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Multidimensional Wealth Inequality: A Hybrid Approach toward Distributional National Accounts in Europe

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Abstract

Distributional National Accounts (DINA) link macroeconomic aggregates with distributional information enabling a better understanding of distributional implications of macroeconomic developments and facilitate cross-country comparisons of inequality. This article proposes a practically feasible framework to allocate components of wealth to different sections of society and serves two functions: a comprehensive measure of net worth and its distribution, and a link to macroeconomic statistics. The article compiles DINA by breaking down twelve components of marketable wealth by wealth and income groups, as well as three major functions of wealth for Austria, Finland, France, Germany and Spain. The three functions of wealth considered are *(i)* precautionary saving, *(ii)* own use of housing assets and *(iii)* income generation via the ownership of businesses or landlordship. The resulting multidimensional wealth distributions reveal large heterogeneity in inequality and help understand (institutional) differences across countries and time. Results are top-tail adjusted using Pareto and Generalized Pareto models, and combining survey data (HFCS) with rich lists, or top wealth shares derived from tax data and leaked information on wealth held in offshore tax havens.

Keywords: Distributional National Accounts (DINA); Wealth Distribution; Micro-macro linkage; HFCS; Top Tail Adjustment

JEL codes: D31, D91, E01, R31

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Data visualization and computations are carried out with `R` (R Core Team, 2017) and `plotly` for `R`.

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1 Introduction

In the middle of the twentieth century it came to be believed that *a rising tide lifts all boats*, meaning that economic growth would eventually benefit all sections of society by increased wealth and higher living standards (Stiglitz, 2016; Hines Jr et al., 2001). The saying was made famous by a speech held by US president John F. Kennedy in 1963 legitimating public investments into a dam project:[1] “These projects produce wealth, they bring industry, they bring jobs, and the wealth they bring brings wealth to other sections of the United States. [...] As the income of Michigan rises, so does the income of the United States. A rising tide lifts all the boats [...].” This belief, as Stiglitz (2016) further argues, evolved into the specific idea of ‘trickle-down economics’ that advocates policies favouring the rich as resources given to the top are believed to trickle down to the rest of society eventually and thus everyone benefits from economic growth.[2]

While the post-war period was characterized by rising equality of incomes and wealth, we do observe the opposite trend today (see Piketty, 2013). Stiglitz (2016) concludes that “the rising tide has only lifted the large yachts, and many of the smaller boats have been left dashed on the rocks.” Hines Jr et al. (2001) come to the conclusion that the gains from economic growth benefit the disadvantaged at least as much as the advantaged, but that the costs associated with an economic downturn are disproportionally born by the disadvantaged.

The other way round, inequality also affects the potential of economic growth: the macroeconomic wealth effect links permanent changes in households’ wealth (directly or indirectly via a credit channel) to consumption (Lettau and Ludvigson, 2004). An unequal distribution of wealth (and thus also unequal access to credit) potentially leads to differential magnitudes of the wealth effect across sections of society (Arrondel et al., 2015, find a decreasing wealth effect when moving up the distribution in France). Several studies have found differences in the marginal propensity to consume out of a one-time income shock across the wealth distribution where low-wealth household tend to consume a much larger share than high-wealth households (see Carroll et al., 2017, for further references). For instance, the distribution of the assets, which experiences a price shock, thus effects that transmission of the macroeconomic shock across the economy. The OECD reports the harmfulness of income inequality on long-term growth as in high-income countries people in disadvantaged households struggle to access quality education implying large amounts of wasted potential and lower social mobility. It is also pointed out that high wealth inequality limits members of the lower middle class to invest (among others) in human capital, which can weaken potential growth (OECD, 2015).

Thus, macroeconomic developments and inequality need to be studied and monitored simultaneously. For that endeavour, suitable distributional data in-line with macro-aggregates are needed. Such statistics are compiled in this article. Distributional data should not stand alone but should rather be linked to the single most important framework to monitor macroeconomic developments: the System of National Accounts. Linkage ensures that economic growth and inequality are seen as two sides of the same coin, and supports a better understanding of the existence and mechanisms of ‘trickling effects’ as well as the design and monitoring of macroeconomic policies. DINA can be used to calibrate macroeconomic models with heterogeneous

[1]Speech by John F. Kennedy on October 3, 1963: “Remarks in Heber Springs, Arkansas, at the Dedication of Grers Ferry Dam.” The American Presidency Project: `http://www.presidency.ucsb.edu/ws/index.php?pid=9455` retrieved June 25, 2018.

[2]The ‘rising tide hypothesis’, however, would be equally in-line with a ‘trickle-up’ theory (giving more resources to the poorest members of society and eventually everyone will benefit) and a ‘build-out form the middle’ approach, where primarily the middle class is supported and ‘trickling effects’ in both directions will ensure that all benefit.

agents. The alignment with the NA is crucial for many such applications.

Thus, what is needed are *Distributional National Accounts* (DINA), that break down (components) of income, consumption and wealth as recorded in the National Accounts (NA) for different sections of society. DINA thus establish a link between macroeconomic aggregates, and different sections of society.

Wealth may be broken down by income and wealth groups, but ideally also groups formed by demographic characteristics such as urban versus rural residents and household composition. Following Fessler and Schürz (2017), a break-down by different functions of wealth (renters, owners and capitalists) would ease the interpretation of inequality. Break-downs by other socio-economic characteristics like occupation or education would follow the tradition of social tables (for income) that are often used to assess inequalities throughout history (see for instance Milanovic et al., 2011).

The idea of DINA is an old one. Piketty (2003) revived the work pioneered by Kuznets (1955), who combined tabulated income data with national income series. Piketty's work for France was extended to the US (Piketty and Saez, 2003) and the UK (Atkinson, 2005). The focus was to measure to income shares over time. This interest has led to the creation of *The World Top Incomes Database* (WTID), which was later transformed into the *WID.world* (Alvaredo et al., 2017) database with an extended focus on income and wealth.

This stream of literature further developed into measuring the entire distirbution in a consistent way with the national accounts. Garbinti et al. (2018) compile DINA for national income in France spanning the period 1900 to 2014. Fixler and Johnson (2014) and Fixler et al. (2017) compile such break-downs for the US. Kennickell (2019) shows how to use the *US Survey of Consumer Finances (SCF)* for the same purpose.

Institutional effort in the form of international working groups has been initiated by the OECD, Eurostat (the EU's statistical institute) and the ECB. The joint OECD-Eurostat *Expert Group on Measuring Disparities in a National Accounts Framework* focuses on distributional indicators for income and consumption (see Zwijnenburg et al., 2017), while the Eurosystem *Expert Group on Linking Macro and Micro Data for the Household Sector* (EG-LMM) works on linking micro data obtained from the *Household Finance and Consumption Survey* (HFCS) with macro data from the financial/national accounts to derive DINA for wealth (see EG-LMM, 2017).

There are recent attempts to compile the joint distribution of the major macro-economic variables income, consumption and wealth – sometimes referred to as the "3D" (see for instance Jäntti et al., 2015; Johnson et al., 2018). The motivation for the 3D approach and multidimensional DINA are similar, namely a more holistic view on households' characteristics and well-being. The 3D (or, whenever leaving out one of the variables, the 2D) approach usually focuses on the distribution of total income, total consumption and net worth, and analyses relationships between them. DINA rather looks at components (of income, wealth or consumption), relates them to the most important macro-economic framework, and thus enable monitoring macro-economic developments from a distributional point of view and a better understanding of underlying mechanisms. The multidimensional approach in this article is an attempt to merge these concepts and take a step towards "DINA in 3D."

While research for income is well developed, less work has been done for wealth. This article aims to fill this gap: it provides an overview regarding concepts and definitions, and discusses micro data sources suitable for distributional break-downs. A particular focus is the measurement of housing wealth in surveys and the NA, and the top tail of the wealth distribution, which contributes heavily to total wealth.

The focus is Europe and forward-looking: how can DINA be gradually incorporated into the framework of regularly compiled official statistics and how can this be done in a as harmonized way as possible across countries?

I propose a hybrid approach that takes into account that a complete integration of distributional data into the framework of NA is currently infeasible as finer break-ups and more harmonization between macro and micro data would be needed. Hybrid DINA consist of two parts: the *integrated account* contains variables on the balance sheet that can directly be linked with micro data providing the distributional structure. The *supplement account* adds further variables necessary to obtain a comprehensive measure of total wealth but that are currently not linkable. Changes in the way micro data is collected and finer break-downs of national accounts will gradually enable a re-allocation of variables from the supplement account to the integrated account. Consumer durables such as vehicles fall outside the scope of NA but are important for a comprehensive measurement of wealth. Such variables will thus always remain in the supplement account.

The hybrid approach enables the compilation of DINA at an early point in time as full integration (which is currently not feasible in many countries) is not a prerequisite but can be achieved over time. At the same time, the approach guarantees that distributional data still provides a comprehensive picture of all components of net worth. Thus, from the very beginning onward DINA serve two functions: first, DINA establish a link between aggregate macroeconomic indicators and the system of measuring macroeconomic activity, the NA. The linkage enables an understanding of the allocation of gains and costs associated with macroeconomic trends and, vice versa, monitoring the influence of inequality on the wider economy. Second, DINA constitute by themselves a comprehensive measure of wealth inequality (and similarly for income and consumption inequality), which thus needs to cover all relevant components of wealth.

I use the HFCS as the main source of micro data. Additionally, I make use of rich lists reporting the names and net worth of the wealthiest individuals and families in a country, and data on top wealth shares compiled from tax data and obtained from the WID.world database (Alvaredo et al., 2017) to adjust for the insufficient representation of the top tail in surveys. I apply a standard Pareto top tail adjustment and provide novel robustness checks relying on a Generalized Pareto model. The missing top tail leads to lower HFCS aggregates in all components of wealth.

I compile detailed hybrid DINA for five European countries (Austria, Finland, France, Germany and Spain) for one year by merging top-tail-adjusted HFCS with national accounts data. The importance of the top-tail adjustment correlates strongly with the quality of the strategy applied in the respective countries to oversample wealthy households. Most components of financial wealth are fully integrated into the national accounts, a pseudo-link is established for housing wealth, and remaining asset classes are captured in a supplement account. I compile break-downs for groups formed by gross household income, household wealth, and the three major functions of wealth described by Fessler and Schürz (2017).

Wealth inequality is largest in Austria and Germany, and lowest in Spain and Finland. France consistently lies in between. Productive assets are predominantly concentrated at the top end of the wealth and income distribution. In Austria and Germany, the wealthiest 20% possess roughly 97% of total business wealth. Only the wealthiest 20% possess large enough amounts of funds and stocks to experience significant shifts in wealth triggered by stock price shocks.

Owner-occupied housing is less unequally distributed, thus large sections of society experience an increase in wealth following a housing market boom. Vice versa, a large proportion of households are affected by drops in house prices. However, only the small groups of capitalists potentially experience both a direct increase in wealth *and* in income due to rising rents. Renters possess hardly any financial assets other than deposits and are often found in the lower half of the income and wealth distribution. Thus, housing market booms potentially redistribute income from the financially rather vulnerable group of renters to the small group of capitalists.

Capitalists are not only overall wealthier than owners and renters, but indeed outperform other types of households in every single asset category: they have more liquid assets, more productive assets but also more valuable vehicles and homes, and more valuables.

Distributional data integrated into the system of national accounts is a missing piece of information, and the detailed information in DINA thus enables a large variety of analyses and modelling, and close monitoring of the inter-linkages of inequality and macroeconomic developments.

The remainder of this article is organised as follows: section 2 proposes the hybrid approach, and discusses micro and macro data and how to link them. The section also describes the groups for which aggregate values are broken down. Issues related to the insufficient representation of the top tail are discussed in subsection 2.5 and a top tail adjustment is performed. Thereafter, section 3 describes the compilation of the hybrid DINA and presents quantitative results. Finally, section 4 concludes. A comprehensive appendix complements the article by providing the full set of numerical results, further background information and mathematical derivations.

2 Distributional National Accounts

2.1 Macroeconomic Statistics: More Than Mere Numbers

The National Accounts constitute the most important and longest established framework measuring macroeconomic developments. They report economic activities within and across economic sectors – households, businesses, the government and the rest-of-the world. They measure the flow of gains from economic activity to the respective sectors taking into account taxes and transfers, and highlight how these gains are distributed to consumption, savings and investment.

The *System of National Accounts* (SNA) constitutes a harmonized standard for national accounting.[3] Although countries generally follow the standard, it is not legally binding and deviations do occur. In contrast, the *European System of National and Regional Accounts* (ESA, 2010), which also follows the SNA but provides more details, is legally binding for EU member states.

However, the NA and its most important output – *Gross Domestic Product* (GDP) – have also been criticised for following too narrow and partly out-dated concepts (see for instance Coyle, 2017). Points of critique include the treatment of natural resources/environmental externalities (e.g., the loss in biodiversity), the omission of home production, the representation of free online services and open-source software as well as other issues related to digitalization, and the general question whether a measure of economic activity is appropriate or whether more direct measures of well-being should be targeted (see Hamilton and Hepburn, 2017).

Regarding the latter issue, GDP growth may be a misleading indicator as it may not benefit all residents equally. In fact, since all these measures are macro-aggregates, it may well be the case that GDP growth is distributed very unequally among different sections of society. It is also not clear whether 'winners' and 'losers' change over time or whether these groups stay rather

[3]The most recent 2008 SNA standard is the outcome of joint initiative between the *United Nations*, the *European Commission*, the *OECD*, the *International Monetary Fund* and the *World Bank Group*.

the same. More transparency regarding the effect of growth on inequality is likely to affect the interpretation and perception of macroeconomic indicators.

Coyle (2017), who elaborates on the *Political Economy of National Statistics*, argues that statistics are not 'neutral', but they feed back into our way of thinking: "statistics [...] help shape the reality, as much as reality determines which statistics are defined and collected" (page 22). Mügge (2016) conceptualizes macroeconomic indicators as "powerful ideas" and states that "[they] are political in both their origins – the choices for or against particular formulas to calculate them – and in their consequences – their use in public policy and the debates surrounding it." Consequently, "indicators specify what counts, for example, growth" and "[w]hen policy-makers and citizens accept these particular construction of macroeconomic concepts, the ideas that inform them solidify power relations by legitimizing some course of action and delegitimizing others." Finally, citizens will use these indicators as yardsticks to gauge whether policies, and subsequently politicians, are serving them well. Consequently, if inequality should matter, it needs to be included into the menu of official statistics and communicated as prominently as other macro-economic indicators.

The discussion about the adequacy of currently measured indicators has been boosted by the *Commission on the Measurement of Economic Performance and Social Progress* headed by Joseph Stiglitz, Amartya Sen and Jean-Paul Fitoussi (also known as the *Stiglitz-Sen-Fitoussi commission*; see Stiglitz et al., 2010), which was created in 2008 on the initiative by the French government aiming to assess the limits of GDP as an indicator of economic performance and social progress, and investigate which additional information and indicators would be needed. They point in the same direction when stating that "what we measure shapes what we collectively strive to pursue – and what we pursue determines what we measure."

The commission lists a number of recommendations how to change current measurement practises. Recommendation 4 states that more prominence should be given to the *distribution* of income, consumption and wealth that should be reported next to average (or aggregate) numbers. They also stress that these dimensions should be linked to each other.

2.2 Integration versus Dashboard Approach

Integrating distributional information into the existing system of macroeconomic indicators is crucial if distributional statistics should be considered and discussed as prominently and broadly as other macroeconomic indicators. For this purpose, linking macro data as reported in the NA with distributive information stemming from micro data is essential. The result is called DINA: *Distributional National Accounts.*

Due to the harmonization of the NA across countries, the integration of distributional data into this system will thus also lead to comparable statistics on inequality enabling multi-country analyses and cross-country comparisons.

The term DINA suggests that NAs should be taken as they currently are and simply enriched by distributional break-downs. Such distributional break-downs can be compiled from survey data, and/or administrative and register data.

Table 1: Hybrid DINA.

	Integrated Account			**Supplement Account**			**Net worth**
	Component 1	...	*Component n*	*Component* $n+1$	...	*Component* $n+m$	
Group 1	$a^I_{1,1}$	...	$a^I_{1,i}$	$a^S_{1,n+1}$	...	$a^S_{1,n+m}$	$\sum_{j=1}^{n} a^I_{1,j} + \sum_{j=n+1}^{n+m} a^S_{1,j}$
⋮	⋮	...	⋮	⋮	...	⋮	⋮
Group g	$a^I_{g,1}$	...	$a^I_{g,n}$	$a^S_{g,n+1}$	...	$a^S_{g,n+m}$	$\sum_{j=1}^{n} a^I_{g,j} + \sum_{j=n+1}^{n+m} a^S_{g,j}$
Aggregate	$\sum_{i=1}^{g} a^I_{i,1}$	...	$\sum_{i=1}^{g} a^I_{i,n}$	$\sum_{i=1}^{g} a^S_{i,n+1}$	...	$\sum_{i=1}^{g} a^S_{i,n+m}$	$\sum_{i=1}^{g} \left(\sum_{j=1}^{n} a^I_{i,j} + \sum_{j=n}^{n+m} a^S_{i,j} \right)$

Notes: The table provides a schematic picture of hybrid DINA. Out of the $n + m$ components of wealth (assets and liabilities), n can be linked to headings in the NA. The remaining m components are (currently) not linkable. To ensure that a measure of total net worth is comprehensive, all $n + m$ components are summed up. Thus, a *horizontal* interpretation of group-specific net worth is possible. Reading DINA in the *vertical* direction leads to totals for each component. Within the integrated account, vertical sums equal totals reported in the NA, whereas in the supplement account no corresponding NA total is required.

Groups are defined via socio-economic or demographic characteristics, or functions of wealth. For instance, wealth or income groups can be established by grouping households into net worth or income quintiles.

Over time, n should increase and m decrease, whereas the total number of components $n + m$ is not meant to change. Re-allocating more components from the supplement account to the integrated account is called the *integration process*. Integration can be achieved by establishing additional split-ups in the NA and creating sub-categories not currently existent in the NA framework.

The more components are integrated, the better the link to GDP will eventually be. (Temporarily) including non-integrated components into DINA will serve the second function of DINA: meaningful overall distributional statistics that are not limited in comprehensiveness due to linking difficulties.

This is, however, not the view followed in this article, as the NA are too narrow in scope to measuring net worth of private households comprehensively. Also, some concepts that are appropriate for the system of NA may not be suitable for measuring wealth distributions comprehensively as the NA have not primarily been designed to measure households' wealth. For instance, NA leave out consumer durables – such as vehicles – although they play a similarly important role in total private wealth as listed shares or holdings in investment funds. The recording of dwellings and land is very specific in the NA and suboptimal when aiming to better understand private wealth and its distribution.

Thus, the view taken here is that DINA should be understood *more broadly* than just a break-down of existing NA aggregates. The appropriateness of DINA should not be limited by the specificities of the NA, but DINA should rather be constructed to be as meaningful and easy-to-interpret as possible.

Hence, the framework of DINA suggested here relies on NA whenever appropriate but calls for finer break-ups of NA whenever needed and additional "supplement" information when essential to achieve a meaningful overall wealth measure. This approach, which neither aims for a complete separation between NA and distributive indicators (a "dashboard" approach), nor a complete alignment of distributional indicators to the current NA framework (an "integrated" approach) is labelled the "hybrid approach."

The hybrid approach serves two functions of DINA: *(i)* a link between macro-data and distributional data, and *(ii)* a comprehensive measure of wealth distributions by itself.

One may argue that the NA and break-downs thereof are not designed to serve the second function as the focus in the NA is on measuring economic activity and not households' wealth (which is just a by-product), and thus these statistics are not meant be interpreted as comprehensive measures of wealth inequality. Although it is possible to steer which numbers are published by statistical offices or central banks, it is impossible to control how they will be interpreted by users. It is naive to assume that DINA will not be understood and interpreted as measure of wealth inequality. Focusing on narrow wealth concepts may thus contribute to a misinformed public discourse.

Answers to the question of how to deal with comparability issues between micro and macro data usually go into the direction of either restricting the analysis to well-comparable components or analysing wealth distributions without relating them to NA. Either approach is limited to serve only one function of distributional data. Although the focus of this article is wealth, a similar case can be made for DINA for income and consumption.

Table 1 shows the hybrid DINA approach schematically. Let there be $n + m$ components of wealth (assets and liabilities alike) that are essential to describe households' wealth appropriately, whereas n components are linkable between the micro and macro source and m components do not meet a sufficient level of comparability.

For all $n + m$ components, group-specific aggregates are computed from the micro source. Groups can be formed by net worth or income quintiles, functions of wealth, or by relying on qualitative characteristics.

The n well-comparable components are linked to the respective NA instruments, i.e., group-specific sub-aggregates are scaled to exactly match the NA aggregate. The scaling ensures that totals are consistent[4] and at the same time that the relative distribution reported by the micro

[4]The integrated components are mainly instruments in the financial accounts, which rely on counterpart information obtained from banks or other financial institutions, and registers. It is fair to assume that the totals are thus more reliable than the reported sums in the survey, which is why scaling – even without the idea

data source is conserved. The set of linked components form the *Integrated Account*.

The remaining m components are not sufficiently comparable but still essential to describe households' wealth in its entirety. These components are not scaled but directly compiled from micro data. These m components form the *Supplement Account*.

Group-specific net worth is obtained by horizontally summing over all group-specific components of wealth.[5] Totals for each component of wealth are obtained by vertically summing over the group-specific sub-aggregates. Total net worth is thus either the sum over group-specific net worth or the sum over component-wise aggregates. As components of wealth are considered that fall outside the scope of NA (e.g., vehicles), the NA instrument *net worth* (B.90) is conceptually not comparable to the more complete measure here.[6]

It is likely that further work on integrating and harmonizing micro and macro data will lead to an increase in well comparable components n and a decrease in insufficiently well comparable components m. Since the set of components needed to comprehensively describe households' net worth is defined *a priori*, i.e., $n + m$ is fixed, the size of DINA will not change due to advancements in the *integration process*. Nor will group-specific aggregates suffer from conceptual comparability issues over time.[7]

2.3 Surveys versus Adminstrative Data

Regarding micro data sources, there are two main approaches (and hybrids thereof) how to measure the distribution of households' wealth: approaches based on household surveys and approaches based on administrative data. The most important type of administrative data are tax data. Tax data can be supplemented with other types of administrative data such as company or property registers. The advantages and shortcomings of either data source are discussed below.

The major advantage of administrative data is its objectivity and its comprehensiveness. If a certain information is collected, there is usually no opt-out option for citizens and/or residents. For instance, information on wages is reported to authorities directly by the employer and is (in the case of tax compliance) thus available for the entirety of all tax-payers in a country.

Nevertheless, tax data are likely to underestimate the top end of the wealth distribution: a recent article by Alstadsæter et al. (2017) makes use of leaked data from offshore financial institutions ("Swiss Leaks" and "Panama Papers"), and information from tax amnesties and audits to understand who owns the wealth in tax havens. They find that the likelihood of owning hidden accounts increases sharply with wealth, the share of evaded taxes increases when moving up the wealth distribution and that the top 0.01% richest households in Scandinavia evade about 25 to 30% of the taxes they owe. These results are strinking, particularly as Alstadsæter et al. (2018) find, that Scandinavians use tax havens much less extensively than residents of other countries. Alstadsæter et al. (2018) re-estimate top wealth shares by including wealth held in offshore tax havens and find increasing shares for all investigated countries, i.e., Denmark, Finland, France, the Netherlands, Norway, Russia, Spain, Sweden, the United Kingdom, and the United States. They also demonstrate that different magnitudes of offshore wealth leads to

of DINA in mind – is desirable. See Appendix A.

[5]Note that liabilities enter the accounts with a negative sign.

[6]Hybrid DINA could also be extended to what is sometimes called "augmented wealth" that specifically includes all types of pension wealth. See also footnote 17.

[7]By freezing $n + m$ there are no comparability issues arising from changes in the definition of net worth. However, when integrating further components these components will be affected by scaling, which – in the case of large quantitative mismatches – still lead to breaks in the series. These breaks are, however, of a different quality than breaks induces by changes in the *concept* of net worth.

modified comparative conclusions about the degree of wealth inequality across these countries. Thus, when relying on tax data only to estimate the wealth distribution, a special treatment of the top tail should be considered.

Administrative data is usually not collected for the purpose of measuring wealth inequality. Thus, tax data describes wealth only *partially* and/or *indirectly*. Statistical procedures need to be applied to infer the wealth distribution (see also Alvaredo et al., 2016). Depending on the type of tax data, there are three major procedures: First, the *income capitalization method* relies on taxable income flows from assets such as dividends or earned interest. Form observed taxes paid, one can – relying on a number of assumptions regarding rates of return, etc. – infer the total stock of a particular asset class owned by an individual or couple (depending on the tax unit).

Second, the *estate multiplier method* relies on data related to estate taxes and aims to infer the wealth of the living from the wealth of the deceased. Also this method needs to establish a number of modelling assumptions including extrapolated mortality rates and the treatment of assets exempt from estate taxes.[8]

Finally, *net worth taxes*, i.e., recurrent taxes on an individual's net worth, could be directly used to impute the total stock. However, such taxes are not very common and, if applied, have usually long lists of exemptions. The OECD reports that the number of OECD countries levying individual net wealth taxes dropped from twelve in 1990 to four in 2017 (OECD, 2018, page 16). These four countries are France,[9] Norway, Spain and Switzerland.

Further complications related to tax data stem from the fact that only parts of wealth (i.e., the particular assets that the tax refers to) are captured, that the unit of measurement is often the individual rather than the household,[10] and that the data usually lacks sufficient information on socio-economic and demographic characteristics needed to create multi-dimensional break-downs of net worth.

When aiming for internationally comparable statistics, the issue of fundamental differences in the design of the tax system and recording practises lead to additional challenges. Frequent changes in tax policies lead to inconsistencies over time.

Wealth surveys, in contrast, are designed to collect all dimensions of wealth at once and additionally provide a long list of socio-economic and demographic information characterizing each household, which can be used to compile multidimensional break-downs of wealth. Surveys also capture asset classes that do not generate observable income flows (such as owner-occupied housing, valuables or vehicles). Survey weights facilitate grossing up results to the entire population.

In contrast to tax systems, which differ strongly between countries, surveys can more easily be harmonized to produce comparable data across countries and time. The HFCS is the result of a harmonization process of wealth surveys across European countries co-ordinated by the ECB. The surveys are *ex ante* harmonized, i.e., the survey design and definitions are harmonized

[8]In case of an inheritance tax, where the receiving of a bequest is taxed (which is less than the total wealth of the deceased in the case of multiple heirs) rather than the estate itself, such an extrapolation needs to rely on even more assumptions.

[9]Since January 2018 the scope of the net wealth tax in France has been reduced and covers now only real estate assets and investments. Before, all non-business assets were considered.

[10]There is no consensus on whether the unit of recording should be individuals of households. Whereas income is generally attributable to an individual, joint ownership of (housing) assets, and thus also their joint benefit, is common practise. Additionally, some countries offer the option of joint taxation for married couples or couples in a civil union. In this case, tax data partly reflects individuals and partly couples, whereas the latter may constitute the entire household or not.

before the survey is carried out. The *Luxembourg Wealth Study* collects and *ex post* harmonizes wealth surveys from a number of developed and emerging countries globally.[11] The OECD (2013) provides international guidelines for micro statistics on household wealth, which are largely followed, thus facilitating international comparability.

Surveys, however, suffer from other types of drawbacks: they rely on sophisticated sampling techniques to guarantee that survey weights lead to accurate results on a country level. Households are sampled based on different types of register data (social security numbers, addresses, unique personal identification numbers, etc.) and the sampling is only as good as the underlying register. Socio-economic and demographic information linked to the register is used to enhance the imputation of the survey weights. Sampling procedures for complex, multi-purpose surveys (such as the HFCS) are complicated and comes with a certain degree of variability. As the registers and the included additional information used for sampling differ across countries, the sampling techniques constitute an obstacle in terms of harmonization.

As wealth is usually very concentrated at the top end of the distribution, it is particularly important that the sampling procedure leads to an adequate representation of the top tail in the final sample. Thus, some type of oversampling strategy is applied in most wealth survyes to have more observations describing the top tail: hence, the impact of every single observation is decreased and the precision of the estimator is increased. Oversampling can only be applied when the register data used to sample households can be linked to wealth (or other information that at least correlates with wealth). The availability of such data as well as the authorization to use them for this purpose differs across countries. This limits the reliability of data produced without oversampling or relying on a very indirect way of oversampling, and also counteracts comparability across countries.[12]

Even the most sophisticated oversampling strategy is, however, unable to sufficiently capture the wealthiest of the wealthy and correct a so-called unit-non-repose bias introduced by wealthy households systematically responding less frequently as less wealthy households. Thus, just as in the case of using tax data, a separate treatment for the top tail is needed. This is discussed in detail in subsection 2.5.

Furthermore, surveys are costly and time-consuming. The fieldwork often runs for several months, and data validation and processing needs additional time, which is why survey data is usually only disseminated with a substantial time lag. Also, surveys are not conducted at high frequency. The HFCS takes place every two to three years only.[13]

Lastly, surveys rely on the ability and willingness of survey participants to accurately respond to all questions. Whereas some questions are easy, others are fairly complicated: estimating the current market value of one's property or business is a complicated task. Cognitive biases may act against accurately reported values.[14] Whereas business owners or shareholders may be better informed about their possessions due to reporting obligations, owner-occupiers may have less incentives to closely follow trends in housing markets.

Surveys themselves can be improved by making use of administrative data and market prices in during the compilation of the survey. For instance, labour income may not be asked for in the survey interview but – with permission of the interviewee – be taken from administrative

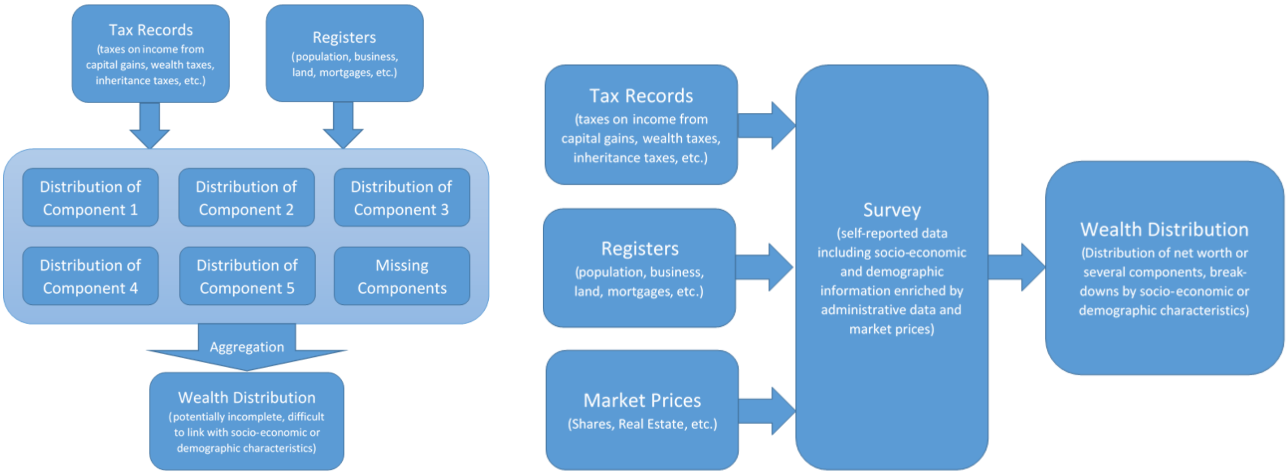
[11] See `http://www.lisdatacenter.org/our-data/lws-database/`.

[12] See subsection 2.5 and Table 4.6 in HFCN (2016) for an overview of oversampling strategies applied in the HFCS. See also Chakraborty and Waltl (2018) for a discussion of the consequences of shortcomings regarding oversampling procedures.

[13] Honkkila et al. (2018) discuss the inter- and extrapolation of linked data between and beyond survey waves.

[14] There is evidence that home-owners tend to *overestimate* the value of their home, which may be explained by a owner-pride factor / endowment effect (see Agarwal, 2007; Heston and Nakamura, 2009, for further references).

Figure 1: Compiling Wealth Distributions from Micro Data.



Notes: The left panel schematically shows the construction of wealth distributions using directly administrative data, and the right panel shows the use of administrative and market prices data *via* a wealth survey to compile wealth distributions. The latter facilitates a link with socio-economic and demographic characteristics.

records. Likewise, mortgage registers or registers documenting the ownership and current value of stocks, investment funds holdings and real estate can help improving the quality of surveys. As discussed above, such additional data can also be used to improve the sample design (in particular for oversampling).

Statistical matching of survey data with other data sources (e.g., market prices) is a possibility to validate survey responses and adjust responses ex-post whenever it seems appropriate. Countries with digitalised land castrates can use this information to link land and properties to survey participants. This data together with automated property valuation models based on market prices can eventually also be used to perform plausibility checks regarding self-reported property prices.

Figure 1 illustrates how wealth distributions can be compiled relying on administrative data only, or by linking administrative, self-reported and market price data via a survey. The latter benefits from the higher accuracy of register data for some instruments but at the same time provides a link between all asset classes and socio-economic and demographic characteristics.

The degree to which administrative data is currently used when compiling surveys differs strongly across countries. There is a lot of progress regarding the collection and digitalisation of data, which offers large potential towards increased quality of official statistics.[15]

In the HFCS, Finland is the superstar when it comes to combining register and survey data (see HFCN, 2016, pp. 24–25). Register data is directly used for all income variables except private transfers and interest received, the ownership and number of cars and other vehicles, business wealth, ownership and values for mutual funds, bonds and listed shares, and education. Additionally, the value of the household main residence and other properties is estimated based on the *Population Information System* and the data in the tax administration's housing company stock register. The values of vehicles were estimated making use of data in several vehicle

[15]Linking survey and administrative data is, however, a delicate issue and needs broad public approval. Interviewees need to give explicit consent when their survey responses are linked to other data sources on an individual level. The legal requirements regarding the possibility to use register data differs across countries. Jäntti et al. (2013) discuss the use of register data in the context of the EU-SILC survey (European Union Statistics on Income and Living Conditions).

registers, price register systems and websites advertising boats for sale. Several components of liabilities were estimated by combining information on tax registers and survey data. Likewise, deposits and contributions to voluntary pension schemes are only partly collected during the interview.

Still, it seems impossible to bring surveys to a level that is sufficient to capture the very top. Thus, an ex-post adjustment of the very top is needed also when the survey has been built based on a rich pool of administrative data.

Concluding, neither tax data nor survey data alone seem to be sufficient, mainly due to the missing wealth at the very top. Due to the wider availability of survey data, their better alignment with the National Accounts and more comprehensive list of socio-economic and demographic characteristics, this article relies on surveys as the major source of information. The surveys are top tail adjusted making use of rich list data, and top wealth shares imputed from tax data and adjusted top wealth shares taking into account wealth store in offshore tax havens as reported in (Alstadsæter et al., 2018).

2.4 Established Links between the HFCS and NA

The HFCS has been specially designed to measure households' wealth, its composition and its distribution across households with different characteristics. In contrast, the NA have not been designed for this purpose, but aim to measure the performance on an economy and the contributions of different sectors. Households form just one out of several sectors.

The wealth concept followed in the HFCS is consistent with the *OECD Guidelines for Micro Statistics on Household Wealth* (OECD, 2013), which are the result of a broad discussion on how to define wealth in an internationally comparable, feasible and meaningful way.

Following the OECD guidelines, wealth is understood as "ownership of economic capital. It is viewed as a dimension of people's economic (or material) well-being, alongside income and consumption. There are other concepts of capital that are important to people's well-being and complement the concept of economic capital, such as human capital, social capital and collectively-held assets. However, while they may have considerable economic value to the people that possess (or have access to) them, they are not material assets and liabilities over which people can exercise ownership rights. They are, therefore, deemed to fall outside the scope [of the guidelines]" (OECD, 2013, page 26) and also this article. In particular, this wealth concept excludes social security pension wealth.[17]

In this article, net worth is composed of twelve components. Table 2 provides details and definitions.

The EG-LMM analysed the conceptual definitions of several variables/instruments appearing in the HFCS and the households' sector balance sheet in the NA. The results are documented in EG-LMM (2017). As indicated in Table 2, liabilities, deposits, bonds, investment funds and

[16]The Houshold Finance and Consumption Survey, Wave 2, Core and derived variables catalogue: `https://www.ecb.europa.eu/home/pdf/research/hfcn/HFCS_Core_and_derived_variables_Wave2.pdf?8d19475a7edb8ff7de6d99a885e527ec`, retrieved June 27, 2018.

[17]Including pension entitlements leads to the concept of *augmented wealth*, which is an informative measure for itself but should be treated sepearatly from standard wealth inequality measure, as argued for instance by Roine and Waldenström (2009): "Conceptually, it is not unproblematic to include retirement wealth in the personal wealth. On one hand, it is a fairly well-defined future benefit stream accruing to each individual in society that highly influences the incentives of individuals to save for retirement. On the other hand, individuals cannot freely access their pension wealth (e.g., to realize it before retirement age), which violates one of the fundamental aspects of private property rights to personal assets. For this reason, the distribution of augmented wealth should be treated separately from the conventional wealth inequality measurement."

Table 2: Assets and Liabilities part of Net Worth.

		HFCS		National Accounts	
		Code	Description	Code	Description
1	Liabilities	DL1000	Total outstanding balance of household's liabilities	F.4	Loans (Liabilities)
2	Deposits	DA21011	Value of sight accounts	F.22	Transferable deposits
		DA21012	Value of saving accounts	F.29	Other deposits
3	Bonds	DA2103	Market value of bonds	F.3	Debt securities
4	Investment Funds	DA2102	Market value of mutual funds	F.52	Investment fund shares or units
5	Listed Shares	DA2105	Value of publicly traded shares	F.511	Listed shares
6	Other Businesses	DA2104	Value of non self-employment private business		
		DA1140	Value of self-employment businesses		
7	Real Estate (business)	DA1121	Value of other real estate property used for business activities		
8	Real Estate (non-business)	DA1122	Value of other real estate property not for business activities		
9	Household's Main Residence	DA1110	Value of household's main residence		
10	Vehicles	DA1130	Value of household's vehicles		
11	Valuables	DA1131	Value of other valuables		
12	Other	DA2106	Value of additional assets in managed accounts		
		DA2107	Money owned to household		
		DA2108	Value of other assets		
		DA2109	Voluntary pension/whole life insurance		

Notes: The table summarizes the definitions of all components of net worth used in this article. Further details about HFCS variables can be found in the variables catalogue.[16] Details regarding the NA instruments are documented in ESA (2010). HFCS counterparts in the NA are only provided in case of high conceptual comparability as assessed by EG-LMM (2017). The items 5, 6 and 7 jointly form the component *Business Wealth*. The sum over items 7, 8 and 9 constitutes *Housing Wealth*.

listed shares are conceptually well-comparable across the two data sources.

Appendix A summarizes the established links and remaining challenges for each component of net worth. In particular, the special case of housing wealth is discussed in detail and a pseudo-link is established by interpreting the residual between total housing wealth in the HFCS (net of real estate assets for business use) and the total value of residential structures in the NA as the value of residential land.

2.5 Adjusting Survey Data: The Missing Wealthy

The HFCS is a voluntary survey aiming to collect information on people's assets and liabilities. Wealth is a very sensitive topic to be covered in a survey and it is known that it is particularity difficult to adequately capture the wealthiest household in such a survey.

Oversampling wealthy households helps to increase the precision of survey results at the very top. If, however, wealthy households are more likely to refuse participation than other households, oversampling is unable to correct a resulting *unit non-response bias*.

Due to the sheer importance of overall holdings by the wealthiest of the wealthy, there is no excuse not to take an extra effort to properly capture them when aiming for a comprehensive and informative measure of total wealth.

A way around this problem is to replace the top tail of the survey-implied wealth distribution by a parametric model. The model of choice is usually a Pareto distribution. The parameters of the Pareto distribution can be estimated by enriching the top survey observations with additional information describing the fortunes of the wealthiest of the wealthy.

In this article, I use three types of extra information to adjust survey results to better capture the top tail of the distribution. First, I make use of rich list data published by newspapers and report the fortunes of the richest individuals and families in a country. Vermeulen (2018, 2016) develops the so-called regression approach to estimate the parameters of a Pareto distribution by combine top survey data with observations from the *Forbes World's Billionaires list.* Bach et al. (2015) and Chakraborty and Waltl (2018) apply this regression approach but rely on national rich lists, which provide much more information than the Forbes list. In this article, I also use national rich lists (see Table 3) for an extended number of countries together with the regression approach.

Table 3: Rich Lists and Oversampling Strategies.

	HFCS fieldwork (second wave)	Oversampling (second wave)	Year of rich list	Rich list compiler	No. of obs.
Austria	06/2014 – 02/2015	No	2014	Trend	100
Finland	01/2014 – 05/2014	Personal income data	2014	Arvopaperi	50
France	10/2014 – 02/2015	Personal wealth data	2014	Capital	100
Germany	04/2014 – 11/2014	Regional indicators, income	2014	Manager Magazin	500
Spain	10/2011 – 04/2012	Personal taxable wealth	2013	El Mundo	200

	HFCS	Rich list	
	Max. wealth [a]	Min. wealth	Max. wealth
Austria	40	100-300 [b]	65,000
Finland	50	35	2,225
France	220	41	37,880
Germany	50	200	31,000
Spain	130	41	43,372

Notes: The table summarizes the different oversampling strategies applied in the HFCS, the HFCS fieldwork periods as well as the respective rich lists used to adjust the top tail. The lower part of the table reports minimum and maximum fortunes in million euros observed in the respective data sources. Minimum and maximum wealth in the rich lists are reported without splitting family clans and excluding non-residents.

[a] Amounts are rounded to *ten million euros* to prevent identification of individuals.

[b] For the lower part of the list, only ranges are provided. As in Chakraborty and Waltl (2018), a random draw from the respective range is used for the estimation.

Rich lists are often criticised for following intransparent methodologies and source data. Additionally, the lists do not follow a consistent measurement unit: sometimes individuals are listed, and sometimes fortunes are reported for the nuclear and/or extended family. Some names on these lists may refer to non-residents.[18] Rich lists have, however, two important advantages:

[18] The lists have therefore been checked by members of the EG-LMM. Non-residents were removed whenever detected and entries likely referring to family clans are randomly split into two to four separate observations.

Table 4: Top wealth shares.

	France (2014)			**Spain** (2012)		
	HFCS data	Tax data	Tax & offshore data	HFCS data	Tax data	Tax & offshore data
Top 0.1%	7.55	8.20	10.84	6.38	7.07	8.72
Top 1%	18.64	23.38	26.01[a]	16.09	21.19	22.84[a]
Top 3%	29.59	35.49	38.13[a]	25.85	32.06[c]	33.71[a]
Top 1% to 0.1%	11.09	15.17		9.71	14.12	
Top 3% to 0.1%	22.04	27.29		19.46	24.99[b]	

Notes: The table reports top wealth shares in %.
[a] These numbers are imputed under the assumption that the bottom 99.9% do not possess any offshore wealth.
[b] The share of the top 3% to top 0.1% is not reported in Martínez-Toledano (2017), so it is interpolated from the share of the top 1% to 0.1% and the top 5% to top 0.1%. The exact value will become available after a revision of the article and results will subsequently be updated.
[c] The share uses the interpolated share of the top 3% to top 0.1%.
Sources: HFCS (2nd wave), Top shares excl. offshore wealth: WID.world database, Garbinti et al. (2016), Martínez-Toledano (2017). Top 0.1% shares adjusted for offshore wealth: Alstadsæter et al. (2018).

first, journalists aim to investigate the total wealth of the richest members of their country regardless of the location of the wealth and holding structures, and, second, they exist in many countries and often constitute the only piece of information about the fortunes of the wealthiest of the wealthy.

Another source of information describing the concentration of wealth are top wealth shares as collected in the WID.world database (Alvaredo et al., 2017). The methodologies applied are transparent and the source data is of high quality. Typically, the main ingredient is tax data, which is combined with other administrative and survey data. The intersection of countries for which top wealth shares are currently available in the WID.world database and the list of countries studied here is only France. The French series was compiled by Garbinti et al. (2018). Additionally, I make use of top wealth shares compiled for Spain by Martínez-Toledano (2017).

I develop a methodology using a Generalized Pareto Distribution (GPD) inspired by Blanchet et al. (2017) in combination with top wealth shares to adjust the top end of the HFCS. GPDs are a family of heavy-tailed distributions containing the standard Pareto distribution as a special case. The non-standard members are less restrictive modelling choices for the top tail: average wealth is not forced to increase proportionally when moving up the distribution, i.e., the crucial modelling assumption in the standard Pareto case regarding the choice of starting point is less relevant. Details are provided in Appendix B.

As top wealth shares imputed from tax data may underestimate wealth concentration due to wealth stored in offshore tax havens, I also use adjusted top wealth shares provided by Alstadsæter et al. (2018). Top wealth shares are reported in Table 4.

Once the wealth distribution is top tail adjusted, I redistribute the adjusted amounts to the different components of wealth following an approach developed by Chakraborty and Waltl (2018). The idea is to rely on observed portfolio structures at the top and redistribute the adjusted amounts accordingly. I extend Chakraborty and Waltl's approach designed for Pareto distributions to GPDs (see Appendix B).

Table 5: Adjusted and Unadjusted HFCS Aggregates: Rich lists.

		Austria		Finland		France		Germany		Spain	
		Unadj.	Adj.	Unadj.	Adj.	Unadj.	Adj.	Unadj.	Adj.	Unadj.	Adj.
1	Liabilities	66.60	67.18	113.97	116.04	961.57	1,011.85	1,020.92	1,063.36	607.55	628.72
2	Deposits	98.75	107.42	51.21	53.02	556.64	600.11	1,007.80	1,062.18	330.60	349.21
3	Bonds	5.27	5.45	1.24	1.87	17.83	28.27	71.92	79.87	14.01	18.50
4	Investment Funds	17.07	27.32	13.79	17.22	65.31	80.02	206.86	253.08	45.72	53.61
5	Listed Shares	5.13	5.87	26.09	29.98	141.19	207.37	146.80	203.11	74.06	85.06
6	Other Businesses	189.61	439.06	34.01	46.61	1,033.54	1,351.47	1,179.28	1,672.31	553.83	650.06
7	Real Estate (business)	20.58	15.43	13.69	14.11	44.95	49.65	169.28	185.87	93.61	107.08
8	Real Estate (non-business)	99.84	153.71	116.98	125.97	1,220.34	1,397.52	1,503.12	1,799.55	1,097.95	1,303.46
9	Household's Main Residence	531.39	632.77	332.79	337.86	3,661.84	3,794.60	4,071.01	4,687.75	2,674.60	2,772.76
10	Vehicles	32.14	37.61	25.99	26.74	222.16	234.73	283.14	289.59	128.77	131.37
11	Valuables	11.87	12.90	–	–	387.97	409.53	112.46	129.57	44.92	53.47
12	Other	42.05	38.76	6.48	6.64	289.71	399.29	409.97	515.48	210.36	299.59
	Total	1,120.29	1,543.49	736.23	776.08	8,603.04	9,564.40	10,182.54	11,941.73	5,875.97	6,452.89
	Change		+37.78%		+5.41%		+11.18%		+17.28%		+9.82%

Notes: The table reports unadjusted and adjusted HFCS totals for different components of net worth in billion euro. Adjustments rely on rich list data and a Pareto model for the top tail. *Sources:* HFCS (2nd wave), own calculations.

For reasons of comparability, I use the same starting point of the tail, i.e., the threshold where the parametric model takes over the empirical distribution implied by the HFCS. The threshold is fixed at one million euro (see Chakraborty and Waltl, 2018, for robustness checks with this regard). In France and Spain, millionaires represent the top 3%.[19]

Adjusting the top tail of the HFCS wealth distribution leads to an increase in total wealth. The increase is large in all countries, which is not surprising given the substantial gap between the largest fortunes observed in the HFCS and the rich lists (see Table 3), or the large differences in top wealth shares implied by the HFCS and other data sources (Table 4).

Table 5 reports adjusted and unadjusted HFCS aggregates. Adjusted aggregates rely on rich lists on a Pareto model for the top tail. The results across countries are quite different and reflect the quality of the survey and, in particular, the oversampling strategy, which differ strongly across countries. In Spain and France, the underlying data to oversample wealthy households is ideal as it is based on personal wealth data. In Finland, no such data is available, but oversampling is applied based on personal income data, which at least correlates with net worth. Additionally, in Finland many variables are not collected via a survey but directly taken from registers, which is why some components of wealth are more trustworthy (see subsection 2.3). In Germany, an indirect geographical oversampling strategy is applied: strategically more households are sampled from high-income municipalities and wealthy street sections in municipalities with more than 100,000 inhabitants. Austria, in contrast, does not oversample at all.

Given these differences, one would thus expect, that a top tail adjustment is least important in Finland, Spain and France, and most important in Austria, which is indeed the case. The overall increase in net worth amounts to 5% in Finland, 10% and 11% in Spain and France respectively, 17% in Germany and 38% in Austria.

Table 6 reports changes in HFCS aggregates for Spain and France when relying on different auxiliary data to perform the top tail adjustment. When relying on top wealth shares derived from tax data only, changes tend to be lower then when relying on rich lists. In contrast, when relying on wealth shares derived from top wealth shares incorporating offshore wealth, the resulting wealth distributions match the rich list adjusted distributions almost perfectly. Both, the overall changes as well as implied top wealth shares are very close. In both countries, the adjustment based on rich lists leads to marginally lower adjustments than the adjustments based on tax and offshore wealth data.

Across instruments, one identifies that due to the accelerating steepness of a GPD as compared to a standard Pareto distribution, instruments that are more prominent at the very top end of the distribution (e.g., Other Businesses, Bonds and Listed Shares) experience larger increases when relying on GPDs. To give an ultimate answer which result to trust more, future research needs to focus on identifying auxiliary data measuring portfolio structures at the very top.

Top wealth shares are not yet widely available, whereas rich lists are. The good match between adjustments based on rich list and top wealth shares, whenever available, increases confidence in rich list adjustments in other countries. In the future, rich lists may become obsolete due to increased information on top wealth shares from more reliable sources. In the meantime, top tail adjustments based on rich lists appear to be reasonably trustworthy approach to make survey data more comparable and better suited for measuring wealth inequality.

Indeed, refraining form top tail adjustments appears to be highly insufficient. First, the in-

[19] Since the HFCS-implied cumulative distribution function is not smooth due to survey weights, quanitles can only be approximated. In Spain, the threshold lies in the interval [96.5%; 97.0%], and in France in [97.0%; 97.5%].

Table 6: Change in HFCS aggregates.

		France			Spain		
		Top shares		Rich list	Top shares		Rich list
		tax data	tax & offshore		tax data	tax & offshore	
1	Liabilities	3.70	4.82	5.23	3.33	4.17	3.49
2	Deposits	6.11	7.16	7.81	5.40	7.14	5.63
3	Bonds	47.72	73.02	58.58	35.78	39.02	32.06
4	Investment Funds	16.72	26.47	22.52	15.61	21.70	17.25
5	Listed Shares	36.66	49.41	46.87	17.63	24.12	14.86
6	Other Businesses	21.70	36.19	30.76	17.51	26.44	17.38
7	Real Estate (business)	6.43	3.91	10.46	1.77	3.14	14.40
8	Real Estate (non-business)	9.96	14.40	14.52	12.35	14.41	18.72
9	Household's Main Residence	2.30	3.17	3.63	3.41	4.27	3.67
10	Vehicles	4.05	5.78	5.66	0.88	1.20	2.02
11	Valuables	3.24	6.56	5.56	20.31	26.46	19.02
12	Other	30.15	42.51	37.83	36.53	45.62	42.42
	Total	7.94	11.80	11.18	8.10	10.44	9.82
Implied top wealth shares in %:							
	Top 10%	50.1	52.1	51.7	46.1	47.3	47.0
	Top 5%	38.9	41.3	40.8	35.7	37.2	36.8

Notes: The table reports changes in aggregates in % after applying top tail adjustments. Adjustments are based on either a Pareto adjustment using rich list data, or a Generalized Pareto adjustment based on top shares imputed from tax data only or by combining tax data with information on wealth stored in offshore tax havens. For the Pareto adjustment, the tail starts at one million euro, which is roughly the 97*th* percentile threshold in both countries. Top share adjustments thus replace the top 3% using shares reported in Table 4.

creases resulting from such adjustments are large. Ignoring the top tail leads to much lower degrees of inequality, distorts aggregates and means, and biases conclusions about portfolio compositions. Second, the cross-country differences regarding the representativeness of the top tail are substantial. These differences mainly stem from an insufficient degree of harmonization of the survey design, in particular differences in sampling and oversampling, and the use of administrative data in the compilation process of the survey. Admittedly, a top tail adjustment is far from perfect due to model assumptions and shortcomings in the auxiliary data. Still, the substantial differences in top tail coverage suggest that HFCS results should not be compared when refraining from a top tail adjustment.

Thus, the hybrid DINA presented in the next section consistently rely on top-tail adjusted data. Due to the wider availability of rich list data, the adjustments are based on these lists.

2.6 Vertical Groups in DINA

So far, I have discussed the *horizontal dimension* of DINA: the selection of components of wealth. Equally important is the selection of groups for which the break-down is performed, i.e., the vertical dimension of DINA. In this article, I compile DINA for wealth groups, gross income groups and groups reflecting three major functions of wealth.

These groupings are selected as they provide a comprehensive picture of the distribution of wealth. Other groupings can serve answering specific questions and should be considered for official statistics: for instance, groups formed by equivalized disposable income representing living standards, groups representing household types defined by the social relationships of household members (female/male singles, couples with different numbers of children, single-parent households, retired couples, etc.), and geographic groupings (administrative regions, and urban versus rural areas).

It is important that characteristics chosen for the vertical grouping of households refer to the *entire* household. A grouping by age or gender is problematic as these characteristics describe the "reference person" rather than the household. The reference person is supposed to represent the financially most knowledgeable person in the household. It turns out that far more men are selected to be this person than women. If this choice does not only reflect financial knowledge but is also driven by gender stereotypes, such analyses will lead to biased results.[20] Likewise, the age of the reference person is an insufficient information: a 30 years old reference person may be a child still living with her parents, a single, a parent, etc. Publishing break-downs by gender or age may thus easily lead to misinterpretation of the data and potentially biased conclusions.

A meaningful choice for vertical grouping is wealth itself: how much of total (or component-specific) wealth is owned by the wealthiest or poorest members of society? A break-down by net worth quintiles reports five groups each consisting of 20% of all households. From these break-down, one can directly derive quintile ratios and quintile distances that relate average amounts held by the poorest 20% to the wealthiest 20% and thus provide an informative summary statistic for inequality.

Additionally, top shares report the proportion of aggregate (component-specific) wealth held by the wealthiest 10%, 5% or even 1%. These shares complement break-downs by quintiles and facilitate the comparison of wealth concentration at the very top.

Income[21] is an equally important household characteristic and another measure of material well-being. Households that are simultaneously income-rich *and* wealth-rich form the financial elite, while households that are income-poor *and* wealth-poor constitute the economically most vulnerable members of society. Thus, looking at the interconnectedness of income and wealth provides a more complete picture of material well-being.

The HFCS only records gross income and thus the allocation of households to groups does not take into account the re-distributional effects of a progressive tax and transfer system. Since I apply a rather broad grouping by merging households by income *quintiles*, the exact income concept is less important. Still, break-downs by equivalized disposable income[22] would be an insightful addition as it describes well differences in the standard of living by taking into account the number of consumption units in each household.[23]

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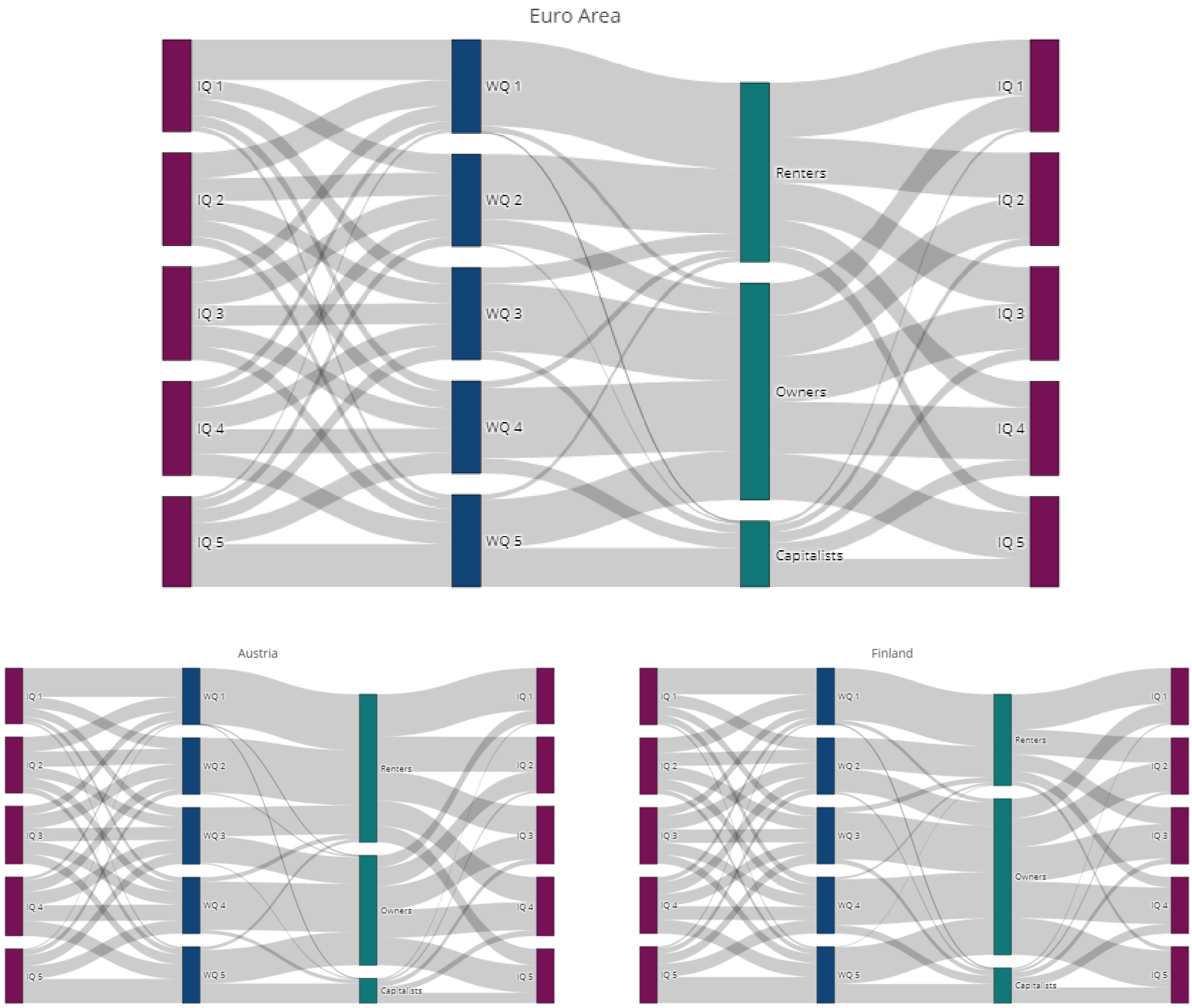
[20]For illustrative purposes one can think of an extreme case scenario where men are always self-selected by the household to be the reference person and only in the absence of a male household member a woman will be interviewed. In this scenario, female-headed households are predominately single or single-parent households, which tend to be poorer than other types of households. Hence, differences found for gender rather represent differences across household types, and thus provide misleading information.

[21]For better comparability with net worth, total household income is considered and no equivalence scaling is applied. Income contains employee income, self-employment income, rental income from real estate property, income from financial assets, income from private businesses other than self-employment, pension income (public, occupational and private), income from regular social transfers, unemployment benefits, and any other sources.

[22]I currently also work on creating break-downs based on disposable income by transforming household gross income following Kuypers et al. (2016).

[23]The OECD-modified equivalence scale weights a household's total disposable income by the number of household members. The equivalence scale takes into account the economic benefits of living in the same

Figure 2: Allocation of Households to Groups.



Notes: The figures show the allocation of households to groups. The top panel shows the allocation for the entire euro area. The bottom panels show results for a country with a high share of renters (Austria) and a country with a relatively low share of renters (Finland). $IQ1$ to $IQ5$ refers to groups formed by gross income quintiles, and $WQ1$ to $WQ5$ to groups formed by net worth quintiles. Interactive versions of the plots are available upon request. *Source:* Author's calculations based on the 2nd wave of the HFCS.

Looking at wealth and income together is a first step toward a multidimensional approach in the understanding of wealth inequality. To provide even deeper insights, I also provide breakdowns reflecting different functions of wealth and thus provide more information about the social implications of an unequal distribution of private wealth. As proposed by Fessler and Schürz (2017), I divide the population into renters, owners and capitalists. *Renters* do not own their home, pay rent to landlords (the capitalists or the state) and mainly hold wealth for precautionary reasons. *Owners* make use of their wealth by living in their own home and thus do not pay rent. Usually, an owners' home represents also her single most important asset. *Capitalists* are owner-occupiers that additionally generate income from their wealth by either renting out further properties to the renters and/or by owning a business. They make profit

household ("economy of scale") as well as difference in consumption needs of adults and children. Thus, the equivalence scale attributes a weight of one to the first adult member of a household, a weight of 0.5 to any other adult household member and 0.3 to all children below 14 years.

by employing renters or owners in their business, and selling goods or services to them or other capitalists. These categories thus represent the three most important funcitions of wealth[24] as argued by Fessler and Schürz (2017): provision, own use, and income generation.

Figure 2 shows the allocation of households to net worth and income groups, and groups formed by three functions of wealth. Across the entire euro area, a bit less than half of the households belonging to the lowest wealth group also belong to the lowest income group. Overall, roughly 8.7% of all households are simultaneously income- and wealth-poor (AT: 10.2%, FI: 9.3%, FR: 8.8%, DE: 9.1%, ES: 6.1%). In contrast, 9.3% are both income-rich and wealth-rich. The shares are similar across the focus countries of this article (AT: 8.5%, FI: 9.2%, FR: 10.5%, DE: 9.2%, ES: 9.3%).

Large shares of renters belong to the lowest two to three wealth quintiles. The share of renters belonging to the third wealth quintile varies across countries with different overall home-ownership rates.[25] In countries with a high share of renters this rate is relatively high (AT 50.8%, DE 61.0%) but it is much lower in counties with high home-ownership rates (ES: 3.5%, FI: 9.1%, FR: 19.1%), i.e., the existence of a substantial group of fairly wealthy renters appears to be a phenomenon of German-speaking Europe. The share of renters in the bottom two wealth groups is high in all countries except Spain (Euro Area: 81.8%, AT: 98.3%, FI: 73.5%, FR: 88.2%, DE: 94.7%, ES: 36.5%). The share of renters belonging to the highest two wealth groups is very low in all countries.

In contrast, capitalists predominantly also belong to the highest wealth and income groups. The probability for a capitalist being also a member of the top income group ranges between 36% and 45%, and the probability to be in the top wealth group conditional on being a capitalist is even higher (54% to 79%). Overall, the share of households that are in the top income, top wealth and capitalists group amounts to roughly 4.5% in the euro area. This share is slightly higher for France and Germany (AT: 3.3%, FI: 3.8%, FR: 5.3%, DE: 5.0%, ES: 4.3%). One can consider these households as society's economic elite.

Owners belong to all wealth and income groups, but are less often found at the very bottom of the wealth or income distribution. Again, the share of wealth-poor owners varies across countries with home-ownership rates but is – given the low home-ownership rate – surprisingly high in Germany (Euro Area: 6.4%, AT: 0.5%, FI: 6.8%, FR: 1.9%, DE: 5.0%, ES: 33.7%).

3 Hyrbid DINA

3.1 Structure

Net worth is defined as total assets minus liabilities. Highly comparable variables (as indicated in Table 2) form the *integrated account* of the hybrid DINA. All other variables currently enter DINA as part of the *supplement account*. This is a very conservative approach. The number of linkable variables is likely to increase in the course of the work of the EG-LMM. Housing wealth is part of the supplement account but can be interpreted as integrated by following the *pseudo link* presented in Appendix A.

[24]Fessler and Schürz (2017) consider three more functions hirarchically above income generation: social status and prestige, transfer (gifts and inheritances), and economic and political power. Although these other functions are important, they may not be additively sperable from other functions of wealth and almost impossible to be measured in a surevy.

[25]Eurostat reports the following home-ownership rates for 2014: EU 69.9%, AT 57.2%, DE 52.5%, FI 73.2%, FR 65.0%, and ES 78.8% (based on EU-SILC data). See Figure 11 for the relative importance of real estate assets for different parts of the distribution. Figure 12 depicts the share of renters and owners by wealth groups.

Table 7: Structure of Hybrid DINA.

							Housing Wealth						
					Business Wealth								
	Liabilities	Deposits	Bonds	Inv. Funds	Listed Shares	Other Businesses	Real estate (business)	Real estate (non-business)	HMR	Vehicles	Valuables	Other	Net Worth
I II III IV V			Integrated Account			Supplement		(pseudo-integrated)			Account		
Σ													

Table 7 shows the structure of the hybrid DINA listing all variables that enter either the integrated or supplement (pseudo-integrated) account.

3.2 Integration

Integration requires distributional break-downs to sum up to NA totals. This is achieved by proportionally scaling group-specific HFCS sub-aggregates guaranteeing the preservation of the distributional attributes. Before scaling, I apply an adjustment of the top tail, which is needed to obtain comparable results across countries as argued in subsection 2.5.

Let y_j denote the NA aggregate for component j entering the integrated account and

$$\sum_{i=1}^{g} x^I_{i,j}$$

the corresponding top-tail adjusted HFCS aggregate, whereas $x^I_{i,j}$ denotes the group-specific sub-aggregates for group i. In the case of groups formed by wealth qunintiles, $x^I_{5,j}$ is corrected upwards due to the top tail adjustment.

In the case of groups formed by income quintiles or qualitative characteristics, the allocation of adjusted wealth to groups is slightly more complicated. The top tail is divided into four strata determined by net worth and each stratum contains 25% of the households in the tail. Within each stratum the share of total wealth held by each group is calculated. The adjusted tail wealth for each instrument and strata is re-distributed to groups following the originally observed shares. This means that all groups may be affected by the top tail adjustment. In practise, the top income quintile usually receives larger shares of the added wealth due to the correlation between wealth and income. As capitalists are predominately found among the wealthiest households, this group is also affected more than renters and owners.

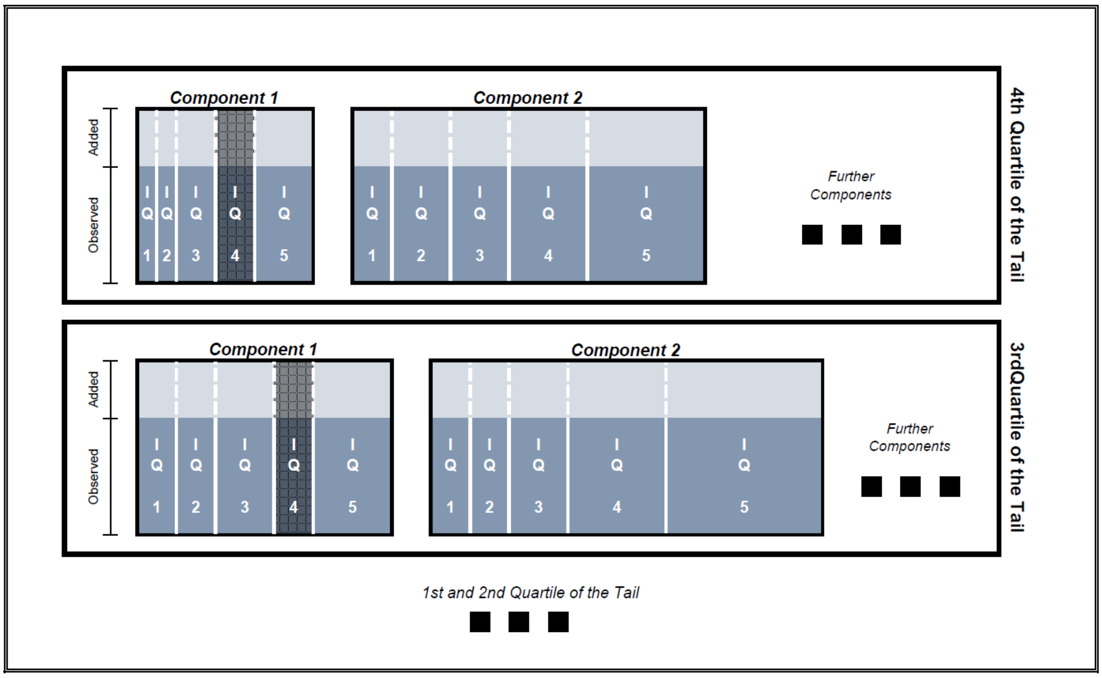
Distributional indicators for component j and group i are given by

$$a^I_{i,j} = x^I_{ij} \cdot \frac{y_j}{\sum_{i=1}^{g} x^I_{i,j}}.$$

Thus, each group-specific aggregate $a^I_{i,j}$ is scaled by its inverse coverage ratio and the aggregate equals the NA total

$$\sum_{i=1}^{g} a^I_{i,j} = y_j.$$

Figure 3: Top Tail Adjustment: Distribution to Vertical Groups.



Notes: The figure shows how the additional euros stemming from the top tail adjustment are distributed to vertical groups: the top tail is divided into four strata representing the four quartiles of the tail in terms of net worth, i.e., the forth quartile represents the wealthiest of the wealthy. Additional wealth is distributed to each strata following the estimated Pareto model. Within each stratum, this added wealth is distributed to each component of wealth by replicating portfolio structures within the stratum (see Chakraborty and Waltl, 2018). When vertical groups refer to anything but wealth, another re-distribution has to be performed: Within each stratum-specific component, the original distribution of the total across, say, income quintiles (IQ 1 to IQ 5) is mapped on the added wealth. For example, the adjusted total of component 1 belonging to IQ 4 in the tail is given by the sum of the shaded areas.

The effect of scaling is large, as coverage ratios tend to be disappointlgly low – even for conceptually highly comparable instruments (see Table 8).[26]

For housing wealth, the coverage ratios are per construction equal to 100% as a ceonsequence of the *pseudo link* described in subsection A.4, thus

$$a^I_{i,housing} = x^I_{i,housing}.$$

Components entering the supplement account are not scaled but enter the account directly, i.e.,

$$a^S_{i,j} := x^S_{i,j}.$$

3.3 Summary Statistics for DINA

DINA summarize the wealth distribution across several dimension – the vertical groups. In case of quintiles, this yields aggregate information for five groups. For comparisons across countries

[26]The top tail adjustment generally increases coverage ratios, but for most instruments they are still far from 100%. As Chakraborty and Waltl (2018) argue, this probably reflects errors along many more dimensions in the survey and the national accounts alike. As noted before in footnote 4, due to the general high reliability of the *integrated* variables in the national accounts, aggregates are preferred to be taken from the national accounts.

Table 8: Adjusted and Unadjusted Coverage Ratios.

		Austria		Finland		France		Germany		Spain	
		Una.	Adj.	Una.	Adj.	Una.	Adj.	Una.	Adj.	Una.	Adj.
1	Liabilities	39.6	39.9	90.5	92.1	84.1	88.5	65.3	68.0	74.8	77.4
2	Deposits	45.7	49.8	63.7	66.0	47.1	50.8	54.8	57.8	43.7	46.1
3	Bonds	12.9	13.3	23.2	35.1	21.5	34.0	42.3	47.0	28.2	37.3
4	Investment Funds	35.6	56.9	92.6	115.6	24.4	29.9	48.1	58.8	29.2	34.2
5	Listed Shares	27.1	31.0	101.4	116.4	90.4	132.8	63.8	88.2	56.7	65.1

Notes: The table reports unadjusted and adjusted coverage ratios in per cent. Totals in the national accounts are averages over the quarters overlapping the HFCS fieldwork period. *Sources:* HFCS (2nd wave), ECB, own calculations.

and time, it is helpful to summarize DINA along a particular dimension in one single number. There are several options to do so, and the article considers up to five different summary statistics describing the set of information within DINA.

For break-downs by wealth itself, I also provide top wealth shares, i.e., the share of (component-specific) wealth held by the wealthiest 5% or 10%. This information is additional and cannot directly be calculated from DINA.

The summary statistics considered are ratios of average holdings across extreme quintiles, absolute distances between average holdings across quintile groups, and a between-group inequality measure inspired by the Theil index.

Denoting $A(X)$ denote the average holding of a specific component of wealth or net worth among group X, e.g., $A(I)$ is the average among the lowest quintile. Relating the extreme groups, namely, the top 20% to the bottom 20%, measures the dispersion of a specific component of wealth along the dimension of the vertical groups. A ratio of, say, $A(V)/A(I) = 5$ thus implies that a household belonging to the top 20% (in terms of income or wealth) owns on average five times more than a household belonging to the bottom 20%.

For some components (and regularly also net worth) average holdings among group I are negative and thus the standard ratio is not meaningful. Therefore, I also relate holdings among the top 20% to average holdings among the bottom 40%, $A(V)/A(I \cup II)$. Hence, $A(V)/A(I \cup II) = 5$ indicates that a household belonging to the top 20% owns, on average, five times more than a household belonging to the bottom 40%.

Similarly, I also calculate the absolute distance between average holdings among the top 20% and the bottom 20% or 40%, i.e., $|A(V) - A(I)|$ and $A(V) - A(I \cup II)$.

These quintile summary statistics are not meaningful for qualitative, unordered break-downs such as, in this article, functions of wealth. Therefore, I impute a measure of between-groups inequality inspired by the Theil index (Theil, 1967). The Theil index is an additively separable inequality measure, i.e., overall inequality can be additively decomposed into within-groups and between-groups inequality. To summarize DINA, the between-groups part is the relevant measure.

The index number itself does not have an intuitive interpretation, but facilitates relative comparisons. Due to relation of the Theil index to negative entropy, a larger index is associated with a larger distance from the uniform distribution, i.e., the distance to perfect equality *along the dimension of the vertical grouping.* The Theil index is again not defined for non-positive wealth.[27]

The Theil index (or more precisely the Theil T index) is defined as

$$T = \frac{1}{n} \sum_{j=1}^{n} \frac{a_j}{\mu} \log\left(\frac{a_j}{\mu}\right),$$

where n denotes the population total, a_j the wealth held by household j and

$$\mu = \frac{1}{n} \sum_{j=1}^{n} a_j$$

the average wealth across the population. The Theil index can be formulated for each component of wealth. For g groups (the vertical groups of DINA), the Theil index decomposes into

$$T = \sum_{i=1}^{g} s_i T_i + \sum_{i=1}^{g} s_i \cdot \log\left(\frac{\bar{a}_i}{\mu}\right), \quad \text{for} \quad s_i = \frac{n_i \cdot \bar{a}_i}{n \cdot \mu},$$

where T_i is the group-specific Theil index, n_i the number of households in group i and $\bar{a}_i$ the average wealth in group i. Consequently, s_i denotes the share of wealth held by group i. The first term describes inequality *within* the groups, and the second term inequality *between* groups. When knowing population totals, it is possible to directly compute the between-group part from DINA,

$$T_{between} = \sum_{i=1}^{g} s_i \cdot \log\left(\frac{\bar{a}_i}{\mu}\right).$$

This measure is reported for all vertical groupings.

3.4 Results

This section highlights some quantitative results and potential uses of hybrid DINA. The full set of results for Austria, Finland, France, Germany and Spain are reported in Appendix C.

Wealth is very concentrated at the very top: the top wealth group possesses substantial shares of total wealth (AT: 81.4%, FI: 66.4%, FR: 70.9%, DE: 81.5%, ES: 66.6%), whereas net worth is negative in the poorest group in Austria, Finland and Germany. In France and Spain, the amount is positive but very small. Ignoring vehicles and valuables, the poorest group would also have negative wealth in France and Spain.

Average net worth among the wealthiest 20% is more than 200 times higher than among the bottom 40% in Austria. This ratio is approximately 70 in Finland, 50 in France and 25 in Spain. In Germany, average net worth among the bottom 40% is still negative.

The wealthiest of the wealthy hold large shares of wealth in all countries analysed in this article: again, Austria has the highest inequality when analysed from this angle: after adjusting for the missing wealthy, the top 5% are found to own 57% of total net worth. In the remaining countries this share varies between 37% in Spain and 46% in Germany.

When assessing the distribution of wealth relative to income groups, the concentration is less extreme, i.e., there is a strong but no perfect correlation between income and wealth: the 20% highest income households respectively possess “only” 55.4% (AT), 48.5% (FI), 58.0% (FR), 61.6% (DE) and 48.3% (ES) of total wealth. The lowest-income group holds small but consistently positive shares of total wealth (AT: 3.3%, FI: 6.4%, FR: 6.0%, DE: 4.3%, ES:

[27] Thus, an overall Theil index comprising within- and between- groups inequality cannot be compiled. Still, the between-groups index is a valuable summary measure for DINA.

8.9%). The poorest groups in terms of income consistently also have on average lowest net worth.

Again, wealth inequality measured against income groups is highest in Austria and Germany, and lowest in Finland and Spain: the 20% income-richest households are on average 5 to 6 times wealthier than the 40% lowest-income households in Finland and Spain. This measure approximately amounts to 11 in Austria, 9 in France and 10 in Germany. The $T_{between}$ measure confirms this ordering of countries.

In most countries, average per household wealth is larger than the average wealth of a household in the fourth wealth quintile and the forth income quintile. Thus, the often communicated number of *average household wealth* is not well suited to describe a typical household.

Across the entire euro area, 36.9% of the households are identified as *renters*, 48.6% as non-capitalist *owners*, and 14.6% as *capitalists*. While the share of capitalists does not vary largely across countries (between 9% in AT and 16% in ES), the shares of renters and owners, respectively, varies significantly.

Average net worth is consistently lowest for renters and highest for capitalists. Average net worth of owners is usually close but slightly lower than the overall average (only in Finland, average wealth of an owner is slightly larger).

Although capitalists form the smallest group, collectively they hold substantially more wealth than renters or owners. Only in Finland, the group of owners (55% of all households) collectivity hold more wealth than the 12.5% capitalist households.

Analysing $T_{between}$, again the German-speaking countries show the highest inequality and Spain and Finland the lowest inequality along the dimension of functions of wealth. It is interesting that the distance between France and the two German-speaking countries is smaller than for other dimensions.

Macroeconomic shocks related to, for instance, stock prices or house prices will transmit very differently across the economy due to different degrees of inequality in their distribution. The detailed break-downs provided by DINA facilitate modelling and monitoring on such a disaggregated level.

Business wealth is heavily concentrated at the top of the distribution: in Austria and Germany the wealthiest 20% own roughly 97% of total business wealth. This share is lower but still above 90% in the other countries. Total holdings in listed shares are predominantly owned by the top wealth groups, i.e., up to 90% of stock market wealth is held by just 20% of all households. The concentration is less dramatic but still substantial when looking at the highest income group (AT: 76.0%, FI: 78.2%, FR: 76.0%, DE: 82.1%, ES: 69.7%).

Housing wealth constitutes the most important asset class in all countries. It is less unequally distributed than business wealth and constitutes the most important asset class for non-capitalist owners. Owner-occupied housing constitutes the largest share of total housing wealth across all countries and across groups formed by wealth or income. Non-owner-occupied housing assets become relatively more important in households' portfolios when moving up the distribution (see also Figure 11). Cross-country differences in the degree of housing wealth inequality is largely determined by differences in home-ownership rates, which are substantially lower in Germany and Austria than in other countries (see footnote 25 and Figure 12).

The fundamental differences in the spread of holdings in financial and housing wealth may also help explaining different magnitudes of the macroeconomic wealth effect: Case et al. (2005) and Bostic et al. (2009) document a much larger effect of changes in housing prices on aggregate consumption as compared to changes in stock market prices or financial wealth in general.

The lowest wealth groups predominantly possess wealth in the form of deposits, vehicles and low amounts of housing wealth. Overall, the total value of vehicles is similarly large as total holdings in listed shares. Vehicles are, however, less unequally distributed across wealth or income groups. In fact, the relative importance of these unproductive assets in households' portfolios is substantial for the two lowest wealth groups (see Figure 11).

The break-down by functions of wealth sheds more light into the potential effects of house price booms: owners experience an increase in wealth whereas capitalists experience an increase in wealth and income due to rising rents. The homes of capitalists are on average more valuable, thus the increase in wealth is stronger for this group. Renters are often found at the lower end of the wealth distribution and are much more likely to be found in the lower half of the income distribution than in the upper half. In flexible rental markets, house price booms may thus potentially redistribute from a rather vulnerable group to the small group of capitalists that are typically wealth- and income-rich.

Capitalists are not only overall wealthier than owners or renters, they indeed outperform other types of households *in every single asset category*. They also have on average larger debts, which may reflect their increased investment possibilities and activities. Capitalists are on average slightly less wealthy than the top wealth group.

As business wealth, stocks and funds are predominantly held by capitalists, booming markets lead to direct gains for these households. In contrast, the wealth-poorest group hardly possesses any productive assets (bonds, investment funds and business wealth): on average less than EUR 1,000 in total in all countries except Spain. In Austria, France and Germany, the average amount is even below EUR 500. This means that a booming economy does not directly impact their economic situation and thus no transmission via a wealth effect is possible.

Stock market booms may have no direct impact on the lowest wealth group as holdings in stocks and investment funds together range on average between EUR 100 and EUR 350 only. Also, the second, third and fourth wealth quintiles possess on average rather small amounts of stocks and funds. Only the top wealth group, who posses on average roughly EUR 70,000 in stocks and funds, can potentially earn substantial amounts from these assets and thus directly benefit from a stock market boom. Similarly, the top income group owns on average roughly EUR 60,000 in stocks and funds, and could thus directly benefit from a booming stock market. On the contrary, in the case of falling stock market prices negative wealth effects are also not to be expected among large sections of society.

The distribution of debts stands out for Spain, where they are large and evenly spread across wealth groups. Average debts among the wealthiest 20% is just 1.3 times the average debts among the poorest households. One explanation is the extraordinary housing boom at the beginning of the century that motivated many people to invest in real estate. After the bust, many were left with substantial mortgage debts. Thus, the share of owners with mortgages is large across all wealth groups (see Figure 11 and Figure 12).

4 Conclusions

The article discusses a framework to compile Distributional National Accounts (DINA). A partial integration of distributional information into the System of National Accounts is suggested, but the article points out the importance of a comprehensive list of variables to achieve a measure of total marketable wealth. This partial integration is called *Hybrid DINA*. Hybrid DINA are also feasible when links between micro and macro data are not (yet) well established for all variables as a step by step integration process is possible without changes in definitions hindering comparability over time.

The framework for DINA suggested in this article is suited to serve two functions: first, DINA establish a link between aggregate macroeconomic indicators and the system of measuring macroeconomic activity, the national accounts. The linkage enables an understanding of the allocation of gains and costs associated with macroeconomic trends and, vice versa, monitoring the influence of inequality on the wider economy. Second, DINA constitute by themselves a comprehensive measure of wealth inequality, which thus needs to cover all relevant components of marketable wealth.

The article further stresses the importance of meaningful vertical groups of DINA. Groupings by wealth, income and functions of wealth are provided. Regarding the latter, the article distinguishes between renters, owners and capitalists, which represent three functions of wealth: provision, own use and income generation. Additionally, suitable summary statistics are derived to provide an adequate overall picture of inequality along these dimensions.

In the empirical section, I combine survey (HFCS) and national accounts (NA) data to compile DINA for Austria, Finland, France, Germany and Spain.

A major problem of wealth surveys is the insufficient coverage of the wealthiest households. Since wealth is heavily concentrated at the very top, exclusively relying on surveys hence leads to an underestimation of the degree of wealth inequality and biased DINA. Therefore, I perform a top tail correction making use of rich list data, which exist in all five countries analysed. For France and Spain, additional information on the concentration of wealth at the top exists: top wealth shares derived from (predominantly) tax data as well as adjusted wealth shares taking into account wealth held in offshore tax havens. These additional pieces of information are used to estimate either a Pareto or a Generalized Pareto distribution that substitutes the top tail in the survey. Top tail adjustments based on rich lists or adjusted top wealth shares lead to very similar results. Making use of unadjusted top wealth shares led to slightly smaller overall changes both in France and Spain. The importance of this adjustment correlates with the quality of the survey design in terms of the use of administrative data and the applied oversampling strategy. For reasons of comparability, a top tail adjustment thus appears to be essential.

High wealth inequality is found along all three dimension analysed in this article: wealth groups, income groups and functions of wealth. Highest inequality is usually documented for Austria and Germany, whereas inequality is lowest in Spain and Finland. France consistently lies in between. Different components of wealth exhibit substantial differences in the degree of inequality: financial wealth (excluding deposits) is much more unequally distributed than housing wealth, deposits or vehicles. Vehicles, an unproductive asset class, are very important among poorer households, but overall the total value of vehicles appears to be similarly high as total holdings in funds or stocks.

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Appendix

A The Conceptual Link between HFCS and NA data

A.1 Financial Assets and Liabilities

Financial assets and liabilities are recorded in the *Financial Accounts (FA)* that form part of the NA. Large parts of FA data is based on counterpart reporting data, i.e., the primary source originates from data reported by banks, investment funds, insurance corporations and pension funds. Thus, the general data quality on loans (liabilities), deposits, debt securities (bonds), investment fund shares and listed shares is high:

> Highest accuracy is achieved for the data on deposits held and loans received as they are reported by banks in the euro area under ECB Regulation ECB/2013/33, which ensures a fully harmonised and almost complete monthly reporting of household deposits held with Monetary Financial Institutions (MFIs), and of loans granted by MFIs. Those are the main sources for the FA. Statistical information on the holdings of money market funds, other investment fund shares, listed shares and debt securities [bonds] are obtained through the new securities holdings statistics (ECB/2012/24) and/or the domain specific statistics for money market and other investment funds (ECB/2013/33 and ECB/2013/38). These data are considered complete and of overall good quality, though the sectoral delineation of holdings is not always straightforward, particularly when the country of residence of the holder and issuer differs. (EG-LMM, 2017, paragraph 26)

The FA instruments *F.4 Loans (liabilities)*, *F.22 Transferable deposits* and *F.29 Other deposits*, *F.3 Debt securities*, and *F.52 Investment fund shares or units* do have a conceptually highly-comparable counterpart in the HFCS (see Table 2). Given the high data quality in the FA for these variables, they enter the integrated part of DINA.

Despite the conceptually well-established link, comparing HFCS to FA aggregates, usually reveals much lower values in the HFCS. Due to the high confidence in the FA data, one can speak of *under-coverage* in the HFCS (see Table 8 and EG-LMM, 2017, for coverage ratios and a discussion). Under-coverage may be the result of all survey-related issues discussed in subsection 2.3. In particular, missing wealth at the top of the distribution may explain parts of the gap although Chakraborty and Waltl (2018) find that the so-called “missing wealthy” explain only few percentage points of the gap in Austria and Germany. See also Table 8.

A.2 Business Wealth

The FA record business wealth in the instruments *F.511 Listed shares*, *F.512 Unlisted shares* and *F.519 Other equity*: Listed and unlisted shares are equity securities listed or unlisted on an exchange. Other equity compromises all other types of equity including, for example, equity in limited liability companies whose owners are partners but not shareholders or real estate assets located in a different country. Dwellings and land used for business purposes are not identifiable in the NA. These assets are merged with residential dwellings and their underlying land.

The HFCS records the variables *self-employed businesses*, *non-self-employed businesses* and *publicly traded shares*. Additionally, real estate assets used for business purposes could be considered as part of business wealth.

For listed shares, the conceptual link between the FA and HFCS is strong. Also, the value of listed shares is highly reliable due to comprehensive micro data (see above). For all other items, the link is problematic. The EG-LMM proposes several re-classifications and split-ups necessary (both in the HFCS and the NA) to establish a reliable link (see EG-LMM, 2017, paragraphs 55 to 60): a particular problem arises from the national accounts' distinction between *producer households* and *quasi-corporations*. Producer households are not considered as a separate institutional unit, and associated assets and liabilities are thus spread over all instruments in the household sector. They cannot be distinguished from holdings by non-producer households. In contrast, when a business is considered as a separate institutional unit, it is labelled a quasi-corporation, and a net value of assets and liabilities is recorded as other equity. Such a distinction is not possible in the HFCS counteracting an unambiguous link.

The distribution of wealth held by producer households across all instruments constitutes a fundamental problem in the comparison of NA and HFCS data. The household sector (S.14) consists of several sub-sectors including employers (S.141) and own-account workers (S.142). If it was possible to separately identify assets forming part of either one of these two sub-sectors, a consistent link could be established. This is, however, currently not the case.

Similarly, in the HFCS more detailed information about the legal forms of businesses would facilitate comparison. Due to differences in legal systems, the legal forms of businesses need to be classified differently across country. There are currently efforts undertaken for such a classification, which, however, can only be implemented in future HFCS waves.

In contrast to other financial assets, the quality of FA data on unlisted shares and other equity is low. Valuation of unlisted shares and other equity is complicated as market values are – in contrast to listed share – not observable. Also, these instruments tend to be affected by vertical balancing (the process of aligning financial and non-financial accounts balancing items) and thus may not be very accurate (see EG-LMM, 2017, paragraph 27).

Thus, integrating components of business wealth other than listed shares is currently problematic. For the sake of a comprehensive measure for net worth across different groups (a horizontal reading of DINA as shown in Table 11) requires these components to be put in a supplement account. Finer recording of business wealth in both, the NA and HFCS, will potentially facilitate a reallocation to the integrated account in the future.

A.3 Consumer Durables and Valuables

Consumer durables are excluded from NA balance sheets. This means that assets such as household appliances, furniture, consumer electronics, but also vehicles like cars, yachts and jets, that could well be considered important for an overall measure of wealth, do not appear in the definition of net worth coming from the NA.

Eliminating consumer durables from total wealth lets the sector as a whole appear to be poorer than it actually is. These missing assets are not equally distributed within society. Indeed, one would expect rather wealthy or high-income households to possess on average more in number and/or more expensive household appliances, furniture, and vehicles, while the relative importance of such assets compared to the overall wealth is probably greater for poorer households.

The HFCS collects the value of vehicles, which a household possesses. It asks for the value of cars and the value of any other vehicle giving motorbikes, trucks, vans, planes, boats, yachts, trailers and caravans as examples.

As compared to other components of net worth, vehicles do not generate income and thus do not contribute to the generation of wealth. Poorer households tend to own relatively large amounts of assets in the form of vehicles but very low amounts in income-generating assets (see DINA results in Table 11). These structural differences in portfolios across the wealth distribution are important to be reflected in DINA.

Also, to serve the second function of DINA, which aims for a comprehensive (horizontal) wealth inequality measure, vehicles should be included in the supplement account. The recording of additional consumer durables in the HFCS would increase the comprehensiveness of the total wealth measure.

Valuables, in contrast, fall within the scope of the national accounts *(AN.13 Valuables)* and are also recorded in the HFCS. The HFCS asks for valuables in general and names jewellery, works of art, and antiques as examples. In the NA, valuables include produced assets that are not primarily used for production or consumption, that are expected to appreciate or at least not to decline in real value, do not deteriorate over time under normal conditions and that are acquired and held primarily as stores of value. They consist of works of art, antiques, jewellery, precious stones, non-monetary gold and other metals, and the like (see ESA, 2010).

Conceptually, the definitions seem to match well. However, currently NA data is only available for four countries in the euro area (Finland, France, Portugal and Latvia). The Finnish HFCS lacks this question. In those countries, where NA estimates exist, HFCS aggregates are considerably larger: the ratio of HFCS aggregates over NA totals ranges between 1.5 in Portugal, 2.9 in France and 4.5 in Latvia for 2014 thus indicating substantial *under-coverage in the NA*.

Given the scarce data availability in the national accounts, valuables are hence not integrated but allocated to the supplement account.

A.4 Housing Wealth

A.4.1 Separation of Land and Structure in the National Accounts

Housing wealth constitutes the most important asset class for large sections of society. A home is often the single most important asset a household possesses and it is a source of essential services – housing is a basic human need. Mortgages with housing assets as collateral are, at the same time, the most important types of liabilities in the household sector (see also Figure 11 and Figure 12). The inclusion of housing wealth is thus crucial when aiming for a comprehensive measure of total wealth.

In the NA, housing wealth is spread over three instruments: *Dwellings (AN.111)*, *Buildings other than dwellings and other structures (AN.112)*, and *Land (AN.211)*.

The instrument *dwellings* refers to residential buildings excluding land. In the household sector, *buildings other than dwellings and other structures* mainly include buildings (excluding land) used for production (and thus non-residential/business) purposes by sole proprietors and partnerships. Dwellings and other buildings are to be recorded at market prices. In the household sector, the aggregate *dwellings* is substantially larger than the aggregate for other buildings.[28]

Land comprises all types of land and is valued at its current market price. ESA (2010) foresees to split land into four sub-categories: *Land underlying buildings and structures (AN.2111)*, *Land under cultivation (AN.2112)*, *Recreational land and associated surface water (AN.2113)* and

[28]Table 9 reports NA balance sheet items for the household sector in Austria, Finland, France, Germany, Belgium, Italy and the Netherlands in 2014: the share of non-residential buildings in the total of all structures ranges between 3.4% in Belgium and 15.6% in Austria.

Other land and associated surface water (AN.2119). Numbers for such detailed break-downs are, however, currently not available in Europe.

When owning a house, typically also the underlying land is owned.[29] In the case of condominia, ownership usually comprises the individually owned part of the structure as well as a share of the collectively owned parts of the structure and underlying land. Thus, an intuitive and common way of thinking of housing wealth is to treat the structure and the underlying land as a bundle of goods. This approach is also followed in the HFCS.

In practical terms, the total value is often more relevant than the separate values of structure and land, e.g., when using housing wealth as a collateral for a mortgage. Likewise, it is hard to imagine to sell a structure but keep the land, or vice versa. Thus, when liquidating housing wealth – by borrowing against or selling it – it is the value of the bundle that counts rather than the separate values.

Measuring separate values implicitly assumes the absence of emergence or bundling/interaction effects, i.e., it is assumed that the sum of the value of the structure and the value of the land equals the total value although the whole might well be more valuable than the sum of its parts: a specific structure might be designed to fit well the physical characteristics of a land plot (e.g., steep terrain or waterways lancing the plot) and thus be worth more when it comes together with this specific land plot. Contrarily, a land plot might be worth more in the absence of a structure that would need to be demolished before the full potential of the plot could be exploited.

In the NA, however, it is important to distinguish between *produced* and *non-produced* assets. While the structure is produced, the underlying land is not. Thus, the price of the structure can be interpreted as the cost of rebuilding it. The price of land has no such interpretation. Structures, in contrast to land, depreciate due to wear and tear.

Larson (2015) points out the difficulties resulting from this requirement: "[u]rban land is typically transacted as part of a bundle including structures and other improvements, making separated land value data difficult to estimate and tabulate. Because the most valuable land is in cities, the issue of land-structure value separability is fundamental to national land value accounting."

Whereas information on dwellings is generally available in the NA of European countries, information on land is still scarce. A first transmission of the value of land is required in the EU as of end-2017. However, there are still substantial data gaps and methodologies are still not fully established in all countries.[30]

In the NA, the value of structures (net of underlying land) is usually estimated via the *Perpetual Inventory Method* (PIM). The stock of dwellings is thus the result of accumulated flows of past investments in dwellings (*Gross Fixed Capital Formation* (GFCF) of dwellings, and substantial repair and maintenance) adjusted for depreciation.[31] The price index associated with dwellings is consequently a construction cost index.

Estimating the value of land is less straight-forward (see Eurostat-OECD, 2015, regarding details about different methodologies). A comprehensive bottom-up approach would require data on the ownership of each parcel, its type (farmland, residential, etc.) and an estimate of

[29]There are diverging ownership arrangements. For instance, it is possible that a private household only owns the structure but leases the underlying land. I do not follow the consequences of such ownership arrangements in this article but focus on the most common case of joint ownership of structure and land.

[30]Available data is presented in Table 9.

[31]The PIM requires crucial assumptions on the depreciation pattern of structures such as an average service life, survival patterns and write-off profiles.

its price. Data on the ownership (private households, government, corporations, etc.) and the type of land is usually available in the cadastre. However, accurate valuation of all land parcels is difficult. Transactions of vacant land, that could feed into (for instance hedonic) valuation models are rare. Particularly in dense urban areas, prices for vacant land are rarely observed, which means that there are hardly any price observations such an imputation can be based on. Thus, high-quality price indices and average prices are hardly available or, if available, not broadly applicable.

Different types of land (land underlying structures, vacant land belonging to different land use zones, etc.) in different locations are expected to follow distinct appreciation trends. Thus, very specific price indices indeed would be needed. Extrapolating from land prices observed in distinct locations and for different types of land is likely to introduce measurement error.

In contrast, measuring the value of real property comprising land *and* structures, i.e., the *combined value of real estate*, appears to be easier as such combined prices are usually observed in the market.

Although the combined value is not directly needed for the compilation of NA, it can serve to compute the value of land indirectly. Standard property price indices are constructed based on transactions and thus reflect the joint price inflation of land and dwellings.[32] Additionally, information on the stock of housing wealth may be available from public real property appraisals (usually needed for real estate taxation) or census information combined with appropriate market price data. Whereas stock information may only be collected infrequently, more frequent price indices can serve to update the value in intermediary periods.

Alternatively, the HFCS could be used as a new data source providing information on the value of housing wealth for the household sector every two to three years for a large number of European countries.[33] For that, it is important to understand, whether self-reported values in the HFCS are accurate and trustworthy.

The combined value of real estate together with the value of dwellings allows one to estimate the value of land as a residual. The residual approach guarantees that total housing wealth is in-line with the independently measured value of the housing stock. Consequently, the accuracy of the split into land and structure depends solely on the quality of the estimated value of dwellings.

In contrast, when land is measured directly, measurement errors in both components, dwellings and land, may imply a very different aggregate than the independently measured stock of housing wealth. In this case, both, the value of dwellings and the value of land, are the result of a demanding modelling exercise, whereas the combined value can be estimated more directly. Thus, the residual approach is likely to generate more meaningful results when evaluated against the reliability of the value for total housing wealth. Admittedly, this is not the prime goal of NA.

As mentioned before, the HFCS constitutes a rather new data source that may help to estimate the combined value for the household sector.[34] If this information is used to impute the value of land residually, a perfect link between micro and macro data is established that also serves the compilation of DINA.

[32]There are attempts to separate indices into a structure and land component to serve national accounting purposes (see Diewert et al., 2015).

[33]Luxembourg currently investigates the potential to use the HFCS for this purpose or whether to rely on cadastre and land transaction data.

[34]It does, however, not solve the problem for other sectors.

A.4.2 Generic Differences between National Accounts and the HFCS

Beside the separation between land and structures, there are further generic issues that currently limit using NA data directly for the compilation of DINA (see also EG-LMM, 2017, Box 3: Housing and other non-financial assets). These problems appear to be particularly relevant when the combined value can not be interpreted in a similar way as the HFCS housing wealth.

First, it is not possible to distinguish land underlying residential structures from land underlying other (e.g., commercial) buildings owned by sole-proprietors and partnerships. Hence, a separation between business and non-business/residential use of land is not possible when using the final numbers reported in the NA. Separate categories would be very informative for analysing the distribution of several components of wealth.

For structures, the separation into residential and non-residential buildings is possible due to the separate categories *Dwellings* and *Buildings other than dwellings and other structures*.

In the HFCS, a separation between residential housing wealth and real estate used for business purposes is possible. The HFCS also allows one to distinguish residential housing wealth by housing tenure providing a very insightful separate aggregate for owner-occupied housing wealth. This is currently not possible in the NA.

Second, in Europe it is currently not possible to distinguish between non-financial assets owned by households and such assets owned by *Non-Profit Institutions Serving Households (NPISHs)*.[35] NPISHs are separate legal entities serving households, which are private non-market producers, and include, for instance, churches and religious societies, political parties, charities, trade unions, and social, cultural, recreational and sports clubs. The separation is currently only possible for financial assets/liabilities.

Third, the separation of the value of land and structure is not consistent: Paragraph 7.52 of the ESA (2010) manual states that: "If the value of the land cannot be separated from that of buildings or other structures situated on it, the combined assets are classified together in the category of the asset that has the greater value." It is thus unclear, how "clean" the data is.

Finally, the NA treat property owned by residents but located abroad very differently than property located in the country of residence. If immovable assets (land, buildings, etc.) are owned by a resident and located in the resident's country, these assets appear as non-financial asset on the balance sheet of the household sector. In contrast, when the immovable asset is located abroad, a so-called *notional resident unit* (NRU) is created for statistical purposes. This NRU is treated as a resident quasi-corporation, that appears as a *financial asset* (more precisely as Other Equity, F.519) in the NA of the country of the owner's residency.

A questionnaire[36] sent to central banks in Europe by the ECB in 2017 revealed that many countries face difficulties in collecting reliable data that can be used to properly measure immovables assets held by residents abroad. Some countries assess the possibility to use HFCS data for this purpose.

Information about the location of the properties (i.e., whether they are located in another country or not) is not available in the harmonized HFCS data set provided by the ECB. Some countries, however, do collect this extra information as part of their national amendment to the HFCS. The possibility to distinguish domestic and foreign assets would be important for the integration of housing wealth.

Savills plc., a provider of global real estate services, provides information on cross-border invest-

[35]The households sector (S.14) and the NPISH sector (S.15) are merged into a single number.

[36]A report summarizing the conclusions from this exercise is available upon request (see Girón et al., 2017).

ments into European real estate markets. They report that in 2017, cross-border investment as compared to domestic investment in Europe are large in all 16 countries analysed and accounted between 24% in Greece and 89% in Poland.[37] Although these numbers do not completely align with what should be measured in the NA (Savills' numbers include institutional investors and all types of real estate), the substantial shares should create concerns regarding adequate reflection of these asset types in the NA.

The HFCS collects information on the current value of the *Household Main Residence* (HMR), as well as the current value of other properties. It also collects information on the use of these properties, thus enabling a distinction between business and private use. In particular, for properties other than the HMR, interviewees are asked to specify the property's *type* (house or flat, apartment building, industrial building/warehouse, building plot/estate, garage, shop, office, hotel, farm, or other) and the *use* (household's holidays or other private own use, business activities by someone in the household, rented or leased to a business or people outside the household, vacant, free use for others, or other).

These classifications are useful to keep as they refer to very different functions of housing wealth: Owner-occupied housing provides shelter to its inhabitants thus fulfilling a basic human need. Other properties not used for business purposes are rather a store of value and thus refer to the asset dimension of housing. In contrast, dwellings and land used for business purposes are productive investments.

If land is measured as a residuum based on a well-measured and well-interpretable combined value of real estate, this combined value can be linked to the HFCS total. The desirable split-ups can be achieved by exclusively relying on the HFCS. DINA are then not affected by the split-up of the combined value into components of structure and land, and not affected by assumptions behind the PIM applied to derive the value of dwellings.

If land is independently measured and the sum of the values of land and dwellings cannot be interpreted as a meaningful measure of total housing wealth, a link with the HFCS is problematic due to the before mentioned measurement problems related to both, dwellings and land, and the generic issues in the NA.

In this article, I thus establish a *pseudo-link* of housing wealth to the NA by assuming a residual approach towards the measurement of land using the HFCS as the basis. This means that I deduct the value of dwellings reported in the NA from the combined housing wealth implied by the HFCS and treat the result as the value of land. The resulting estimate for land is not perfect since the value of dwellings suffers from including of NPISH and other generic issues in the NA,[38] and the inclusion of real estate assets located abroad in the HFCS. Still, this attempt guarantees perfect alignment between the NA and HFCS aggregate per construction, hence serve the purpose of DINA, and is in-line with NA requirements. Given the yet scare data on land in the NA, the pseudo-link additionally provides benchmark estimates for this asset class.

A.4.3 A "Pseudo Link" for Housing Wealth: The Value of Land as a Residual

[37]See `http://pdf.euro.savills.co.uk/european/briefing-notes/eib-march-2018.pdf`, retrieved on June 14, 2018.

[38]The value of land in this setting equals the combined value for S.15 minus the value of dwellings for S.14 *plus* S.15. However, the share of S.15 in the value of dwellings is expected to be negligibly small for dwellings (see also EG-LMM, 2017, Box 3: Housing and other non-financial assets).

Table 9: The value of land as a residual.

		Austria	Finland	France	Germany	Spain	Belgium	Italy	The Netherlands
(1)	*National Accounts* (incl. households and NPISHs)								
(1a)	Dwellings (residential)	393,350	249,464	3,460,226	4,047,208	–	516,509	2,510,419	691,289
(1b)	Other buildings (non-residential)	72,714	23,374	169,263	436,184	–	18,280	340,755	67,358
(1c)	Land (res. + non-res.)	380,465	118,636	3,352,400	2,385,159	–	783,401	3,554,082	651,649
(1d)	Total; *(1a)+(1b)+(1c)*	846,529	391,474	6,981,889	6,868,551	–	1,318,190	6,405,257	1,410,296
(1e)	Total excl. other buildings; *(1d)-(1b)*	773,815	368,100	6,812,626	6,432,367	–	1,299,909	6,064,501	1,342,938
(2)	*HFCS Housing Wealth* (residential, only households)								
(2a)	Unadjusted	631,228	449,771	4,882,177	5,574,125	3,772,551	1,143,699	4,258,282	1,205,889
(2b)	Adjusted	786,477	463,827	5,192,118	6,487,307	4,076,224	–	–	–
(3)	*Implied Value of Land Owned by Private Households* (residential); *(2)-(1a)*								
(3a)	Unadjusted	237,878	200,307	1,421,951	1,526,917	–	627,188	1,747,862	514,600
(3a')	Unadjusted; share of *(1c)*	37.48	X	57.58	35.98	–	19.94	50.82	21.03
(3b)	Adjusted	393,127	214,363	1,731,892	2,440,100	–	–	–	–
(3b')	Adjusted; share of *(1c)*	X	X	48.34	X	–	–	–	–
(4)	*Implied Housing Wealth* (non-residential and NPISH); *(1d)-(2)*								
(4a)	Unadjusted	215,301	X	2,099,712	1,294,426	–	174,493	2,146,975	204,407
(4b)	Adjusted	60,052	X	1,789,771	381,244	–	–	–	–
(5)	*Coverage Ratios; (2)/(1e)*								
(5a)	Unadjusted	81.57	122.19	71.66	86.66	–	87.98	70.22	89.79
(5b)	Adjusted	101.64	126.01	76.21	100.85	–	–	–	–
(5c)	Pseudo link *(2)/[(1a)+(3)]*	100.00	100.00	100.00	100.00	–	100.00	100.00	100.00

Notes: Amounts are in million euro. National accounts data are for 2014 and refer to AN.111 Dwellings, AN.112 Other buildings and structures, and AN.211 Land for the combined household and NPISH sector (S.14 + S.15). HFCS values exclude housing wealth for business use (i.e., DA1122 plus DA1110). Coverage ratios are defined as HFCS total over NA total. *Source:* 2nd wave HFCS, Eurostat.

There are two major generic problems regarding non-financial assets in the NA: first, assets owned by NPISHs are indistinguishable from asserts owned by private households, and, second, land underlying non-residential buildings and structures, and/or used for production by sole-proprietors and partnerships are indistinguishable from total land.

The report of the EG-LMM (2017) states that the share of NPISH in dwellings (AN.111) is expected to be small, whereas in other asset classes it may be considerably larger.

In the HFCS, housing wealth can be strictly separated into business and non-business (residential) use. Treating the NA instrument dwellings as pure residential and free from NPISH, one can compute the implied value of residential land owned by the household sector by deducting the value of dwellings from the HFCS total of residential housing wealth (see lines *(3a)* and *(3b)* in Table 9). This can be done by relying on the unadjusted or adjusted HFCS totals.

Without a top tail adjustment, the implied value of residential land owned by the household sector is lower than the overall value of land (except as in Finland), implying a share of NPISH and non-residential land in the total value of land of roughly 20% in Belgium and the Netherlands, 36-38% in Germany and Austria, 51% in Italy and 58% in France.

When performing a top-tail adjustment, the share shrinks to virtually zero in Austria and Germany, and is reduced in France.

Given the differences in scope of the NA and the HFCS, coverage ratios do not only measure a quantitative mismatch between NA and HFCS totals but also a quantification of the different scopes. Generally, coverage ratios are large but smaller than 100% when refraining from a top tail adjustment. A top tail adjustment increases coverage ratios and leads to a virtually perfect match in Austria and Germany.

A pseudo-link is established by interpreting the sum of the implied value of residential land owned by private households (lines (3a) and (3b) in Table 9) and the NA total for residential dwellings as total housing wealth excl. NPISHs and non-residential land. This is per construction equal to the HFCS housing wealth indicated by coverage ratios reaching 100% (line (5c) in Table 9). This concept is followed in the hybrid DINA presented in this article.

B A Generalized Pareto Adjustment of the Top Tail Relying on Top Wealth Shares

Top income as well have become an important measure to understand the evolution of inequality over time and to compare degrees of inequality across countries (see Piketty and Saez, 2003, 2006). These series are made available via the WID.world database (Alvaredo et al., 2017), and long series are now available for a considerable list of countries.

Data on top wealth shares are more sparse. The WID.world database currently contains information for China, Russia, the United States, the United Kingdom and France.[39] Additionally, Martínez-Toledano (2017) provides data for Spain.

The shares for France and Spain, which also participate in the HFCS, are mainly based on tax data (see Garbinti et al., 2016, for a documentation for France). Additionally, Alstadsæter et al. (2018) adjust these wealth shares by including wealth stored in offshore tax havens.

In the following, I describe a methodology how to use top wealth shares as auxiliary information to adjust the top tail in the HFCS. The procedure can be applied whenever there is an additional piece of information available describing the wealth at the top.[40]

[39]`https://wid.world/data/`, retrieved on Novemer 6, 2018.

[40]In theory, one could also use rich lists to calculate average wealth at the very top and proceed as described

The following procedure is based on two major assumptions: first, the survey is successful in correctly measuring assets and liabilities for the entire distribution except the wealthiest $p\%$. Second, the distribution of wealth within the top tail follows a *Generalized Pareto Distribution* (GPD). GPDs are a family of heavy-tail distributions including the standard Pareto distribution as a special case. Thus, the distributional assumptions are less strict than the usual Pareto adjustment.

B.1 From Shares to Total Wealth

I assume that the survey measures the wealth of the bottom $(100 - p)\%$, $p \in (0, 100)$, of the population correctly, but misses crucial parts at the very top. Furthermore, I assume that the wealth share held by the top $p\%$ is accurate.

Let α denote the "true" wealth share of the top $p\%$ and α^* the observed share according the HFCS. Let furthermore w_p denote the wealth of the top $p\%$ of the population in euros, e.g., w_{100} refers to total wealth and w_1 to the wealth of the top 1%. Likewise, I denote the observed total wealth as reported in the HFCS by w_p^*. Furthermore, I assume that the survey gets the corresponding quantile right.[41]

The assumption that the HFCS is a reliable source for the bottom $(100-p)\%$ of the population yields

$$w_{100} - w_p = w_{100}^* - w_p^*. \tag{1}$$

Furthermore, the assumption that the top tail is incomplete in the HFCS implies $w_p > w_p^*$, or equivalently

$$\exists\, \varepsilon > 0 : \quad w_p = w_p^* + \varepsilon,$$

which together with (1) yields $w_{100} = w_{100}^* + \varepsilon$.

While w_p, w_{100} and ε are unobserved, one does observe w_p^*, w_{100}^*, α and α^*. Per definition,

$$\alpha^* = \frac{w_p^*}{w_{100}^*} \quad \text{and} \quad \alpha = \frac{w_p}{w_{100}} = \frac{w_p^* + \varepsilon}{w_{100}^* + \varepsilon}$$

and hence

$$\frac{\alpha}{\alpha^*} = \frac{w_{100}^*(w_p^* + \varepsilon)}{w_p^*(w_{100}^* + \varepsilon)} \quad \text{and} \quad \varepsilon = \frac{(\alpha^* - \alpha) \cdot w_p^* w_{100}^*}{\alpha w_p^* - \alpha^* w_{100}^*}.$$

Using the population total obtained from the HFCS, the adjusted average wealth among the top $p\%$ is given by

$$AVG(p) = \frac{w_p^* + \varepsilon}{p\% \cdot n}.$$

B.2 From Total Wealth to Instrument-Specific Aggregates

The total wealth of the top $p\%$ is changed, which needs to be broken down on instrument-level: As Chakraborty and Waltl (2018) show, applying average portfolio shares when aiming for such a break-down is not enough. Stratifying the tail into, say, four strata defined as quartiles of the tail distribution and applying stratum-specific shares, which can be observed from the HFCS, is a feasible strategy.

here. However, the usual large gap between the lowest observation on a rich list and the top observation in the HFCS makes this approach infeasible (see also Table 3).

[41] Chakraborty and Waltl (2018) find that their adjustment for the "missing wealthy" leads to changes in quantiles from roughly the 98%th or 99%th quantile onwards in Austria and Germany. Top tail adjustments should thus start at or below the 98%th quantile.

As there is no distributional information within the top $p\%$, one needs to impose a parametric model to retain this information. This is done by employing a *Generalized Pareto Inter- and Extrapolation*. This method is proposed by Blanchet et al. (2017) and originally designed to recover historic wealth and income distributions from tabulated data. Historic data is rarely available in the form of micro data, but often brackets, i.e., the average wealth for certain quantile ranges, are available. The interpolation, which is based on quintic Hermite splines, recovers an entire distribution from this information.

For the top bracket, say the top 3%, interpolation is not feasible as no upper bound is known. For this last bracket, Blanchet et al. (2017) propose an extrapolation using a GPD. The parameters are estimated to match the average wealth in the top bracket but also match the interpolated distribution from the bracket before, i.e., it is additionally guaranteed that the resulting distribution has a continuously differentiable quantile function and matches the last observed quantile.

The family of GPDs is defined as

$$F_{GPD}(x|\mu,\sigma,\xi) = \begin{cases} 1-\left(1+\frac{\xi(x-\mu)}{\sigma}\right)^{-1/\xi}, & \text{for } \xi \neq 0, \\ 1-e^{-(x-\mu)/\sigma}, & \text{for } \xi = 0, \end{cases}$$

where $\mu \in \mathbb{R}$, $\sigma \in (0,\infty)$ and $\xi \in \mathbb{R}$. The distribution is defined for all $x \geq \mu$ (in the case of $\xi \geq 0$) or $\mu \leq x \leq \mu - \sigma/\xi$ (in the case of $\xi < 0$). The family is very general and includes the standard Pareto distribution ($\xi > 0$ and $\mu = \sigma/\xi$), the (shifted) exponential distribution ($\xi = 0$) and the uniform distribution ($\xi = -1$) as special cases.

Following Blanchet et al. (2017), I focus on the cases $0 < \xi < 1$, which guarantees that the estimated distribution approaches a power law and has finite expectation.

I apply the interpolation on the brackets $(10\%; 25\%)$, $(25\%; 50\%)$, $(50\%; 75\%)$, $(75\%; 80\%)$, $(80\%; 90\%)$ and $(90\%; p\%)$ using average wealth for each bracket and quantiles calculated from the HFCS. The upper tail $(p\%, 100\%)$ is modelled by a GPD extrapolation. The average wealth in the top bracket hence is not the average measured by the HFCS but the adjusted average $AVG(p)$!

Using only these few pieces of information, the interpolation method is able to recover the full HFCS distribution almost perfectly. The top part of the distribution becomes steeper as a result of the top tail adjustment (see Figure 4). The estimated GPD at the top is smoothly matched with the empirical HFCS distribution. There is no kink in the distribution, which may be the case in a standard Pareto adjustment.

Table 10 reports all estimated parameters. In both countries, average tail wealth directly inferred from the HFCS is lowest, followed by top share adjusted tail wealth relying on shares excluding offshore wealth and adjusted tail wealth relying on rich lists. It is consistently highest when relying on top wealth shares including offshore wealth.

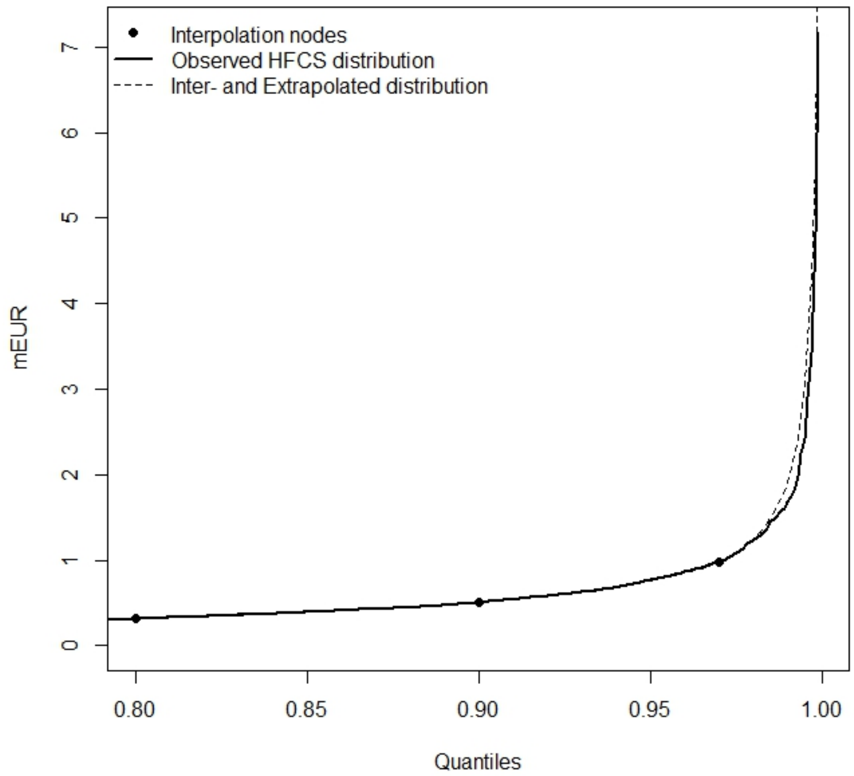
To redistribute total tail wealth across its components, I follow the so-called analytical approach proposed by Chakraborty and Waltl (2018) but adapt the methodology so that it does not only work for a standard Pareto distribution but also for a GPD.

For that, I need to calculate the expected value for each stratum. Mirroring the set-up in Chakraborty and Waltl (2018), I will eventually calculate the conditional expectation for four strata defined as quartiles of the tail distribution, i.e., the estimated GPD.

For that, the quantile function $F_{GPD}^{-1}(p)$ is needed, which is obtained by solving $F_{GPD}(x) = p$:

$$F_{GPD}^{-1}(p) = \mu + \frac{\sigma}{\xi} \cdot \left[(1-p)^{-\xi} - 1\right].$$

Figure 4: Top tail of the Wealth Distribution.



Notes: The figure plots the quantile function for France measured from the HFCS and the result from the inter- and extrapolation for $p = 3$, i.e., the adjustment starts at the 97% quantile. Below the 97% quantile, the observed and interpolated distributions match almost perfectly. The top tail adjustment leads to a steeper quantile function above the 97% quantile.

Average wealth within stratum $Q = [F_{GPD}^{-1}(p_1); F_{GPD}^{-1}(p_2)]$ is then given by

$$\begin{aligned} E_{GPD}(Y|Y \in Q) &= \frac{1}{p_2 - p_1} \int_{p_1}^{p_2} F_{GPD}^{-1}(q)\, \mathrm{d}q \\ &= \mu - \frac{\sigma}{\xi} + \frac{\sigma}{\xi(\xi-1)(p_2 - p_1)} \cdot \left[(1-p_2)^{1-\xi} - (1-p_1)^{1-\xi}\right]. \end{aligned}$$

Average (unconditional) tail wealth is obtained by setting $p_1 = 0$ and $p_2 = 1$,

$$E_{GPD}(Y) = \mu - \frac{\sigma}{\xi} + \frac{\sigma}{\xi \cdot (1-\xi)}.$$

Per construction, $E_{GPD}(Y) = AVG(p)$.

For a standard Pareto distribution with threshold parameter y_0 and shape parameter ϑ, one substitutes $y_0 = \mu = {}^{\sigma}/_{\xi}$ and $\vartheta = {}^{1}/_{\xi}$, and obtains

$$E_{Pareto}(Y|Y \in Q) = \frac{\vartheta y_0}{(1-\vartheta) \cdot (p_2 - p_1)} \cdot \left[(1-p_2)^{1-1/\vartheta} - (1-p_1)^{1-1/\vartheta}\right]$$

as derived in Chakraborty and Waltl (2018), appendix D.

Table 10: Estimation Results.

		France				Spain			
		Rich List	Top Shares Tax	Top Shares Adj. Tax	HFCS	Rich List	Top Shares Tax	Top Shares Adj. Tax	HFCS
Average Tail Wealth		3.27	2.97	3.33	2.27	3.25	3.12	3.37	2.29
Pareto	y_0	0.98	–	–	–	1.03	–	–	–
	ϑ	1.43	–	–	–	1.46	–	–	–
GPD	μ	–	0.98	0.98	–	–	1.03	1.03	–
	$1/\xi$	–	1.39	1.32	–	–	1.40	1.35	–
	σ	–	0.56	0.56	–	–	0.60	0.60	–

Notes: For reasons of comparability, all adjustments target exactly the top 3%, i.e., $x_0 = \mu = F^{-1}_{HFCS}(0.97)$ are given by the 97%th quantile of the empirical distribution. Average Tail Wealth, y_0, μ and σ are reported in million euros. The Pareto shape parameter ϑ corresponds to the GPD parameter $1/\xi$, and the Pareto threshold parameter y_0 to the GPD parameter μ. A GPD is identical to a standard Pareto distribution, if $\xi > 0$ and $\sigma/\xi = \mu$. The latter condition is not met by any estimated GPD.

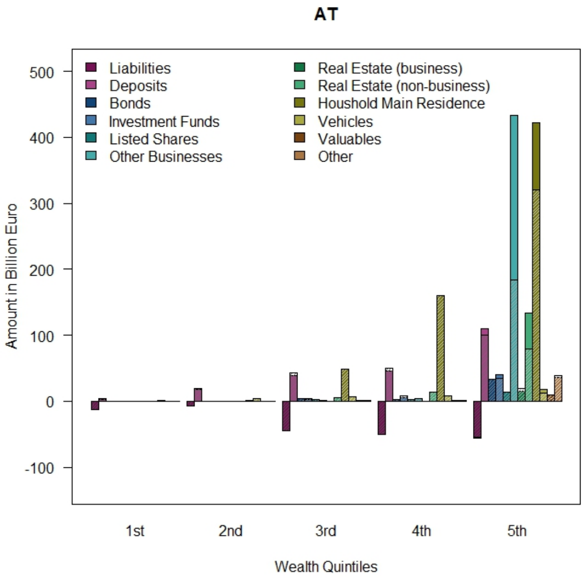
For each wealth stratum (i.e., each quartile of the tail distribution), the total wealth is calculated by multiplying the respective conditional expectation by the number of households belonging to the wealth stratum. The resulting stratum-specific wealth is redistributed to components of wealth by multiplying it by an average portfolio structure observed for the respective quarter in the HFCS. This yields component-specific aggregates for the tail and, by adding them to the HFCS aggregates outside the tail, total components-specific aggregates.

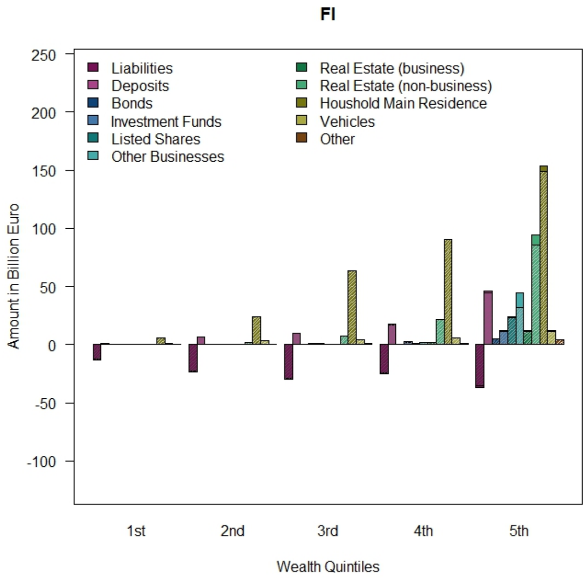
C Hybrid DINA

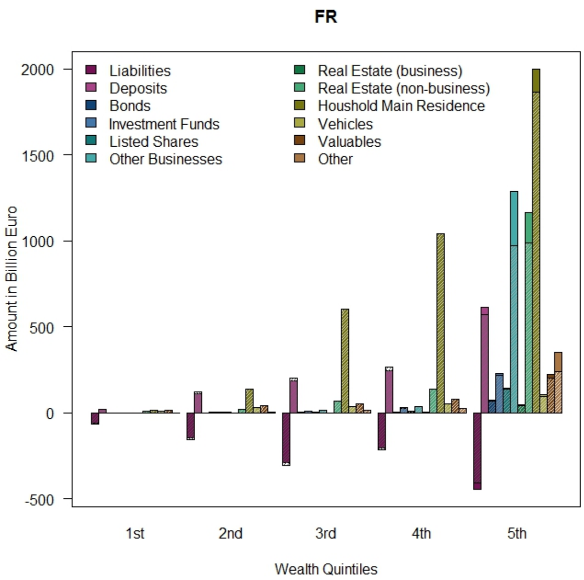
This appendix provides the full set of DINA results for Austria, Finland, France, Germany and Spain. Figure 5 and Figure 6 show break-downs by wealth groups with and without top-tail adjustment. Table 11 reports the corresponding numbers.

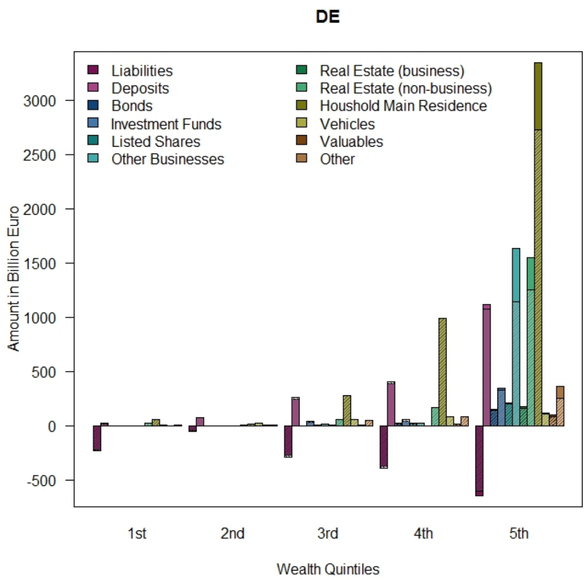
Figure 7 and Figure 8 show break-downs by income groups. Table 12 present again the corresponding numbers.

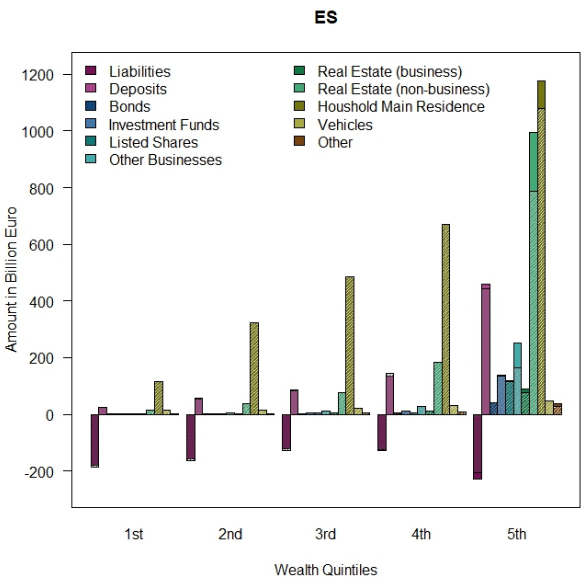
Figure 5: DINA for Wealth Groups: Aggregates.





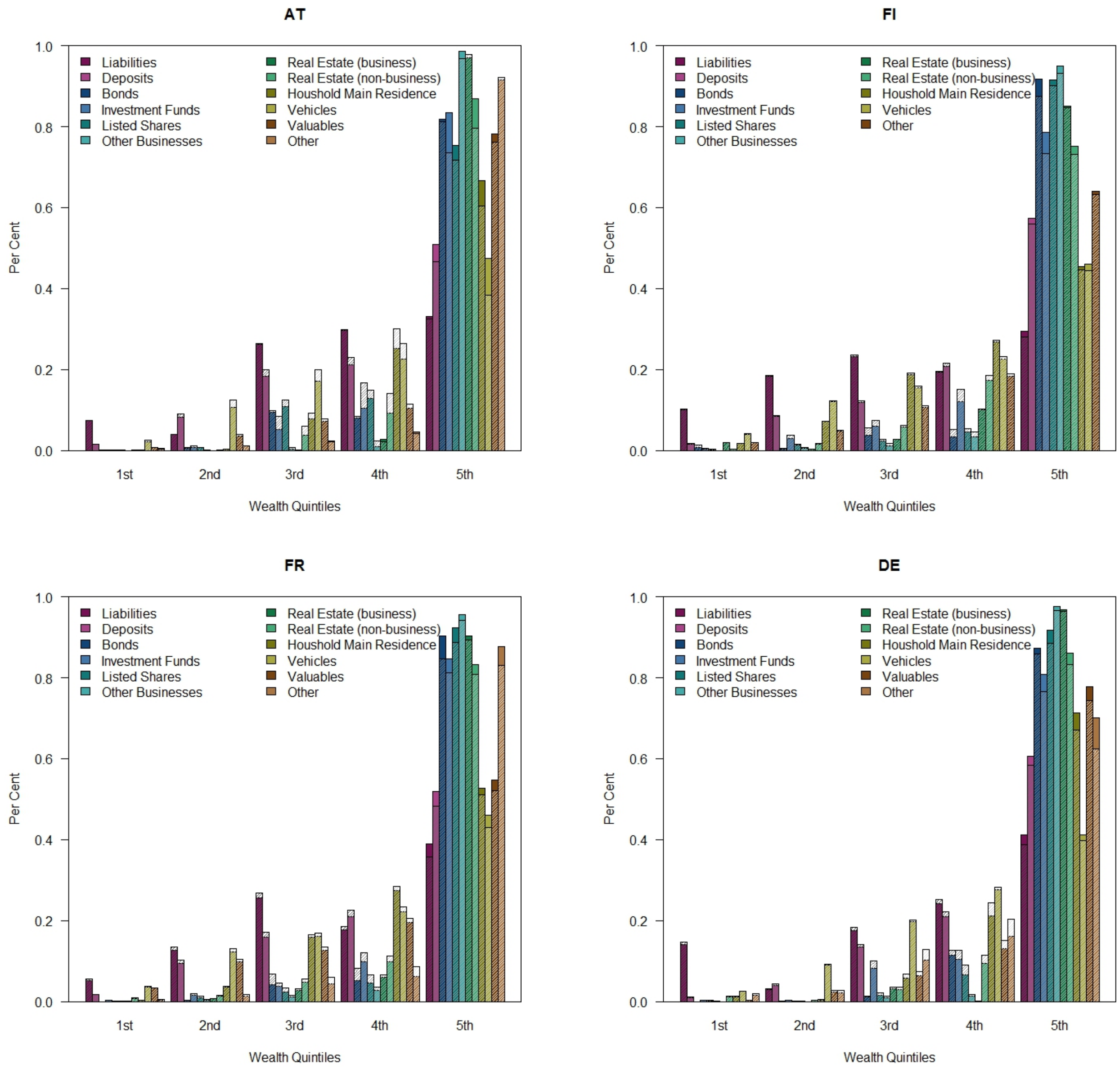


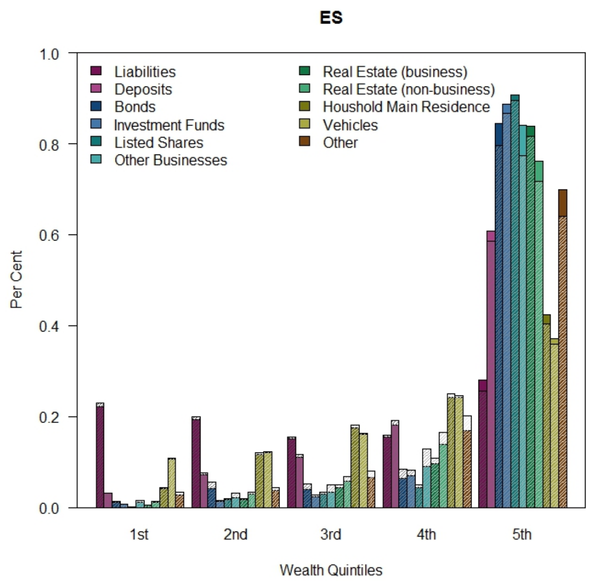




Notes: The figures show Hybrid DINA. Amounts are in billion euro and are broken down by net worth quintiles. Dashed bars show amounts before the Pareto adjustment and full bars after Pareto adjustment.

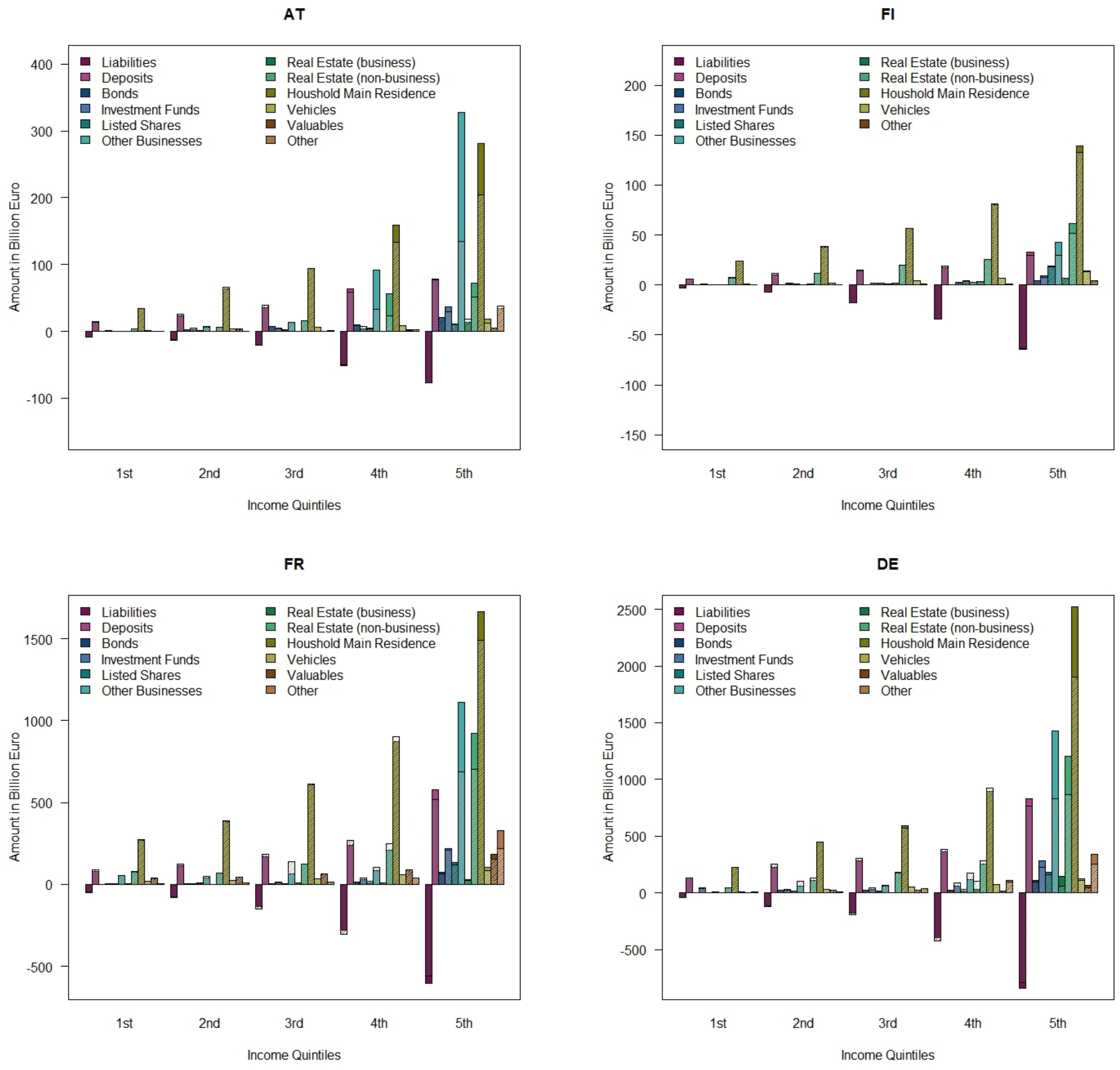
Figure 6: DINA for Wealth Groups: Shares.

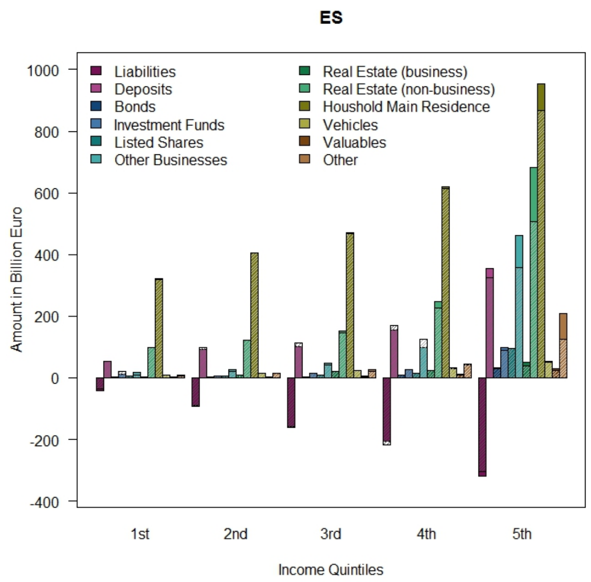




Notes: The figures show shares of different assets/liabilities held by each net worth quintile. Dashed bars show shares before the Pareto adjustment and full bars after Pareto adjustment.

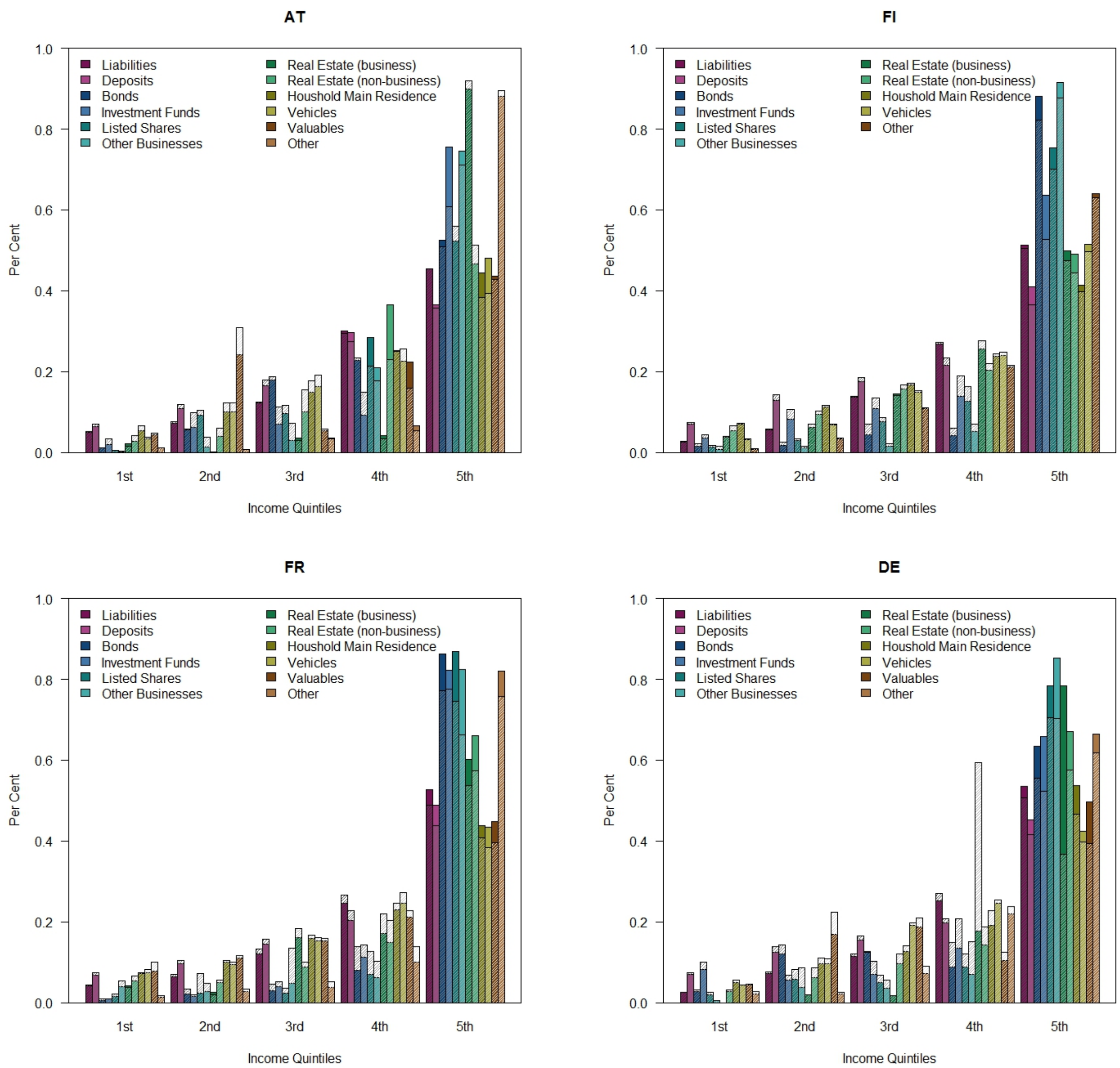
Figure 7: DINA for Income Groups: Aggregates.

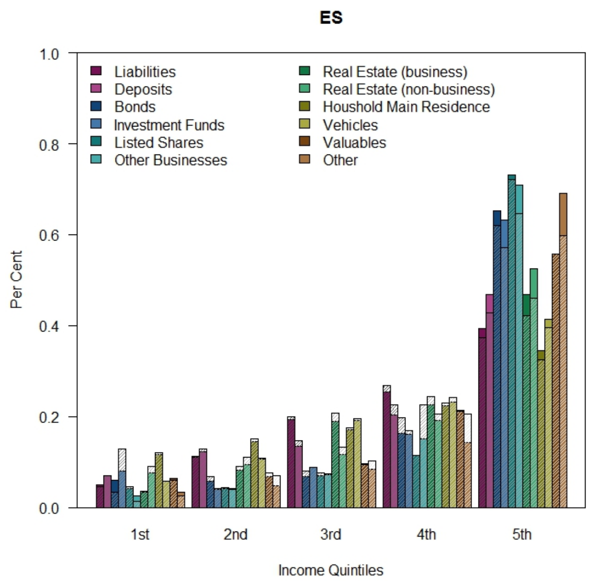




Notes: The figures show Hybrid DINA. Amounts are in billion euro and are broken down by gross income quintiles. Dashed bars show amounts before the Pareto adjustment and full bars after Pareto adjustment.

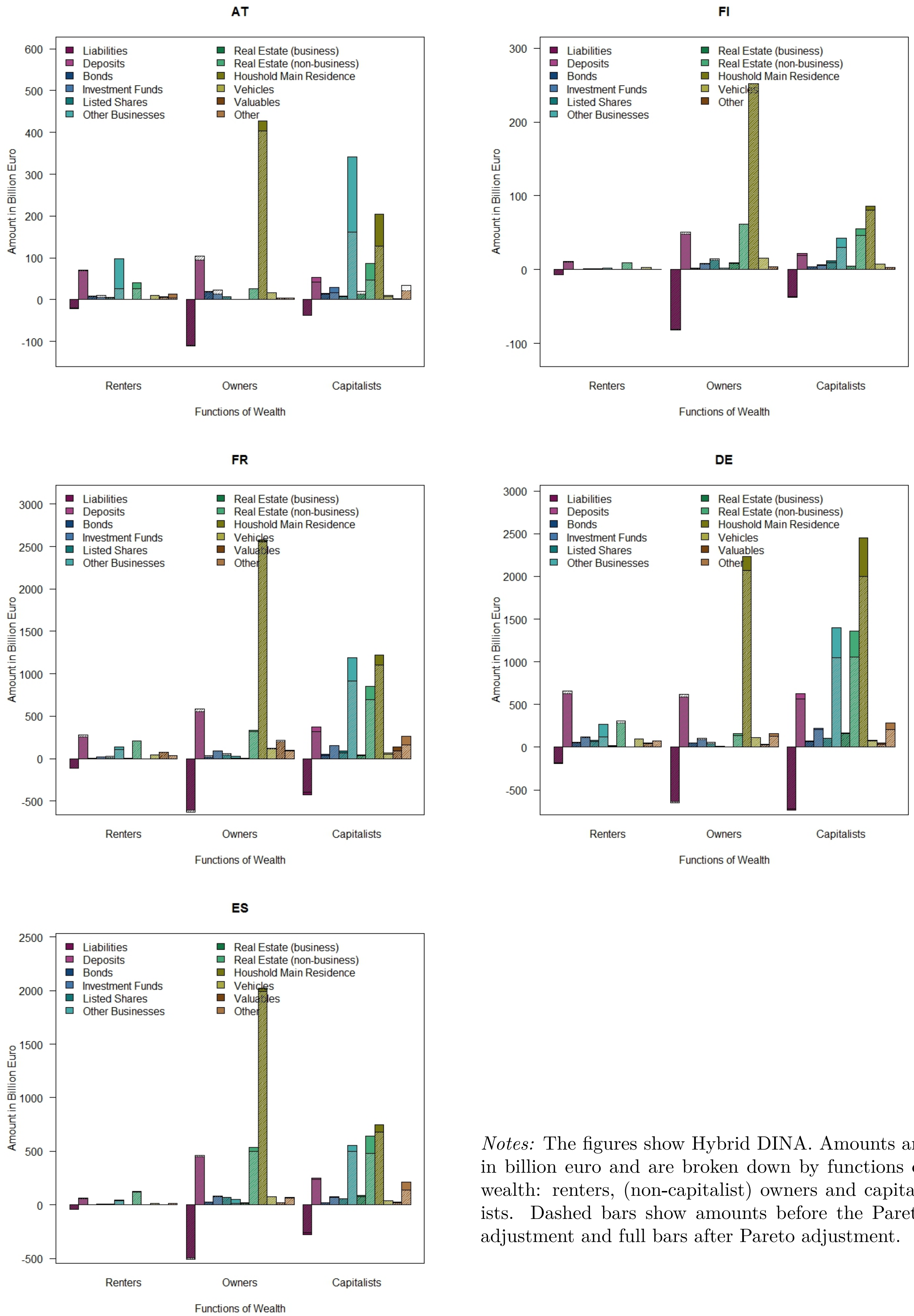
Figure 8: DINA for Income Groups: Shares.





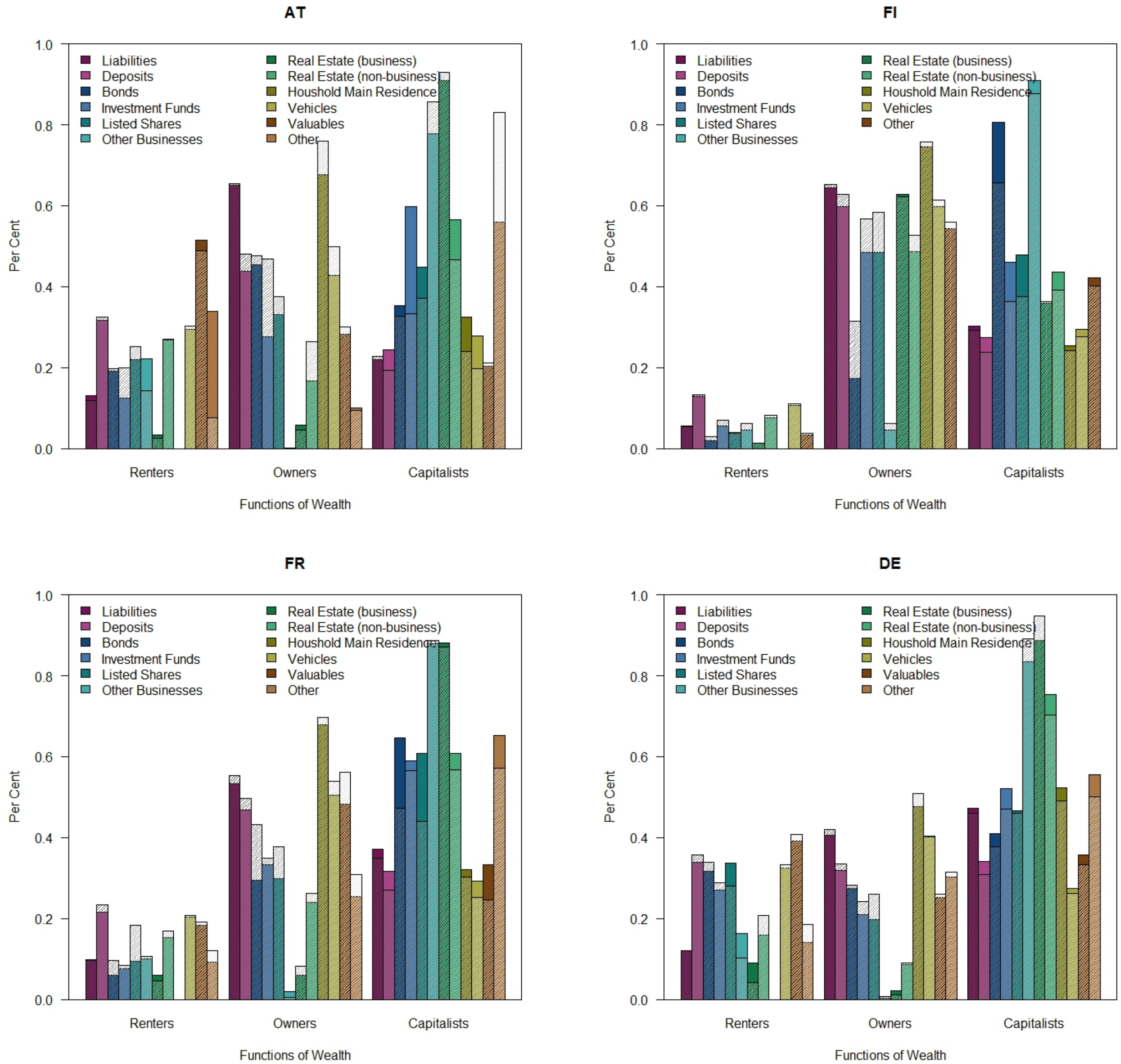
Notes: The figures show shares of different assets/liabilities held by each gross income quintile. Dashed bars show shares before the Pareto adjustment and full bars after Pareto adjustment.

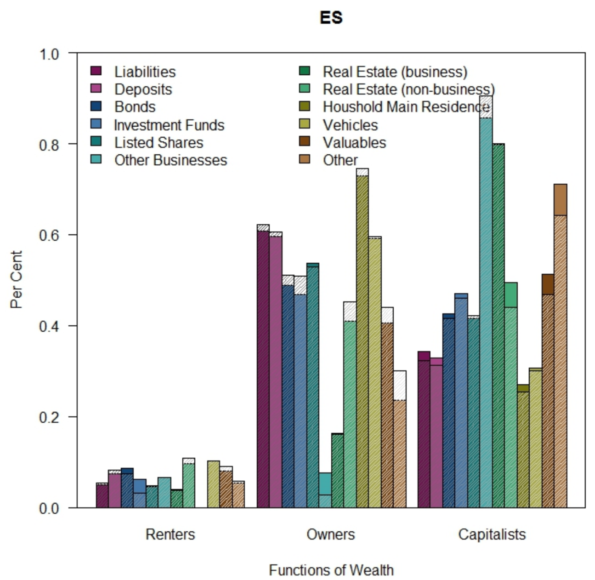
Figure 9: DINA for Functions of Wealth: Aggregates.



Notes: The figures show Hybrid DINA. Amounts are in billion euro and are broken down by functions of wealth: renters, (non-capitalist) owners and capitalists. Dashed bars show amounts before the Pareto adjustment and full bars after Pareto adjustment.

Figure 10: DINA for Functions of Wealth: Shares.





Notes: The figures show shares of different assets/liabilities held by by functions of wealth: renters, (non-capitalist) owners and capitalists. Dashed bars show shares before the Pareto adjustment and full bars after Pareto adjustment.

Table 11: DINA for Wealth Groups.

Austria (Wealth Groups), $n = 3,862,526$ households

								Housing Wealth					
					Business Wealth								
	Liabilities	Deposits	Bonds	Inv. Funds	Listed Shares	Other Businesses	Real estate (business)	Real estate (non-business)	HMR	Vehicles	Valuables	Other	Net Worth
I	-12.33	3.20	0.04	0.04	0.03	0.12	0.00	0.21	0.46	0.84	0.09	0.17	-7.13
II	-6.53	17.70	0.25	0.33	0.12	0.07	0.00	0.10	1.59	4.01	0.46	0.46	18.55
III	-44.01	39.53	3.85	2.52	2.07	1.40	0.03	5.90	48.98	6.42	0.92	0.88	68.49
IV	-49.87	45.56	3.29	5.03	2.45	4.28	0.42	14.08	159.55	8.52	1.35	1.77	196.43
V	-55.52	109.91	33.44	40.10	14.28	433.20	14.98	133.41	422.19	17.83	10.08	35.48	1209.38
Σ	-168.27	215.89	40.87	48.02	18.95	439.06	15.43	153.71	632.77	37.61	12.90	38.76	1485.70
$A(V)/A(I)$	4.50	34.40	933.25	900.76	544.07	3498.01	–	621.48	911.20	21.31	110.50	211.65	–
$A(V)/A(I \cup II)$	5.89	10.52	230.47	211.52	193.09	4529.20	–	861.50	412.09	7.36	36.67	113.26	211.89
$\|A(V) - A(I)\|$	2236	5526	1730	2074	738	22424	776	6897	21837	880	517	1829	62990
$\|A(V) - A(I \cup II)\|$	921	3528	1702	2037	724	22411	776	6876	21648	422	465	1772	61439
Top 10%	19.6	35.3	49.6	76.8	56.8	97.1	94.1	77.2	47.2	35.5	72.9	87.7	65.1
Top 5%	12.7	22.5	37.0	61.6	41.6	94.8	91.5	66.1	35.9	26.8	51.7	84.6	56.9
$T_{between}$	0.21	0.36	0.98	1.03	0.85	1.53	–	1.13	0.77	0.29	0.84	1.23	–

Finland (Wealth Groups), $n = 2,622,499$ households

								Housing Wealth					
					Business Wealth								
	Liabilities	Deposits	Bonds	Inv. Funds	Listed Shares	Other Businesses	Real estate (business)	Real estate (non-business)	HMR	Vehicles	Valuables	Other	Net Worth
I	-12.61	1.29	0.04	0.06	0.06	-0.01	0.27	0.37	5.53	1.06	–	0.13	-3.81
II	-22.98	6.68	0.02	0.45	0.35	0.24	0.04	2.03	24.28	3.20	–	0.32	14.64
III	-29.08	9.55	0.20	0.89	0.60	0.56	0.38	7.30	63.61	4.16	–	0.71	58.88
IV	-24.27	16.74	0.18	1.79	1.18	1.53	1.41	21.70	90.63	6.03	–	1.22	118.14
V	-37.00	46.10	4.88	11.71	23.55	44.30	12.00	94.57	153.81	12.29	–	4.26	370.48
Σ	-125.94	80.37	5.32	14.90	25.74	46.61	14.11	125.97	337.86	26.74	–	6.64	558.33
$A(V)/A(I)$	2.93	35.78	111.18	199.40	425.17	–	43.73	252.81	27.83	11.56	–	33.11	–
$A(V)/A(I \cup II)$	2.08	11.57	156.12	46.15	115.47	387.71	76.40	78.74	10.32	5.77	–	18.97	68.43
$\|A(V) - A(I)\|$	1860	3418	369	888	1792	3379	894	7184	11309	856	–	315	28544
$\|A(V) - A(I \cup II)\|$	2607	2300	363	815	1734	3344	867	6846	7183	287	–	256	26603
Top 10%	18.2	40.5	89.3	68.6	84.6	91.2	71.1	55.4	27.5	29.1	–	48.6	55.1
Top 5%	11.4	27.6	84.7	58.2	77.0	84.9	52.7	38.9	16.5	18.6	–	33.9	39.7
$T_{between}$	0.05	0.44	1.23	0.87	1.23	–	1.05	0.84	0.33	0.24	–	0.55	–

France (Wealth Groups), $n = 29,017,678$ households

							Housing Wealth						
					Business Wealth								
	Liabilities	Deposits	Bonds	Inv. Funds	Listed Shares	Other Businesses	Real estate (business)	Real estate (non-business)	HMR	Vehicles	Valuables	Other	Net Worth
I	-59.71	19.71	0.00	0.73	0.06	1.79	0.03	10.09	15.16	8.26	13.33	1.55	11.01
II	-145.79	111.82	0.21	4.19	1.34	4.83	0.36	18.30	136.38	28.91	40.43	5.29	206.28
III	-291.61	188.18	3.52	9.80	3.52	16.24	1.40	67.88	601.68	37.59	51.97	17.31	707.48
IV	-201.67	247.80	4.26	26.10	7.06	37.72	3.00	137.61	1041.14	51.95	79.77	24.81	1459.54
V	-444.24	613.64	75.06	226.63	144.14	1290.90	44.87	1163.64	2000.23	108.02	224.02	350.33	5797.24
Σ	-1143.01	1181.16	83.05	267.46	156.11	1351.47	49.65	1397.52	3794.60	234.73	409.53	399.29	8181.56
$A(V)/A(I)$	7.44	31.13	–	309.97	2399.30	721.08	1791.04	115.36	131.93	13.07	16.81	225.52	526.74
$A(V)/A(I \cup II)$	4.32	9.33	726.07	92.02	205.88	390.18	230.81	81.98	26.40	5.81	8.33	102.45	53.36
$\|A(V) - A(I)\|$	2650	4094	517	1557	993	8885	309	7951	13682	688	1452	2404	39881
$\|A(V) - A(I \cup II)\|$	229	2416	514	1494	974	8806	304	7629	11697	232	803	2320	36961
Top 10%	28.7	35.2	87.0	75.0	85.8	91.9	79.3	68.5	33.0	31.0	40.4	80.1	51.7
Top 5%	19.9	23.9	82.1	63.8	77.1	84.4	54.7	53.5	20.6	22.0	31.7	71.3	40.8
$T_{between}$	0.17	0.36	–	1.04	1.27	1.38	1.21	0.99	0.48	0.25	0.36	1.11	0.74

Germany (Wealth Groups), $n = 39,672,000$ households

							Housing Wealth						
					Business Wealth								
	Liabilities	Deposits	Bonds	Inv. Funds	Listed Shares	Other Businesses	Real estate (business)	Real estate (non-business)	HMR	Vehicles	Valuables	Other	Net Worth
I	-220.98	18.73	0.01	1.22	0.42	0.87	0.00	20.00	56.65	7.39	0.41	8.02	-107.25
II	-46.73	74.43	0.08	1.13	0.09	1.30	0.00	5.26	18.65	26.28	2.98	10.87	94.35
III	-275.11	247.27	2.06	35.54	3.61	16.85	5.86	54.75	274.47	57.20	8.29	52.35	483.16
IV	-377.12	385.67	19.52	44.47	15.08	21.12	0.06	171.32	992.05	79.73	17.04	83.01	1451.96
V	-643.65	1113.09	148.34	347.86	211.07	1632.16	179.95	1548.22	3345.47	118.99	100.84	361.24	8463.58
Σ	-1563.57	1839.20	170.02	430.23	230.26	1672.31	185.87	1799.55	4687.28	289.59	129.57	515.48	10385.80
$A(V)/A(I)$	2.91	59.42	10522.73	284.13	505.94	1867.38	–	77.40	59.05	16.10	245.72	45.07	–
$A(V)/A(I \cup II)$	4.81	23.90	3220.83	294.96	835.77	1501.02	89315.70	122.56	88.86	7.07	59.41	38.26	–
$\|A(V) - A(I)\|$	2131	5517	748	1748	1062	8224	907	7704	16580	563	506	1781	43208
$\|A(V) - A(I \cup II)\|$	546	4672	747	1730	1059	8206	907	7550	16106	260	474	1631	42798
Top 10%	24.9	37.7	77.1	63.0	76.1	94.2	94.7	71.0	48.3	25.6	55.1	53.0	57.9
Top 5%	17.5	22.9	51.3	48.9	63.2	89.0	91.9	57.5	34.5	14.9	46.3	42.8	45.9
$T_{between}$	0.21	0.53	1.18	0.96	1.27	1.47	–	1.08	0.80	0.26	0.87	0.69	–

Spain (Wealth Groups), $n = 17,429,812$ households

						Business Wealth		*Housing Wealth*					
	Liabilities	Deposits	Bonds	Inv. Funds	Listed Shares	Other Businesses	Real estate (business)	Real estate (non-business)	HMR	Vehicles	Valuables	Other	Net Worth
I	-179.97	23.17	0.52	1.00	0.24	4.98	0.52	14.71	116.31	13.93	1.50	3.28	0.19
II	-157.12	54.51	2.10	2.09	2.17	6.01	1.81	37.71	324.46	15.85	1.99	6.67	298.25
III	-122.34	82.98	1.93	3.65	3.81	9.75	4.64	75.41	485.61	21.07	3.57	10.27	580.35
IV	-125.12	136.50	3.15	11.03	5.76	27.72	10.21	182.07	670.01	31.78	9.06	27.23	989.39
V	-227.74	459.92	41.92	138.87	118.59	601.59	89.91	993.57	1176.36	48.75	37.34	252.14	3731.22
Σ	-812.30	757.07	49.61	156.64	130.59	650.06	107.08	1303.46	2772.76	131.37	53.47	299.59	5599.41
$A(V)/A(I)$	1.27	19.85	81.34	138.77	484.10	120.86	172.78	67.55	10.11	3.50	24.86	76.77	19236.48
$A(V)/A(I \cup II)$	1.35	11.84	32.10	89.89	98.06	109.48	77.24	37.91	5.34	3.27	21.37	50.64	25.00
$\|A(V) - A(I)\|$	548	5012	475	1582	1358	6846	1026	11232	12164	400	411	2856	42812
$\|A(V) - A(I \cup II)\|$	5123	3495	421	1523	1305	6651	978	10198	3383	124	348	2665	35965
Top 10%	19.7	41.5	78.4	76.6	80.6	84.6	61.2	62.7	27.9	22.1	57.0	73.1	47.0
Top 5%	15.3	28.9	63.6	67.3	69.6	79.2	49.5	48.1	18.5	14.8	49.9	65.0	36.8
$T_{between}$	0.03	0.46	0.98	1.14	1.20	1.26	1.01	0.81	0.21	0.11	0.65	1.00	0.64

Notes: The table reports DINA figures for wealth broken down by wealth groups (quintiles of the net worth distribution). Numbers are in billion euro and top tail adjusted. Pink cells form the integrated account: numbers are thus scaled to match national accounts totals. Blue cells are pseudo-integrated: the sum of the real estate (non-business) and HMR is interpreted as households' housing wealth excl. NPISH – a split-up that is currently not reported in the NA. $A(V)/A(I)$, $A(V)/A(I \cup II)$, $A(V)/A(I)$, $|A(V) - A(I \cup II)|$ and $T_{between}$ are summary statistics as defined in subsection 3.3.

Table 12: DINA for Income Groups.

Austria (Income Groups), $n = 3,862,526$ households

							Housing Wealth						
					Business Wealth								
	Liabilities	Deposits	Bonds	Inv. Funds	Listed Shares	Other Businesses	Real estate (business)	Real estate (non-business)	HMR	Vehicles	Valuables	Other	Net Worth
I	-8.39	13.88	0.47	0.98	0.10	0.69	0.33	4.15	34.16	1.23	0.57	0.40	48.57
II	-12.12	23.35	2.24	2.97	1.76	5.72	0.03	6.04	63.59	3.76	3.13	0.32	100.80
III	-20.67	35.54	7.35	3.37	1.82	13.23	0.56	15.56	93.96	6.12	0.69	1.36	158.88
IV	-50.60	64.20	9.31	4.40	5.37	91.81	0.65	56.15	159.40	8.45	2.89	2.56	354.60
V	-76.50	78.92	21.49	36.30	9.90	327.62	13.87	71.81	281.65	18.05	5.63	34.11	822.86
Σ	-168.27	215.89	40.87	48.02	18.95	439.06	15.43	153.71	632.77	37.61	12.90	38.76	1485.70
$A(V)/A(I)$	9.12	5.69	45.93	37.08	103.02	472.86	42.60	17.28	8.24	14.71	9.96	84.91	16.94
$A(V)/A(I \cup II)$	7.46	4.24	15.88	18.38	10.66	102.25	78.59	14.08	5.76	7.23	3.05	94.66	11.33
$\lvert A(V) - A(I)\rvert$	88168	84196	27217	45720	12694	423199	17535	87574	320370	21779	6557	43640	1002312
$\lvert A(V) - A(I \cup II)\rvert$	85755	78065	26070	44431	11616	419948	17728	86351	301328	20137	4895	43694	968508
$T_{between}$	0.29	0.17	0.42	0.74	0.44	0.89	1.17	0.43	0.23	0.28	0.28	1.11	0.41

Finland (Income Groups), $n = 2,622,499$ households

							Housing Wealth						
					Business Wealth								
	Liabilities	Deposits	Bonds	Inv. Funds	Listed Shares	Other Businesses	Real estate (business)	Real estate (non-business)	HMR	Vehicles	Valuables	Other	Net Worth
I	-3.20	5.66	0.08	0.52	0.36	0.33	0.54	6.81	23.62	0.82	–	0.05	35.59
II	-7.12	10.35	0.09	1.21	0.74	0.54	0.88	11.91	38.20	1.79	–	0.22	58.81
III	-17.34	14.13	0.24	1.62	1.97	0.70	2.05	19.79	56.43	4.00	–	0.71	84.30
IV	-33.78	17.36	0.22	2.08	3.28	2.37	3.61	25.60	80.09	6.39	–	1.40	108.64
V	-64.51	32.86	4.69	9.47	19.39	42.67	7.03	61.86	139.51	13.75	–	4.26	270.98
Σ	-125.94	80.37	5.32	14.90	25.74	46.61	14.11	125.97	337.86	26.74	–	6.64	558.33
$A(V)/A(I)$	20.19	5.81	59.73	18.19	54.14	127.58	13.10	9.08	5.91	16.80	–	81.08	7.61
$A(V)/A(I \cup II)$	12.51	4.10	55.19	10.94	35.18	98.07	9.95	6.61	4.51	10.54	–	31.40	5.74
$\lvert A(V) - A(I)\rvert$	116904	51858	8801	17062	36293	80718	12379	104953	220956	24650	–	8015	448780
$\lvert A(V) - A(I \cup II)\rvert$	113165	47379	8788	16405	35925	80526	12056	100093	207058	23723	–	7856	426644
$T_{between}$	0.39	0.16	1.09	0.48	0.78	1.23	0.34	0.26	0.17	0.35	–	0.61	0.24

France (Income Groups), $n = 29,017,678$ households

	Liabilities	Deposits	Bonds	Inv. Funds	Listed Shares	Other Businesses	Real estate (business)	Real estate (non-business)	HMR	Vehicles	Valuables	Other	Net Worth
					Business Wealth								
							Housing Wealth						
I	-48.01	80.38	0.46	2.24	2.33	53.61	2.10	74.93	270.37	17.35	31.74	5.65	493.16
II	-73.54	113.96	1.80	4.26	3.52	37.12	1.25	68.15	380.74	22.14	44.98	11.04	615.42
III	-137.98	170.78	2.39	10.79	3.73	64.40	7.97	123.19	606.28	35.68	62.72	14.80	964.77
IV	-281.47	239.58	6.72	30.06	10.77	83.45	8.48	208.91	873.94	57.71	86.45	40.00	1364.61
V	-602.02	576.45	71.67	220.11	135.75	1112.90	29.84	922.33	1663.26	101.85	183.64	327.80	4743.60
Σ	-1143.01	1181.16	83.05	267.46	156.11	1351.47	49.65	1397.52	3794.60	234.73	409.53	399.29	8181.56
$A(V)/A(I)$	12.54	7.17	156.49	98.26	58.18	20.76	14.21	12.31	6.15	5.87	5.79	57.99	9.62
$A(V)/A(I \cup II)$	9.91	5.93	63.40	67.74	46.37	24.53	17.81	12.89	5.11	5.16	4.79	39.29	8.56
$\|A(V) - A(I)\|$	95460	85477	12271	37540	22989	182526	4781	146014	240007	14560	26174	55509	732389
$\|A(V) - A(I \cup II)\|$	93261	82585	12155	37366	22887	183947	4854	146598	230498	14147	25034	55046	721855
$T_{between}$	0.36	0.25	1.06	0.97	1.07	0.91	0.48	0.53	0.20	0.20	0.19	0.94	0.38

Germany (Income Groups), $n = 39,672,000$ households

	Liabilities	Deposits	Bonds	Inv. Funds	Listed Shares	Other Businesses	Real estate (business)	Real estate (non-business)	HMR	Vehicles	Valuables	Other	Net Worth
					Business Wealth								
							Housing Wealth						
I	-38.41	129.65	4.83	35.03	4.63	8.79	0.00	48.22	228.32	12.40	5.56	11.15	450.17
II	-111.86	228.24	20.66	23.91	13.52	61.73	3.77	112.84	447.92	28.07	21.79	10.71	861.29
III	-180.23	283.94	21.66	30.42	11.31	60.85	3.18	174.77	595.74	55.30	24.25	37.41	1118.59
IV	-395.56	364.77	15.09	57.77	20.50	115.53	33.02	256.29	893.88	71.16	13.61	113.40	1559.47
V	-837.51	832.60	107.78	283.11	180.30	1425.41	145.91	1207.44	2521.43	122.65	64.36	342.82	6396.28
Σ	-1563.57	1839.20	170.02	430.23	230.26	1672.31	185.87	1799.55	4687.28	289.59	129.57	515.48	10385.80
$A(V)/A(I)$	21.80	6.42	22.32	8.08	38.98	162.07	–	25.04	11.04	9.89	11.57	30.74	14.21
$A(V)/A(I \cup II)$	11.15	4.65	8.46	9.61	19.87	40.42	77.46	14.99	7.46	6.06	4.71	31.37	9.75
$\|A(V) - A(I)\|$	100712	88596	12975	31266	22140	178541	18390	146100	289009	13895	7410	41801	749409
$\|A(V) - A(I \cup II)\|$	96084	82383	11978	31967	21580	175205	18152	142028	275170	12907	6388	41829	723502
$T_{between}$	0.40	0.20	0.49	0.51	0.81	1.02	–	0.57	0.33	0.22	0.28	0.65	0.44

Spain (Income Groups), $n = 17,429,812$ households

						Business Wealth		*Housing Wealth*					
	Liabilities	Deposits	Bonds	Inv. Funds	Listed Shares	Other Businesses	Real estate (business)	Real estate (non-business)	HMR	Vehicles	Valuables	Other	Net Worth
I	-40.58	52.49	2.92	12.39	5.49	17.01	3.66	98.46	323.18	7.48	3.44	9.83	495.76
II	-89.32	92.90	2.90	6.17	5.56	27.40	8.86	121.83	404.12	13.88	3.67	14.37	612.34
III	-156.98	102.15	3.38	13.82	9.03	46.53	20.34	150.94	472.00	25.18	5.17	25.25	716.82
IV	-206.32	154.75	8.06	25.26	14.88	97.77	24.15	248.48	619.27	30.56	11.42	42.91	1071.20
V	-319.11	354.77	32.35	99.00	95.63	461.35	50.07	683.75	954.19	54.27	29.77	207.24	2703.29
Σ	-812.30	757.07	49.61	156.64	130.59	650.06	107.08	1303.46	2772.76	131.37	53.47	299.59	5599.41
$A(V)/A(I)$	7.86	6.76	11.06	7.99	17.43	27.12	13.68	6.94	2.95	7.26	8.66	21.08	5.45
$A(V)/A(I \cup II)$	4.91	4.88	11.11	10.67	17.32	20.78	8.00	6.21	2.62	5.08	8.37	17.13	4.88
$\|A(V) - A(I)\|$	79899	86713	8440	24847	25860	127465	13313	167901	181016	13423	7554	56629	633261
$\|A(V) - A(I \cup II)\|$	72908	80917	8443	25738	25850	125975	12567	164549	169406	12504	7520	55978	616540
$T_{between}$	0.18	0.22	0.52	0.48	0.68	0.66	0.28	0.29	0.07	0.19	0.37	0.61	0.22

Notes: The table reports DINA figures for wealth broken down by income groups (quintiles of the gross household income distribution). Numbers are in billion euro and top tail adjusted. Pink cells form the integrated account: numbers are thus scaled to match national accounts totals. Blue cells are pseudo-integrated: the sum of the real estate (non-business) and HMR is interpreted as households' housing wealth excl. NPISH – a split-up that is currently not reported in the NA. $A(V)/A(I)$, $A(V)/A(I \cup II)$, $A(V)/A(I)$, $|A(V) - A(I \cup II)|$ and $T_{between}$ are summary statistics as defined in subsection 3.3.

Table 13: DINA for Functions of Wealth.

Austria (Functions of Wealth), $n = 3,862,526$ households

					Business Wealth		*Housing Wealth*						
	Liabilities	Deposits	Bonds	Inv. Funds	Listed Shares	Other Businesses	Real estate (business)	Real estate (non-business)	HMR	Vehicles	Valuables	Other	Net Worth
R	-21.94	68.52	7.81	5.97	4.18	97.10	0.52	41.10	0.00	11.05	6.65	13.16	234.12
	-10851	*33893*	*3865*	*2952*	*2066*	*48029*	*259*	*20330*	*0*	*5464*	*3289*	*6512*	*115808*
O	-109.49	94.77	18.59	13.30	6.29	0.59	0.88	25.55	427.85	16.07	3.63	3.91	501.93
	-72869	*63070*	*12371*	*8850*	*4183*	*393*	*588*	*17005*	*284746*	*10692*	*2419*	*2603*	*334051*
C	-36.84	52.61	14.47	28.75	8.49	341.37	14.03	87.06	204.92	10.50	2.62	21.68	749.65
	-108889	*155491*	*42755*	*84982*	*25081*	*1008950*	*41455*	*257309*	*605662*	*31039*	*7742*	*64074*	*2215653*
Σ	-168.27	215.89	40.87	48.02	18.95	439.06	15.43	153.71	632.77	37.61	12.90	38.76	1485.70
	-43565	*55895*	*10581*	*12432*	*4906*	*113672*	*3996*	*39795*	*163823*	*9738*	*3341*	*10034*	*384646*
$T_{between}$	0.35	0.14	0.37	0.88	0.49	1.50	1.92	0.74	–	0.19	0.07	0.75	0.65

Renters (R): 52.34%, Owners (O): 38.90%, Capitalists (C): 8.76%

Finland (Functions of Wealth), $n = 2,622,499$ households

					Business Wealth		*Housing Wealth*						
	Liabilities	Deposits	Bonds	Inv. Funds	Listed Shares	Other Businesses	Real estate (business)	Real estate (non-business)	HMR	Vehicles	Valuables	Other	Net Worth
R	-6.84	10.32	0.10	0.84	0.98	2.10	0.19	9.52	0.00	2.85	–	0.23	20.28
	-8068	*12171*	*122*	*989*	*1151*	*2480*	*219*	*11238*	*0*	*3363*	–	*267*	*23932*
O	-81.07	48.02	0.92	7.21	12.47	2.10	8.85	61.41	251.88	16.02	–	3.61	331.44
	-55976	*33160*	*638*	*4979*	*8613*	*1450*	*6114*	*42404*	*173925*	*11059*	–	*2495*	*228860*
C	-38.04	22.03	4.30	6.85	12.29	42.41	5.07	55.03	85.97	7.88	–	2.81	206.60
	-116415	*67418*	*13151*	*20953*	*37623*	*129793*	*15517*	*168425*	*263108*	*24109*	–	*8584*	*632266*
Σ	-125.94	80.37	5.32	14.90	25.74	46.61	14.11	125.97	337.86	26.74	–	6.64	558.33
	-48025	*30645*	*2030*	*5680*	*9816*	*17775*	*5380*	*48034*	*128830*	*10198*	–	*2534*	*212898*
$T_{between}$	0.27	0.14	1.25	0.44	0.50	1.61	0.42	0.38	–	0.18	–	0.43	0.37

Renters (R): 32.32%, Owners (O): 55.22%, Capitalists (C): 12.46%

France (Functions of Wealth), $n = 29,017,678$ households

	Liabilities	Deposits	Bonds	Inv. Funds	Listed Shares	Other Businesses (*Business Wealth*)	Real estate (business) (*Business Wealth*)	Real estate (non-business) (*Housing Wealth*)	HMR (*Housing Wealth*)	Vehicles	Valuables	Other	Net Worth
R	-110.62	254.13	5.00	20.52	14.62	136.77	2.99	212.96	0.00	47.76	75.44	37.19	696.76
	-9238	*21224*	*417*	*1714*	*1221*	*11423*	*250*	*17786*	*0*	*3988*	*6300*	*3106*	*58191*
O	-608.56	553.39	24.42	89.13	46.49	27.34	2.95	334.96	2576.35	118.54	197.95	101.36	3464.32
	-47484	*43179*	*1906*	*6954*	*3627*	*2133*	*230*	*26136*	*201024*	*9249*	*15446*	*7908*	*270310*
C	-423.83	373.64	53.63	157.81	95.01	1187.36	43.71	849.59	1218.24	68.44	136.14	260.74	4020.48
	-100247	*88375*	*12684*	*37326*	*22472*	*280838*	*10339*	*200949*	*288144*	*16187*	*32200*	*61672*	*950939*
Σ	-1143.01	1181.16	83.05	267.46	156.11	1351.47	49.65	1397.52	3794.60	234.73	409.53	399.29	8181.56
	-39390	*40705*	*2862*	*9217*	*5380*	*46574*	*1711*	*48161*	*130768*	*8089*	*14113*	*13760*	*281951*
$T_{between}$	0.31	0.13	0.73	0.60	0.61	1.37	1.35	0.57	–	0.13	0.17	0.70	0.45

Renters (R): 41.26%, Owners (O): 44.17%, Capitalists (C): 14.57%

Germany (Functions of Wealth), $n = 39,672,000$ households

	Liabilities	Deposits	Bonds	Inv. Funds	Listed Shares	Other Businesses (*Business Wealth*)	Real estate (business) (*Business Wealth*)	Real estate (non-business) (*Housing Wealth*)	HMR (*Housing Wealth*)	Vehicles	Valuables	Other	Net Worth
R	-189.33	625.29	53.71	115.99	77.63	271.28	16.91	285.22	0.00	94.08	50.65	72.63	1474.05
	-8576	*28323*	*2433*	*5254*	*3516*	*12288*	*766*	*12919*	*0*	*4262*	*2294*	*3290*	*66769*
O	-635.01	587.55	46.47	89.93	45.42	3.99	4.09	156.27	2233.78	116.06	32.63	156.19	2837.36
	-54446	*50377*	*3984*	*7710*	*3895*	*342*	*351*	*13399*	*191525*	*9951*	*2797*	*13392*	*243276*
C	-739.23	626.36	69.84	224.32	107.21	1397.04	164.87	1358.07	2453.50	79.45	46.30	286.66	6074.39
	-124619	*105591*	*11773*	*37815*	*18074*	*235512*	*27794*	*228941*	*413610*	*13394*	*7805*	*48326*	*1024015*
Σ	-1563.57	1839.20	170.02	430.23	230.26	1672.31	185.87	1799.55	4687.28	289.59	129.57	515.48	10385.80
	-39413	*46360*	*4286*	*10845*	*5804*	*42153*	*4685*	*45361*	*118151*	*7300*	*3266*	*12994*	*261792*
$T_{between}$	0.49	0.14	0.22	0.38	0.28	1.23	1.36	0.92	–	0.12	0.13	0.55	0.58

Renters (R): 55.65%, Owners (O): 29.40%, Capitalists (C): 14.95%

Spain (Functions of Wealth), $n = 17,429,812$ households

						Business Wealth		*Housing Wealth*					
	Liabilities	Deposits	Bonds	Inv. Funds	Listed Shares	Other Businesses	Real estate (business)	Real estate (non-business)	HMR	Vehicles	Valuables	Other	Net Worth
R	-40.66	56.67	4.24	9.69	6.08	43.18	4.30	125.07	0.00	13.34	4.30	15.93	242.15
	-13819	*19259*	*1441*	*3295*	*2065*	*14673*	*1462*	*42504*	*0*	*4534*	*1462*	*5413*	*82289*
O	-493.40	450.73	24.23	73.36	70.24	49.40	17.36	533.86	2024.80	77.77	21.72	70.49	2920.56
	-42402	*38735*	*2082*	*6305*	*6036*	*4245*	*1492*	*45878*	*174006*	*6683*	*1867*	*6058*	*250985*
C	-278.23	249.67	21.14	73.58	54.27	557.48	85.42	644.53	747.96	40.26	27.44	213.18	2436.71
	-97599	*87580*	*7416*	*25812*	*19038*	*195553*	*29964*	*226091*	*262371*	*14123*	*9626*	*74778*	*854753*
Σ	-812.30	757.07	49.61	156.64	130.59	650.06	107.08	1303.46	2772.76	131.37	53.47	299.59	5599.41
	-46604	*43436*	*2847*	*8987*	*7492*	*37296*	*6144*	*74784*	*159081*	*7537*	*3068*	*17189*	*321255*
$T_{between}$	0.13	0.10	0.20	0.27	0.21	1.19	0.98	0.29	–	0.07	0.33	0.74	0.24
Renters (R): 16.88%, Owners (O): 66.76%, Capitalists (C): 16.36%													

Notes: The table reports DINA figures for wealth broken down by functions of wealth (renters, non-capitalist owners and capitalists). Numbers are in billion euro and top tail adjusted. Italic numbers indicate average amounts per household. Pink cells form the integrated account: numbers are thus scaled to match national accounts totals. Blue cells are pseudo-integrated: the sum of the real estate (non-business) and HMR is interpreted as households' housing wealth excl. NPISH – a split-up that is currently not reported in the NA.

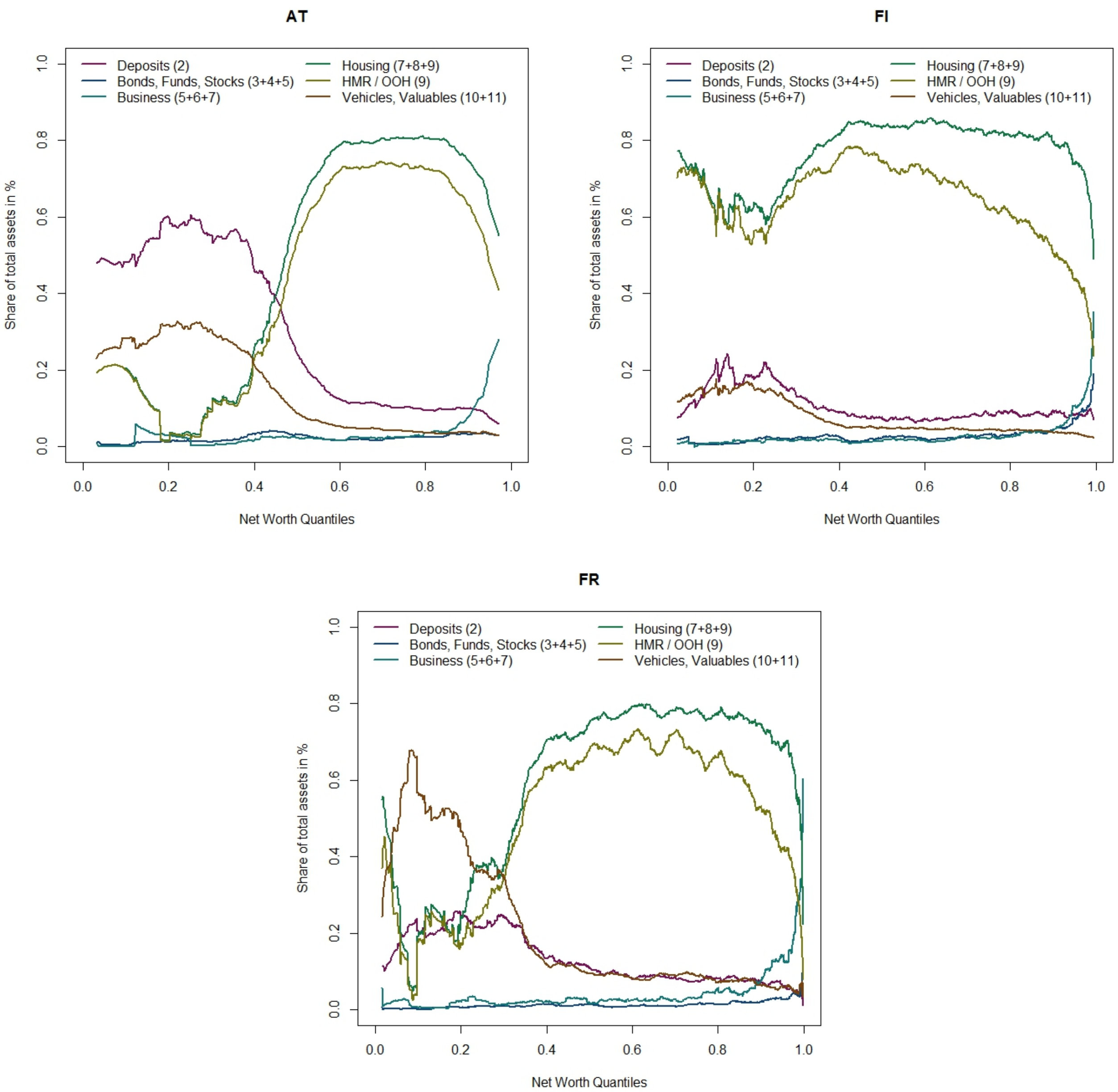
$T_{between}$ measures between group inequality as described in subsection 3.3. As renters per definition do not own their HMR, the Theil index is not well defined for this instrument.

As the groups are not of equal size, their seize is reported as share of total households in the bottom line of each panel. This information can be used to derive average numbers for each cell.

D Relative Importance of Different Asset Classes Over the Distribution

Figure 11 shows the relative importance of different asset classes (as per cent of total assets) over the wealth distribution as a moving average. Figure 12 depicts the tenure status by wealth group. All figures use unadjusted data from the second wave of the HFCS.

Figure 11: Relative Importance of Different Asset Classes.



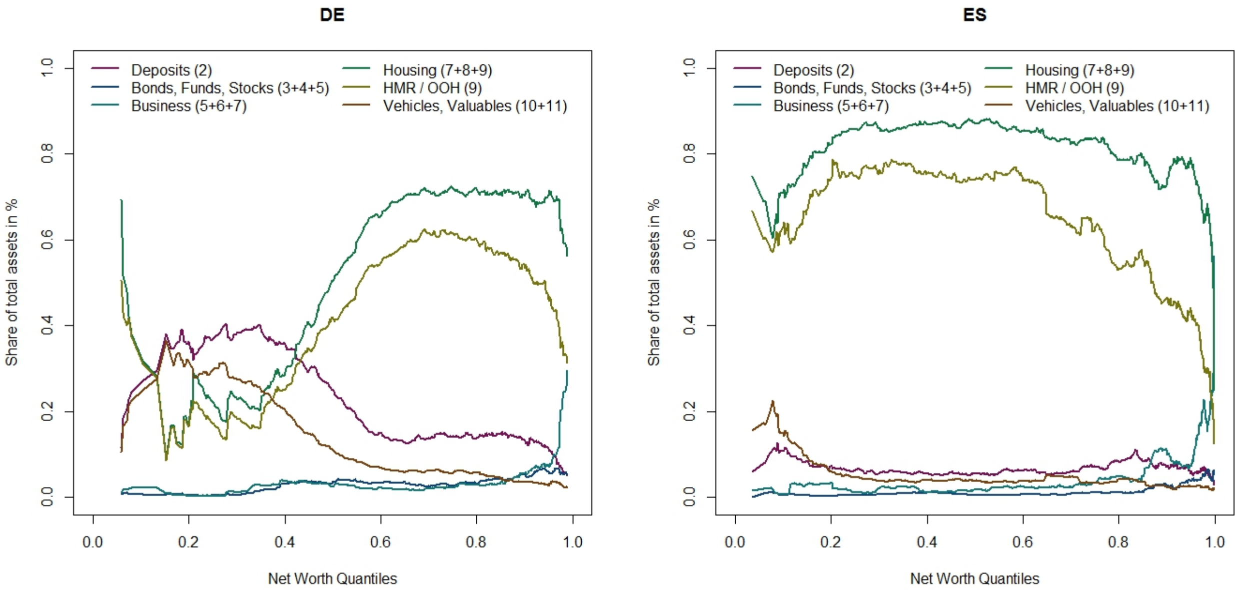


Figure 12: Tenure Status by Wealth Group.