay in the availability of policy-relevant statistics. For instance, SPI datasets covering the years 2017-18 and 2018-19 were only released in November 2021, whereas initial National Accounts estimates for 2019 were released in October 2020. However, in our setting, use of the National Accounts does not help since producing the numerator already relies on the release of SPI data/

Supplementing the SPI with survey data requires an additional time investment. However, we argue that this is a necessary burden. In the absence of this step, there is a risk that the income total obtained from the SPI will continue to diverge from the true income total as the personal allowance increases, giving rise to a top income share series which is superficially steep (see Figure D1). Adding the adjustment for missing benefit incomes using admin data imposes little extra work as these tabulations are readily available and user-friendly, though in practice this step makes only a small difference to total income. Both the FRS and government expenditure tabulations are made available well ahead of the SPI Public Use Tapes, meaning that these adjustments do not come at the expense of timeliness.

National Accounts figures are typically subject to revisions on an annual basis, and the quantitative effects of these can be significant. Cumulative revisions made to the Blue Book estimates for 2015 between the publications of the 2016 and 2021 Blue Books resulted in a 3.6% increase Atkinson’s income control total despite no change to the definition (see Figure D3). By contrast, the SPI data are generally fixed from

the time of publication. This means that there is no need to update previous SPI-based estimates and policy implications, whereas National Accounts-based estimates ought to be revised to reflect the latest (and most accurate) figures.

6 Estimates of top income shares

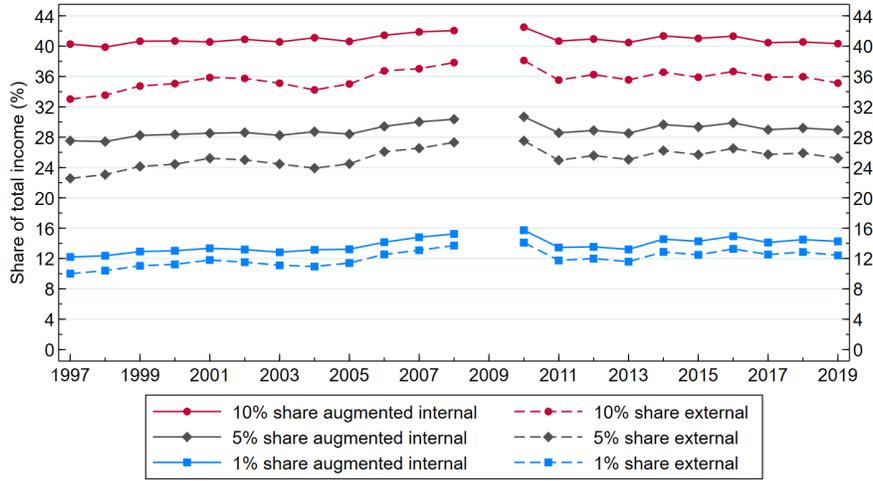
To construct our two alternative top share series, we divide the numerator ($Y(x)$) which is the same in both series, by either the augmented internal denominator (Y_{AI}) or the external denominator (Y_E).

Figure 3 illustrates how the choice of denominator affects top pre-tax fiscal income shares. The predominant difference is in the levels: the pre-tax income share of the top 1% is 1-2 percentage points higher using the augmented internal control total than the external total. This means that by using an income control total which diverges from the fiscal income definition, we under-state the extent of income inequality in the UK.

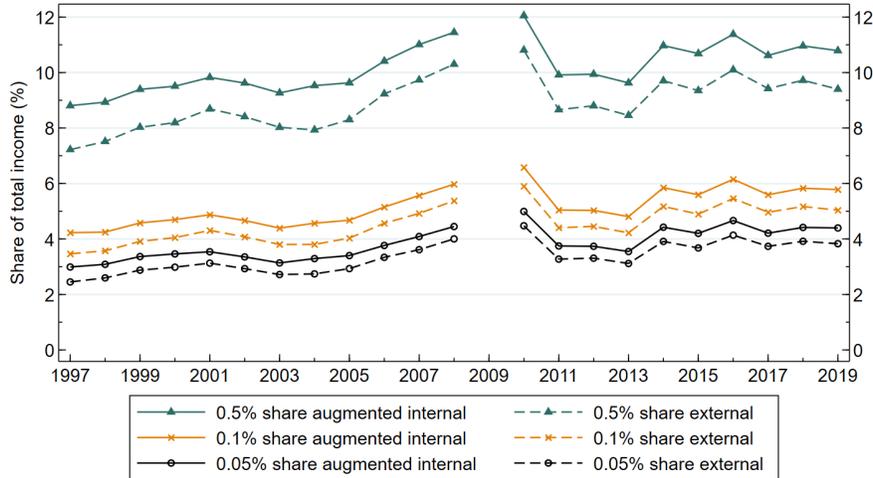
Using an augmented internal control total, the income share of the top 1% rose in the lead up to the Financial Crisis, from 12.2% in 1996-97 to 15.2% in 2007-08, an increase of 25%. This was followed by a steep decline immediately after the Financial Crisis, though this is likely to reflect income-forestalling and income-delaying responses to the increase in the top rate of income tax (Seely, 2014; Browne and Phillips, 2017). Between 2010-11 and 2018-19, the top 1% share rose slightly from 13.5% to 14.3%. Using an external control total implies a slightly steeper rise in inequality in the late 1990s, but otherwise the two series follow similar trends.

Figure 3: Top fiscal income shares using our augmented internal and external income control totals

(a) Top 10%, 5%, and 1% shares



(b) Top 0.5%, 0.1%, and 0.05% shares



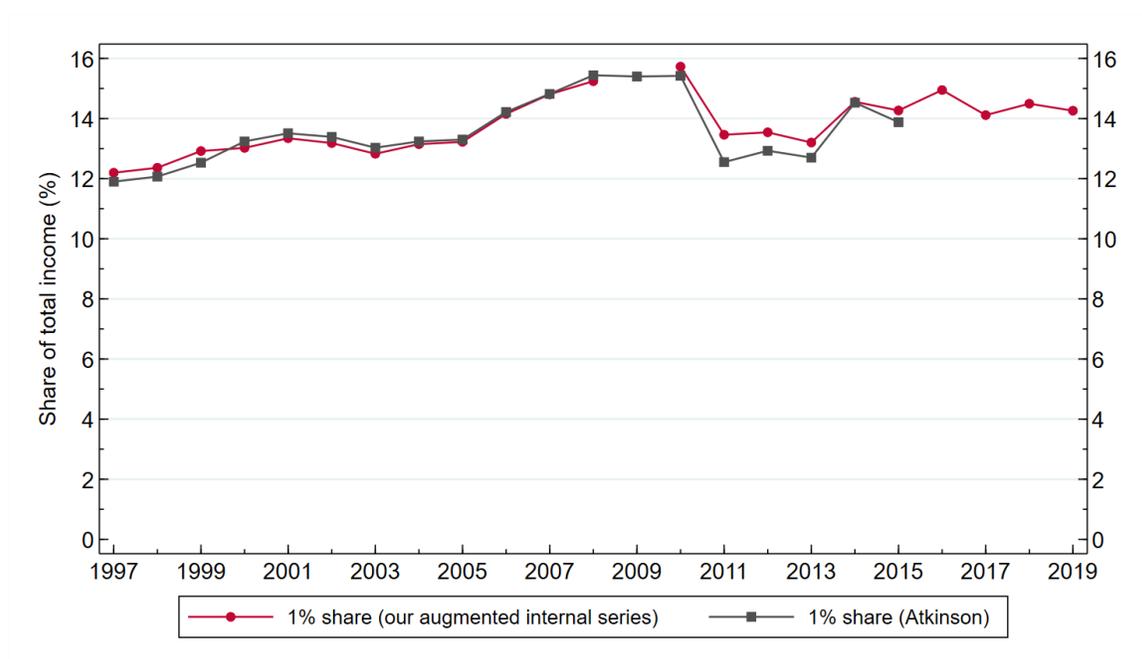
Notes: Augmented internal top shares are constructed by dividing aggregate pre-tax fiscal income among the top X% (based on the Survey of Personal Incomes (SPI)) by our preferred SPI-based pre-tax fiscal income total (Section 4.1). External top shares are constructed by dividing aggregate pre-tax fiscal income among the top X% (based on the SPI) by our National Accounts (NA) based fiscal income control total (Section 4.2). All top shares are defined relative to the total number of individuals aged 15 or older in the population living in the UK.

Source: Authors' calculations based on the SPI, Family Resources Survey and Benefit Expenditure and Caseload Tables (augmented internal); and the UK National Accounts (external).

Since 2009-10, our series diverges from the Atkinson top income share series (Fig-

ure 4), which has been used as a benchmark in previous studies (e.g. Burkhauser et al., 2018b). The top 1% share rose by 1.3 percentage points between 2010-11 and 2014-15 according to the Atkinson series, but by just 0.8 percentage points according to our augmented internal series. Our results therefore affect our understanding of what has been happening to UK inequality in recent years. Atkinson’s series implies that in the aftermath of the Financial Crisis, income inequality dropped below levels observed since the beginning of the 21st Century, before rising again from 2013-14 onwards. By contrast, our estimates imply that top shares dropped less severely, down to levels observed immediately prior to the Financial Crisis in 2005-07.

Figure 4: **Top 1% share: our augmented internal series and the Atkinson series**



Notes: Our ‘augmented internal’ shares are constructed by dividing aggregate pre-tax fiscal income among the top X% (based on the Survey of Personal Incomes (SPI)) by our preferred augmented internal pre-tax income total (Section 4.1). All top shares are defined relative to the total number of individuals aged 15 or older in the population living in the UK. ‘Atkinson’ is the fiscal income series developed by Atkinson (2005b) and subsequently extended in Atkinson (2012, 2013, 2014); Atkinson and Ooms (2015); Alvaredo (2017).

Source: Authors’ calculations based on the SPI, Family Resources Survey (FRS) and Benefit Expenditure and Caseload Tables (our augmented internal); and WID (‘Atkinson’).

Top shares have risen in the past two decades, but in relative terms much more so at the very top of the income distribution (Figure A2). While the share of income

earned by the top 10% remained stable between 1996-97 and 2018-19, the top 1% (0.1%) share grew by 17% (37%) over the same period.

7 Conclusion

We outline two approaches one could adopt to construct an income control total for measuring top income shares: an augmented internal control total based on tax and survey data; and an external control total based on the National Accounts. These approaches can be judged against four desirability criteria, which we define as (i) comparability between the numerator and denominator; (ii) comparability over time; (iii) comparability across countries; and (iv) practical considerations. We argue that while the external income total serves none of these goals, the augmented internal income total serves all but the third goal of international comparability. On this basis, we advocate the use of an augmented internal income control total for constructing a fiscal income series.

Our top share series for the UK based on this augmented internal control total displays a higher level of inequality and a slightly flatter trend relative to a series based on the previous fiscal income control total (Alvaredo, 2017) published in the *World Inequality Database*. Using an updated external control total, the pre-tax fiscal income share of the top 1% rose from 10.0% to 12.4% between 1996-97 and 2018-19. In contrast, our augmented internal series suggests the top 1% share was around 2 percentage points higher over this period, rising from 12.2% to 14.3% over the same period. This increase in income shares is even more pronounced, in relative terms, further up the income distribution.

Though we focus on the UK context, there are broader lessons to be learned from our findings. Regardless of the income definition one chooses to target, constructing accurate top share estimates almost always requires combining multiple data sources as, in most countries, no single data sources covers incomes received by the whole population. We show that using macroeconomic aggregates from the National Accounts is not a neat and tidy solution to this problem: unless one is targetting National Income as defined in the National Accounts (as in the headline estimates on the *World Inequality Database*), it is incredibly challenging to reconcile National Accounts components with one's chosen definition. This can have a significant quantitative effect on the results.

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