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WEALTH INEQUALITY: A HYBRID APPROACH TOWARD MULTIDIMENSIONAL DISTRIBUTIONAL NATIONAL ACCOUNTS IN EUROPE

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This article proposes a practically feasible framework for compiling Multidimensional Distributional National Accounts (MDINAs) serving two functions: a comprehensive measure of (components of) net worth and their distribution, and a link to macroeconomic statistics. I break down 12 components of marketable wealth by wealth and income groups, and three functions of wealth for Austria, Finland, France, Germany, and Spain. MDINA complemented by summary indicators reveal large heterogeneity in the degree of inequality, and shed light on differences in the structure of wealth portfolios across and within countries. I combine data collected in the largely harmonized HFCS survey and adjust for remaining differences in survey modes regarding the treatment of the top tail using (Generalized) Pareto models estimated from rich lists or top wealth shares derived from tax data and leaked information on wealth held in offshore tax havens. Measured inequality increases strongest in countries where surveys refrain from appropriate top-tail corrections.

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1. INTRODUCTION

Over recent years, more and more economists, and social scientists in general, have been looking at phenomena from a distributional angle. A major prerequisite

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This article uses data from the *Household Finance and Consumption Survey (HFCS)*. The results published, and the related observations and analyses may not correspond to results or analyses of the data producers.

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for research of this form as well as targeted policy decisions is the availability of multidimensional, distributional data comparable across countries (see also Atkinson and Brandolini, 2001).

Comparability can be achieved by incorporating distributional data into the widely-used and well-established *System of National Accounts (SNA)*. Further, it is only by jointly assessing micro- and macro-data that the impact of macroeconomic developments for different sections of society is revealed. Therefore, I link the definitions used in the SNA to currently existing micro-data in the form of top-tail adjusted survey data, and create detailed break-downs.

Such break-downs are usually compiled for wealth or income itself and are commonly referred to as *Distributional National Accounts (DINA)*. 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), US, the UK (Atkinson, 2005), and henceforth to many more countries worldwide (for surveys of this literature, see Atkinson *et al*., 2011, Alvaredo *et al*., 2013). A milestone constitutes the creation of *The World Top Incomes Database,* later re-named the *World Inequality Database,* with an extended focus on income *and* wealth (Alvaredo *et al*., 2011-2017).[1]

This article goes a step further and creates detailed breakdowns of total wealth and single wealth components by sections of society: household wealth, household income, and functions of wealth (following Fessler and Schürz, 2017), termed *Multidimensional Distributional National Accounts (MDINA)*. I supplement these accounts by meaningful summary indicators enabling easy-to-spot variation: absolute and relative deviations across groups, top shares, and a truncated Theil index measuring between-groups variation. I also compute these indicators for each wealth component.

In Europe, both, the (legally binding) *European System of National Accounts (ESA)* and a comprehensive and regularly compiled household survey,*The Household Finance and Consumption Survey (HFCS)*,[2] are largely, though not entirely, harmonized across participating countries. Establishing harmonized DINA and MDINA could hence build on these advantages and provide powerful data sources usable by policy-makers as well as researchers.

In this spirit, I identify, describe and perform all the steps necessary to compile such accounts and adjust for artificial deviations because of differences in survey modes across countries in the HFCS. The resulting manual points out possible improvements aiming for even better MDINA in the future complementary[3] to the efforts of international working groups steered by the OECD, Eurostat and the ECB. In particular, the work of the Eurosystem *Expert Group on Linking Macro*

[1]2018 WID.world World Inequality Report, http://wir2018.wid.world/, retrieved on June 26, 2018.
[2]The Household 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.
[3]Kennickell (2019) performs similar analyses with a focus on wealth using the *US Survey of Consumer Finances (SCF)*. Arrondel *et al*. (2014), Kuypers *et al*. (2016) and Kuypers *et al*. (2019) assess wealth and, as here, use HFCS data. Bartels and Metzing (2019) perform complementary work with a focus on income using the *European Union Statistics on Income and Living Conditions (EU-SILC)*.

and Micro Data for the Household Sector (see EG-LMM, 2020) relates to wealth and is thus closely tied in with this article.[4]

I select a set of five countries: Austria (AT), Finland (FI), Germany (DE), France (FR), and Spain (ES). This choice allows me to holistically demonstrate how to compile cross-country comparable MDINA using HFCS data. In particular, these countries comprise all the variety needed for meaningful comparisons: they differ greatly from a geographical and demographic point of view, in terms of households' typical wealth composition, and, most importantly, in survey-specific aspects. With regard to the latter, I refer to differences in survey sampling strategies that are *not* harmonized across participating countries.

Refraining from oversampling very affluent households—a group small in number but large in combined wealth—such as in Austria, results in a particularly large impact of the top-tail adjustment, whereas the reverse holds for Finland, where oversampling of the rich is combined with incorporating a great deal of administrative data into survey responses. As a result, top-tail corrections using national rich lists lead to an increase in measured net worth of only 5 percent in Finland and but 38 percent in Austria (see also Chakraborty and Waltl, 2018; Bach *et al*., 2019).

When breaking down wealth by income groups, I find the lowest inequality in Finland and Spain: there, the 20 percent income-richest households are on average five to six times wealthier than the 40 percent income-poorest households. By comparison, for Austria this measure amounts to roughly 11, for Germany about ten, and for France nine—revealing substantial variation.

The results reported here already constitute a rich data source, but the focus is still *forward-looking*: What is currently possible and what could be achieved in the future? How can MDINA be gradually incorporated into the framework of regularly compiled official statistics, and how can this be achieved in as harmonized a way as possible across countries? Further, the breakdowns presented are designed as *building blocks* that can be combined to perform own analyses, for example, creating breakdowns for different wealth definitions or using specific categories such as only financial or housing wealth. This *building-block strategy* aims to be a source rather than a substitute for other initiatives, such as *The Credit Suisse Global Wealth Report*.[5]

The *hybrid approach* acknowledges that a complete integration of distributional data into the framework of NA is currently un-feasible, as finer breakdowns, and more harmonization between definitions specific for macro- and micro-data

[4]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).

[5]The *Global Wealth Report* is published annually by the globally acting wealth manager, investment bank and financial services company *Credit Suisse*. The study estimates total wealth holdings and distributional breakdowns for the adult-population worldwide. The estimates are derived in a similar fashion as here although there are three main distinctions: the pure focus on wealth without linking it to other categories such as income and types of households, a missing match with totals reported in the national accounts (NA), and an individual instead of a household perspective that I follow here in-line with NA methodology. Details are provided on a yearly basis in the respective *Databooks*, see https://www.credit-suisse.com/about-us/en/reports-research/global-wealth-report.html, retrieved on January 15, 2020.

would be needed. Thus, hybrid MDINA consist of two parts: the *integrated account* contains variables on households' balance sheets that can be directly linked to an item's distributional structure inferred from micro-data. The *supplement account* adds further items necessary to obtain a comprehensive measure of total wealth, but lack a macro counterpart. Changes in the way micro-data are collected and finer breakdowns of national accounts will hopefully gradually enable the reallocation of some variables from the supplement account to the integrated account.

There are, however, also items that are likely to permanently remain in the supplement account, such as consumer durables (e.g. vehicles) as they fall outside the scope of NA. Nevertheless, leaving these components out would have important *distributional implications* given that vehicles constitute a major portfolio component for low-income and low-wealth households.

The hybrid approach enables the compilation of MDINA 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 gradually over time. Yet, the approach guarantees that distributional data still comprise all relevant wealth components. Thus, from the very beginning MDINA serve two functions: first, they establish a link between aggregate macroeconomic indicators and the system of measuring macroeconomic activity—the National Accounts. Linking 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, MDINA constitute by themselves a comprehensive measurement of wealth distributions, which thus need to cover *all* relevant components of wealth—also those *not* being part of NA.

The remainder of this article is organized as follows: Section 2 proposes the hybrid approach and discusses how to link and break-down the micro- and macro-data used. Issues related to the insufficient representation of the wealthiest members of society in surveys are discussed in Subsection 2.4. and a top-tail adjustment is performed. Subsequently, Section 3 describes and computes MDINA. Section 4 concludes. A comprehensive appendix complements the article by providing the full set of quantitative results, supporting figures, and further background information.

2. Multidimensional Distributional National Accounts

2.1. *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.

Because of 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 terms DINA and MDINA suggest that NA should be taken as they currently are, and simply enriched by distributional breakdowns. These distributional breakdowns can be compiled from survey data, and/or administrative and

register data. This is, however, *not* the approach I follow here, as the NA are too narrow in scope to measure net worth of private households comprehensively. In addition, some concepts that are appropriate for NA may not be suitable for meaningful MDINA as the NA have not *primarily* been designed to measure fine-grained components of households' wealth. For instance, NA leave out consumer durables—such as vehicles—although these play a similarly important role in total households' 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, MDINA need to be understood *more broadly* than just a breakdown of existing NA aggregates. Breakdowns should not be limited by the specificities of the NA. Therefore, the framework of MDINA relies on NA *whenever appropriate,* but calls for finer divisions of NA *whenever needed* and additional "supplement" information when it is essential in order to achieve a meaningful overall wealth measurement. This approach, which aims neither 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 labeled the "hybrid approach."

The hybrid approach serves two functions of MDINA: (1) a link between macro-data and distributional data, and (2) a comprehensive measure of wealth distributions by itself. One may argue that the NA and breakdowns thereof are not designed to serve the second function as the focus in the NA is primarily on measuring economic activity and not households' wealth (which is in fact just a by-product), and thus these statistics are *not meant* to be interpreted as comprehensive measures of wealth inequality. Although it is in principle possible to steer which numbers are published by statistical offices or central banks, it is impossible to control how they are interpreted by data users. It is almost naive to assume MDINA would not be understood and interpreted as a measure of wealth inequality. Focusing on narrow wealth concepts for the sheer sake of alignment with NA concepts may thus contribute to a misinformed public discourse.

Answers to the question of how to deal with imperfect comparability between micro- and macro-data usually go into the direction of either restricting the analysis to suitably comparable components or analyzing wealth distributions without relating them to NA. Either approach is limited in terms of serve *only one* of the two functions stated above.

Table 1 demonstrates the hybrid MDINA approach schematically. Let there be $n + m$ components of wealth (assets and liabilities alike) that are essential to describe households' wealth holistically. Thereby, n components are linkable between the micro- and macro-source, and m components do not reach a sufficient degree of comparability.

For all $n + m$ components, group-specific aggregates are computed from the micro-source. I form such *vertical groups* in subsection 2.5 by net worth, income quintiles, and functions of wealth. In principle, any other breakdown by meaningful quantitative and qualitative characteristics could be achieved in a similar manner.

The n suitably comparable components are linked to the respective NA instruments; that is, group-specific sub-aggregates are scaled to exactly match the NA

TABLE 1
HYBRID MDINA

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

aggregate. The scaling ensures that totals are consistent[6] and at the same time relative proportions of asset classes derived from the micro-data are preserved. Linked components jointly 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 because of missing macro totals but directly compiled from micro-data. These *m* components form the *Supplement Account*.

Group-specific net worth is obtained by horizontally summing all the group-specific components of wealth.[7] Totals for each component of wealth are obtained by vertically summing over the group-specific sub-aggregates. Total net worth is thus equivalently either the sum of group-specific net worth or the sum of 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 broader measure here.[8]

It is likely that further work on integrating and harmonizing micro- and macro-data will lead to an increase in suitably comparable components *n,* and a decrease in insufficiently suitably comparable components *m*. As the set of components needed to comprehensively describe households' net worth is defined *a priori*; that is, $n + m$ is fixed, the size of MDINA will not change because of advancements in the *integration process*. Nor will group-specific aggregates suffer from conceptual comparability issues over time.[9]

2.2. *Surveys versus Administrative Data*

There are two main approaches (and hybrids thereof) to measuring the distribution of households' wealth: approaches based on household surveys and administrative data (see Alvaredo *et al*., 2016, for an overview).

Even when relying on seemingly objective, official tax data, the top tail may be underestimated because of "hidden wealth" stored in off-shore tax havens (Alstadsæter *et al*., 2018). On top, administrative data are usually not collected for the purpose of measuring wealth inequality. Thus, tax data describe wealth only *partially* and/or *indirectly*. Statistical procedures need to be applied to infer the wealth distribution.

Net worth taxes, that is, recurrent taxes on an individual's net worth, could be directly used to impute the total stock. Yet, such taxes are rare and, if applied,

[6]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 of MDINA in mind—is desirable. See Appendix A.

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

[8]Hybrid MDINA could also be extended to what is sometimes called "augmented wealth'" that specifically includes all types of pension wealth (see also Table 17). This is particularly relevant for statistics about countries having in place fundamentally different schemes of public services, for example, the way pension wealth is treated in the Netherlands (see Honkkila and Kavonius, 2013; EG-LMM, 2020).

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

usually subject to several exemptions. The OECD reports that the number of OECD countries levying individual net wealth taxes dropped from 12 in 1990 to only 4 in 2017 (OECD, 2018, p. 16). These four countries are France,[10] 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,[11] and that the tax data source usually lacks sufficient information on the socioeconomic and demographic characteristics needed to create multidimensional breakdowns of net worth.

When aiming for internationally comparable statistics, the issue of important differences in the design of tax systems and recording practices lead to additional challenges. Relatively frequent changes in tax policies imply inconsistencies over time.

Wealth surveys, in contrast, are designed to collect all the components of wealth at once, and additionally provide a long list of socioeconomic and demographic information characterizing each household. Surveys also capture asset classes that do not generate observable income flows (e.g. owner-occupied housing, valuables, and vehicles). Survey weights facilitate grossing up results to population totals.

In contrast to tax systems, which differ strongly between countries, surveys can more easily be harmonized to produce comparable data across countries and over time. The HFCS is the result of such a harmonization endeavor of wealth surveys scatted across European countries and coordinated by the ECB. The surveys are *ex ante* harmonized, that is, the survey design and definitions are harmonized before the survey is carried out.[12]

Surveys, however, suffer from other types of drawbacks: they rely on sophisticated sampling techniques to guarantee that survey weights lead to accurate results at a country level. Households are sampled based on different types of register data (social security numbers, addresses, unique personal identification numbers, etc.). The sampling is only as good as the underlying registers. Socioeconomic and demographic information linked to the register is used to enhance the imputation of the survey weights. Sampling procedures for complex, multipurpose surveys (such as the HFCS) are complicated and involve 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.

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

[11]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 practice. In addition, some countries offer the option of joint taxation for married couples or couples in a civil union. In this case, tax data partly reflect individuals and partly couples, whereas the latter may constitute the entire household or not.

[12]The *Luxembourg Wealth Study* collects and *ex post* harmonizes wealth surveys from a number of developed and emerging countries globally. See http://www.lisdatacenter.org/our-data/lws-database/. The OECD (2013) provides international guidelines for micro-statistics on household wealth, which are largely followed, thus facilitating international comparability.

As wealth is usually highly concentrated at the top end of the distribution, it is particularly important for the sampling procedure to lead to an adequate representation of wealthy households in the final sample. Thus, most survey compilers apply some type of *oversampling strategy*: therefore, 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 permission to use them for this purpose differs across countries. This limits the reliability of data produced without oversampling or relying on indirect ways for oversampling—thereby detracting from comparability across countries.[13]

Even the most sophisticated oversampling strategy is still unable to sufficiently capture the wealthiest of the wealthy and sufficiently correct for the so-called *unit-non-response bias* introduced by wealthy households systematically responding less frequently than 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 2.4.

Furthermore, surveys are costly and time-consuming. The fieldwork often runs for several months, and data validation and processing need additional time. Accordingly, survey data are usually only disseminated with a substantial time lag. In addition, surveys are not conducted at high frequency. The HFCS, for example, is only conducted every 2–3 years.[14]

Lastly, surveys rely on the ability and willingness of survey participants to accurately respond to all questions. Although some questions are simple, others are fairly difficult: For example, estimating the current market value of one's main residence or a non-listed business is a complicated task. Cognitive biases may also act against accurately reported values.[15] Whereas business owners or shareholders may be better informed about their possessions because of reporting obligations, owner-occupiers may have fewer incentives to closely follow trends in housing markets.

Surveys can be improved by making use of administrative data and market prices within the survey itself. For instance, wages as part of income may not be asked for in the survey interview but could—with the permission of the interviewee—be retrieved from administrative records. Likewise, mortgage registers or registers documenting the ownership and current value of stocks and investment fund holdings can help improve the quality of survey results. As discussed above, such additional data can also be used to improve the sample design—particularly for targeted oversampling.

[13]See subsection 2.4 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.

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

[15]There is evidence that home-owners tend to *overestimate* the value of their home in-line with an owner-pride factor or endowment effect (for further references see Agarwal, 2007; Heston and Nakamura, 2009; Lepinteur and Waltl, 2021).

Statistical matching of survey data and 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 digitized land cadastres can use this information to link land and properties to survey participants. These data, together with automated property valuation models based on market prices, can eventually also be used to perform plausibility checks regarding self-reported current 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 items yet simultaneously provides a link between all asset classes as well as socioeconomic and demographic characteristics.

The degree to which administrative data are currently used when compiling surveys differs strongly between countries. There has been a great deal of progress regarding the collection and digitization of data, which offers large potential toward increased quality of official statistics.[16]

In the HFCS, Finland appears to be the superstar with regard to combining register and survey data (see HFCN, 2016, pp. 24–25). Register data are directly used for all income variables (except private transfers and interest received), education, the ownership and number of cars and other vehicles, business wealth, ownership and values for mutual funds, bonds and listed shares. In addition, the current values of the household's 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. Likewise, the current values of vehicles is estimated making use of data in several vehicle registers, price register systems, and websites advertising items for sale. Several components of liabilities are estimated by combining information on tax registers and survey data.

Nevertheless, it appears impossible to bring surveys to a level sufficient to capture the very top of the wealth distribution. Thus, an *ex-post* adjustment for the very top seems necessary 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 because of the wealth missing at the very top. Due to the increasing availability of survey data, their better alignment with the NA, and more comprehensive list of socioeconomic and demographic characteristics, this article relies on the HFCS as the major source of information.

2.3. *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. By contrast, the NA were *not* designed for this purpose, but with the aim of

[16]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 differ across countries. Jäntti *et al*. (2013) discuss the use of register data in the context of the EU-SILC survey.

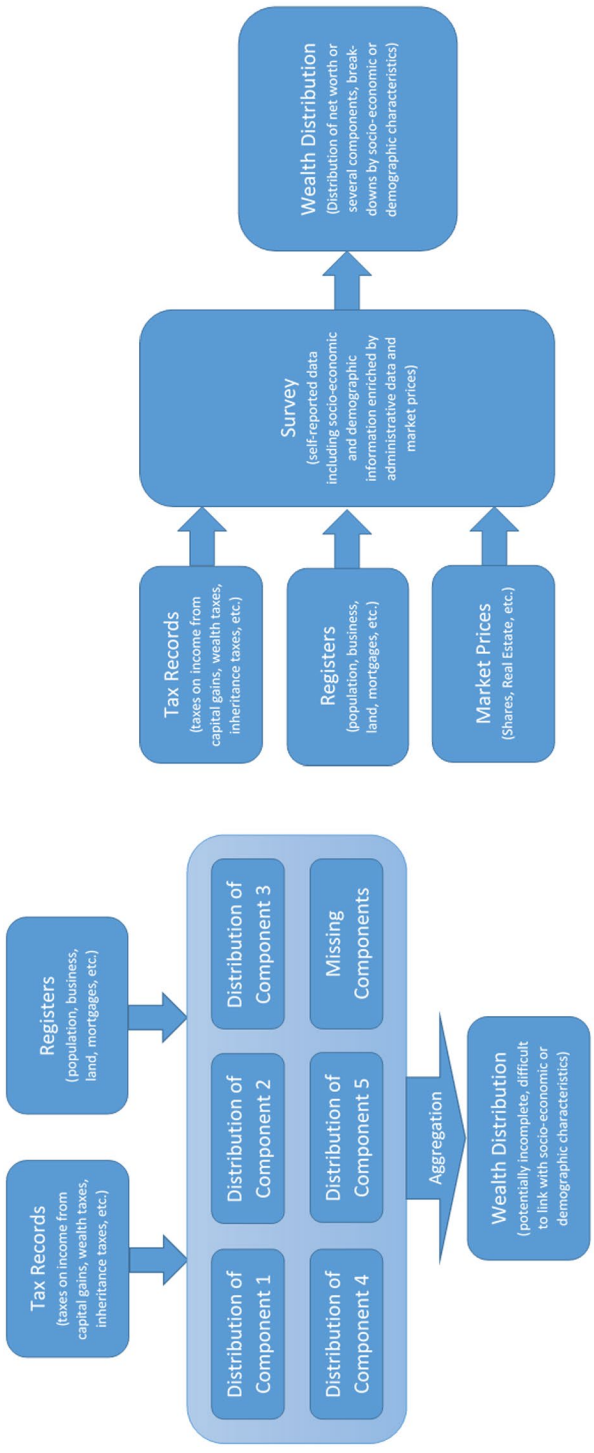

Figure 1. Compiling Wealth Distributions from Micro Data

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

measuring 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, p. 26) and also this article. In particular, this wealth concept excludes social security pension wealth.[17]

In this article, net worth is composed of 12 components. Table 2 provides details and definitions.

The EG-LMM analyzes 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 (2020). As indicated in Table 2, liabilities, deposits, bonds, investment funds, and listed shares are conceptually suitably 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.

2.4. *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

[17]Including pension entitlements leads to the concept of *augmented wealth*, which is an informative measure for itself but should be treated separately 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 the components of net worth used in this article. Further details about HFCS variables can be found in the variables catalog. Details regarding the NA instruments are documented in ESA (2010). HFCS counterparts in the NA are only provided in the case of high conceptual comparability as assessed by EG-LMM (2020). The items 5, 6, and 7 jointly form the component *Business Wealth*. The sum of items 7, 8, and 9 constitutes *Housing Wealth*.

participation than other households, oversampling is unable to correct a resulting *unit non-response bias*.

Because of the sheer importance of overall holdings by the wealthiest of the wealthy, additional effort to properly capture them appears of utmost importance when aiming for a comprehensive and informative measure of total wealth.

A possible approach could be 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 such extra information: rich lists, top wealth shares, and top wealth shares adjusted for wealth stored in offshore tax havens.

I make use of rich list data published by newspapers and report the fortunes of the richest individuals and families in a country (see Table 3). Vermeulen (2016, 2018) develops the so-called regression approach to estimate the parameters of a Pareto distribution by combining top survey data with observations from the *Forbes World's Billionaires list*. Bach *et al*. (2019) and Chakraborty and Waltl (2018) apply this regression approach but rely on *national rich lists* providing more information than the Forbes list.

Rich lists are often criticized for following in-transparent methodologies and source data. In addition, 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: 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*., 2011-2017). The methodologies applied are transparent, and the source data are of high quality. Typically, the main ingredient comprises tax data, which are 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 results in only France. The French series was compiled by Garbinti *et al*. (2018). In addition, 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) combined 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 modeling choices for the top tail: average wealth is not forced to increase proportionally when moving up the distribution; that is, the crucial

[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 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	2225
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 is reported without splitting family clans and excluding non-residents.

[a]Amounts are rounded to *ten million euros* to prevent the 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.

modeling 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 because of 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). For reasons of comparability, I use the same starting point of the tail, that is, 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 percent.[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 are available, but oversampling is applied based on personal income data, which at least correlates with net worth. In addition, 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 2.2). 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 percent in Finland, 10 percent and 11 percent in Spain and France, respectively, 17 percent in Germany, and 38 percent 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 than

[19]As the HFCS-implied cumulative distribution function is not smooth because of survey weights, quantiles can only be approximated. In Spain, the threshold lies in the interval [96.5 percent; 97.0 percent], and in France in [97.0 percent; 97.5 percent].

TABLE 4
Top Wealth Shares

	France (2014)			Spain (2012)		
	HFCS Data	Tax Data	Tax and Offshore Date	HFCS Data	Tax Data	Tax and 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 percentages.

[a]These numbers are imputed under the assumption that the bottom 99.9 percent do not possess any offshore wealth.

[b]The share of the top 3 percent to top 0.1 percent is not reported in Martínez-Toledano (2017), so it is interpolated from the share of the top 1 percent to 0.1 percent and the top 5 percent to top 0.1 percent.

[c]The share uses the interpolated share of the top 3 percent to top 0.1 percent.

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).

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	1011.85	1020.92	1063.36	607.55	628.72
2	Deposits	98.75	107.42	51.21	53.02	556.64	600.11	1007.80	1062.18	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	1033.54	1351.47	1179.28	1672.31	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	1220.34	1397.52	1503.12	1799.55	1097.95	1303.46
9	Household's main residence	531.39	632.77	332.79	337.86	3661.84	3794.60	4071.01	4687.75	2674.60	2772.76
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	1120.29	1543.49	736.23	776.08	8603.04	9564.40	10,182.54	11,941.73	5875.97	6452.89
	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 to model for the top tail.

Sources: HFCS (second wave) and own calculations

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 percentage 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 97th percentile threshold in both countries. Top share adjustments thus replace the top 3 percent using shares reported in Table 4.

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 and 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.

For instruments that are more prominent at the very top end of the distribution (e.g. other businesses, bonds, and listed shares) I find a larger increase when relying on GPDs because of the accelerating steepness of a GPD as compared to a standard Pareto distribution. Future research needs to focus on identifying auxiliary data measuring portfolio structures at the very top to provide a final answer which results to trust more.

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 for other countries. In the future, rich lists may become obsolete because of increased information on top wealth shares from more reliable sources. In the meantime, top-tail adjustments based on rich lists appear to be a reasonably trustworthy approach to make survey data more comparable and better suited for measuring wealth inequality.

Indeed, refraining from any type of top-tail adjustments appears to be highly unsatisfactory. First, the increases resulting from such adjustments are large. Ignoring the top tail leads to much lower degrees of measured 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 because of model assumptions and shortcomings in the auxiliary data. Still, the substantial differences in top-tail coverage suggest that HFCS results should not be compared if not using a top-tail adjustment.

Accordingly, the hybrid MDINA presented in the next section consistently rely on top-tail adjusted data. Because of the wider availability of rich list data, the adjustments are based on these lists.

2.5. *Vertical Groups*

To this point, I have discussed the *horizontal dimension* of MDINA: the selection of components of wealth. Equally important is the selection of groups for which breakdowns are created; that is, the vertical dimension of MDINA. In this article, I compile MDINA 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 or 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 the 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-year-old reference person may be a child still living with her parents, a single person, a parent, etc. Publishing breakdowns 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 the total (or component-specific) wealth is owned by the wealthiest or the poorest members of society? A breakdown by net worth quintiles reports five groups each consisting of 20 percent of all households. From these breakdowns, one can directly derive quintile ratios and quintile distances that relate the average amounts held by the poorest 20 percent to the wealthiest 20% and thus provide an informative summary statistic for inequality.

In addition, top shares report the proportion of aggregate (component-specific) wealth held by the wealthiest 10 percent, 5 percent, or even 1 percent. These shares complement breakdowns 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, whereas 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 consider the re-distributional effects of a progressive tax and transfer system. Because I apply a relatively broad grouping by merging households by income *quintiles*, the exact income concept is less important. Nevertheless,

[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. Therefore, 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, 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.

breakdowns by equivalized disposable income would be an insightful addition as it describes well differences in the standard of living by considering the number of consumption units in each household.[22]

Looking at wealth and income together is a first step toward a multidimensional approach to understand 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, they 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 also represents her single most important asset. *Capitalists* are owner-occupiers who additionally generate income from their wealth by either renting out further properties and/or by owning a business. They make profit 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 functions of wealth[23] 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 the groups formed by three functions of wealth. Across the entire Euro Area, slightly less than half of the households belonging to the lowest wealth group also belong to the lowest income group. Overall, roughly 8.7 percent of all households are simultaneously income- and wealth-poor (AT: 10.2 percent, FI: 9.3 percent, FR: 8.8 percent, DE: 9.1 percent, ES: 6.1 percent). In contrast, 9.3 percent are both income-rich and wealth-rich. The shares are similar across the focus countries of this article (AT: 8.5 percent, FI: 9.2 percent, FR: 10.5 percent, DE: 9.2 percent, ES: 9.3 percent).

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.[24] In countries with a high share of renters, this rate is relatively high (AT 50.8 percent, DE 61.0 percent) but it is much lower in countries with high home-ownership rates (ES: 3.5 percent, FI: 9.1 percent, FR: 19.1 percent); that is, 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

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

[23]Fessler and Schürz (2017) consider three more functions hierarchically 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 separable from other functions of wealth and almost impossible to be measured in a survey.

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

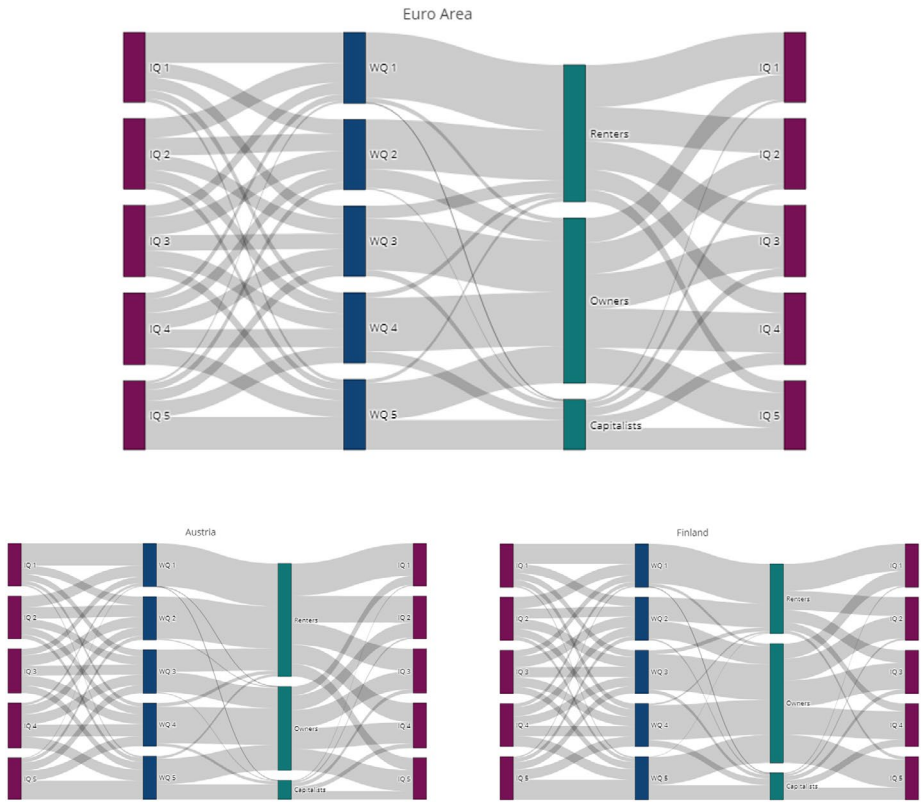

Figure 2. Allocation of Households to Groups

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). IQ 1 to IQ 5 refer to the groups formed by gross income quintiles, and WQ 1 to WQ 5 to the groups formed by net worth quintiles. Interactive versions of the plots are available upon request.

Source: Author's calculations based on the second wave of the HFCS.

percent, AT: 98.3 percent, FI: 73.5 percent, FR: 88.2 percent, DE: 94.7 percent, ES: 36.5 percent). 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 percent and 45 percent, and the probability to be in the top wealth group conditional on being a capitalist is even higher (54–79 percent). Overall, the share of households that are in the top income, top wealth, and capitalists group amounts to roughly 4.5 percent in the Euro Area. This share is slightly higher for France and Germany (AT: 3.3 percent, FI: 3.8 percent, FR: 5.3 percent, DE: 5.0 percent, ES: 4.3 percent). 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

TABLE 7
STRUCTURE OF HYBRID MDINA

							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													

owners varies across countries along with home-ownership rates but is—given the low home-ownership rate—surprisingly high in Germany (Euro Area: 6.4 percent, AT: 0.5 percent, FI: 6.8 percent, FR: 1.9 percent, DE: 5.0 percent, ES: 33.7 percent).

3. HYBRID MDINA

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 MDINA. All other variables currently enter MDINA 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.

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

3.2. *Integration*

Integration requires distributional breakdowns 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 2.4.

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

$$\sum_{i=1}^{g} x_{i,j}^{I}$$

the corresponding top-tail adjusted HFCS aggregate, whereas $x_{i,j}^{I}$ denotes the group-specific sub-aggregates for group i. In the case of groups formed by wealth quintiles, $x_{5,j}^{I}$ is corrected upward because of 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 percent of the households in the tail. The share of total wealth held by each group is calculated within each stratum. The adjusted tail wealth for each instrument and stratum is re-distributed to groups following the originally observed shares. This means that all groups may be affected by the top-tail adjustment. In practice, the top income quintile usually receives larger proportions of the added wealth because of 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 (Figure 3).

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

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

The effect of scaling is large, as coverage ratios tend to be disappointingly low—even for conceptually highly comparable instruments (see Table 8).[25]

For housing wealth, the coverage ratios are per construction equal to 100 percent as a consequence 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, that is,

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

3.3. *Summary Statistics for MDINA*

MDINA summarize the wealth distribution across several dimensions—the vertical groups. In the case of quintiles, this yields aggregate information for five

[25]The top-tail adjustment generally increases coverage ratios, but for most instruments they are still far from 100 percent. 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 Table 5, because of the general high reliability of the *integrated* variables in the national accounts, aggregates are preferred to be taken from the national accounts.

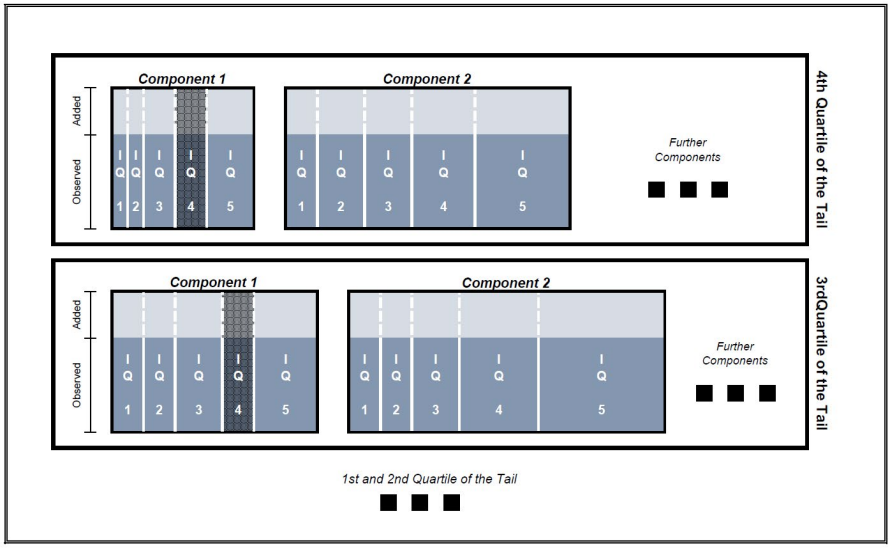

Figure 3. Top-Tail Adjustment: Distribution to Vertical Groups

Notes: The figure shows how the additional euros stemming from the top-tail adjustment are distributed among vertical groups: the top tail is divided into four strata representing the four quartiles of the tail in terms of net worth; that is, the fourth quartile represents the wealthiest of the wealthy. Additional wealth is distributed to 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 other than 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.

groups. For comparisons across countries and time, it is helpful to summarize MDINA along a particular dimension in one single number. There are several options to do so, and I consider in this article up to five different summary statistics describing the set of information within MDINA.

For breakdowns by wealth itself, I also provide top wealth shares, that is, the share of (component-specific) wealth held by the wealthiest 5 percent or 10 percent. This information is additional and cannot be directly derived from MDINA.

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.

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

TABLE 8
ADJUSTED AND UNADJUSTED COVERAGE RATIOS

		Austria		Finland		France		Germany		Spain	
		Unadj.	Adj.	Unadj.	Adj.	Unadj.	Adj.	Unadj.	Adj.	Unadj.	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 percentage. Totals in the national accounts are averages over the quarters overlapping the HFCS fieldwork period.

Sources: HFCS (second wave), ECB, and own calculations.

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 average holdings among the top 20 percent to average holdings among the bottom 40 percent, $A(V)/A(I \cup II)$. Therefore, $A(V)/A(I \cup II) = 5$ indicates that a household belonging to the top 20 percent owns, on average, five times more than a household belonging to the bottom 40 percent.

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

These quintile summary statistics are not meaningful for qualitative or other unordered breakdowns 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; that is, overall inequality can be additively decomposed into within-groups and between-groups inequality. To summarize MDINA, the between-groups part is the relevant measure.

The index number itself does not have an intuitive interpretation, but facilitates relative comparisons. Because of relation of the Theil index to negative entropy, a larger index is associated with a larger distance from the uniform distribution, that is, the distance to perfect equality *along the dimension of the vertical grouping*. The Theil index is again not defined for non-positive wealth.[26]

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 MDINA), the Theil index decomposes into

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

where T_i is the group-specific Theil index, n_i the number of households in group i, and $\overline{a}_i$ 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 population totals are known, it is possible to directly compute the between-group part from MDINA,

[26]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 MDINA.

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

This measure is reported for all vertical groupings.

3.4. *Interpretation of Hybrid MDINA*

This section highlights some quantitative results and potential uses of hybrid MDINA. The full set of results for Austria, Finland, France, Germany, and Spain are reported in Appendix C. These tables also allow one to easily compute further measures, for example, inequality measures based on a truncated definition of total wealth.

Wealth is highly concentrated at the very top of the distribution: the top wealth group possesses substantial shares of total wealth (AT: 81.4 percent, FI: 66.4 percent, FR: 70.9 percent, DE: 81.5 percent, ES: 66.6 percent), 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 percent is more than 200 times higher than among the bottom 40 percent 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 percent is still negative.

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

When assessing the distribution of wealth relative to income groups, the concentration is less extreme; that is, there is a strong but no perfect correlation between income and wealth: the 20 percent highest income households respectively possess "only" 55.4 percent (AT), 48.5 percent (FI), 58.0 percent (FR), 61.6 percent (DE), and 48.3 percent (ES) of total wealth. The lowest-income group holds small but consistently positive shares of total wealth (AT: 3.3 percent, FI: 6.4 percent, FR: 6.0 percent, DE: 4.3 percent, ES: 8.9 percent). The poorest groups in terms of income consistently also have on average the lowest net worth.

Wealth inequality measured against income groups is again highest in Austria and Germany, and lowest in Finland and Spain: the 20 percent income-richest households are on average five to six times wealthier than the 40 percent 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 fourth income quintile. Thus, the frequently communicated number of *average household wealth* is not ideally suited to describe a typical household.

Across the entire Euro Area, 36.9 percent of the households are identified as *renters*, 48.6 percent as non-capitalist *owners*, and 14.6 percent as *capitalists*. Although the share of capitalists does not vary substantially across countries (between 9 percent in AT and 16 percent in ES), the shares of renters and owners, respectively, vary significantly.

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

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

Analyzing $T_{between}$, the German-speaking countries again show the highest inequality, and Spain and Finland the lowest inequality along the dimension of functions of wealth. It is interesting that the gap 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 because of different degrees of exposure: Some asset price shocks have an impact on a large proportion of housholds while others affect only few. The detailed breakdowns provided by MDINA facilitate modeling and monitoring on such a dis-aggregated level.

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

Housing wealth constitutes the most important asset class in all countries. It is less unequally distributed than business wealth and forms 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 12). Cross-country differences in the degree of housing wealth inequality are largely determined by differences in home-ownership rates, which are substantially lower in Germany and Austria than in other countries (see Figure 24 and Figure 11).

The fundamental differences in the spread of holdings in financial and housing wealth may also help explain the 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 compared with 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 12).

The breakdown by functions of wealth sheds more light onto the potential effects of house price booms: owners experience an increase in wealth, whereas capitalists experience an increase in both, wealth *and* income, because of rising rents. The homes of capitalists are on average more valuable; thus the increase in wealth is greater 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 relatively 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 opportunities 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. By 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. In addition, the second, third, and fourth wealth quintiles possess on average rather small amounts of stocks and funds.

Only the top wealth group, who possess 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 percent are 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 Figures 11 and 12).

4. Conclusions

This article discusses a framework to compile *Multidimensional Distributional National Accounts* (MDINA). A partial integration of distributional information

into the *System of National Accounts* (SNA) is suggested, but the article points out the importance of an extended list of variables to achieve a measure of total marketable wealth. This partial integration is termed *Hybrid MDINA*. Hybrid MDINA 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 suggested framework for MDINA is suited to serve two functions: first, MDINA 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, MDINA 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 MDINA. 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. In addition, 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 NA data to compile MDINA for Austria, Finland, France, Germany, and Spain.

One major problem of wealth surveys is the insufficient coverage of the wealthiest households. As wealth is heavily concentrated at the very top of the distribution, exclusively relying on surveys therefore leads to an underestimation of the degree of wealth inequality and biased MDINA. Therefore, I perform a top-tail correction making use of rich list data, which exist in all five countries analyzed. 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 considering 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.

A high level of wealth inequality is found along all three dimensions analyzed 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 show 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.

This article applies the proposed framework to one survey wave only. With every additional survey wave, such MDINA could be re-estimated and thus yield a comprehensive monitoring tool over time.

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Supporting Information

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

A The Conceptual Link between HFCS and NA Data
A.1 Financial Assets and Liabilities
A.2 Business Wealth
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