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**Article**

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# Significant Statistical Uncertainty over Share of High Net Worth Households

By Christian Westermeier and Markus M. Grabka

The analyses of wealth inequality based on survey data usually suffer from undercoverage of the upper percentiles of the very wealthy. Yet given this group's substantial share of total net worth, it is of particular relevance. As no tax data are available in Germany, the largest fortunes can only be simulated using "rich lists." For example, combining the *Forbes* list, with its approximately 50 German US dollar billionaires, with survey data results in an increased aggregate total net worth for all households in Germany in 2012 of between one-third and 50 percent, depending on the scenario. Moreover, the share of the richest one percent of the population (about 400,000 households) rises from approximately one-fifth to one-third. After reassessment, the richest ten percent of the population's share of total net worth is estimated to be between 64 and 74 percent, depending on the scenario. These reassessments are characterized by a high degree of uncertainty which eventually can only be reduced by improving the base data.

Typically, individuals' net worth, the sum of all their assets, is far more unequally distributed than current income. This is evident, for instance, from the fact that only a relatively small proportion of the population accounts for a considerable share of the entire net worth.<sup>1</sup> Given that the exact figures on the percentage of the richer social strata and the precise distribution of wealth provide an important basis for tax and social policies, there is significant public interest in the status quo and developments in wealth distribution in Germany. However, the existing data bases have a significant flaw in terms of representing high net worth individuals sufficiently (see Box 1 on the general problem of measuring wealth). Using econometric estimation techniques, the aim of the present study is to simulate the upper margin of wealth distribution to obtain an improved data base for the entire distribution of wealth as well as key distribution ratios.

The findings presented in this report are based on a research project funded by the Hans Böckler Foundation to analyze wealth distribution in Germany<sup>2</sup> and extended analyses by DIW Berlin on describing the amount, composition, and distribution of private net worth from 2002 to 2012.<sup>3</sup> The empirical basis is the data from the Socio-Economic Panel (SOEP) longitudinal study of households collected by DIW Berlin together with the field-work organization *Infratest Sozialforschung*.<sup>4</sup> Every five years since 2002, a series of focused interviews have been conducted to gather data on net worth (2002, 2007,

<sup>1</sup> See M. M. Grabka and C. Westermeier, "Persistently High Wealth Inequality in Germany," DIW Economic Bulletin, no. 6 (2014).

<sup>2</sup> "Vermögen in Deutschland- Status-quo-Analysen und Perspektiven," Project number: S-2012-610-4; project management: Markus M. Grabka.

<sup>3</sup> See Grabka and Westermeier, "Persistently High Wealth Inequality."

<sup>4</sup> The SOEP is a representative longitudinal study of households conducted every year since 1984 in western Germany and since 1990 in eastern Germany, see G. G. Wagner, J. Göbel, P. Krause, R. Pischner, and I. Sieber, "Das Sozio-oekonomische Panel (SOEP): Multidisziplinäres Haushaltspanel und Kohortenstudie für Deutschland – Eine Einführung (für neue Datennutzer) mit einem Ausblick (für erfahrene Anwender)," *ASA Wirtschafts- und Sozialstatistisches Archiv*, vol. 2, no. 4 (2008): 301–328.

Table 1

**Raw Distribution of Household Net Worth<sup>1</sup> in SOEP and PHF**

In euros

	<i>PHF (2010/11)</i>		<i>SOEP (2012)</i>	
Mean	195,170		154,380	
Median	51,358		46,680	
90th percentile	442,320		380,740	
95th percentile	661,240		563,100	
99th percentile	1,929,344		1,349,640	
Share of top one percent of total net worth in percent	24.3		18.2	
Share of top five percent of total net worth in percent	45.7		39.0	
Maximum value in millions	76.3		45.5	
Total net worth in trillions	7.742		6.278	
<i>Base data:</i>				
Number of households with net worth of ...	Unweighted	Projection for the entire population	Unweighted	Projection for the entire population
Over 500,000 euro	654	3,261,599	862	2,516,656
Over 1,000,000 euro	246	1,051,254	270	708,424
Over 3,000,000 euro	45	239,407	42	108,366
Total of all households	3,565	39,672,983	10,711	40,657,024

<sup>1</sup> Households (excluding the institutional population).

Sources: SOEPv29; "Private Haushalte und ihre Finanzen" study.

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High net worth individuals tend to be underrepresented in survey random samples.

and 2012). Although the SOEP study establishes available assets on a personal level, the data are then aggregated on the household level for the purpose of analysis. This dataset is thus comparable with the panel study "Households and their finances" (*Private Haushalte und ihre Finanzen, PHF*) conducted by the Deutsche Bundesbank in 2010/2011,<sup>5</sup> which comprised a slightly more comprehensive portfolio of questions on current net worth.<sup>6</sup>

## Multimillionaires Underreported in Population Surveys

In 2012, according to the SOEP survey, total net worth in Germany amounted to just under 6.3 trillion euros (see Table 1), approximately 1.5 trillion euros less than the figures reported in the *PHF* for 2010/2011. However, the comparability of the two surveys is limited, not only due to the different times of the surveys and the components of individual net worth taken as parameters (see also Box 1), but also since the *PHF* study made particular efforts to identify high net worth households and include them

disproportionately in interviews.<sup>7</sup> This approach leads to enhanced estimates on the upper margin of wealth distribution and, in addition, after projections to the entire population, shows a higher aggregate of net worth.

The improved coverage of wealthy households has virtually no effect on the median<sup>8</sup> of the household net worth. In the *PHF* study, this value was equivalent to approximately 51,000 euros, while it was just under 47,000 in the SOEP study. However, the mean of the distribution of wealth is sensitive to the improved representation of wealthy households. While the SOEP reports a figure of almost 155,000 euros per household in 2012 (not adjusted for inflation), the *PHF* records an equivalent amount of 195,000 euros, a good 40,000 euros more. Moreover, looking at the percentiles on the upper margin of distribution, it becomes evident that the estimates from the *PHF* lead to significantly higher figures. Here, for instance, the cut-off for the 95th percentile (661,000 euros) is slightly over 100,000 euros above

<sup>5</sup> U. von Kalkreuth and H. Hermann, "Vermögen und Finanzen privater Haushalte in Deutschland: Ergebnisse der Bundesbankstudie," Deutsche Bundesbank Monthly Reports (6) (2013): 25–51.

<sup>6</sup> HFCN, "The Eurosystem Household Finance and Consumption Survey: Methodological report for the first wave," ECB Statistical Paper Series, no. 1 (2013).

<sup>7</sup> In the *PHF*, this oversampling of high-income households is based on a regional oversampling in areas with high income and high net worth households. Although the SOEP also utilizes oversampling from the 2002 survey year, this only comprises households with an above-average income. However, rather than there being a perfect correlation between income and net worth, high-income households may also only have a low net worth.

<sup>8</sup> The median is the value separating the wealthier 50 percent of the population from the poorer half and is robust against distortions on the upper distribution margin.

## Box 1

**Data Sources on the Distribution of Wealth**

Not only does the national accounts approach face a number of methodological and statistical problems, but so too does the analysis of the distribution of wealth based on microdata representative of the population.

Neither approach takes into account—as is common the world over—the entitlements to statutory pension insurance. Accumulated pension-related claims are converted into personal earning points which do not unequivocally indicate social security assets and therefore are hardly directly ascertainable in a survey; this applies equally to occupational pension entitlements. However, since the majority of the working population is subject to compulsory pension insurance or has pension-related claims, for example, in the form of training or childrearing periods, social security assets in the statutory pension scheme in particular can be assumed to represent the most frequent component in household net worth. Pension insurance data analyses have shown that 91 percent of men and 87 percent of women aged 65 or over have statutory pension entitlements. (In eastern Germany, the corresponding figures are even higher at 99 percent.)

Other components of net worth are also commonly not addressed in population surveys since they are particularly difficult to record, such as household effects, including the value of vehicles. Neither of these two asset components flow into the concept of net worth underlying this analysis. Thus, due to these limitations, in comparison to the national accounts approach, the net worth in these figures is, all other things being equal, underestimated.

In population surveys, assets are usually recorded at the household level. In this context, the SOEP methodology has a special feature since it records the individual assets of each respondent aged 17 or over. In contrast to only recording household assets, this approach can show differences within households and partnerships while it still allows the individual worth to be added to obtain a result for a particular household. Hence, the present analyses refer to the net worth of households. The data collection methods do not gather information on the assets held by children, so this, too, is underestimated.

A comparison of aggregated assets based on the SOEP and the sectoral and overall economic balance sheets of the German Federal Statistical Office (FSO) is complicated by a number of differences in distinctions and definitions. The following reasons for this are germane in this context. First, the FSO categorizes households together with private non-profit organizations. Second, in addition to durable consumer goods, other types of assets are also included which are not recorded in the SOEP, including cash, the value of livestock and crops, equipment, intangible fixed assets, claims against private health insurance companies, commercial loans, and commercial holdings in residential buildings. Third, the SOEP generally records the current market value of real estate while the FSO calculates its replacement value. However, market value differs significantly from the replacement value of portfolio properties. As a result, the SOEP's 2002 calculation for net worth on this basis totaled almost 90 percent of the balance sheet figure arrived at by the FSO, but it was only 64 percent

SOEP estimates; in the 99th percentile, this gap has already increased to almost 580,000 euros (approximately 1.9 million in comparison to 1.35 million).

Accordingly, the *PHF* records a higher number of households with a net worth of one million euros. The extrapolated *PHF* figure amounts to just over one million households, while the SOEP equivalent is around 700,000 households.<sup>9</sup> In the *PHF*, the estimated num-

ber of households with a net worth of more than three million euros is also almost twice as high.

The improved data on wealthy households is important at the upper margin of the wealth distribution. Despite both surveys making particular efforts to recruit wealthy households for interviews, both random samples here share the problem that they hardly include any multi-millionaires with a net worth of over five million euros and no billionaires at all.<sup>10</sup>

<sup>9</sup> In the SOEP, the last additional random sample to improve the statistical force of wealthy households was taken in 2002. Here, high-income households were overrepresented in the random sample. Due to "panel mortality," the number of households and individuals in the panel decrease over time because of respondents' refusal to participate or demographic processes, such as migration or death. As a result, solely in terms of the upper margin of wealth distribution, this sample's cover is constantly eroded. On this, see J. Schupp, J. R. Frick, J. Goebel, M. M. Grabka, O. Groh-Samberg, and G. G. Wagner, "Zur

verbesserten Erfassung von Haushaltsnettoeinkommen und Vermögen in Haushaltssurveys," in *Reichtum und Vermögen – Zur gesellschaftlichen Bedeutung der Reichtums- und Vermögensforschung*, eds. T. Drüyen, W. Lauterbach, and M. Grundmann (Wiesbaden: 2009), 85–96.

<sup>10</sup> The Federal Statistical Office's cross-sectional Income and Consumption Survey (Einkommens- und Verbrauchsstichprobe, EVS) is conducted every five years to establish the net worth situation of private households. However, the

in 2012. In the case of residential buildings, the quantitatively most important asset component, the coverage rate fell from 129 percent in 2002 to slightly under 103 percent in 2012. Here, liabilities are recorded at 73 percent. With aggregate gross monetary assets at 33 percent, the SOEP, as in all other wealth surveys worldwide, has significantly underestimated their value.

A comparison with the wealth survey conducted by the German Federal Bank in 2010/11 (*Private Haushalte und ihre Finanzen, PHF*) shows that the SOEP slightly underestimated per capita net worth at 86,000 euros, compared to the PHF's 95,000 euros. Here, it should also be taken into account that the PHF conducts a far more detailed survey of the asset situation, for example, also explicitly taking into account the value of vehicles.

Since 2002, the SOEP has included a subsample of "high-income households" in a concerted effort to counter the widespread problem in population surveys of not having a statistically significant subgroup of higher incomes and assets. In the context of high inequality in personal wealth distribution, this subsample and the sufficiently large number of wealthy households in the SOEP is especially important. In particular, the relationship between income and wealth distribution for all groups, and above all for the group of high-income earners, can also be shown in greater detail, since assets, asset income, and savings depend to a large extent on disposable income. Nevertheless, despite this dedicated subsample, the problem remains that surveys such as the SOEP effectively do not contain top high net worth individuals. This applies in particular to billionaires as well as multi-millionaires with a net worth in the triple-digits million range. As a result, the true

extent of wealth inequality is underestimated. Germany presently has no available external statistics, for instance, wealth tax statistics, to validate this potential underestimation.

The need to provide fair market value of assets also presents such surveys with a fundamental problem. Estimating fair market value in a survey is difficult, especially when the object was inherited or purchased a long time ago and respondents do not have sufficient knowledge of the current market. As is well known, valuing business assets is also particularly difficult. In contrast to regular income, asset values can be very volatile and this further complicates their evaluation. Aside from the overall sensitivity of this issue, this in turn increasingly results in refusals to answer asset-related questions.

Not only does the SOEP conduct extensive consistency checks on the individual data, but it also uses multiple imputations to replace all missing asset values. Due to the use of longitudinal data from the repeated wealth surveys in 2002, 2007, and 2012, the quality of the imputation is better than in the case of a single survey.

After extrapolation and weighting factors are applied, the SOEP microdata underlying these analyses give a representative picture of the sample in households and thus allow conclusions to be drawn about the entire population. Members of the population in institutions (for example, in nursing homes) were not taken into account. The weighting factors correct differences in the designs of the various SOEP samples as well as the participation behavior of respondents after the first interview. The framework data of the microcensus is adjusted to increase its compatibility with official statistics.

In the research presented here, external information on billionaires in Germany from the *Forbes* list was included to correct the continuing underrepresentation of high net worth individuals.<sup>11</sup> Unfortunately, with few exact details provided on how these lists are compiled, the estimates are likely to be highly imprecise. On the basis of

the assumptions explained below, the upper margin of the distribution of wealth follows a Pareto distribution which can then be used to simulate the upper margin of the survey data (see Box 2). To estimate the Pareto distribution parameters, the data at the SOEP survey's top level have been taken together with information from the US *Forbes* magazine on German billionaires and, using this information, the top section in the SOEP survey's distribution of wealth has been simulated. On the basis of the resulting distribution, more precise estimates can be calculated to show, for example, the shares of the top one or top 0.1 percent of the distribution of wealth.

Since applying the Pareto method to simulate the top net worth households results in estimates with a considerable degree of uncertainty, two scenarios, each with an upper and lower limit, are presented for all three years

EVS uses a cut-off threshold so that households above a certain income threshold are excluded from the sample. In 2008, this point was set at a net household income of 18,000 euros. Since income and net worth are related, this resulted in the undercoverage especially of high-income households in the EVS.

<sup>11</sup> Alternatively, information on high net worth individuals in Germany is available in the manager magazin "rich list." However, since the less detailed estimates in the triple-digit million area result in heaping effects, it was decided to use the *Forbes* list. On this basis, an estimate of the top high net worth individuals for 2007 using the SOEP data has already been published; S. Bach, M. Beznoska, and V. Steiner, "A Wealth Tax on the Rich to Bring Down Public Debt? Revenue and Distributional Effects of a Capital Levy in Germany," *Fiscal Studies*, vol. 35 (1) (2014): 67–89.

Table 2

**German Citizens in the *Forbes* List of Dollar Billionaires**

In billion euros

	2002	2007	2010	2012
Number of entries	34	55	53	55
Total net worth	159.8	185.4	159.5	188.7
Maximum	30.9	15.1	17.2	19.1
Net worth of households from FSO national accounts	6,409	7,709	8,621	9,286
Proportion of high net worth individuals and FSO aggregate in percent	2.49	2.40	1.85	2.03

Sources: Destatis 2013; *Forbes* magazine, *The World's Billionaires* List.

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According to *Forbes* magazine, 55 German US dollar billionaires had a net worth of nearly 190 billion euros in 2012.

of the SOEP surveys (2002, 2007, and 2012). These reflect the maximum and minimum values based on different assumptions regarding the parameters of the Pareto distribution itself.

### In 2013, According to *Forbes* Magazine, Net Worth of Germany's Dollar Billionaires Amounted to Just Under 230 Billion

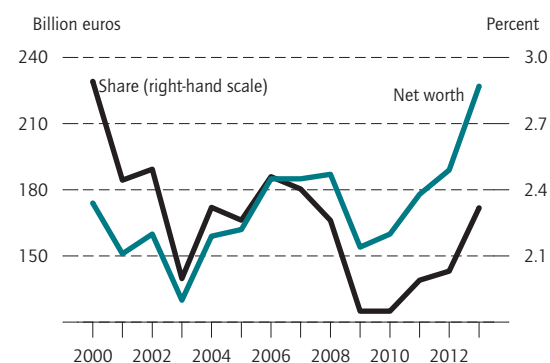
*Forbes* magazine<sup>12</sup> compiles a global list of billionaires with a personal net worth of over one billion dollars. In 2002, approximately 34 individuals (or families) in Germany fell into this category (see Table 2), this number rose to 55 by 2007, and then remained on this level until 2012.<sup>13</sup> Figure 1 shows the total net worth of Germany's US dollar billionaires according to the *Forbes* list, as well as the share of the total assets of those dollar billionaires and the net wealth of households in Germany<sup>14</sup> for 2000 to 2013. Since 2001, this proportion has varied between approximately 1.8 and 2.5 percent, and thus only changed minimally. The total net worth of German dollar billionaires reached its absolute minimum of just under 130 billion euros in 2003 after the new economy bubble burst. The maximum over this period was slightly under 230 billion euros, recorded in 2013. Hence, according to the *Forbes* list, the total net

<sup>12</sup> [www.forbes.com/billionaires/list/#tab:overall\\_country:Germany](http://www.forbes.com/billionaires/list/#tab:overall_country:Germany), accessed November 3, 2014.

<sup>13</sup> The reduction of the maximum shown in Table 2 from 30.9 billion euros to 15.1 billion euros from 2002 to 2007 is due to the *Forbes* list separating Karl and Theodor Albrecht's assets into two individual households after 2002.

<sup>14</sup> The data on the development of total net worth are taken from the national accounts, Federal Statistical Office, *Sektorale und Gesamtwirtschaftliche Vermögensbilanzen 1991–2012* (2013).

Figure 1

**Net Worth of German Citizens in the *Forbes* List and Their Share of Total Net Worth<sup>1</sup>**

<sup>1</sup> Net worth in the *Forbes* list related to net worth in the Federal Statistical Office's national accounts.

Sources: Destatis 2013; *Forbes* magazine, *The World's Billionaires* List.

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According to *Forbes* magazine, the wealth of dollar billionaires is rising again since the end of the financial crisis.

worth of German dollar billionaires has increased by 30 percent since 2000.<sup>15</sup>

### The Total Net Worth of Households Rose Sharply from 2002 to 2007 ...

Taking into account the reassessed top levels of net worth in the SOEP, total net worth rose from 5.8 trillion euros in 2002 to 7.8 trillion euros (see Figure 2) in Scenario 1 (see below and Box 2 on the differences between Scenarios 1 and 2). This represents an increase of over one-third of the total net worth, and so emphatically underscores the extreme relevance of very high net worth individuals for wealth distribution.

Here, the variation on the basis of diverse assumptions for 2002 and 2007 is less than in 2012, since the parameters are within a narrower band of variance. Moreover, the sample quality on the upper margin of distribution is better in these years.<sup>16</sup>

<sup>15</sup> However, among other things, this growth is based on a changed dollareuro exchange rate. The conversion into euros was based on the exchange rate on March 1 of the year in question, since this is always close to the publication date of the annual *Forbes* list.

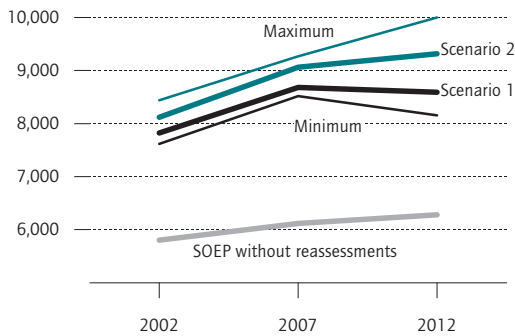
<sup>16</sup> An indicator of the quality of the sample on the upper margin of distribution is, for example, the quotient from the actual sample size  $n$  versus the weighted number of households  $N$ , which exceed a certain wealth threshold. In addition, a regression estimator is used to estimate the parameters for the Pareto distribution which takes into account the weighting of the cases.



Figure 2

### Total Net Worth of Households<sup>1</sup> with Reassessment of the Top Margin of Wealth

In billion euros



<sup>1</sup> Households, excluding the institutional population.

Sources: SOEPv29; Forbes magazine; own calculations.

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The simulation of the highest net worth individuals had a significant effect on the estimated total net worth of households.

On the basis of this expanded dataset, aggregated total net worth increased by just under ten percent between 2002 and 2012 (Scenario 1) but continued to remain behind the growth recorded by the German Federal Statistical Office's (FSO's) aggregated national wealth.<sup>17</sup>

### ... and Only Changed Minimally in the Years of the Financial Crisis

For a number of reasons, in comparison to 2002 and 2007, estimates of the volume of private net worth in 2012 are subject to considerable statistical uncertainty. First, the parameters of the Pareto distribution are difficult to identify, and broader intervals have to be estimated. Second, in comparison to the other years, a scaling parameter in the model was varied more robustly to compress net worth. This corrected the number of observations on the upper margin of the base sample in the SOEP survey which had fallen sharply between 2002 and 2012. Hence, the inequality of the distribution among the top high net worth individuals may well be substantially overestimated in Scenario 1 (without the scaling

parameter).<sup>18</sup> As a result, the inequality in wealth distribution on the upper margin in Scenario 1 is probably overestimated, while total net worth is underestimated.

Scenario 2 takes this situation into account by correcting the distribution on the assumption that the sample might be distorted toward the middle class (middle class bias).<sup>19</sup> Consequently, Scenario 2 records higher total net worth overall. Depending on the year in question, this raises the aggregated total net worth by 40 to 48 percent over the SOEP sample without reassessment of the top high net worth individuals. Moreover, this Scenario not only shows an increase in wealth from 2002 to 2007, but this growth also continued in 2012 so that the total net worth in 2012 amounted to approximately 9.3 trillion euros. According to this estimate, aggregated net worth grew by just under 15 percent in comparison to 2002.

Due to the lack of external data—for example, wealth tax statistics—as well as valid samples on the assets of high net worth individuals, the estimates of aggregated total net worth are associated with a high degree of uncertainty—evident, *inter alia*, in the significant difference between Scenarios 1 and 2. In 2012, this difference amounted to over 700 billion euros, or over eight percent in relation to Scenario 1.

### The Richest One Percent Own between 31 and 34 Percent of Total Net Worth

The expanded dataset also facilitates an estimate of the share of wealth owned by the richest one percent in the distribution of wealth (see Figure 3). In 2012, according to this data, the top one percent owned over 30 percent of the total net worth (Scenario 1).<sup>20</sup> Compared to the base SOEP scenario without reassessment, this represents growth of over two-thirds (18 percent). The growth is even stronger in Scenario 2, with the top one percent estimated to own 34 percent of total net worth, a figure

<sup>18</sup> The Pareto distribution estimates clearly indicate the inequality in the distribution of Pareto-distributed top net worth individuals. The lower the coefficient, the higher the inequality. Thinning out the observations on the survey's upper margin leads to underestimating the parameter; at the same time, the number of persons on the upper margin is similarly underestimated, which reduces total assets as well as the top net worth individuals and the value overall.

<sup>19</sup> For selective non-response in wealth surveys in the USA, see A. Kennickell and R. L. Woodburn, "Consistent Weight Design for the 1989, 1992, and 1995 SCFs, and the Distribution of Wealth," Federal Reserve Board, Survey of Consumer Finances Working Papers (1997).

<sup>20</sup> For the period of 2010/2011, depending on the assumptions, comparable estimates for top high net worth individuals based on HFCS and Forbes data show the top five percent owning 51 to 53 percent of total net worth; see P. Vermeulen (2014), "How fat is the top tail of the wealth distribution?," Working Paper Series 1692, European Central Bank. Estimates using the SOEP and Forbes data result in a share owned by top five percent of 52 percent (Scenario 1) to 57 percent (Scenario 2).

<sup>17</sup> On the basis of the Federal Statistical Office's national accounts, the net worth of private households and non-profit private organizations has grown by 50 percent. This growth, far larger than in the survey data, may be primarily due to different methods of valuation, since real estate is listed at replacement cost in the national accounts but at market prices in the surveys.

## Box 2

**Methodological Aspects of Estimating the Assets of High Net Worth Individuals**

In the upper part of the distribution, a Pareto distribution can be used to estimate the distribution of income and assets. The distribution's probability density is then given by

$$f(x) = \frac{\alpha}{w_{min}} \left( \frac{w_{min}}{x} \right)^{\alpha+1}$$

where  $\alpha$  is a constant parameter, also known as the Pareto coefficient, and  $w_{min}$  describes the threshold from which a particular distribution can be approximated using a Pareto distribution.

The model used here to estimate the upper margin of wealth distribution is based on a combination of survey data and data on the absolute peak of distribution derived from all those with German citizenship on the list of billionaires published annually by the US *Forbes* magazine. However, the *Forbes* lists do not provide sufficient details every year to be able to determine whether these individuals are also living in Germany.<sup>1</sup>

To estimate the assets of high net worth individuals, it is necessary to combine survey datasets and the *Forbes* list, since there is no alternative source of data which provides a near adequate picture of their real wealth.

The method applied here started by estimating the Pareto distribution parameters on the basis of the net worth of households in the surveys and the data on the high net worth individuals. In this process, it was assumed that the individuals on the *Forbes* list each represent a single household.<sup>2</sup> Afterwards, the empirically observed cases between  $w_{min}$  and the billionaires known from the *Forbes* list were deleted, and this part simulated in the dataset to match the estimated Pareto distribution. As a result, the inequality statistics and the percentages of the richer strata were recalculated. These then convey a more realistic picture of the associations than the original survey data.

Since the *Forbes* list gives the net worth of individuals in US dollars, the exchange rate on March 1 of the year in question

was taken to convert the amounts into euros. March 1 is always close to the publication date of the *Forbes* list in spring.

This process, though, is connected to additional assumptions which lead to an increased degree of uncertainty in the estimates, as explained below.

(1) For example, no statistical tests are applicable to determine or falsify a selected  $\alpha$  or  $w_{min}$  when working with data from different sources. Here,  $w_{min}$  is determined graphically; simulations, however, show that the estimated value of  $\alpha$  relative to  $w_{min}$  exhibits a robustly regular shape, i.e., at least one range of values can be given which, with a very high probability, also includes the real value of  $w_{min}$ . Setting  $w_{min}$  too low leads to results underestimating the concentration of wealth on the upper margin; if the figure is set too high, the concentration is overestimated. For these calculations,  $w_{min}$  represented a band from 900,000 to 1,350,000 euros. The variation effect results in a "minimum" and a "maximum" (see below).

(2) Surveys suffer from a differential nonresponse on the upper margins of wealth distribution. Studies in the US have shown that the probability of taking part in such a survey is negatively correlated to an individual's net worth.<sup>3</sup> Since extrapolation factors are allowed for when calculating the Pareto parameter with a regression estimator,<sup>4</sup> these should, as far as possible, take into account the structure of the differential nonresponse. Should this either not be possible or only partially since, as in reality, the structure is simply unknown, the concentration of net worth on the upper margin will be overestimated, as can be demonstrated accordingly in simulations.

(3) The problems in estimating  $\alpha$  described in (2) are also connected to the question of exactly how many households lie above the value of  $w_{min}$ . If one assumes a typical distortion toward the middle class in the sample data, i.e., including a disproportionate number of persons from the middle or upper middle class, the figure for households in the Pareto distribution estimated on the basis of the survey will be too

<sup>1</sup> Moreover, there may also be individuals living in Germany who are not German nationals but should be classified together with other private households.

<sup>2</sup> It is not possible to tell from the *Forbes* list whether the households of these individuals include other members or not.

<sup>3</sup> See A. Kennickell and R. L. Woodburn, "Consistent Weight Design for the 1989, 1992, and 1995 SCFs, and the Distribution of Wealth," Federal Reserve Board, Survey of Consumer Finances Working Papers (1997).

<sup>4</sup> It is not possible to determine the  $w_{min}$  parameter using the alternative of maximum-likelihood estimation if the observations are taken from two different datasets, see P. Vermeulen (2014).



low, while the inequality within the group of the top high net worth individuals will be overestimated (see (2)). Hence, one can observe here two contrary effects for inequality and the concentration of wealth on the upper margin.

(4) The issue of the reliability of the data in "rich lists" published in such magazines as *Forbes* also remains unresolved. Assuming that mistakes in the details are merely coincidental would have a negligible effect on the estimated assessments here. However, should the estimates be structurally too high or too low, this would have a significant impact on the estimations. Admittedly, since neither the sources of data nor the method of obtaining the information are made public, the details in the list ultimately cannot be verified.<sup>5</sup>

#### Two Scenarios to Determine the Distribution of High Net Worth Individuals

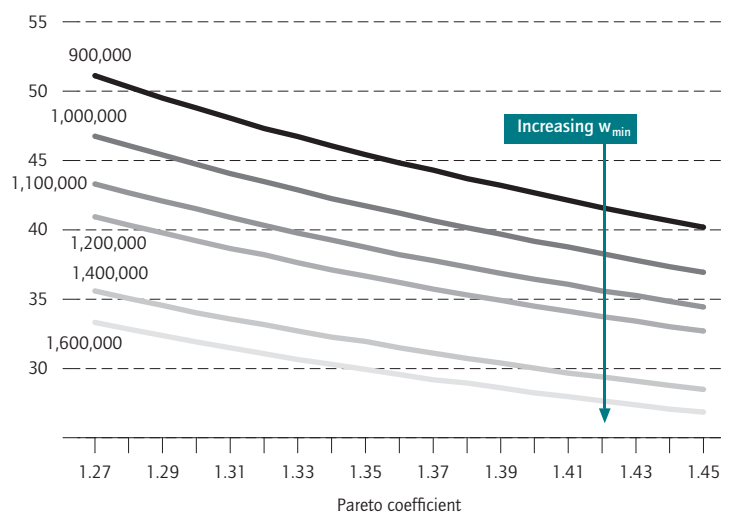
Here, the parameter  $w_{min}$  is calculated both graphically and empirically since  $\alpha$  follows a regular path relative to  $w_{min}$  and so the two parameters can be determined simultaneously. Determining  $w_{min}$  using other methods or expert previous knowledge can distort the calculations. For example, the illustration shows how the total net worth in 2012 after reassessing the high net worth sector varies relative to  $\alpha$  and  $w_{min}$ . The lower  $w_{min}$  is, the higher the reassessed amount of wealth. A similar pattern can be observed with the Pareto coefficient  $\alpha$ . If  $w_{min}$  is set too low for a particular calculation, this results, in this empirical case, in a more severe distortion in the estimation of total net worth than setting  $\alpha$  too low.

In order to remedy (2) and (3) we have introduced an additional scaling parameter which serves to compress the observed distribution on the upper margin to counter the potential underestimation of  $\alpha$  (inequality too high) as well as produce variations in the number of households above  $w_{min}$  (increasing total net worth, smaller gaps between survey and external data). In the simulation, the scaling parameter variation amounted to a minimum value of 0.95 and a maximum of 1.2.

<sup>5</sup> When US federal tax authority researchers compared the tax data of deceased persons and the *Forbes* list, they discovered that the list overestimated net worth by approximately 50 percent, primarily due to assessment difficulties, fiscal distinctions, and poor assessment of liabilities, see B. Raub, B. Johnson, and J. Newcomb: "A Comparison of Wealth Estimates for America's Wealthiest Descendants Using Tax Data and Data from the *Forbes* 400," National Tax Association Proceedings, 103rd Annual Conference on Taxation (2010): 128–135.

Figure

#### Changes to Total Net Worth<sup>1</sup> by Reassessment in Relation to $\alpha$ and $w_{min}$ In percent



<sup>1</sup> Households, excluding the institutional population.

Sources: SOEPv29; *Forbes* magazine; own calculations.

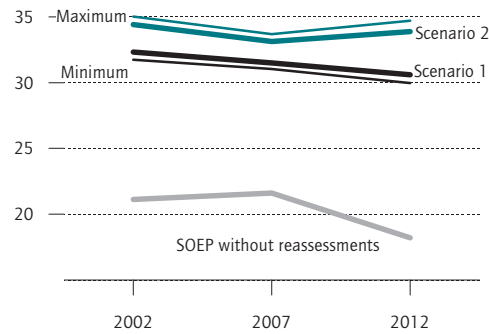
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As a result, this facilitated a scenario with least compression ("Scenario 1") as well as a scenario with maximum compression ("Scenario 2"). Additional variations within Scenarios 1 and 2 result from estimating different values for  $w_{min}$  and  $\alpha$  in line with the uncertain identification of parameters (particularly in 2012) due to the lower number of observations on the upper margin of distribution in the SOEP survey. Following the parameter  $w_{min}$  as determined by the graph, the regression estimates of the  $\alpha$  parameter fluctuate between 1.33 and 1.38 (in 2002 and 2012) as well as 1.35 and 1.40 (in 2007). In the graphs, the minimum and maximum values of the estimations from varying this parameter are clearly labeled "minimum" and "maximum."

Figure 3

### Share of the Top One Percent of Total Net Worth<sup>1</sup>

In percent



<sup>1</sup> Households, excluding the institutional population.

Sources: SOEPv29; Forbes magazine; own calculations.

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The simulation shows an estimated share of the top one percent of approximately 30 to 35 percent.

almost twice as high as that in the SOEP survey without the requisite reassessment.

In addition, over time, the base scenario shows different trends from the expanded dataset. While a slight reduction in the share of the top one percent can be identified in the base scenario between 2002 and 2012 (21 percent to 18 percent), no significant change is evident in the estimates using the expanded dataset, even with the financial market crisis during this period.

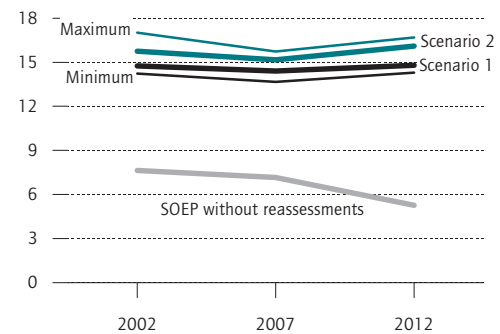
With the same variation in assumptions and parameters, the share of the richest 0.1 percent of households in Germany is between 14 and 16 percent (see Figure 4). Hence, in comparison to the SOEP survey without reassessment, the wealth share of these top high net worth households has tripled (five percent in 2012).

We define the wealthy as the richest ten percent of households minus the top one percent, i.e., all those households between the 90th and 99th percentile of wealth distribution (see Figure 5). According to the estimates of total net worth using base scenario data, their share from 2002 to 2012 was approximately 36 percent. The expanded dataset allows the extrapolation of various trends. In Scenario 2, between 2002 and 2012, this group's share of wealth increased by four percentage points to 38 percent. In Scenario 1, the share of the wealthy also rose initially by around four percent between 2002 and 2007 but declined slightly again in the following years. However, in comparison to the SOEP

Figure 4

### Share of the Top 0.1 Percent of Total Net Worth<sup>1</sup>

In percent



<sup>1</sup> Households, excluding the institutional population.

Sources: SOEPv29; Forbes magazine; own calculations.

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In 2012, reassessment tripled the share of the top 0.1 percent.

survey without reassessments, the reassessment at the upper margin resulted in virtually no change in the net worth share of the wealthy.

Overall, on the basis of these figures, the richest ten percent of the wealth distribution accounts for 74 percent (Scenario 2) of total net worth in 2012. This value is substantially higher than the previously published figure of over 60 percent based on sheer population surveys.<sup>21</sup>

## Conclusion

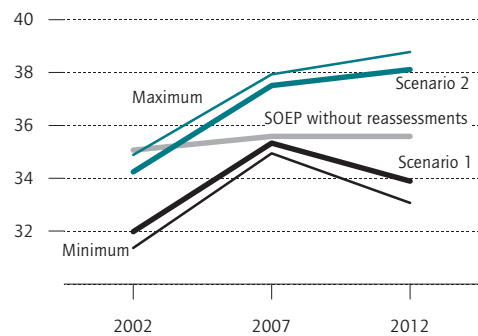
In recent years, the targeted surveys by the SOEP and the Bundesbank's PHF study have considerably improved the data available on the distribution of private wealth in Germany, although the situation is still not entirely satisfactory. However, this only applies to the sector of high net worth individuals. Despite considerable efforts to include the very wealthy in the random sample interviews, this has only had limited success in surveys since hardly any multimillionaires participate and—also due to their very low numbers—no billionaires are in the samples. However, given that wealth distribution shows far greater inequality than current income—as is known in principle from other studies—the very wealthy are more important for statistically determining inequality ratios in such random samples. Including the very wealthy in a

<sup>21</sup> See for example J. R. Frick and M. M. Grabka, "Gestiegene Vermögensungleichheit in Deutschland," Wochenbericht des DIW Berlin, no. 4 (2009): 54–67.

Figure 5

### Share of the Wealthy of Total Net Worth<sup>1</sup>

In percent



<sup>1</sup> Households 90th to 99th percentiles, households, excluding the institutional population.

Sources: SOEPv29; Forbes magazine; own calculations.

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Reassessment has relatively little impact on the wealthy's share of net worth.

reassessment of the figures can lead to improved estimates for the sum of aggregate wealth as well as wealth inequality overall. The validity of such a reassessment is, however, based on a number of assumptions which generate a greater level of insecurity in the estimated results. In particular, there is a lack of valid external statis-

tics or official lists<sup>22</sup> to calibrate estimates and increase their accuracy. In other countries, for example in Spain, wealth tax details provide data that are considerably more precise. In Germany, although this problem cannot be completely resolved by targeted and more comprehensive surveys, it can be substantially reduced.

Although the estimates presented here are calculated from an expanded SOEP dataset based on a variety of assumptions, they do tend to indicate there is, in all probability, considerably higher wealth inequality in Germany than the standard survey data could have feasibly described previously. For example, the top one percent may well account for over 30 percent of the total net worth, and the top 0.1 percent for as much as approximately 14 to 17 percent. As a result, in comparison to the estimates solely based on surveys, the top 0.1 percent's share of total net worth tripled in 2012.

The uncertainty of the estimates shows that improving the possible methods for acquiring statistical data on the net worth of households continues to be an important task. Here, policymakers also have to play their part and work together with the research community on projects to improve the insufficiency of the existing datasets.

<sup>22</sup> Sweden, for example, has compiled a register for decades of all persons subject to a wealth tax. The data from these censuses allow valid statements on the distribution of wealth and national wealth overall. However, recently Sweden suspended its wealth tax so that now this country also has difficulties in making valid statements on wealth distribution.

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