The Micro-Macro Gap in Property Incomes: Consequences for Household Income Inequality[1]

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This article investigates the gap in property income between household survey data and national accounts. We show that coverage ratios of property income in the European Union Statistics on Income and Living Conditions (EU-SILC) and the European Central Bank's Household Finance and Consumption Survey (HFCS) are well below those typically found for other income components, and we apply multiple strategies for scaling survey data up to national-accounts aggregates. We evaluate how different imputation strategies and assumptions on rates of return affect the distribution of property incomes in Eurozone countries. The results suggest that subjective choices made during data processing have a strong impact on reported income inequality measures. Conditional on the method used, inequality can change by up to 60 Gini points for the marginal distribution of property income and by more than 5 Gini points for gross total household income.

Keywords: Property income, generalised Pareto estimation, national accounts
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Introduction

Economists have recently shown increased interest in the distribution of both aggregate household income and single income components. Due to exceptionally scarce data, property incomes, such as interest and dividends, have attracted comparatively little attention in the literature. Although property income generally constitutes a rather small fraction of total household income, it plays a key role in income inequality. Empirical studies have observed that property income is much more unequally distributed than income from employment and thus exerts a notable effect on the distribution of household incomes (Fräßdorf *et al.* 2011, García-Peñalosa and Orgiazzi 2013, Roine and Waldenström 2015, Schlenker and Schmid 2015, Milanovic 2016).

For a long time, lack of available data has hampered comprehensive research on property income. Individual tax records are rarely available, and when they are, they are often inconsistent with macro-economic aggregates from national accounts (Piketty and Saez 2003, Piketty *et al.* 2018). A major factor underlying this mismatch is the substantial underreporting in tax data due to tax evasion and avoidance, and offshore investment (Saez and Zucman 2016). Given the scarcity and deficiencies of administrative records, household surveys are being used extensively as an important alternative resource for inequality research. Nonetheless, there is a substantial mismatch between survey income data and the corresponding macro-economic aggregates in national accounts (Goda and Sanchez 2018). This article evaluates and assesses the distributional consequences of multiple approaches to closing the micro-macro data gap for property income. We apply a number of common methods to harmonise survey information and national-accounts data and to show their implications for various inequality measures for property income and gross household income.

The discrepancy between survey and national-accounts data is usually caused by multiple factors. First, surveys based on representative household samples may have difficulty covering the very top of the distribution and consequently miss a significant amount of property income. The lacking information for the top is linked to the low probability of drawing households with very high incomes into survey samples. Moreover, non-response is positively correlated with household income and wealth, and thus the highest at the top (Vermeulen 2017, Eckerstorfer *et al.* 2015, Groves 2006). To account partially for potential non-response bias, some household surveys aim to remedy undercoverage *ex ante*, by oversampling rich households. Alternatively, some works apply *ex-post* statistical imputation procedures for the missing top data, assuming that

the underlying income distribution follows a Pareto distribution or similar functional form (Feenberg and Poterba 1993, Burkhauser *et al.* 2010, Piketty and Saez 2003, Waltl and Chakraborty 2022, Wildauer and Kapeller 2022). Second, there is a potential for widespread misreporting of property income across the whole distribution due to various reasons, such as recall errors and social-desirability bias (Moore *et al.* 2000, Angel *et al.* 2019). Third, conceptual differences between the data sources such as varying target populations, variable definitions, and diverging time frames might lead to a significant gap (Törmälehto 2011, Kavonius and Honkkila 2013, Chakraborty *et al.* 2019).

We use data from the European Union Survey on Income and Living Conditions (EU-SILC) and the European Central Bank's Household Finance and Consumption Survey (HFCS) to quantify the mismatch in property-income data between household surveys and national accounts for Eurozone countries. Since the HFCS provides information on net household wealth, it proves more suitable for a broader range of imputation methods to close the micro-macro gap. We carefully adjust the data for conceptual differences in order to increase comparability and apply multiple techniques, such as simple upscaling, imputation procedures, and rate-of-return-based approaches. We find that the results of these exercises differ substantially in terms of property-income inequality, but less so for overall household-income inequality. Given the substantial micro-macro mismatch in most Eurozone countries, our findings urge caution when analysing property income from household surveys.

Data

It is essential to define property income precisely since the terminology differs significantly in the literature. While most works refer to *capital income*, benchmark guidelines for household-income statistics commonly use the term *property income* (Canberra Group 2011). Therein, property income is defined as receipts arising from the ownership of assets, *i.e.*, monetary returns from financial assets (interest, dividends), non-financial assets (rent), and royalties. In this article, we aim to follow this definition closely and document necessary adaptions, such as in the case of rent. Roine and Waldenström (2015) point out that some forms of property income, such as corporate dividends and income from interest-bearing bank deposits, are easier to observe than others, such as realised capital gains and imputed rents of home ownership. Most available datasets, however, do not aim to comply with these theoretical definitions but rather to collect practical information (*e.g.*, for taxation purposes).

In many countries, aggregate (macro-economic) income data can be obtained from national accounts (NA), whereas individual (micro-economic) information is derived from tax statistics. Although national accounts are easily accessible in the Eurostat database, reliable micro data broken down into different income sources is scarce. Unlike income from employment, property income is rarely and insufficiently available in tax data, with few exceptions (Saez and Zucman 2016). The reasons for this deficiency are numerous but usually boil down to a mix of rudimentary taxation practices, tax avoidance, and tax evasion. Capturing capital gains in administrative data is even more challenging and thus often excluded in research, although there is limited evidence of the increasing relevance of realised capital gains as an income source (Roine and Waldenström 2015).

Household surveys have become an additional and indispensable source for the analysis of property income. While there is a broad variety of national surveys collecting income data, such as the Panel Study of Income Dynamics (PSID) of the United States, the Socio-Economic Panel (SOEP) of Germany, and the British Household Panel Survey (BHPS) for the United Kingdom, cross-country comparisons are complex and challenging due to methodological idiosyncrasies. On these grounds, harmonised cross-country surveys, such as the EU-SILC and its younger companion HFCS have become valuable resources for research in Europe. EU-SILC has been managed by Eurostat since 2003, and it serves as a benchmark dataset for income analysis as well as the monitoring of poverty and social inclusion in the European Union. It includes both cross-sectional data and a rotational panel component with an annual sample size of roughly 140,000 households in the European Union member states. EU-SILC provides variables that are reported partly on the individual level and partly on the household level. Moreover, some information is gathered from registers in many countries where administrative data is available (Eurostat 2020). This results in conceptual differences for the variable, property income. While most countries obtain this information via questionnaires, some countries, such as Finland, France, Spain, and Slovenia, use register data (Zardo Trindade and Goedemé 2020). A couple of countries ask only one general question about property income, whereas others request single components of property income separately. In addition, questionnaires differ in whether the question is posed only to the primary respondent (such as in Belgium) or to each adult (such as in Greece).

The HFCS is comparatively young, with its second wave conducted in 2014 and released by the European Central Bank (ECB) early in 2017. In this wave, approximately 85,000 households were interviewed across the Eurozone. Similar to EU-SILC, participation in HFCS is voluntary for most of the participating countries. The questionnaire focuses on the

financial soundness of private households, making HFCS the first cross-country harmonised-wealth survey in the Eurozone that also includes detailed income and consumption data. While personal characteristics are addressed at the individual level, the "financially knowledgeable person" provides information at the household level, such as real and financial assets, liabilities, private businesses, intergenerational transfers, gifts, consumption, and savings. Contrary to EU-SILC, HFCS replaces missing values with multiple imputations, resulting in a more complex survey design. These imputations are based on econometric estimates and take into account information collected from other households but also consider para-data obtained by the interviewer during the field work and include other aspects, such as the general appearance of dwellings and related observable attributes (Eurosystem Household Finance and Consumption Network 2016a). The HFCS is conducted by the national central banks in each participating country, which results in minor differences in survey methodology and post-processing (see Table A1 for an overview).

Since the two datasets focus on different core topics, coverage, and data quality differ slightly for some variables of interest. Nevertheless, EU-SILC and HFCS are largely harmonised and most suitable for cross-country comparisons of household indicators. Both datasets' questionnaires gather information on property incomes and are therefore the most promising data sources for our study.

Our analysis begins by determining whether there is a mismatch between the household survey data and the macro-economic aggregates from national accounts. This assessment requires a careful demarcation of the income concepts and the comparison of the two data sources must account for four factors: i) sector demarcation, ii) divergent target populations, iii) differing income definitions, and iv) varying reference periods.

First, we are interested in the property income of private households, which is virtually impossible to align with sector demarcation in national accounts. Eurostat provides data for the sector "Households" (S.14), according to the System of National Accounts (SNA). This sector, however, also comprises unincorporated enterprises (entrepreneurs, liberal professions, farmers, *etc.*), unless their accounts are sufficiently detailed to present their activity as that of a quasi-corporation. Unfortunately, national accounts do not provide separate information for households and unincorporated enterprises. This might have a substantial effect on the gap between survey data and macro-economic aggregates, as we will discuss later.

Second, national accounts and household surveys cover slightly different target populations. EU-SILC and HFCS focus on private households and their members at the time of data collection. Persons living in collective

households and in institutions are generally excluded from the target population (for the HFCS, see Eurosystem Household Finance and Consumption Network 2016a), whereas these are covered in sector S.14 in the national accounts. According to SNA definitions, the sector includes all residential households, including institutional residence households, as afforded persons staying in hospitals, retirement homes, convents, prisons, and similar facilities for an extended period of time. To correct for deviating population sizes, we follow Kavonius and Honkkila (2013) and adjust aggregate values obtained from surveys with inverse population coverage ratios (see Table A2).

Third, income definitions between EU-SILC, HFCS, and national accounts are not exactly aligned and need to be arranged to produce comparable results. In the SNA, since 1993, the category property income (D.4) comprises interest before the Financial Intermediation Services Indirectly Measured (FISIM)[2] allocation (D.41G), distributed income of corporations (D.42), reinvested earnings on foreign direct investment (D.43), investment income disbursements (D.44), and rent (D.45). Interest (D.41) is collected by owners of financial assets, such as deposits or debt securities (*e.g.*, bills or bonds). Property income distributed by corporations (D.42) can be received via either dividends from company shares or withdrawals from the profits of quasi-corporations. Earnings retained as reinvested in foreign direct investment (D.43)[3] are treated as though they had first been distributed to the owners, who then reinvested these earnings in the equity of the enterprise. Other investment income (D.44) is linked to property income from insurance policies, pension entitlements or mutual funds and is limited to the property income that could be gained by institutions in favour of the policy holder (Eurostat 2013).

Unfortunately, household surveys do not include variables that correspond to the categories D.43 and D.44 in the national accounts. Another major inconvenience is the differentiation between *rent* and *rentals* in the SNA. While rent[4] is a form of property income (D.45), rentals are defined as the sales of services and thus as self-employment income. As a consequence, the SNA captures exclusively income from renting out land (and resources) in D.45 but conflates income from renting out residential properties with other types of self-employment income. The surveys, however, do not distinguish between these two concepts and collect combined information on rent and rentals. We choose therefore to exclude any type of rental income from our definition of property income for a sensible comparison. As shown in Table 1, we compare national-accounts data with survey information for interest and distributed income from corporations, which account for 75 *per cent* of SNA property income in the

European average. The data for interest (D.41G) and distributed income of corporations (D.42) are provided by national statistical offices, but the actual property-income data is collected by central banks and varies according to national regulations.

Table 1
Availability of property income in surveys

System of National Accounts	HFCS	EU-SILC
Interest before FISIM allocation (D.41G)	HG0410	} HY090G
Distributed income of corporations (D.42)	HG0510	
Reinvested earnings on FDI (D.43)		
Investment income disbursements (D.44)		
Rent (D.45)	[HG0310]	[HY040G]

Note: This table contrasts available items in national-accounts and survey data (HFCS, EU-SILC). Due to methodological differences, only property income from interest payments and dividends (D.41G and D.42) are fully comparable, while income from rent (D.45) is not. For more details on the methodology, see Eurostat (2013) for national accounts, Eurosystem Household Finance and Consumption Network (2016a) for HFCS and Eurostat (2020) for EU-SILC.

Fourth, the reference periods for reported income in the surveys vary across countries and must be adjusted to find the corresponding values from national accounts.[5] National accounts are available only for the calendar year, with reference periods ranging from moving time-windows of varying lengths to simple calendar years. For countries whose survey reference periods extend past the turn of a year, we assign as the period the year with the greatest number of survey months. For instance, the fieldwork period for HFCS 2014 in Greece ran from June 2014 to October 2014, and the income reference period was determined as the 12 months preceding the interview. Thus depending on the time of the interview, the income reference period lasted from June 2013 to October 2013. In the case of Greece, we assigned 2014 as the reference year for the comparison with national-accounts data.

Given all of the issues that arise as a result of conceptual differences between macro- and micro-economic data, we take great care to include only information that we deem comparable. After adjusting the data as described, we obtain information for 18 European countries. Table 2 presents the overall coverage of property income in EU-SILC and HFCS by country. The coverage ratios vary substantially across countries and surveys. The coverage in France exceeds 100 *per cent*, whereas in Greece, both surveys consistently cover less than 6 *per cent* of property income. The numbers for France in EU-SILC are biased, however, as pensions in the

Table 2
Property-income coverage of EU-SILC and HFCS, 2014

	Property Income		
	EUR (Bn.)	SILC (%)	HFCS (%)
France	42.698	243.8	182.0
Finland	6.257	74.3	74.7
Luxembourg	0.485	34.6	67.4
Estonia	0.454	17.7	63.6
Slovakia	1.240	1.9	45.2
Latvia	0.915	7.2	43.8
Netherlands	20.174	49.9	41.6
Spain	31.531	60.0	31.7
Hungary	2.996	4.3	30.0
Belgium	19.635	14.1	24.0
Slovenia	0.538	71.4	18.2
Cyprus	1.143	15.2	17.5
Portugal	14.747	8.0	17.5
Austria	20.074	8.7	15.0
Germany	260.417	11.0	10.2
Poland	11.799	8.7	5.9
Italy	157.319	6.5	5.3
Greece	7.162	5.2	3.6
Weighted Average	30.8	25.0	
	excl. France	14.5	12.9

Note: The reference period of all sources is consistent with the country-specific reference year of the HFCS, as shown in Table A1. National accounts are based on the private household sector (S.14). Malta and Ireland are excluded, due to missing data. EU-SILC and HFCS were adjusted for different target populations.
Source: Eurostat revision: 03/17/2022; HFCS 2014; EU-SILC; Authors' calculations.

form of interest or dividend income from private insurance plans are occasionally included (Zardo Trindade and Goedemé 2020). We find remarkable differences between the two surveys for Slovakia, where EU-SILC covers only 1.9% and HFCS 45.2% of (very small) macro-economic aggregates, and Slovenia, where EU-SILC covers 71.4% and HFCS only 18.2%. On average, EU-SILC covers roughly 31 *per cent* (14.5% excluding France) of property income reported in the national accounts, whereas HFCS only covers approximately 25 *per cent* (13 *per cent* excluding France). The expectation that HFCS covers property income slightly better than EU-SILC, due to its focus on wealth-related questions, cannot be confirmed.

With few exceptions, coverage ratios for property income in HFCS and EU-SILC are significantly lower than those for other sources of income.[6] The literature identifies two common survey characteristics associated with poor coverage of income: *non-response* and *underreporting* (Vermeulen 2016). The micro-macro gap might be caused by missing (wealthy) households in the survey sample, refusal to participate in the questionnaire or underreporting across the whole target population. In the following section, we address these different reasons and propose various approaches to close the gap.

Method

Inconsistencies between the income covered by surveys and national accounts are not limited to property incomes. These disparities are typically the result of varying income definitions, underreporting, and/or undercoverage. The latter two have also been identified as reasons for the substantial underestimation of the top shares of the wealth distribution (Eckerstorfer *et al.* 2015, Vermeulen 2017). The literature has addressed these issues by proposing a variety of strategies for obtaining improved estimates that are consistent with national accounts for both income and wealth (Garbinti *et al.* 2020, Piketty *et al.* 2018). Broadly speaking, such data adjustments either scale values according to some predefined pattern, impute the available data for, say, underreporting of the top of the distribution or re-estimate variables as a whole.

We evaluate systematically all of these approaches for property income by defining scenarios and variations to cover conservative and extreme assumptions. We assess four major scenarios that differ in complexity in order to scale up the survey data to the national-accounts aggregates. These include 1) scaling survey totals to the national accounts in three variations (a-c), 2) imputing property incomes to recover the missing top, 3) imputing property income based on holdings of wealth in three variations

Table 3
Scenario Overview

Scenario	NA Upscaling	Pareto Imputation
0 Raw Data	✗	✗
1 Scaled to NA		
1a) flat relative increase	✓	✗
1b) split gap equally	✓	✗
1c) gap to Top 1%	✓	✗
2 Impute property income	✓	Property income
3 Calculate from wealth		
3a) flat rate of return (RoR)	✓	✗
3b) 3a w/imputed wealth	✓	Wealth
3c) 3b + rich lists	✓	Wealth
4 Varying rate of return		
4a) 3c + linear increasing RoR	✓	Wealth
4b) 3c + sigmoid-form RoR	✓	Wealth
4c) 3c + exponential-form RoR	✓	Wealth

Note: This table shows the various adjustment scenarios to align property incomes from survey data with national accounts.

(a-c), and 4) imputing income from wealth assuming different rates of return, again in three variations (a-c). Table 3 provides an overview of the four different adjustment mechanisms and their sub-approaches.

In Scenario 1, we scale property-income data up to the reference values from the national accounts. We use three sub-approaches:

1a) imputing a flat relative increase to the whole population, assuming that all households underreport a same specified fraction of their property income;

1b) distributing or splitting the absolute value of the missing property income equally among all observations, implying thus that lower incomes are more likely a result of underreporting (this assumption is also held in the other sub-approaches);

1c) assigning the total gap to the top 1 *per cent* of property-income receivers, assuming thereby an extreme of underreporting at the very top.

Scenario 2 is the most common approach for imputing wealth and top incomes, in which the upper tail of the distribution is assumed to follow a Pareto distribution (to correct for undercoverage at the top) and the

remaining gap after Pareto imputation is assigned to the whole distribution. The validity of the Pareto assumption for property incomes has not been tested for such incomes as thoroughly as it has for other income concepts or wealth (Davies and Shorrocks 2000, Atkinson 2017). Nevertheless, given the popularity of the Pareto technique in accounting for undercoverage at the upper tail in different contexts, this scenario could be viewed as a likely candidate for the case of capital income. Scenario 2 is typically applied in settings where overall data coverage is assumed to be acceptable, the exception being at the top of the distribution. Given that the share of property income covered by surveys is well below those of other income components, this approach may be difficult to justify. It is likely that the variable as a whole suffers from low data quality; therefore, imputing the top might yield low validity overall.

As property income in household surveys may be unreliable, Scenario 3 suggests imputing property income to households based on the underlying survey information on wealth (HFCS only). A major argument in favour of this approach is that wealth (stocks) may be easier for respondents to grasp than flows from these assets. The literature refers to irregularities of payments and the undervaluation of property income by households, which may pose additional difficulties when collecting this type of data (Fräßdorf *et al.* 2011, Smeeding and Weinberg 2001, Atkinson and Bourguignon 2000, Gottschalk and Smeeding 1997). Furthermore, the accurate measurement of household wealth using detailed information and multiple checks is a major goal of the HFCS questionnaire. This may thus be a promising approach to impute property income to households.

To generate property incomes from wealth stocks, a rate of return must be determined. We follow Andreasch and Lindner (2016) and link financial stocks to flows (property income) in national accounts to obtain interest rates. Financial assets and their respective flows are properly matched and then divided to calculate average rates of return. This is only a conservative estimate, as the literature demonstrates that wealthier households achieve higher rates of return on their asset portfolio (Piketty 2014, Fagereng *et al.* 2020, Bach *et al.* 2020). Both differential rates of return for different asset categories and wealth distribution rankings would thus be ideal. Due to a lack of such data, we take the conservative approach: we compile all financial income flows (D.41G and D.42) in accordance with our framework, and we divide these aggregate values by the respective income-generating assets. Since surveys only cover private households, we focus on the household sector (S.14) in the SNA. Stocks and flows are taken for the same time period and aligned with the HFCS reference period. Table A4 shows the results, with rates of return ranging from 0.8% for Luxembourg to 9.6% for Latvia.

Using a uniform rate of return is a conservative approach that avoids making explicit assumptions about marginal differences between households. The resulting property incomes thus form a lower bound. We enrich this imputation Scenario with different sub-approaches for the underlying household wealth variable:

3a) based on the original wealth data from the HFCS survey;

3b) adjusting the original wealth data using a Pareto estimation to impute wealth, addressing thereby undercoverage at the top;

3c) incorporating 'rich lists' (see below) to improve the Pareto estimation of the previous sub-approach.

All three sub-approaches then apply the average rates of return from national accounts to impute property incomes.

'Rich lists' for Pareto estimations, as in Scenario 3c, are often compiled by journalists for magazines (such as *Forbes*) that survey the richest individuals either in the world or in a particular country (national 'rich lists'). The undercoverage in HFCS data becomes evident when we compare the richest households in the survey with the 'poorest' observations in 'rich lists'. For example, while the HFCS 2014 reports the richest household in Austria with a net wealth of EUR43 million, the threshold to enter the national 'rich list' of the Austrian magazine *Trend* is around EUR100 million. In comparison to international 'rich lists', national compilations typically include more observations; while *Forbes* "The World's Billionaires" lists only 8 Austrians, *Trend*'s national equivalent lists 100 families. It is important to note, however, that 'rich lists' are far from perfect. The collection of data relies on many unpublished sources, the methodical approach is not fully transparent, and net wealth is sometimes only reported as within a range rather than as a precise amount. Another major conceptual issue is the inconsistency of the unit of observation, which varies between individuals, households, and families (which may consist of several households). Despite these issues, 'rich lists' are still considered to be a valuable source for calibrating Pareto estimations and excluding them would imply ignoring relevant information on the top 1 *per cent* of the distribution. The national 'rich lists' used in this article are shown in Table A3.

Finally, we relax the assumption of the average rate of return, which applies to all households regardless of their position in the distribution. Previous research points to rising rates of return along the distribution, where wealthy households at the top can accrue higher returns on their assets than poor households at the bottom. Scenario 4 therefore assumes different functional forms of these increasing rates of return:

4a) suggesting a linear increase as in Fagereng *et al.* (2020);

4b) implying a sigmoid function, featuring low rates at the bottom, a steep increase around the median, and high returns for the upper half of the distribution;

4c) replacing the assumption of 4b) with an exponential function, with a focus on the top 20 *per cent* where interest rates are highest.

These different functional forms are calibrated iteratively to match eventually the national-accounts aggregates, as in all previous scenarios.

Pareto Imputation

We use generalised Pareto curves for Pareto imputation of property-income and wealth data. We briefly introduce the general idea here, but we also refer the interested reader to the extensive work by Blanchet *et al.* (2022). Generalised Pareto curves are defined as a function of the exponential parameter, α; more precisely, the inverted Pareto coefficient is $b(p) = \frac{\alpha}{\alpha-1}$, where p is a given percentile of the distribution at hand. The major innovation here lies in the fact that $b()$ is a function that is allowed to vary in terms of p, whereas in classic Pareto imputation settings, b was assumed to be a fixed value above a certain threshold p (or x in absolute income terms). All interpolations are carried out using the R package gpinter, which uses a combination of splines interpolation and generalised Pareto curves.

In contrast to standard Pareto imputation, the use of generalised Pareto curves has several advantages particularly for the investigation of property incomes. First, generalised Pareto curves are more flexible, in their not assuming a strict power law but rather allowing the exponential parameter to vary along the distribution. This has been shown to provide much better fits than fitting a distribution with one fixed parameter (Blanchet *et al.* 2022). Second, our data include micro-data observations from the HFCS, as well as additional imputations for the top 1 *per cent* in some scenarios. This leaves us with a mixed dataset of micro-economic observations and one aggregated percentile. By using generalised Pareto curve interpolation, we can reproduce a continuous density for the full (property) income distribution, allowing us to calculate easily various moments of the distribution.

Results

We analyse the distributional differences of filling the micro-macro gap using HFCS data based on the analysis of property-income coverage of the EU-SILC and HFCS, as well as using our ex-ante defined scenarios. While the

average coverage rate of the EU-SILC has been slightly higher than that of the HFCS (14.5% versus 12.9%, respectively, excluding France as a high leverage observation), imputing property income via wealth is only feasible for HFCS because EU-SILC lacks wealth information.

To analyse the distributional implications of the subjective decision to scale property-income data up to national-accounts aggregates, we use the "big four" Eurozone countries included in the HFCS – Germany, Italy, France, and Spain – to illustrate our imputation scenarios. Results for all other countries are available in the Appendix and are highlighted here below only if they contribute to a distinctive pattern not found in the main analysis.

Table 4
Inequality of property income, gross total income, and net wealth in HFCS 2014

	Property Income			**Gross Total Income**			**Net Wealth**
	Gini	Top 10%	Top 1%	Gini	Top 10%	Top 1%	Gini
Austria	0.93	0.89	0.57	0.48	0.32	0.07	0.73
Belgium	0.80	0.67	0.24	0.51	0.33	0.08	0.59
Cyprus	0.97	1.00	0.60	0.54	0.36	0.08	0.72
Germany	0.94	0.90	0.49	0.56	0.40	0.11	0.76
Estonia	0.99	1.00	0.84	0.60	0.41	0.11	0.69
Spain	0.96	0.95	0.58	0.55	0.38	0.10	0.67
Finland	0.96	0.95	0.64	0.51	0.34	0.08	0.65
France	0.87	0.79	0.39	0.51	0.35	0.09	0.68
Greece	0.98	1.00	0.66	0.50	0.32	0.06	0.60
Hungary	0.88	0.83	0.35	0.55	0.38	0.09	0.64
Ireland	0.98	1.00	0.75	0.55	0.37	0.09	0.75
Italy	0.85	0.75	0.32	0.53	0.36	0.08	0.60
Luxembourg	0.95	0.94	0.53	0.54	0.37	0.09	0.65
Latvia	0.98	0.99	0.72	0.62	0.45	0.15	0.78
Malta	0.87	0.80	0.29	0.52	0.34	0.06	0.57
Netherlands	0.92	0.87	0.37	0.48	0.30	0.05	0.70
Poland	0.98	1.00	0.71	0.51	0.33	0.07	0.59
Portugal	0.92	0.86	0.49	0.56	0.39	0.10	0.68
Slovenia	0.98	1.00	0.70	0.55	0.37	0.09	0.63
Slovakia	0.99	0.99	0.88	0.52	0.34	0.08	0.49

Source: HFCS 2014; Authors' calculations.

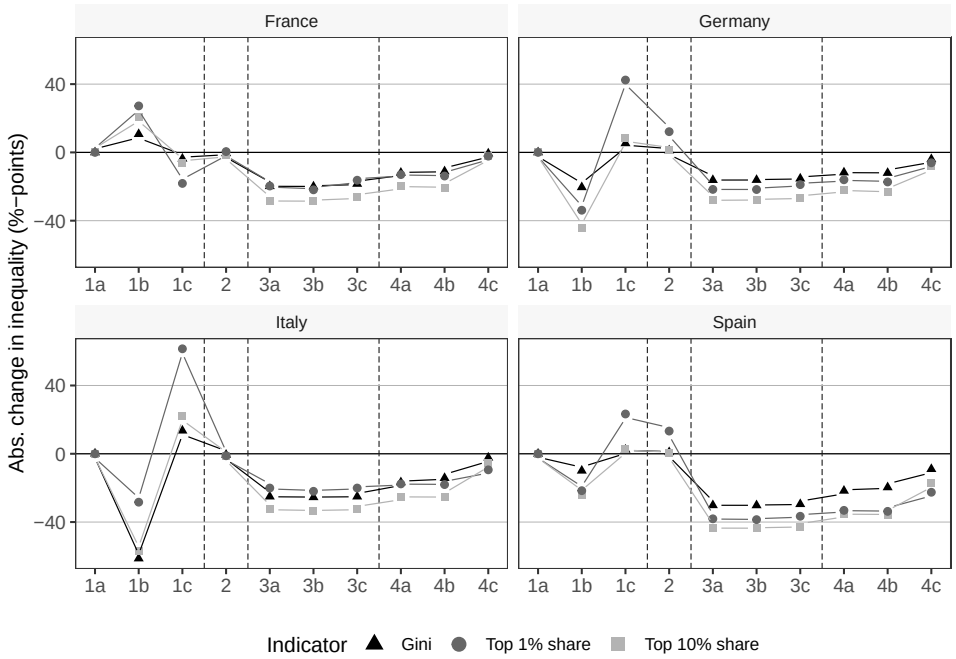
We begin by evaluating the income distribution in the raw survey data (Scenario 0). Table 4 displays inequality measures for adjusted HFCS data that correspond to national-accounting conventions in terms of definition, population size, and coverage for all available countries. This table provides the baseline measures for the four scaling scenarios carried out in the remainder of this article. We find that property income is much more

unequally distributed than gross total household income in all countries. Some Gini values almost double, as in Greece (where the Gini amounts to 0.98 for property income and 0.5 for total income), Slovakia or Austria. Overall, Gini values for property income range between 0.8 (Belgium) and more than 0.99 (Estonia, Slovakia) and are therefore substantially higher than total-income values.

In addition to the Gini index, we provide top income shares specifically to highlight distributional changes at the upper tail of the distribution. In the HFCS survey, the income share of the top 10 *per cent* approaches 100 *per cent* for some countries, for example, Cyprus, Estonia, Greece, Ireland, Poland, and Slovenia. This extent of inequality is particularly remarkable, as other income components typically feature much lower top shares. A similar picture can be drawn for the property-income shares of the top 1 *per cent*. These amount to approximately 88 *per cent* in the case of Slovakia and more than 70 *per cent* in Estonia, Ireland, Latvia, Poland, and Slovenia. Belgium has a much lower income share of 24 *per cent*, which is still very high when compared to the respective value for total income. The extreme concentration of property income at the top has a decisive impact on the following scenario analyses, in which we allocate the gap between the survey and national accounts to households. Note that closing the micro-macro gap may necessitate scaling down for countries with survey coverage rates greater than 100 *per cent*, as is the case for France in our data.

Figure 1 depicts the deviations in inequality measures across all scenarios for property incomes in the four selected countries. The results for the entire sample of countries are provided in Figure A1. Scenario 1a features a relative scaling of the original data up to national-accounts aggregates, mirroring the inequality measures of the baseline scenario. Scenario 1b equally distributes the micro-macro gap to all households in absolute terms. This approach significantly decreases inequality measures compared to the baseline, since households at the lower end of the distribution receive a relatively large share of property income. For example, we find a remarkable drop in the Gini coefficient for Italy of roughly 60 index points, whereas there was a smaller decrease for Germany and Spain. Scenario 1b has the most equalizing effect on the distribution of all of our scenarios. As previously mentioned, France is a special case, where this scenario results in a higher Gini due to the involved downscaling. Due to the strong distributional assumptions involved, Scenario 1b appears to be rather inadequate in explaining the micro-macro gap. In contrast, Scenario 1c allocates the whole gap to the top 1 *per cent* and may be justified by differential non-response at the top. Consequently, the income shares of the top 1 *per cent* increase substantially, except when coverage rates exceed 100 *per cent* and the top 1 *per cent* absorbs all downscaling (for France).

Figure 1
Changes in property-income inequality



Note: This figure shows the absolute changes in inequality indicators for property incomes in the 10 different Scenario approaches as compared to a baseline, Scenario 0.

In Scenario 2, we apply Pareto imputation directly to the survey property-income data while closing the micro-macro gap as described above.[7] The inequality measures for Scenario 2 are very similar to the baseline Scenario and the relative upscaling in Scenario 1a, indicating that our Pareto imputation does not increase the income concentration at the top in general. It is worth noting again, however, that the inequality of property income is already very high in the baseline scenario. This finding as well as a closer examination of the underlying data suggest that the original property-income variable from the survey and its distribution are a poor starting point for Pareto estimation. Therefore, we examine wealth-based approaches that calculate property incomes using information on private household wealth from the HFCS survey.

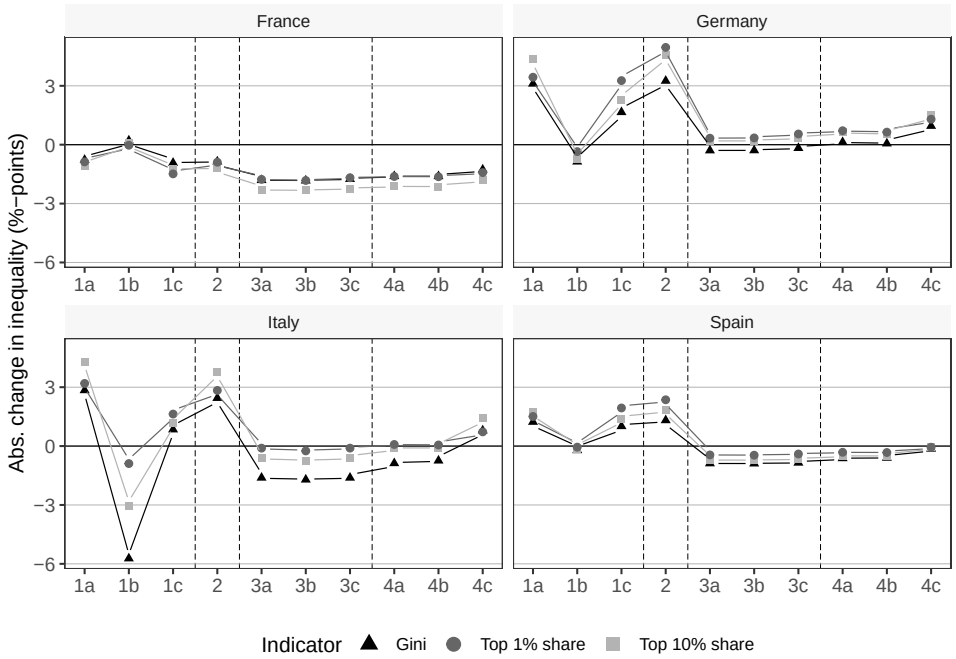
Scenario 3 provides various alternatives to this wealth-based approach. In sub-approach 3a, we apply a flat rate of return on the raw wealth data; in sub-approach 3b, we add complexity by 'correcting' these raw data using a Pareto estimation to impute wealth; and in sub-approach 3c we enrich this new data with information from 'rich lists'. Figure 1 shows that the wealth-based approaches of Scenario 3 result in lower property-income

inequality than the baseline scenario. This is because the distribution of assets is more equal than the distribution of property income (see also Table 4). Subsequently, property income imputed from wealth mirrors this lower inequality. Particularly when assuming a flat rate of return from the national accounts (as in sub-approach 3a), the inequality measures are substantially reduced. Interestingly, while the application of Pareto imputation (as in sub-approach 3b) has little effect on the results in sub-approach 3a, including 'rich lists' in the wealth-based Pareto estimation (as is done in sub-approach 3c) results in slightly higher income inequality for all countries in the sample.

Based on the last approach of Scenario 3, 3c, we now assume different functional forms for the rate of return. In all three sub-approaches of Scenario 4, we deviate from the assumption of a flat rate of return and assume increasing returns over the distribution. Our results show that these play a significant role for the top shares. The most conservative approach of this scenario, 4a (linearly increasing rate of return) reduces inequality substantially compared to the baseline and the three approaches of Scenario 3. Swapping the linear function with a sigmoid function (strong increase around median) does not change these results much. This is not unexpected, since the asset distribution is strongly skewed, and changes in the rate of return around the median do not generate large volumes of income. Notably, the Pareto imputation with an exponential increase in the rate of return on wealth (as applied in sub-approach 4c) strongly shifts the Gini upwards for all countries, bringing inequality levels back to those seen in the baseline scenario. Only for the case of Belgium do we find an increase of inequality measures for sub-approach 4c, which seems to be linked to the low overall property-income inequality in the raw survey data combined with a low average rate of return, around 2 *per cent* (see Figure A1).

After analysing the effects of closing the micro-macro gap along these scenarios for the property-income variable, we now evaluate the changes in the distribution of total household income. We replace the property-income component in total income with the adjusted values from our four scenarios and observe changes in the overall inequality measures shown in Figure 2. While a relative scaling of property income up to national-accounts aggregates (as in sub-approach 1a) results in no change in property-income inequality measures, it does affect total income. An increase in the share of the less equally distributed property income in total income increases inequality. For instance, the Gini coefficient for total income rises by more than three index points in Germany, whereas the income share of the top 1 *per cent* climbs three percentage points in Italy. Again, downscaling in France, due to overcoverage of property income in the survey data, results in decreasing inequality measures.

Figure 2
Changes in gross total income inequality



Note: This figure shows the absolute changes in inequality indicators for property incomes in the 10 different Scenario approaches as compared to a baseline, Scenario 0.

While applying Pareto estimation on property income in Scenario 2 had hardly any distributional effects on property income itself, it does increase total income inequality. These effects are very similar to those of Scenario 1a. Interestingly, wealth-based approaches seem to have almost no impact on total income inequality in Germany. In France and Spain, these scenarios lead to an equalizing effect in the total income distribution. Looking at results for the whole country sample in Figure A2, we observe very similar patterns for Italy, Austria, and to a certain degree, Germany, while other countries like the Netherlands, Luxembourg, and Slovenia show less pronounced distributional effects. Overall, wealth-based approaches to close the micro-macro gap in property income mainly result in lower inequality measures for total household income.

Conclusion

A comparison of household-surveys and national-accounts data on property income reveals a considerable micro-macro gap for most Eurozone countries (with the exception of France). The reasons for this mismatch are manifold,

and there are numerous ways to approach this issue. In this article, we study four scenarios that address the adjustment of micro data to correspond to national accounts. Depending on the method used to close the micro-macro gap, we analyse the differences in income inequality measures and compared them to the raw data of the HFCS.

We demonstrate the distributional consequences of extreme approaches, such as allocating the gap equally to every household or to only the top 1 *per cent*. In other scenarios, we fully impute property income by applying rates of return on household assets. As an extension of these wealth-based approaches, we build on Pareto estimation to account for the well-documented lack of affluent households in survey data. As net wealth is more evenly distributed than property income, wealth-based approaches reduce the inequality measures for both property and total income. The inequality measures under consideration are barely affected by the Pareto estimation, even when national 'rich lists' are included. Depending on the specific functional form of the rate of return (flat, linear or exponential increase), the top shares come close to the respective values in the raw micro data.

Although our results do not indicate a clear-cut superior scenario, some conclusions can be drawn from our analysis. First, since underreporting is more concentrated at the top, Scenario 1c seems more likely than Scenario 1b, but it also reaches the extreme, upper bound for unobserved inequality. Second, estimations of property income based on wealth data might be significantly driven by the effective oversampling strategies in the survey design. For surveys that are unable to capture fully the top tail of the wealth distribution, we suggest incorporating all available information on the wealthiest households (as in sub-approach 3c. Despite the varieties of approaches within Scenario 3, the assumption of constant yields results in conservative estimates (as in sub-approach 3a). Third, some scholars suggest that rates of return rise disproportionately with wealth, but the approximate functional relationship between wealth and returns remains vague and requires further research. Therefore, Scenario 4 provides a range of estimates and resulted in no clear preference for a specific sub-approach.

Researchers studying income inequality should be aware of the potential of significant undercoverage (overcoverage) of certain income components in total household income data. There are several feasible approaches for adjusting for this micro-macro gap, and the necessity for adjustment increases with the size of the gap. These approaches, however, have markedly different effects on inequality measures. Researchers should thus bear in mind the distributional implications associated with their specific choice of data-imputation methods and back up their results with supplementary information.

Appendix

Table A1
Survey design, HFCS 2014

	Property income coverage (%)	Response rate[1] (%)	Oversampling[2]	Income period[3]	Wealth period[3]	Register data[4]	Compulsory participation[1]
Austria	15.0	50	no	2013	2014		
Belgium	23.0	30		2013	2014		
Cyprus	17.9	60		2013	2014		
Estonia	39.3	64		2012	2013		
Finland	73.4	64		2013	2013	yes	
France	182.0	65		2014	2014	yes	yes
Germany	9.1	19		2013	2014		
Greece	3.2	41		2014	2014		
Hungary	30.6	39		2014	2014		
Italy	5.4	43	no	2014	2014		
Luxemburg	59.7	23		2013	2014		
Latvia	43.8	53		2013	2014		
Netherlands	41.6	32	no	2013	2013		
Poland	7.8	54		2013	2014		
Portugal	20.3	85		2012	2013		yes
Slovenia	20.3	41		2013	2014		
Slovakia	164.4	53		2013	2014		
Spain	37.5	32		2010	2012		

Note: The reference time of assessment of the respective income or wealth had to be fixed to a concrete year date. In ambiguous cases, the decision was based on the length of a period within one year; *e.g.*, if the fieldwork on assets and liabilities was executed from June 2014 to February 2015, we expect that more cases can be attributed to 2014 because the survey covered more months in 2014 than in 2015 (7 vs. 2 months), and we fix the data year as 2014.

Source: Eurosystem Household Finance and Consumption Network (2016a)[1]: Table 5.1[2], Table 4.6[3], Table 9.1[4], Table 3.3; Authors' calculations

Table A2
Population: Deviation between SNA, EU-SILC, and HFCS

	Eurostat	**SILC**	**HFCS**
	Individuals	(% of Eurostat)	(% of Eurostat)
Austria	8,479,823	96.7	97.4
Belgium	11,159,407	98.7	99.9
Cyprus	861,939	99.1	97.1
Estonia	1,322,696	100.4	97.3
Finland	5,438,972	98.7	98.7
France	66,312,067	89.1	97.1
Germany	80,645,605	99.2	99.3
Greece	10,892,413	98.4	98.6
Hungary	9,866,468	98.3	98.3
Italy	60,789,140	100.1	100.0
Latvia	2,012,647	98.1	98.1
Luxembourg	543,360	93.4	93.5
Netherlands	16,804,432	99.2	98.7
Poland	38,040,196	99.4	100.1
Portugal	10,514,844	99.7	99.7
Slovakia	5,413,393	96.4	96.4
Slovenia	2,059,953	97.5	100.1
Spain	46,576,897	99.3	98.7

Sources: Eurostat revision: 17/03/2022; HFCS: 2014; EU-SILC; Authors' calculations

Table A3
National 'Rich Lists'

Country	Source	Reference Year
Austria	*Trend*	2014
Belgium	—	2016
Cyprus	—	—
Germany	*Manager Magazin*	2014
Estonia	http://top.wpmurdk.mbp.ee	2013
Spain	http://www.forbes.es www.elmundo.es	2013
Finland	iltasanomat.fi	2011
France	www.challenges.fr	2014
Greece	—	—
Hungary	www.penzcentrum.hu	2014
Ireland	www.independent.ie	2014
Italy	research.omicsgroup.org *Forbes* 2013	—
Latvia	—	—
Netherlands	www.quotenet.nl	2013
Poland	www.forbes.pl	2014
Portugal	economiapt.com	2014
Slovenia	www.politikis.si www.vzmd.si www.finance.si	2015
Slovakia	www.aktuality.sk www.pluska.sk	2014

Note: The reference year marks the nearest available national 'rich list' with a maximum tolerance of 2 years.
Source: Authors' compilation

Table A4
Financial and Real Assets
Liabilities and Financial Income in National Accounts, 2014

	Financial Assets (EUR *Bn.*)	Financial Income (EUR *Bn.*)	Rate of Return (%)
Austria	445.60	21.64	4.9
Belgium	942.19	19.00	2.0
Cyprus	40.36	1.02	2.5
Germany	3725.46	253.07	6.8
Estonia	21.18	0.62	2.9
Spain	1522.86	26.73	1.8
Finland	241.58	6.26	2.6
France	4017.63	42.70	1.1
Greece	231.20	7.16	3.1
Hungary	75.92	3.00	3.9
Italy	3148.20	157.32	5.0
Luxembourg	61.35	0.51	0.8
Latvia	9.62	0.92	9.6
Netherlands	893.66	20.37	2.3
Poland	250.87	10.19	4.1
Portugal	274.84	13.25	4.8
Slovenia	27.94	0.50	1.8
Slovakia	60.77	1.29	2.1

Note: The reported values correspond to the country-specific reference year of the HFCS, as shown in Table A1. We denote D.41G and D.42 as financial income, while we take transferable deposits (F.22) + Other deposits (F.29) + Short-term debt securities (F.31) + Long-term debt securities (F.32) + Listed shares (F.511) + Unlisted shares (F.512) + Investment fund shares (F.52) + Life insurance and annuity entitlements (F.62) + Pension entitlements (F.63) + Financial derivatives and employee stock options (F.7) + Other accounts receivable / payable (F.8) as comparable financial wealth, which is in line with Andreasch and Lindner (2016).
Source: Eurostat revision: Assets: 11/02/2022; Income: 17/03/2022; HFCS: 2014; EU SILC; Authors' calculations.

Figure A1
Changes in property-income inequality

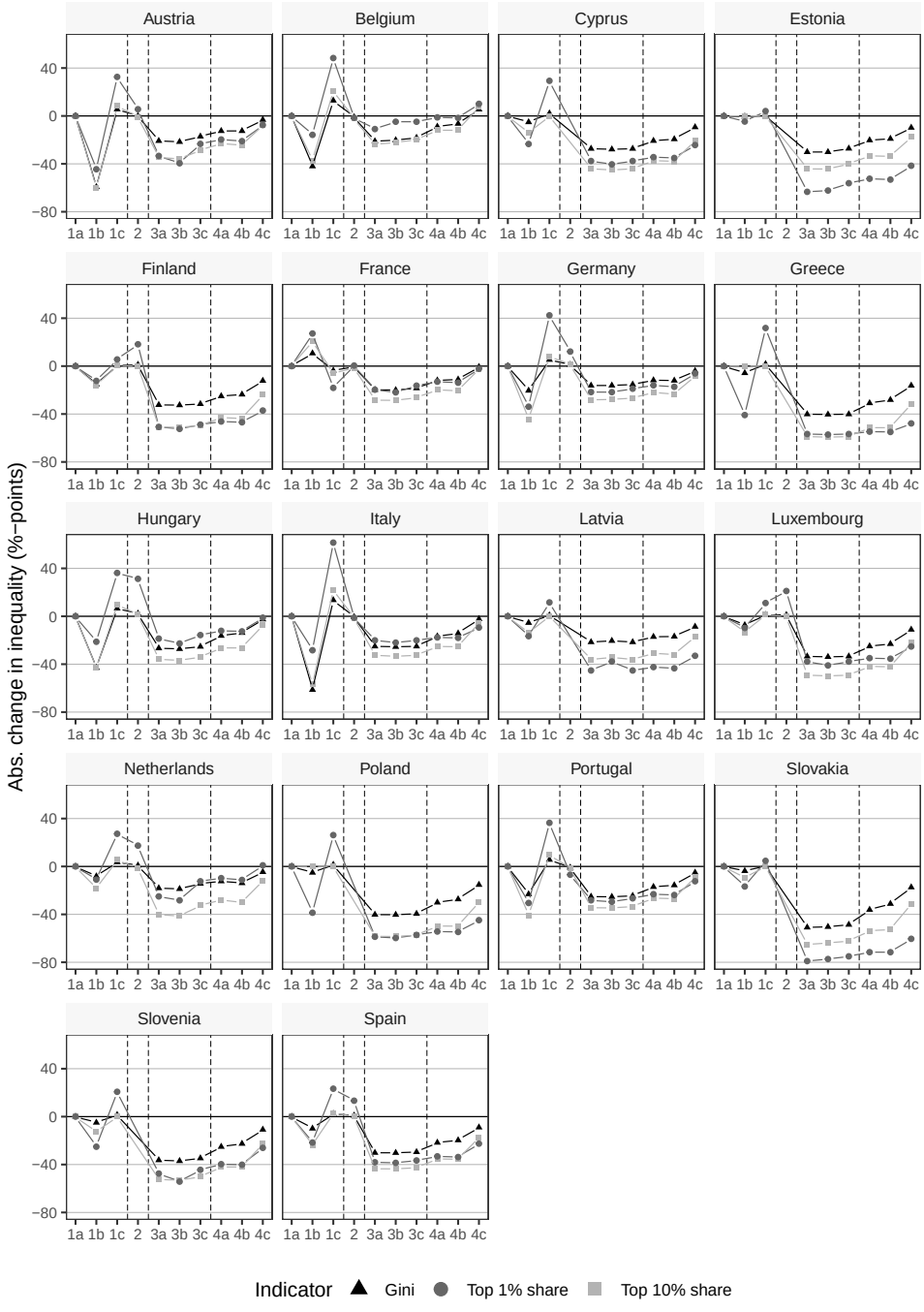
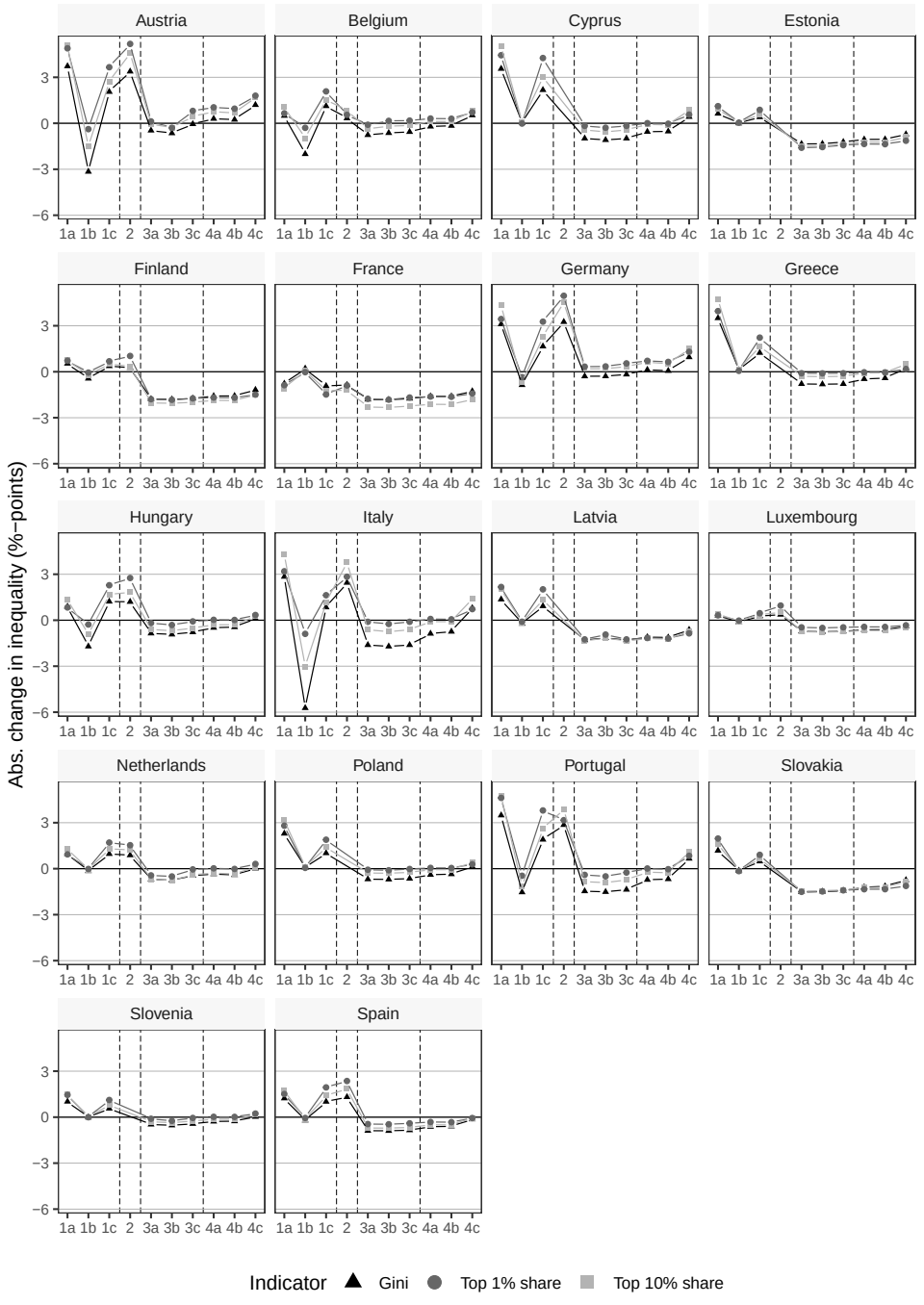


Figure A2
Changes in gross total income inequality



Notes

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[2] Within the SNA framework, D.41 also includes FISIM. FISIM aims to account for indirect service charges levied by financial institutions on deposits that eventually decrease the effective rate of interest. The idea is that without banks retaining a fraction of the interest for their services, the income from interest would be higher (Lequiller and Blades 2014). Surveys typically observe effective interest income from bank deposits and related financial products, so we consider only D.41G, which excludes the FISIM component.

[3] Reinvested earnings on foreign direct investment describes a type of property income that arises in a foreign (un-)incorporated enterprise.

[4] "Rent is the income receivable by the owner of a natural resource (the lessor or landlord) for putting the natural resource at the disposal of another institutional unit (a lessee or tenant) for use of the natural resource in production. The terms under which rent on land is payable is expressed in a resource lease. A resource lease is an agreement whereby the legal owner of a natural resource that has an infinite life makes it available to a lessee in return for a regular payment recorded as property income and described as rent." Statistical Commission 2008, p. 7-28

[5] Table A1 provides an overview of the HFCS 2014 fieldwork details, including the reference year for the income data. The EU-SILC reference period for income refers to a calendar year.

[6] Coverage shares for income from employment and self-employment can be provided by the authors upon request.

[7] Due to the fact that we present results only for countries with valid α-parameters, some data points are missing in Figure A1, such as those for Poland, Slovenia, and Slovakia.

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