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Is the top tail of the wealth distribution
the missing link between the
Household Finance and
Consumption Survey and
national accounts?



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Household Finance and Consumption Network (HFCN)

This paper contains research conducted within the Household Finance and Consumption Network (HFCN). The HFCN consists of survey specialists, statisticians and economists from the ECB, the national central banks of the Eurosystem and a number of national statistical institutes.

The HFCN is chaired by Ioannis Ganoulis (ECB) and Oreste Tristani (ECB). Michael Haliassos (Goethe University Frankfurt), Tullio Jappelli (University of Naples Federico II) and Arthur Kennickell act as external consultants, and Juha Honkkila (ECB) and Jiri Slacalek (ECB) as Secretaries.

The HFCN collects household-level data on households' finances and consumption in the euro area through a harmonised survey. The HFCN aims at studying in depth the micro-level structural information on euro area households' assets and liabilities. The objectives of the network are:

- 1) understanding economic behaviour of individual households, developments in aggregate variables and the interactions between the two;
- 2) evaluating the impact of shocks, policies and institutional changes on household portfolios and other variables;
- 3) understanding the implications of heterogeneity for aggregate variables;
- 4) estimating choices of different households and their reaction to economic shocks;
- 5) building and calibrating realistic economic models incorporating heterogeneous agents;
- 6) gaining insights into issues such as monetary policy transmission and financial stability.

The refereeing process of this paper has been co-ordinated by a team composed of Pirmin Fessler (Oesterreichische Nationalbank), Michael Haliassos (Goethe University Frankfurt), Tullio Jappelli (University of Naples Federico II), Sébastien Pérez-Duarte (ECB), Jiri Slacalek (ECB), Federica Teppa (De Nederlandsche Bank) and Philip Vermeulen (ECB).

The paper is released in order to make the results of HFCN research generally available, in preliminary form, to encourage comments and suggestions prior to final publication. The views expressed in the paper are the author's own and do not necessarily reflect those of the ESCB.

ABSTRACT

The financial accounts of the household sector within the system of national accounts report the aggregate asset holdings and liabilities of all households within a country. In principle, when household wealth surveys are explicitly designed to be representative of all households, aggregating these micro data should correspond to the macro aggregates. In practice, however, differences are large. We first discuss conceptual and generic differences between those two sources of data. Thereafter we investigate missing top tail observation from wealth surveys as a source of discrepancy. By fitting a Pareto distribution to the upper tail, we provide an estimate of how much of the gap between the micro and macro data is caused by the underestimation of the top tail of the wealth distribution. Conceptual and generic differences as well as missing top tail observations explain part of the gap between financial accounts and survey aggregates.

JEL Codes: C46, D31, E01

Key words: financial accounts, HFCS, wealth inequality, Pareto distribution, households

Non-technical summary

This paper is concerned with the reconciliation of household wealth surveys with financial accounts (FA) data within the system of national accounts (SNA). Household wealth surveys such as the Household Finance and Consumption Survey (HFCS) provide detailed information on the value of assets and liabilities held by individual households within a country. The financial accounts of the household sector report the value of aggregate asset holdings and liabilities of all the resident households. In practice, differences between those two data sources are large, where usually the value of the aggregated survey data is below the macro aggregates.

The reconciliation of household wealth surveys with FA data is an important issue for a number of reasons. First, household wealth surveys have been combined with FA data (and with other administrative data) to analyse the evolution of wealth inequality. Inequality is high on the political and economic research agenda. When aggregate wealth from wealth surveys differs substantially from macro aggregates, the inequality measured using such surveys can become questionable. Second, several European and international groups have been established with the underlying motivation to include distributional measures in the SNA as well as having timely distributional data. Before survey information can be used satisfactorily, the observed differences with the FA have to be understood.

This paper documents and analyses differences between the HFCS and the FA and provides estimates on how much of the gap between household wealth surveys and the FA is caused by the underrepresentation of the top tail of the wealth distribution in surveys. We use the first wave of the HFCS and FA data from Austria, Germany, France, Spain and Finland. Conceptual linkages and generic statistical differences between the HFCS and the FA are discussed. To reconcile the data of HFCS and FA we develop what we call “adjusted concepts of financial assets” which have more comparability between the two data sources. We find that gaps become smaller but are still substantial using these adjusted concepts. Finally, we add a Pareto tail to the household wealth surveys to allow for the missing wealthy. We estimate how much of the gap can be attributed to this group. We find that especially for countries doing no oversampling or having a less effective oversampling strategy, adding a Pareto tail can explain a significant part of the micro-macro gap, while for countries having a more effective oversampling strategy, adding a Pareto tail explains less of the gap. We also show that the current treatment of self-employed businesses in the HFCS makes reconciliation challenging. Here the issue is which part of sole-proprietors and partnerships included in the survey are assigned in FA to the household sector and which ones are classified as quasi-corporations and hence are recorded in the non-financial corporations’ sector. In the latter case the household only holds a net equity position in the business (other equity). Contrary, if the sole-proprietors and partnerships are recorded in the household sector the assets and liabilities may be spread over the balance sheet of the household sector and the net value recorded in the survey may very well include real assets and liabilities.

1. INTRODUCTION

Household wealth surveys provide detailed information on the value of assets and liabilities held by individual households within a country. The financial accounts (FA) of the household sector within the system of national accounts (SNA) report the value of aggregate asset holdings and liabilities of all the resident households. In principle, when household wealth surveys are explicitly designed to be representative of all resident households in the country, aggregating these micro data should correspond to the macro aggregates. In practice, however, differences are large, where usually the value of the aggregated micro data is below the macro aggregates. This fact has giving birth to an infant literature (Antoniewicz 2000, Kavonius and Törmälehto 2010, Henriques and Hsu 2014, Kavonius and Honkkila 2013, Andreasch et al 2013 and Dettling et al. 2015) which attempts at understanding the striking differences observed between aggregates produced by household wealth surveys and those reported in the financial accounts. This paper contributes to this infant literature.

The reconciliation of household wealth surveys with FA data is an important issue for a number of reasons. First, household wealth surveys have been combined with FA data (and with other administrative data) to analyse the evolution of wealth inequality. In a recent paper, Bricker et al. (2016a) show that calibrating the US Survey of consumer Finances data to the FA substantially affects the top shares of the wealth distribution. This helps to explain why Saez and Zucman (2016), who also use the FA and combine it with tax records, obtain higher and faster rising shares.

Inequality is high on the political and economic research agenda. Stiglitz, Fitoussi and Sen (2009) and Piketty (2014) illustrate the importance of distributional information of wealth in analysing economic progress. Central banks are also increasingly interested in the distributional issues as these have been recognised to interact with monetary policy. For instance, the IMF/FSB report to the G20 Finance Ministers and Central Bank Governors' data gap initiative emphasised in particular a need for including distributional information in macro data. Tissot (2015) discusses the G20 Data Gap Initiative, the benefits of collecting micro data and its interest for macroprudential and monetary policies. When aggregate wealth from wealth surveys differs substantially from macro aggregates, the inequality measured using such surveys can become questionable.

Second, several European and international groups have been established with the underlying motivation to include distributional measures in the SNA as well as having timely distributional data. Survey information is likely to be used as one input. However, before such survey information can be used satisfactorily, the observed differences with the FA have to be understood. Similar kind of work has been done in the U.S. (see e.g. Dettling et al. (2015), Henriques and Hsu (2014) and Antoniewicz (2000) for comparisons between the Flows of Funds and the Survey of Consumer Finances). While the scientific discussion about Distributional national accounts in a sense of *national income*, see e.g. the work by Piketty et al. (2018), is more advanced, work about Distributional National Accounts in the sense of wealth is very limited so far (see e.g. Alvaredo et al. (2016) and Alvaredo et al. (2017)).

While wealth surveys are one distinct source for analysing wealth inequality, research has shown that the upper parts of the wealth distribution are often missing in household wealth surveys (See e.g. Bach, et al. (2015), Eckerstorfer et al. (2016) and Vermeulen (2016, 2018)). As the wealth distribution is highly skewed and these upper parts own significant shares of total wealth this leads to an underestimation of aggregate wealth compared to the FA. The main contribution of this paper is to provide estimates on how much of the gap between household wealth surveys and the FA is caused by the underrepresentation of the top tail of the wealth distribution in surveys.

We use the first wave of the Household Finance and Consumption Survey (HFCS) and FA data from Austria, Germany, France, Spain and Finland. This choice of countries is determined by the need to combine three sources of data: the HFCS data, the FA data and extraneous data that allow us to estimate the top. We use the Forbes billionaires list as such extraneous data.

We first discuss the conceptual linkages and generic statistical differences between the HFCS and the FA. Although both are designed to capture the components of wealth of households, conceptual and statistical differences imply that any comparison has its limitations. We focus on how financial assets are captured in both sources (and leave real assets for future study). First, we do a naïve comparison, where we ignore these conceptual and statistical differences, of total financial assets in the HFCS and the FA. Such a naïve comparison indicates serious differences in the magnitudes between the micro and the macro aggregates. Second, we attempt at reconciling the data of HFCS and FA by developing what we call “adjusted concepts of financial assets” which have more comparability between the two data sources. We follow here the line of work by Kavonius and Törmälehto (2010). We find that gaps become smaller but are still substantial using these adjusted concepts. Finally, we focus on the wealthiest households and add a Pareto tail to the household wealth surveys to allow for the missing wealthy. We estimate how much of the gap can be attributed to this group. We find that especially for countries doing no oversampling or having a less effective oversampling strategy, adding a Pareto tail can explain a significant part of the micro-macro gap, while for countries having a more effective oversampling strategy, e.g. based on taxable wealth, adding a Pareto tail explains less of the gap.

To estimate a Pareto tail, we follow the procedures in Vermeulen (2018) and use three different methods. The estimation method of the Pareto tail is of importance. Using the regression method including the Forbes data yields the highest estimates for the tail and can explain more of the micro-macro gap while using other methods (pseudo maximum likelihood method and the regression method without the Forbes) explains much less. Although including the Forbes data increases the tail significantly, in the cases where countries used an effective oversampling strategy (Spain and France) the micro-macro gap is affected much less. This crucially depends on the weight allocated to the tail in the survey, which is much less in these countries.

The rest of the paper is organised as follows: Section 2 analyses the generic statistical and conceptual differences between the two sources. Based on this analysis, we develop two different adjusted concepts for financial assets with the intention to base the comparison only on those

financial instruments that are included in both sources and that are conceptually comparable. For the two adjusted concepts we indicate the differences between the HFCS and the financial accounts. The third section focuses on the methodology to estimate the tail of the wealth distribution based on Vermeulen (2018). In section 4 we finally analyse how the estimated tail based on the Pareto distribution changes the remaining gaps for one of the adjusted concepts developed in section 2. The final section concludes.

2. THE HOUSEHOLD FINANCE AND CONSUMPTION SURVEY AND THE FINANCIAL ACCOUNTS: HOW ARE THEY RELATED?

We use survey data from the first wave of the HFCS for Austria, Germany, France, Spain and Finland. The HFCS is a triennial survey which provides individual household data on the components of wealth and some income items. It is collected in a harmonised way in 15 euro area countries for a sample of more than 62,000 households. The five countries used in our study account for more than 38,000 of these households. We use macroeconomic data from the FA which are part of the SNA. They provide aggregated macro level balance sheet data for institutional sectors including the households sector.

This section is divided into three parts. The first part discusses the conceptual linkages, i.e. the linkage between the different assets and liabilities items as they are reported in the HFCS and the FA. To facilitate the discussion, we refer to the items with their exact name labels as they are coded in those two sources. Financial asset items in the FA are coded combining the letter F with a number whereas in the HFCS they are coded with the letter HD with a number (collected on the household level), PF with a number (collected for each person of the household aged 16 and older) and D for derived items (e.g. aggregated). We use the current national accounts system of the European Union (ESA 2010). For the complete list of codes see System of National Accounts (2010) and ECB (2012).

The second part focuses on generic differences that have a potential effect on how well the aggregates derived from the survey are able to match the aggregates of FA. Finally, in the third part we derive different adjusted concepts of financial assets which aim to provide a more comparable picture of financial assets than a purely naïve comparison can provide. The purpose of this section is to quantify generic conceptual and statistical differences (see also a similar discussion in Kavonius and Törmälehto (2010) based on ESA95).

Table 1: Overview of the balance sheets in the financial accounts and the HFCS

FA (ESA 2010)	HFCS
FINANCIAL ASSETS (+)	
F.21 Currency	N/A
F.22+F.29 Deposits	HD1110+HD1210 Deposits
F.3 Debt Securities	HD1420 Bonds and other debt securities
F.4 Loans	HD1710 Money owed to household
F.5 Equity and investment fund shares	HD1510 Shares, publicly traded
	HD1010 Investment in non-self-employed business
	HD0200 Investment in self-employed business ¹
	HD1320x Mutual Funds
F.6 Insurance, pension and standardised guarantee schemes	PF0920 Voluntary pension/whole life insurance schemes
	PF0700 Occupational Pension Plans ²
F.7 Financial derivatives and employee stock options	HD1920 Other financial assets
F.8 Other accounts receivable	
N/A	HD1620 Managed Accounts
LIABILITIES (-)	
F.4 Loans	DL1100 Mortgages and loans
	DL1200 Other, non-mortgage debt (Outstanding debts on credit cards, credit lines and overdraft balances, Non-collateralised loans)
F.8 Other accounts payable	N/A
FINANCIAL NET WORTH	
NON-FINANCIAL ASSETS (+)	
N.111 Dwellings	HB0900 Household main residence
N.112 Other buildings/structures	HB28\$x + HB2900 Other properties
N.113 Machinery and equipment	N/A
N.13 Valuables	HB4710 Valuables
N/A	HB4400+HB4600 Vehicles
N.211 Land	N/A (included in entries above)
NET WORTH	

Note: 1. HD0200 is classified as real wealth in the survey. 2 Excluded usually in the survey definition of financial wealth in the HFCS, but collected in most countries.

2.1 CONCEPTUAL LINKAGES

Although the HFCS uses concepts which are aligned to the FA where possible, the exact definitions differ sometimes to fit the purpose of the questionnaire as data have to be collected in a way that households can understand the questions and provide the appropriate information. This might involve asking households about assets or liabilities that do not fit the FA breakdowns, or skipping some items entirely, for concerns that have to do with the interviewing process. This is e.g. the case with currency which is only reported in the FA under item F.21 Currency but is not collected in the HFCS. Asking in a survey about currency at home is generally seen as too sensitive or intrusive.

Table 1 provides an overview of the balance sheet of the FA and the HFCS, only including the items that are relevant for households. The table also indicates items, which are not collected in either of the two sources (e.g. Currency). Table A1 in the Appendix shows furthermore the linkages on a more detailed financial instrument level. This represents an updated table as shown in Kavonius and Törmälehto (2010) with some refinements of their linkages and changes that came into place through the change from ESA95 to ESA2010.

To compare coverage of both sources we will define below an “adjusted concept of financial assets.” Especially those assets and liabilities that are not covered in either of the two sources have to be first eliminated in defining such a concept to make both sources as comparable as possible. But also assets and liabilities that are hard to compare would have to be excluded to not distort the comparability on an aggregated level. Table A1 in the Appendix also gives more detail on the financial instruments that we excluded from the adjusted concept of financial assets (which we define in section 2.3) and provides a comment for each instrument as regards the comparability. As Kavonius and Törmälehto (2010) have already examined and discussed the linkages between the HFCS and FA, we refrain from a discussion on the linkages on a financial instrument level here. There are two important differences in the classification to their approach which are worth to note:

First, in the FA the item ‘F.51 Equity’ consists of the sum of the following three items: ‘F.511 Listed shares’, ‘F.512 Unlisted shares’ and ‘F.519 Other equity’. Listed shares are equity securities listed on an exchange whereas unlisted shares are accordingly equity securities not listed on an exchange. Other equity comprises all forms of equity other than those classified in the sub-categories listed shares and unlisted shares, e.g. equity in limited liability companies whose owners are partners and not shareholders. For further explanations see ESA2010, pp 142-144. The HFCS also collects the value of publicly traded shares (HD1510) which can be linked to F.511 Listed shares’. But contrary to the classification in FA (‘Unlisted shares’ and ‘Other equity’), the classification in the HFCS is based on the household’s activity in the enterprise. If the household is self-employed or has an active role in running the business, any unlisted shares or other equity the household would own in the business would be classified in the HFCS as ‘HD02000 Investment in self-employed business’. If the household is just invested in the business e.g. as a silent partner without having an active role in running the business and there are no publicly traded shares, then it is classified as a ‘HD1010 Non-self-employment not

publicly traded business'. In the HFCS, the value of self-employed businesses is regarded as real wealth, whereas any investments in non-self-employed businesses are regarded as financial assets in the survey classification. To match the categorisation of financial assets in FA we reclassify the value of self-employed businesses to financial assets (other equity).

Second, the SNA2008 introduced new breakdowns for F.6 insurance, pensions and standardised guaranteed schemes which allow to better link the concepts between the HFCS and FA. F.61 Non-life insurance technical reserves are not covered by the HFCS wealth concept. F.62 Life insurance and annuity entitlements correspond with the HFCS item voluntary pensions/whole life insurance schemes. The data in FA is typically based on actuary information on technical reserves reported by insurance corporations. F.63 Pension entitlement corresponds with the HFCS item “current value of all occupational pension plans that have an account” which could be either an amount similar to the present value, or a current (and lower) early liquidation value of the insurance contract (deducting a surrender charge)”. However, as the concept in FA does not only cover pensions that have an account balance and as the stock of occupational pensions of households that are already retired is not included in the survey (and in the FA they are), we exclude the pension entitlements in the adjusted concept of financial assets. F.64 Claims of pension funds on pension managers, F.65 Entitlement to non-pension benefits and F.66 Provision for calls under standardised guarantees are not included as it is not considered to be relevant for the comparison.

While we would like to include non-financial assets in our analysis, the ESA Transmission Programme requires the transmission of annual data on land only by end-2017. Therefore, this gap in the national accounts data transmission makes it not possible for us to include these in our analysis.

2.2 GENERIC DIFFERENCES

This section focuses on the generic differences between the HFCS and FA. While the conceptual linkage is important to point out differences in definition and to exclude asset classes that are not comparable, by generic differences we refer to differences that potentially affect all assets and liabilities though to a different extent. We briefly go through the following differences: (1) population differences; (2) timing; (3) potential measurement errors in the FA; (4) underreporting and item non-response in the HFCS; and (5) Differences caused by the treatment of sole-proprietors/partnerships and quasi-corporations.

Population

In the comparisons of FA and the HFCS there are potentially two generic differences with regard to the population: (1) the difference caused by the fact that non-profit institutions serving households (NPISH) are reported in FA in the same aggregate with households. However, in the euro area countries this is less of an issue as most of the countries transmit the households separately from the NPISH. This is also the case in the countries which are discussed in this paper. (2) Differences in the definition of the household sector and the HFCS population. FA have a resident approach, covering all households that plan to stay for at least one year, and

irrespective of periods spent abroad of less than one year. In the HFCS non-resident citizens are not excluded in all countries. In the HFCS persons living in institutions e.g. in prisons or retirement homes are excluded in most countries; persons with the intention of staying less than 6 months in the country are also excluded from the target population. Therefore, the household weights, which are designed to represent the target population, do not include these specific excluded groups in most countries. Any comparison has to take this into account and the country totals of the survey or FA have to be adjusted. As an estimate using per capita amounts seems reasonable with the caveat that this assumes that the excluded groups have the same average wealth as the rest of the population, which may not be the case. For instance, people living in retirement homes may have a different than the average per capita wealth.

Table 2: Comparison of population between FA (ESA 95 population data) and HFCS

Country Code	Population FA (historical vintage)	Target population HFCS	Difference total	Difference in %
Austria	8,388,130	8,021,945	366,185	4
Germany	81,629,370	81,085,984	543,386	1
Spain	45,456,960	45,632,180	-175,220	0
Finland	5,336,910	5,271,534	65,376	1
France	64,444,520 ¹	62,464,244	1,980,276	3

Note 1. French overseas territories included in the FA, whereas the HFCS only includes “metropolitan France”.

Table 2 compares the population numbers between FA and the HFCS. The number for FA is based on the last available vintage that corresponds to the reference year of the fieldwork period and is based on the European Commission’s ESA95 Transmission Programme population data. Because of the above mentioned excluded groups the population in the HFCS should generally be lower than the one for the whole population. This is the case for all countries except for Spain. The reason for the “negative” difference is that the Spanish census results have been revised after the first wave results.

Timing and frequency

The primary drawbacks of the HFCS are the biennial to triennial frequency and the lag between data collection and data release. Furthermore, the different fieldwork periods may raise concerns about comparability on an aggregated level. The first wave of the HFCS was carried out from 2008/2009 to 2011. For the comparison of the FA with the HFCS, FA data which are closest to the mean of the fieldwork period for each country are used. This is based on annual (year-end) figures as some EU countries do not yet provide quarterly FA backdata for ESA2010, which would better match the fieldwork period of the first wave. Table 3 gives an overview of the different fieldwork periods and the annual end date for FA which is taken for the comparison. The timing can contribute to any observed difference as the value of assets and liabilities may change between the time the survey was conducted and the period taken for FA.

Table 3: Fieldwork period and time periods for comparison

Country	Fieldwork	Assets & Liabilities	FA (annual end)
Austria	09/10 – 05/11	Time of interview	Q42010
Germany	09/10 – 07/11	Time of interview	Q4/2010
Spain	11/08 – 07/09	Time of interview	Q4/2008
Finland	01/10 – 05/10	31/12/2009	Q4/2009
France	10/09 – 02/10	Time of interview	Q4/2009

Note: Source of fieldwork period, Assets & Liabilities is ECB (2013).

Potential measurement errors in the FA data

As the FA is based on other statistical sources and the validation of primary statistics, it is possible that errors are inherited from source statistics. Additionally, as the FA is a closed and balanced system, it is possible that some of the household aggregates are adjusted by adding balancing adjustments. In some cases balance sheet items can even be based on residual estimations. However, in the euro area countries and in particular in countries we analyse in this paper, the FA balance sheets are mostly based on counterpart information. Although such data might usually be thought of as being relatively accurate, even counterpart information can contain errors. Also for not all counterpart data one might be able to identify the right sector to classify data (e.g. between S.11 Non-financial corporations and S.14 Households) Potential measurement errors in the FA are also discussed in Kavonius and Törmälehto (2010) and Kavonius and Honkkila (2013).

Underreporting and item non-response in the HFCS

Item non-response refers to the problem that for some assets and liabilities the household may not report any value. There are several approaches to alleviate this issue. In the HFCS the problem of item non-response is tackled by multiple imputation, which is the leading method (Rubin 2004). This means that the HFCS, instead of providing one imputed value for each missing one, is giving a set of values drawn from the distribution of values, conditional on the characteristics of the household and the other variables. A full dataset for the main financial instruments without missing values is provided (ECB, 2013). This reduces the overall coverage problem between the survey and FA for these items as the imputed values increase the total amounts of the survey accordingly. One measurement problem that remains apart from item non-response is that the household still may not accurately estimate the value of some assets or liabilities, or denies that it possesses the financial instrument. This might also be one reason for discrepancies between the HFCS and FA.

Differences caused by the treatment of sole-proprietors/partnerships and quasi-corporations

FA distinguishes between producer households (to be classified within the household sector/S.14) and quasi-corporations (to be classified within the non-financial corporations sector S.11). This distinction is relevant because it affects the gross wealth of the household sector and the composition of the household balance sheet. In the FA framework it depends whether the business is a separate institutional unit or not: *“Quasi-corporations are unincorporated enterprises that function as if they were corporations. Quasi-corporations are treated as*

corporations: that is, as separate institutional units from the units to which they belong in recognition of their distinct economic and financial behaviour.” (ESA2010, p. 422). Unincorporated enterprises are part of the household sector (S.14) and are classified as producer households if they are not considered as a separate institutional unit as described above. Financial and non-financial assets as well as financial liabilities of these unincorporated enterprises are spread over the various items of the household balance sheets and it is not possible to distinguish between wealth of the unincorporated enterprise and wealth of the household. In this case there is no value of net equity recorded in ‘F.519 Other Equity’. If, however, the economic activity is considered to be a separate unit, any property rights are classified in FA as equity participation held by the household (other equity) and this separate institutional unit is then classified in S.11 or S.12.

The survey definition of self-employed businesses (including sole-proprietorships and partnerships) ideally enables to identify values for the net value of the business separately from other non-business related positions of the household. This conceptual difference implies that for producer households there is a net value collected in the survey whereas in FA the assets and liabilities of these producer households are spread over the different instruments. The question is which instruments are affected by this difference and to what extent. Real assets and liabilities may as well be affected as financial assets. To have a measure on the size of this difference for each of the instruments would need separate accounts for sole-proprietorships and partnerships. This might account for part of the difference in the coverage ratios of many instruments as well as on an aggregated level for each component of net wealth (financial assets, real assets and liabilities). For legal forms other than sole-proprietorships and partnerships (e.g. limited liability companies) the household holds a net equity position in the business both in the FA and in the HFCS.

Table 4 provides an overview of the different types of businesses and how they are recorded in the HFCS and FA. As can be seen, the main comparability issue arises only for those sole-proprietors and partnerships which are not classified as quasi-corporations and hence are recorded in the household sector in FA indistinguishable from the “private part of the household” (case 1). For these, there is a net value for the business provided in the HFCS whereas in the FA the assets and liabilities of the business are spread across the balance sheet of the household sector including real assets and liabilities. Hence, for this part of the sole proprietors and partnerships it is not known if the net value of the business provided in the HFCS should be allocated to financial assets, real assets or liabilities in FA. For quasi-corporations (case 2), there is a net value provided in the HFCS and also a net value recorded in the FA. The same applies to the other incorporated businesses: there is in principle no difference in the recording, as both in the HFCS and in the FA there is a net value provided, although differences in the valuation might still occur.

Table 4 furthermore provides an overview which of the described cases is included or excluded in the HFCS in each of the concepts described in the next section. For the other instruments Table A1 in the annex provides an overview which instruments are excluded from both sources in the adjusted concepts.

Table 4: Recording of businesses and inclusion in the different concepts

Case	Type of business	Net/Gross Value		Included/Excluded in the HFCS			Comment
		HFCS	FA	Naïve comparison	Adjusted concept 1	Adjusted concept 2	
1	Sole proprietorships and partnerships which are <u>not</u> classified as quasi-corporations in FA	Net value	Gross Values: Recorded in the household sector indistinguishable from the “private part of the household”. The assets and liabilities of the business part are distributed across the household balance sheet (including financial assets, real assets and liabilities)	Excluded	Included	Excluded	The net value might include real assets
2	Sole proprietorships and partnerships which could be classified as quasi-corporations in FA.	Net value	Net value (other equity)	Excluded	Included	Excluded	In principle comparable but quasi-corporations would be difficult to identify in the HFCS based on the information provided in the survey.
3	Limited liability companies and other incorporated businesses	Net value	Net value (other equity)	Excluded	Included	Included	

2.3 ADJUSTED CONCEPTS OF FINANCIAL ASSETS

The aim of this section is to derive two adjusted concepts of financial assets. The intention to go from a naïve comparison to an adjusted concept is to base the comparison on those financial instruments which are included in both sources and are conceptually comparable. The adjusted concepts allow providing a more reliable indication of those financial assets that are covered in both the HFCS and the FA. We define the ‘coverage ratio’ as measuring the per capita amount of

financial assets covered by the survey, e.g. a value of 98% would imply that the per capita amount of the HFCS is only 2% below the per capita amount in FA.

$$(1) \quad \text{Coverage Ratio} = \frac{DA2100}{AF}$$

Where AF refers to the total financial assets in the FA and DA2100 refers to the total financial assets in the HFCS.

2.3.1 NAÏVE COMPARISON

The naïve comparison takes the concepts of financial assets as they are in the HFCS and in the FA. This serves a benchmark but this concept includes also non-comparable instruments (e.g. F.21 Currency, which is not covered by the HFCS) and uses different classifications (e.g. of the value of self-employed) which distort the picture of the actual coverage ratios. The HFCS concept of financial assets does not include the value of self-employed businesses as well as the value of occupational pension plans which are accordingly also not included in the naïve comparison. Therefore it is not surprising that the naïve comparison shows relatively low coverage ratios of 34% to 43% for financial assets (results are presented in Table 5).

FA:

$$(2) \quad AF_{Naïve} = F.21 + F.22 + F.29 + F.3 + F.4 + F.5 + F.6 + F.7 + F.8$$

HFCS:

$$(3) \quad DA2100_{Naïve} = HD1110 + HD1210 + HD1320x + HD1420 + HD1010 + HD1510 + HD1620 + HD1710 + HD1920 + DA2109$$

2.3.2 ADJUSTED CONCEPT 1

For the adjusted concept 1 we include on the survey side the value of self-employed businesses (DA1140 (which is the sum of (HD080x) + HD0900)) in the comparison (reclassification from real assets to financial assets) and we exclude the amount owed to the household (HD1710) as well as the other financial assets (HD1920). In the FA we exclude F.21 Currency, F.4 Loans (Assets), F.7 Financial derivatives and F.8 Other accounts receivable. For pensions we only include F.62 Life insurance and annuity entitlements and exclude the other sub-categories (F.61, F.63-F.66) as these are not comparable to the survey (see discussion above). As can be seen in Table 5, going from a naïve comparison to the adjusted concept 1 significantly increases the coverage ratio for financial assets (to 55% in Finland and even 98% in Austria). Putting these numbers in perspective, it is noteworthy that in their comparison of the Flow of funds Accounts (FFA) and the Survey of Consumer Finances (SCF) in the US, Henriques and Hsu (2014) conclude that the net worth of the SCF in comparable terms is above the net worth of the FFA. More recently, Bricker et al (2016b) show that much of the wealth gap between the SCF net wealth and FA wealth seems to be for assets where market prices are not easily observed. E.g. Bricker et al (2016b) show that in 2013 SCF housing was 36 percent above the FA estimate, but SCF non-housing assets were only 6 percent above the FA.

The adjusted concept 1, as it includes all self-employed businesses most likely overstates the coverage ratio as the value for sole proprietors and partnerships may also include real assets (see discussion above about the delineation between sole-proprietors and quasi-corporations).

FA:

$$(4) \quad AF_{adj1} = F_{Naïve} - F.21 - F.4 - F.61 - F.63 - F.64 - F.65 - F.66 - F.7 - F.8$$

HFCS:

$$(5) \quad DA2100_{adj1} = DA2100_{Naïve} - HD1710 - HD1920 + DA1140$$

2.3.3 ADJUSTED CONCEPT 2

In the HFCS the value for self-employed businesses can be broken down by legal status (see Table A1 in the Appendix). Therefore, the distinction between sole-proprietorships, partnerships and other incorporated businesses is possible. While the adjusted concept 1 includes the net values of all legal forms of self-employed businesses in the HFCS (including sole proprietors and partnerships), the adjusted concept 2 excludes sole proprietors and partnerships from the value of self-employed businesses in the survey. For FA we keep the corresponding instrument F.5 Equity the same in both concepts. The intention of this adjusted concept is that it serves as a lower benchmark as it only comprises the net value of those legal forms in the survey that are in the FA recorded in the non-financial corporations' sector and consequently the household only holds a net equity position in the business (other equity). Thus, for the legal forms included in this concept both in the FA and in the HFCS the household holds a net equity position.

As can be seen in Table 5, the coverage ratios for the adjusted concept 2 are higher compared to the naive comparison but significantly lower compared to the adjusted concept 1 where all legal forms of self-employed businesses are included. Certainly, adjusted concept 2 underestimates the coverage ratios as it excludes all financial assets of sole-proprietorships and partnerships from the survey.

For improving the comparability between the HFCS and the FA further, the following information would be needed: first, an estimate of sole proprietorships and partnerships included in the HFCS that are classified as quasi-corporations in the FA (case 2 in Table 4). Second, for the sole-proprietors and partnerships which are recorded in the household sector, one would need the breakdown to financial assets, real assets and liabilities (case 1 in Table 4).

FA:

$$(6) \quad AF_{adj2} = F_{Naïve} - F.21 - F.4 - F.61 - F.63 - F.64 - F.65 - F.66 - F.7 - F.8$$

HFCS:

$$(7) \quad DA2100_{adj2} = DA2100_{Naïve} - HD1710 - HD1920 + DA1140 - DA1140_{Sole\ proprietorships/independent\ professionals + partnerships}$$

Table 5: Coverage ratios of financial assets for the household sector (S.14) – Naïve comparison vs. adjusted concepts

Country	Coverage Ratio (%)			Share of total financial assets in the FA covered in the adjusted concepts (same in both concepts) (%)
	Naïve comparison	Adjusted concept 1	Adjusted concept 2	
Austria	35	98	46	87
Germany	43	86	67	77
Spain	34	75	59	82
Finland	37	55	45	83
France	38	59	51	90

Notes: Reported is the coverage ratio of the different concepts. The naïve comparison includes all assets as given in the two sources without taking into account the conceptual comparability. For the adjusted concepts 1 and 2 we make adjustments to increase the conceptual comparability. The share of total FA shows the assets covered in the adjusted concepts 1 and 2 as a percentage of total financial assets in the financial accounts (same for both concepts).

Sources: HFCS and Financial Accounts

3. THE WEALTH DISTRIBUTION AND METHODOLOGY TO ESTIMATE THE TAIL

In this section, we first discuss the general problem of wealth surveys, i.e. fact that top tail observations are missing, which is often caused by differential unit non-response. We also discuss which oversampling strategies are used by countries to mitigate this issue in the HFCS. In the second part we explain the methodology to estimate the top tail of the wealth distribution by a Pareto distribution. Our approach and discussion builds on Vermeulen (2018). The third part discusses the Forbes list and its consistency with the statistical data. These data are used for the estimations of the Pareto tail.

3.1 OVERSAMPLING, WEALTH DISTRIBUTION AND DIFFERENTIAL UNIT NON-RESPONSE IN THE HFCS

In general, the bias in the HFCS caused by unit non-response is reduced by weight adjustments (Pérez-Duarte et al. 2010). But as the wealth distribution is often skewed, unit non-response of the wealthiest households, or the fact that the extremely wealthy households are rarely included in the survey sample, is still usually a problem. Income and wealth concentrations are likely to be underestimated using survey data, as there is a high concentration of wealth in the top quintile and the response rates of especially this quintile is usually lower. For the top tail of the wealth distribution there is some evidence on how response rates correlate with the amount of wealth owed by a household. Based on the Survey of Consumer Finance from the US, Kennickell and Woodburn (1999) have documented the following response rates based on different strata (differential unit non-response): 34% for USD 1 million to 2.5 million and 14 % for USD 100 million to 250 million. For the stratum which likely includes the wealthiest households Kennickell (2008) observes an overall response rate of 10%. Bricker et al. (2016b) report response rates for more recent SCF waves in the wealthiest SCF stratum of around 12 %, around 25% in the second stratum rising to around 50% in the last two least-wealthy strata. This is still

lower than the response rate of around 70% in the SCF area probability sample. However Bricker et al. (2016a) nicely demonstrate that even though response rates are low at the top of the wealth distribution, the survey participants are observationally equivalent to the non-respondents. This demonstrates the usefulness and effectiveness of oversampling.

For the HFCS the amount of wealth owned by the top tail varies from country to country and available evidence suggests that the response rates declined to a different extent in different countries. For the 2011 wave, the Spanish survey of household finances documented the following response rates by wealth strata: Stratum 5 (0.9 to 2 million) 31%, Stratum 6 (2 to 6 million) 26%, Stratum 7 (6 to 25 million) 21% and Stratum 8 (wealth above 25 million EUR) 21%. The survey also has a panel-component for which the response rate drops from 74% to 62% for these wealth strata (Bover et al. 2014). Contrary, in Finland – although response rates varied across different strata, age groups, regions and education level, non-response rates did not increase along the level of taxable wealth for the Finnish Household Wealth Survey of 2004 (Pérez-Duarte et al., 2010).

Some countries have oversampled wealthy households in the HFCS to increase the precision at the top. Table 6 gives an overview of the oversampling strategy for the countries included in our analysis. Germany used an oversampling strategy based on geographical areas which resulted in a less effective oversampling than in France and Spain which used net wealth or taxable wealth. One should expect that oversampling increases the precision of the aggregated survey values and therefore make them potentially closer to the FA for a single survey.

Table 6: Oversampling in the first wave of the HFCS by country

Country	Oversampling wealthy households	Basis for oversampling	Effective oversampling rate of the top 5%
Austria	No	n.a	4
Germany	Yes	Geographical areas	148
Spain	Yes	Taxable wealth	314
Finland	Yes	High-income employees, self-employed and farmers	85
France	Yes	Net wealth	208

Notes. Source is HFCS. Effective oversampling rate of the top 5%: $(S95 - 0.05)/0.05$, where S95 is the share of sample households in the wealthiest 5%. Wealthiest households are defined as having higher net wealth than 95% of all households, calculated from weighted data (ECB 2013).

Even with oversampling, it remains uncertain how much of the wealth of the wealthiest households is actually covered by the survey. This in turn is one reason for part of the gap between the amounts of FA and aggregated amounts from the survey. The methodology presented in the next section addresses exactly this issue. The idea is to replace the observations above a certain threshold of net wealth per household by an estimated Pareto distribution and see which impact this has on the coverage ratio of the HFCS in comparison to FA. In terms of the coverage ratio, capturing the value of assets from these wealthiest households might be even more relevant for specific instruments, as there are particular financial assets which are largely

owned by a small fraction of the wealthier households. We concentrate here on net wealth figures as well as on the adjusted concept of financial assets and leave the breakdown on particular instruments for future research (see Chakraborty and Waihl (2018)). The methodology to estimate the Pareto tail is the same approach as in Vermeulen (2018). Therefore, we keep the explanation here short.

3.2 METHODOLOGY

Wealth is heavily skewed at the top and the literature has reached a consensus that the top of the wealth distribution is well approximated by a Pareto distribution (Davies and Shorrocks 1999). The Pareto distribution has two parameters, the tail exponent α and the Threshold parameter T . The distribution is given by the following complementary cumulative distribution function (ccdf):

$$(8) \quad P(W > w) = \left(\frac{T}{w}\right)^\alpha$$

The Pareto distribution is defined on the interval $[T, \infty)$ and $\alpha > 0$. The threshold T is the lower bound of the distribution. Estimating a Pareto distribution on a simple random sample is fairly straightforward. The maximum likelihood estimator of α from a random sample of n observations drawn from a Pareto distribution with a given threshold T is given by:

$$(9) \quad \alpha_{ml} = \left[\sum_i \frac{1}{n} \ln \frac{w_i}{T} \right]^{(-1)}$$

Alternatively, the tail exponent has been estimated in the literature using linear regression on ranked data. Let i be the rank of the observation (with rank 1 being the highest observation). The Pareto tail exponent α can be estimated by:

$$(10) \quad \ln(i - 0.5) = C - \alpha \cdot \ln(w_i)$$

Where the “subtract 0.5 from the rank” is suggested in Gabaix and Ibragimov (2011).

However, wealth survey data does generally not consist of a simple random sample. In particular, sample observations have weights. Vermeulen (2018) shows that taking into account the weights can be done in the regression method above, using the ranked n highest observations:

$$(11) \quad \ln(i - 0.5) \frac{N_{fi}}{\bar{N}} = C - \alpha \cdot \ln(w_i)$$

where N_{fi} is the average weight of the highest i sample points and \bar{N} is the average weight of all n highest sample points. This regression method can be used in two ways. First, estimate α using only the survey data (i.e. the highest n observations). Alternatively, these observations can be pooled with data of rich lists which contain datapoints that are higher than the highest

observation in the survey (this joint dataset is then ordered first). Using this regression method works particularly well when combining the survey data with such extraneous data points.

A particular problem is the choice of the threshold T . There is no clear-cut way in finding a “correct” threshold. However, the Pareto distribution has the interesting property that a distribution with tail exponent α and threshold, when restricted above $T^* > T$ remains a Pareto with the same tail exponent. It therefore seems prudent with survey data to take a high threshold. This avoids taking lower observations that are not Pareto distributed. However, there is a trade-off: A higher threshold T^* implies using less data to estimate α . It is probably best to estimate α using different thresholds of the data and check for sensitivity.

After estimating the α for a given threshold T , the n observations can be replaced by the estimated Pareto distribution. The mean of a Pareto distribution is given by $\frac{\alpha}{\alpha-1}T$, so that we can say that the total wealth in the Pareto tail is given by $n\bar{N} \left(\frac{\alpha}{\alpha-1}\right)T$, where $n\bar{N}$ is the total sum of weights of the highest n observations in the survey sample.

We use the thresholds 500,000 euro, 1 million euro and 2 million euro to estimate α and we use the same thresholds to replace the survey observations by the estimated Pareto tail. The Pareto distribution is estimated using the above described methods: (1) the pseudo maximum likelihood. Specifically, we use the pseudo-maximum likelihood estimator which has the same form as the maximum likelihood estimator but takes into account the weights of the sample observations in the survey (see Vermeulen 2018). (2) the regression method excluding data from the Forbes and (3) the regression method including data from the Forbes.

3.3 FORBES DATA

The wealth concept of the Forbes list does not strictly follow any defined concept and therefore, it should be interpreted as a proxy. The wealth concept typically covers the net wealth and thus, the split between assets and liabilities is not available. Four conceptual issues related to using these estimates in statistical estimations can be identified. First, the estimations are based either on interviews of billionaires themselves or their handlers, employees, rivals etc. This implies that it is impossible to cover all the asset types or to have similar type of market valuation to FA or household surveys. On the methodology used by Forbes, Dolan (2016) states that “*not that we pretend to know what is listed on everyone’s private balance sheet, though some folks do provide that information. We do attempt to vet these numbers with all billionaires. Some cooperate, others don’t.*” Almost all the families on the Forbes list from the countries analysed in this paper have earned their money in businesses and therefore, it can be assumed that the majority of their net wealth is in equity. For the Forbes list, the privately-owned businesses have been valued by coupling estimates of revenues or profits with prevailing price-to-revenues or price-to-earnings ratios for similar companies (Dolan 2016). The method can be considered similar to the methods used in the valuation of the unlisted equity in the FA.

Second, the wealth concept does not cover all asset types as these are partly based on external estimations. Additionally, the wealth concept also covers items which are defined as durable goods in the NA (such as yachts). Third, sometimes the fortune is distributed to the different family members and sometimes it is not and a large number of family members is aggregated (Dolan 2016). The starting point in statistics and in particular in the HFCS is that the applied unit is the household. In the case of the Forbes lists it is very well possible that the applied family concept covers several households or contrary one person e.g. the head of the household.

Fourth, the Forbes list covers families by nationality and it does not correspond with the residence concept applied in the HFCN and SNA. The families living outside of the country of their citizenship should not be included in the HFCN population but they are included in the Forbes list. A brief analysis proved that the majority of these families are actually resident in the countries of their citizenship. For instance, in the case of Finland all six persons who are on the list are also residents in Finland. In larger countries where the number of billionaires is also higher, there are some families which live outside the country of their citizenship. In the future work, it can be considered to allocate these types of families to their resident countries. Even though there are these drawbacks in using the Forbes list, the data are one of the best proxies for the very top tail of the wealthiest households (alternatives being national rich lists).

4. RESULTS

4.1 ESTIMATES OF THE PARETO COMPARED WITH THE HFCS

We estimate the Pareto tail exponent using the three methods described above, for the three thresholds. The results for the Pareto tail exponent (α) are provided in Table 7. The Pareto tail index estimates coincide with those as found by Vermeulen (2018). In general a lower α implies higher tail net wealth and higher total net wealth. As described earlier we replace the tail net wealth of the survey observations above each of the thresholds by the estimated net wealth from the Pareto distribution. Hereby we assume that the weights in the HFCS allocated to those households having net wealth above these thresholds are correct.

Table 7: Pareto tail index (alpha)

	Pseudo max.likelihood			Regression method excl. Forbes			Regression method incl. Forbes		
	$\geq 2M$	$\geq 1M$	$\geq 500T$	$\geq 2M$	$\geq 1M$	$\geq 500T$	$\geq 2M$	$\geq 1M$	$\geq 500T$
Austria	1.67 (0.42)	1.42 (0.30)	1.34 (0.16)	1.87 (0.72)	1.65 (0.45)	1.44 (0.26)	1.47 (0.06)	1.47 (0.05)	1.43 (0.08)
Germany	1.41 (0.26)	1.43 (0.17)	1.61 (0.10)	1.87 (0.35)	1.64 (0.23)	1.54 (0.13)	1.38 (0.04)	1.39 (0.02)	1.40 (0.01)
Spain	1.71 (0.27)	2.05 (0.18)	1.85 (0.08)	1.67 (0.13)	1.76 (0.11)	1.87 (0.08)	1.59 (0.05)	1.69 (0.05)	1.80 (0.05)
Finland	2.01 (0.23)	2.47 (0.18)	2.26 (0.06)	1.94 (0.57)	2.13 (0.23)	2.27 (0.10)	1.60 (0.14)	1.88 (0.13)	2.16 (0.08)
France	1.65 (0.09)	1.84 (0.08)	1.75 (0.04)	1.67 (0.13)	1.78 (0.08)	1.83 (0.06)	1.50 (0.02)	1.63 (0.03)	1.73 (0.03)

Notes: The table shows the results of three different methods to estimate the Pareto tail index (alpha). For each of the three methods, we vary the threshold that is used for the estimation of the alpha. Mean over the results computed in each of the five impicates and standard errors in parentheses. *Sources:* HFCS and Forbes

Table 8 gives an overview of the weights in % of the population. Obviously, increasing the threshold decreases the weights allocated to these households. Nevertheless, the weights allocated to households above each of the threshold, varies from country to country, e.g. the weight of households in Austria having net wealth above 2 million euro is 1.9% compared to Finland with only 0.3%.

Table 8: Weights below and above threshold

	$\geq 2M$		$\geq 1M$		$\geq 500T$	
	Below	Above	Below	Above	Below	Above
Austria	0.981	0.019	0.954	0.046	0.887	0.113
Germany	0.991	0.009	0.974	0.026	0.918	0.082
Spain	0.992	0.008	0.964	0.036	0.865	0.135
Finland	0.997	0.003	0.986	0.014	0.937	0.063
France	0.992	0.008	0.970	0.030	0.896	0.104

Notes: The table shows the weights allocated in the HFCS above and below three different thresholds for the given countries. The thresholds refer to net wealth. The sum of the weights corresponds to the size of the target population (see Table 2). *Source:* HFCS

Table 9 shows the net wealth below and above the thresholds as measured in the HFCS.

Table 9: Net wealth below and above threshold HFCS (bn EUR)

	≥2M		≥1M		≥500T		Total
	Below	Above	Below	Above	Below	Above	
Austria	673	327	528	472	357	643	1,000
Germany	5,907	1,836	4,945	2,798	3,489	4,254	7,743
Spain	4,273	685	3,637	1,321	2,475	2,483	4,958
Finland	384	25	349	60	267	142	409
France	5,466	1,036	4,620	1,883	3,200	3,303	6,503

Notes: The table shows the net wealth, aggregated over households below and above the threshold as it is given in the HFCS. The thresholds refer to net wealth. The total shows the aggregated net wealth in the HFCS for each country. Source: HFCS

Table 10 to Table 12 provides the estimates of tail net wealth using the different methods to estimate the tail. They also provide for each estimate a comparison in terms of the HFCS tail (Pareto tail divided by the HFCS tail). Furthermore, the tables provide an estimate in terms of actual net wealth of the HFCS when the tail is replaced by the Pareto estimate (estimated net wealth when tail is replaced by the Pareto divided by the actual net wealth of the HFCS).

Table 10 shows the tail net wealth using the *pseudo maximum likelihood method* without the Forbes list. The tail does not significantly increase for those countries that used an effective oversampling strategy (Spain and France). But especially in Austria and Germany having less effective oversampling strategies the estimated Pareto tail increase the tail compared to the HFCS as well as total net wealth. The total effect on net wealth is lower compared to the effect on the tail as the weight of those households having net wealth above each of the thresholds is taken into account.

Table 11 shows the tail net wealth using the *regression method excluding the Forbes list*. Similarly not much is added to the HFCS tail using either of the thresholds for those countries with an effective oversampling strategy. Generally, the estimates get more imprecise the higher the threshold is as fewer sample observations from the survey can be taken for the analysis. This seems to be especially prevalent for those countries using a less effective oversampling strategy. The lower estimated tail for Austria and Germany with a threshold of 2 million euro is most likely based on this fact and the results need to be interpreted with caution. However, using a lower threshold generally bears the risk to include observations in the estimate that may not be Pareto distributed. Finally, Table 11 shows the results *including the Forbes data into the regression method*. This yields the highest estimates for the tail as well as for net wealth in line with the results from Vermeulen (2018). It even adds net wealth for those countries that used an effective oversampling strategy although to a minor extent compared to those countries with a less effective oversampling strategy.

REPLACEMENT OF HOUSEHOLDS IN THE SURVEY ABOVE THRESHOLD BY THE PARETO TAIL

Table 10 : Estimated net wealth above threshold (tail wealth) using Pseudo max.likelihood

	≥2M			≥1M			≥500T		
	Tail net wealth (bn EUR)	Tail net wealth in % of HFCS tail wealth	Estimated net wealth in % of HFCS net wealth	Tail net wealth (bn EUR)	Tail net wealth in % of HFCS tail wealth	Estimated net wealth in % of HFCS net wealth	Tail net wealth (bn EUR)	Tail net wealth in % of HFCS tail wealth	Estimated net wealth in % of HFCS net wealth
Austria	354	108	103	590	125	112	842	131	120
Germany	2,536	138	109	3,496	125	109	4,304	101	101
Spain	672	98	100	1,213	92	98	2,503	101	100
Finland	26	106	100	58	96	99	142	100	100
France	1,064	103	100	1,820	97	99	3,374	102	101

Table 11: Estimated net wealth above threshold (tail wealth) using Regression method excluding Forbes

	≥2M			≥1M			≥500T		
	Tail net wealth (bn EUR)	Tail net wealth in % of HFCS tail wealth	Estimated net wealth in % of HFCS net wealth	Tail net wealth (bn EUR)	Tail net wealth in % of HFCS tail wealth	Estimated net wealth in % of HFCS net wealth	Tail net wealth (bn EUR)	Tail net wealth in % of HFCS tail net wealth	Estimated net wealth in % of HFCS net wealth
Austria	305	93	98	443	94	97	699	109	106
Germany	1,585	86	97	2,694	96	99	4,651	109	105
Spain	696	102	100	1,438	109	102	2,472	100	100
Finland	27	110	101	65	108	101	142	100	100
France	1,045	101	100	1,896	101	100	3,188	97	98

Table 12: Estimated net wealth above threshold (tail wealth) using Regression method including Forbes

	≥2M			≥1M			≥500T		
	Tail net wealth (bn EUR)	Tail net wealth in % of HFCS tail wealth	Estimated net wealth in % of HFCS net wealth	Tail net wealth (bn EUR)	Tail net wealth in % of HFCS tail wealth	Estimated net wealth in % of HFCS net wealth	Tail net wealth (bn EUR)	Tail net wealth in % of HFCS tail net wealth	Estimated net wealth in % of HFCS net wealth
Austria	444	136	112	546	116	107	710	110	107
Germany	2,678	146	111	3,747	134	112	5,708	134	119
Spain	752	110	101	1,521	115	104	2,587	104	102
Finland	35	141	103	74	123	103	148	104	101
France	1,258	121	103	2,149	114	104	3,427	104	102

Notes to Tables 10 to 12: The tail net wealth shows the net wealth estimated by each of the methods using the three specified thresholds. The tail net wealth in % of HFCS tail divides the estimated tail net wealth above the specified threshold by the tail net wealth as it is measured in the HFCS. The estimated net wealth in % of HFCS net wealth takes the estimated net wealth when the tail is estimated and aggregated together with the net wealth below the threshold from the survey and divides the sum by the aggregated net wealth as it is measured in the HFCS.

In the next section we analyse how replacing the tail by the Pareto distribution changes the coverage ratios of the adjusted concepts discussed above. We limit the analysis to the last estimation method including the Forbes list and the adjusted concept 1. For the calculations we take the mean over the results computed in each of the five implicates provided in the HFCS.

4.2 COMPARISON WITH THE ADJUSTED CONCEPT OF FINANCIAL ASSETS

In the previous section the tail of the wealth distribution was estimated by taking net wealth as the underlying concept. But so far we have not broken down the net wealth into its components – financial assets, real assets and liabilities. To make these estimates comparable to the adjusted concept of financial assets discussed in section 2.3 we need to allocate the estimated tail net wealth to financial assets, real assets and liabilities.

To obtain a first estimate, we use the HFCS to calculate the aggregate shares of financial assets, real assets and liabilities for those households that have net wealth above each of the thresholds. Using those shares we can allocate the Pareto tail net wealth. To give an indication how this allocation changes with net wealth, Table 12 shows the shares above each of the thresholds constructed using the HFCS. The share of financial assets is increasing while the share of real assets is decreasing with a higher threshold of net wealth for all countries included in the study. For these households, liabilities play a minor role (1% - 6%). For the breakdowns provided in Table 13 we have already reclassified self-employed businesses to financial assets.

Table 13: Total share of assets and liabilities for households above different thresholds (in % of net wealth)

	≥2M			≥1M			≥500T		
	Financial Assets	Real Assets	Liabilities	Financial Assets	Real Assets	Liabilities	Financial Assets	Real Assets	Liabilities
Austria	59	42	1	57	44	1	50	52	2
Germany	57	47	3	49	56	5	43	63	6
Spain	49	53	2	39	65	3	31	74	4
Finland	67	39	6	46	59	6	31	76	6
France	57	45	3	48	55	3	39	65	5

Notes: The percentages show the total share of assets and liabilities for those households having net wealth above each threshold. In this breakdown, the value of self-employed businesses has already been classified within the financial assets. *Source:* HFCS

In Table 14 we show a finer breakdown of financial assets for the households in the survey having net wealth above the threshold of 2 million euro. One sees that the large part of net wealth for these households consist of the value of self-employed businesses (representing 28% of net wealth in France versus 51% in Austria).

Table 14: Total share of financial assets for households with net wealth above 2M (in % of net wealth)

	Austria	Germany	Spain	Finland	France
DA2101 Deposits	3	2	5	3	2
DA2102 Mutual Funds	2	2	2	7	2
DA2103 Bonds	2	2	0	1	1
DA1140 Value of Self-Employment Businesses	51	46	33	33	28
DA2104 Value of Non Self-Employment Private Business	0	0	5	0	4
DA2105 Shares, Publicly Traded	0	2	2	22	6
DA2106 Managed Accounts	0	0	0	0	0
DA2107 Money Owed To Households	1	0	1	0	0
DA2108 Other Assets	0	1	0	0	1
DA2109 Voluntary Pension/Whole Life Insurance	0	2	1	1	13
Total Financial Assets	59	57	49	67	57

Notes: The Table shows in percentages the asset allocation for households with net wealth above 2M EUR for financial assets (% in terms of net wealth). *Source:* HFCS

We suspect that the share of financial assets and specifically equity is further increasing for the wealthier households that are not included in the survey. We base this conjecture on the fact that it is often owners of large businesses that can be found on rich lists. After allocating net wealth to an instrument level, we apply the same procedure to derive the adjusted concept 1 – reallocate self-employed businesses to financial assets and exclude again those instruments from the adjusted concept that are not or hardly comparable. The effect of this procedure on the coverage ratios is shown in Table 15. The table also shows the change in the coverage ratio compared to Table 5. This can be interpreted as the change in the coverage ratio which is based on replacing the tail by the Pareto estimate.

Table 15: Coverage Ratio of adjusted concept 1 (financial assets) if tail wealth is replaced using regression method including Forbes

Country	Coverage Ratio (%) Adjusted concept 1 (≥2M)	Increase in %	Coverage Ratio (%) Adjusted concept 1 (≥1M)	Increase in %	Coverage Ratio (%) Adjusted concept 1 (≥500T)	Increase in %
Austria	110	(+12)	105	(+7)	103	(+5)
Germany	100	(+14)	100	(+14)	104	(+18)
Spain	78	(+3)	81	(+6)	78	(+3)
Finland	59	(+4)	59	(+4)	56	(+1)
France	63	(+4)	63	(+4)	60	(+1)

Notes: The brackets show the change in the coverage ratio to the adjusted concept 1 for the household sector (S.14) when the tail is replaced with the Pareto estimate. *Sources:* HFCS, FA and Forbes

We only apply this procedure using the regression method including the Forbes and the adjusted concept 1. We take the aggregated portfolio structure above each threshold of those households included in the survey. Thus, a lower threshold also implies a lower percentage of net wealth allocated to financial assets as can be seen from Table 13. The intention is to point out one further measurement problem that arises when breaking down the estimated tail net wealth to financial assets and real assets. As the net wealth of the Forbes is almost always originated from listed or unlisted incorporations, most likely the large bulk of their net wealth is invested in equity. So the estimates gained here can only be understood as an indication of the portfolio allocation of the top tail, but most likely the net wealth estimated by the Pareto could be allocated even more to financial assets/equity reducing the gap for financial assets even further.

As can be seen, adding the estimated tail increases the coverage ratio for all countries but to a larger extent for countries with a less effective oversampling strategy. For Spain, Finland and France the increase from adding the Pareto tail including the Forbes is not sufficient to reduce the gap to FA. For Austria and Germany when taking the threshold of 2 million euro the coverage ratio is increased significantly. To see why this is the case: first, the two countries have lower estimated alphas (for the regression method including Forbes), hence a bigger estimated tail. Second, the weights allocated to households above the 2 million euro threshold is highest in Austria and Germany. Third, the share of financial assets in Austria is relatively high. Taking a lower threshold implies here apart from taking different estimated alphas and weights also taking a lower portfolio share for financial assets. The share of financial assets for those households having net wealth above 500,000 euro most likely underestimates the share of financial assets of the Pareto tail and thus also underestimated the coverage ratios. The adjusted concept 1 seems to work particular well for Austria and Germany, but one has to keep in mind that two opposing influences still have an impact which have not been estimated here. On the one hand the value of real assets of sole-proprietors may be included in the adjusted concept 1 in financial assets. Excluding these real assets would lead to a lower coverage ratio for financial assets. On the other hand, taking a higher portfolio share of financial assets would lead to an even higher coverage ratio for financial assets. This higher portfolio share can be assumed from the discussion on the Forbes and when taking into account the development of the share in financial assets when increasing the threshold.

5. CONCLUSION

Using data from the HFCS and the FA, we have made a thorough comparison between both sources for financial assets for Austria, Germany, France, Spain and Finland. We have briefly reviewed the linkages between both sources on an instrument level. Furthermore, we have pointed out and partly estimated basic statistical differences between both sources that have a potential effect on the comparability between both sources.

By developing an adjusted concept of financial assets we have shown that a large part of the gap in comparison to a naïve comparison can already be explained by conceptual differences and by a reclassification of self-employed businesses from real assets to financial assets aligning the concepts of financial and real assets across both sources. Identifying comparable items is essential before being able to actually calculate more reliable coverage ratios.

One challenge in deriving adjusted concepts for financial assets is the treatment of self-employed businesses. Here the issue is which part of sole-proprietors and partnerships included in the survey are assigned in FA to the household sector and which ones are classified as quasi-corporations and hence are recorded in the non-financial corporations' sector. In the latter case the household only holds a net equity position in the business (other equity). Contrary, if the sole-proprietors and partnerships are recorded in the household sector the assets and liabilities may be spread over the balance sheet of the household sector and the net value recorded in the survey may very well include real assets and liabilities. Although, this does not have an effect on the coverage ratios in terms of net wealth, it has a significant effect on the coverage ratio of financial assets on an aggregated level as well as on an instrument level.

Focusing on the wealthiest households we have used the estimation procedure from Vermeulen (2018) and replaced those observations in the survey (households) above three different thresholds (500,000 euro, 1 million euro and 2 million euro) by an estimated Pareto tail. Hereby we allocate the same weights to the estimated tail as allocated to households above these thresholds in the HFCS. Using the estimates from the Pareto we have shown the effect on the tail itself and the effect on net wealth. For the countries using already an effective oversampling strategy the estimates without the Forbes list seem not to add much to net wealth and to the coverage ratio. For countries with a less effective/no oversampling strategy the Pareto estimates seems to increase the tail, net wealth and eventually the coverage ratio. This is one of the main contributions of this paper: we analyse how the coverage ratios for comparable financial assets (adjusted concept) changes when the top tail is replaced by a Pareto distribution including the Forbes list and which factors are of importance for the final results.

It seems that for counties with an effective oversampling strategy the increase in the coverage ratio is lower than for countries with a less effective oversampling strategy. Apart from oversampling three factors are relevant for the final results: first, the estimated alpha is crucial as *a lower estimated alpha leads to a bigger estimated tail*. Second, *the weight allocated to households having wealth above the thresholds is different* from country to country and hence leads to a different effect on net wealth. Third, *the portfolio allocation to financial assets is relevant when net wealth is broken down to its components (financial assets, real assets and liabilities)*. Households having higher net wealth seem to be more invested in financial assets. The analysis shows that it is reasonable to assume that the largest part of financial assets of the wealthiest households is equity. This matters for the estimated coverage ratios for financial assets as a higher portfolio share in financial assets implies that a larger part of the estimated tail wealth is allocated to financial assets.

In the future we need to continue to work on adjusting the concept of net wealth including real assets and liabilities. For the estimation of the coverage ratio of the different components it would be valuable to have an estimate on the share of financial assets, real assets and liabilities held by sole-proprietors and partnerships as this would give an estimation by how much the adjusted concept for financial assets (adjusted concept 1) overestimates the coverage ratio.

The analysis shows that the threshold for estimating the alpha might be of importance as the outcome of the Pareto index might be quite different when taking different thresholds. Generally, there is a trade-off as increasing the threshold decreases the number of households on which the estimates are based on. But taking a lower threshold bears the risk of including observations (households) that are not Pareto distributed. The threshold is of equal importance for taking the portfolio shares of net wealth allocated to financial assets, real assets and liabilities as this has an impact to the coverage ratio for each component of net wealth. In the analysis of this paper we have kept the thresholds for estimating the alpha and the portfolio shares the same. A sensitivity analysis when varying these, e.g. estimating the alpha based on the 500,000 euro threshold but varying the share of financial assets held by these households, would be one way to further analyse the effect on the coverage ratios. Although the regression method including the Forbes shows on average lower alphas and hence a bigger tail, the coverage ratios crucially depend on the weight allocated to the tail in the survey. This in turn is based on the sampling procedure applied by each country. Thus, varying the weight and see the effect on the coverage ratio would be worth examining as the weight differs quite a bit between the countries.

Finally returning back to our initial question stated in the title ‘Is the Top Tail of the Wealth Distribution the Missing Link between the Household Finance and Consumption Survey and National Accounts?’ The answer is a qualified ‘yes but partially’. We have shown that the estimated Pareto tail might explain part of the coverage ratio for financial assets but to a less extent than we initially expected. For those countries that have a less effective oversampling strategy a larger part of the gap to FA seems to be explained by the estimated top tail. But apart from the applied oversampling strategy the change in the coverage ratio depends on the distribution of wealth in each country (leading to different alphas), the weight allocated to households in the in the top of the distribution, and the portfolio allocation of the wealthy households. Finding the ‘correct’ estimates for each measurement problem is a difficult task. The question remains for some countries in our analysis why the coverage ratios using the adjusted concepts are still relatively low and further explanations have to be found. One such explanation is underreporting. We leave this for future research.

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Appendix

Table A 1: Correspondence table: Financial wealth in HFCS and FA

ESA 2010 Code	FA/ Instrument Name	HFCS Variable Code(s)	HFCS Variable	Adjusted concept	Remarks
	Assets				
F.2	Currency and deposits				
F.21	Currency	N/A	N/A	Excluded	FA: holdings by households included but estimated due to the lack of direct sources. HFCS: Not collected.
F.22	Transferable deposits	HD1110	Sight accounts	Included	Specific conceptual differences exist but are unlikely to be significant (e.g. deposit like instruments with non-deposit taking corporations are included in the HFCS which are classified as short term loans in FA.
F.29	Other deposits	HD1210	Savings accounts	Included	
F.3	Debt securities	HD1420	Bonds	Included	Conceptual differences are not known.
F.4	Loans	HD1710	Amount owed to household	Excluded	Not fully comparable, loans between households missing from FA in practice for most countries (conceptually wise they are included).
F.5	Equity and investment fund shares			Included	
F.511	Listed shares	HD1510	Publicly traded shares	Included	
F.512	Unlisted shares	HD1010	Investment in non-self-employment not publicly traded shares (ownership only as an investor or silent partner)	(Partly) Included dependent on adjusted concept	<ul style="list-style-type: none"> - In the HFCS, classification is based on the household's activity in the enterprise. - FA value includes assets that are classified as real wealth in the HFCS (value of self-employment businesses) and has to be reallocated to financial wealth. - The split between 'Unlisted shares' and 'Other equity' cannot be made in the survey. Investments in self-employed businesses could be included in 'Unlisted shares' or 'Other Equity'. - The value of sole proprietorships or partnerships are spread over the different instruments in FA if it is not considered as a separate legal entity (quasi-corporation). - In the HFCS, the value can be provided for the different legal status, although the legal status is not imputed in all countries. ("Unknown" category).
F.519	Other equity	DA1140 (Sum of HD080x) + HD0900	Investments in Self-Employment Businesses 1 - Sole proprietorship / independent professional 2 - Partnership 3 - Limited liability companies 4 - Co-operative societies		

ESA 2010 Code	FA/ Instrument Name	HFCS Variable Code(s)	HFCS Variable	Adjusted concept	Remarks
			5 - Non-profit making bodies 6 - All other Forms (Spain) 7 - Unknown (not imputed)		
F.521	Money Market Fund shares/units	HD1320c	Investments in mutual funds c - Funds predominantly investing in money market instruments	Included	Value dependent on fund type not imputed in every country. The breakdown by type of fund may not be available and only the total HD1330 is imputed in all countries. Hence the distinction between MMF and non-MMF funds may not be made in these countries.
F.529	Non-MMF Fund shares/units	HD1320x	a - Funds predominantly investing in equity b - Funds predominantly investing in bonds d - Funds predominantly investing in real estate e - Hedge funds f - Other fund types (specify)	Included	
F.6	Insurance, pension and standardised guaranteed schemes				
F.61	Non-life insurance technical reserves	N/A	N/A	Excluded	Non-life included in NA. Assets in non-life (e.g. health insurance, term insurance) can be significant.
F.62	Life insurance and annuity entitlements	DA2109 (Sum of PF0920 over household members)	Voluntary pension/whole life insurance schemes	Included	
F.63	Pension entitlements	Sum of PF0700 over household members	Current Value Of All Occupational Pension Plans That Have An Account	Excluded	It is not clear if defined benefit plans are included in this variable in the HFCS. Furthermore, pensions are prone to measurement problems in surveys.
F.64	Claims of pension funds on pension managers	N/A	N/A	Excluded	F.64-F.66 likely to be irrelevant for households.

ESA 2010 Code	FA/ Instrument Name	HFCS Variable Code(s)	HFCS Variable	Adjusted concept	Remarks
F.65	Entitlements to non-pension benefits	N/A	N/A	Excluded	
F.66	Provision for calls under standardised guarantees	N/A	N/A	Excluded	
F.7	Financial derivatives	HD1920	Other financial assets	Excluded	Financial derivatives are not a separate item in the HFCS and are included in 'Other financial assets'. Definition of 'Other accounts receivable/payable' not comparable to 'Other financial assets', different definitions.
F.8	Other accounts receivable/payable				
		HD1620	Managed accounts	Included	May be spread over the FA balance sheet of the household depending on set up of the management and dependent on the assets invested in. Does not, however, affect comparability of total financial assets.

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