the review of income and wealth

Review of Income and Wealth
Series 70, Number 2, June 2024
DOI: 10.1111/roiw.12637

AN EXAMINATION OF PUBLIC INCOME REDISTRIBUTION

BY JACOB NIELSEN ARENDT*

The Rockwool Foundation Research Unit

AND

MADS LYBECH CHRISTENSEN

The Danish Centre for Social Science Research

This study examines the extent of public income redistribution in a Scandinavian welfare state. We confirm previous findings where the redistributive effect of cash transfers is larger than that of in-kind transfers, indirect taxes, and collective consumption, but their difference depends substantially on common methodological choices. First, we apply administrative data to identify actual use of in-kind transfers and compare their redistributive effects to those from simpler allocation rules advocated in the distributional national account literature when actual transfers are not observed. Second, we show that the use of the insurance value (age and gender specific mean use) as an alternative allocation brings the redistributive effect of in-kind transfers far closer to that of cash transfers. Third, we adjust for life cycle differences and show that while in-kind transfers mainly redistribute income across age groups, redistribution from cash transfers takes place both within and across age groups.

JEL Codes: D31, H24, H72

Keywords: inequality, income redistribution, cash and in-kind transfers, public policy

1. INTRODUCTION

Rising income inequality is observed throughout the Western hemisphere, and a natural question is whether governments can or should mitigate such rise, for instance by redistributing income. However, merely assessing how much income is redistributed is difficult because a large portion of public redistribution occurs in the form of non-cash transfers and taxes which are often not observed on an individual level.

This study combines insights from two strands of literature to shed light on the extent of public income redistribution (see references below). We focus on family equivalized income inequality but, inspired by the distributional national account (DINA) literature, we include the major components of public income and expenditures: direct and indirect taxes, cash transfers, in-kind transfers, and collective consumption expenditure. In-kind transfers are defined by individual use of childcare, schooling, education, youth social care, health care, and elder care. Indirect taxes include, for instance, value added taxes, and collective consumption is public

*Correspondence to: Jacob Nielsen Arendt, The Rockwool Foundation Research Unit, Ny Kongensgade 6, 1472 Copenhagen K, Denmark (jar@rff.dk).

expenditures that cannot be individualized, such as expenditures on defense and criminal justice. The context is a universal welfare state, Denmark, where public taxes and tariffs constitutes roughly 48 percent of total gross national income, and public consumption constitutes a third of total consumption.[1]

Our first contribution is that we take advantage of access to rich administrative data, where we observe detailed in-kind transfers at the individual level and compare this to two simpler allocation methods: a simple lump-sum transfer or a neutral transfer in proportion to disposable income. These simple allocation methods have, for instance, been advocated by the WID team who have advanced research on DINA substantially in recent years (Alvaredo et al., 2021). Along a similar vein, we compare the two simple allocation mechanisms when applied to indirect taxes and collective consumption expenditure. We also compare the results for indirect taxes to a third alternative, also advocated in Alvaredo et al. (2021), where indirect taxes are obtained from aggregate consumption by income groups from external survey results.

Second, following these comparisons of allocation methods, we contrast the use of actual in-kind transfers to the use of their insurance value, which has become customary in the literature on extended income (Aaberge et al., 2018; Eurostat, 2013; Figaro and Paulus, 2015). Two arguments for using the insurance value are: (a) To avoid scenarios where expensive treatments re-rank individuals, without considering the reduced living conditions of those in need of treatment (Aaberge and Langøren, 2006), and (b) That providing insurance against unexpected events is a primary rationale for universal welfare states, and such insurance value accrues to everyone ex-ante, independently of actual use. The insurance value is typically measured as the expenditure according to age- and gender-specific mean use which is available for many countries.[2] We believe that the insurance approach is a viable alternative to the simpler per capita or disposable income methods applied in the DINA literature.

Our last contribution is to apply another insight from the income and wealth inequality literature: That the distribution of income measured in a cross-section may exacerbate income differences measured over longer time spans (e.g., Almås and Mogstad, 2012; Atkinson, 1971; Paglin, 1975). In the current context this implies that redistributive effects of public transfers may be exacerbated if the transfers covary with income across the life cycle. We compare two simple age adjustments to examine how life cycle variation alters the redistributive effects of public cash and non-cash transfers.

The analyses are conducted on rich administrative full population Danish data from 2008 to 2017 that include information on individual income, income taxes, and in-kind transfers related to the individual use of childcare, schooling, education, youth social care, health care, and elder care. For each type of public service, we estimate average public expenditure per user at different levels of detail. The

[1] See https://www.statistikbanken.dk/, Table SKTRYK and NAHC1.

[2] See, for instance, health care spending by age and gender in OECD countries: https://stats.oecd.org/Index.aspx?DataSetCode=EBDAG, while other expenditures can readily be combined with patterns of use.

redistributive effect of a transfer is measured as the percentage change in inequality when the transfer is added to pre-transfer income.[3] An important backdrop for our analysis is that inequality in family equivalized disposable income, measured by the Gini coefficient, has increased by 40 percent in Denmark from 1994 to 2018, while inequality in pre-tax and transfer income has almost been stable during the same period (The Ministry of Finance, 2020). It is therefore natural to ask what a more complete picture of public income redistribution looks like.

We find that the redistributive effect of cash transfers is much larger than that of non-cash transfers, but that their relative size depends greatly on methodological choices: While the redistributive effect of taxes and cash transfers is as high as 38–44 percent, the redistributive effect of in-kind transfers is at most 7 percent throughout the period from 2008 to 2017 when measured by actual receipt of in-kind transfers. In comparison, the redistributive effect of in-kind transfers allocated as lump-sums is 11 percent, and only 2 percent when allocated in proportion to disposable income. Neither of the simple allocation rules therefore mimics actual receipt well in the current scenario. Adding collective consumption expenditure reduces inequality by 5 percent, whereas indirect taxes allocated per capita or by income specific consumption widen inequality by up to 10 percent. Again, the redistributive effects of indirect taxes and collective consumption are negligible when allocated in proportion to disposable income.

Looking at specific types of in-kind transfers, actual receipt of in-kind transfers related to the use of social care, health care, and elder care also widens inequalities. Since the actual receipt of in-kind transfers do not account for the reduced living conditions for those in higher need of these services, a common alternative is to allocate these in-kind transfers by their insurance value (age- and gender- specific mean expenditures). We show that this more than doubles the redistributive effect of in-kind transfers to 15 percent. Using the insurance value for cash transfers as well, reduces their redistributive effect to 22–24 percent, bringing the redistributive effects of cash and in-kind transfers much closer.

The redistributive effect of actual receipt of in-kind transfers vanishes when we adjust for age differences in disposable income, whereas it is only reduced to 21–31 percent for cash transfers. This implies that in-kind transfers mainly redistribute income across age groups, whereas redistribution from cash transfers takes place both within and across age groups.

Sensitivity analyses show that the overall picture that cash transfers have a far larger redistributive effect does not depend on the sequence of which transfers are added to pre-transfer income and holds when inequality is measured with the percentile ratios. The use of percentile ratios reveals that redistribution from in-kind transfers is larger in the top half of the income distribution, while the opposite is true for cash transfers.

[3] The pre-transfer income concept differs in the main analyses for different types of transfers, but we show that the sequence of transfers does not alter overall conclusions. In the summary we refer to the redistributive effect of taxes and cash transfers as the change in the Gini coefficient when cash transfers are added and taxes subtracted from market income, and the redistributive effect of in-kind transfers is the change in the Gini coefficient when in-kind transfers are added to disposable income.

The study adds to the literature on the redistributive effects of specific public transfers, taxes and cash transfers in particular (Joumard et al., 2012; OECD, 2011; Alvaredo et al., 2021; Piketty et al., 2014; Heisz and Murphy, 2016) but also to the smaller literature on "extended income" aiming at adding the value of in-kind transfers to personal income (Evandrou et al., 1993; Smeeding et al., 1993; Garfinkel et al., 2006; Aaberge and Langøren, 2006; Paulus et al., 2010; Aaberge et al., 2010; Koutsampelas and Tsakloglou, 2013; Aaberge et al., 2018; Aaberge et al., 2019; Hérault and Jenkins, 2022), and the literature on distributional national accounts, that has seen numerous recent advancements (O'Higgins and Ruggles, 1981; Piketty et al., 2018; Auten and Splinter, 2019; Saez and Zucman, 2020; Bozio et al., 2018; Alvaredo et al., 2021; Carranza et al., 2021; Blanchet et al., 2022, to mention just a few).[4]

2. The Public Sector in Denmark

Our study focuses on public redistribution in Denmark, where the public sector provides many services free of charge, that is, as in-kind transfers to its citizens. The public sector finances the health care system, child-care, primary schooling, upper secondary and tertiary education, as well as social support to disadvantaged groups and elder care to disabled elderly. Thus, there are no copayments for hospitalizations or social support, nor any tuition for higher education. Instead, access is governed by other rules such as assessments by the general practitioners for health care, and by social care workers for need of social support and access to education is based on high school grade point averages. Denmark also offers a wide array of cash transfers with a high level of generosity, targeting both students, unemployed, disabled and the elderly. To finance services and transfers, Denmark has a high level of income tax rates consisting of a local flat rate and a highly progressive national tax rate. The local municipalities determine (up to some degree) both the local income tax level and are responsible for providing child-care, schooling, social care, and elder care, while five regions and the government are responsible for providing, respectively, health care and upper secondary or tertiary education. To insure against too large a dispersion in service levels across rich and poorer municipalities, the central government provides a block grant to municipalities. Spending levels and local tax rates are restricted through budget agreements, and there are financial sanctions in case agreements are defaulted or taxes are raised beyond fixed total level.

3. Methods

We use a standard framework for the analysis of disposable income inequality: We focus on adults, assume an equal sharing of income per household member, and use the modified OECD equivalence scale. For a given type of baseline

[4] The literature on valuation of in-kind transfers dates further back and often looks at single in-kind transfers, e.g., Gillespie (1965); Le Grand (1978); Smeeding (1982); Moffitt (1989), and Lieber and Lockwood (2019).

income, y_b, we measure the redistributive effect of a given tax or transfer, t, as the relative change in inequality when the transfer is added to the baseline income (Musgrave and Thin, 1948; Reynolds and Smolensky, 1977):

$$R(t) = \frac{I\left(y_b + t\right) - I\left(y_b\right)}{I\left(y_b\right)} \tag{1}$$

Where I is a measure of inequality, so R is negative if the transfer reduces inequality. We measure inequality by the Gini coefficient in the main part of the analysis and contrast it to percentile ratios to provide insight on redistributive effects in the bottom and top part of the distribution. We take a pragmatic approach and value in-kind transfers by average public expenditures on public services and focus on different ways to allocate these expenditures across individuals.[5]

Our study is closely related to the ongoing work of the team who are working on establishing distributional national account methods and have established the world inequality database.[6] Bozio et al. (2018) and Blanchet et al. (2022) find that while a lump-sum allocation of in-kind transfers and collective consumption produces larger redistributive effects compared to an allocation in proportion to disposable income, the allocation rule does not affect trends in redistributive effects in France, Europe and the US. We add to existing literature by comparing different types of allocations of in-kind transfers, indirect taxes, and collective consumption, and by adjusting for life cycle variations. This is described further in the following.

(1) As an outset for our analysis, we compare actual consumption of in-kind transfers (average expenditures at various levels of aggregation described in the Appendix S1) to the simplified allocation methods often used and recommended in the DINA literature: per capita and in proportion to disposable income (Alvaredo et al., 2021).
(2) As highlighted in the DINA literature, the traditional focus on cash transfers, as well as the inclusion of in-kind transfers in the extended income literature, omits a substantial part of both public incomes and expenditures. To obtain a more complete picture of income redistribution, we include both indirect taxes and collective consumption expenditure. While the latter may be less important for a pure distributional perspective, they are included in DINA analyses, and it is therefore important to know the consequences of different allocation methods applied in different strands of literature. We compare allocations of collective consumption expenditures and indirect taxes according to the simple rules used for in-kind transfers; either as an equal lump-sum to all adults or proportionally to disposable income. Since allocation per capita is an individual allocation mechanism, we also allocate in proportion to individual

[5] Smeeding et al. (1982) is a pioneer study of the most common alternative valuation methods for in-kind transfers.

[6] https:\\wid.world.

disposable income. Once allocated, we convert all incomes to equivalized incomes to hold the unit of analysis constant. This implies that allocation in proportion to disposable income is not neutral by construction, as it would be using equivalized income. For indirect taxes we also compare results to an allocation based on aggregate consumption by four overall income groups, as also suggested in Alvaredo et al. (2021), see the Appendix S1 for further details.

(3) As an alternative to the simple allocation methods for in-kind transfers, we examine their redistributive effect when they are allocated across individuals according to the insurance approach that is often utilized in the extended income literature (Smeeding, 1982; Smeeding et al., 1993). The argument for the use of the insurance value is often to avoid scenarios where expensive treatments re-rank individuals, without considering the reduced living conditions of those in need of treatment (Aaberge and Langøren, 2006). Another argument is that providing insurance against unexpected events is a primary rationale for universal welfare states, and that such insurance value accrues to everyone ex-ante, independently of future use. The insurance approach assigns the average expenditures of public services to different groups of users with a similar risk of use of public services. We predict the insurance value by simple age- and gender-specific use, which is standard in the literature for health and elder care (Garfinkel et al., 2006; Aaberge and Langøren, 2006; Aaberge et al., 2010; Paulus et al., 2010; Koutsampelas and Tsakloglou, 2013; Eurostat, 2013). We have compared the age- and gender-specific predictions to a specification that also included education, but this had no impact on the results. The insurance approach could be a useful alternative to allocations per capita and in proportion to disposable income when individual utilization is not observed, when external information on age related consumption is available. For consistency, we also apply the insurance value for cash transfers, since they too provide insurance, against disability and unemployment.

(4) While the objective of cash transfers is to alleviate consequences of low income, in-kind transfers are more often allocated according to specific needs, irrespective of income levels. When the need for public services differs across age groups, in-kind transfers will redistributive income across age groups. The redistribution effect from in-kind transfers is therefore exacerbated if life cycle variation in consumption of public services covary with life cycle variation in income. Unfortunately, we do not observe lifetime incomes nor transfers, and as a second-best alternative, we follow studies on income and wealth inequality and adjust for age (Almås and Mogstad, 2012; Atkinson, 1971; Friesen and Miller, 1983; Mookherjee and Shorrocks, 1982; Paglin, 1975; Pudney, 1993; Wertz, 1979). We compare two age adjustments: a simple adjustment where we subtract mean age specific income and a regression-based method based on Almås and Mogstad (2012). The regression-based approach allows age to be correlated with other determinants of income, and adjusts for differences across age, net of other determinants. We control for gender, education, family type (described by being single and the number of children), immigrant or descendant status, and calendar year.

In addition to the methodological comparisons, we conduct two sensitivity analyses. First, we examine whether the redistributive effects depend on the order in which transfers are added. This has been shown to matter for direct taxes (Hérault and Jenkins, 2022). When evaluating redistributive effects, it is customary to add cash transfers to market income and in-kind transfers to disposable income, as we do in most of the analyses. We show how sensitive the redistributive effects are when each transfer is either added first or last in the sequence of all transfers. However, like Hérault and Jenkins (2022), we argue that the natural order for cash transfers and income taxes is to add them to the pre-tax or pre-benefit income, because direct taxes are based on gross income and indirect taxes are paid from the post-tax income. The natural order is less clear for in-kind transfers and collective consumption expenditures. Second, we examine the redistributive effect with the use of alternative inequality measures, based on ratios of the 10^{th}, the 50^{th} and the 90^{th} percentile ratios, which are very common, particularly in the DINA literature. These ratios enable us to explore the redistributive effects in the tails of the distributions, whereas the Gini is more sensitive to changes near the mode of the income distributions. For space considerations, we only consider the redistributive effects based on actual consumption without regard to the sequence of transfers.

4. Data

We utilize administrative register data from Statistics Denmark with full populations and individual information on cash income and public service use. We focus on incomes from 2008 to 2017 as we have excellent data on both cash and in-kind transfers for this period.

Table 1 shows the key income concepts used in this study: market income, disposable income, in-kind transfers, collective consumption expenditure and indirect taxes. Disposable income is market income plus cash transfers minus income taxes, and extended income is disposable income plus in-kind transfers. Market income includes income from employment, self-employment, capital income (including imputed rent from home ownership) as well as payments from private pensions. Cash transfers include unemployment, sickness, and disability benefits; student grants; public pensions; temporary cash transfers; and housing and child subsidies.[7] Taxes include both national and local income taxes and capital taxes. The in-kind transfers are described in short below and in detail in the Appendix S1.

4.1. *In-Kind Transfers, Collective Consumption Expenditure and Indirect Taxes*

In-kind transfers are non-monetary transfers related to the use of public services, while indirect taxes include value added taxes (VAT) on consumption

[7] Note that both imputed rent and housing subsidies are sometimes treated as an in-kind transfer (Evandrou et al., 1993; Smeeding et al., 1993; Paulus et al., 2010) or considered separately (Figaro and Paulus, 2015). We decided to include imputed rent as part of both market income and disposable income, such that our definition of disposable income follows the definition from Statistics Denmark, and the only difference between market income and disposable income is taxes and cash transfers. See https://www.dst.dk/da/Statistik/dokumentation/Times/personindkomst/dispon-13 for more details on disposable income (in Danish).

Table 1
Types of Income and Type of Expenditure Data

Income type	Definition	Expenditure aggregation level
Market income	Labor income and income from self-employment, capital income, private pension, imputed rent for house owners	Individual
+ Transfer income	Public cash transfers include student grants, public- and disability pensions (incl. early retirement), unemployment-, sickness-, and housing and child benefits	Individual
− Direct taxes	Income taxes (national and municipal), property tax, capital tax	Individual
= Disposable income		
+ Child care and schooling	Public child care and elementary schooling.	Municipal
+ Education	Upper secondary and tertiary education	Type of education
+ Social care	Preventive care, foster care, institutional care for youth. Concact person, social support and institutional care for disabled or disadvantaged adults.	Municipal
+ Health care	Services from the public sickness insurance, in- and outpatient hospitalizations (somatic and psychiatric)	Individual
+ Elder care	Home care in own home and in residential homes, rehabilitation	National
= Extended income		
Collective consumption expenditures	Public services that cannot be individualized, e.g. defense and criminal justice	National
Indirect taxes	Value added tax (VAT), property tax and tariffs on energy and water.	National or income group

Note: Further details are provided in Appendix S1.

and other tariffs, e.g., on property and energy consumption. In many countries, neither in-kind transfers nor indirect taxes are observed on an individual level. We do not observe indirect taxes either in the current study but take advantage of access to administrative data with information about individual use of public services to measure actual use of in-kind transfers. We include the following public services: childcare, schooling, education, health care, elder care, and social care for youth. While we know the users of each service, we do not know the individual costs of use. The value of public in-kind transfers is therefore calculated as average public expenditures on the services, where expenditures are averaged at different levels of aggregation. The most detailed expenditures are found for health care, where each type of health care use is reimbursed on an individual basis, corresponding to the specific treatment given. For childcare, schooling, and youth social care, we allocate the average annual municipal gross expenditure to each user. For education, we measure average public expenditure per student for a given type of

Table 2
Mean Family Equivalised Incomes, 2008–2017 (2017 Euro)

	Mean	Growth (2008–2017)
1. Market income	39865	9.1%
2. Transfer income	9343	13.5%
3. Direct taxes	15326	2.4%
4. Disposable income (1 + 2–3)	33881	13.6%
In-kind transfers		
5. Childcare and School	2484	−7.3%
6. Education	1302	−7.5%
7. Health Care	2745	12.2%
8. Elder Care†	566	45.3%
9. Youth Social Care	202	6.5%
10. In-kind transfers (5 + 6 + 7 + 8 + 9)	7299	7.0%
11. Extended income (4 + 10)	41180	12.5%
12. Collective consumption expenditure	4550	1.9%
13. Indirect taxes (method 1)	10395	−2.3%
14. Indirect taxes (method 2)	10029	7.0%
Observations per year	4,406,100	

Notes: Non-users of in-kind transfers are allocated zero value. The transfers and income types are defined in Table 1. The means are for the entire Danish adult population in 2009–2017, excluding persons with negative disposable income. Measured in 2017 prices. Collective consumption expenditures are from national statistics. Indirect taxes are based on consumer surveys (method 1) and national tax statistics (method 2).

† Growth is shown from 2009 because 2008 is an outlier.

education. Expenditure on elderly care is obtained as number of hours of home- and residential-care times average wage for staff providing the services. Further details are found in the Appendix S1.

Annual national collective consumption expenditure is obtained from Statistics Denmark while indirect taxes are obtained in two ways: Either from annual national taxes reported by the Danish Customs and Tax Administration, or as percentages from consumption patterns by income groups obtained from the household budget survey collected by Statistics Denmark.[8] Further details are found in the Appendix S1.

4.2. *Descriptive Statistics*

Table 2 shows that the mean of equivalized market income across the period from 2008 to 2017 is €40,000, and that taxes and cash transfers reduces this to a disposable income of €34,000 (rows 1 and 4). Table 2 also shows that the value of in-kind transfers roughly corresponds to the value of cash transfers minus taxes (row 11), and extended income (the sum of disposable income and in-kind transfers) is therefore close to the market income. The value of collective consumption expenditure per capita is shown in row 12 and corresponds to around two-thirds of the value of in-kind transfers, while indirect taxes correspond roughly to expenditures on transfer income (and the two methods provide the same mean). By and large, the current study includes twice the size of public expenditures and

[8] https://www.statistikbanken.dk/, Table FU01.

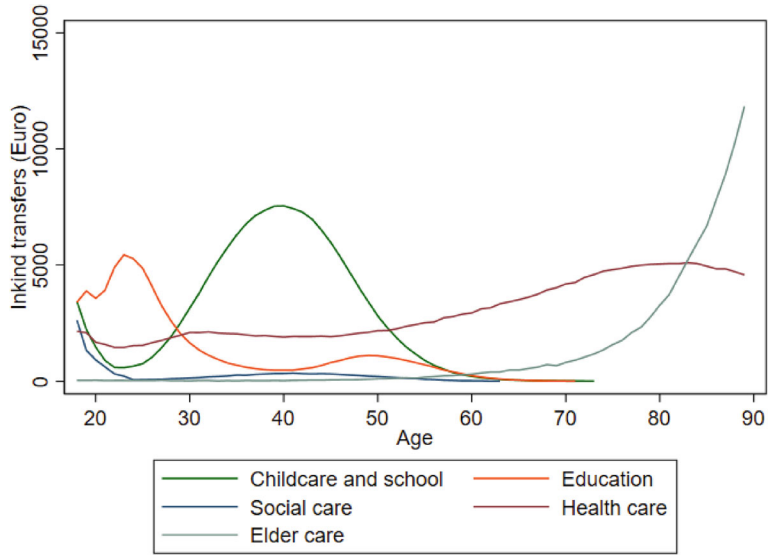

Figure 1. In-kind transfers by age, 2017.
Note: All transfers are family-equivalized.

incomes, as studies focusing only on transfer income and income taxes. The sum of disposable income, in-kind transfers and collective consumption is € 222 bn., which is just short of total national consumption of €237 bn., reported by Statistics Denmark.

Rows 5 to 9 split the in-kind transfers into different types of transfers. The average of the in-kind transfers is highest for health care followed by childcare, schooling, and education. The average level hides important differences across groups as shown in Figure 1 for 2017. In-kind transfers peak three times during the individual's life cycle: in the 20s when participating in education, from the late 20s until the early 50s due to transfers from childcare and schooling for families with children, and from the late 70s and onward due to a very steep increase in elder care. These spikes occur on top of a relatively smooth increase in health care transfers over the life cycle.

The redistributive effect of public incomes and expenditures depends on the extent to which they are taken from or accrue groups with different levels of pre-transfer income. Figure 2 provides a first impression of the size of the redistributive effect by showing the mean public transfers by pre-transfer income deciles. It shows that both taxes and cash transfers are dispersed unequally by market income, as expected (Figure 2a), while the actual distribution of in-kind transfers is far less distributed across deciles of disposable income (Figure 2b). Actual in-kind transfers are more equally distributed than the allocation in proportion to disposable income. Figure 2d shows similar differences between the distribution of indirect taxes, when allocated per capita and in proportion to disposable income. It also shows that the distribution based on consumer survey is close to the distribution in proportion to disposable income. We quantify how

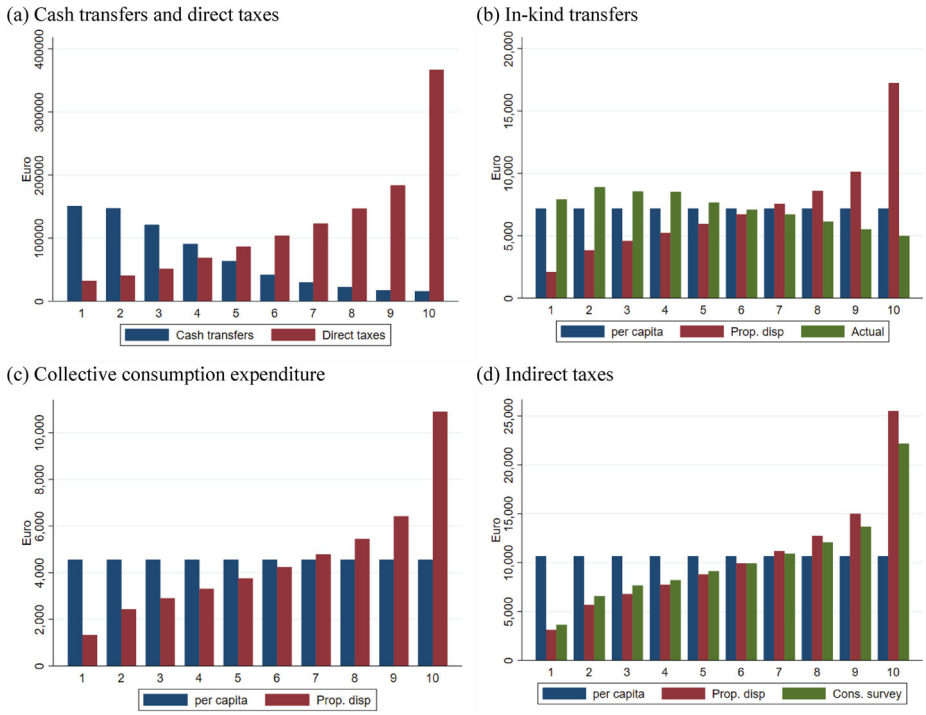

Figure 2. Distribution of public taxes and transfers by market income deciles (a) and disposable income deciles (b–d), 2017.

Notes: The first axis contains income deciles for market income in (a) and for disposable income in (c) and (d). Collective costs are from national statistics. Indirect taxes are based on consumer surveys and national tax statistics. Collective consumption and the sum of in-kind transfers are allocated proportionally to disposable income (disp) and per capita (cap). All transfers and incomes are family-equivalized and are described in more detail in Table 1 and the Appendix S1.

these observations matter for the redistributive effect of cash and in-kind transfers in the following sections.

5. Results

5.1. *The Redistributive Effect of Taxes and Cash Transfers*

Figure 3a depicts that the Gini coefficient in market income has been increasing slightly from 2008 to 2017 from 0.45 to 0.47, while inequality in disposable income has increased by 16 percent from 0.26 to 0.30 over the same period.[9,10]

Figure 3b shows the relative difference in income inequality, before and after taxes and cash transfers, where a larger negative number implies a greater amount of redistribution. While inequality is reduced by 45 percent in 2008 when taxes

[9] The upwards shift in the Gini coefficient from 2009 to 2010 is mainly generated by a policy change that placed a cap on employer administrated pension contribution (Ministry of Economics and the Interior 2013, p. 76). The employer administrated pension contributions are not included in pre-transfer

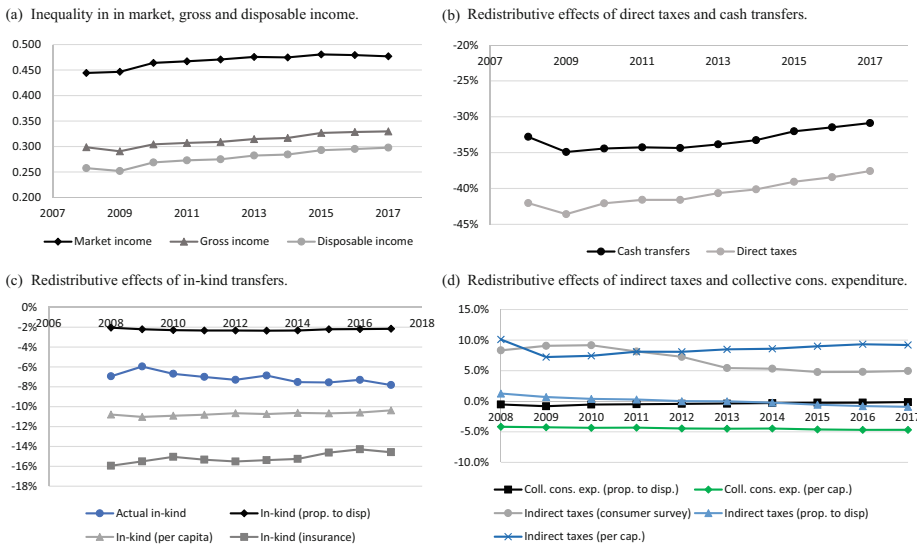

Figure 3. Inequality and redistributive effects, 2008–2017.

Notes: All incomes are family-equivalized. Panel (a) shows annual income inequality measured by Gini coefficients. (b) shows the relative change in the Gini coefficient when adding cash transfers to market income (black) and thereafter subtracting direct taxes (grey). (c) and (d) shows the relative change in the Gini coefficient when adding in-kind transfers, indirect taxes and collective consumption expenditure to disposable income.

and cash transfers are included, it is only reduced by 38 percent in 2017. The redistributive effect of taxes and cash transfers has therefore decreased by 16 percent over this 10-year period.

It is against this backdrop, of rising inequality in disposable income and a reduced redistributive effect of taxes and cash transfers, that we examine the redistributive effect of public transfers more closely.

5.2. *The Redistributive Effect of Public In-Kind Transfers*

Figure 3c shows the redistributive effect of in-kind transfers when they are allocated across individuals in four different ways: Actual receipt of in-kind transfers, the simplified allocations based on the per capital and disposable income

income, and since large employer administrated payments were mainly paid out to high income earners, these earners instead received a higher disposable income when the cap was introduced.

[10] Statistics Denmark reports a similar value of inequality in disposable income, www.statistikbanken.dk, Table IFOR41. OECD reports a value of 0.26 in 2018, (https://stats.oecd.org/Index.aspx?DataSetCode=IDD), and Eurostat reports a value of 0.275 in 2019 (https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en). The difference in inequality reported by Statistics Denmark, Eurostat and OECD stems from methodological differences (Causea, Hermansen, Ruiz, Klein, & Smidova, 2016), mainly from the inclusion of imputed rent from home ownership in the measure used by Statistics Denmark (and therefore by us).

suggested in the DINA literature, and the insurance approach, commonly utilized in the extended income literature. Following the customary approach in the extended income literature, we add in-kind transfers to disposable income, whereas taxes and cash transfers are added to market income. We consider the sensitivity to the sequence of transfers below. The insurance approach is utilized for health, social, and elder care as is customary, and the insurance value is predicted from age-and gender- specific regressions. We compared this to an age-, gender-, and education-specific allocation, but the results were indistinguishable (see Figure A.1 in Appendix S1).

Figure 3c shows that the redistributive effect of in-kind transfer varies is at its lowest value around 2 percent, when in-kind transfers are allocated in proportion to disposable income, and as high as 11 percent when allocated as lump-sum transfers per capita. The redistributive effect of actual in-kind transfers is almost exactly in between these, varying between 6 percent to 8 percent.

Figure A.2 in the Appendix S1 shows the redistributive effect of the actual in-kind transfers when added separately to disposable income. It shows that collective consumption expenditure per capita and education transfers have the single largest redistributive effects, followed by health care, childcare, and schooling, while social care and elder care have a very limited redistributive effect and even increase inequality in some years. The latter occurs because social and elder care includes institutionalized care which is very expensive and accrue a small population, effectively counting socially disadvantaged and sick elderly as richer because of their disadvantages. Such results do not occur when utilizing the insurance approach: Figure 3c shows that the redistributive effect increases substantially when in-kind transfers related to health, social, and elder care are allocated according to their insurance value, as is customary in the extended income literature (their separate redistributive effects are shown in Table A.2 in Appendix S1). For instance, while the redistributive effect of in-kind transfers is 7.8 percent in 2017 when actual consumption is applied, it is 14.6 percent when the insurance value is used. The reason for the increase in redistributive effect is that the insurance value spreads the expenses in proportion to age-specific use, which peaks at ages where income is low.

We argue that when utilizing the insurance approach for some in-kind transfers, it seems consistent to use it for cash transfers as well, because they too are providing insurance against periods with unemployment and sickness. When doing this, the redistributive effect of cash transfers decreases from 38 percent to 22 percent in 2017 and by a similar amount in 2008 (Figure A.1 in Appendix S1). While the results do not change the fact that cash transfers have larger redistributive effects than in-kind transfers, the difference between the effects of cash transfers and in-kind transfers is much smaller when we use the insurance value rather than actual consumption.

5.3. *The Redistributive Effect of Indirect Taxes and Collective Consumption Expenditure*

So far, we have disregarded a substantial part of both public expenditures and incomes: incomes from indirect taxes and collective consumption expenditure. Figure 3d shows the redistributive effects of indirect taxes and collective

consumption expenditure, when they are allocated as lump-sum (per capita), in proportion to disposable income and, for indirect taxes, by income specific consumption. The redistributive effects are, naturally, small when allocating in proportion to disposable income. When allocated as lump-sum transfers, the redistributive effect of collective consumption expenditure varies between 4–5 percent. Indirect taxes are regressive and widen inequalities by 9–10 percent when allocated as lump-sums, and by 4–9 percent when allocated by income specific consumption. The underlying Gini coefficients are reported in Table A.1 in Appendix S1.

The redistributive effect of in-kind transfers, and collective consumption expenditure per capita corresponds, for instance, to a reduction of the Gini coefficient from 0.30 to 0.26 in 2017. While this is not unimportant, it is far less than the reduction of cash transfers. Adding indirect taxes into the equation, raises the Gini again to 0.29 or 0.30.

5.4. *Redistribution Between and Within Age Groups*

This section presents estimates of the redistributive effect that seeks to account for the potential covariation between use of public transfers and income over the life cycle. We do so by adjusting for age differences in pre-transfer income. Two adjustments are used: a simple age-specific adjustment and a regression-based adjustment that adjusts for age, net of other determinants of income: gender, family status, immigrant status, and education. The adjustments are shown in Figure A.3 in Appendix S1. They show that while the simple adjustment completely smoothens the age development of income (by construction), the regression-based adjustments leave a drop in income at low and high ages. This is primarily due to lower education levels at these ages. Table 3 shows that the age adjustments reduce the redistributive effect from in-kind transfers from 6–8 percent to 3–5 percent, confirming that in-kind transfers are often received at stages in life where disposable incomes are low, and therefore redistribute a large share of income across, not within, age groups. The age adjustment also reduces the redistributive effect for cash transfers. For instance, the redistributive effect of cash transfers is, for instance, reduced in 2017 from 38 to 26 percent or 31 percent. Nevertheless, the redistributive effect is much larger

Table 3
Redistributive Effects with Age-Adjusted Income, 2008 and 2017

	No Adjustment		Simple Age-Adjustment		Regression Adjustment	
	2008	2017	2008	2017	2008	2017
Cash transfers and direct taxes	−42.0%	−37.6%	−26.3%	−26.4%	−21.1%	−30.7%
In-kind transfer	−6.9%	−7.8%	−3.2%	−4.7%	−4.1%	−5.3%

Notes: Redistributive effects obtained as the relative change in the Gini coefficient when adding transfers to pre-transfer income. For cash transfers, pre-transfer income is market incomes, and for in-kind transfers, pre-transfer income is disposable income. The age adjustment adjusts pre-transfer income by age-specific means. The regression-adjustment is based on Almås and Mogstad (2012) and only subtracts age specific mean income, net of other determinants: gender, family type, immigrant status and education.

Table 4
Redistributive Effect of Each Transfer, When Added First or Last

	2008		2017	
	First	Last	First	Last
Cash transfers	−33%	−45%	−31%	−42%
Direct taxes	10%	−5%	11%	−5%
Childcare and School	−3%	2%	−3%	1%
Education	−3%	−3%	−3%	−3%
Health Care	−6%	−1%	−6%	−1%
Elder Care	0%	1%	0%	0%
Youth Social Care	−1%	0%	−2%	1%
Collective consumption expenditure	−8%	−3%	−7%	−3%
Indirect taxes	−11%	5%	−10%	4%

Notes: The relative change in Gini coefficients, when adding each transfer first to market income, or last, once all other transfers have been added. Collective consumption expenditures are from national statistics and allocated per capita. Indirect taxes are based on consumer surveys.

for cash transfers than for in-kind transfers even with adjustments for life-cycle variation in income.

5.5. *Sensitivity Analyses*

The Sequence of Transfers

It is customary to consider the redistributive effect of cash transfers by adding cash transfers to market income, while the redistributive effect of in-kind transfers is considered by adding them to disposable income. Here, we consider whether the order in which transfers are added matters. The results are presented in Table 4 and they show that the order in which transfers are added to market income matters for some transfers. The redistributive effects are larger for child-care and schooling, health care, collective consumption and indirect taxes when these transfers are added first, as opposed to last, and that the opposite is in fact true for cash transfers and direct taxes, while it does not make a big difference for the remaining transfers. However, as we argued in section 3, every sequence is not natural because there is a natural pre-transfer income when it comes to taxes, but not when it comes to in-kind transfers and collective consumption expenditures. The main take-away therefore is that the redistributive effects of in-kind transfers and collective consumption expenditure are partly muted when added as the last transfer, whereas the redistributive effect of cash transfers is far larger than that of other transfers irrespective of the order in which transfers are added.

Choice of Inequality Measure

This section present results with the ratio of the 90th, 50th and 10th per-centiles as alternative inequality measures. For space considerations, we only consider the redistributive effects based on actual consumption and the most common pre-defined sequence of transfers. Table 5 shows that the use of an alternative inequality measure does not alter the fact that cash transfers and direct

Table 5
Redistributive Effects with Alternative Inequality Measures

	P90/P50		P50/P10	
	2008	2017	2008	2017
Cash transfers	−11%	−14%	−91%	−91%
Direct taxes	−8%	−6%	−10%	−8%
In-kind transfers	−7%	−6%	1%	−5%
Collective consumption−indirect taxes	3%	3%	10%	7%

Note: The redistributive effects are relative changes in the percentile ratios, when transfers are added sequentially in the order shown from the top.

taxes have a much larger redistributive effect than other incomes and transfers. For instance, while the P90/P50 ratio was 2.01 for market income in 2008, it was 1.64 for disposable income, 1.53 for extended income, but 1.57 after collective consumption expenditure and indirect taxes (see Table A.3 in Appendix S1). The reported ratio P50/P10 in Table 5 reveals that the redistributive effect of taxes and cash transfers mainly occurs in the bottom half of the distribution (P50/P10), whereas the redistributive effect of in-kind transfers is at least as large in the top half of the distribution as in the bottom. Indirect taxes, on the other hand, mainly widen inequalities at the bottom of the distribution.

6. Discussion

Despite the substantial increase in disposable income inequality that has occurred in many countries over recent decades, we know surprisingly little about how the public sector redistributes income. Recent studies on distributional national accounts and in-kind transfers have advanced this area of research, but many data limitations and methodological challenges remain. We contribute to this literature by comparing how the redistributive effect of cash and non-cash transfers depends on the how the transfers are allocated across individuals and age groups.

Our first analysis compares the redistributive effects of in-kind transfers, indirect taxes, and collective consumption expenditure when they are allocated in different ways across individuals. We find that, while none of the methods alter the fact that cash transfers and direct taxes have the largest redistributive effect, the magnitude of redistribution differs substantially depending on methodology.

While simple lump-sum allocations may seem as a reasonable a priori approximation in the case of services provided in a universal welfare, it produces redistributive effects of in-kind transfers that are nearly 50 percent larger when compared to actual use. By contrast, allocations in proportion to disposable income will by construction limit the amount of redistribution and therefore seems unsuitable without strong prior evidence. The choice of allocation method is therefore not innocuous. The overestimation of lump-sum transfers, compared to actual use, is particularly

large for expensive services to the elderly and disadvantaged youth: Actual receipt of in-kind transfers related to elder care and social care widen income inequalities, thereby limiting the overall redistributive effect of in-kind transfers. We argue that an ex-ante approach, based on the insurance value utilized in the extended income literature, may be a suitable pragmatic alternative that avoids the simplistic lump-sum allocation. We argue, however, that if the insurance principle is used for in-kind transfers, it should also be considered cash transfers, for consistency. The use of the insurance approach brings the redistributive effect of in-kind transfers and cash transfers closer.

Different allocation rules may therefore produce different redistributive effects. Another reason that the redistributive effects from different studies may be difficult to compare is that it they are usually calculated from cross-sectional data. Even if all persons have similar life cycle incomes and life cycle use of public services, transfers related to the use of public services may seem highly redistributive if the use of services coincide more with periods with low income at some point in time or country than others. The covariation is likely to be high in most countries for transfers related to childcare, education, and elder care. To eliminate such life cycle variations, we use age adjustments as applied in the income and wealth inequality literature. While the redistributive effect of cash transfers is reduced by up to 50% when redistribution across age is eliminated, the age-adjustment nearly wipes out the redistributive effects of in-kind transfers (measured by actual consumption). This shows that, in the current study, in-kind transfers almost exclusively redistribute income across rather than within age groups, while cash transfers redistribute a large amount of income both within and across age groups, in accordance with their different purposes.

The literature on public income redistribution is too vast and heterogeneous to summarize, but a few comparisons to previous studies seems valuable. First, the reduction in redistributive effects of cash transfers and direct taxes over time that we observe has also occurred in other OECD countries, including the Nordic countries (Causea and Hermansen, 2018; Pareliussen et al., 2018), and has been shown to contribute to rising disposable income inequality net of demographic change (The Ministry of Finance, 2020). Yet, it at odds with the recent comparisons between the US and Europe, where pre-tax income inequality is seems to be the primary reason for different developments in pre- and post-tax income inequality (Bozio et al. 2020, Blanchet et al., 2022). Second, the redistributive effect that is obtained from the insurance value of in-kind transfers corresponds roughly to findings from previous studies for Denmark for earlier years (Aaberge et al., 2018; Eurostat, 2013). That said, the results may clearly depend on the context. We may expect that the redistributive effects of in-kind transfers are small in a universal welfare state with limited co-payments and limited means testing. The findings in Garfinkel et al. (2006) point in this direction: Differences in inequality among 10 Western countries are reduced once in-kind transfers are accounted for. They argue that this is because countries such as the US, Canada and Australia spend relatively more on in-kind transfers than on cash transfers, and spending is more progressive because of means-testing and because in-kind transfers are less financed by

indirect taxes than in European countries. However, other cross-country comparisons do not point towards systematic differences in redistributive effects of in-kind transfers across nations but, if anything, tend to find that in-kind transfers have a similar absolute effect on inequality, implying that relative redistributive effects are larger in countries that are more equal prior to in-kind transfers (Paulus et al., 2010; Eurostat, 2013; Aaberge et al., 2018).

A few caveats and limitations should be stressed. It is important to stress that the analyses are purely descriptive, as are most other studies of income inequality. An important limitation is that even though the current study has access to detailed data on actual use of public services delivered in-kind, we only measure local average expenditures for several public services, and more detail could be added, for instance in the form of costs for children or the elderly with special needs. Finally, we apply simple estimates of insurance values. Both the insurance and the actual consumption value likely do not capture the value placed on public services. Future research is encouraged to elaborate analyses along these lines.

We make no claim that there is one correct method to examine redistributive effects of public incomes and expenditures, but that different methods have their own merits, describing for instance, actual use of transfers ex-post of redistribution, or ex-ante of redistribution by the insurance value, and with or without life cycle adjustments. The different results stress the need for an explicit discussion of the aim of the analyses and a choice of methodology that reflect this aim.

Acknowledgements

Funding from the ROCKWOOL Foundation is greatly appreciated. This work was conducted while Mads Lybech Christensen was employed at the ROCKWOOL Foundation. We are grateful for comments from participants in the ROCKWOOL Foundation's internal seminar, from the editor and two anonymous reviewers.

References

Aaberge, R. and A. Langøren, "Measuring the benefits from public services. The effects of local government spending on the distribution of income in Norway," *Review of Income and Wealth*, 52(1), 61–83, 2006.

Aaberge, R., M. Buller, A. Langøren and M. Mogstad, "The distributional impact of public services when needs differ," *Journal of Public Economics*, 94, 549–62, 2010.

Aaberge, R., A. Langøren and P. Y. Lindgren, "Accounting for in-kind transfers in comparisons of income inequality between the Nordic countries," *Nordic Economic Policy Review*, 17, 175–205, 2018.

Aaberge, R., L. Eika, A. Langøren and M. Mogstad, "Local governments, in-kind transfers, and economic inequality," *Journal of Public Economics*, 180, 103966, 2019.

Almås, I. and M. Mogstad, "Older or Wealthier? The Impact of Age Adjustment on Wealth Inequality," *Scandinavian Journal of Economics*, 114, 24–54, 2012.

Alvaredo, F., Atkinson, A. B., Chancel, L., Piketty, T., Saez, E. and Zucman, G. (2021). Distributional National Accounts Guidelines: Methods and Concepts Used in WID.world. WID.world Working Paper Series No. 2016/2, revised September May 28, 2021.

Atkinson, A. T., "The Distribution of Wealth and the Individual Life Cycle," *Oxford Economic Papers*, 23, 239–54, 1971.

Auten, G. and D. Splinter, "Top 1 Percent Income Shares: Comparing Estimates Using Tax Data," *AEA Papers and Proceedings*, 109, 307–11, 2019.
Blanchet, T., L. Chancel and A. Gethin, "Why is Europe Less Unequal than the United States?" *American Economic Review: Applied Economics*, 14, 480–518, 2022.
Bozio, A., Garbinti, B., Goupille-Lebret, J., Guillot, M. & Piketty, T. (2018). Inequality and Redistribution in France, 1990-2018: Evidence from Post-Tax Distributional National Accounts (DINA). WID.world Working Paper Series 2018/10.
Carranza, R., Morgan, M. and B. Nolan (2021). Top Income Adjustments and Inequality: An Investigation of the EU-SILC. World Inequality Lab, Working Paper No 2021/17.
Causea, O., Hermansen, M., Ruiz, N., Klein, C. & Smidova, Z. (2016). Inequality in Denmark through the looking glass. Economics Department Working papers, No. 1341.
Causea, O. & Hermansen, M. (2018). Income redistribution through taxes and transfers across OECD countries. VOX, CEPR Policy Portal.
Evandrou, M., J. Falkingham, J. Hills and J. Le Grand, "Welfare Benefits In Kind and Income Distribution," *Fiscal Studies*, 14(1), 57–76, 1993.
Eurostat (2013). The distributional impact of public services in European countries. Eurostat, Methodologies and Working Papers.
Figaro, F. and A. Paulus, "The Distributional Effects of Taxes and Transfers Under Alternative Income Concepts: The Importance of Three "I"s," *Public Finance Review*, 43, 347–72, 2015.
Friesen, P. and D. Miller, "Annual Inequality and Lifetime Inequality," *Quarterly Journal of Economics*, 98, 139–55, 1983.
Garfinkel, I., L. Rainwater and T. Smeeding, "A Re-examination of Welfare States and Inequality in Rich Nations: How In-kind Transfers and Indirect Taxes Change the Story," *Journal of Policy Analysis and Management*, 25, 897–919, 2006.
Gillespie, W., "The effect of public expenditure on the distribution of income," in R. Musgrave (ed), *Essays in Fiscal Federalism*, Brookings Institution, Washington, DC, 1965.
Hansen, E. B., L. Eskelinen and V. T. Christensen, *Genoptræning af hjemmeboende ældre. Analyse af effekter i Københavns Kommunes træningscentre*, AKF, Copenhagen, 2007.
Hérault, N. and S. Jenkins, "Redistributive Effect and the Progressivity of Taxes and Benefits: Evidence for the UK, 1977–2018," *Journal of Income Distribution*, 31, 1–25, 2022.
Heisz, A. and B. Murphy, "The Role of Taxes and Transfers in Reducing Income Inequality," in D. A. Green, W. C. Riddell, and F. St-Hilaire (eds), *Income Inequality: The Canadian Story*, Montreal: The Institute for Research on Public Policy, 2016.
Hjelmar, U., A. Rønnow Bruun and Y. Bhatti, *Normeringer på danske plejecentre. Et overblik baseret på en survey blandt danske plejecentre*, VIVE, Copenhagen, 2017.
Joumard, I., M. Pisu and D. Bloch, "Tackling income inequality: The role of taxes and transfers," *OECD Journal: Economic Studies*, 2012, 37–70, 2012.
Koutsampelas, C. and P. Tsakloglou, "The Distribution of Full Income in Greece," *International Journal of Social Economics*, 40, 311–30, 2013.
Le Grand, J., "The Distribution of Public Expenditure: The Case of Health Care," *Economica*, 45, 125–42, 1978.
Lieber, E. M. and L. M. Lockwood, "Targeting with In-Kind Transfers: Evidence from Medicaid Home Care," *American Economic Review*, 109, 1461–85, 2019.
Moffitt, R., "Estimating the value of an in-kind transfer: The case of food-stamps," *Econometrica*, 57, 385–409, 1989.
Mookherjee, D. and A. Shorrocks, "A Decomposition Analysis of the Trend in UK Income Inequality," *Economic Journal*, 92, 886–902, 1982.
Musgrave, R. A. and T. Thin, "Income Tax Progression, 1929-48," *Journal of Political Economy*, 56, 498–8, 1948.
OECD, *Divided We Stand: Why Inequality Keeps Rising*, OECD Publishing, 2011.
O'Higgins, M. and P. Ruggles, "The Distribution of Public Expenditures and Taxes Among Households in the United Kingdom," *The Review of Income and Wealth*, 27, 298–326, 1981.
Paglin, M., "The Measurement and Trend of Inequality: A Basic Revision," *American Economic Review*, 65, 598–609, 1975.
Pareliussen, J. K., M. Hermansen, C. André and O. Causa, "Income Inequality in the Nordics from an OECD Perspective, "*Nordic Economic Policy Review*, 17, 17–65, 2018.
Paulus, A., H. Sutherland and P. Tsaklogou, "The Distributional Impact of In-kind Public Benefits in European Countries," *Journal of Policy Analysis and Management*, 29, 243–66, 2010.
Piketty, T., E. Saez and S. Stantcheva, "Optimal Taxation of Top Labor Incomes: A Tale of Three Elasticities," *American Economic Journal: Economic Policy*, 6, 230–71, 2014.
Piketty, T., E. Saez and G. Zucman, "Distributional national accounts: Methods and estimates for the United States," *Quarterly Journal of Economics*, 133, 553–609, 2018.

Pudney, S., "Income and Wealth Inequality and the Life Cycle: A Non-Parametric Analysis for China," *Journal of Applied Econometrics*, 8, 249–76, 1993.
Reindahl, S., M. Jakobsen, C. Kolodziejczyk, J. Søgård and J. Kjellberg, *Omkostninger ved rygning i et livstidsperspektiv. Modelberegninger baseret på registerdata*, VIVE, Copenhagen, 2019.
Reynolds, M. and E. Smolensky, *Public expenditures, taxes, and the distribution of income: The United States, 1950, 1961, 1970*, Academic Press, New York, 1977.
Saez, E. and G. Zucman, "The Rise of Income and Wealth Inequality in America: Evidence from Distributional Macroeconomic Accounts," *American Economic Review*, 34, 3–26, 2020.
Smeeding, T., *Alternative methods for valuing selected in-kind transfer benefits and measuring their effect on poverty. Technical Paper No. 50. Bureau of the Census*, U.S. Government, Washington, 1982.
Smeeding, T. M., P. Saunders, J. Coder, S. Jenkins, J. Fritzell, A. J. M. Hagenaars, R. Hauser and M. Wolfson, "Poverty, inequality, and family living standards impacts across seven nations: The effect of noncash subsidies for health, education and housing," *Review of Income and Wealth*, 39, 229–56, 1993.
Statistics Denmark, *Danish GDP and GNI. Sources and methods. 2012*, Statistics Denmark, Copenhagen, 2016.
The Ministry of Economics and the Interior, *Fordeling og incitamenter*, Økonomi- og Indenrigsministeriet, København, 2013.
The Ministry of Finance, *Ulighedsredegørelsen*, Finansministeriet, København, 2020.
Wertz, K., "The Measurement of Inequality: Comment," *American Economic Review*, 69, 670–2, 1979.

Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web site:

Appendix S1. Supporting Information