GLOBAL WEALTH INEQUALITY ON WID.WORLD: ESTIMATES AND IMPUTATIONS

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1 Introduction

This technical note describes the coverage of countries with available wealth distribution series, as well as the sources and imputation procedures used to construct global wealth inequality estimates. All wealth distribution series described in this note are available on www.wid.world.[1]

2 Countries with available data

The coverage of countries with available wealth distribution series conforming with Distributional National Accounts (DINA) represents approximately three quarters of global household wealth in 2023 and it varies across regions in the world.

- Europe: It is the continent with the greatest coverage. All details regarding the sources, methods and countries covered in Europe can be found on Blanchet and Martínez-Toledano (2023). Wealth distribution series for Russia are available from 1995-2015 and are based on Novokmet, Piketty, and Zucman (2018). In last year's update, we included wealth distribution series for the Netherlands from 1894-2017 (see Martínez-Toledano, Sodano, and Toussaint (2023) for all methodological details).
- North America and Oceania: This region has wealth distribution series available for the United States from 1913-2022, which are based on Saez and Zucman (2020) and

[1]This technical note replaces the previous technical note on the 2022 global wealth inequality update (see Chancel and Piketty, 2023).

recently updated for 2020-2022.

- Latin America: In last year's update, we included wealth distribution series for Uruguay from 2009-2016, which are based on De Rosa Leiva (2023).
- Asia: This region has wealth distribution series for China, Korea, India and Indonesia. Wealth distribution series for China are available from 1978-2015 and come from Piketty, Yang, and Zucman (2019). Wealth distribution series for Korea are available from 2000-2013 and are based on Kim (2018). In last year's update, we included wealth distribution series for Indonesia from 2000-2014 (see Martínez-Toledano, Sodano, and Song (2023) for all methodological details). In this year's update we are including new series for India available from 1961-2022 that are based on Bharti et al. (2024). These series replace previous series for India based on **tbharti2018wealth**.
- Africa: This region has wealth distribution series for South Africa available from 1993-2017 and based on Chatterjee, Czajka, and Gethin (2020).

3 Imputation Methods

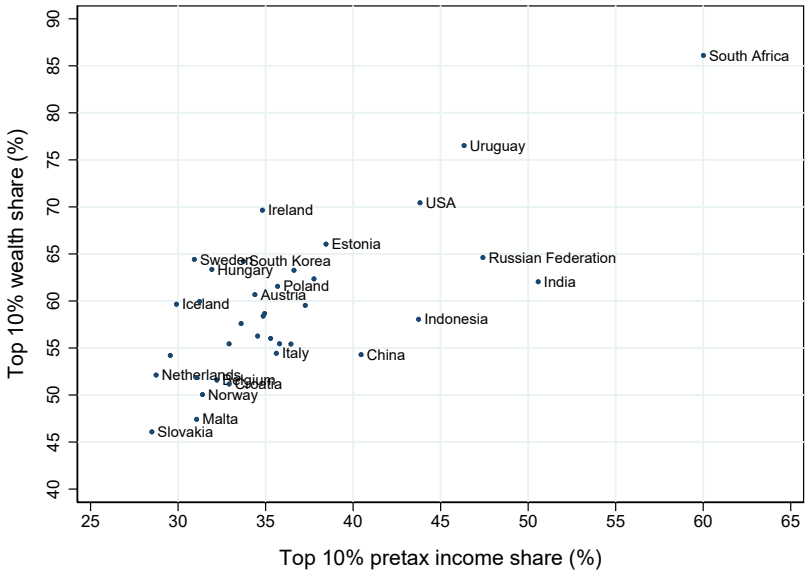
3.1 Imputation of Wealth Aggregates

The benchmark series provide wealth aggregates for a very large set of countries, based on official national accounts, International Monetary Fund data, BIS data on Locational Banking Statistics, OECD Pension Wealth data, Foreign Asset Liabilities and other sources. In order to provide wealth series for the world as a whole, i.e. every country in the world, we rely on a series of imputations described in Bauluz et al. (2024).

3.2 Imputation of Wealth Distributions

Our starting point are the wealth distribution series described in Section 2. These series mobilize household estate tax data, income tax data and household wealth surveys. The so-called "estate-multiplier method" recovers the wealth distribution of country based on the wealth of those who die, and on mortality rates of different age groups. The so-called "income capitalization method" recovers the value of assets of an individual or a group, based on the income generated by these assets. Key studies were produced over the past decades mobilizing one technique or the other for most rich countries and some emerging countries (see countries in Figure 1).

For countries and years not covered by such methods, we estimate the distribution for 1995-2023 using a series of systematic, transparent imputations. Our basic method for the distribution of wealth rests on the observation that wealth inequality is highly correlated with income inequality, as shown in Figure 1.



Source: Author's estimates based on the World Inequality Database. *Note:* Each country's data point refers to the average top 10% share over all the years for which both income and wealth inequality are observed.

Figure 1: Correlation Between Wealth and Income Inequality

We estimate the distribution of wealth in a given country i using a weighted average of the wealth distribution of other countries for which it is observed. To exploit the correlation of Figure 1, we give more weight to countries that have a similar level of income inequality.

We first normalize the wealth distribution to one in every country. Then, we calculate a_{itp}, the average normalized wealth of the g-percentile p in country i in year t as:

$$a_{itp} = \frac{\sum_{j,s} \frac{1}{h} K\left(\frac{r_{ti} - r_{jt}}{h}\right) a_{jsp}}{\sum_{j,s} \frac{1}{h} K\left(\frac{r_{it} - r_{js}}{h}\right)}$$

where $r_{js} \in [0, 1]$ is the position of country j in year s in the ranking of all countries and all years in terms of top 10% income share, and where K is a standard Gaussian kernel.

The key parameter of that equation is the bandwidth h, which determines the degree of smoothing. We use a leave-one-country-out cross-validation procedure to determine an optimal bandwidth $h = 0.32$.

3.3 Correction with Forbes Ranking

The set of estimates produced at this stage underestimates in some years the number of billionaires as compared to Forbes data. In order to recover the number of Forbes billionaires, we rescale the top of the distribution with Forbes data, assuming that aggregate wealth is unchanged and the distribution within the non-billionaire group is

unchanged. By doing so we are able to produce series that are consistent with rich lists.

The above method increases the gap between the top of the distribution and the rest, even though the global middle 40% remains relatively unaffected by the changes. Both at the country and the global level, the upward trend of the top 0.001% share is reinforced, with a peak following the Covid-19 global pandemic.

Forbes data

We harmonize historical billionaire sources published by Forbes between 1995 and 2023. We collapse individual billionaires by country of reference, and exclude those whose country cannot be matched to the WID data. We obtain a dataset with a number of billionaires and their total net wealth in each country between 1995 and 2023.
In our benchmark series, we compute the total net worth of billionaires (before Forbes correction) and the fraction of individuals above 1 billion dollars using cumulative distribution functions and tools available in the gpinter Pareto interpolation package[2]. We use the most recent exchange rate and price index available to express all country-series in market exchange rate dollars (or MER euros).

Correction

In cases where WID.world billionaire wealth is lower than Forbes, we add to the 127^{th} g-percentile of each country the difference between the theoretical and Forbes total wealth of billionaires. We leave WID.world benchmark series unchanged otherwise. In cases where we add the difference between Forbes and WID.world benchmark series, the same amount is subtracted proportionately to each group of the bottom 99.999% to keep aggregate wealth constant and to keep the relative shares inside the rest of the distribution unchanged. In practice, the gap is usually small as compared to the total wealth of the bottom 99.999% and only has very minor impacts on the wealth of these groups.
The exact formula of the correction applied to each bracket average is the following:

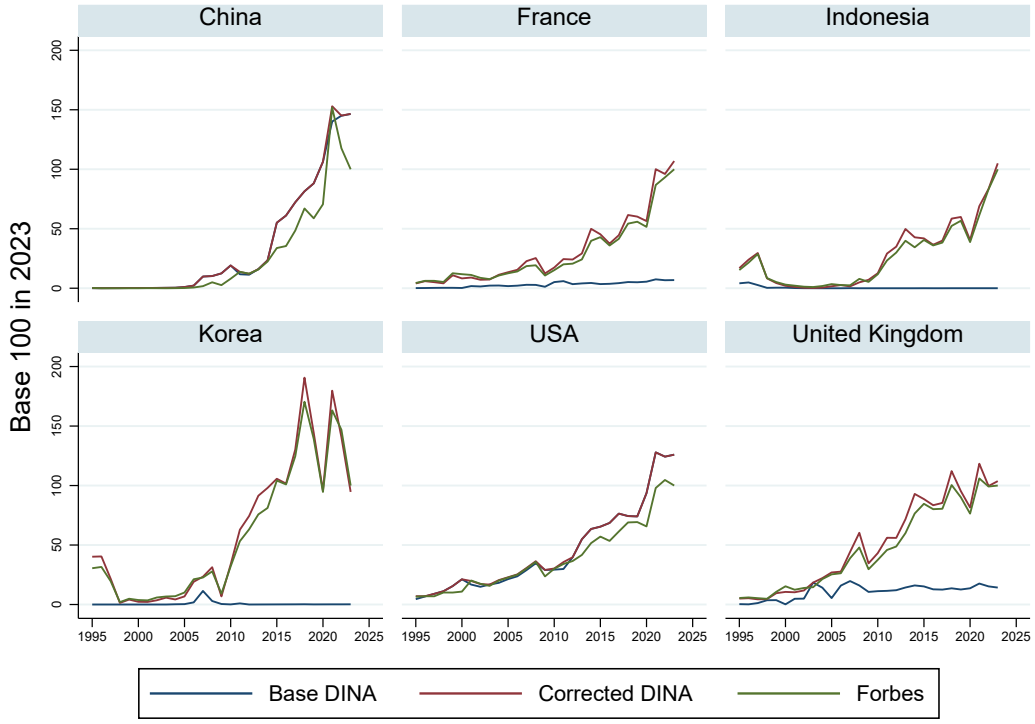
$$a_{corr} = a \times \frac{1 - max(\frac{w_{Forbes} - w_{WID}}{n_{Forbes}}, 0) \times n_{Forbes}}{w_{tot}}, \tag{1}$$

Where a is the bracket average of each percentile, w_{Forbes} and w_{WID} are respectively the Forbes and WID estimates of billionaire wealth, n_{Forbes} is the Forbes number of billionaires, and w_{tot} is aggregate wealth in the country. Note that a_{corr} is necessarily smaller than a since we want the correction of the top wealth to be upwards only. This formula takes out the added Forbes worth from the whole distribution. We then add the amount of wealth

[2]The distributions are fitted using generalized Pareto interpolation, for which an online tool (`https://wid.world/gpinter/`) as well as an eponymous R package have been designed. For details on the procedure, see Blanchet, Garbinti, et al., 2018.

that was subtracted from the distribution back to the 127$^{\text{th}}$ g-percentile only using the following formula:

$$a_{corr} = a_{corr} + max(\frac{w_{Forbes} - w_{WID}}{n_{Forbes}}, 0) \times \frac{n_{forbes}}{pop_{tot}} \quad \text{if} \quad p = 99.999 \tag{2}$$



Source: Author's estimates based on wealth distribution imputations and Forbes historical data.

Figure 2: Wealth of billionaires in selected countries, 1995-2023

From this modified distribution, we compute new shares and bracket averages after fitting them through gpinter again in order to ensure that the general fit of the distribution corresponds to the top correction. The corrected number of billionaires is computed using the same technique as before, multiplying the fraction of individuals beyond the billionaires threshold by country population in each year. Examples of the correction are given in Figure 2. We then aggregate the country series by re-ranking all g-percentiles in a single distribution, which allows us to obtain and document global trends.

Adjustments within the top 0.001%

This first correction yields better approximations of the global worth and number of billionaires, but national and regional figures remain uneven (See columns 3-4 of Table 1). We thus proceed to a second correction, which takes place mostly within the 127$^{\text{th}}$

g-percentile instead of adjusting the whole of the distribution of each country. For each country, we compute various thresholds at 1, 10, 100 millions as well as 1, 10 and 100 billions. After computing the top average of wealth at these thresholds, we rescale the total wealth and number of billionaires to match Forbes data. This second correction is applied to generate the input data used by the Wealth Tax Simulator available on WID.world (www.wid.world/world-wealth-tax-simulator). This correction does affect other WID.world wealth inequality data series, which provide information up to the top 0.001%.

The second correction shifts wealth from lower brackets to the upper brackets in the case where billionaires were underestimated, while wealth is redistributed to the millionaires if the converse is true. The former case is of little effect on the general distribution, since wealth can be concentrated at its upper end instead without needing any change below (any increase in the top average of a group leaves untouched the lower brackets). The latter is of more consequence, because multimillionaires can usually spill outside of the last g-percentile, and an upwards reevaluation of their wealth induces a re-ranking problem in the top 1%. Fortunately, this issue is limited to a very small number of countries and of little magnitude, and can be solved cases by explicitly restricting changes to thresholds included in each country's 127^{th} g-percentile. This correction is illustrated at the regional level alongside base data and the former correction in Table 1. Overall, this allows for estimates of the very top of the distribution to be much closer to reality than in our benchmark series.

Region	Uncorrected		1st correction		2nd correction		Forbes	
	N.	Worth	N.	Worth	N.	Worth	N.	Worth
East Asia	749	2759	758	3053	686	2381	684	2381
Europe	244	998	350	2829	510	2513	509	2513
Latin America	87	462	90	511	92	419	90	420
MENA	85	416	88	506	81	238	79	238
North America	1715	5874	1730	6124	849	4932	848	4932
Russia & Central Asia	94	455	98	520	120	516	118	515
Sub-Saharan Africa	16	62	18	88	11	64	11	64
South & South-East Asia	201	1573	212	1978	303	1144	301	1144
World	3191	12599	3354	15609	2652	12207	2640	12207

Table 1: Worth ($ bn) and number of billionaires across the world, 2023

As one can see from Table 1, our uncorrected wealth inequality series display a total billionaire wealth of 12.6 trillion $ in 2023 (for 3191 billionaires), versus 12.2 trillion $ according to Forbes (for 2640 billionaires). So even without any correction, we are relatively close to the Forbes ranking. This can be interpreted as the fact that our methods for measuring wealth inequality - based upon various sources including national accounts, income capitalization method, estate multiplier method and wealth surveys - are broadly

consistent with Forbes methods when it comes to estimating the total wealth of global billionaires.

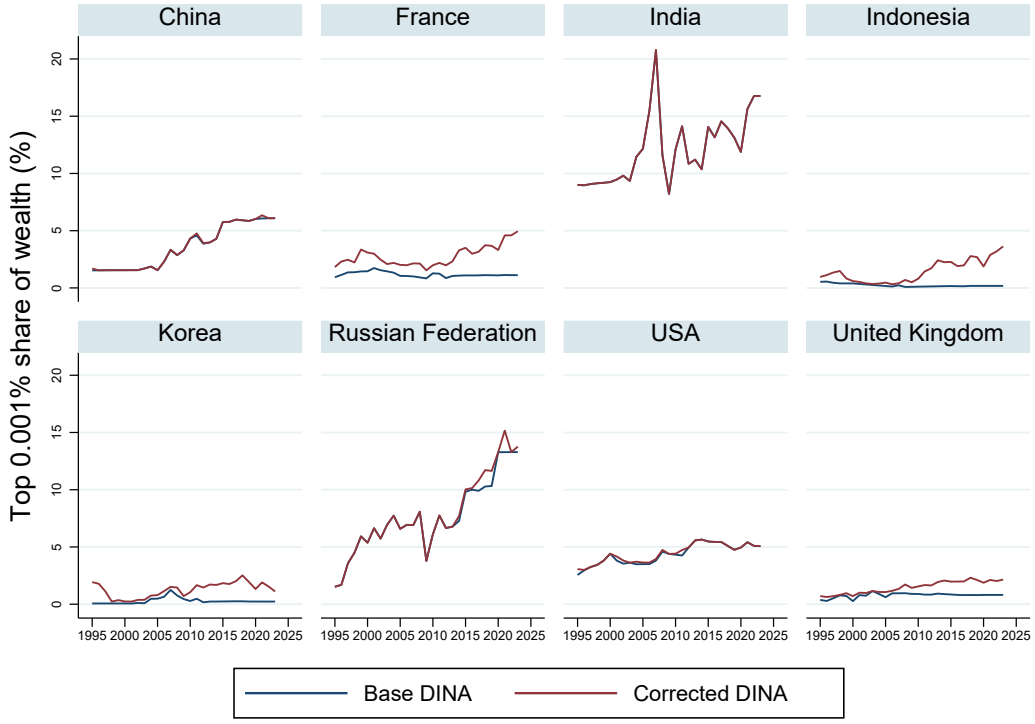
Though we consider this to be relatively reassuring regarding our ability to measure the top-end wealth distribution (and also to simulate wealth tax revenues, for instance), we stress that several caveats are in order. First, though many of our uncorrected wealth inequality series indeed rely on fully independent sources in order to estimate top-end wealth (typically a mixture of national accounts, income capitalization method and estate multiplier method; see e.g. our series for the US, France or the United Kingdom), there are countries where we use the Forbes ranking or other rich lists in the first place (see e.g. China or India).

Next, the fact that our uncorrected series and Forbes estimates are relatively close when it comes to global billionaire wealth seems to be due to a combination of offsetting forces. On the one hand, our estimates are based upon individual wealth, while Forbes estimates look at broader family units (without specifying very clearly their concept of family unit). That is, in effect, they include individuals who are not individual billionaires, and their total billionaire wealth should be larger than ours. On the other hand, Forbes rankings and other rich lists look mostly at direct ownership of business assets and tend to neglect diversified portfolios (again without defining very precisely the concept of wealth that they are trying to measure). This effect goes in the opposite direction and appears to compensate the first one. Needless to say, we would need much more financial transparency and publicly available data on top wealth groups (e.g. via a public financial register such as the one we have been calling for; see e.g. the World Inequality Reports 2018 and 2022) in order to be able to offer a more detailed and satisfactory analysis of these various effects, and more generally to reach a better understanding of top-end wealth distribution dynamics.

Finally, and most importantly, we stress that our uncorrected series and Forbes estimates are relatively close when it comes to global billionaire wealth, but that our corrections using Forbes data have significant effects in terms of rebalancing global billionaire wealth into the various world regions and countries. Generally speaking, using the Forbes estimates leads us to rebalance billionaire wealth toward Europe and away from other regions in 2023 (see Table 1). Looking at the evolutions over the 1995-2023 period, we see that our raw uncorrected estimates for countries like France or Britain significantly underestimate billionaire wealth (see Figure 2).

We also describe on Figure 3 the impact for corrected versus uncorrected top 0.001% wealth shares, and on Figure 4 the impact for corrected vs uncorrected top 1% wealth shares. As one can see, the effects can be quite large for top 0.001% wealth shares, but are more limited for top 1% wealth shares (by construction, since we only apply a correction

for billionaires, and not for the entire shape of the top end of the wealth distribution). Given the large uncertainty about top 0.001% wealth shares, it is possible, however, that we significantly underestimate top 1% wealth shares and that a more extensive correction is called for. Again, we would need to get access to more extensive publicly available data on top wealth groups in order to say more on this.



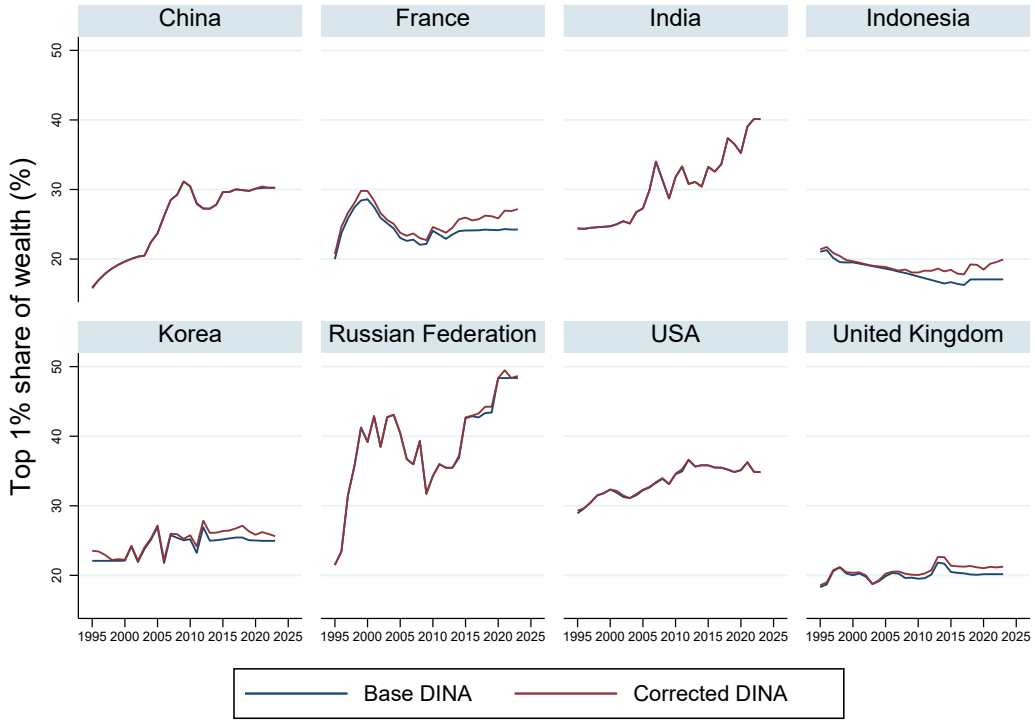
Source: Author's estimates based on wealth distribution imputations and Forbes historical data.

Figure 3: Share of wealth belonging to top 0.001% in selected countries, 1995-2023

4 List of countries imputed

We provide in this section a list of imputed countries for wealth distribution series depending on the availability of wealth data.

- Countries with distributional financial accounts (see Blanchet and Martínez-Toledano, 2023 and working papers available on WID.world); these countries represent 74.3% of global household wealth in 2023:
  Austria, Belgium, China, Croatia, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, India, Indonesia, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Russian Federation, Slovakia, Slovenia, South Africa, South Korea, Spain, Switzerland, Uruguay, USA, United Kingdom.



Source: Author's estimates based on wealth distribution imputations and Forbes historical data.

Figure 4: Share of wealth belonging to top 1% in selected countries, 1995-2023

- Countries with wealth distribution imputed on income inequality data using the methodology described in this document; these countries represent 25.7% of global household wealth:
  Afghanistan, Albania, Algeria, Angola, Argentina, Armenia, Australia, Azerbaijan, Bahamas, Bahrain, Bangladesh, Belarus, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cabo Verde, Cambodia, Cameroon, Canada, Central African Republic, Chad, Chile, Colombia, Comoros, Congo, Costa Rica, Cote d'Ivoire, Cuba, Czech Republic, DR Congo, Djibouti, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea , Eritrea, Ethiopia, Gabon, Gambia, Georgia, Ghana, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Iceland, Iran, Iraq, Israel, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Korea, Kuwait, Kyrgyzstan, Lao PDR, Lebanon, Lesotho, Liberia, Libya, Macao, Madagascar, Malawi, Malaysia, Maldives, Mali, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Montenegro, Morocco, Mozambique, Myanmar, Namibia, Nepal, New Zealand, Nicaragua, Niger, Nigeria, North Korea, North Macedonia, Oman, Pakistan, Palestine, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Qatar, Romania, Rwanda, Sao Tome and Principe, Saudi Arabia, Senegal, Serbia, Seychelles, Sierra Leone, Singapore, So-

malia, South Sudan, Sri Lanka, Sudan, Suriname, Swaziland, Sweden, Syrian Arab Republic, Taiwan, Tajikistan, Tanzania, Thailand, Timor-Leste, Togo, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Uganda, Ukraine, United Arab Emirates, Uzbekistan, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe.

4.1 Improving our series

We stress at the outset that our current wealth inequality estimates remain unsatisfactory. We will improve them as soon as we access better country-level household wealth surveys and tax data. Our Inequality Transparency Index (see www.wid.world/transparency) presents a detailed evaluation of the quality of income and wealth statistics country by country. Ultimately, improving wealth inequality series requires more collaboration between the different actors of the inequality data ecosystem (including national and international statistical agencies, tax authorities and research institutions).

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