Office for National Statistics

Article

How accounting for differences in need for public services impacts UK income inequality statistics

Experimental statistics that build on an equivalisation method to develop a simplified needs-adjusted scale for equivalising our measure of final income that better accounts for disparities in the need for social transfers in kind across different age groups.

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1 . Main points

- Equivalisation is the process of adjusting income statistics to enable more meaningful comparisons of incomes across households with different sizes and compositions; this research shows that the choice of equivalisation method has a substantial impact on our headline income and inequality statistics.
- To illustrate this, we develop a simplified needs-adjusted (SNA) scale for equivalising the Office for National Statistics's (ONS's) measure of final income (net of all taxes and including cash and in-kind benefits); this aims to better account for disparities in the need for social-transfers-in-kind (such as education and health) across different age groups.
- We can compare the headline results from this new scale to those derived from other more conventional approaches; equivalising final income with the SNA scale instead of the Organisation for Economic Co-operation and Development (OECD) modified scale - which is a more conventional measure - leads to a fall in median final income of £4,500 per year on average between financial year ending (FYE) 2014 and FYE 2019.
- Furthermore, switching from the OECD-modified to the SNA scale increases inequality of final income, with the Gini coefficient increasing by an average of 0.6 percentage points over the same period.
- The impact of switching equivalisation scales from the OECD-modified to the SNA scale is greatest for households with children and older people, reflecting their relative higher need for education and healthcare services respectively.
- The ONS is considering more research in this area to further explore the most appropriate equivalisation scales for use with final income and other measures of income more broadly; to provide your views, please email hie@ons.gov.uk.

2 . Equivalisation and why it matters

Overview of equivalisation

Statistics on household income and income inequality typically require comparing the relative positions of households and people on the income distribution. To do this, differences in household size and composition need to be accounted for. For example, a two-person household with a total income of £30,000 might not be able to obtain the equivalent standard of living as a single-person household with the same income because of the increased living costs that an additional member might bring. However, a two-person household is unlikely to need twice the income of a one-person household to maintain equivalent standards of living. This is because of economies of scale that occur with additional household members. For example, two people living together only need to pay to heat the same number rooms as a single person.

Equivalisation scales are designed to account for this. Each member of a household is assigned a weight, and this is used to adjust income to measure "equivalised" income. This implicitly compares each household to a "reference household" (usually a couple without children). A household's equivalised income is the income that would provide the same quality of life, if the household had the same makeup as the reference household. Therefore, for a household larger than the reference household (for instance, two adults and two children), their equivalised income will be lower than cash income.

Why the choice of equivalisation scale matters

There are a variety of equivalisation scales, which take into account different aspects of household make-up, discussed by the Social Metrics Commission (SMC) in their 2019 report. At the most basic, there is the "square root" scale, which simply uses the square root of household size as the weight. Other scales, such as the widely used "Organisation for Economic Co-operation and Development (OECD) modified" scale (see next subsection), give adults and children different weights. Others weight single-parent households differently, such as the "Three Parameter Scale" used in the US for the Supplemental Poverty Measure and the Joseph Rowntree Foundation "Minimum Income Standard" (MIS) scale.

Research shows that the scale used for equivalisation can have profound effects on measures of income inequality and rates of poverty, both overall and within specific demographic groups. The SMC found that using the MIS scale resulted in a 14 percentage point increase in the poverty rate for single-parent households and a 10 percentage point decrease in the poverty rate for single pensioners, when compared to the OECD-modified scale. By contrast, the Three Parameter Scale produced a five percentage point increase in the poverty rate for single-parent households, a seven percentage point increase in the poverty rate for single pensioners, and a three percentage point decrease in the poverty rate for couples with children.

The OECD scale

The most widely used equivalisation scale, both in the UK and internationally, is the OECD-modified scale, shown in Table 1. This was first proposed in the 1990s as a compromise position between the different existing scales, rather than being agreed as the single definitive scale. Those proposing the approach noted, "this is a pragmatic choice and should be viewed as arbitrary [...] In our view, more research efforts should be devoted to the choice of equivalence scales" (Hagenaars, de Vos and Zaidi, 1994). The SMC (2019) have suggested that as different measures of income include and exclude different aspects of income, which may have different economies of scale, this must be considered when choosing which scale to apply to which measure.

Table 1: Weights applied to different household members in OECD-modified equivalence scale (before housing costs)

Type of Household Member	Equivalence value
First adult	0.67
Additional member aged 14 and over	0.33
Child aged: 0-13	0.2

Source: Office for National Statistics – How accounting for differences in need for public services impacts UK income inequality statistics

Notes

1. Similar to other Office for National Statistics (ONS) statistics on household income this is an adaption of the Organisation for Economic Co-operation and Development (OECD) modified scale where the reference household is a two-adult household rather than a single-person as per the conventional OECD-modified scale.

The OECD-modified equivalisation scale assigns different weights to adults, which it defines as those aged 14 years and over, and to children aged under 14 years. After the first adult in the household, additional adults are assigned half the weight of the first, while children have a weight approximately one-third that of the first adult.

It should be noted that the choice of scale used typically varies depending on whether income is considered before or after accounting for the cost of housing. For example, measures of income “after housing costs” (AHC) use a different version of the scale, typically known as the “companion” scale where the first and additional adults are weighted more equally to account for fewer economies of scale associated with non-housing related expenditures. For instance, there is likely to be a larger proportionate increase in household expenditure on food compared with rent when a household gains another member.

Table 2 demonstrates the impact of the OECD-modified scale, highlighting the amount of income before equivalisation that different household types would need to maintain the same living standards as two adults with £20,000 annual disposable income. A single adult would require £13,400, whereas a household of two adults and one child would require £24,000. A single adult with a single child would require £17,400, and a single adult with two children would require £21,400.

Table 2: Example of unequivalised and equivalised (using OECD-modified scale) household income by household type

Household composition	Equivalence value	Unequivalised disposable income	Equivalised disposable income
2 adults	1	£20,000	£20,000
1 adult	0.67	£13,400	£20,000
2 adults, 1 child	1.2	£24,000	£20,000
1 adult, 1 child	0.87	£17,400	£20,000
1 adult, 2 children	1.07	£21,400	£20,000

Source: Office for National Statistics – How accounting for differences in need for public services impacts UK income inequality statistics

3 . Considering an alternative scale for equivalisation

Different methods of equivalisation may be needed, depending on the specific measures of income that are being considered. For example, the modified Organisation for Economic Co-operation and Development (OECD) scale was formulated around the concept of disposable income – defined as income including cash benefits, less direct taxes. However, the Office for National Statistics (ONS) publishes other measures of income, which include and exclude different taxes and benefits compared to disposable income.

An important measure produced is "final income", which includes social transfers in kind (STIK) from the government (for example, education, health care, and adult social care service). Households are assigned extra income based on the services they receive, with income also subtracted based on the amount of indirect taxes paid, such as Value Added Tax (VAT). The ONS has published statistics on measures of income including STIK since 1961, which allows for the impact of these extra items on income growth and inequality to be assessed.

Currently, measures of final income are also equivalised using the OECD-modified scale; however, we consider a new scale that may be more suitable, adapting an approach proposed by Aaberge, Langorgen and Lindgren (2013), which in turn builds on the OECD-modified scale to create a "simplified needs-adjusted" (SNA) scale. It is based on the average level of STIK received by individuals in different age groups. For more detail on the methodology used, see Section 7: Data sources and quality.

This alternative SNA scale includes eight different age categories, each with a different weight, shown in Table 3. This accounts for the different level of need for STIK, which varies widely across age groups; for example, older adults are likely to require more health care as a result of age-related conditions and also for social care. By contrast, children are also likely to have a greater need for health care and education services. There are other demographic groups that are also likely to have an increased need for STIK, such as people with disabilities - while accounting for this is beyond the scope of this article, the ONS is carefully considering this in future work on this topic.

Table 3: Simplified needs-adjusted equivalisation scale as applied by household composition

Age group	1st member	Additional members
under 5	-	0.34
5 to 15	-	0.41
16 to 34	0.66	0.35
35 to 44	0.65	0.35
45 to 54	0.68	0.38
55 to 64	0.67	0.37
65 to 74	0.73	0.43
75 and over	0.83	0.53

Source: Office for National Statistics – Living Costs and Food Survey

An important distinction between the SNA scale and the OECD-modified scale is the manner in which they define children. While the OECD-modified scale defines those aged 14 and 15 years as adults (as can be seen in Table 1), the SNA scale groups these individuals into the 5- to 15-years-old age band, as this is the group that will be in compulsory full-time education.

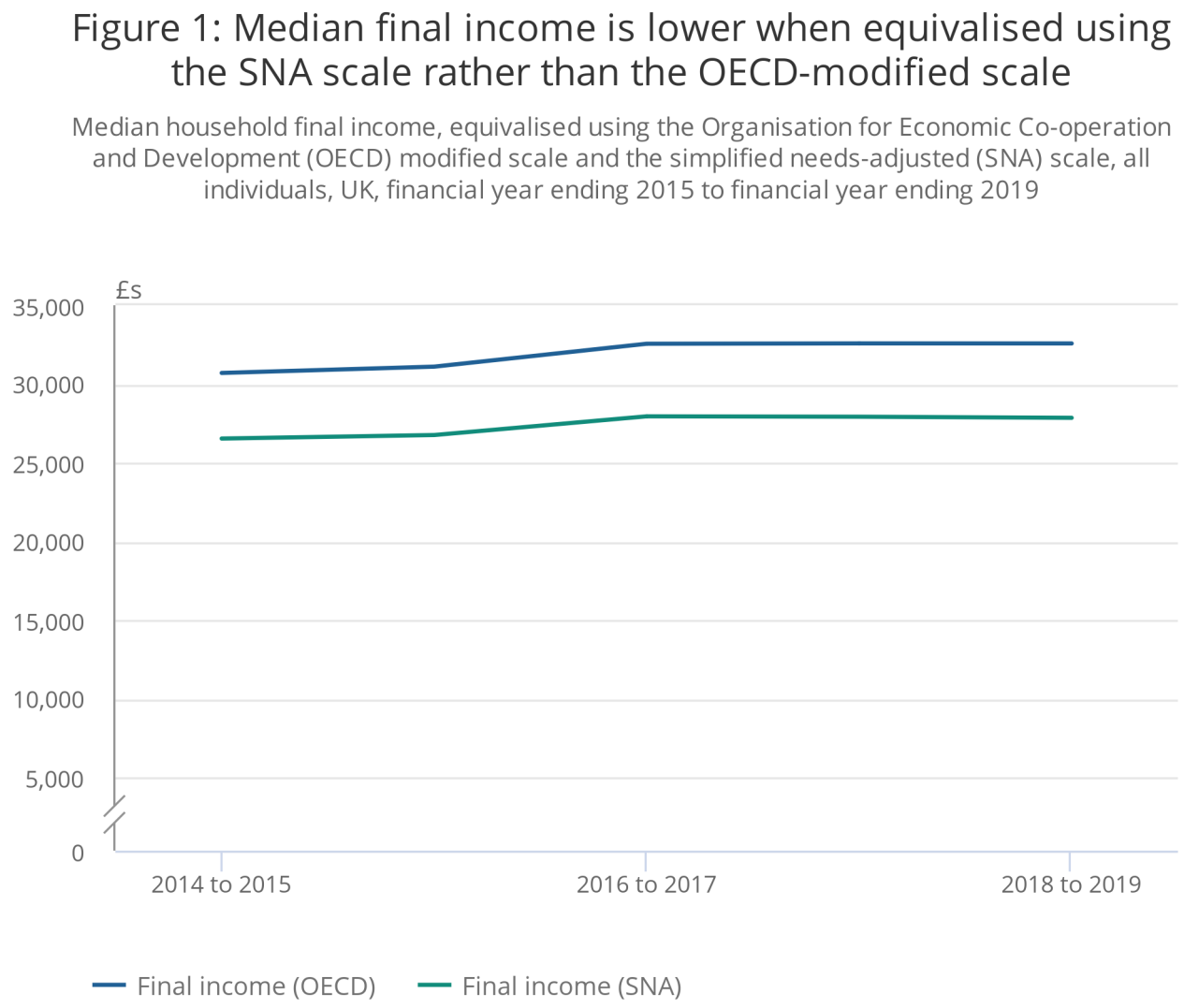
Children and older people are most impacted by the switch from the OECD-modified scale to the SNA scale, with children aged under 14 years and adults aged 75 years and over having the greatest proportional increase in the weight attributable to them. This recognises that while children and older adults receive more STIK in the form of health care and education, and health care and adult social care respectively, they also have greater needs for these services. Therefore, the implication is that households with children or older adults need greater levels of final income to achieve the same living standards as other households.

The new SNA scale weights a child similarly to an additional adult. Essentially, this argues that while a child might need less disposable income than an adult (for instance, because they require less food and receive discounted transport), this is offset by the additional greater needs of the child for STIK.

4 . Impact of the alternative SNA scale on estimates of income inequality

Figure 1: Median final income is lower when equivalised using the SNA scale rather than the OECD-modified scale

Median household final income, equivalised using the Organisation for Economic Co-operation and Development (OECD) modified scale and the simplified needs-adjusted (SNA) scale, all individuals, UK, financial year ending 2015 to financial year ending 2019



Source: Office for National Statistics – Living Costs and Food Survey

Notes:

1. Incomes are adjusted for inflation using the Consumer Prices Index including owner occupiers' housing costs (CPIH) excluding Council Tax.

2. 2018 to 2019 represents the financial year ending 2019 (April to March), and this applies for all other years expressed in this format.

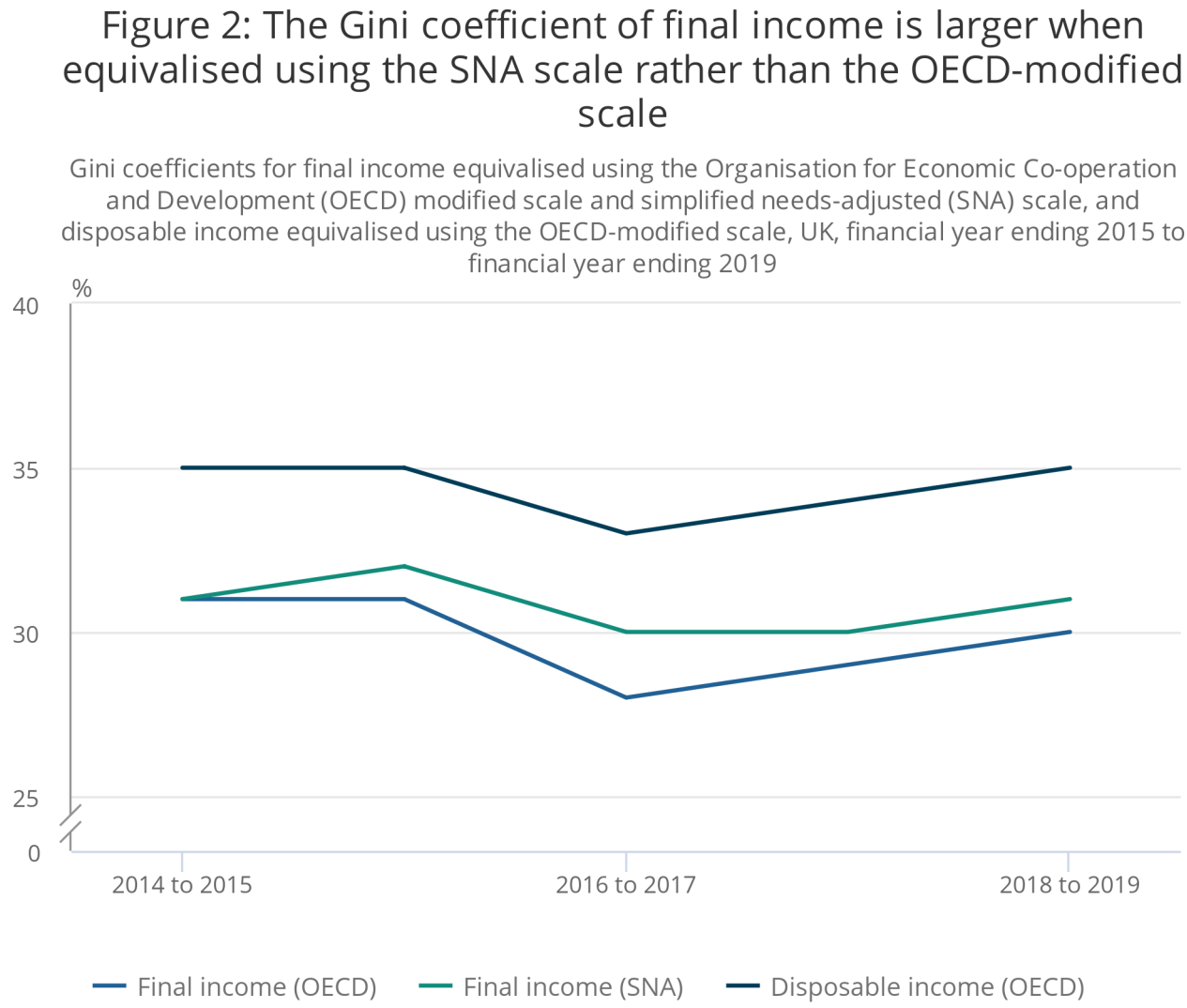
As shown in Figure 1, in every year between the financial year ending (FYE) 2015 and FYE 2019 the median final income is, on average, £4,500 lower when equivalised with the simplified needs-adjusted (SNA) scale compared with the Organisation for Economic Co-operation and Development (OECD) modified scale. This reflects the increased weights of children and older adults when using the SNA scale. It also highlights that the OECD-modified scale could be leading to an overstating of equivalised final income and thus highlights the role of social transfers in kind (STIK) in raising living standards.

For assessing household income inequality, the Gini coefficient is one of the most used measures. The measure ranges from 0% (representing a situation where all people have equal income) to 100% (representing a situation where a single person has all income). Over the full time series, starting from 1977, the Gini coefficient on equivalised final income (using the OECD-modified scale) is lower than for equivalised disposable income, meaning that taken together indirect taxes and STIK reduce income inequality.

Figure 2 shows that this holds true for simplified needs-adjusted (SNA) equivalised final income, which has a Gini coefficient on average 4.0 percentage points lower than that of OECD-modified-equivalised disposable income between the FYE 2014 and FYE 2019. However, over this period, the Gini coefficient for SNA-equivalised final income was on average 0.6 percentage points higher than that of OECD-modified-equivalised final income. This indicates that when different needs across age groups are accounted for, the impact of STIK on income inequality falls. This suggests that the OECD-modified scale may underestimate income inequality on a final income basis.

Figure 2: The Gini coefficient of final income is larger when equivalised using the SNA scale rather than the OECD-modified scale

Gini coefficients for final income equivalised using the Organisation for Economic Co-operation and Development (OECD) modified scale and simplified needs-adjusted (SNA) scale, and disposable income equivalised using the OECD-modified scale, UK, financial year ending 2015 to financial year ending 2019



Source: Office for National Statistics – Living Costs and Food Survey

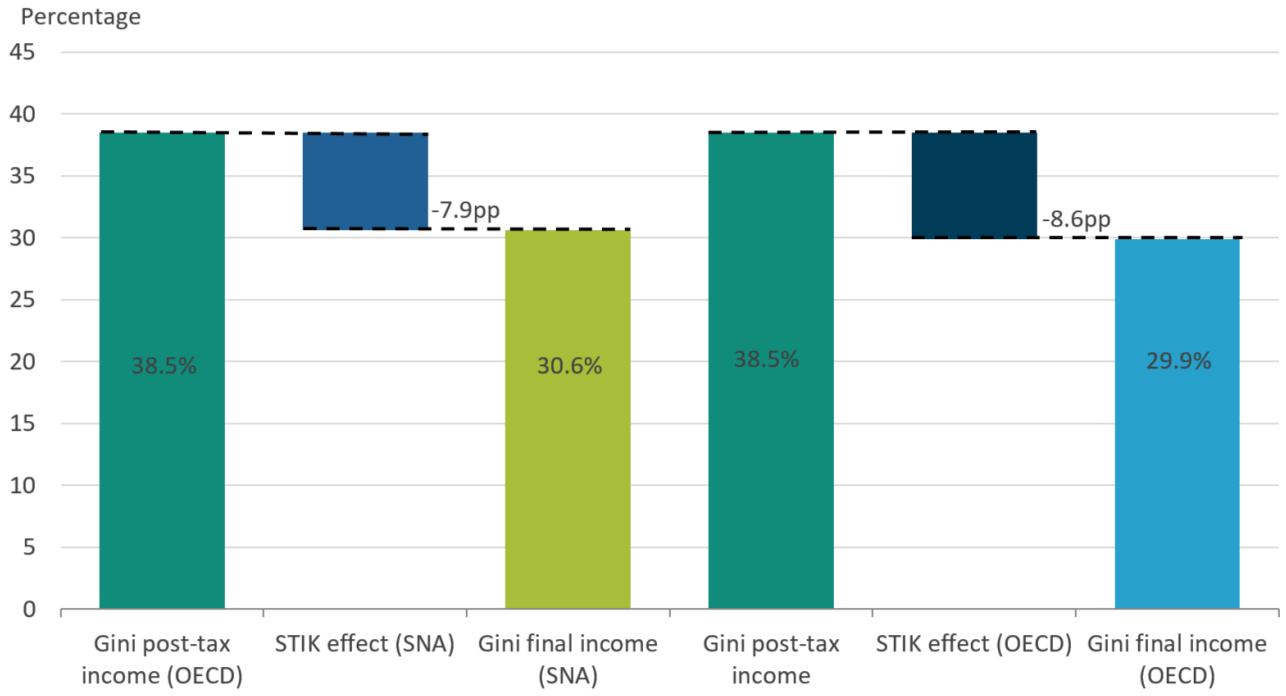
Notes:

1. 2018 to 2019 represents the financial year ending 2019 (April to March), and this applies for all other years expressed in this format.

Figure 3 highlights that when final income is equivalised using the SNA scale, the effect of STIK in reducing inequality is 7.9 percentage points, as opposed to 8.6 percentage points when the OECD-modified scale is used. This suggests that using the OECD-modified scale to equivalise final income overstates the effects of STIK on income inequality.

Figure 3: The effect of STIK is reduced when final income is equivalised using the SNA scale rather than the OECD-modified scale

Changes in Gini coefficient across different stages of income, UK, financial year ending 2019



Source: Office for National Statistics - Living Costs and Food survey

The characteristics of the Gini coefficient make it particularly useful for making comparisons over time, between countries, and before or after taxes and benefits. However, one drawback of the Gini is that as a single summary indicator, it cannot distinguish between different-shaped income distributions. For that reason, it is useful to look at this measure alongside other measures of inequality.

One such measure is the S80 to S20 ratio, which is the ratio of the total income received by the richest 20% of people to that received by the poorest 20%. In addition, the P90 to P10 compares the ratio of the income of the person at the bottom of the top 10% to that of the person at the top of the bottom 10%. Finally, the Palma ratio takes the ratio of the income share of the richest 10% of households to that of the poorest 40% of households.

As highlighted in the accompanying dataset, in contrast to the Gini coefficient, all three of these measures are similar for both SNA-equivalised final income and OECD-modified-equivalised final income, when compared between the FYE 2014 and FYE 2019.

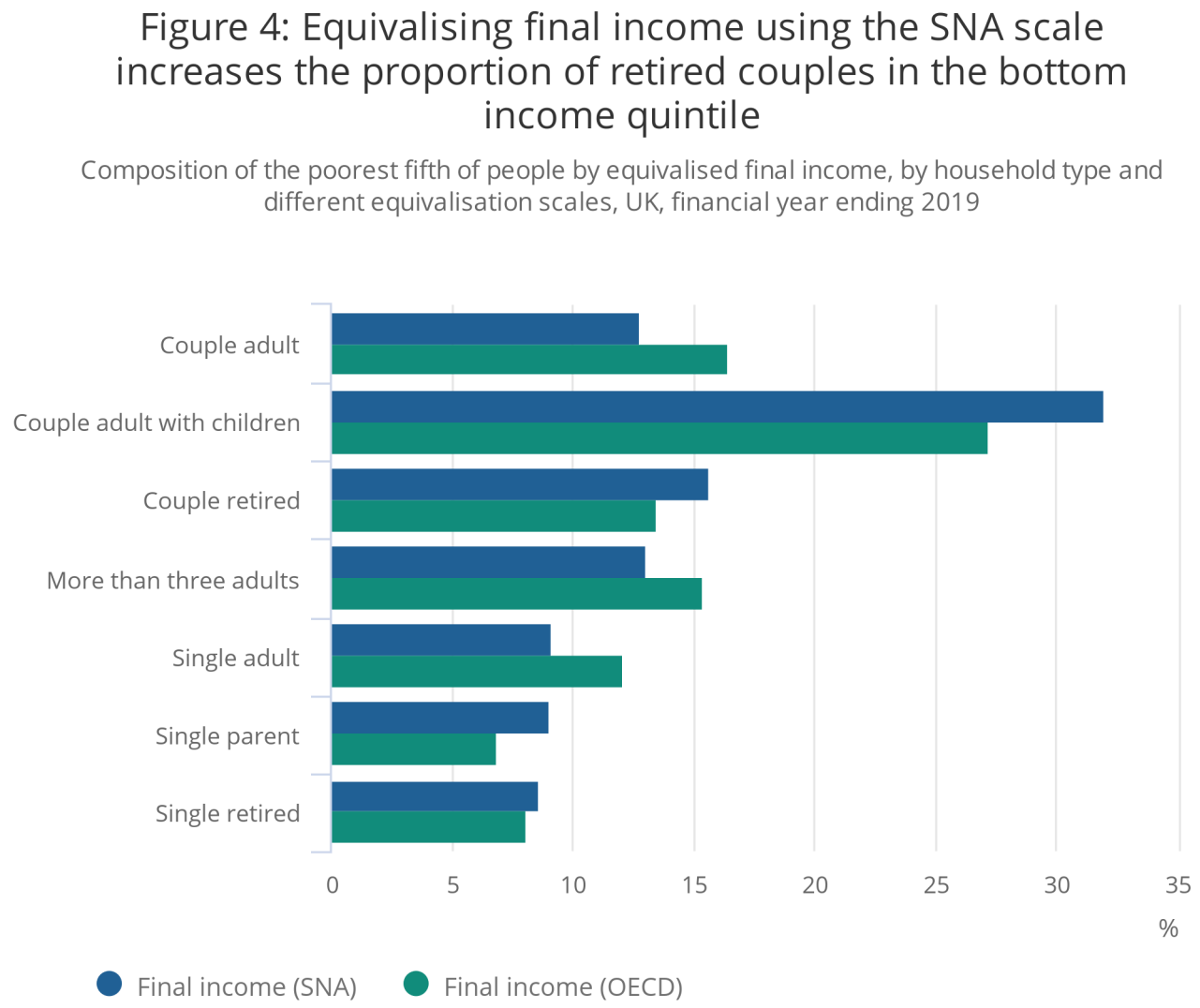
Given that these three measures focus more on the ends of the distribution, these findings suggest that the changes in final income resulting from using the SNA scale have a greater effect towards the middle of the income distribution. This is borne out when comparing the change in average final income across different income quintiles when using the SNA and OECD equivalence scales. As demonstrated in the accompanying dataset, the changes are proportionally larger in the second, third and fourth quintiles than in the first or fifth.

5 . Effects of the alternative SNA scale on the income distribution

An alternative way to look at changes to the income distribution is to consider how the composition of different income quintiles, both in terms of age groups and household type, is affected by the change in equivalisation scale.

Figure 4: Equivalising final income using the SNA scale increases the proportion of retired couples in the bottom income quintile

Composition of the poorest fifth of people by equivalised final income, by household type and different equivalisation scales, UK, financial year ending 2019



Source: Office for National Statistics – Living Costs and Food Survey

Notes:

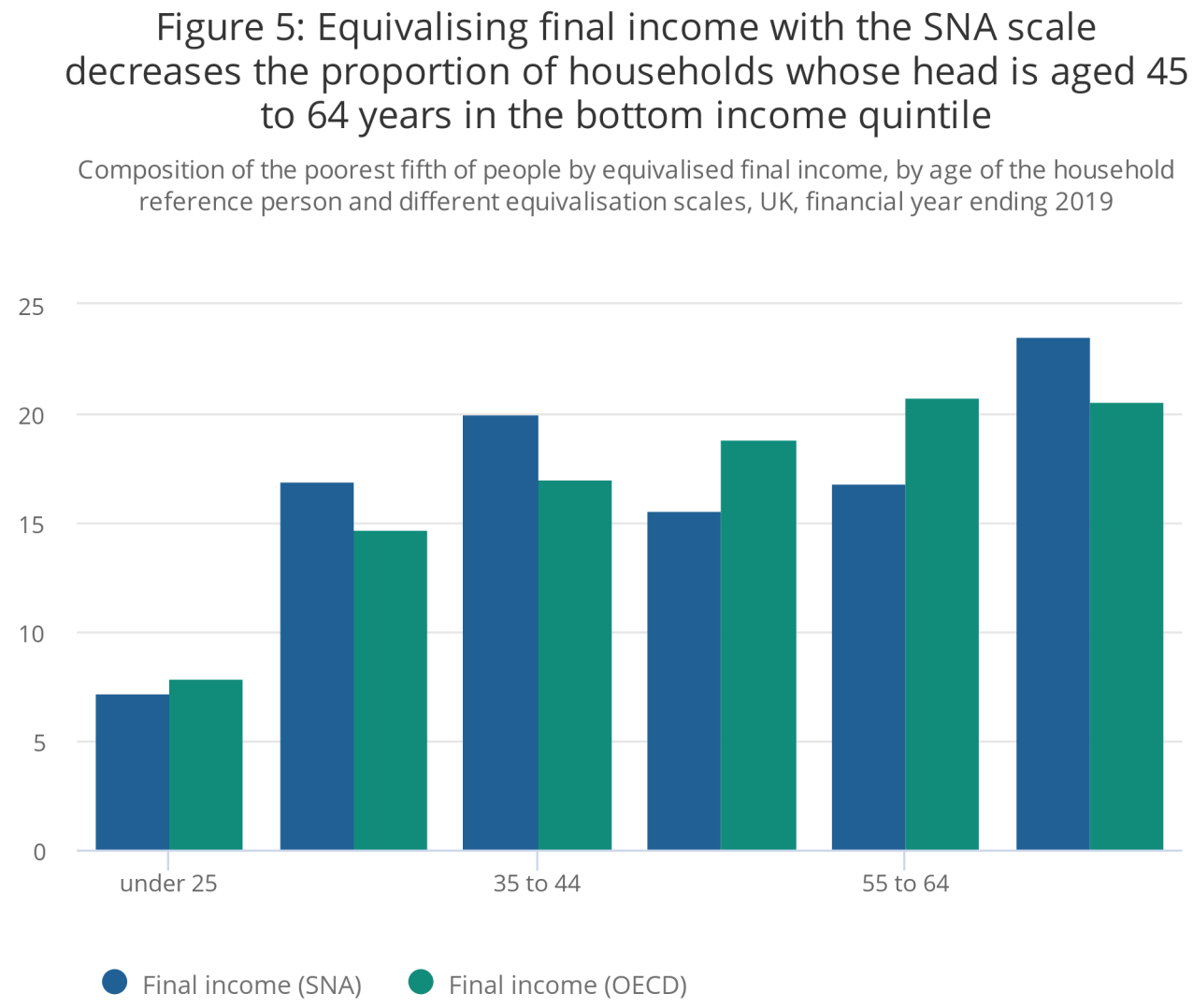
1. Individuals are ranked according to final income equivalised with the simplified needs-adjusted (SNA) scale and Organisation for Economic Co-operation and Development (OECD) modified scale respectively.

Figure 4 demonstrates how the use of different equivalisation scales affects the household composition of the poorest fifth of households. It shows that using the alternative scale results in the poorest fifth of households having a higher proportion of households with children and retired households and a lower proportion living in households without children. For example, people living in couples with children constitute 32% of the poorest fifth of households when simplified needs-adjusted (SNA) equivalised final income was considered, while the figure was 27% for Organisation for Economic Co-operation and Development (OECD) equivalised final income.

This is because of the higher weight that the SNA method attributes to older adults and children, and it again illustrates that recognition of the increased need for social transfers in kind (STIK) offsets the extra final income received by households with these members.

Figure 5: Equivalising final income with the SNA scale decreases the proportion of households whose head is aged 45 to 64 years in the bottom income quintile

Composition of the poorest fifth of people by equivalised final income, by age of the household reference person and different equivalisation scales, UK, financial year ending 2019



Source: Office for National Statistics – Living Costs and Food Survey

Notes:

1. Individuals are ranked according to final income equivalised with the simplified needs-adjusted (SNA) scale and Organisation for Economic Co-operation and Development (OECD) modified scale respectively.

2. The household reference person is the householder who: owns the household accommodation; is legally responsible for the rent of the accommodation; has the household accommodation as an emolument or perquisite; or has the household accommodation by virtue of some relationship to the owner who is not a member of the household. If there are joint householders, the household reference person will be the one with the higher income. If the income is the same, then the eldest householder is taken.

As the SNA scale assigns different weights according to age group, Figure 5 examines how this treatment affects the composition of the poorest fifth of people as measured by final income. Using SNA-equivalised final income, the poorest fifth of people have a lower proportion of households where the head is aged between 45 and 54 years (16%) or 55 and 64 years (17%), compared to the OECD-modified-equivalised final income (19% and 21%, respectively). Additionally, the poorest fifth have a higher proportion of individuals living in households with a head aged 65 years and over using SNA-equivalised final income (24%) than for using OECD-modified-equivalised final income (21%).

6 . Equivalisation data

Distributional consequences of equivalising household income accounting for social transfers in kind
Dataset | Released 12 October 2020
Reference tables to accompany Understanding how accounting for differences in need for public services impacts income inequality statistics (Experimental), covering the period 2014 to 2015 and 2018 to 2019. Equivalisation is the process of adjusting income statistics to account for the fact that households of different compositions will require different incomes to have the same standard of living.

7 . Glossary

Stages in the redistribution of income

The five stages are:

- household members begin with income from employment, private pensions, investments and other non-government sources; this is referred to as "original income"
- households then receive income from cash benefits; the sum of cash benefits and original income is referred to as "gross income"
- households then pay direct taxes; direct taxes, when subtracted from gross income, is referred to as "disposable income"
- indirect taxes are then paid via expenditure; disposable income minus indirect taxes is referred to as "post-tax income"
- households finally receive a benefit from services (benefits-in-kind); benefits-in-kind plus post-tax income is referred to as "final income"

Note that at no stage are deductions made for housing costs.

Equivalisation

Comparisons across different types of individuals and households (such as retired and non-retired or rich and poor) or over time are made after income has been equivalised. Equivalisation is the process of accounting for the fact that households with many members are likely to need a higher income to achieve the same standard of living as households with fewer members. Equivalisation considers the number of people living in the household and their ages, acknowledging that while a household with two people in it will need more money to sustain the same living standards as one with a single person, the two-person household is unlikely to need double the income.

Social transfers in kind

Social transfers in kind (STIK) are services provided by the government that would otherwise have to be paid for. The three largest components of STIK that are measured in these data are health care, education and adult social care

8 . Data sources and quality

Methodology

The data used were datasets from the Living Costs and Food Survey (LCF) and the Effects of Taxes and Benefits (ETB) release. To increase the sample size, five years of data were combined, from the financial year ending (FYE) 2015 to FYE 2019. Each year's data were converted into nominal prices using the Consumer Prices Index including owner occupiers' housing costs (CPIH) excluding Council Tax.

The simplified needs-adjusted (SNA) equivalisation scale was defined following the methodology laid out by Aaberge, Langorgen and Lindgren (2013):

- Eight age groups are defined (under 5 years, 5 to 15 years, 16 to 34 years, 35 to 44 years, 45 to 54 years, 55 to 64 years, 65 to 75 years, and 75 years and over); the reference household is defined as two adults in the 35 to 44 years age group.
- For each age group, a so-called "gamma parameter" is defined; this is the mean social transfers in kind (STIK) received by an individual of that age group (for example, for those aged 45 to 54 years this is £2,028 per year, and for those aged 35 to 44 years this is £1,352 per year).
- For each household, the gamma parameters were summed across household members to give a household gamma parameter (for example, for a household containing one person aged 45 to 54 years and one aged 35 to 44 years, the gamma parameter for the 45 to 54 years age group was added to the gamma parameter for the 35 to 44 years age group to give £3,380 per year).
- For each household, a "cash parameter" representing cash income is defined as the median Organisation for Economic Co-operation and Development (OECD) modified equivalised before housing costs (BHC) disposable income (£28,964 per year), multiplied by the BHC OECD-modified weight for the household (In this example, one, giving a cash parameter of £28,964 per year).
- The cash parameter and gamma parameter for each household are added together and divided by this value for the reference household (£31,668 per year); this defined the needs-adjusted (NA) scale (in this example, £28,964 plus £3,380, giving £32,344, then divided by £31,668 to give 1.021).
- To provide a more tractable and easily computed scale, the SNA scale was derived from the NA scale using a linear regression (ordinary least squares) of the NA scale weight on the number of household members in each age group.

Compared to Aaberge, Langorgen and Lindgren, this methodology differs very slightly. Initially, they defined 14 different age groups and differentiated males and females. However, as they found only negligible differences between males and females, this was omitted. For the SNA scale, they combined age groups to give eight age groups, and this was the number chosen for this work.

9 . Future developments

This work on the simplified needs-adjusted (SNA) equivalence scale highlights the importance of using the most suitable equivalence scale because of the differences in resulting income, income inequality measures and income distribution across population subgroups. While the SNA scale might achieve a more appropriate way to equivalise specifically final income, it is only one example, and it would be preferable to investigate additional options for developing an equivalisation scale suitable for use with final income. This could then be compared to the SNA and Organisation for Economic Co-operation and Development (OECD) modified scales.

It should also be considered that the SNA scale is essentially a modification or extension of the before housing costs (BHC) OECD-modified scale. The methodology used to create this scale could also be applied using a different equivalisation scale developed for disposable income as a "base", for example, using the after housing costs (AHC) OECD-modified scale. As the Social Metrics Commission (SMC) and others have highlighted, there are issues with the OECD-modified scale even as applied to disposable income and using it as the base for the SNA scale risks replicating these issues.

The Office for National Statistics (ONS) is considering a work programme to assess the viability of the OECD-modified scale and to assess and develop alternatives with greater empirical foundations. We welcome any feedback or views to feed into this work programme. Please get in touch by emailing hie@ons.gov.uk.

Additional factors to be considered in future developments of equivalising final income include how to improve the estimation of needs for social transfers in kind (STIK) rather than relying on the policy-dependent measure of government spending. Accounting for likely additional needs for STIK in certain demographic groups, such as people with disabilities and single-parent families, is also an area that could be addressed.

10 . Related links

Effects of taxes and benefits on UK household income: financial year ending 2019
Bulletin | Released 23 June 2020
The redistribution effects on individuals and households of direct and indirect taxation and benefits received in cash or kind, analysed by household type and the changing levels of income inequality over time.

The distributional impact of public services in European countries
Eurostat working paper | Released 27 May 2013
The rationale and methodology for creating a needs-adjusted scale for equivalising final income.

Poverty statistics in the late 1980s
Eurostat research paper | Released 13 July 1995
Discusses issues around inequality and poverty statistics and proposes the Organisation for Economic Co-operation and Development (OECD) modified equivalisation scale.

Equivalisation in poverty measures: can we do better?
Report | Released 18 December 2019
This Social Metrics Commission (SMC) report explores in more detail income equivalisation and developing new equivalisation scales.