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Welfare type and income inequality: an income source decomposition including in-kind benefits and cash-transfers entitlement

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Abstract
This paper aims to understand whether a shift towards a more balanced cash transfer and service-based welfare system is valuable in terms of reducing income inequality and what factors mostly contribute to the income inequality evolution. To examine this, I first impute the monetary values of in-kind benefits and then reassess Gini coefficients across countries and welfare regimes. I also compare the role of cash transfers by functions and, more importantly, by how they are allocated. By means of factor source decomposition, the elasticities confirm wages as being the income source that creates most inequalities, while taxes play the most equalising role together with cash transfers. However, universal services such as healthcare and compulsory education outperform most of the cash transfers included in the analysis, with a stronger effect in the Mediterranean countries. Although in-kind services play a marginal role in explaining the changes in the Gini coefficient between 2008 and 2017, results suggest that a coordinated view of cash transfers and public services, as well as increasing the share of non-contributory means tested transfers, can reduce income inequality in all welfare regimes.

Keywords Cash transfers · Income inequality · Inequality measurement · In-kind benefits · Welfare provision

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1 Introduction

According to the current literature (e.g. Bourguignon, 2017; Gustafsson & Johansson, 1999; Milanovic, 2015; OECD, 2008; Rodrik, 1998, etc.) one of the main drivers that could explain income inequality is the welfare regime. Indeed, each single state can shape and adjust total income distribution through taxes and transfers at all stages of the business cycle.

In this sense, there is a substantial body of literature investigating the general redistributive effects of state intervention which focuses on the disposable income definition, i.e. through taxes and cash transfers (for example Caminada et al., 2017; OECD, 2008; Raitano, 2016, etc.). Two main alternative approaches are used for the estimation of such redistributive capacity.

The first approach—known as the *sequential accounting approach*—relies on the contributions of Kakwani (1977) and Reynolds-Smolensky (1977). The overall redistributive effect is computed as the percentage reduction in the Gini coefficient, i.e. as the relative difference between the Gini coefficient for disposable income—computed after taxes and transfers—and the Gini coefficient for market income. For example, the OECD (2008, 2011) and Caminada et al., (2017, 2019) implement this approach showing that cash transfers outperform taxes in reducing the Gini coefficients.

The alternative approach is the *factor source decomposition* first introduced by Fei et al. (1978) and Pyatt et al. (1980) and extended by Shorrocks (1982). It consists of determining which income source contributes the most to income inequality. For example, Jännti (1997) found that the primary source of inequality is wage inequality originating in the labour market and confirmed that taxes and social transfers reduce inequality, with taxes playing the larger part. Similarly, Raitano (2016) observed that, proportionally, earnings from work make up for the largest contribution to total inequality. Adopting a welfare-regime perspective, he found that the largest overall redistribution occurred in the Scandinavian countries. Rani and Furrer (2016) and Fuest et al. (2010) obtain similar results.

However, independently of the method,[1] the existing literature mostly focus on the disposable income definition, excluding relevant components like public services (refer to Canberra, 2011 for an extensive discussion about the best proxy of economic wellbeing). Some exceptions in literature like Verbist et al. (2019), Vaalavuo (2011, 2020), Aaberge et al., (2013, 2017), or Aaberge and Langørgen (2006) and Aaberge et al. (2010) exclusively focus on in-kind benefits, missing important comparisons with cash transfers by functions and entitlement. Lastly, a dynamic perspective focused on how marginal contributions of each income source of the extended income definition evolve over time is missing in the existing literature.

[1] A more advanced technique is to use tax-benefit microsimulations using EUROMOD. Paulus et al. (2010) is an example of applying the study of distributional effects of in-kind benefits using such microsimulations.

Therefore, this paper aims at filling these gaps considering a comprehensive and dynamic comparison between cash-transfers (by functions and entitlement) and in-kind services.

Indeed, from a policy perspective it would be useful to know the redistributive capacity of cash transfers not only by function (e.g. allowances for unemployment, old-age, survivors, sickness, disability, education, family/child, housing and social exclusion), but also the inequality effects of higher shares of contributory cash transfers (means-tested or not), or one that uses non-contributory transfers.

Furthermore, the budget structure of a country evolves over time and is increasingly shifting towards a service-based welfare system with higher ratios of in-kind benefit expenditure over GDP (see the Eurostat Social Expenditure Dataset). Is this a valuable strategy in terms of reduction of inequality? And what type of cash transfers still outperforms the in-kind benefits?

And finally, while the existing literature mostly deals with levels, i.e. the impact of a given program (being a cash-transfer or an in-kind service) on inequality at given points in time, this paper extends the previous literature providing a better understanding of the dynamic redistributive effects of both cash transfers and public services. In other words, what are the income sources that mostly determine the income inequality evolution? To the best of my knowledge, this is the first paper addressing this dynamic perspective across countries including a detailed comparison between types of cash-transfers (classified by function and entitlement) and in-kind services.

For this purpose, I use the Lerman and Yitzhaki (1985) Gini decomposition approach focusing on the EU15 countries. Using the *factor source decomposition* allows to estimate the elasticities of income inequalities to changes in income sources. More specifically, it is possible to estimate the effects of a small percentage change in one specific income source on the total Gini coefficient (ceteris paribus). Therefore, the elasticities have a more direct and immediate policy implications compared to the *sequential accounting approach*. Indeed, as Paul (2004) argues, the government interventions contribute to change the income sources only at the margin, and therefore the elasticities are the most relevant elements to observe. Furthermore, this decomposition method is immune by the path-dependence problem—later discussed in Sect. 3.1—characterising the sequential-accounting approach, as all the redistributive effects are computed simultaneously.

Results confirm wages as being the income source with the highest disequalising effects, while taxes play the most equalising role together with cash transfers, particularly in the Nordic countries. However, universal services such as healthcare and compulsory education outperform the redistributive power of most of the cash transfers included in the analysis, with a stronger effect in the Mediterranean countries. Although in-kind services play a marginal role in explaining the changes in the Gini coefficient between 2008 and 2017, results suggest that a shift towards a service welfare is beneficial in terms of inequality reduction.

The rest of the paper is organised as follows. In Sect. 2, I introduce the relevance of the in-kind benefits in public budgets. In Sect. 3, I introduce the Lerman and Yitzhaki (1985) decomposition method along with the imputation techniques of the

in-kind services. In Sect. 4, I present the results that stem from the above-mentioned technique, and further discuss them in Sect. 5.

2 The role of in-kind benefits and cash transfers

The existing literature on in-kind benefits and cash transfers addresses mostly two lines of research: the welfare effects on the labour supply decisions and welfare redistributive effects, i.e. their impact on income inequality (or other relevant economic outcomes).

The standard economic theory predicts lower labour supply because of cash-transfers programs (e.g. Becker, 1965). However, some mixed evidence exists with studies observing the expected negative effects, while others non-significant labour supply changes (see Moffitt, 2002 for a review of existing studies in the USA). More recently, Baird et al. (2018) provide a comprehensive review of the labour market effects of different cash-transfers program. They conclude that both conditional and unconditional cash transfers result in little or no change in labour supply decisions.

As for the in-kind transfers, the theoretical literature is scant (Murray, 1980; Leonesio, 1988; Muffitt, 2002) and mostly conclude that when in-kind transfers are structured in a way such that the individual is constrained to over-consume the provided good, if such good is substitute with labour, then the labour supply is likely to increase. On the contrary, when labour and the in-kind transfer are perfect complement, the labour supply tends to decrease. Few studies empirically test this theoretical prediction. For example, Binglay and Walker (2013) consider in-work cash and in-kind transfers and find large positive effects on the labour supply among single-mothers in UK.

In terms of inequality reduction, an extensive literature has been produced on the redistributive effects of taxes, cash transfers and in-kind benefits. Focusing on the latter, Callan et al. (2008) have argued that distributional analysis based on disposable income considering only cash transfers may severely bias estimates and results. In the first seminal study evaluating the impact of in-kind benefits (education, health and social housing), Smeeding et al. (1993) concluded that adding the monetary value of these services to final income has a positive and significant effect in terms of reducing poverty and inequality. Subsequently, this line of research has been developed further with the contributions of Garfinkel et al., (2005, 2006), Marical et al. (2006), Callan et al. (2008), Verbist et al. (2019), Vaalavuo (2011, 2020), Aaberge et al., (2013, 2017) and Törmälehto and Sauli (2013), which have all used varieties of a sequential accounting approach. Conversely, Aaberge and Langørgen (2006) and Aaberge et al. (2010) use the Gini decomposition technique to analyse the distributional role of local government services.

However, as anticipated, these studies do not include an integrated analysis comparing cash-transfers (by functions and entitlements) and in-kind benefits and—more importantly—lack a dynamic perspective focused on marginal contributions of each income source. Therefore, in this paper, I will try to combine these contributions, by comparing cash transfers and in-kind benefits—across welfare types—with the aim of understanding whether in-kind benefits have a more, less or equivalent

redistributive efficacy, and if this has changed over time. It should be noticed that in estimating the inequality effects, the fiscal externalities (e.g. the effect of a government program on the public budget through labour supply choices) characterising the first line of research are not considered. However, using the observed per-capita monetary values of each program in a dynamic perspective—comparing 2008 and 2017—may help to internalise into the analysis the potential changes in the public budgets due to fiscal externalities.

The above-mentioned literature about redistribution has developed two main approaches for the estimation and imputation of non-cash transfers.

Firstly, their production cost is used to value them, since these products and services are produced and supplied outside a typical market framework and do not typically display a price. Alternatively, they can be valued by calculating their cash-equivalence, i.e. the amount that the household would have paid for similar services in the private market. However, this latter approach is much more data-demanding and does not consider that public services may have characteristics that are extremely different from services produced and supplied by the market.

As for allocation of monetary value to the household income, this depends on the type of service being assessed. The actual use allocation, i.e. monetary values allocated to the households according to the effective consumption of the service, is mostly used for public services like education (including pre-primary), social housing and public transport (Verbist et al., 2019). However, this method is highly data-demanding and difficult to implement, as microdata reporting information about social services consumption may be rare.

The alternative method adopted in the literature, mostly for health-care services and long-term elderly care, is the insurance value approach as the availability of the services and the possibility to use them may be more important than their actual use. For example, for a chronically ill person it is more valuable the possibility to intensively access the public healthcare rather its actual consumption. Indeed, the actual use approach may falsely represent he/she as better off compared to a healthy individual. In other words, using the insurance value approach may compensate for bad outcomes. Furthermore, it is less data-demanding compared to the actual use approach.

With the insurance approach, the aggregate value of the service will be imputed equally between individuals who share the same characteristics (age, gender) and/or household structure (with children, employed, etc.). This can be thought of like the State paying an insurance premium that is equal for all individuals who having the same probability of accessing the service.

Independently of the method adopted, the literature observes in-kind services as positively reducing poverty and inequality. If such positive effects of in-kind benefits on reducing income inequality exist, the underlying hypothesis is that an expansion of this kind of expenditure may imply a stronger redistributive impact over time. Symmetrically, a contraction of such services due to financial crises may undermine the equalising effects of in-kind services.

Indeed, as Esping-Andersen and Myles (2011) argue, the structure of welfare regimes is changing and shifting from cash transfers to in-kind benefits. This is confirmed by looking at the evolution of cash and in-kind expenditures over GDP across

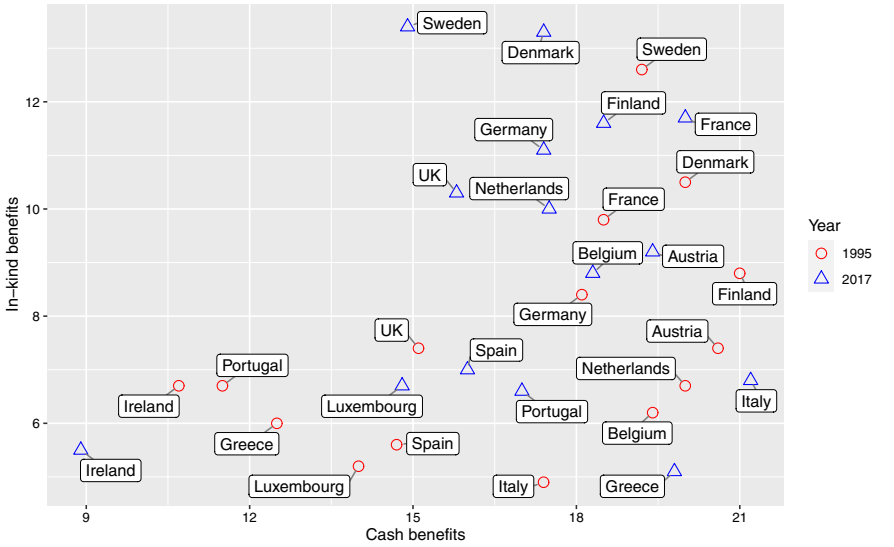

Fig. 1 Cash and in-kind benefits plot—percentage of GDP. *Source*: author's own elaboration based on representation using Eurostat Social Expenditures Dataset. *Note*: The comparison between 1995 and 2017 is intended to provide a longer-term perspective on changes in budget composition, which may not be detectable over a shorter time period

the EU15. Comparing the overall average cash benefits in terms of GDP in 1995 and in 2017, there is a 0.3 percentage point increase, while in-kind expenditures increased by 1.3 percentage points.[2]

Focusing on cross-country heterogeneity in the expenditure composition, Kautto (2002) has complemented Esping-Andersen's (1990) categorisation of welfare regimes by including in-kind services. According to his analysis, the Nordic countries (Sweden, Denmark and Finland) are characterised by high share of both cash transfers and in-kind services; the liberal regime is characterised by a high share of services, but a low share of cash transfers; the conservative regime has high levels of cash transfers and low levels of services; and lastly, the Southern European countries have low levels of both cash transfers and services. The relationship between the two variables can be clearly observed in Fig. 1.

2.1 Welfare regimes

In this section, I briefly discuss the welfare regime typology applied in the analyses, following the contribution made by Esping-Andersen (1990). Esping-Andersen's analysis of the main cross-national and historical variations in social rights and

[2] I used the Eurostat Social Expenditures Dataset (https://ec.europa.eu/eurostat/web/social-protection/data/database). I acknowledge that net social expenditures over GDP are a better measure, but neither Eurostat nor SOCX OECD disentangles the net measure by functions and by type of transfer.

welfare state stratification led him to group European countries into three basic welfare regime clusters. The *liberal welfare state* is characterised by means-tested programmes, modest universal transfers, and/or modest social-insurance plans. The beneficiaries of these programmes tend to be the poorest in society, but the low number of people entitled to them; the limited benefits of the programmes and the stigma associated with them often lead the beneficiaries to rely on the labour market to supplement or extend their incomes. The UK and Ireland are the main proponents of this welfare regime.

In the *social-democratic welfare state,* universalistic and de-commodification principles dominate, with the aim of overcoming the dualism between the State and the market, and of promoting equality of the highest standards and not just of minimum needs. In this way everyone is included in the universal insurance system.

Countries in central Europe (most notably France and Germany) constitute the third regime, the *corporatist welfare state*. Here, the most important characteristic is the preservation of the differential status generated in the active labour force: consequently, rights are tied to contributions, and hence, also to class and status. The state is the key actor in providing welfare policies, but the focus on the horizontal dimension of the welfare distribution limits its redistributive impact.

Ferrera (1996) extends Esping-Andersen's contribution, adding a new welfare specification. Differently from the other models, in the *Mediterranean welfare state,* family and Church are the main actors that provide social support, whereas the state is just a residual actor. An individual's current and previous employment status determines whether he or she is entitled to social security benefits. Mediterranean countries show a dualised labour market, where on the one hand the male breadwinner is more likely to enjoy employment stability, and on the other, women, young people and immigrants suffer more precarious employment. Spain, Italy, Portugal and Greece are example of these Southern European welfare states.

2.2 Welfare types and inequality

The structural characteristics of the welfare system of a given country directly affect individual labour supply choices, but also the labour market institutional structure. Therefore, the structural differences across the welfare types are likely to influence both the market and disposable income distributions, generating different levels of redistribution.

Korpi and Palme (1998) adjusted the classification model introduced in the previous section to account for the types of social insurance programs. They found that countries with targeted benefits (flat-rate means-tested amounts) have higher income inequality, introducing the 'paradox of redistribution'. Korpi (2000), extended the previous work and observe that mostly all liberal countries (USA, UK, Australia and Ireland) display high level of income inequality, while the Nordic countries (Sweden, Norway and Finland) present the lowest level of inequality. These findings have been confirmed more recently, with Esping-Andersen and Myles (2011) showing a negative correlation between social public expenditures over GDP and income inequality. Similarly, Raitano (2016) and Caminada et al., (2017) find that the Nordic

countries are the most equal ones, while countries in the liberal regimes the most unequal. The validity of this classification is confirmed also when adding in-kind benefits (Vaalavuo, 2011).

I will use the presented (exogenous) classification to interpret the redistributive analysis and factor source decomposition. However, I will test how valid this classification is in explaining the relative contributions of different factors to inequality with a hierarchical cluster analysis (see "Appendix"—cluster analysis).

3 Data and methods

I use the European Union Statistics on Income and Living Conditions (hereafter EU-SILC) microdata on the EU15 countries[3] (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and UK) to estimate the redistributive effects of various income sources across countries and over time (comparing 2008 with 2017). In this way, I can explore the main income sources that contribute to changes in equality levels.

Since 2008, data for the EU15 countries include all the necessary gross-income components, allowing me to estimate the inequality effect of each income factor.[4] Moreover, in 2017 the EU-SILC data break down social transfers not only by function (unemployment, old-age, survivors, sickness, disability, education, family allowances, housing allowances and social exclusion allowances), but also distinguish the contributory or non-contributory nature of the transfers (and whether they are means-tested or not). This allows to work with the same definition of income over time—thus avoiding comparability issues[5]—and to take into account the nature of the cash transfer (only in 2017).

Furthermore, the EU-SILC data also include a variable which imputes respondents' housing rental payments. The monetary value of the social housing service can therefore be directly estimated (further details in the subsequent section).

The main problem with the data has to do with its harmonisation or, specifically, with how to treat the negative and null income values. The EUROSTAT recommendation for bottom coding is to set all negative values to zero and then bottom code at 15% of the median equivalised disposable income. However, for the income source decomposition it is necessary for each income component to add up exactly to the total disposable household income. This means that it necessary to bottom-code each single income component. However, because the proportions of negative and

[3] I focus on the EU15 in order to consider the standard classification of welfare regimes, excluding post-socialist countries that may present different structural characteristics.

[4] The only limitation refers to the lack of important capital income components, like capital gains. The absence of such income components may underestimate the overall income inequality.

[5] Formally, the EU-SILC income definition is evolving over time. The main change is between 2008 and 2011, where pensions received through individual private plans (PY080G) are added to the definition of total disposable household income. However, the microdata include this information for all years, allowing us to simply add this component to the income in 2008 and obtain exactly the same definition of income for the two selected years.

null incomes are very close to 0 in all countries, here all negative total disposable household incomes and their relative factor components will be set to zero. As for top-coding, here the incomes are trimmed at the top 0.5 percent.

I will rely on the Gini coefficient as my inequality measure due to its simplicity and common use as a summary index. Because it is very sensitive to the values at the extremes of the distribution and these will be trimmed, it is possible that there is some bias in the estimates provided below. There are no significant differences between the Gini coefficients obtained with the method implemented here and the official EUROSTAT statistics.

Furthermore, as the basis for computing any income inequality measures is total disposable household income, I use the assumption of income pooling—i.e. that household resources are equally shared by its members. Therefore, the total disposable household income is adjusted to the household size using the modified OECD scale[6] to obtain the equalised disposable income. As for the in-kind benefits, the current literature proposes different approaches. Smeeding et al. (1993) assume no income-sharing for the services in-kind and aggregate the non-cash services at the household level and express it in per-capita terms. Differently, Garfinkel et al. (2006) argue that the standard approach is to apply the same equivalence scale to both cash and in-kind transfers. The underlying reason is that such simple approach is half-way solution between the absence of economies of scale argument—implying in-kind benefits expressed in per-capita terms—and the absence of (equal) income sharing within the household, which involve that in-kind benefits should be added to the equivalent income on individual basis. Aaberge et al. (2010) develop a new equivalent scale as a weighted average of scales for cash-income and in-kind transfers, differentiating the needs for cash and non-cash incomes. However, this approach requires detailed data to distinguish the heterogeneity of public expenditures by individual needs. For this reason, I apply the solution proposed by Garfinkel et al. (2006), using the same equivalence scale for both cash and in-kind monetary values. As a robustness, I will replicate the analysis adding the (non-equivalised) in-kind benefits to the equivalent income on individual basis.

3.1 Lerman and Yitzhaki Gini decomposition

As mentioned above, *factor source decomposition* has been extensively discussed in Shorrocks (1982), and its extension to the Gini coefficient is seen in Lerman and Yitzhaki (1985). This is the Gini decomposition that is used here to identify the redistributive effect of each income component, including in-kind benefits.

Lerman and Yitzhaki (1985) demonstrate that the total income inequality measured by the Gini coefficient can be decomposed in the following way:

[6] This scale assigns a weight of 1 to the head of household, a weight of 0.5 to each additional adult in the household and a value of 0.3 to each child.

$$G = \sum_{k=1}^{K} S_k G_k R_k \tag{1}$$

That is, the total Gini coefficient is equal to the sum of the product of three elements for each income component *k:*

1. S_k, which is the share of the income source k on the total income.
2. G_k, which is the inequality index for the specific k-th source of income, in this case, the Gini coefficient.
3. R_k, which is the (rank) correlation between the k-th income source and the total income. A positive (negative) value means that factor k is positively (negatively) correlated with the total income.

Therefore, if an income source is unequally distributed (high G_k) and negatively correlated ($R_k < 0$) with the total income, its increase might reduce income inequality. Conversely, if the k-th source is unequally distributed and also significantly and positively related to total income, then its increase might contribute positively to deepening income inequality.

The valuable aspect of the Lerman and Yitzhaki (1985) approach is that it makes it possible to estimate the effect on inequality caused by a marginal change in each income source.

For example, consider a proportional change in the *household* income source k equal to ε. The partial derivative of the Gini coefficient with respect to the proportional change (ε) is:

$$\frac{\partial G}{\partial \varepsilon} = S_k\left(G_k R_k - G\right) \tag{2}$$

where G is the Gini coefficient before the marginal change in the k-th source.

Therefore, the percentage change in income inequality as a consequence of a 1 percentage point change in income source k is:

$$\frac{\partial G/\partial \varepsilon}{G} = \frac{S_k G_k R_k}{G} - S_k \tag{3}$$

In other words, the Gini elasticity is equal to the relative contribution ($\frac{S_k G_k R_k}{G}$) to inequality of income source k minus the share of source k in the total income. It should be noticed that the sum of the elasticities across all sources k is zero: multiplying all k household income sources by ε leaves the total Gini coefficient unchanged. It follows that the elasticity of a given source k is interpreted ceteris paribus i.e. the percentage change in the Gini coefficient because of 1% increase in source k when all the other sources are constant. Furthermore, from Eq. 3 it emerges that the percentage change in the Gini coefficient will be negative if the share of the source k is larger than the relative contribution to income inequality. This means that if the source k has a relative high share, but its relative contribution to the overall income inequality is low (because of low correlation with the total income, R_k, or

because of low within inequality G_k), its marginal increase will reduce the overall Gini coefficient.

An additional property of the Lerman and Yitzhaki (1985) method is that the following relationship is true:

$$\Delta Gini = \sum_{k=1}^{K} \Delta(S_k G_k R_k) \tag{4}$$

In words, the change in income inequality equals the sum of the changes in the contributions to income inequality of each single component k. The contribution can be further decomposed following Podder and Chatterjee (2002) who define the evolution of the Gini coefficient over time as the sum of the share effect and the concentration coefficient effect. The former represents the change in the Gini coefficient due to changes in the shares of the different sources of income (S_k); the latter is the change in the inequality over time because of changes in the concentration coefficient ($G_k R_k$). Jurkatis and Strehl (2014) propose a similar decomposition and argue that an increase in the concentration coefficient—due to higher rank correlation and/or higher inequality of income source k—always rises the Gini coefficient. Differently, an increase in the share of an income source k leads to higher-income inequality only if this source k has a disequalising effect (concentration coefficient lower than the overall Gini index).[7]

This property will be applied in order to assess the main determinants of inequality changes between 2008 and 2017. In practical terms, to ease the discrete computation, I will take the difference in the contribution ($S_k G_k R_k$) to income inequality for all the k components between 2008 and 2017 and observe to what extent each source contributes to the evolution of the Gini coefficient over the decade.

The choice of decomposition method seems to be somewhat arbitrary (as Caminada et al., 2017 claim). Here I present some theoretical justifications for my choice.

The *sequential accounting approach* computes the redistributive effect of each component step by step, while the *factor decomposition* is simultaneous. Therefore, in the former approach, the order of the income factors matters. For example, the unemployment benefit effect is computed by adding it to the market income or subtracting it from the gross income (Caminada et al. 2017 compute it in both ways and define the inequality contribution as the average of the two computations). This means that the choice of the factor source decomposition helps avoid the ordering issue.

The second—and perhaps most important—difference between the approaches relates to their "normative" foundations. As argued by Fuest et al. (2010), the very different results obtained by the sequential accounting approach and the factor source decomposition depend on the effects of an equally distributed lump sum. It reduces inequality in the sequential accounting approach, but not in the factor source

[7] In continuous time the following relation holds: $\dot{G} = \sum_k \left(R_k G_K - G\right)\dot{S}_k + \sum_k S_k(\dot{R}_k G_k + R_k \dot{G}_k)$ where $\dot{G}$, $\dot{S}$, $\dot{R}$ and $\dot{G}_k$ are the time-derivative of the overall Gini coefficient, shares, rank correlation and Gini coefficient of income source k, respectively.

decomposition. Indeed, Shorrocks (1982) imposed the normalisation assumption to find a standard decomposition technique for any inequality measure.[8] Recalling the main elements of the income source decomposition, an equally distributed lump sum will have a correlation with the total income distribution (G_k) equal to zero and therefore a null contribution to the inequality index.

Lastly, the factor source decomposition allows us to observe the elasticity of each income factor: it is possible to calculate the effects of a small percentage change in one specific income factor on the total Gini coefficient (holding the others constant). On the one hand, the calculation of such elasticities allows us to overcome Shorrocks' (1982) failure to detect the inequality reduction as a consequence of a lump-sum transfer to all individuals in a population. On the other, elasticities are very relevant from a policy perspective; Paul (2004) argues that the change made to a given income source by a government intervention can occur only at the margins, and therefore the elasticities are the most relevant elements to observe.

Therefore, differently from Rani and Furrer (2016) and Fuest et al. (2010), I will focus primarily on estimating the elasticity of each income component.

3.2 In-kind monetary values

To add the in-kind benefits to the total disposable household income and estimate their elasticities, it is necessary to determine the monetary value of the different services under assessment.

As anticipated in Sect. 2, one way to determine the value of each service is to estimate its production costs, i.e. the public expenditure on the service. This is the main method adopted here. As for the imputation of monetary values to individuals/households, a mixed approach is used, imputing their actual use or the insurance value depending on the available information.

3.2.1 Healthcare

Starting with healthcare, I use OECD data on per-capita health expenditures to determine the monetary value of the service. However, not all individuals receive the same flat monetary amount for healthcare services, since this depends on the use they make of those services. For this reason, I apply a combination of the insurance-value approach and the actual-use imputation technique. Vaalavuo (2011) applies a similar approach and calculates age-specific health expenditures based on European Commission data. In her method, each age-group has its own specific per-capita expenditure reflecting their probability of accessing the service.

[8] To better understand the "normative" foundation differences, consider the following example. If we add a lump sum to all households' incomes, the sequential accounting system would detect a large overall inequality reduction, as expected. However, Shorrocks' decomposition fails to detect this reduction because of the normalisation assumption. This assumption states that adding a constant to all households has zero inequality contribution because it has zero correlation to the total disposable income distribution. It is also due to this violation of the uniform addition assumption (Morduch and Sicular, 2002) that the Lerman-Yitzhaki elasticities are more valuable regarding the relevance of income components.

Following the same underlying logic, I use information on the "actual use" of health services to predict probabilities of access to healthcare. These probabilities are then used to weight the per-capita expenditures. As a result, all individuals sharing the same observable characteristics will have the same probability of access and, in turn, the same imputed monetary value for health services.

In practical terms, I start by defining a dummy measuring whether the individual accessed the health service during the year. Next, I use a logistic regression to estimate the probabilities of accessing the service, using age-groups, gender, education, employment status and income-quintiles as independent variables. It should be noted that in this computational exercise, it is not possible to distinguish between public or private health services. The impossibility to consider the frequency/intensity of the participation and by which type of needs is an additional drawback of this approach. For example, a chronically ill person may require higher access and/or more expensive treatment compared to a person with the same observable characteristics (in terms of logistic regression covariates). However, in this approach these two individuals will have the same imputed monetary value without differences based on intensity/type of health assistance.

3.2.2 Education: pre-primary, compulsory and tertiary

For pre-primary education I adopt the actual-use approach. The EU-SILC microdata reports information on whether a child is using a pre-primary educational service and if so, for how many hours per week. Therefore, for each country, I first compute the average number of hours that each child uses the service. Next, I divide the total expenditure incurred by the state in pre-primary education per child receiving the service by the average number of hours of use, so as to obtain a per-hour cost. Finally, this per-hour cost is multiplied by the hours effectively used by each child within a household. The underlying assumption for this computational exercise is that the per-hour cost is the same across the whole of the single country under assessment.

Regarding compulsory education, i.e. primary and secondary education, the standard and easiest approach is to assume 100% attendance for those in the age bracket to attend compulsory school and impute the per-capita expenditure to each student. However, to have a more realistic estimation that adjusts for dropping out of school, I multiply the per-student expenditure by the official (net) enrolment rate obtained by the UNESCO statistics.[9] I do not impute any monetary value to those in the compulsory secondary education (over 16s) who report that they are not enrolled in any school programme and are working.

The imputation of the monetary value of tertiary education relies on the same technique used for primary and secondary education. However, to avoid biased estimates in the redistributive (or regressive) effect of higher education per household, I follow Vaalavuo (2011) and exclude households that consist of only university students. In fact, these households are temporarily classified as "poor" households,

[9] http://data.uis.unesco.org/Index.aspx#

made up of young people that live only with money their parents give them. Including these student households may distort the distribution estimate, especially if the household is really part of another one, as it may lead to an overestimation of the redistributive effect (or a less regressive one). Ideally, it would have been better to add the value of attending tertiary education to parents' household income, but there is no information to link the two households.

In this case, the heterogeneity in the distributions of single-students households affects the cross-country comparison. However, such distortion is likely to be significant only for countries with the highest share of excluded single-students households. Table 2 in "Appendix" reports the share of excluded households by country. The Nordic countries (Denmark, Finland, Sweden) and Netherlands are those with the highest share ranging from 30 to 50 percent (in line with Valaavuo, 2011). As a robustness, I will compare the elasticities of tertiary education with and without the exclusion of single-tertiary students households, expecting differences only in the cases of Denmark, Finland, Sweden and Netherlands.

3.2.3 Social housing

Since 2007, the EU-SILC data provide a variable (HY030) with the household's imputed rental income for leased properties in each country. Theoretically, this monetary amount could be added (excluding interest on mortgages) to owners' household incomes as a return on investment. The per-household monetary value of these imputed rents can be added to the disposable income of households living in social housing as the value of the social service.

In the EU-SILC dataset it is possible to observe tenant status and to distinguish between owners, individuals who are renting on the private market (who do not receive any returns in terms of imputed rent) and individuals renting from the social market (i.e. at a reduced rent and/or for free). Since I am interested in the monetary value of social housing services, I only add the imputed rent to the disposable income of households renting outside the private market, i.e. from public or non-profit institutions.

The main problem with this approach is comparability across countries and the stability of the estimation. As Törmalehto and Sauli (2013) note, the EU-SILC data do not adopt a unique technique for imputing rents, but each country implements its own approach. Some countries may adopt hedonic regressions with Heckman selection-bias correction, while others adopt a simple regression approach. Another problem is that countries differ in how they report the imputed rent, i.e. gross or net, without specifying which costs are deducted in the latter case.

In the EU-SILC user dataset, there are nine countries (AT, BE, ES, EL, FR, LU, PT, SE, IE) that have both gross and net imputed rents, while five countries (DK, FI, IT, NL, UK) only provide gross rents. One country—Germany—provides only net rents. Therefore, I use the gross imputed rent in order to maximise the number of available countries. As a consequence, Germany is excluded from the imputation. Denmark does not have sufficient information to identify households renting at a reduced price or rent-free, and hence, I also exclude it from the imputation. Finally,

because the Netherlands has a very high share of negative imputed rents, it is also excluded from the imputation.

4 Results

Before introducing the decomposition results and the respective income elasticities, I briefly provide a general overview of the changes in inequality between 2008 and 2017, and of how much each country redistributes overall, by comparing the Gini coefficient on market income and the Gini index on disposable income.

As expected, countries belonging to the liberal and the Mediterranean welfare regimes are those with the highest level of the inequality, while countries in the social democratic regime have the lowest level of income inequality. In contrast, focusing on market income inequality, all coefficients fluctuate around 0.50. This means that the redistributive capacity of each country plays a sizeable role in determining the resulting heterogeneity in disposable income inequality. Specifically, the largest effect of State intervention is in Nordic countries, while the reverse is true for the liberal and Mediterranean countries. Countries in the central European contributory regime are in the middle.

Comparing 2008 with 2017, inequality has increased in most countries. The exceptions are Portugal, UK, Germany, France, Belgium and Finland. Denmark and Sweden, particularly, have experienced the highest increase in inequality in disposable incomes, which are now at comparable levels to those of some continental countries (Belgium and the Netherlands).

4.1 Income-source elasticities on the original income components

To obtain an idea of the distributional effects of each income component, in this section I firstly present the decomposition results—specifically the income-source elasticities—for the last available year (2017) and then present the dynamic changes over time. It should be reminded that the absence of some important capital income components concentrated at the top of the income distribution, e.g. capital gains, is likely to underestimate the total income inequality and, in turn, the estimated elasticities (e.g. Advani & Summers, 2020).

Figure 2 reports the estimated income-component elasticities using the disposable income definition (market income, cash transfers and taxes).

As expected, the highest elasticities are observed for wages. The Gini coefficient increases by a range of 0.1 to 0.57 percent as a consequence of a 1% increase in the wage component (ceteris paribus). The highest percentage increase in the Gini coefficient is observed in the Nordic countries. This is explained by the fact that although they have a comparably unequal distribution of wages with respect to the other countries, the Nordic ones have a stronger positive correlation of wages with the total income distribution.

Conversely, the Nordic countries also have the highest equality-enhancing effect exerted by taxes: for a 1% increase in taxes, the average reduction in the Gini

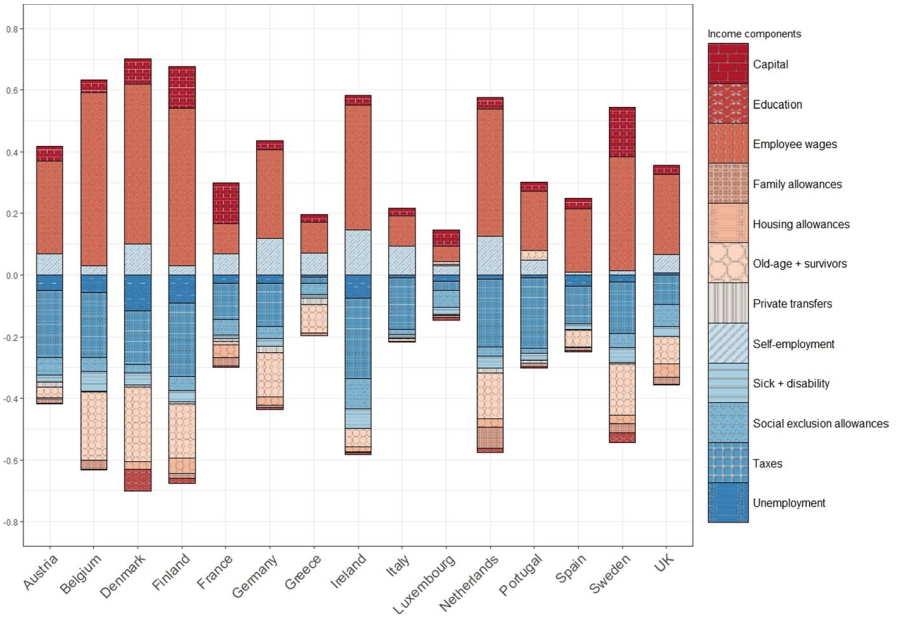

Fig. 2 Income-component elasticity. *Source*: author's own calculation using EU-SILC data. *Notes*: the results ought to be interpreted as follows. For a 1% increase in a given income component k, the Gini coefficient will be increased (or decreased) by the % reported in the graph. Elasticities add up to 0, meaning that if all components simultaneously change by 1%, the effect on the Gini coefficient will be 0

coefficient in Sweden, Finland and Denmark is about 0.20%. This is explained by the highest share of taxes (S_k) and the strongest negative correlation (R_k) with total income, compared to other countries.

However, taxes have an equalising effect in all countries: this ranges from 0.09% in the Gini reduction in the UK to 0.24% in Finland.

Among the social transfers, the most interesting component is the old-age and survivors' benefits. This has an equalising effect, with a negative elasticity in almost all countries. However, studies by Rani and Furrer (2016) and by Fuest et al. (2010) report that its relative contribution to inequality (i.e. $\frac{S_k G_k R_k}{G}$) is positive in most countries. What is causing these apparently contradictory results?

Recalling the definition of elasticity as $\frac{S_k G_k R_k}{G} - S_k$, once the share of component k is subtracted, it is possible to obtain a negative elasticity from a previous positive relative contribution.

For example, take the case of Germany. Computing the relative contribution of the old-age transfer turns out to be positive, which means that it positively contributes to inequality; however, for a 1% increase in this cash transfer, Germany's Gini coefficient drops by about 0.15%. This is because the old-age transfer has a moderate share in the total income (see Table 4 in "Appendix"), and in subtracting it from the positive relative contribution, the elasticity ends up being significantly negative.

All other social transfers have an inequality reduction effect which is more in line with the *sequential accounting approach* (although with a lower

magnitude compared to the effect of taxes), with stronger effects observed in the Nordic countries.

4.2 Effects of in-kind benefits

In this section, I present the elasticities of in-kind benefits, i.e. the effects on the Gini coefficient of a marginal increase of 1% in each service.

The expectation is that as the share of the population that has access to the in-kind service grows, the equalising effect of its monetary value will also increase. Indeed, the percentage difference in the average total disposable household income with and without in-kind benefits is largest in the first quintile.

However, there may be some services, specifically tertiary education, that have a regressive effect on inequality. This is because the significant and positive association between wages and education not only increases wage differentials between workers with different levels of education/experience (between wage inequality), but also the dispersion of wages among workers with the same observable characteristics (within wage inequality)—see Lemieux (2006) for more details.

The impact of educational transfers on inequality is also likely to be regressive for another important reason: if the offspring of the wealthier classes are more likely to attend the university than the offspring of the working class, then the monetary value of this service would mostly benefit the rich, worsening overall inequality. In other words, the rich would be the ones benefitting the most from this in-kind service. The robustness test for the tertiary education reveals that the elasticities are almost identical with and without excluding the single-tertiary students' households for almost all countries but Denmark, Finland, Sweden and Netherlands. As expected, excluding the single-students household in these countries implies a less equalising/stronger disequalising effect of tertiary education (see Table 3 in "Appendix").

Figure 3 reports the elasticities computed using the extended income definition, i.e. adding the in-kind benefits. To highlight the comparison between cash transfers and in-kind, I report only the elasticities of these income components.

Excluding old-age cash transfers, healthcare and primary-secondary in-kind benefits have the strongest inequality reduction effect in most countries. This is particularly true for the Mediterranean countries, where the in-kind services perform systematically better than cash transfers in reducing inequality. Indeed, these are the countries where the percentage change in average incomes, with and without monetary values for health services, displays the highest change in the bottom quintiles.

Specifically, for a 1% increase in the monetary healthcare component, the Gini coefficient declines by between 0.02 and 0.11%, while the primary and secondary monetary transfers account for a variation in the Gini coefficient of between $+0.01\%$ and -0.06%.

Regarding the effect of compulsory primary and secondary education, in all countries except Denmark and Finland, it is redistributive. The null impact of compulsory education on reducing inequality in these countries is due to the highest positive correlation between education benefits and total income distributions; this offset all the equalising effects that might have been expected, compared to all other

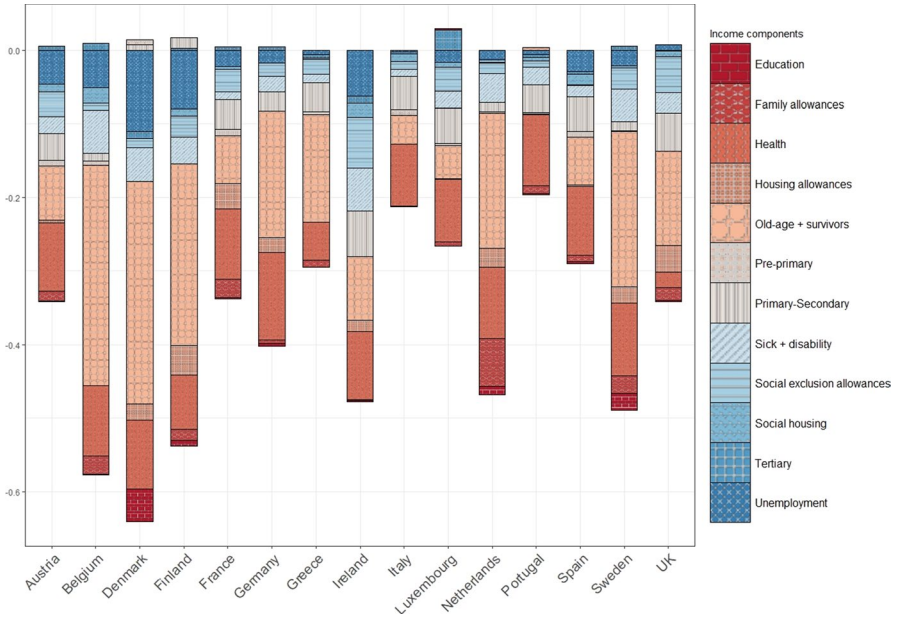

Fig. 3 Elasticities of in-kind benefits and cash transfers. *Source*: author's own calculation using EU-SILC data. *Note*: The results are for 2017, but similar results were obtained for 2008. Elasticities do not add up to zero because all other income components—market income and taxes—are excluded from the graph

countries. This may suggest that in countries with a more compressed income distribution, in-kind benefits have a lower equalising effect. Indeed, compared to all other countries, Denmark and Finland display the lowest percentage change in the average income at the lowest quintile when adding the monetary values of primary and secondary education. This result seems to be coherent with the low elasticity of inequality to the benefits obtained from compulsory education.

In all countries, pre-primary education, tertiary education and social housing have a negligible share of total disposable household income—not exceeding 1% in any country—and therefore a minor effect on the Gini coefficient. However, this is not sufficient to argue that these services are not valuable in terms of policy strategies. For example, investing in pre-primary education more than for other large programs like healthcare, may be beneficial for inequality reduction.[10]

[10] The current method is not suitable for evaluating the redistributive effects of changes in euro terms in one program compared to the same euro change in another program. For this purpose, a more detailed micro-simulation (e.g. EUROMOD) is recommended. However, as a raw exercise, I estimate the elasticities adding 100 euros firstly to healthcare transfers (all other elements at their original values) and subsequently the same 100 euros to the pre-primary service (all other elements at their original values). Comparing these scenarios to the baseline model, the augmented pre-primary service displays a stronger increase in its equalizing power compared to the augmented healthcare values. Tables and results available upon request.

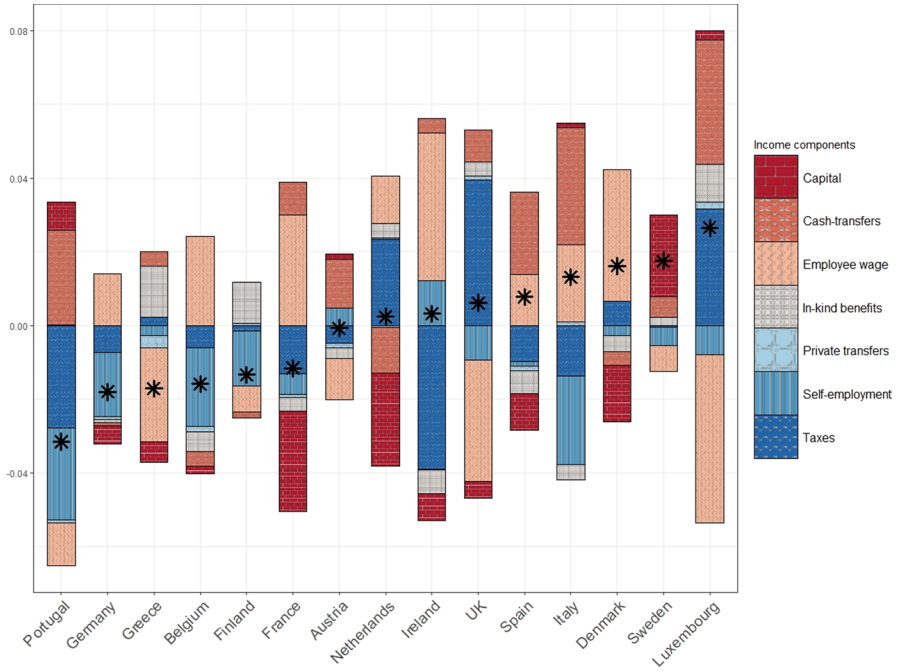

Fig. 4 Determinants of changes in the Gini coefficient over time. *Source*: author's own calculation, based on EU-SILC data. *Note*: countries are ordered according to the absolute change in the Gini coefficient (star-pointer). Positive values mean that the change is towards an increase in inequality; negative, that the change is towards a decrease in inequality

All in all, these results confirm the equalising effects of in-kind benefits and are coherent with the expectation that lower amounts distributed to a small share of households do not significantly affect the inequality measure. Results hold when in-kind benefits are added to the individuals in non-equivalised form.[11]

4.3 Decomposing the Gini coefficient changes between 2008 and 2017

Finally, I present the main determinants behind the changes in the Gini coefficient between 2008 and 2017 across countries, using all income components, i.e. including in-kind benefits.[12]

Figure 4 displays the absolute differences between 2008 and 2017 in each component's contributions ($S_k G_k R_k$) to the change in the Gini coefficient over time, while Table 6 in "Appendix" shows the same information in table format. In other words, this figure helps to understand how much of the evolution of the income inequality is explained by the changes in the contributions of the different income sources.

[11] Tables are available upon request.

[12] The inclusion of in-kind benefits lowers income inequality compared to the measure based on disposable income.

Independently of whether inequality increased or decreased over time, changes in the contribution of employee wages, taxes and cash transfers are the most important elements in determining the evolution of income inequality between 2008 and 2017. Given the years of financial crisis, it seems reasonable that the most important determinants of changes in inequality are those stemming from the labour market—labour income—and fiscal policies (taxes and cash transfers).

To go into more detail, when the source of the increased inequality was a change in taxes, as in the case of the UK (or Luxembourg), the negative contribution of taxes to inequality in 2017 was lower than in 2008, i.e. it became less equalising. Conversely, in Portugal the equalising effects of taxes increased over time.

When it came from wages, the inequality stemming from the labour market gained even more importance. This was the case in Spain, Italy and Denmark.

Cash transfers positively contributed to the rise of inequality in all countries, meaning that their equalising power decreased over time. This is probably due to the policies of shrinking public budgets and spending cuts implemented to tackle the crisis. Specifically, old-age benefits were hit the most: in Spain and Italy their negative elasticities between 2008 and 2017 dropped almost by half, making them far less equalising (compare the elasticities in Tables 4 and 5 in "Appendix").

As for in-kind benefits, their equalising contribution to the Gini change tends to be relatively small, due to the minor changes in the share of in-kind benefits over GDP. The most relevant exception is Greece, where in-kind benefits contribute positively to the Gini change, i.e. they are far less equalising in 2017 compared to in 2008. This is reasonable since Greece experienced the harshest austerity measures with severe cuts to the balance and to services. As observable in Fig. 1, it is the only country with a lower share of both cash and in-kind expenditures over GDP in 2017 compared to 1995.

The equalising effects of in-kind benefits decreased over time—therefore pointing towards higher-income inequality—in Luxembourg, Finland, Netherlands and the UK. In Luxembourg this is explained by the contraction in per-capita health expenditure, which passed from 4700 euros in 2008 to 4271 in 2017, and by the regressive effect played by tertiary education. Similarly, in Netherlands and the UK, the share (S_k) of health expenditures decreased over time, contributing to decreased equalising power (*share-effect*). In Finland, the main source of these lower effects on equality is due to primary and secondary education. As mentioned in the previous section, Finland has a neutral/null effect due to the highest rank correlation with total income distribution (R_k), which increased during the decade. This implies that the effect of primary and secondary education limits the reduction in the Gini coefficient (*concentration coefficient effect*).

Therefore, it can be concluded that where per-capita monetary values of in-kind benefits increased over time and their contributions to the change in the Gini coefficient are fairly constant, the hypothesis that in-kind benefits contribute to the decreasing income inequality trend is verified.

4.4 Contributory versus non-contributory cash transfers

Based on the results in the previous section, it is possible to conclude that cash transfers still outperform in-kind benefits in determining (dis)equalising effects. In

this section, I further disentangle what type of cash transfers has the strongest equalising power.

For this purpose, I compare the effects of contributory means-tested, contributory non-means-tested, non-contributory means tested and non-contributory non-means-tested factors on income inequality. I do not divide the cash transfers by functions, but rather aggregate them by entitlement criteria, exploiting the additional information included in the EU-SILC data starting from the year 2014. I start by distinguishing each social transfer by function (unemployment, old-age, survivors, sickness, disability, education, family, social exclusion and housing); next, I divide the total amount of the transfer for each function by entitlement criteria; finally, I add these amounts across functions. For example, the total of the contributory means-tested transfers equals the sum of the monetary amounts of all functions registered as being contributory and means-tested. Note that in some countries (Greece, Finland, France, Luxembourg, Netherlands, Sweden and the UK), the contributory means-tested amounts are not reported, because this type of scheme is not available at the national level.[13] Table 1 shows the elasticities for each country and entitlement criteria of the benefits.

Table 1 Gini elasticities of cash transfers by entitlement criteria and country. *Source*: author's calculation based on EU-SILC data

Country	Contributory mt	Contributory non-mt	Non-contributory mt	Non-contributory non-mt
Austria	0.002	− 0.093	− 0.043	− 0.062
Belgium	0.000	− 0.425	− 0.034	0.014
Germany	− 0.037	− 0.189	− 0.049	0.008
Denmark	− 0.045	− 0.075	− 0.374	− 0.044
Greece		− 0.155		0.000
Spain	− 0.019	− 0.051	− 0.053	0.000
Finland		− 0.274	− 0.155	− 0.025
France		− 0.083	− 0.091	− 0.015
Ireland	− 0.009	− 0.070	− 0.181	− 0.035
Italy	− 0.008	− 0.027	− 0.013	− 0.013
Luxembourg		− 0.063	− 0.006	− 0.052
Netherlands		− 0.068	− 0.108	− 0.177
Portugal	− 0.004	− 0.015	− 0.024	− 0.004
Sweden		− 0.253	− 0.038	− 0.083
UK		− 0.119	− 0.100	− 0.034

Results refer to 2017, but the same holds for 2008; "mt" stands for means-tested

[13] EU-SILC data flag all contributory means-tested entitlement criteria that do not exist at the national level.

As can be seen, contributory non-means-tested and non-contributory means-tested cash transfers are the most effective in reducing inequality. I also observe significant heterogeneity across countries, mostly depending on the share of each component compared to the total income. The interaction between the non-means tested and contributory nature of a transfer has an especially important equalising effect in Belgium, Sweden and Finland, followed by Austria, Germany and France, i.e. in the continental regimes. On average, in these countries, a 1% increase in all contributory non-means tested transfers reduces the Gini coefficient by 0.192 per cent.

The Nordic countries are where cash transfers have the strongest equalising effects—consistently with the results of previous sections—but while in Finland and Sweden the largest part of the equalising effect comes from contributory non-means-tested transfers, in Denmark it is the opposite. In fact, in Denmark a marginal increase in non-contributory means-tested transfers makes the Gini coefficient decrease by 0.37% (all else being equal).

These differences observed between contributory and non-contributory transfers are due to elements of source decomposition (see Table 7 in "Appendix"). The correlation (R_k) between non-contributory means-tested transfers and total income is highly negative, i.e. favouring the poorest, but the shares of these transfers on this total income are much lower than the contributory non-means tested transfers in all countries. The only exception is Denmark, where the share of contributory non-means-tested transfers represents 9% of total income, while that of non-contributory means-tested transfers represents 13%. Given the strong negative correlation between the latter component and income, the resulting elasticities for Denmark are reasonable.

In sum, on the one hand, the low share of the non-contributory cash transfers, a typical consequence of their means-tested nature, prevents them from having a much larger equalising impact, one expected from their strong negative correlation with total income distribution. On the other hand, the equalising impact that contributory transfers could exert because of their higher share only materialises in countries where these transfers have a strong negative correlation with total income, which explains the apparent contrasting results between relative contribution and elasticities presented in the previous sections.

5 Conclusions and discussion

This paper aims at enriching the existing literature providing new evidence about the redistributive impact of in-kind benefits compared to the cash-transfer structure (by function and entitlement criteria), and—more importantly—their contribution to the evolution of income inequality over time.

If efficiency and optimisation concepts constantly guide governments and policymakers' actions, this paper tries to provide additional guidelines in terms of how shaping fiscal policy interventions aimed at reducing income inequality. This is very relevant in a context of rapidly evolving welfare systems and high budgetary pressures. Indeed, from a policy perspective it would be useful to know which social benefits—both in terms of functions and entitlements—favour a more equal income

distribution so to adjust resources from an unequal to a more equal welfare program. Furthermore, to explore whether the increase in in-kind service expenditures over GDP is a valuable strategy in terms of income inequality, the analysis included the per-capita monetary values of healthcare, pre-primary, compulsory and tertiary education, as well as social housing services.

For this purpose, I have adopted the Lerman and Yitzhaki (1985) Gini decomposition approach focusing on the EU15 countries. More specifically, this method permits to identify the factors that most contribute to increase and decrease in income inequality estimating the direct effects of a marginal change in specific income components on the inequality index. Analysing the elasticities is more relevant from a policy perspective and has an immediate interpretation. In the same metric, the elasticities display the contribution of the various income components to the reduction or increase in inequalities and hence facilitate governments' decisions in favouring one policy or another from an equality perspective.

The results showed—in line with past research and economic theory—that wages are the most relevant component in shaping overall income inequality. Indeed, wages have the highest disequalising elasticities, ranging from a 0.1 to a 0.57 percent increase in inequality for a 1% increase in the wage component (ceteris paribus). Conversely, taxes play the most equalising effect, with stronger results in the Nordic countries where, for a marginal increase in taxes, the average reduction in the Gini coefficient is of about 0.20%. Cash transfers also have equalising effects in almost all countries, with once again stronger effects in the Nordic ones. Among these cash transfers, the old-age and survivors benefits contribute the most to reducing inequalities. This was to be expected, as these benefits represent, on average, 18% of the total income in the EU15, while all other benefits do not exceed 1.4%. In other words, the reason for the high equalising effect of old-age and survivors transfers is that they make up a relatively high share of total income.

In-kind benefits, particularly universal services such as healthcare and compulsory education, further contribute to a reduction in inequality, especially in countries with high levels of inequality. The strongest equalising effects of healthcare and compulsory education are observed in the Mediterranean countries, characterised by high Gini indexes and low shares of in-kind benefits over GDP. In general, these services outperform all other cash transfers in terms of marginal contributions, while pre-primary and tertiary education and social housing do not display such relevant effects, probably due to their lower numbers and/or low share of beneficiaries relative to the whole income distribution.

To understand what the contribution of in-kind benefits is to the evolution of the Gini coefficient between 2008 and 2017, I decomposed the change in the Gini coefficient. This exercise reveals that changes in employee wages, taxes and cash transfers are the most important elements in determining the evolution of income inequality. Indeed, countries with increasing income inequality are characterised by higher contributions made by labour income and lower relevance of taxes and cash transfers.

In-kind benefits play a minor role in explaining the changes that took place in the decade under assessment, but evidence from almost all countries shows that they contribute to reducing the Gini coefficients, confirming the hypothesis that expansionary in-kind benefits are beneficial for reducing inequalities over time. The most

relevant exception is Greece, whose severe cuts in benefits contributed to the disequalising effects of in-kind services.

Finally, I widen the comparison to consider the social transfer entitlement criteria. Results show that contributory non-means tested and non-contributory means-tested transfers are the most effective schemes for reducing inequalities. Continental countries—Austria, Belgium, Germany and France—and Finland and Sweden appear to rely more on contributory non-means-tested schemes. The effects of these schemes are stronger in Nordic countries, with Denmark being the only country with a strong Gini reduction due to a non-contributory means-tested scheme (0.37% for a 1% increase in these transfers).

The main reason why contributory non-means tested transfers are more relevant than non-contributory ones is that they occupy a larger share of total income. If non-contributory means-tested schemes had the same share as contributory ones—as in case of Denmark—they would have a stronger redistributive impact, since they are strongly and negatively correlated with the total income distribution, thus favouring the most economically disadvantaged.

All in all, it has been observed that the primary source of inequality lies in the labour market—and that policy interventions should be directed in that direction. However, it is also observed that although cash transfers still represent the lion's share in redistributive capacity, the shift towards a service welfare (Fig. 1) is beneficial in terms of inequality reduction in all welfare regimes—especially for the Mediterranean countries. These results suggest that if a government aims to reduce income inequality, it should take a coordinated perspective of public services and cash transfers, and reallocate the available resources based on the inequality reduction capacity of each program to maximise the overall redistributive capacity. For example, if the per-euro change in pre-primary educational services results in higher inequality reduction (i.e. higher negative elasticities) compared to the same euro-change in educational cash transfers, then more resources should be allocated to pre-primary services. This would result in a mixed welfare structure where the share of cash-benefits and in-kind services depends on their redistributive capacity. Indeed, the analysis on the main determinants of income inequality dynamics confirms the necessity for governments to adopt a *coordinated view* of taxes, cash-benefits—both in terms of functions and entitlements—and in-kind benefits when shaping their fiscal actions (Lustig, 2018).

There are some important limitations to the present work that could be addressed in future research. In particular, the analysis of in-kind benefits does not take into account the costs of accessing the services, which should be discounted. Moreover, differences in quality both within and between countries in the services provided were not considered. It is also necessary to develop service efficiency indexes in relation to expenditures to weight the monetary value of the quality of the service. More importantly, it may be necessary to discount the part of the services provided by the private sector, both in healthcare and in education.

Finally, some important (capital) income components like capital gains are not included in the income definition, resulting in an underestimation of income inequality. These (important) technical aspects should be the subject of future research.

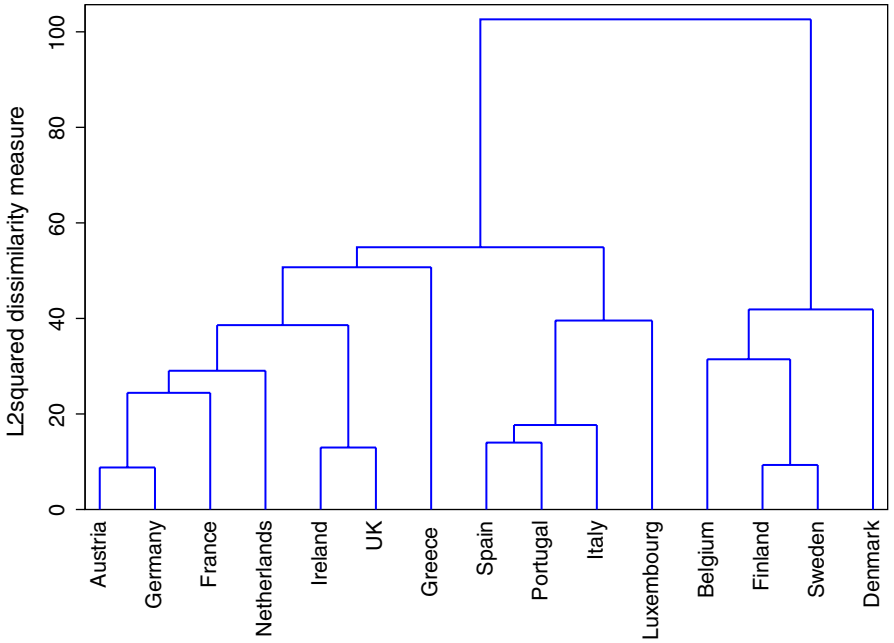

Fig. 5 Hierarchical cluster resulting dendrogram. *Source*: Own elaboration on EU-SILC data

Appendix

Cluster analysis

Within the paper I have taken as exogenous the welfare-regime definitions following the Esping-Andersen's (1990) contributions. Although results seem to suggest that this classification is fairly appropriate, I perform a hierarchical cluster analysis to check whether countries fit this external definition, based on the elasticities of the income components and on the level of income inequality.

In the hierarchical cluster the default distance of measure is the Euclidean distance; however, there are different ways to clustering the units of analysis. In this case, I use the most common criteria: the Ward's approach. It minimises the within-cluster variance and therefore defines the groups of clusters leading to the minimum increase in the total within-cluster variance once merging observations.

The result is a dendrogram, which continues to link countries until all are grouped together. This means that the closest countries are linked firstly and more distant lastly—the height of the link determines the distance between countries.

I report here the resulting cluster analysis based on the elasticities and income inequality. All measures have been standardized (Fig. 5).

As plotted, the social-democratic countries are the most distant ones, linked as last ones to the other groups of countries. The first linking are the continental countries on the left-corner, although Greece seems to be closest to the continental group, while Spain, Italy and Portugal cluster all together as the Mediterranean regime.

Table 2 Share of excluded single-student households attending tertiary education. *Source*: Own computation on EU-SILC data

Country	2008	2017
Austria	0.121	0.150
Belgium	0.043	0.017
Germany	0.232	0.187
Denmark	0.568	0.389
Greece	0.231	0.149
Spain	0.012	0.011
Finland	0.348	0.344
France	0.145	0.112
Ireland	0.021	0.012
Italy	0.032	0.023
Luxembourg	0.006	0.026
Netherlands	0.319	0.341
Portugal	0.004	0.020
Sweden	0.466	0.464
UK	0.067	0.030

Table 3 Elasticities of tertiary education with and without excluding single-student households. *Source*: Own computation on EU-SILC data

	2008		2017	
	Without exclusion	With exclusion	Without exclusion	With exclusion
Austria	0.013	0.015	0.002	0.006
Belgium	0.013	0.014	0.008	0.009
Germany	0.005	0.008	0.001	0.005
Denmark	− 0.012	0.002	− 0.029	− 0.010
Greece			− 0.006	− 0.005
Spain	0.002	0.002	− 0.004	− 0.003
Finland	0.004	0.010	− 0.007	0.003
France	0.006	0.008	0.002	0.005
Ireland	0.015	0.015	− 0.010	− 0.009
Italy	− 0.004	− 0.004	− 0.003	− 0.003
Luxembourg			0.028	0.028
Netherlands	0.001	0.006	− 0.018	− 0.004
Portugal	0.001	0.001	− 0.004	− 0.003
Sweden	− 0.003	0.005	0.000	0.006
UK	− 0.004	− 0.003	− 0.001	− 0.001

Belgium and Netherlands are the strongest exception of the traditional welfare regime definition: they are theoretically closer to the continental one, but here they are clustered with the social-democratic countries. Indeed, over-time the level of inequality of Belgium and Netherlands behaves more similarly to the Nordic

Table 4 Income-source elasticities in 2008

	Austria	Belgium	Germany	Denmark	Greece	Spain	Finland	France	Ireland	Italy	Luxembourg	Netherlands	Portugal	Sweden	UK
Income Source															
Employee wages	0.486	0.511	0.343	0.556	0.233	0.316	0.505	0.138	0.509	0.221	0.406	0.431	0.304	0.594	0.431
Self-employment	0.068	0.116	0.166	0.126	0.085	0.027	0.073	0.102	0.127	0.238	0.071	0.164	0.087	0.033	0.117
Capital	0.048	0.036	0.034	0.142	0.038	0.064	0.121	0.201	0.050	0.031	0.052	0.116	0.014	0.095	0.037
Private transfers	− 0.004	0.009	− 0.010	− 0.002	0.001	0.005	− 0.006	− 0.002	0.001	− 0.004	− 0.003	− 0.011	0.000	− 0.002	− 0.002
Cash transfers															
Unemployment	− 0.034	− 0.083	− 0.041	− 0.098	− 0.008	− 0.013	− 0.063	− 0.018	− 0.050	0.008	− 0.004	− 0.012	− 0.012	− 0.028	− 0.006
Old-age + survivors	− 0.122	− 0.243	− 0.165	− 0.271	− 0.057	− 0.113	− 0.198	− 0.107	− 0.084	− 0.127	− 0.129	− 0.117	− 0.056	− 0.261	− 0.135
Sick + disability	− 0.025	− 0.041	− 0.016	− 0.084	− 0.014	− 0.013	− 0.045	− 0.005	− 0.063	− 0.011	− 0.026	− 0.04	− 0.017	− 0.063	− 0.023
Education	− 0.001	0.000	− 0.004	− 0.031	0.001	0.000	− 0.006	− 0.002	0.000	0.001	− 0.002	− 0.012	0.002	− 0.024	− 0.002
Social exclusion	− 0.044	− 0.008	− 0.026	− 0.009	− 0.006	− 0.002	− 0.042	− 0.030	− 0.086	− 0.009	− 0.033	− 0.016	− 0.009	− 0.025	− 0.033
Family allowances	− 0.004	− 0.010	− 0.017		− 0.007	− 0.001	− 0.016	− 0.010	− 0.002	0.000	− 0.017	− 0.059	− 0.008	− 0.019	− 0.023
Housing	− 0.006	0.000	− 0.002	− 0.031	− 0.001	0.000	− 0.029	− 0.032	− 0.021	0.000	− 0.005	− 0.021	0.000	− 0.027	− 0.031
Taxes	− 0.233	− 0.183	− 0.153	− 0.242	− 0.177	− 0.132	− 0.207	− 0.110	− 0.220	− 0.204	− 0.164	− 0.297	− 0.174	− 0.194	− 0.194
In-kind benefits															
Health	− 0.096	− 0.086	− 0.086	− 0.085	− 0.078	− 0.071	− 0.080	− 0.085	− 0.085	− 0.083	− 0.103	− 0.106	− 0.070	− 0.073	− 0.072

Table 4 (continued)

	Austria	Belgium	Germany	Denmark	Greece	Spain	Finland	France	Ireland	Italy	Luxembourg	Netherlands	Portugal	Sweden	UK
Pre-primary	− 0.008	− 0.006	0.000	−0.001		− 0.01	− 0.001	− 0.01		− 0.006	− 0.007	− 0.005	− 0.002	− 0.003	− 0.004
Primary–Secondary	− 0.031	− 0.006	− 0.030	0.027		− 0.048	− 0.009	− 0.032	− 0.070	− 0.038	− 0.032	− 0.019	− 0.055	− 0.006	− 0.050
Tertiary	0.015	0.014	0.008	0.002		0.002	0.010	0.008	0.015	− 0.004		0.006	0.001	0.005	− 0.003
Social housing	− 0.010	− 0.019			− 0.001	− 0.011	− 0.006	− 0.005	− 0.023	− 0.011	− 0.004		− 0.004	− 0.002	− 0.008

Table 5 Income-source elasticities in 2017. *Source*: Own computation on EU-SILC data

	Austria	Belgium	Germany	Denmark	Greece	Spain	Finland	France	Ireland	Italy	Luxembourg	Netherlands	Portugal	Sweden	UK
Income Source															
Employee wages	0.458	0.715	0.429	0.648	0.239	0.376	0.601	0.272	0.587	0.250	0.187	0.550	0.376	0.498	0.347
Self-employment	0.093	0.054	0.138	0.109	0.127	0.031	0.039	0.085	0.175	0.152	0.034	0.149	0.069	0.019	0.076
Capital	0.054	0.042	0.032	0.074	0.029	0.041	0.131	0.138	0.034	0.031	0.056	0.038	0.033	0.160	0.028
Private transfers	− 0.007	0.000	− 0.014	− 0.003	− 0.017	− 0.001	− 0.004	− 0.007	0.000	0.000	0.005	− 0.012	− 0.003	− 0.002	0.000
Cash transfers															
Unemployment	− 0.046	− 0.051	− 0.018	− 0.110	− 0.006	− 0.029	− 0.079	− 0.022	− 0.063	− 0.002	− 0.016	− 0.012	− 0.006	− 0.021	0.007
Old-age + survivors	− 0.074	− 0.299	− 0.172	− 0.302	− 0.146	− 0.064	− 0.247	− 0.065	− 0.086	− 0.039	− 0.045	− 0.183	0.004	− 0.211	− 0.128
Sick + disability	− 0.023	− 0.058	− 0.021	− 0.046	− 0.012	− 0.015	− 0.036	− 0.010	− 0.058	− 0.010	− 0.023	− 0.040	− 0.024	− 0.044	− 0.028
Education	− 0.001	− 0.001	− 0.004	− 0.044	0.000	− 0.003	− 0.008	− 0.001	− 0.002	0.000	0.002	− 0.012	− 0.002	− 0.023	− 0.002
Social exclusion	− 0.033	− 0.009	− 0.018	− 0.012	− 0.020	− 0.001	− 0.028	− 0.031	− 0.069	− 0.010	− 0.033	− 0.014	− 0.009	− 0.029	− 0.048
Family allowances	− 0.013	− 0.024	− 0.005		− 0.010	− 0.009	− 0.015	− 0.025	− 0.001	− 0.001	− 0.005	− 0.065	− 0.010	− 0.024	− 0.017
Housing	− 0.004	0.000	− 0.020	− 0.022	0.000	− 0.003	− 0.040	− 0.034	− 0.016	0.000	− 0.001	− 0.026	0.000	− 0.022	− 0.036
Taxes	− 0.263	− 0.243	− 0.188	− 0.202	− 0.084	− 0.157	− 0.246	− 0.156	− 0.318	− 0.221	− 0.045	− 0.257	− 0.283	− 0.193	− 0.116
In-kind benefits															
Health	− 0.092	− 0.096	− 0.119	− 0.093	− 0.052	− 0.094	− 0.074	− 0.095	− 0.092	− 0.084	− 0.085	− 0.097	− 0.097	− 0.098	− 0.021

Table 5 (continued)

	Austria	Belgium	Germany	Denmark	Greece	Spain	Finland	France	Ireland	Italy	Luxembourg	Netherlands	Portugal	Sweden	UK
Pre-primary	− 0.008	− 0.006	0.000	0.007	− 0.004	− 0.008	0.000	− 0.008	0.000	− 0.007	− 0.003	− 0.002	− 0.002	− 0.001	0.000
Primary–Secondary	− 0.037	− 0.010	− 0.026	0.008	− 0.039	− 0.047	0.014	− 0.040	− 0.062	− 0.045	− 0.049	− 0.012	− 0.038	− 0.013	− 0.051
Tertiary	0.006	0.009	0.005	− 0.010	− 0.005	− 0.003	0.003	0.005	− 0.009	− 0.003	0.028	− 0.004	− 0.003	0.006	− 0.001
Social housing	− 0.011	− 0.021			− 0.002	− 0.015	− 0.010	− 0.004	− 0.019	− 0.011	− 0.006		− 0.005	− 0.003	− 0.007

Blank cells refer to income sources not available. Social housing is not available in Germany, Netherlands and Denmark

Table 6 Gini coefficient and income-source contribution changes between 2008 and 2017. *Source*: Own computation on EU-SILC data

	Austria	Belgium	Germany	Denmark	Greece	Spain	Finland	France	Ireland	Italy	Luxembourg	Netherlands	Portugal	Sweden	UK
Income Source															
Employee wages	− 0.011	0.024	0.014	0.036	− 0.025	0.014	− 0.007	0.030	0.040	0.021	− 0.045	0.013	− 0.012	− 0.007	− 0.033
Self-employment	0.005	− 0.021	− 0.017	− 0.003	− 0.003	− 0.001	− 0.015	− 0.005	0.012	− 0.024	− 0.008	0.000	− 0.025	− 0.005	− 0.009
Capital	0.001	− 0.002	− 0.005	− 0.015	− 0.006	− 0.010	0.000	− 0.027	− 0.007	0.001	0.003	− 0.025	0.008	0.022	− 0.005
Private transfers	− 0.001	− 0.001	− 0.001	0.000	− 0.003	− 0.001	0.001	− 0.001	0.000	0.001	0.002	0.000	− 0.001	0.000	0.001
Unemployment	− 0.002	0.005	0.004	− 0.003	0.000	− 0.004	− 0.002	− 0.001	− 0.002	0.000	− 0.002	0.001	0.002	0.000	0.005
Old-age + survivors	0.015	− 0.002	− 0.005	− 0.001	0.005	0.029	− 0.001	0.015	0.004	0.033	0.032	− 0.010	0.028	0.009	0.007
Sick + disability	0.000	− 0.002	− 0.001	0.001	0.001	0.000	0.001	− 0.003	0.000	0.001	0.001	− 0.001	− 0.002	− 0.001	− 0.001
Education	0.000	0.000	0.000	− 0.002	0.000	− 0.001	0.000	0.000	− 0.001	0.000	0.002	0.000	− 0.002	0.000	− 0.001
Social exclusion	0.001	− 0.002	0.003	0.000	− 0.001	0.000	0.002	− 0.001	0.001	− 0.001	− 0.002	0.001	0.000	− 0.002	− 0.003
Family allowances	− 0.001	− 0.002	0.002		− 0.001	− 0.001	0.000	− 0.002	0.000	0.000	0.002	− 0.002	0.000	− 0.001	0.002
Housing	0.000	0.000	− 0.003	0.001	0.000	0.000	− 0.001	0.000	0.001	0.000	0.001	− 0.001	0.000	0.001	− 0.001
Taxes	− 0.005	− 0.006	− 0.007	0.007	0.002	− 0.010	− 0.001	− 0.013	− 0.039	− 0.014	0.032	0.023	− 0.028	− 0.001	0.040
Health	− 0.001	− 0.001	0.000	− 0.002	0.001	− 0.003	0.000	0.000	0.000	0.000	− 0.001	− 0.001	− 0.007	0.001	0.002
Pre-primary	0.001	0.000	0.000	0.005	0.003	0.000	0.000	0.001	0.001	0.000	− 0.001	0.000	0.000	0.002	− 0.001

Table 6 (continued)

	Austria	Belgium	Germany	Denmark	Greece	Spain	Finland	France	Ireland	Italy	Luxembourg	Netherlands	Portugal	Sweden	UK
Primary–Secondary	− 0.002	− 0.003	0.001	− 0.005	0.009	0.000	0.013	− 0.003	− 0.002	− 0.002	− 0.005	0.008	0.009	− 0.001	0.002
Tertiary	− 0.001	− 0.002	− 0.002	− 0.002	0.000	− 0.002	− 0.002	− 0.001	− 0.007	0.000	0.017	− 0.003	− 0.001	0.000	0.000
Social housing	0.000	0.000			0.000	− 0.001	− 0.001	− 0.001	0.002	− 0.002	0.000	0.000	0.000	0.000	0.000
Gini	− 0.001	− 0.016	− 0.018	0.016	− 0.017	0.008	− 0.013	− 0.012	0.003	0.013	0.027	0.002	− 0.032	0.018	0.006

Table 7 Income-source elasticities by cash-transfers entitlements: 2017. *Source*: Own computation on EU-SILC data

Income source	Austria			Belgium			Germany			Denmark			Greece		
	S	R	G	S	R	G	S	R	G	S	R	G	S	R	G
Contributory means	0.022	0.259	0.968	0.000	− 0.152	0.999	0.020	− 0.219	0.942	0.024	− 0.217	0.927	–	–	–
Contributory non-mt	0.186	0.143	0.792	0.234	− 0.278	0.621	0.123	− 0.157	0.821	0.086	0.036	0.858	0.349	0.238	0.692
Non-contributo-ryMeans	0.014	− 0.479	0.933	0.009	− 0.581	0.963	0.022	− 0.328	0.908	0.131	− 0.611	0.708	–	–	–
Non-contributory Non-mt	0.058	− 0.019	0.680	0.005	0.797	0.998	0.067	0.342	0.797	0.033	− 0.099	0.788	0.000	0.435	0.999
Taxes	− 0.271	− 0.853	− 0.523	− 0.251	− 0.804	− 0.520	− 0.313	− 0.778	− 0.493	− 0.388	− 0.913	− 0.389	− 0.411	− 0.860	− 0.406
Health	0.105	0.206	0.128	0.108	0.153	0.149	0.138	0.269	0.118	0.106	0.218	0.128	0.075	0.555	0.160
Pre-primary	0.009	0.025	0.933	0.013	0.128	0.900	0.000	0.324	0.998	0.017	0.355	0.914	0.015	0.190	0.920
Primary-secondary	0.059	0.115	0.753	0.071	0.253	0.720	0.046	0.140	0.764	0.068	0.357	0.727	0.072	0.114	0.736
Tertiary	0.019	0.319	0.925	0.021	0.336	0.902	0.015	0.340	0.936	0.015	0.075	0.962	0.007	0.075	0.927
Housing	0.009	− 0.062	0.917	0.011	− 0.218	0.931	–	–	–	–	–	–	0.012	0.235	0.961
	Spain			Finland			France			Ireland			Italy		
	S	R	G	S	R	G	S	R	G	S	R	G	S	R	G
Contributory means	0.009	− 0.323	0.939	–	–	–	–	–	–	0.005	− 0.200	0.958	0.007	− 0.062	0.836
Contributory non-mt	0.200	0.276	0.750	0.219	− 0.078	0.719	0.223	0.197	0.746	0.111	0.108	0.831	0.274	0.331	0.732
Non-contributory means	0.023	− 0.407	0.874	0.048	− 0.625	0.809	0.034	− 0.519	0.754	0.068	− 0.516	0.764	0.005	− 0.426	0.968
Non-contributory non-mt	0.000	0.373	0.992	0.030	0.053	0.718	0.018	0.043	0.765	0.029	− 0.097	0.489	0.016	0.060	0.938
Taxes	− 0.153	− 0.898	− 0.627	− 0.275	− 0.907	− 0.467	− 0.203	− 0.856	− 0.481	− 0.198	− 0.882	− 0.708	− 0.270	− 0.900	− 0.544
Health	0.096	0.053	0.117	0.090	0.287	0.139	0.109	0.215	0.136	0.106	0.212	0.145	0.095	0.248	0.124
Pre-primary	0.013	0.122	0.901	0.004	0.223	0.964	0.011	0.064	0.906	0.005	0.238	0.953	0.012	0.114	0.921
Primary-secondary	0.050	0.024	0.740	0.068	0.357	0.758	0.060	0.109	0.712	0.069	0.038	0.619	0.056	0.070	0.751

Table 7 (continued)

	Spain			Finland			France			Ireland			Italy		
	S	R	G	S	R	G	S	R	G	S	R	G	S	R	G
Tertiary	0.014	0.232	0.903	0.011	0.289	0.968	0.015	0.331	0.927	0.017	0.120	0.891	0.010	0.206	0.929
Housing	0.011	− 0.105	0.943	0.005	− 0.215	0.971	0.006	0.071	0.957	0.018	− 0.026	0.903	0.011	0.016	0.936
	Luxembourg			Netherlands			Portugal			Sweden			UK		
	S	R	G	S	R	G	S	R	G	S	R	G	S	R	G
Contributory means	–	–	–	–	–	–	0.002	− 0.405	0.991	–	–	–	–	–	–
Contributory non-mt	0.202	0.216	0.798	0.146	0.152	0.816	0.262	0.337	0.767	0.184	− 0.117	0.759	0.140	0.051	0.833
Non-contributory means	0.008	0.065	0.872	0.030	− 0.664	0.894	0.011	− 0.369	0.868	0.011	− 0.660	0.924	0.049	−0.359	0.831
Non-contributory non-mt	0.054	0.011	0.680	0.085	− 0.338	0.740	0.003	− 0.060	0.968	0.053	− 0.186	0.709	0.039	0.053	0.735
Taxes	− 0.161	− 0.545	− 0.591	− 0.325	− 0.877	− 0.472	− 0.251	− 0.930	− 0.627	− 0.281	− 0.913	− 0.435	− 0.205	− 0.816	− 0.562
Health	0.093	0.149	0.129	0.111	0.183	0.153	0.099	0.047	0.110	0.122	0.321	0.143	0.034	0.161	0.706
Pre-primary	0.005	0.105	0.971	0.006	0.154	0.925	0.008	0.224	0.938	0.012	0.227	0.939	0.002	0.254	0.981
Primary-secondary	0.071	0.112	0.714	0.059	0.247	0.745	0.078	0.201	0.710	0.077	0.268	0.732	0.072	0.121	0.704
Tertiary	0.041	0.470	0.900	0.012	0.161	0.934	0.014	0.228	0.915	0.008	0.416	0.972	0.002	0.125	0.977
Housing	0.006	0.001	0.970	–	–	–	0.004	− 0.060	0.957	0.001	− 0.249	0.994	0.004	− 0.242	0.933

"mt" stands for means-tested

countries. However, it is more likely that it is the increasing level of inequality in the Nordic countries that closes the distance with Belgium and Netherlands, rather than the other way round (Tables 2, 3).

Income-source decomposition tables

See Tables 4, 5, 6 and 7.

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References

Aaberge, R., Bhuller, M., Langørgen, A., & Mogstad, M. (2010). The distributional impact of public services when needs differ. *Journal of Public Economics, 94*, 549–562.

Aaberge, R., & Langørgen, A. (2006). 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.

Aaberge, R., Langørgen, A., & Lindgren, P. (2013). The distributional impact of public services in European countries. *Journal of Public Economics*, *180*.

Aaberge, R., Langørgen, A., & Lindgren, P. (2017). The distributional impact of public services in European countries. In A. B. Atkinson, A.-C. Guio, & E. Marlier (Eds.), *Monitoring Social Europe, Chapter 8* (pp. 159–174). Publications of the European Union.

Advani, A., & Summers, A. (2020). Capital gains and UK inequality. WID working paper n. 2020/09.

Baird, S., McKenzie, D., & Özler, B. (2018). The effects of cash transfers on adult labor market outcomes. *IZA Journal of Development and Migration, 8*, 22.

Becker, G. (1965). A theory of the allocation of time. *The Economic Journal, 75*(299), 493–517.

Binglay, P., & Walker, I. (2013). The labour supply effects of a partial cash-out of in-kind transfers to single mothers. *IZA Journal of Labour Economics, 2*, 1.

Bourguignon, F. (2017). World changes in inequality: An overview of facts, causes, consequences and policies. *Bank for International Settlement Working Papers*, (654).

Callan, T., Smeeding, T., & Tsakloglou, P. (2008). Short-run distributional effects of public education transfers to tertiary education students in seven European countries. *Education Economics, 16*(3), 275–288.

Caminada, K., Wang, J., Goudswaard, K., & Wang, C. (2017). Income inequality and fiscal redistribution in 47 LIS-countries, 1967–2014. *LIS working papers 724*, LIS Cross-National Data Center in Luxembourg.

Caminada, K., Wang, J., Goudswaard, K., & Wang, C. (2019). Has the redistributive effect of social transfers and taxes changed over time across countries? *International Social Security Review, 72*, 3–31.

Canberra Group. (2011). *Handbook on Household Income Statistics*. United Nations.

Esping-Andersen, G. (1990). *The three worlds of welfare capitalism*. Princeton University Press.

Esping-Andersen, G., & Myles, J. (2011). The welfare state and redistribution. *The Oxford Handbook of Economic Inequality*.

Fei, J. C. H., Ranis, G., & Kuo, S. W. Y. (1978). Growth and the family distribution of income by factor components. *The Quarterly Journal of Economics, 92*(1), 17–53.

Ferrera, M. (1996). The southern model of welfare in social Europe. *Journal of European Social Policy, 6*(1), 17–37.

Fuest, C., Niehues, J., & Peichl, A. (2010). The redistributive effects of tax benefit systems in the enlarged EU. *Public Finance Review, 38*(4), 473–500.

Garfinkel, I., Rainwater, L., & Smeeding, T. (2005). Welfare state expenditures and the redistribution of well-being: Children, elders, and others in comparative perspective. *Luxembourg Income Study, Working paper n. 387.*

Garfinkel, I., Rainwater, L., & Smeeding, T. (2006). 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*(4), 897–919.

Gustafsson, B., & Johansson, M. (1999). In search of smoking guns: What makes income inequality vary over time in different countries? *American Sociological Review, 64*, 585–605.

Jännti, M. (1997). Inequality in five countries in the 1980s: The role of demographic shifts, markets and government policies. *Economica, 64*(255), 415–440.

Jurkatis, S., & Strehl, W. (2014). Gini decompositions and Gini elasticities: On measuring the importance of income sources and population subgroups for income inequality. *Discussion Papers 2014/22, Free University Berlin,* School of Business & Economics.

Kakwani, N. C. (1977). Measurement of tax progressivity: An international comparison. *The Economic Journal, 87*(345), 71–80.

Kautto, M. (2002). Investing in services in west European welfare state. *Journal of European Social Policy, 12*, 53–65.

Korpi, W. (2000). Faces of inequality: Gender, class, and patterns of inequalities in different types of welfare states. *Social Politics, 7*(2), 127–191.

Korpi, W., & Palme, J. (1998). The paradox of redistribution and strategies of equality: Welfare state institutions, inequality, and poverty in western countries. *American Sociological Review, 63*(5), 661–687.

Lemieux, T. (2006). Increasing residual wage inequality: Composition effects, noisy data, or rising demand for skill? *The American Economic Review, 96*, 461–498.

Leonesio, M. (1988). In-kind transfers and work incentives. *Journal of Labor Economics, 4*, 515–529.

Lerman, R. I., & Yitzhaki, S. (1985). Income inequality effects by income source: A new approach and application to the United States. *The Review of Economics and Statistics, 67*(1), 151–156.

Lustig, N. (2018). *Commitment to equity handbook: Estimating the impact of fiscal policy on inequality and poverty*. Brookings Institution Press.

Marical, F., Mira D'Ercole, M., Vaalavuo, M., & Verbist, G. (2006). Publicly-provided goods and the distribution of resources. *OECD economic studies* n. 44.

Milanovic, B. (2015). *Global inequality: A new approach for the age of globalizations*. Harvard University Press.

Moffitt, R. A. (2002). Welfare programs and labor supply. In A. J. Auerbach & M. Feldstein (Eds.), *Handbook of public economics, edition 1, volume 4, chapter 34* (pp. 2393–2430). Elsevier.

Morduch, J., & Sicular, T. (2002). Rethinking inequality decomposition, with evidence from rural China. *The Economic Journal, 112*(476), 93–106.

Murray, M. (1980). A reinterpretation of the traditional income-leisure model, with application to in-kind subsidy programs. *Journal of Public Economics, 14*, 69–81.

OECD. (2008). *Growing unequal? Income distribution in OECD countries*. OECD Publishing.

OECD. (2011). *Divided we stand: Why inequality keeps rising*. OECD Publishing.

Paul, S. (2004). Income sources effects on inequality. *Journal and Development Economics, 73*(1), 435–451.

Paulus, A., Sutherland, H., & Tsakloglou, P. (2010). The distributional impact of in-kind public benefits in European countries. *Journal of Policy Analysis and Management, 29*(2), 243–266.

Podder, N., & Chatterjee, S. (2002). Sharing the national cake in post reform New Zealand: Income inequality trends in terms of income sources. *Journal of Public Economics, 86*(1), 1–27.

Pyatt, G., Chen, C. N., & Fei, J. (1980). The distribution of income by factor components. *The Quarterly Journal of Economics, 95*(3), 451–473.

Raitano, M. (2016). Income inequality in Europe since the crisis. *Intereconomics, 51*(2), 67–72.

Rani, U., & Furrer, M. (2016). Decomposing income inequality into factor income components. *ILO Research Paper* no. 15.

Reynolds, M., & Smolensky, E. (1977). *Public expenditures, taxes and the distribution of income: The United States, 1950, 1961, 1970*. Academic Press.

Rodrik, D. (1998). Why do more open economies have bigger governments? *Journal of Political Economy, 106*(6), 997–1032.

Shorrocks, A. F. (1982). Inequality decomposition by factor components. *Econometrica: Econometric Society, 50*(1), 193–211.

Smeeding, T., et al. (1993). Poverty, inequality, and family living standards impacts across seven nations: The effect of noncash subsidies for health, education and housing. *The Review of Income and Wealth, 39*(3), 229–256.

Törmalehto, V.-M., & Sauli, H. (2013). The distributional impact of imputed rent in EU-SILC 2007–2010. *Eurostat methodologies and Working papers.*

Vaalavuo, M. (2011). Towards an improvement measure of income inequality: The impact of public services on income distribution. European University Institute.

Vaalavuo, M. (2020). Use of public health and social care services among the elderly in Finland: An under-examined mechanism of redistribution. *Journal of European Social Policy, 0*(2), 176–189.

Verbist, G., Förster, M., & Vaalavuo, M. (2019). The impact of publicly provided services on the distribution of resources. Review of new results and methods. *OECD Social, Employment and Migration Working Papers*.