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Developing distributional national accounts: first attempt to estimate a joint distribution for income and wealth for the euro area

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Abstract

In recent years, projects have sought to embed distributional aspects within national accounts, with household distributional information set to feature in the next System of National Accounts. There is growing emphasis on capturing all material dimensions of welfare—income, consumption, and wealth—at both macro and micro levels within a unified framework. This paper develops distributional multidimensional accounts for income and wealth, building on the Distributional Wealth Accounts (DWA), an experimental quarterly dataset first released in January 2024 by the European System of Central Banks. The DWA integrates the Household Finance and Consumption Survey (HFCS) with macro statistics on household financial and non-financial balance sheets. We use the HFCS's micro population to estimate consistent joint income transactions for these households, enabling analysis of the joint distribution of income and wealth, including wealth by income decile. This is the first multi-country approach to cover complete income accounts to disposable income and full balance sheets on a shared household sample.

JEL-codes: D30, D31, E01 and E21

Key words: income distribution, national accounts, distributional national accounts, income, households

Non-technical summary

Distributional accounts of household income and wealth have been a strong focus of new developments in economic statistics in the past ten years. The first G20 Data Gaps initiative, launched in 2009, made household distributional information a priority, and this has carried forward to subsequent editions. Further, the next update to the System of National Accounts is widely expected to include guidance on statistics about the distribution of household income, consumption, and wealth.

This paper presents data on the joint distribution of income and wealth in the euro area countries, conceptually and methodologically consistent with the national accounts. In particular, the distribution of income is directly linked to and comparable with the Distributional Wealth Accounts (DWA), recently published on the experimental basis and further developed by the European System of Central Banks Expert Group on Distributional Financial Accounts. Like the DWA, the data presented here use the Household Finance and Consumption Survey (HFCS) as the main primary source of distributional information on wealth and income. This allows us (1.) to propose a framework to estimate income accounts consistent with the distributional balance sheets; and (2.) to attempt to integrate income flows from financial investments and other household assets to analyse the plausibility of the estimation methods.

Other initiatives, such as the OECD/Eurostat distributional national accounts or the World Inequality Database (WID), have estimated distributional income accounts in Europe. The WID measures differ from those in this article in that they map all the aggregate national income to household groups. Here, we focus only on the income attributed to the household sector in the national accounts. The OECD/Eurostat approach, in turn, is conceptually similar to this paper, but it focuses on mapping the distribution of household income but does not include the aspect of having consistent income distribution with the wealth accounts.. Here, instead, we focus on the consistency of the income accounts with the financial accounts side, paying closer attention to financial income and the joint distribution of income with wealth.

First, we provide a linkage between HFCS and national accounts income items. This linkage covers all the components of the disposable income. The HFCS covers several items that correspond directly with the national accounts, but there are also several items that do not have a direct correspondence. For these items, an indirect correspondence, which proxies the true distribution as closely as possible, is used. After this, the differences between the direct measures from the HFCS and national accounts are

analysed. The coverage gap (mismatch between aggregate figures) is corrected following a procedure analogous to the DWA, namely to account for differences in the target population of the HFCS and for known issues that affect sampling of the wealthiest households.

Finally, with our novel dataset, we explore the distributions of various subitems of household income and wealth and examine relevant measures that can be derived from them. We focus particularly on debt-to-income ratios and gross rates of return on financial investments, which are two important examples where the balance sheet and income data are combined. Debt-to-income ratios are rather flat across all income deciles (except for the first income decile), but more complex patterns appear in the wealth deciles, showing higher indebtedness among the middle- and top-income decile. In the case of gross rates of return, a strong increasing pattern may be observed in the distribution per income, whereas a concave pattern can be identified in the distribution of returns per net wealth. Finally, we compare our results to those compiled in the context of Eurostat. In general, the distribution by quintile matches closely for most items, including the shares held by the top quintile. The top shares are slightly higher in the DWA case, suggesting that the method used to impute high income to "wealth rich" households does yield slightly different results from a method that supplements the survey data based on a Pareto tail estimation on the income distribution, as in the data compiled by Eurostat. Consequently, this leads to smaller shares in the lower quintiles.

1. Introduction

This paper presents data on the joint distribution of income and wealth in the euro area countries, conceptually and methodologically consistent with the national accounts.[2] In particular, we provide a distribution of income that is directly linked to and comparable with the Distributional Wealth Accounts (DWA), recently developed in the context of the European System of Central Banks (ESCB) Expert Group on Distributional Financial Accounts (EG DFA). Like the DWA, the data presented here use the Household Finance and Consumption Survey (HFCS) as the primary source of distributional information on wealth and income. This allows us (1.) to propose a framework to estimate income accounts consistent with the distributional balance sheets; and (2.) to attempt to integrate income flows from financial investments and other household assets to analyse the plausibility of the estimation methods.

Distributional accounts of household income and wealth have been a strong focus of new developments in economic statistics in the past fifteen years. The first G20 Data Gaps initiative, launched in 2009, made household distributional information a priority, and this has carried forward to subsequent editions.[3] Further, the next update to the System of National Accounts is widely expected to include guidance on statistics about the distribution of household income, consumption, and wealth.[4]

Distributional national accounts have received much political attention. Following the influential report by Joseph E. Stiglitz, Amartya Sen, and Jean-Paul Fitoussi (2009), the European Commission launched the "GDP and Beyond" initiative, which included several motions to improve the analysis of social progress, including distributional national accounts. As a result, Eurostat and the OECD have developed distributional accounts covering income, consumption, and saving.[5] As in the project presented here, the approach is to break down national accounts aggregates and reveal their underlying distributions.

An alternative effort to develop distributional national accounts has been produced by the World Inequality Database (Piketty, Saez, and Zucman, 2018; Blanchet and Martinez-Toledano, 2023). Their

[2] There are several approaches which combine consistent income and wealth measures, for instance: Fisher et. al, 2022. Jäntti et. al. 2015. Kuypers et. al. 2021. Waltl 2022. Wronski 2021. The difference in the approach presented in this paper that we combine joint distribution of household income and wealth which is consistent with the corresponding national aggregates.
[3] Recommendations 8 and 9 covers household distributional information. See: IMF, G20 DGI Recommendations and Data. IMF 2022.
[4] See: United Nations 2021.
[5] See: Coli, Istatkov, Jayyousi, Oehler and Tsigas 2022.

approach differs from that of the OECD/Eurostat project[6]: they distribute the entire gross national income, rather than the income of the household sector, over the population.[7] Further, in this work the focus is mostly on the income, and particularly property income, earned by the wealthiest households ("top 1%"), while other distributional accounts aim to analyse the overall distribution. Additionally, they have also extended their approach to the total wealth distribution estimates. Waltl (2022) has further worked on this approach and linked this Piketty et. al. approach of total economy income with the household balance sheets.

Finally, in December 2015, in the context of the ESCB, the Expert Group on Linking Micro and Macro data for Household Sector (EG LMM) was established. Its mandate was to investigate the linkage between the Eurosystem HFCS – a household survey covering households' asset and liabilities, launched in 2011 – and the aggregate Financial Accounts, with a view to building distributional accounts of household wealth in the euro area.[8] This group did not focus only on the linkage as such, but also on the main differences between the two datasets and the reasons for gaps between the two. As with income accounts, close attention was paid to known difficulties in adequately capturing the wealthiest households in the HFCS. As the wealth distribution in most countries is highly skewed, with a very long right-tail, undersampling these households could affect distributional results considerably, and their consistency with the aggregate wealth accounts.[9] The EG LMM delivered its final report in 2019 and the EG DFA was established to continue this work.[10]

While development of distributional income accounts has been performed in the OECD/Eurostat project as described, they cannot be linked directly with the distributional household balance sheets from the DWA, as they rely on different underlying data sources. This paper fills this gap by providing distributional accounts of household income and wealth in the euro area, consistent with national accounts for the household sector on both dimensions (in the latter case, the Financial Accounts), relying on data from the HFCS. The focus is on the actual household income accounts and balance sheets. None of the other projects in this field have provided such results.

[6] See about the OECD approach: Zwijnenburg, Bournot and Giovannelli 2017. Zwijnenburg, Bournot, Grahn and Guidetti 2021.
[7] More about the differences of these two approaches in: Zwijnenburg 2019.
[8] Some papers concerning the data linking were written before the EG LMM was established, and they also provided a starting point for this work (Kavonius and Törmälehto 2010, Honkkila and Kavonius 2013. Kavonius and Honkkila 2013.).
[9] For example, the missing rich was applied in distributional wealth context in: Chakraborty et. al. 2016 which is available updated in: Chakraborty et. al. 2019. The methodology was further developed for instance in: Chakraborty and Waltl 2018. Cantarella et. al. 2023.
[10] The final report is available: ECB 2020.

Our paper provides an initial exploration of these data, both in the cross-section dimension – showing the full joint distribution of income and wealth, and the distribution of various specific income components looking at the development of these distributions over the decade of the 2010s.

This paper is organised as follows: first, we discuss the data and methodology, i.e. we provide a short description of the non-financial accounts and HFCS and how these data are connected. We also discuss the linkage of the balance sheet and income items and how the DWA are estimated. After this discussion, we focus on how consistent income and wealth accounts are estimated, and then we discuss the results of this paper and how they compare with the results of the OECD. Finally, we conclude.

2. Data and methodology

2.1. Data HFCS and QSA

The HFCS has been set up as a decentralised, harmonised multi-national survey to collect micro data on household finances in the euro area as well as some EU countries outside the euro area. The survey focuses on household finances, including detailed information on assets and liabilities. The survey also covers income, several variables on consumption, demographics, inheritances/gifts, and employment. Each euro area country (National Central Bank together with a survey agency or National Statistical Institute) is expected to conduct its own survey.

The survey output is harmonised across involved EU countries, having a common set of target variables rather than questions, summarised in a "blueprint questionnaire". In addition, to maximise data comparability, survey methodologies across HFCS countries have been a priori harmonised to a large degree by introducing common recommendations on issues like survey mode, sampling, weighting, imputation, and variance estimation. This means that the output variables are comparable but there can be large differences in reliability of the results. The underlying reason is that the surveys have several methodological differences. For instance, several surveys are based on the CAPI (Computer Assisted Personal Interviews). In Finland, balance sheet variables are collected from registers or via register-based estimations for the sample of the EU-SILC survey. In the Netherlands the data are collected by using a web-survey. This has clearly impact on the quality of the results as the register data do not include non-response errors and the response rates and the quality of results in the web-surveys is typically lower than in the regular surveys. Additionally, there are much variation for instance in the

over-sampling strategies. In some countries over-sampling strategy is based on the income variables as in some other countries the used indicator is for instance postal code or there is no over-sampling strategy at all. The survey is triannual and, so far, there have been four survey waves on which the data have been released: in April 2013, December 2016, March 2020 and July 2023. Practically, the model presented in this paper is estimated on these waves.[11]

We use a combination of macroeconomic data from various sources, which together provide accounts of both the financial and non-financial assets of the household sector. This includes various aspects of households' financial balance sheets, covering their evolution over time (i.e. revaluations (price changes) and other changes in volume) at a quarterly frequency. Finally, we also use data on income from annual accounts of non-financial transactions, as they provide additional breakdowns compared to the quarterly accounts. For the purposes of this paper (in line with ECB practice), we label this integrated accounting systems and datasets Quarterly Sector Accounts (QSA) and Annual Sector Accounts (ASA).

The accounts are integrated, encompassing the transaction accounts and the balance sheet, and including other changes. The accounts for the euro area are compiled by the ECB according to the European System of Accounts (ESA2010), which is the European application of the System of National Accounts 2008 (SNA2008). The country-level non-financial data are typically compiled by the National Statistical Offices and collected by Eurostat. The corresponding European aggregates are compiled by Eurostat. Correspondingly, the country-level financial accounts data are typically compiled by the National Central Banks, or in some cases statistical offices. The QSA and ASA both start in 1999, although for some countries detailed income breakdowns are available only beginning from 2012.

The national accounts system is closed and the whole system covering the income accounts and balance sheet should be consistent. In the distributional accounts, this materialises in the following way; the property income flows should be consistent with the underlying assets, i.e. the income flows divided by the underlying balance sheets should correspond to the rates of returns from the other data sources. In the case of the distributional accounts, this means that the rates of the returns needs to be plausible also at the detailed breakdown level. This consistency in a sense can also indirectly be derived from the vertical consistency, i.e. the requirement that the net lending/borrowings calculated from financial and

[11] Further information on the methodological issues: ECB 2020b. ECB 2023. ECB 2023b.

non-financial accounts are equal. If the stock-flow consistency[12] holds and the accounts are horizontally consistent, then implicit rates of returns are also most likely plausible.[13]

In the next subsection, we explain the method we propose to link the microeconomic information on distributions from the HFCS with the macroeconomic aggregates obtained from the annual and quarterly sector accounts. We rely heavily on work performed over the past years, while augmenting it to incorporate all significant components of household income.

2.2. Update of the linkage

In the context of the work of the Expert Group on the Distributional Financial Accounts (EG DFA), the DWA have already been created and also applied in this paper. The corresponding estimation method and, in particular, the applied linkage is described in ECB (2020). The EG DFA work does not cover the income linkage, but the income linkage between HFCS and National Accounts is presented in Honkkila and Kavonius (2013), with respect to income instruments that have a close correspondence from a methodological perspective. In this paper, we also provide linkage for income instruments without a direct correspondence, benefiting from the distributional information available in the DWA as well as from additional estimation models.

Table 1 shows a typology between the HFCS and national/sector accounts for all of the main components of disposable income, including instruments for which a direct correspondence between the two data sources is available – as presented in Honkkila and Kavonius (2013) – and also the instruments which do not have a direct correspondence in two statistics (marked with grey in the table). It should be emphasised that the HFCS includes only a limited number of the income items and therefore, there is not often a direct correspondence between the income items. Additionally, as the perspective of national accounts is production process and the perspective of the HFCS is households, some concepts are simply defined differently in the two data sources. As the paper aims to the joint distribution of income and wealth, using different data source is not an option. The household population needs to be the same through the asset types. In the future work, the enrichment of the HFCS by the additional sources is considered to be the way forward.

[12] Stock in period t is equal to stock in period t-1 plus financial transactions in the given period plus the revaluations and other changes.
[13] This aspect of the income flows and balance sheets have been analysed in: Kavonius and Honkkila 2016. Honkkila et. al. 2018.

Table 1. Typology between HFCS and national/sector accounts, on the left column shows percentage (%) share of disposable income in the euro area

% of disposable income	National accounts		HFCS
	Generation of income account		
10.1	B2G	Operating surplus	Imputed based on value and size of the household main residence.
13.6	B3G	Mixed income	Self-employment income, Rental income from real estate property
	Allocation of primary income account		
79.1	D11	Wages and salaries *(resource)*	Employee income
	D12	Employers' social contributions *(resource)*	Not relevant, as it does not have an impact on disposable income.
0.7	D41G,	Interest (without FISIM); Dividends and Withdrawals from income of quasi-corporations *(resource)*	Income from financial investments, Income from private business other than self-employment
7.7	D421, D422		
2.0	D41G	Interest *(use)*	The distribution of outstanding amount of mortgages and private loans is a proxy.
0.0	D43	Reinvested earnings on foreign direct investment *(resource)*	Not relevant, as it does not have an impact on disposable income[1].
2.6	D441	Investment income attributable to insurance policy holders *(resource)*	The distribution of outstanding amount of life insurance is a proxy.
	D442	Investment income payable on pension entitlements *(resource)*	The distribution of outstanding amount of voluntary pension insurance is a proxy. However, this does not have impact on disposable income (cancels out).
	D443	Investment income attributable to collective investment *(resource)*	The distribution of outstanding amount of mutual funds is a proxy.
0.1	D45	Rent *(use/resource)*	The distribution of self-employment income is a proxy.
	Secondary distribution of income account		
16.8	D5	Taxes on income and wealth *(use)*	Imputed based on employee income, income from financial investments and income from private business other than self-employment.
29.3	D611	Employers' actual social contributions *(use)*	Not relevant, as it does not have an impact on disposable income.
	D612	Employers' imputed social contributions *(use)*	Not relevant, as it does not have an impact on disposable income.
	D613	Households' actual social contributions *(use)*	The distribution of employee income is a proxy.
	D614	Households' social contributions supplements	A small item and impact zero on disposble income
31.0	D62	Social benefits other than social transfers in kind *(resource)*	Income from occupational and private pensions, Income from public pensions, Income from unemployment benefits, Income from regular social transfers
2.1	D71	Non-life insurance premiums *(use)*	The distribution of household main residence is a proxy for the net non-life insurance premiums/claims. D71 is almost equal to D72 which means that the impact on disposable income is marginal.
2.2	D72	Non-life insurance claims *(resource)*	
4.8	D75	Miscellaneous current transfers *(resource)*	Income from private transfers
3.3	D75	Miscellaneous current transfers *(use)*	Gives alimony and charity payments

Note: The items without direct linkage are marked with grey.
[1] Reinvested earnings of households are zero for most of the euro area countries, with the exception of one country where small values are observed.

Items with a direct correspondence

As presented in Table 1, direct linkages between sector accounts and HFCS can be established for some income instruments, but even for those instruments the linkage may not be fully one to one compatible, therefore some further information needs to be considered when applying this mapping.

Mixed income / entrepreneurial income. In the context of national accounts, mixed income refers to the income of sole-proprietorships and partnerships, which are classified to the household sector. In the case of mixed income, compensation from the invested income cannot be distinguished from the labour input. When the net property income flows to sole proprietorships and partnerships are added to mixed income, the result is entrepreneurial income. The self-employment income (and income from property rental) in the HFCS would best correspond with the entrepreneurial income of the household sector but these data are available for only a few EU countries. Therefore, we keep this aggregation in our linkage exercise. We link the national accounts mixed income to the sum of the HFCS variables that refer to income from self-employment and income from property rental.

Wages and salaries. The linkage between HFCS and Sector Accounts for wages and salaries is direct, but it needs to be noted that the sector accounts concept does not include employee stock options[14], which are covered by the HFCS. Additionally, wages and salaries in kind are included in the sector accounts, which are not part of the HFCS.

Income from financial investments i.e. interest (without FISIM[15]), dividends, and withdrawals from income of quasi-corporations. It should be noted that the sector accounts concept of income from financial investments also covers interest and dividends received/paid by unincorporated enterprises. Additionally, in the standard sector accounts, the interest flows exclude FISIM.

Social benefits other than social transfers in kind. Social benefits other than social transfers in kind map with HFCS at the total level; however theoretically, social benefits are available in sector accounts broken down by social security benefits in cash, private funded social benefits, unfunded employee social benefits, and social assistance benefits in cash. However, this level of detail is not available in international data sources and therefore also the linkage is provided only at the total level.

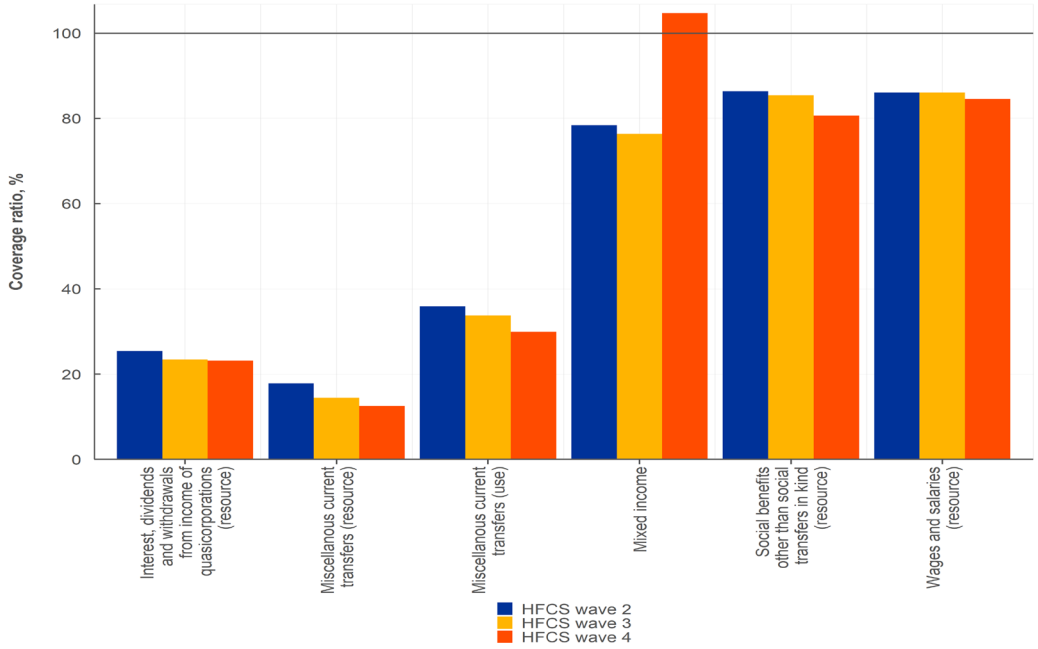
[14] Kavonius 2006, 585-597.
[15] FISIM stands for Financial Intermediation Services Indirectly Measured. It is an estimate of the value of the services provided by financial intermediaries, such as banks, for which no explicit charges are made, and are covered in the interest generated by certain financial assets such as deposits and loans.

Miscellaneous current transfers (resource). This sector accounts item covers transfers from sectors other than the government. However, the transfers between different households are practically consolidated in the Sector Accounts and are therefore not visible in that dataset. However, the intra-household transfers can be relevant in the distributional measures but as the HFCS has only limited information on the reception of presents and not about who is donating, this has not been included in this paper.

Miscellaneous current transfers (use). We link the use of current transfers with alimony and charity payments information available in HFCS, but it needs to be noted that this is only part of the transfers. In order to obtain a better linkage, transactions such as membership payments etc. should in principle be included. However, those data are not in the HFCS.

For an indication of the comparability of HFCS and sector accounts sources, we compute the coverage ratio for each of the items with the direct linkage, i.e. the ratio of the estimate for the total in the HFCS and corresponding aggregates from the sector accounts. These are reported in Figure 1, for HFCS waves 2,3 and 4, and the coverage variation reported in the Appendix.

Figure 1 – Coverage ratios for income variables with direct linkage, HFCS waves, euro area



Source: Authors' calculations based on ASA and HFCS.

Overall, the data on wages and salaries and social benefits from the micro and macro sources are quite comparable, with high coverage ratios across all countries (usually above 80%, with very few cases of over-coverage). For the other items, the gap is much wider. In particular, wide gaps are observed in income from financial investment and mixed income. Typically, the differences between property income are larger, as these are difficult to capture partly due to data source limitations and partly due to unequal distribution. The mixed income is in itself conceptually difficult, and it is not necessarily even clear whether the target population in practice in surveys and national accounts is the same.

The coverage gaps in current transfers are also very high, with larger gaps on the resources side, but those are typically very small items compared to other income sources (in most countries, this item represents less than 3% of the total disposable income). However, it should be noted that the transfers between the households are not included in this data set, which potentially can have a large impact on the low-income households. Looking at the coverage ratios across the three observed waves, there are no major differences for any of the items.

Key features of the variables used for the comparison are given in Table 2 below, showing the totals for income from financial investments, and total financial assets (including deposits, listed shares, investment fund shares, debt securities, and unlisted equity)[16] for the euro area household sector. Values reported refer to sector accounts and totals estimated from the raw HFCS sample, respectively.

Table 2. Coverage and gross rate of return of income from financial investments and financial assets, HFCS waves, euro area

	Coverage ratio			**Gross rate of return HFCS**			**Gross rate of return QSA**		
	Wave 2	Wave 3	Wave 4	Wave 2	Wave 3	Wave 4	Wave 2	Wave 3	Wave 4
Income from financial investments	25.4%	23.4%	23.1%	2.3%	1.9%	1.3%	4.7%	3.9%	3.4%
Financial assets	50.9%	47.9%	60.6%	-	-	-	-	-	-

Source: Authors' calculations based on QSA, ASA and HFCS data.

[16] In the wealth inequality literature (e.g. Blanchet and Martinez-Toledano, 2023), the financial assets concept typically includes claims linked to life insurance and voluntary pension entitlements. Here, we exclude this for consistency with the national accounts classification, particularly as income from such investments is not included in the item for income from financial investments.

The coverage of financial assets in the HFCS is also quite low in all waves. However, at close to 50% it is still substantially higher than the coverage of income from financial investments. This implies that the average gross return rate, computed simply as the ratio of total income to total financial assets, is much lower in the HFCS. The sector accounts return rate, 3.4%, is about double that observed in the HFCS wave 4.

Such a difference could come from a general issue in capturing income from financial investments in the survey, or from the known under-sampling of wealthy households: the distribution of such income can be expected to be highly skewed, so this could have a large impact on the HFCS estimate of the aggregate amount.

Instruments without a direct correspondence

Concerning the rest of the income items, which do not have a direct correspondence between the HFCS and sector accounts and whose distributional information therefore cannot be directly derived from the HFCS, we estimate the distributions based on additional variables. Practically, to estimate distribution of these flows, one of the following approaches is used with the following priorities:

a) imputations based on other available HFCS variables (e.g. taxes are imputed based on the received incomes, together with information on tax rates);

b) distributional information from the corresponding balance sheet item is used as a proxy[17] (e.g. investment income attributable to insurance policy holders is estimated to have the same distribution as stock of life insurance obtained from DWA);

c) distributional information from a related flow is used as a proxy (e.g. rent is estimated to have the same distribution as self-employment income).

Further comments on the linkage of instruments without a direct correspondence between the two data sources are presented below:

[17] This is the same approach as applied in Kavonius and Törmälehto (2021, 2022) and Kavonius and Törmälehto, 2023.

Interest (use). The HFCS does not include paid interest, and therefore the distribution of outstanding amounts of liabilities from DWA must be used as a proxy for distribution of interest. The use of other property income is not relevant for the households.

Rent (use/resource).[18] This is a small item, related mainly to agricultural land, i.e. self-employment, therefore distribution of HFCS variable self-employment income is taken as the best proxy.

Non-life insurance premiums and non-life insurance claims. There is no direct correspondence for this income instrument in the HFCS. Also, non-life insurance is composed of various types of insurance, the largest being health, motor, and property insurances (Insurance Europe, 2021), but a split between these types is not available. In lieu of better information, we take the value of the household main residence as a proxy to estimate the distribution of the net non-life insurance premiums/claims.

Taxes on income and wealth and households' actual social contributions. Information on taxes and social contributions is not available in the HFCS and is therefore imputed based on underlying incomes.[19] We follow an approach that has been used in the literature (Slacalek, 2020), which leverages data on tax wedges from external sources. These data are used to impute, for each household observation, an amount of income taxes and social contributions. In our case, we use data on average tax and social contribution rates by income decile at the country level, obtained from EUROMOD (2020), so the tax rates applied will differ depending on the position of the observation in the gross income distribution. The taxes T_i and social contributions C_i for each observation i are then computed as follows:

$$T_i = \tau_{D_{inc}(i)} \times \left(\text{wage income}_i + \frac{2}{3}\text{self-employment income}_i\right)$$

$$C_i = \tau^{C}_{D_{inc}(i)} \times \left(\text{wage income}_i + \frac{2}{3}\text{self-employment income}_i\right)$$

[18] This does not include *rentals,* namely from dwellings and underlying land, as, in the national accounts, these are distinguished from *rents* pertaining to natural resources such as agricultural land (see ESA2010, p. 104)

[19] This tax item also covers taxes from wealth and property income which are not included in the distributional measure. The underlying reason is that we do not have information on the distribution of wealth on which taxes are paid. Additionally, the property income taxation is often separated from the income taxation. Thus, the relation and distribution between property income and taxes does not follow the same pattern with the other income types.

where τ and τ^C represent, respectively, the tax and contribution rate for each gross income decile D_{inc}. Following Slacalek (2020), as an assumption, only 2/3 of gross income from self-employment is regarded as taxable.

Operating surplus. We distribute operating surplus of households based on imputed rents calculated at the household level from the HFCS. In the case of national accounts, the operating surplus of the household sector is by definition related to owner-occupied housing. Practically, it is imputed income flow generated from the owner-occupied housing without the related property income flows, i.e. in practice, related interest payments. Unfortunately, neither pure imputed rents nor property income flows related to the owner-occupied housing are reported in the ESA Transmission Programme. Therefore, the operating surplus is used to proxy imputed rents.

For the calculation of imputed rents, which is proxied by using operating surplus, i.e. non-cash income in the form of housing services derived from owner-occupied residences (for which data is available in the HFCS), we essentially follow the procedure used in List (2023), which also uses the HFCS.[20] This procedure is based on the capital market approach, which relies on the market value of the owner-occupied residence, for which data is available in the HFCS (where it is referred to as household main residence, HMR). The procedure is summarised in the equation below:

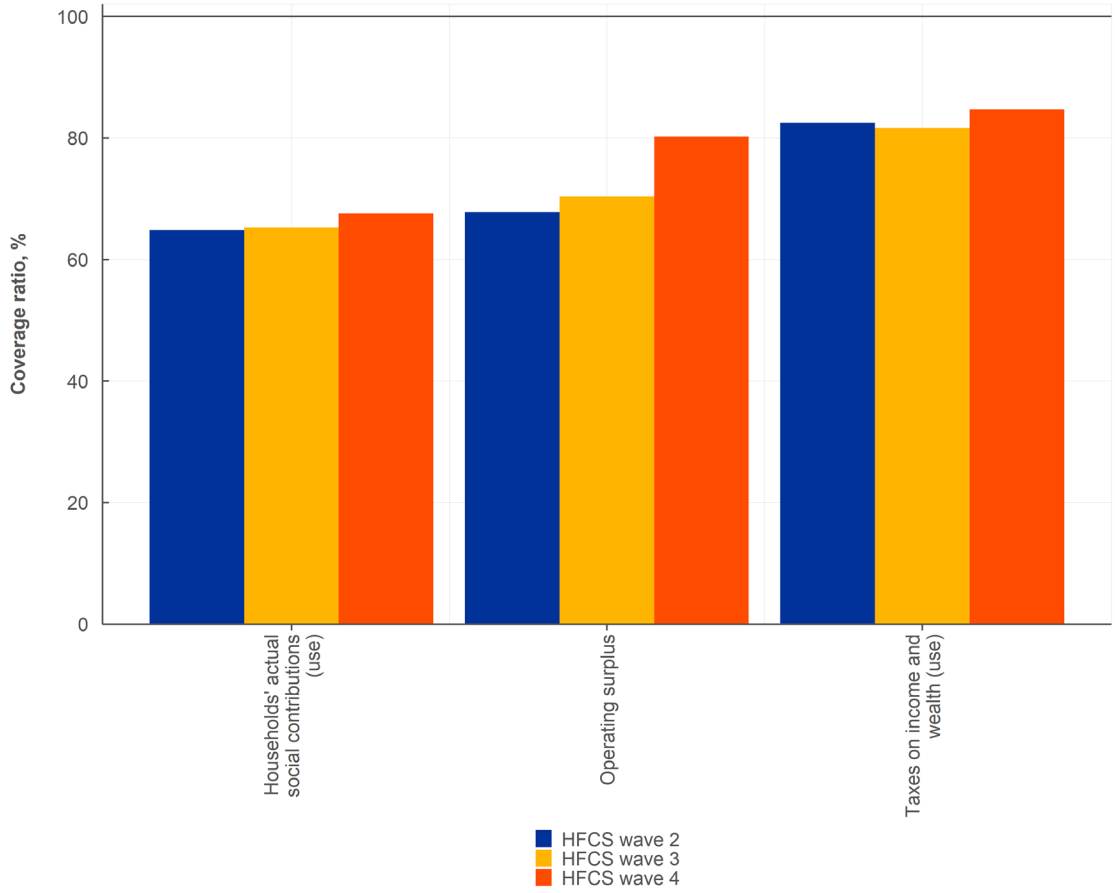
$$operating\ surplus_i = HMR\ value_i \times \mathrm{r} - HMR\ size_i \times m$$

Where V_i is the market value of the household main residence, r is an exogenous interest rate (set at 3%), $S(V_i)$ is the size (in squared meters) of the residence, and m is a maintenance costs parameter. List (2023) also provides values for τ^P and m at the country level, [21] which we draw from.

For the income instrument with imputed values and for which we have developed independent estimates, we assess the coverage ratios i.e. the ratio of the imputations for the total and corresponding aggregates from the sector accounts for an indication of the comparability between the two sources. These are reported in Figure 2 - Coverage ratios for income variables after incorporating imputations described above, HFCS waves, euro area.

[20] There is a small change with respect to the formula used there, as we calculate imputed rent based on the full value of the household main residence, without deducting mortgage debt.
[21] See Appendix S.1., Table A.5.

Figure 2 - Coverage ratios for income variables after incorporating imputations described above, HFCS waves, euro area



Source: Authors' calculations based on ASA and HFCS.

For all the three income items with imputed values, namely households' actual social contributions, operating surplus, and taxes on income and wealth, the imputed values are relatively close to the sector accounts totals: we observe relatively high coverage ratios on the euro area level and also across countries (usually above 60%). The coverage ratios for imputed variables are overall of similar size as the items with direct linkage, i.e. mixed income, social benefits, and wages and salaries, as presented in Figure 1 above.

2.3. Vertical linkages

In practice, there are two linkages between income and wealth. These linkages are called vertical linkages. The first is the linkage between non-financial and financial transactions. The connecting balancing item is net lending/borrowing. However, the current data availability does not allow us to estimate this for distributional accounts, mainly for three reasons. First, there is not enough data in the

HFCS to estimate the breakdown for consumption and capital account, and thus estimate the distributional net lending/borrowing. Second, the distributional balance sheets do not cover the corresponding transactions, and therefore the estimation of distributional financial accounts net lending/borrowing is not possible. Third, at the macro level, the financial and non-financial net lending/borrowing for household sector are not fully consistent.

Therefore, we focus here on a second, more specific aspect, namely the consistency of property income and underlying assets. As in Honkkila, Kavonius and Lefebvre (2018) and Kavonius and Honkkila (2016), we focus on the consistency of interest income and underlying assets. According to ESA2010, interest (D.41) is property income receivable by the owners of certain specific financial assets for putting them at the disposal of another institutional unit. It applies to the following financial assets: deposits (AF.2); debt securities (AF.3); loans (AF.4); and other accounts receivable (AF.8).[22] For the other property income flows, there is not such a direct relation between the income flow and underlying assets as in the case of interests, i.e. there is no reference rate, for instance, for paid dividends.

This means that paid and received gross[23] interest should be consistent with these stocks, i.e. if these interest flows are divided by these stocks, the result should be either the actually paid or received interest rate. It is important to notice that consistency does not mean one to one consistency with some reported market interest rate. The reason is that these "implicit paid/received interest rates" are based on interests that are paid/received on stocks which follow different interest contracts from past periods, and therefore the levels of these implicit rates cannot even correspond with the current market interest rates. Usually, the accumulated income of the period in question is compared to the stock of closing balance sheet. It should be noted that as the stocks are valued at market prices, the prices changes can have strong even short-term impact on the rates of return. The correspondence and consistency should therefore appear in the development of the actual time series. The level of actual market interest rate and the implicit interest rate should even be different, but the development/trend of these series should be similar.

2.4. DWA methodology and its extension to household income items

The DWA are household distributional balance sheets including financial and non-financial assets and liabilities. An overview of DWA and the methodology used to build them is presented in detail by Engel et al. (2022) and in ECB (2020). We provide a brief summary here. The starting point for this work is

[22] ESA2010, 4.42.
[23] i.e. without FISIM adjustment.

the updated linkage (presented in Section 2.2) which is already used in the analysis of the coverage rates and which for the missing parts completed in previous sections. The methodology presented in section focuses on the completion of micro data.

DWA are built by linking QSA financial data as well as data on non-financial assets for the household sector with distributional information from the HFCS. The instruments covered by the dataset currently cover roughly 90% of the total assets and liabilities of households. The remaining items, namely currency, pension entitlements[24], and other accounts payable/receivable, were judged to suffer from low comparability between the macro and micro data sources and were therefore excluded (EG LMM Report, 2020). Moreover, social security claims are not considered here, as they are not part of household financial wealth in the national accounts.

Beyond conceptual concerns, there are further technical issues in linking the two sources. Such issues are reflected in the fact that aggregates estimated based on the HFCS do not fully cover the corresponding totals in the sector accounts, which are in general reliable. These so-called "coverage gaps" vary widely, depending on the country and specific asset type. To achieve distributional statistics consistent with the national accounts, DWA includes several adjustments to bridge these gaps. These linking steps are listed below:

1. **Population adjustment.** The different household populations between the HFCS and sector accounts are adjusted to correspond to the sector accounts population. This decreases the difference between the net wealth available in the two sources by roughly one percentage point for most euro area countries.
2. **Instrument coverage adjustments.** These are applied to both the HFCS and QSA data to ensure they are fully comparable and are mainly related to non-financial assets (e.g. regarding the institutional sector scope of the QSA data on housing, which also covers non-profit institutions); the quantitative impact of such adjustments is generally very small.
3. **Additional imputations to specific HFCS variables.** In the HFCS dataset, "managed accounts" are provided as a single variable: these are assets legally owned by the household, even if they are managed by an external party (e.g. a bank or investment fund). We reallocate

[24] The national accounts' pension entitlements are relatively small as they cover only pensions schemes other than social security. The vast majority of the European pension entitlements are in the social security schemes and are contingent assets and *not* genuine assets. See: Kavonius 2025.

these amounts to other balance sheet items, this adjustment represents less than 0.5% of total net wealth. Similarly, bank deposits data are plagued by comparability issues, e.g. due to timing differences between the micro and macro data. A simple outlier detection and imputation model is used to adjust those data, adjusting the total net wealth for around one percentage point.

4. **Missing wealthy in the HFCS.** The missing wealth-rich households are included in the DWA sample using information on the richest households, supplemented by Pareto estimation procedures.[25] The HFCS covers middle-class households well, but typically misses rich households. As wealth is typically quite unequally distributed (considerably more than income), this has a considerable impact in most countries. The impact varies depending on how inequal the country is, as well as what oversampling strategies the HFCS national compilers have applied in order to capture these wealthiest households. For euro area aggregate, the inclusion of missing wealth-rich households decreases the difference between the net wealth available in the two sources by approximately 10%.

5. **Final proportional adjustment.** Finally, the households in the DWA sample are grossed up to the level of the sector accounts for each instrument. This implies that each household's reported value is adjusted in proportion.at instrument level to cover the remaining gap between the HFCS and sector accounts. It should be noted that this might change the ranking (according to their wealth) of the households in the sample (as the adjustments for individual instruments are different). This final adjustment closes the gap between the HFCS and QSA, with the total adjustment amounting to approximately 13% of net wealth.

The DWA data used in this paper are built using all of these adjustments, following essentially the same methodology as described in Engel et al. (2022) and ECB (2020). These steps are applied separately to the datasets from each HFCS wave.

The DWA methodology is then extended to disposable income and its subcomponents, in order to obtain income distribution consistent with the distribution of wealth in the original DWA dataset. Our method does not rely on any parametric model of the joint distribution of income and wealth. Further, it leaves the distribution of wealth unchanged with respect to the basic DWA process, including the estimation of a Pareto tail. In this paper, we complement DWA with a distribution of income based on income

[25] The methodology for estimation of the missing rich was applied in distributional wealth context in: Chakraborty et. al. 2016, which is available updated in: Chakraborty et. al. 2019. It was further developed for instance in: Chakraborty and Waltl 2018. Cantarella et. al. 2023.

available in the HFCS, consistent with the adjustments made to HFCS data in building DWA, i.e. broadly following the same steps 1-5 as described above for the income items.

We turn to providing more details on the imputations made to the wealthy households incorporated in the DWA dataset.

Estimation procedures for the euro area aggregate

Euro area aggregate is constructed by merging household level data for all euro area countries, which have undergone all the necessary adjustments as previously described (steps 1-5). However, the QSA for the euro area does not simply consist of the sum of the figures for the individual countries but is subject to certain balancing adjustments needed to compile sector accounts which show consistent results for all sectors. Therefore, the aggregated euro area micro dataset also needs to be adjusted to properly match the euro area QSA. Since these adjustments are generally fairly minor, a simple proportional adjustment for each instrument has been implemented.

Imputations of income variables for "add rich" households

For most countries, the base DWA micro dataset contains, beyond the HFCS sample, some "added rich" households i.e., synthetic observations based on the estimated Pareto tail of the wealth distribution. To these "added wealth rich" households, estimates of all the different assets and liabilities components considered in the DWA are assigned. In the data presented in this paper, these synthetic households, generated based on the marginal distribution of net wealth, are complemented by imputed values for the income variables. To be clear, the micro dataset underlying the "income DWA" reported in this paper does not include any additional synthetic income-rich households, but only the "added rich" already used in the original DWA (as presented in Engel et al., 2022).

In general, the approach taken here is to impute micro-level values based on the levels of those variables observed for the wealthiest observations in the HFCS sample for the respective country. The mean value of observations in the top decile by net wealth is taken for this purpose. This value is not taken from the original HFCS but from an intermediate adjusted micro data set which already incorporates adjustments up to the Pareto estimation step (i.e. population adjustment, instrument coverage adjustments, managed

accounts and deposits imputations). This approach is applied for the income data relative to operating surplus income, mixed income, wages and salaries, social benefits, and other current transfers.

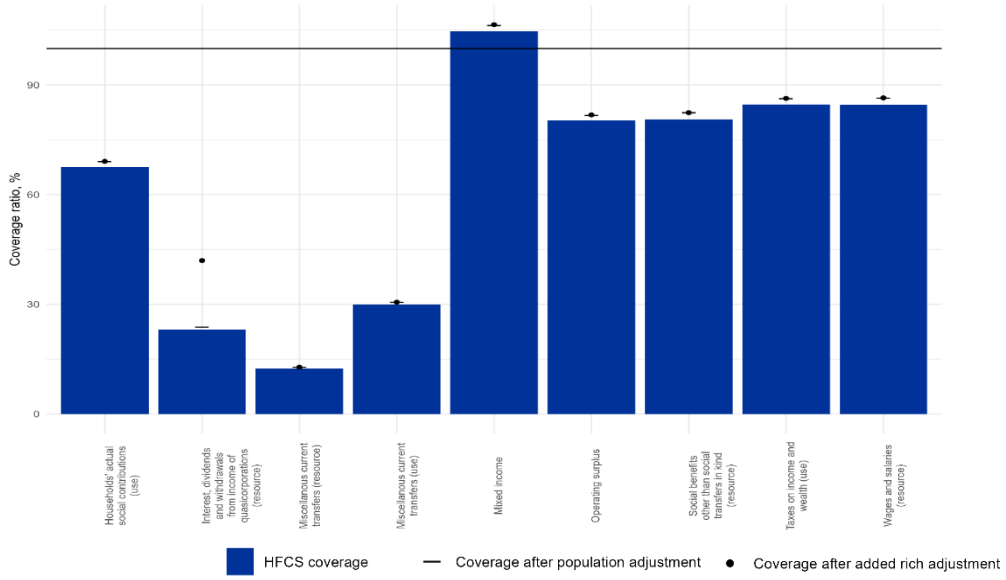
For income from financial investments, the imputations for the "added rich" households are instead based on the aggregate return rates calculated from the macro data on financial assets and the corresponding income flows. These return rates are multiplied by the financial asset amounts for each synthetic household, to impute financial income flow for the "added rich". This implies that in terms of the amount of received property income corresponds with the size of the balance sheet. Concerning other income flows of these households, the amount corresponds with similar flows of average rich in the HFCS sample. This implies that there is no automatic connection of wealth rich being also income rich. The income structure corresponds the average structure observed in the survey. This is also practically the only option as we want to keep the balance sheets, and the related income flows consistent also at the micro level.

For income taxes and social contributions, the imputations for the "added rich" are calculated based on the imputed values for the various income components, according to the same procedure used for HFCS observations.

Finally, for the income account items allocated based on proxy variables (as per Table 1), we consider in each case final distributions, i.e. after all DWA adjustments. This means the distributions of those items will also incorporate the effects of the "added rich".

The impact of the imputations of income variables for "added rich" households is presented in Figure 3, where the starting coverage ratio at HFCS level is compared with the coverage obtained after imputing the values for the added rich households. Since population adjustment has a very small impact on the improvement of the coverage ratio, it is not presented in the chart. The increase of the coverage ratio due to the added rich step is most notable for income from financial investments, as the added wealthy rich typically hold large amounts of financial assets and thus obtain high incomes from this address. Coverage for other income instruments is improved to a smaller extent.

Figure 3 - Coverage ratios for income variables in HFCS, after population adjustment and after added rich adjustment, HFCS wave 4, euro area



Source: Authors' calculations based on QSA, HFCS, and DWA data.

3. Results and discussion

In this section, we present the results obtained from applying the described procedures to link income components in the HFCS to the annual sector accounts, in a framework analogous to the DWA. We first provide an overview of the income and wealth distributions, both linked to the sector accounts, and in the second part show the distributions of different income components, as well as a first look into other dimensions of heterogeneity that can be assessed with these data. Finally, we compare the results with other efforts to produce distributional accounts for euro area countries, showing that the distribution of income is largely comparable with these alternative sources.

In general, we look at results for the euro area as a whole and focus mostly on results for 2020, the period which matches wave 4 of the HFCS. Additional results comparing the last three HFCS waves are mostly shown in the Appendix.

3.1. A first glance at the distributions of income and wealth

We begin by presenting the overall distributions of household wealth and income in our linked dataset. Throughout the ensuing results and discussions, household disposable income, equivalised disposable income, and DWA total net wealth refer to the following concepts:

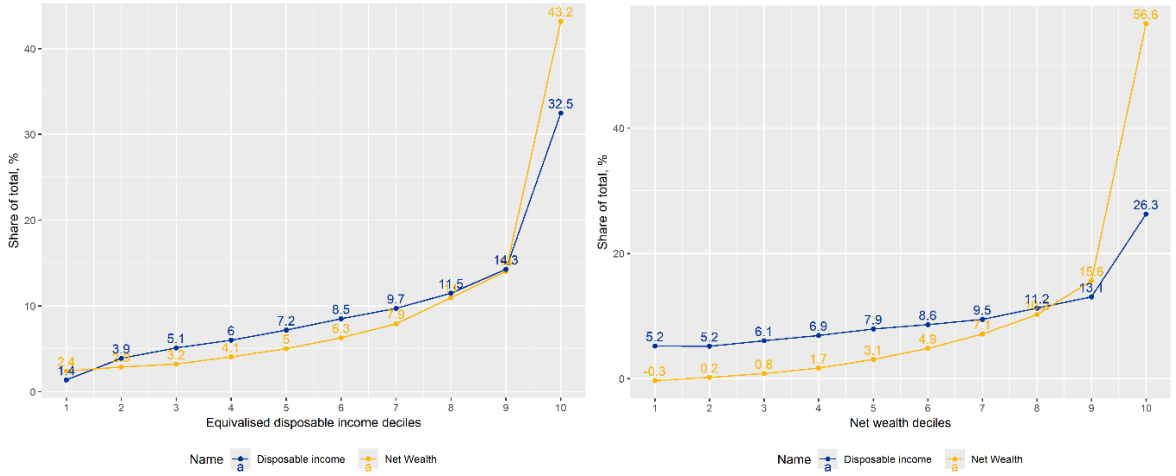
- **Total disposable income** – in line with statistical standards, this refers to the total income of a household, after taxes, social contributions, and other deductions, that is available for consumption.
- **Total equivalised disposable income** – refers to total disposable income, divided by the number of household members converted into equivalised adults using the modified OECD equivalence scale. [26]
- **DWA total net wealth** – refers to household wealth, i.e. financial and non-financial assets, net of liabilities. As explained in ECB (2020), assets are composed of deposits, debt securities, listed shares, unlisted shares and other equity, investment fund shares, life insurance, housing wealth, and "non-financial business wealth" (i.e. non-financial assets used for production purposes) while liabilities are composed of mortgage and non-mortgage loans. It also should be emphasised that this is not fully consistent with the national accounts net wealth because all balance sheet items are currently not included in the DWA.

The dataset obtained from our linkage exercise allows us to explore the distribution of overall household income and wealth, including all income components as well as the joint distribution of income and wealth, in both cases consistent with the sector accounts. In most of the analyses below, we group households into deciles, based either on their positions in the distribution of equivalised disposable income, or on the distribution of net wealth. When analysing the distribution across income groups, we use equivalised disposable income in order to ensure better comparability across different households' sizes and compositions.

Figure 4 shows the overall picture. The yellow lines show the distribution of net wealth, conditional on equivalised disposable income (i.e. by equivalised disposable income decile group) in the left panel and by net wealth decile group on the right panel. Likewise, the blue lines show the distribution of disposable income, conditional on equivalised disposable income on the left panel, and conditional on wealth decile on the right panel.

[26] The OECD modified equivalence scale allocates a weight of 1 to the first adult, 0.5 to the second and each subsequent person aged 14 and over; and 0.3 to each child aged under 14 (OECD, 2013).

Figure 4 - Distributions of disposable income and net wealth by equivalised disposable deciles (LHS) and net wealth decile (RHS), HFCS wave 4, euro area



Source: Authors' calculations based on QSA, HFCS, and DWA data.

As commonly observed, the distributions of income and wealth are both strongly unequal and right skewed. In both cases, the top two deciles hold most of the total income/wealth, although with a clear difference between the two, as wealth is visibly more unequal than income. The top 10% share of wealth is around 60%, while the top 10% share of income is only 32.5%.

A first look at the joint distributions already shows a complex pattern. Although the sharing of wealth across income deciles is more equal than the marginal distribution of wealth, the highest income households are still far more likely to also have high wealth – the top 10% of earners hold about 46% of wealth. Conversely, the wealth-richest households have a reasonably high income, but the distance to the wealth-middle class is not so large. This is consistent with a joint distribution where wealthy households do not necessarily earn large incomes at the same time.

Some further insight into the characteristics of the joint distribution of income and wealth, as estimated in our data, can be obtained from Table 3, which reports how the population is distributed jointly by income and wealth decile groups. Each cell reports the share of population belonging both to the income decile in the vertical axis and the wealth decile in the horizontal axis. Note that if all households belonged to the same decile in the marginal distributions of both income and wealth, there would be 10% of the population in each cell of the main diagonal in the matrix in Table 3, while all others would be zero.

Table 3. Cross-tabulation of the joint distribution of population by disposable income and net wealth deciles, HFCS wave 4, euro area

Disposable income decile	Net wealth decile 1	2	3	4	5	6	7	8	9	10	Total
1	2.7%	1.8%	1.6%	1.2%	0.7%	0.7%	0.5%	0.4%	0.3%	0.2%	10%
2	1.8%	2.3%	1.7%	1.2%	1.0%	0.7%	0.5%	0.4%	0.2%	0.1%	10%
3	1.4%	1.9%	1.7%	1.4%	1.2%	0.8%	0.7%	0.5%	0.3%	0.1%	10%
4	1.1%	1.3%	1.3%	1.4%	1.4%	1.2%	0.9%	0.7%	0.4%	0.3%	10%
5	0.9%	0.9%	1.2%	1.2%	1.2%	1.4%	1.2%	1.0%	0.6%	0.3%	10%
6	0.7%	0.7%	0.9%	1.2%	1.2%	1.4%	1.5%	1.1%	0.8%	0.5%	10%
7	0.6%	0.5%	0.7%	1.0%	1.3%	1.3%	1.3%	1.5%	1.3%	0.6%	10%
8	0.4%	0.3%	0.4%	0.8%	1.0%	1.2%	1.5%	1.7%	1.7%	1.1%	10%
9	0.2%	0.2%	0.2%	0.5%	0.7%	0.8%	1.4%	1.8%	2.4%	1.9%	10%
10	0.1%	0.1%	0.2%	0.2%	0.3%	0.4%	0.5%	1.1%	2.1%	5.0%	10%
Total	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	100%

Source: Authors calculations based on QSA, HFCS, and DWA data.

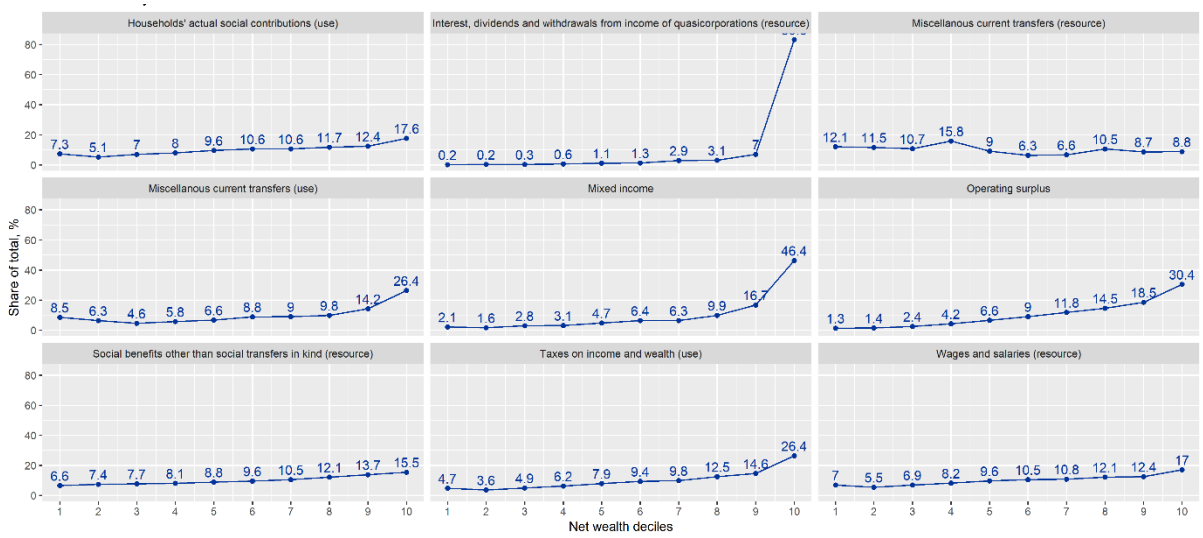
Large differences between the decile position of a given household in the two distributions are relatively rare. Still, the correspondence between households' positions on the income and wealth distributions is far from perfect. Note, for example, that households from the middle quintile (sum of deciles 5 and 6) by income are well represented in the bottom 10% of net wealth (~1.6%), while the inverse occurs less (~1.4%). Such a pattern would be consistent, for example, with the existence of a group of relatively young households with high income who, at an early stage of their life cycle, have not yet accumulated substantial wealth.

3.2. Distributions of various income components and other heterogeneities

Distributions of income components

In Figure 5 below, we show the distributions by net wealth decile group of the 9 directly matched or imputed income categories listed earlier, for the period matching HFCS wave 4.

Figure 5 – Distributions of directly matched or imputed income variables conditional on net wealth decile, HFCS wave 4, euro area



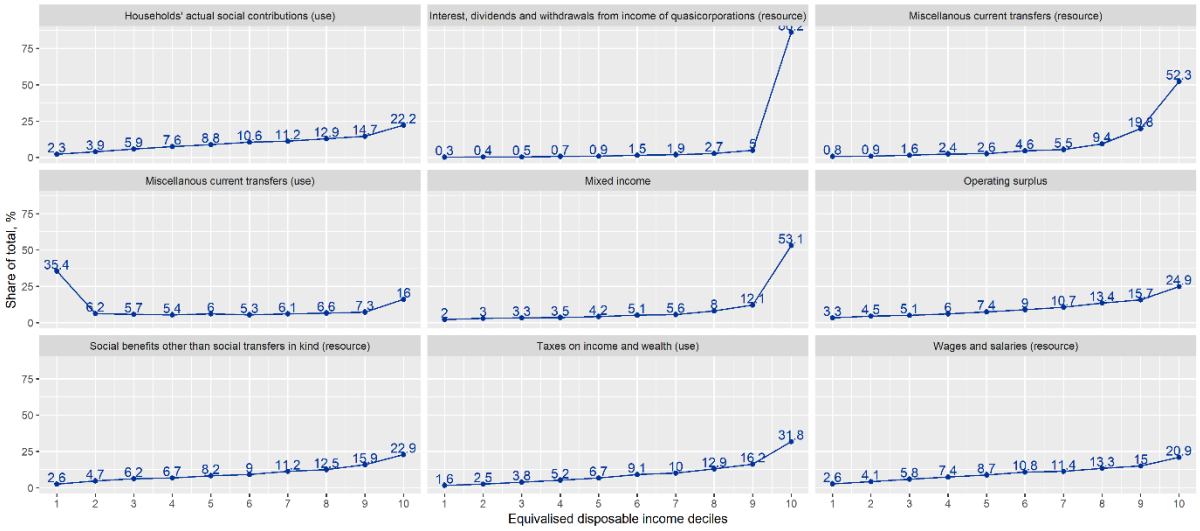
Source: Authors calculations based on QSA, HFCS, and DWA data.

The distribution of income on financial investments, i.e. interest, dividends, and withdrawals from income of quasi-corporations is clearly more unequal compared to the other categories, with a substantially higher share of income received by the top 10% households, and also by the next 10% (decile 9). A more unequal distribution is also observed in mixed income, albeit to a smaller degree than in financial investments. The observed patterns do not seem to change over time, as the picture across HFCS waves shows (Figure 17 in Appendix).

The distributions reported in Figure 5 can be compared with the distribution of net wealth reported in the previous subsection (Figure 4, right panel), in both cases by net wealth decile groups. Note that the income from financial investments and mixed income, which is generated from the wealth invested in financial and non-financial assets as well as labour input, is less unequally distributed than this underlying wealth. This is corroborated by the analysis of implicit return rates on financial investments performed in the next subsection.

Figure 6 shows the distributions of the same items, but now ordering households by equivalised disposable income decile. The patterns look similar, even if the skewness of the distribution of wages and salaries is now more evident. Also, in the case of income distribution, the observed patterns do not seem to change over time, as the picture across HFCS waves shows (*Figure* 18 in Appendix).

Figure 6 – Distributions of income variables conditional on equivalised disposable income decile, wave 4, euro area



Source: Authors' calculations based on QSA, HFCS, and DWA data.

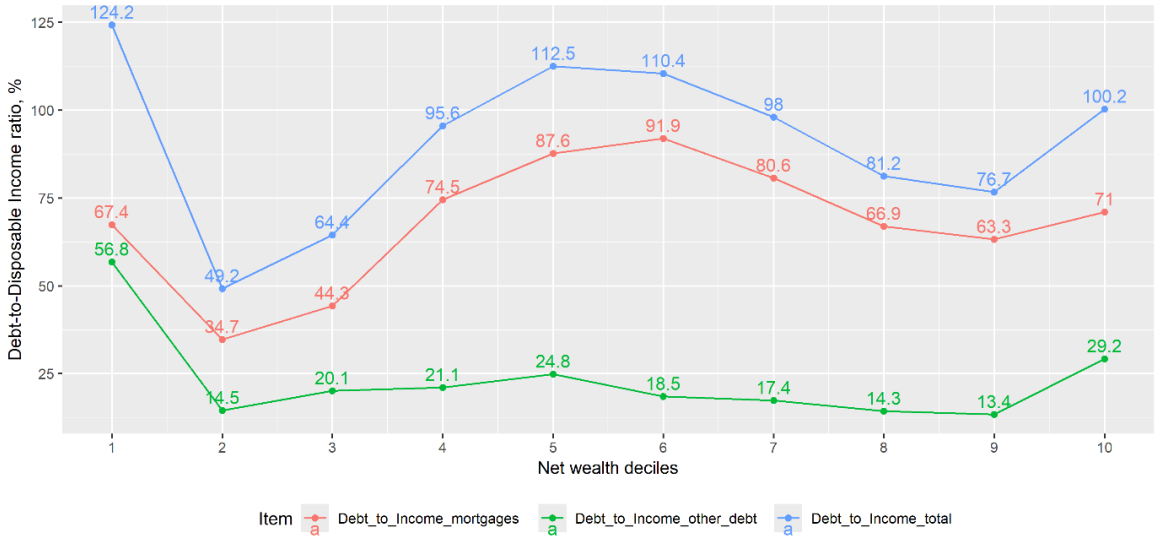
The patterns above show a distribution of income from financial investments and mixed income (investments in non-financial assets as well as labour input) that is much more unequal compared to the income sources related to labour earnings (wages and social benefits). Top shares are more than twice as high in the capital income sources (i.e. financial investments and mixed income) than in wages. This is in line with the expected pattern: capital income, originating in financial and non-financial wealth, which is highly concentrated at the top, appears to make an important contribution to overall income inequality.

It should be noted that these results must be taken with some degree of caution. First, our imputations at the top of the distribution (income of "added rich" households, as explained in Section 2) may miss the mark. Second, the coverage gaps observed in some of the income components above are relatively high, which may suggest the distributions in the HFCS may be inaccurate or poorly comparable with their sector accounts counterparts. An important assumption in the linking procedure is that the distribution of the "gap" (i.e. the income amounts added to the micro dataset in order to match the sector accounts aggregates) is broadly similar to the pre-existing distribution in each instrument. Insofar as this assumption might miss the mark, there would be some degree of error in the distributions presented.

Debt-to-income ratios

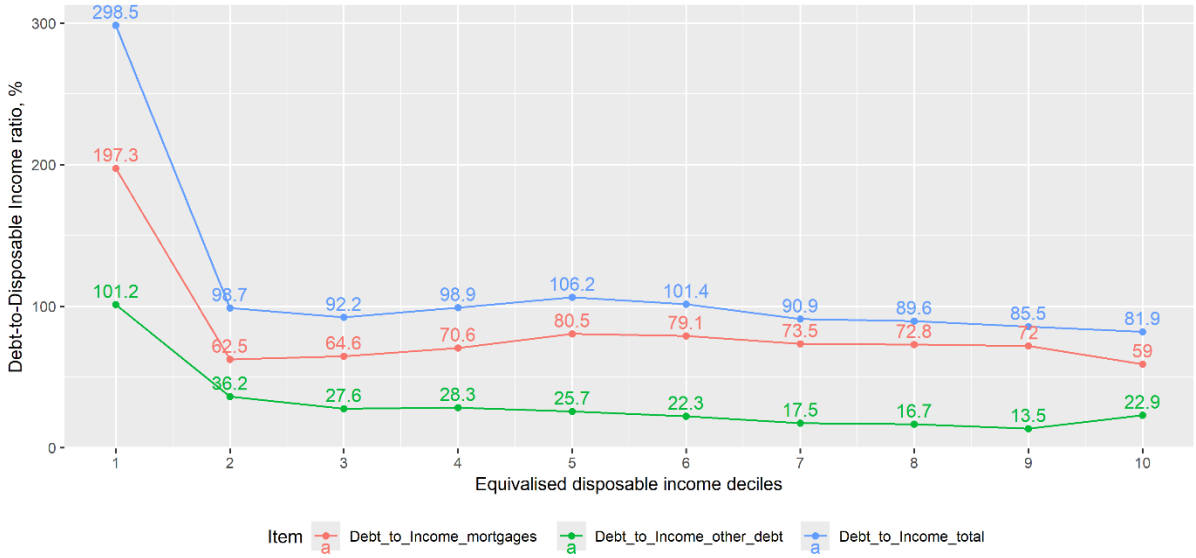
Figure 7 and Figure 8 s how the development of the debt-to-disposable income ratio across equivalised disposable income and net wealth deciles, for wave 4. This ratio presents a crude measure of debt service burden and is commonly used for analyses regarding financial stability.[27]

Figure 7 – Debt-to-disposable income ratios by net wealth decile, wave 4, euro area



Source: Authors' calculations based on QSA, HFCS, and DWA data.

Figure 8 – Debt-to-disposable income ratios by equivalised disposable income decile, wave 4, euro area



Source: Authors' calculations based on QSA, HFCS, and DWA data.

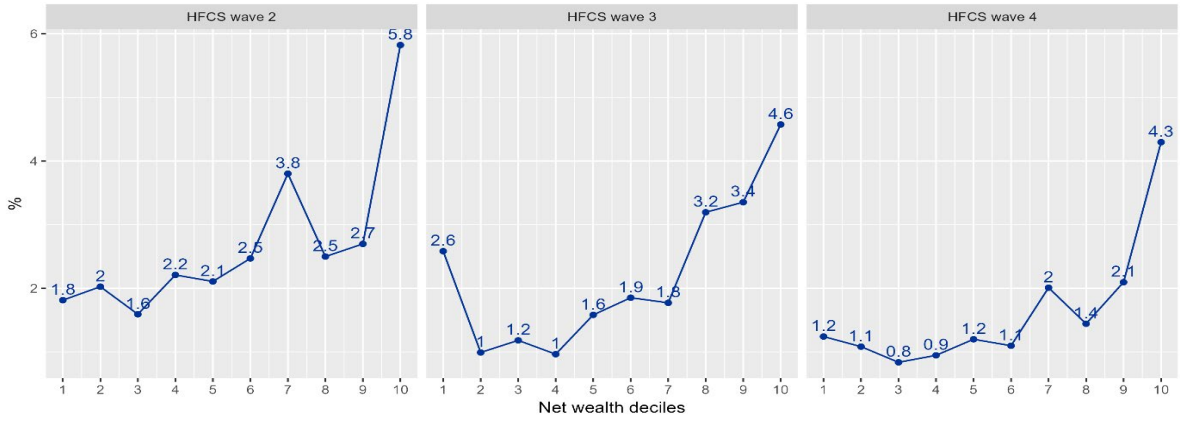
[27] An example of such an analysis for the euro area is Ampudia et al. (2016).

The ratio is decomposed in mortgage debt and other debts, shown by the red and green curves respectively, adding up to the total debt-to-income ratio, plotted in blue. A mass of very highly indebted households is located at the bottom deciles both by income and wealth. However, there is a clear difference between the income distribution and wealth distribution in this sense. Along the income distribution, this ratio is rather flat for higher deciles. High income earners are slightly less indebted, but the difference is not large. Conversely, when looking at this ratio along the wealth distribution, the patterns are more complex. There is a trough in the 2nd decile, with the ratio then increasing over the first few bottom deciles (except the 1st), peaking at decile 5, and then stabilising or declining slowly, with a second peak at the top. It should be noted that in the first decile the income level is low, and it can be compensated by taking loan (for instance: students) as higher in the income distribution household is, more likely they borrow for an investment (for instance: mortgage). The plots also show that most of this pattern is driven by mortgage debt, except for the peak at the top decile, where other debt seems to play a role.

Gross rates of return

In Figure 9 and Figure 10, we observe gross return rates on financial investments. These are computed at the household level as income from financial investments (which is provided as a single variable), divided by the sum of outstanding financial assets (which include deposits, listed shares, investment fund shares, debt securities, and unlisted equity), across equivalised disposable income and net wealth quintiles respectively. Each of the figures includes three charts, one for each HFCS wave period 2,3 and 4.

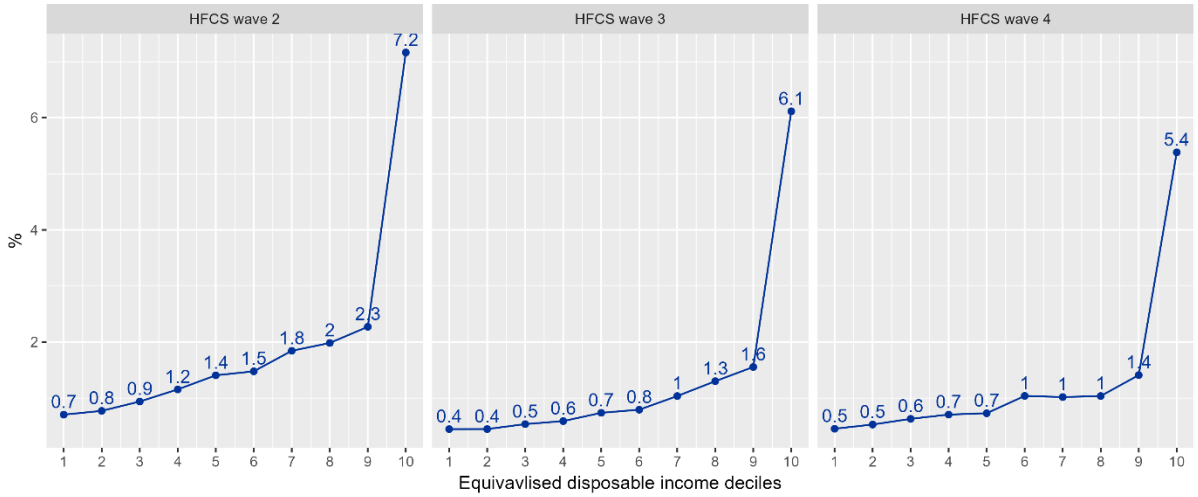
Figure 9 – *Gross rates of return on financial investments by net wealth quintile, HFCS waves*, euro area



Source: Authors' calculations based on QSA, HFCS, and DWA data.

The bottom quintile has higher returns than the next quintile. This perhaps surprising pattern suggests the presence of some highly indebted but relatively asset and/or income-rich households in the bottom wealth quintile, who exhibit higher returns compared to other households at the bottom of the wealth distribution. This bottom "peak" in returns seems to be present in other studies of returns on wealth (see namely Fagereng et al., 2020, Fig. 2.A and OA.16.A). Then, an increasing pattern can be observed, with the highest returns observed at the top of the distribution.

Figure 10 - Gross rates of return on financial investments by equivalised disposable income quintile, HFCS waves, euro area



Source: Authors' calculations based on QSA, HFCS, and DWA data.

Conversely, the relationship with the income level is slowly increasing from quintiles 1 to 4, and reaching a high peak in quintile 5, as presented in Figure 10. As households' income level increases, the returns on financial wealth increase strongly, from close to zero at the bottom to levels clearly above average at the top. No clear differences regarding the inequality of these returns emerge across waves.

Note that the very high average returns observed for top quintiles may in part be a product of our linkage exercise, given the large coverage gaps in income from financial investments. The large amounts added to the income of the richest households may lead to an overstatement of their return rates.

3.3. Sensitivity analysis

Linking assumptions

To ensure that our key results on the joint distribution of disposable income and net wealth are not driven by specific assumptions and mapping items in our linkage procedure, we systematically re-ran the full linking and gross-up procedure under all 32 permutations of five alternative assumptions. Each experiment toggles one of the following five treatments against our baseline approach:

- **Income from financial investments**
  - *Impacted instrument:* Interest (without FISIM); Dividends and Withdrawals from income of quasi-corporations (D41G resource, D421, D422).
  - Baseline approach: use the income from financial investments directly reported in the HFCS.
  - Alternative approach: replace these flows with an estimate calculated as the product of each household's DWA asset holdings with a proxy for the average rate of return obtained from the QSA country-level data on revaluation.
- **Financial income from assets not available in the HFCS**
  - *Impacted instruments***:** Interest paid (D41G, use), Investment income attributable to insurance policy holders (D441), Investment income payable on pension entitlements (D442), Investment income attributable to collective investment (D443).
  - *Baseline approach*: distribute each flow across households in proportion to the corresponding asset stock (after final grossing up).
  - *Alternative approach*: impute the flow (before grossing up) as the product of the DWA asset stock and rate of return data from the QSA.
- **Allocation of income taxes and employee social contributions**
  - *Impacted instruments:* Taxes (D5), social contributions (D613).
  - *Baseline approach*: apply average tax and contribution rates, by gross income decile, taken from EUROMOD, to the labor income observed in the HFCS.
  - *Alternative approach*: allocate the aggregate of taxes and contributions strictly in proportion to the labor income of households.
- **Imputed rents from owner-occupied housing**

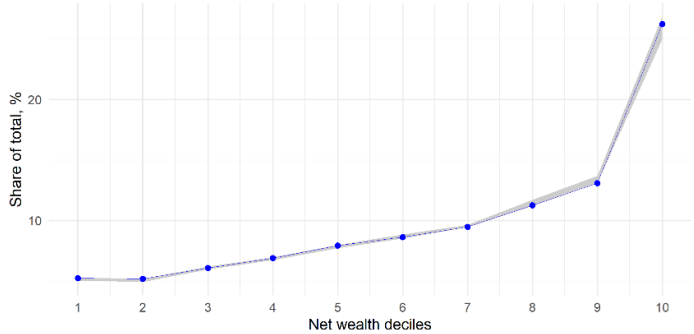
- *Impacted instrument:* Imputed rents -> Operating surplus (B2G).
- *Baseline approach*: derive owners' imputed rent from the capital-market formula (housing value × user-cost share + size × construction-cost factor − property tax).
- *Alternative approach:* multiply each dwelling's gross housing value by an external rent-yield estimate, yielding a direct proxy for the corresponding rental value.

- **Calculation of imputed rents and grossing-up of housing wealth**
  - *Impacted instrument:* Imputed rents -> Operating surplus (B2G).
  - *Baseline approach*: compute imputed rent on the raw HFCS housing values before the proportional gross-up of housing wealth
  - *Alternative approach:* first apply the gross-up to housing wealth (including dwellings not used in production) and then calculate imputed rent on the adjusted totals. Note that imputed rent is not grossed-up as there is no QSA counterpart.

For each of the 32 scenarios, we regenerated the micro-dataset adjusting each time a subset of the above assumptions. All intermediate processing steps—population adjustment, Pareto tail, interpolation of survey waves—were left unchanged. These five switches cover every income component whose baseline value relies on proxy distributions, as together they account for **98.6 % of disposable income**, leaving only minor items (1.4 %) outside the test.

In Appendix we show full results of these exercises, including the impact on the distribution of all income items and DWA assets considered. Here, we focus on presenting the results of the overall joint wealth distribution, observed as (i) the share of total disposable income accruing to each net-wealth decile and (ii) the share of total net wealth held by each equivalized disposable-income decile.

Figure 11 – Results of sensitivity analysis on the distribution of disposable income by net wealth decile, HFCS wave 4, Euro area

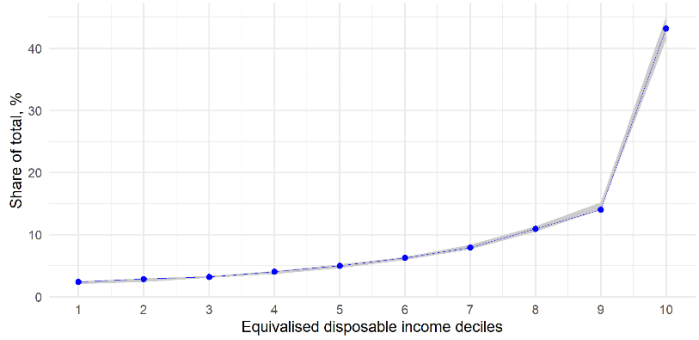


decile_nw	min_value	baseline_value	max_value
1	5	5.2	5.3
2	4.9	5.2	5.2
3	6	6.1	6.2
4	6.7	6.9	7
5	7.7	7.9	8
6	8.5	8.6	8.8
7	9.4	9.5	9.7
8	11.2	11.2	11.7
9	13.1	13.1	13.7
10	25	26.3	26.9

Source: Authors' calculations based on OECD, HFCS, and DWA data.

Across the 32 runs the robustness envelope around the estimates for shares of income by net wealth decile is narrow (Figure 11). For the bottom nine net-wealth deciles the maximum deviation from the baseline never exceeds 0.15 percentage points (pp); for the top decile the range is 0.25 pp around a baseline share of 32.5 %. The full results in the Appendix show that there is higher sensitivity in some income components, namely taxes on income and wealth, which would become more equally distributed under alternative assumptions, and operating surplus (i.e. mostly imputed rents), that would be more skewed under some alternatives. In any case, differences are, at most, within 4 p.p.

Figure 12 – Results of sensitivity analysis on the distribution of net wealth by disposable income decile, HFCS wave 4, Euro area



decile_incm_eq	min_value	baseline_value	max_value
1	2.1	2.4	2.5
2	2.4	2.9	3
3	3.1	3.2	3.3
4	3.7	4.1	4.2
5	4.6	5	5.2
6	6	6.3	6.4
7	7.7	7.9	8.4
8	10.5	11	11.4
9	14	14	15.2
10	41.4	43.2	45.1

Source: Authors' calculations based on OECD, HFCS, and DWA data.

The picture is also stable when looking at the distribution of net wealth by income decile (Figure 12). The top income decile's share of net wealth fluctuates by at most 2 p.p. around its baseline of 43%. In the Appendix, we can see that in key assets that take up most of households portfolio, namely housing wealth and listed shares, the estimated distribution by income deciles is highly insensitive to these assumptions. A few items, such as nonfinancial business wealth, are more sensitive, but in any case, the shares of these assets held by deciles below the top are very small, and overall, these are a small part of aggregate household wealth.

We turn to looking at the individual impact of each of the above alternative assumptions. Table 4 presents the outcome of five sensitivity runs, in which each alternative assumption is activated individually while all other steps remain at their baseline settings. The exercise focuses on two headline measures of the distribution of disposable income for HFCS wave 4: (i) the share accruing to the top net-wealth decile and (ii) the standard Gini coefficient.

Table 4. Impact of alternative assumptions on selected distributional indicators of disposable income, Euro area, wave 4

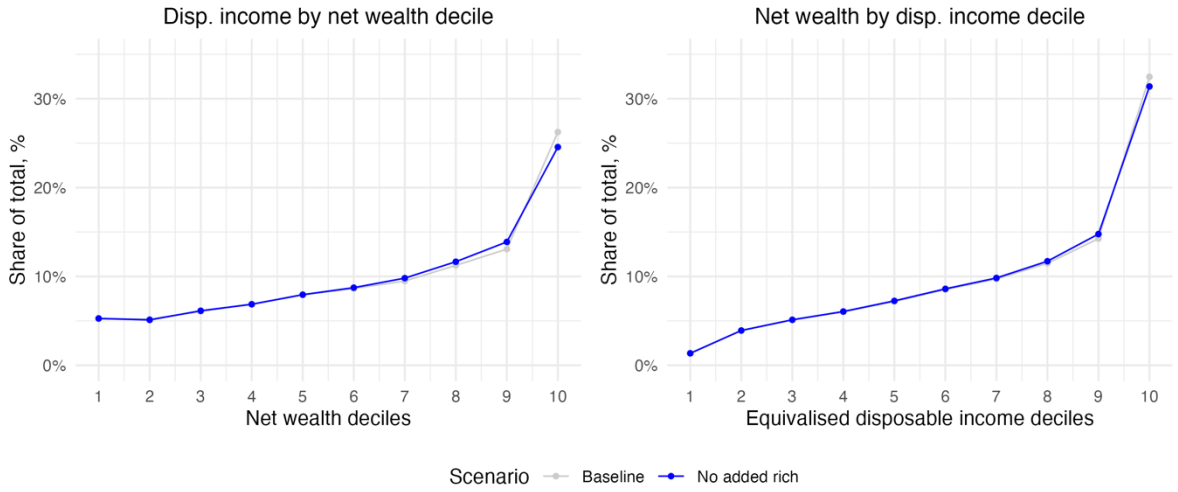
Adjustment	Disposable income			
	Top 10% share	Δ vs. baseline	Gini coef.	Δ vs. baseline
Baseline	*25.78*	*0.00*	*0.444*	*0.000*
External rent-yield calculation	26.40	0.62	0.448	0.004
Proportional taxes & contributions	26.17	0.39	0.456	0.012
Proxy flows on non-survey assets	25.81	0.02	0.444	0.000
Rent imputed after gross-up	25.91	0.12	0.442	-0.002
Return rates for fin. Income	24.99	-0.79	0.432	-0.012

The results confirm that the baseline estimates do not hinge excessively on any of these assumptions used in the linking procedure. The largest departure arises when financial investment income is allocated via the aggregate return rates: the top decile share falls by 0.8 percentage points and the Gini coefficient by 0.012. Two other switches—applying an external rental yield to impute owner-occupied rents, and reallocating income taxes and social contributions in strict proportion to labor income—raise the top decile share by 0.6 pp and 0.4 pp respectively, with corresponding Gini increases of 0.004 and 0.012. The remaining alternatives shift both indicators by less than 0.1 p.p. In all cases the direction of change is consistent with the economic intuition behind the adjustment, and the absolute magnitudes remain well within one percentage point for the top-decile share and 0.012 for the gini. Overall, the baseline distribution of disposable income is therefore considered robust to these modelling choices.

Impact of added rich

We turn to analysing the impact on the distributional-linkage and gross-up procedure for income variables of the "added rich" adjustment, that complements the adjustments already made on the base DWA dataset. We rerun the procedure without "added rich", leaving all other steps identical to the baseline. We then recompute the share of total disposable income by net-wealth decile and the share of total net wealth by equivalised disposable-income decile under this "no added rich" scenario. The results are shown in Figure 13. We do not reexamine here the effect on the wealth series, as that sensitivity is already documented in Engel et al. (2022).

Figure 13 – Results of sensitivity analysis on the effect of added rich adjustment on the distributions of disposable income by net wealth decile and of net wealth by income decile, HFCS wave 4, Euro area



Source: Authors' calculations based on OECD, HFCS, and DWA data.

Omitting the added-rich imputation yields distributions that are slightly less right-skewed: the top decile's share of disposable income falls by about 2 percentage points (from roughly 27 % to 25 %), and its net-wealth share declines by a similar amount. Deciles 5–9 each gain a few tenths of a percentage point in their income share, while the wealth shares are unaltered; other deciles shift by only fractions of a point in both cases. In the Appendix, we show this impact for specific income variables.

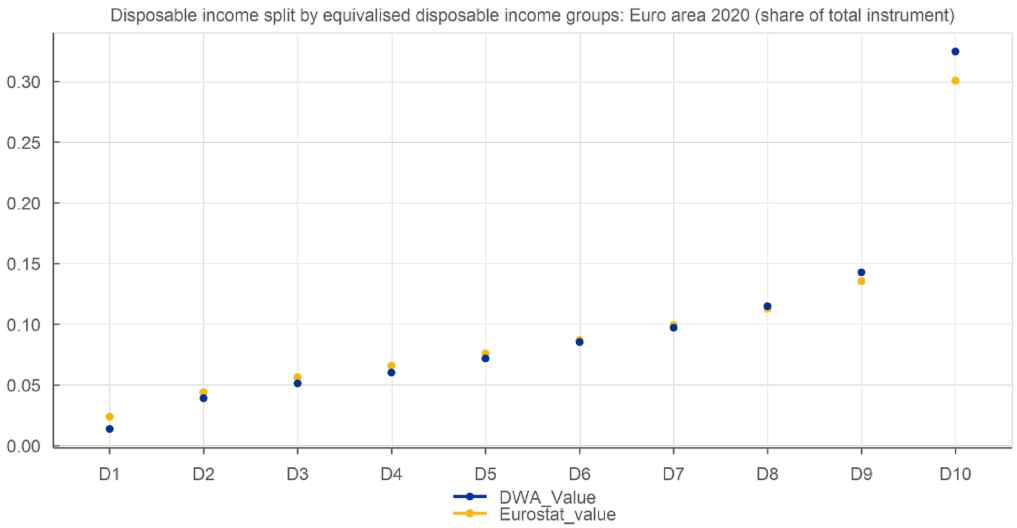
3.4. Comparison with Eurostat distributional income accounts

In this section, we compare the distribution of various income components in our dataset against those available in other distributional accounts. We first look at total disposable income and wages and salaries. We then focus on the most relevant components of capital income. In all cases, our numbers appear close to the distributional income accounts data compiled by Eurostat (originating in a joint effort with the OECD, Zwijnenburg et al. 2021).

Since this data does not include all euro area countries, nor years matching the three waves of the HFCS, we cannot compare it directly with the data presented in the previous sections. Therefore, we compare

the average across countries available in both datasets, weighted by aggregate household net wealth, for the year 2015.[28]

Figure 14 – Distribution of disposable income, average of available countries, comparison with Eurostat



Source: Authors' calculations based on Eurostat, HFCS, and DWA data.
Note: data for FR are not included in the Eurostat euro area aggregate, as those are not available for 2020. Deciles in Eurostat euro area are calculated as a sum of country deciles, however in DWA, deciles are recalculated using household level data (i.e. considering EA as one country).

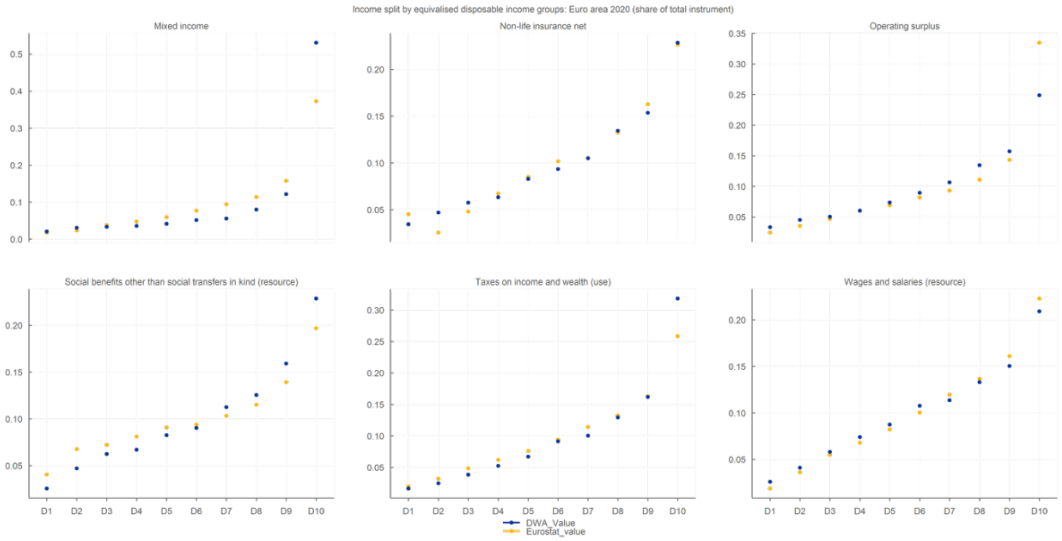
We first look at total disposable income, plotting its marginal distribution in Figure 14, showing the share of the aggregate disposable income received by each decile group (of the same variable). There are no clearly visible differences between our data and the OECD/Eurostat dataset except at the top and bottom deciles. In the former case, our dataset displays a *higher* share for the top decile, at 32.5% vs. the Eurostat's 30%; in the latter the difference is smaller than 1 p.p., both datasets showing a very low share at around 2% of total disposable income.

Such differences are unsurprising given both the nature of the underlying data on wages and salaries, and the adjustments made in the two datasets. Importantly, the OECD/Eurostat dataset relies on EU-SILC to obtain the distribution of wages and salaries, while DWA uses the HFCS. There are some important differences here, e.g. the former includes data on income taxes and contributions directly while the latter relies on estimates for these. In this sense, it is reassuring that while the DWA income distribution is somewhat more skewed, the general picture is very similar.

[28] Having said that, the OECD/Eurostat dataset only has data for a few years, which differ between countries. In most countries, we are able to take 2015 values for all data sources, and where this is not possible in the OECD/Eurostat data we take the first year available.

We then look at the distribution of specific income items. Figure 15 plots the marginal distributions of income in the following items: mixed income, non-life-insurance claims (net), operating surplus, social cash benefits other than transfers in kind, taxes on income and wealth (use), and wages & salaries, from DWA and the Eurostat series. Overall, it appears that most capital income items are more unequally distributed in the DWA than in Eurostat, a difference that may reflect the upward corrections we apply for the under-sampling of wealthy households.

Figure 15 – Distribution of capital income items, average of available countries, comparison with Eurostat



Source: Authors' calculations based on Eurostat, HFCS, and DWA data.

The largest discrepancies appear in mixed income and social benefits. In the DWA, the top decile receives just over one-half of total mixed income, compared with just under 40 % in Eurostat; social benefits are also somewhat more concentrated in the top three deciles, with correspondingly smaller shares for the bottom three deciles. These gaps likely stem, in the former case, from our adjustments for under-sampled self-employed and landlord households.

For operating surplus and for wages & salaries, the pattern reverses. Eurostat's series are the more unequal, with the top decile capturing roughly one-third of operating surplus (versus about one-quarter in the DWA). Our use of a uniform user-cost formula applied to survey-reported dwelling values appears to mute the right tail relative to Eurostat's capital-stock approach. In wages & salaries, the difference is small but leans the other way, perhaps because Eurostat applies a dedicated Pareto correction to income while the DWA does not; the DWA's "add-rich" step nevertheless delivers a broadly similar distribution.

Overall, our takeaway from these comparisons is the following. Despite relying on different primary data and adjustment strategies, the DWA and Eurostat procedures (and, for total disposable income, the WID) yield similar shapes for most income distributions while remaining fully consistent with national-accounts aggregates. We believe this provides additional confidence in our depiction of the joint distribution of income and wealth in euro area countries, and in the initial results we derive from it.

4. Conclusions

This paper extends the framework of the DWA to also cover household income components required to compile household's equivalised disposable income, allowing us to produce a joint distribution according to net wealth and disposable income, with both concepts matched with Sector Accounts. The first part of the paper presents the data and methodology, including the linkage between HFCS and the sector accounts income items. As in DWA, the distributional information on income is obtained from the HFCS, adjusted for population differences, enhanced with the missing wealthy observation, and grossed up to match the Sector Accounts aggregates. In the second part of the paper, preliminary results of these distributional income accounts are presented and discussed, focusing on both net wealth deciles as well as equivalised disposable income deciles. All the data presented refer to the euro area and for the years corresponding to the second and third HFCS waves.

With consistent wealth and income distributional accounts, we shed new light on economic inequalities in the euro area. Just by looking at the joint distributions of total disposable income and net wealth, we can already observe a rather complex pattern. Net wealth is more equally distributed according to the distribution per income deciles compared to the distribution per wealth deciles, although the highest income households are still more likely to also have high wealth. We also observe that less than a quarter of households belong to the same decile in both distributions.

With this novel dataset, we can also focus on specific subitems of income and wealth, as well as on relevant measures that can be derived from them. In this paper we focus on debt-to-income ratios and on gross rates of return, both analysed with respect to equivalised disposable income and wealth deciles. Debt-to-income ratios are rather flat across all income deciles (with the exception of the first income decile), but more complex patterns appear when we look at the wealth deciles, showing higher indebtedness among the middle- and top-income decile. In the case of gross rates of return, a strong increasing pattern may be observed in the distribution per income, whereas a concave pattern can be identified when looking at the distribution of returns per net wealth.

Overall, the joint distribution of income and wealth accounts presented in this paper show promising results, especially for the more equally distributed income components, which also tend to have a higher coverage. The results are relatively comparable with the country results based on the methodology agreed with Eurostat although the results presented of this paper show higher income share to the top quintiles and correspondingly lower shares for lower quintiles.

References

Ampudia, M., Van Vlokhoven, H., and Żochowski, D. (2016). Financial fragility of euro area households. *Journal of Financial Stability*, *27*, 250-262.

Blanchet, T., and Martínez-Toledano, C. (2023). Wealth inequality dynamics in Europe and the United States: Understanding the determinants. *Journal of Monetary Economics*, *133*, 25-43.

Cantarella, M., Neri, A., and Ranalli, M. G. (2023). Estimating the Distribution of Household Wealth: Methods for Adjusting Survey Data Estimates Using National Accounts and Rich List Data. Review of Income and Wealth. https://doi.org/10.1111/roiw.12657

Chakraborty, R., I. K. Kavonius, S. Pérez-Duarte, and P. Vermeulen (2016). Is the Top Tail of the Wealth Distribution the Missing Link between the Household Finance and Consumption Survey and National Accounts? IARIW 34th General Conference, Dresden, Germany, August 21-27, 2016. Retrieved 21 June 2022, from http://old.iariw.org/dresden/chakraborty.pdf

Chakraborty, R., I. K. Kavonius, S Pérez-Duarte., and P. Vermeulen (2019). Is the Top Tail of the Wealth Distribution the Missing Link between the Household Finance and Consumption Survey and National Accounts? Journal of Official Statistics, 35(1), 31-65. https://doi.org/10.2478/jos-2019-0003

Chakraborty, R. and S. R. Waltl, (2018). Missing the wealthy in the HFCS: micro problems with macro implications. Working Paper Series, no. 2163, European Central Bank.

Coli, A., R. Istatkov, H. Jayyousi, F. Oehler and O. Tsigas (2022). Distributional national account estimates for household income and consumption: methodological issues and experimental results. Eurostat Manuals and guidelines, OECD and Eurostat, Luxembourg.

Engel, J., P. Gayà Riera , Grilli, J. and P. Sola, (2022), Developing reconciled quarterly distributional national wealth – insight into inequality and wealth structures. Working Paper Series, no. 2687, European Central Bank.

EUROMOD (2020). EUROMOD statistics on Distribution and Decomposition of Disposable Income version no. I3.0+.

European Central Bank (ECB 2020b): The Household Finance and Consumption Survey: Results from the 2017 wave. European Central Bank Statistics Paper Series No 36/March 2020, https://www.ecb.europa.eu/pub/pdf/scpsps/ecb.sps36~0245ed80c7.en.pdf?bd73411fbeb0a33928ce4c5ef2c5e872

European Central Bank (ECB 2023): Household Finance and Consumption Survey: Methodological report for the 2021 wave. European Central Bank Statistics Paper Series No 45/2023, https://www.ecb.europa.eu/pub/pdf/scpsps/ecb.sps46~3563bc9f03.en.pdf?a784410aa7de63bd5d2b510ab0086e40

European Central Bank (ECB 2023b): Household Finance and Consumption Survey: Methodological report for the 2021 wave. European Central Bank Statistics Paper Series No 46/2023, https://www.ecb.europa.eu/pub/pdf/scpsps/ecb.sps46~3563bc9f03.en.pdf?a784410aa7de63bd5d2b510ab0086e40

European Central Bank (ECB 2020): Understanding household wealth: linking macro and micro data to produce distributional financial accounts. Expert Group on Linking macro and micro data for the household sector. European Central Bank Statistics Paper Series No 37/July 2020, https://www.ecb.europa.eu/pub/pdf/scpsps/ecb.sps37~433920127f.en.pdf

European System of Accounts 2010 (ESA2010), Publications Office of European Union, Luxembourg 2013.

Fisher, J. D., Johnson, D. S., Smeeding, T. M., & Thompson, J. P. (2022). Inequality in 3-D: Income, Consumption, and Wealth. Review of Income and Wealth, *68*(1), 16-42.

Honkkila, J., I. K. Kavonius and L. R. Lefebvre (2018). Linking Macro and Micro Household Balance Sheet Data – time series estimation. IARIW 35th General Conference, Copenhagen, Denmark, August 20-25, 2018. Retrieved 21 June 2022, from http://old.iariw.org/copenhagen/kavonious.pdf

Honkkila, J. and I. K. Kavonius (2013). Micro and macro analysis on household income, wealth and saving in the euro area. European Central Bank Working Papers No 1619, https://www.ecb.europa.eu//pub/pdf/scpwps/ecbwp1619.pdf

IMF, G20 DGI Recommendations and Data, https://www.imf.org/en/News/Seminars/Conferences/DGI/g20-dgi-recommendations-and-data#:~:text=In%202009%2C%20the%20G20%20Finance,following%20the%20global%20financial%20crisis.

IMF (2022): G20 Leaders Welcome New Data Gaps Initiative to Address Climate Change, Inclusion and Financial Innovation, https://www.imf.org/en/News/Articles/2022/11/28/pr22410-g20-leaders-welcome-ndgi-to-address-climate-change-inclusion-financial-innovation

Insurance Europe (2021). European insurance industry database, updated 5 August 2021, https://www.insuranceeurope.eu/statistics

Jäntti, M., E. M. Sierminska and P. van Kerm (2015): Modeling the joint distribution of income and wealth. Measurement of Poverty, Deprivation, and Economic Mobility, vol. 23, 301-327.

Kavonius, I. K. and J. Honkkila (2016). Deriving household indebtedness indicators by linking micro and macro balance sheet data. Statistical Journal of the IAOS, vol. 32, no. 4, pp. 693-708, https://doi.org/10.3233/SJI-161017

Kavonius, I. K., and J. Honkkila (2013). Reconciling Micro and Macro Data on Household Wealth: A Test Based on Three Euro Area Countries. Journal of Economic & Social Policy, 2013(2), [3].

Kavonius, I. K. (2006). The implication of employee stock options and holding gains for disposable income and household saving rates in Finland. Journal of Official Statistics, 22(3), 585-597.

Kavonius, I. K. (2025). Pension in the national accounts and wealth surveys: how do they impact economic measures? National Accounting Review, 7(1), 1-27. https://doi.org/10.3934/NAR.2025001

Kavonius, I. K. and V-M. Törmälehto (2010). Integrating Micro and Macro Accounts – The Linkages Between Euro Area Household Wealth Survey and Aggregate Balance Sheets for Households. IARIW

31st General Conference, St-Gallen, Switzerland, August 22-28, 2010. Retrieved 20 June 2022, from http://www.iariw.org/papers/2010/7aKavonius.pdf

Kavonius, I. K., and V-M. Törmälehto (2022). Is the financial market driving income distribution? – An analysis of the linkage between income and wealth in Europe. European Central Bank Working Paper Series; No. 2707, European Central Bank. https://doi.org/10.2866/934742

Kavonius, I. K. and V-M. Törmälehto (2021). Is the Financial Market Driving the Income Distribution? – An analysis of the Linkage between Income and Wealth in Europe. IARIW 36th General Conference, Oslo, Norway (online), August 23-27, 2020. Retrieved 21 June 2022, from https://iariw.org/wp-content/uploads/2021/08/iariw_kavonius_tormalehto_paper.pdf

Kavonius, I. K., and V-M Törmälehto (2023). Is property driving income distribution? – An analysis of the linkage between income and wealth in Finland, France and Spain. Journal of Comparative Economics, 51(3), 858-879. https://doi.org/10.1016/j.jce.2023.02.006

Kuypers, S., F. Figari and G. Verbist (2021). Redistribution in a joint income–wealth perspective: A cross-country comparison. Socio-Economic Review, vol.19, issue 3, 929-952.

List, E. (2023). Housing and Income Inequality in Europe: Distributional Effects of Non-Cash Income from Imputed Rents. Review of Income and Wealth 69 (2), 504-532. https://doi.org/10.1111/roiw.12597

OECD (2013), OECD Framework for Statistics on the Distribution of Household Income, Consumption and Wealth, OECD Publishing, Paris, https://doi.org/10.1787/9789264194830-en.

Piketty, T., E. Saez and G. Zucman (2018). Distributional National Accounts: Methods and Estimates for the United States. The Quarterly Journal of Economics, Vol. 133, Iss. 2, 553–609, https://doi.org/10.1093/qje/qjx043

Stiglitz, J.E., Sen, A. and Fitoussi, J.P. (2009). Report by the Commission on the Measurement of Economic Performance and Social Progress, https://ec.europa.eu/eurostat/documents/8131721/8131772/Stiglitz-Sen-Fitoussi-Commission-report.pdf (uploaded: 17 January 2023).

United Nations (2021). WS.2 Distribution of household income, consumption and wealth. System of National Accounts Global Consultations, https://unstats.un.org/unsd/nationalaccount/RAdocs/WS2_Dist_HH_Inc_Cons_Wealth_Paper.pdf

Waltl, S. R. (2022). Wealth inequality: A hybrid approach toward multidimensional distributional national accounts in Europe. Review of Income and Wealth 68 (1), 74-108

Wronski, M. (2021). Multidimensional inequality in the European Union. The joint distribution of household income, wealth, and consumption. Economics and Sociology, 14(3), 205-219.

Zwijnenburg, J., S. Bournot and F. Giovannelli (2017). OECD Expert Group on Disparities in a National Accounts Frame-work—Results from the 2015 Exercise. OECD Statistics Working Paper No. 76.

Zwijnenburg, J., S. Bournot, D. Grahn and E. Guidetti (2021). Distribution of household income, consumption and saving in line with national accounts – Methodology and results from the 2020 collection round. OECD Statistics Working Papers, No 01.

Zwijnenburg, J. (2019). Unequal Distributions: EG DNA versus DINA Approach. AEA Papers and Proceedings, 109, 296–301, 2019. https://doi.org/10.1257/pandp.20191036.

Appendix – tables and figures

Figure 16 - Variation in coverage rations across individual euro area countries, HFCS waves

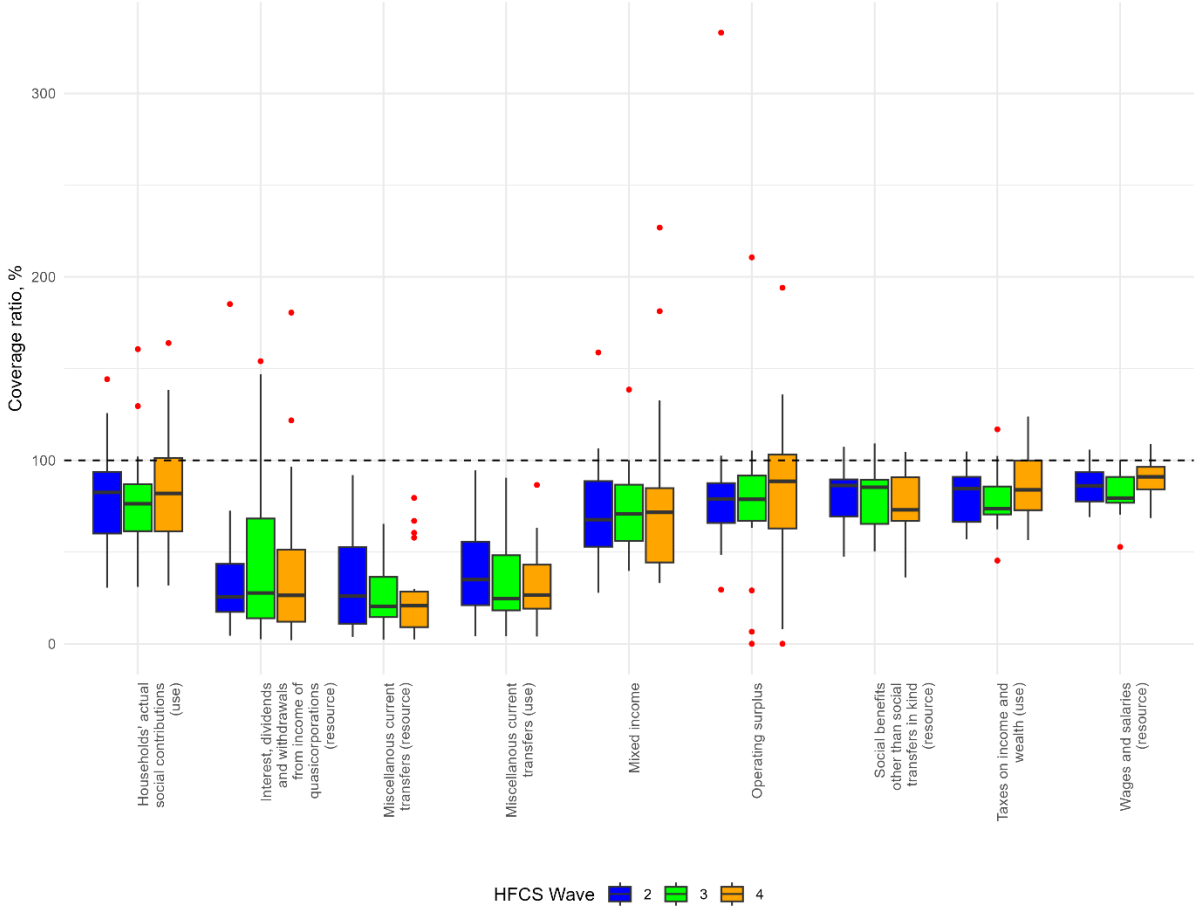
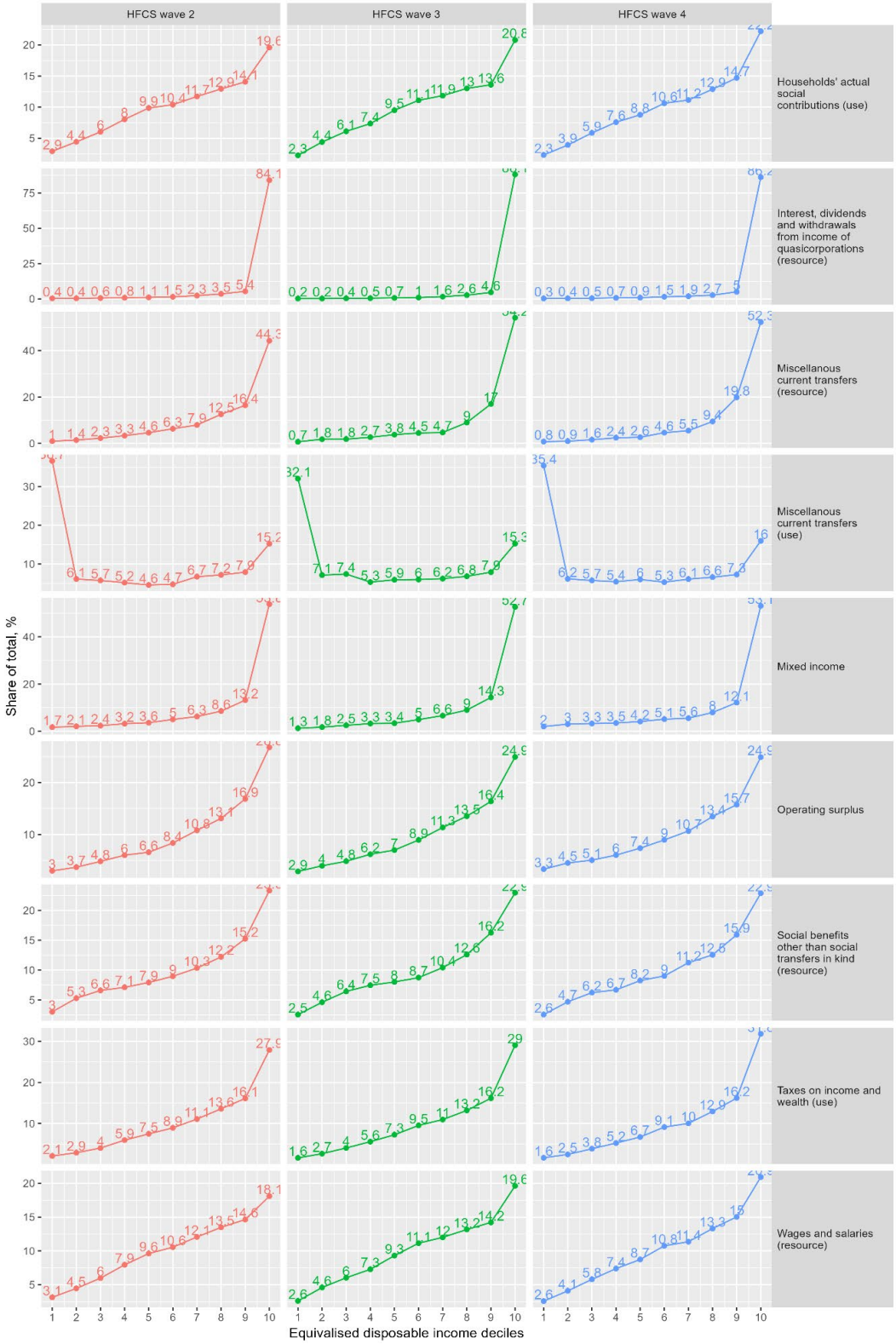


Figure 17 – Distributions of income variables conditional on net wealth decile, HFCS waves, euro area

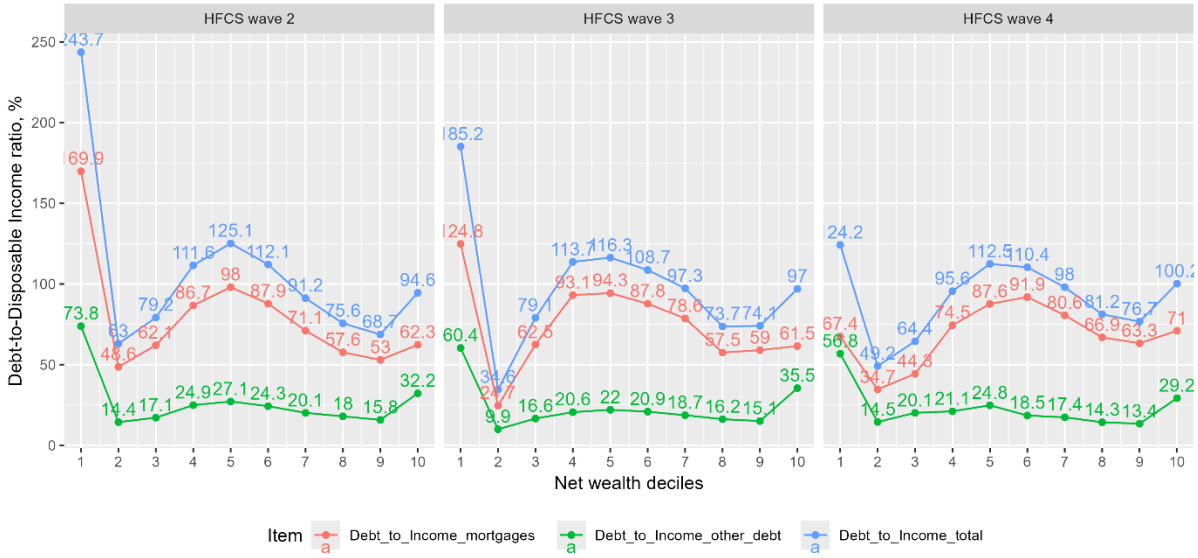
Source: Authors' calculations based on QSA, HFCS, and DWA data.

Figure 18 – Distributions of income variables conditional on equivalised disposable income decile, HFCS waves, euro area



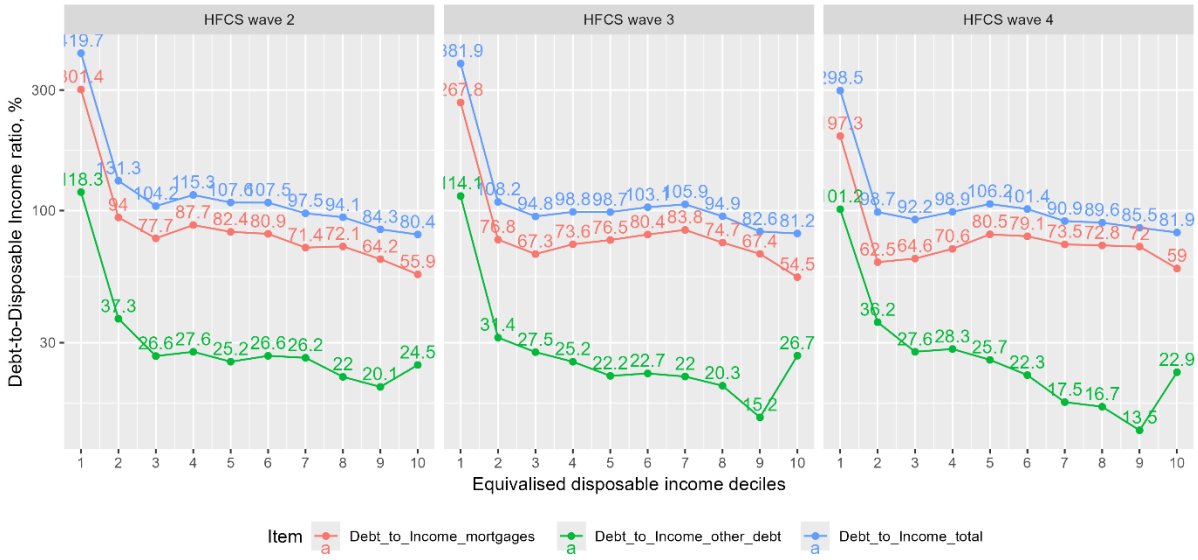
Source: Authors' calculations based on QSA, HFCS, and DWA data.

Figure *19 – Debt-to-income ratios by net wealth decile, HFCS waves, euro area*



Source: Authors' calculations based on QSA, HFCS, and DWA data.

Figure 20 – Debt-to-income ratios by equivalised disposable income decile



Source: Authors' calculations based on QSA, HFCS, and DWA data.

Note: log scale in y-axis

Figure 21 – Results of sensitivity analysis on the distribution of disposable income components by net wealth decile, HFCS wave 4, Euro area

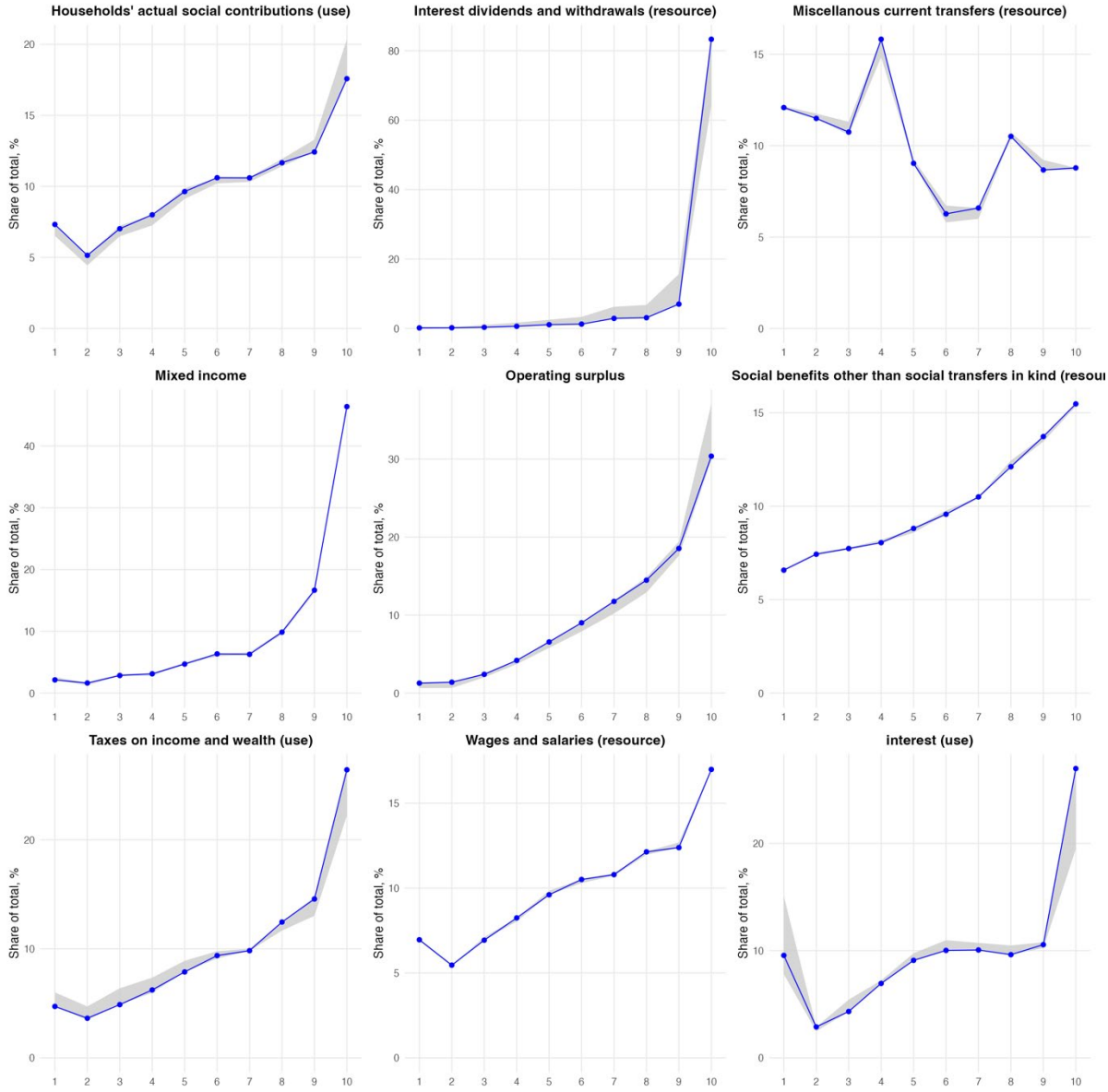
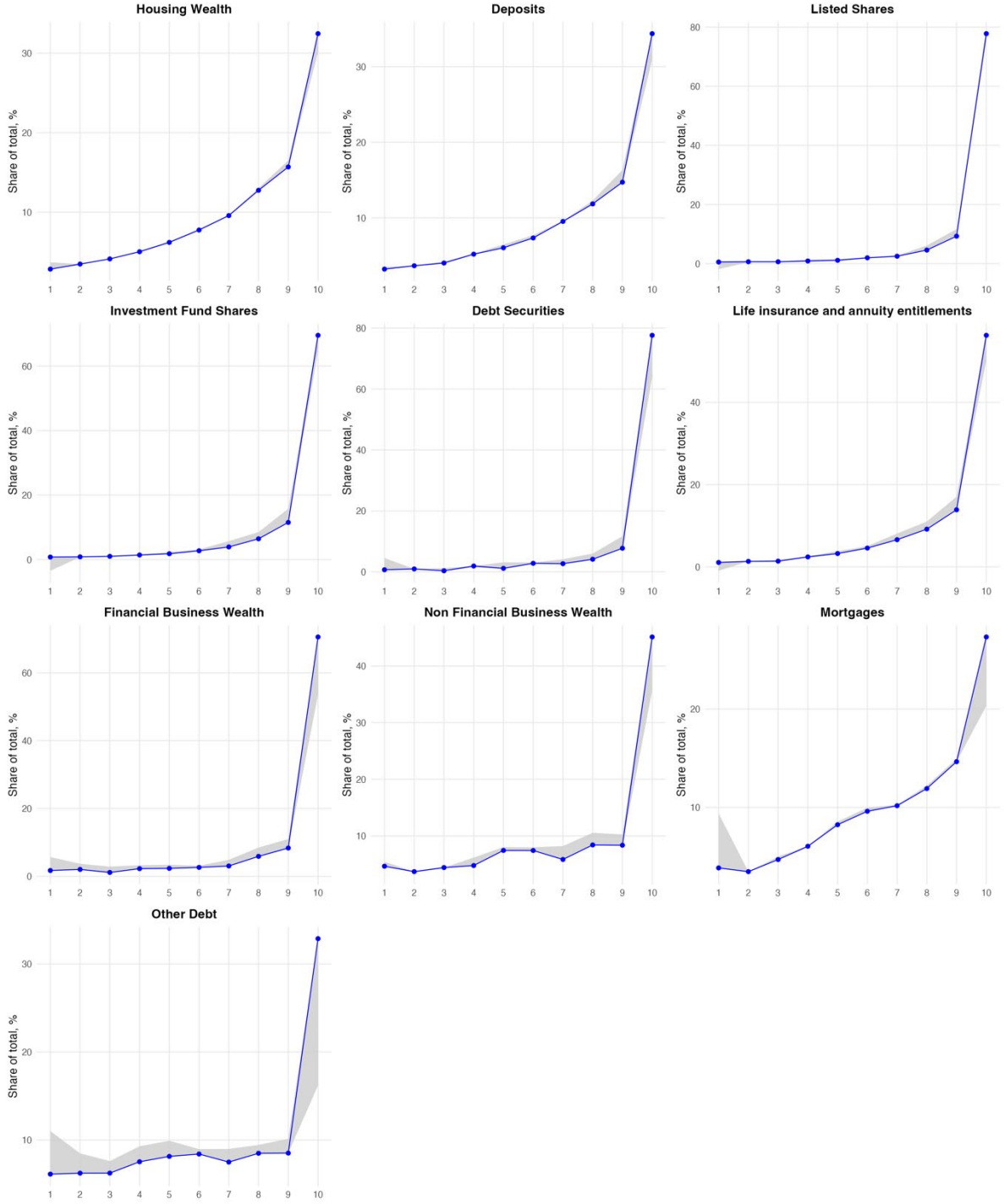


Figure 22 – Results of sensitivity analysis on the distribution of net wealth components by disposable income decile, HFCS wave 4, Euro area



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