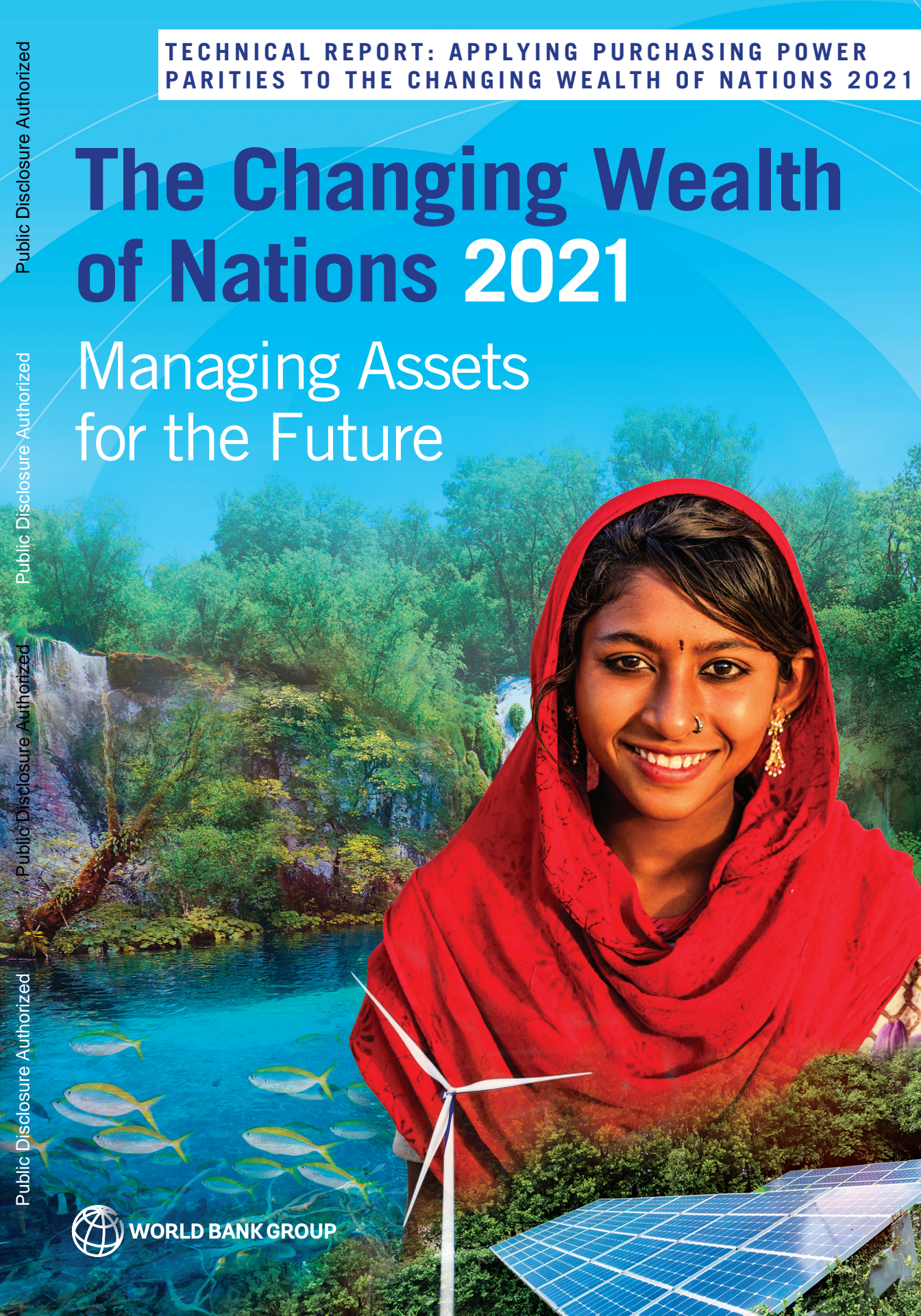


TECHNICAL REPORT: APPLYING PURCHASING POWER
PARITIES TO THE CHANGING WEALTH OF NATIONS 2021

The Changing Wealth of Nations 2021

Managing Assets for the Future



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WORLD BANK GROUP

THE CHANGING WEALTH OF NATIONS 2021

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TECHNICAL REPORT

**APPLYING PURCHASING POWER PARITIES TO THE
CHANGING WEALTH OF NATIONS 2021**

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Applying Purchasing Power Parities to *The Changing Wealth of Nations 2021*

Background Technical Paper

Prepared by Esther Naikal, Glenn-Marie Lange, Nada Hamadeh, and Marko Rissanen¹

Background

National wealth, measured comprehensively to include all assets—produced, human, and natural capital—generates national income. Sustained economic growth over the long term requires investment to build this broad portfolio of assets and management of the distribution among asset classes. While a macroeconomic indicator like GDP provides an important measure of economic progress, it is a flow measure that captures income and production but does not measure the underlying asset base. Hence, used alone, GDP may provide misleading signals about the state of the economy, the efficiency of asset utilization, and the sustainability of development. GDP does not reflect depreciation and depletion of assets; it does not indicate whether accumulation of wealth keeps pace with population growth, or whether the mix of different assets will support a country's development goals. GDP indicates whether an economy is growing; wealth indicates the prospects for maintaining economic growth over the long term. Economic performance is best evaluated by monitoring both GDP growth and wealth.

The World Bank has an on-going initiative to measure national wealth and changes in wealth to monitor long-term economic well-being and guide the development process through the lens of a country's portfolio of assets. The first report, *Where is the Wealth of Nations? Measuring Capital for the 21st Century* (2006) was a 'proof of concept' that demonstrated that wealth accounts could be constructed for a large number of countries. It estimated wealth for one year, for about 140 countries. The second edition, *The Changing Wealth of Nations: Measuring Sustainable Development in the New Millennium* (2011), provided time series of wealth accounts for 140 countries from 1995 to 2005 that examined the dynamic relationship between development and wealth. *The Changing Wealth of Nations 2018: Building a Sustainable Future* (2018) included, for the first time, an explicit measure of countries' human capital, disaggregated by gender and including the self-employed.

Great progress on measuring comprehensive wealth has been achieved by the previous reports. The primary motivation of the previous work was to provide a better measure of sustainability and economic performance, but did not address how to embed the wealth perspective in economic analysis. *The Changing Wealth of Nations 2021: Managing Assets for the Future* (forthcoming 2021) will break new ground by focusing on policy analysis and applying the lens of wealth to important economic development issues, including the potential risks to asset value from climate change and the COVID-19 pandemic.

¹ We are grateful to the Technical Advisory Group of the International Comparison Program who provided comments on an early draft of this paper presented at their meeting October 28, 2019. Elements from the written comments received are captured in Annex 1.

All previous editions of the Changing Wealth of Nations (CWON) estimated national wealth only in market exchange rates (MER). CWON 2021 will complement MER-based wealth accounts by applying purchasing power parities (PPPs) to value the wealth accounts. MERs convert wealth into a common currency (for example, the US dollar), facilitating global comparisons. Values in MER are most useful for understanding macroeconomic and fiscal policy issues. These might include quantifying the collateral available for international loans or estimating the ability to repay loans in foreign currency. Asset values at market exchange rates are also highly policy-relevant for other kinds of domestic policy analysis relying on comparable market prices and valuations. MER-based wealth therefore remains the default presentation of the CWON dataset.

However, MERs are not always useful for cross-country comparisons of material well-being because they do not reflect the relative purchasing power of the currency in each country. One US dollar in the United States can buy much more in India, for example, while typically buying less in Norway. For comparison of material well-being, PPPs are used to value total wealth, incorporating a common currency while eliminating price level differences across countries.

This background paper starts with the motivation for using PPPs to complement MER valuation, presents the methodology for applying PPPs, then reviews results based on data from CWON 2021 to determine how much PPPs might change the development story. The paper closes by identifying conceptual and empirical issues that arise in applying PPPs to national wealth that should be addressed in future work. This paper incorporates comments provided by a large number of external experts in this field and colleagues in the World Bank's Development Economics Vice Presidency, the Poverty Global Practice, and the Macroeconomics, Trade and Investment Global Practice.

Valuing wealth in purchasing power parities

To adjust for differences in cost of living and better understand material well-being across countries, the International Comparison Program (ICP) (Box 1) estimates global PPPs for a broad category of goods and services.

PPPs measure the total amount of goods and services that a single unit of a country's currency can buy in another country. The PPP between countries A and B measures the number of units of country A's currency required to purchase a basket of goods or services in country A compared to one unit of country B's currency to purchase a similar basket of goods in country B. PPPs can thus convert the cost of a basket of goods and services into a common currency while eliminating price level differences across countries. In other words, PPPs equalize the purchasing power of currencies. Due to large differences in price levels across economies, MER-converted GDP does not accurately measure the relative sizes of economies and material well-being levels. PPPs make it possible to compare the output of economies and their inhabitants' welfare in 'real' terms, thus controlling for price level differences across countries.

The common currency used for the PPP global comparison is the US dollar, and so each economy's PPP is standardized by dividing it by that economy's US dollar exchange rate.

Box 1. International Comparison Program and Purchasing Power Parities

The International Comparison Program (ICP) is a worldwide statistical initiative led by the World Bank under the auspices of the United Nations Statistical Commission, with the main objective of providing comparable price and volume measures of gross domestic product (GDP) and its expenditure aggregates among countries within and across regions. Through a partnership with international, regional, sub-regional, and national agencies, the ICP collects and compares price data and GDP expenditures to estimate and publish purchasing power parities (PPPs) of the world's economies. The 2017 ICP round covered 176 economies for the reference year 2017. The next ICP round is being conducted for the reference year 2021. Additional information can be found at <https://www.worldbank.org/en/programs/icp>

In the context of the World Bank's comprehensive wealth accounts, which is the sum of a broad range of assets including produced, natural, human, and net financial capital, the approach to estimating wealth accounts in PPPs depends on the purpose of the analysis. At its core, the main motivation for using PPPs for wealth accounting is similar to the ICP, whose objective is to control for price level differences across countries and provide comparable international volume measures of GDP and its expenditure components. The objective of estimating wealth using PPPs is to construct comparable cross-country estimates of wealth that are not impacted by the different price levels between the countries or the volatility of MERs.

However, using PPPs in wealth accounting requires several theoretical and empirical considerations, none of which have been exhaustively addressed at this stage. The foremost issues are whether using PPPs for wealth is conceptually appropriate for cross-country comparisons, which level(s) of PPPs should be used, and how the constant value time series should be constructed based on PPPs. An additional consideration is what assumptions should be made about future relative prices using PPPs, given the forward-looking nature of wealth accounts. The core CWON wealth accounts generally assume constant future prices, given the lack of information and/or difficulty to make consistent projections on a global scale. Strong assumptions would also need to be applied when using PPPs.

At this initial experimental and exploratory stage, two approaches can be considered when applying PPPs to the wealth accounts. (See Annex 1 for a more detailed technical discussion on using PPPs in wealth accounts.) One approach would be to design PPPs that allow converting each asset into comparable international aggregates, decomposing each component into price and quantity, and constructing a stock price index. This approach addresses the productive value of assets and would be useful for productivity measurement analyses (such as total factor productivity) and comparing outputs and inputs across countries. However, this approach would require significant research and statistical undertaking beyond the work scope at this initial stage.

A second approach would be to take a consumption-based approach and view total wealth as a measure of future consumption possibilities. This approach is more useful for comparing real income across countries; it is also empirically easier to implement. The authors follow the consumption-based approach for estimating PPP-based wealth for all countries, recognizing the need for further research.

The next decision is to choose the level of PPP. The ICP publishes global PPPs (US \$ = 1) for a total of 44 expenditure components, in line with the System of National Accounts (SNA) framework, where GDP is

measured from the expenditure side. The main aggregates in the ICP classification of final expenditure on GDP include the following consumption-related headings:

- Individual Consumption Expenditure by Households
- Individual Consumption Expenditure by Non-Profit Institutions Serving Households (NPISH)
- Individual Consumption Expenditure by Government
- Collective Consumption Expenditure by Government

Given the choice of using consumption-oriented PPPs, a decision needs to be made on the government sector's extent. Based on expert consultations, the authors would ideally use total consumption-level PPPs that include households, NPISH, and both government sectors (individual consumption + collective consumption), with the reasoning that by and large, all government activities provide some utility to households. However, currently, the ICP does not officially publish total consumption-level PPPs. Therefore, the wealth accounts are valued using the closest published heading: actual individual consumption-level PPPs, where actual individual consumption (AIC) covers the individual consumption expenditures of households, NPISHs, and government. Comparing this PPP to total consumption PPP, AIC excludes the collective consumption expenditure by the government. The authors, therefore, use AIC-level PPPs as a proxy measure for the current estimates and will continue to collaborate with the ICP team for future work.

This first attempt at estimating PPP-based wealth just scratches the surface of the technical questions and complicated methodological issues surrounding the correct measurement and usage of PPP-based national wealth. But this approach has the advantage of being simple to implement and straightforward to understand. By providing the first set of global PPP-based wealth, the authors aim to illustrate the importance of considering differing costs of living across countries and provide additional wealth metrics to the development narrative.

Data and methodology

The methodology for estimating PPP-based wealth accounts is relatively straightforward, given the decision to follow a simplified consumption-based approach to valuing wealth in PPPs as described in the previous section.

Total wealth based in PPPs is calculated by dividing total wealth in constant 2018 US\$ at MER – already estimated in the CWON 2021 core accounts – by the price level ratio of the 2018 AIC-level PPP conversion factor to MERs. OECD and Eurostat publish annual data (including the year 2018) on AIC PPPs for select countries; ICP data on PPPs are available globally for the year 2017, so the 2018 value is extrapolated using countries' consumer price index. Additional gap-filling steps are implemented to maximize country coverage to make a meaningful comparison between the MER-based wealth as published in CWON 2021² and the PPP-based figures. The data sources used are listed below in table 1, with the methodology and country-specific data sources further detailed in Annex 2.

² The baseline MER-based wealth figures for comparison to PPPs are the same as the core accounts published in CWON 2021, except for the exclusion of Venezuela and Yemen due to lack of data.

Table 1. Data sources

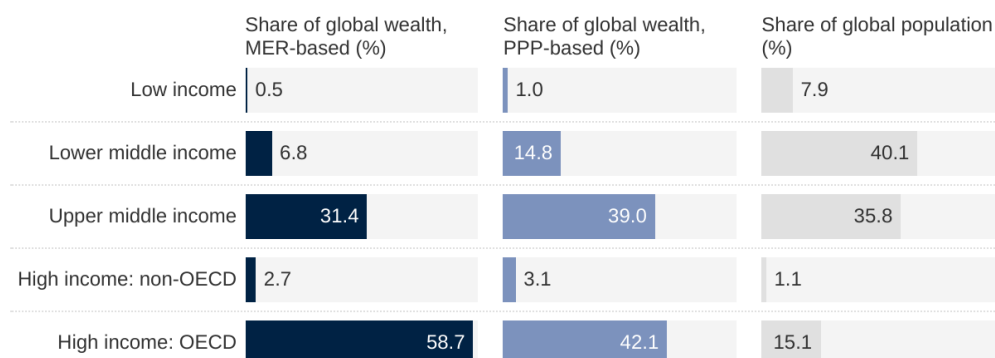
Indicator	Data Source	Notes
Total wealth	CWON 2021	<i>Estimated in constant 2018 US\$ at market exchange rates</i>
Actual individual consumption-level PPPs	ICP 2017, OECD, Eurostat	
GDP-level PPPs	World Bank’s World Development Indicators (WDI)	<i>Used when AIC-level PPPs are not available</i>
Market exchange rates	ICP 2017, OECD, WDI	
Consumer price index	WDI, IMF’s Macroeconomic & Financial data	
GDP deflator	WDI	<i>Used when CPI data are not available</i>

The following sections focus on the comparison of the wealth accounts based on PPPs to market exchange rates.

Shift in the global distribution of wealth

The PPP-based wealth results show a clear and expected shift in the global distribution of wealth in 2018. When wealth is measured using PPPs, the share of global wealth for low income and lower middle income countries increases from 7.3 percent to 15.8 percent (figure 1). Both upper middle and high income non-OECD countries also increase their share of global PPP-based wealth by a smaller margin. Therefore the global share of wealth for OECD countries decreases from 58.7 to 42.1 percent. Inequality across income groups is still apparent, as the vast majority of the global population reside in low and middle income countries (84 percent) and yet hold a much smaller portion of the world’s wealth – 39 percent in MER-based wealth and 55 percent in PPP-based wealth.

Figure 1. Share of global MER-based and PPP-based wealth and population, by income group, 2018

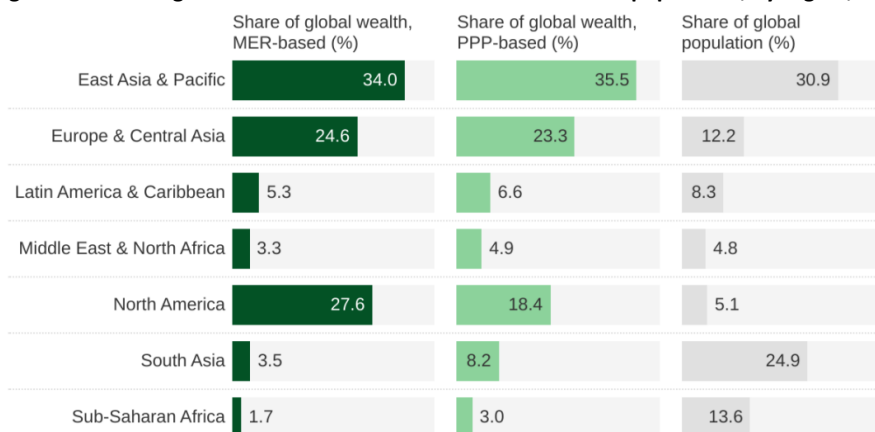


Source: Authors’ calculations

Figure 2 shows the shifting distribution of global wealth by geographic region. South Asia’s share of PPP-based global wealth is 2.3 times higher than in MER in 2018, the highest increase across regions. Sub-

Saharan Africa follows with almost doubling its share of PPP-based global wealth. But even with their share increase in PPP-based wealth, South Asia and Sub-Saharan Africa combined still only hold 11 percent of global wealth while containing almost 40 percent of the global population. Only two regions show decreases in their share of PPP-based global wealth: Europe and Central Asia, driven by Western European countries, and North America.

Figure 2. Share of global MER-based and PPP-based wealth and population, by region, 2018

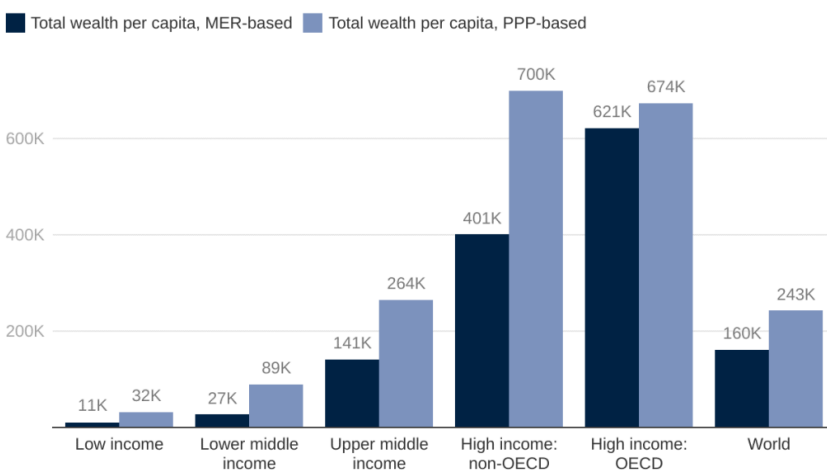


Source: Authors' calculations

Narrowing differences in total wealth per capita across groups

Assessing wealth on per capita terms, figures 3 and 4 compare total wealth per capita in 2018 for MER-based and PPP-based wealth by income group and geographic region.

Figure 3. Total wealth per capita, MER-based and PPP-based, by income group, 2018 (2018 US\$)



Source: Authors' calculations

In MER-based wealth, the global average wealth per person is \$160,437 in 2018. Valued in PPPs, the average total wealth per person increases 50 percent to \$242,516. The largest gains in PPP-based wealth per capita compared to MERs are in the lower middle income group, where, driven by India, the PPP-based total wealth per capita is 3.3 times higher than in MERs in 2018, followed by the low income group where PPP-based wealth is 3 times higher. PPP-based wealth per capita in the upper middle income group increases by 88 percent, driven in large part by China which contains over half the population of all upper middle income countries.

When wealth is based in PPPs, the wealthiest income group in 2018 becomes the high-income non-OECD group, with total wealth per capita at \$699,548 compared to the OECD’s \$673,663. On the one hand, this result is due to many OECD countries’ near-parity of their purchasing power with the US as well as the handful of countries with *lower* PPP-based wealth compared to MERs (e.g., Australia, Denmark, Norway, Iceland, Luxembourg). On the other hand, this result reflects the US dollar’s greater purchasing power across the board in high-income non-OECD countries. Specifically, Saudi Arabia drives the per capita trend in this aggregate group with 44 percent of its population and has a relatively lower price level ratio of the AIC PPP conversion factor to MER at 0.45. This results in Saudi Arabia’s PPP-based wealth per capita estimated at \$726,435, compared to MER-based \$324,194 in 2018.

Finally, OECD’s total wealth per capita in 2018 is 58 times greater than the low-income average. However, this gap narrows to 21 times when valued in PPPs; while still a large difference, the PPP-based measure demonstrates greater equality across income groups.

Looking at the comparison of MER- and PPP-based total wealth per capita by geographic region in 2018 (figure 4), South Asia again sees the greatest increase in PPP-based total wealth at almost \$80,000 per capita to \$22,680 in MER. Average wealth per capita in Sub-Saharan Africa also jumps 2.6 times higher in PPPs compared to MER.

Figure 4. Total wealth per capita, MER-based and PPP-based, by region, 2018 (2018 US\$)



Source: Authors’ calculations

Country-level results

Finally, this section takes a closer look at the country-level results of PPP-based total wealth in 2018. The full set of country data are provided in Annex 3.

Figure 5 singles out the six economies with the largest shares of wealth in MER- and PPP-based global wealth in 2018, compared to the rest of the world. When wealth is measured in MERs, the US holds the largest share of global wealth in 2018 at 25 percent, followed closely by China at 21 percent. The four remaining countries (of the top six) hold significantly smaller global wealth shares, ranging from 3 to 6 percent. When wealth is measured in PPPs, China leaps ahead of the US, with the largest share of global wealth at 23 percent. The US's share reduces to 16 percent (though its absolute amount remains the same in both MER- and PPP-based wealth). India jumps up to the third-largest share of PPP-based global wealth at 7 percent, and Russian Federation also moves up to the fifth place.

Figure 5. Share of MER- and PPP-based global wealth for six largest economies, 2018 (percent)

Figure 5a. MER-based global wealth

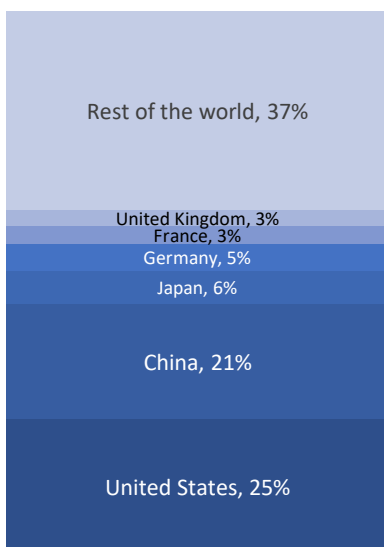
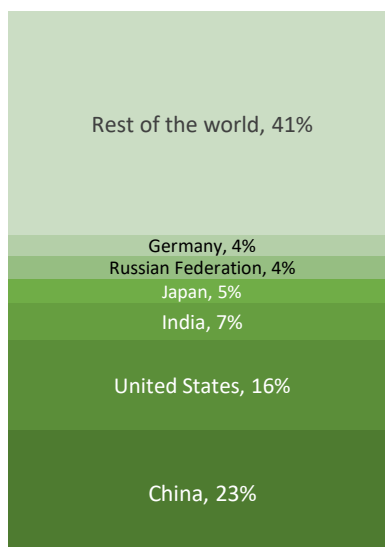


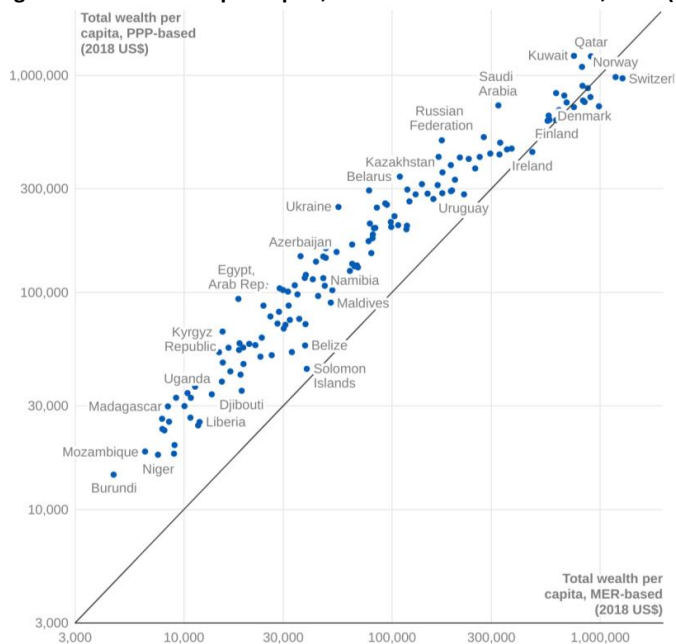
Figure 5b. PPP-based global wealth



Source: Authors' calculations

Figure 6 provides a scatterplot of all countries' total wealth per capita in 2018, with the MER-based value on the x-axis and the PPP value on the y-axis on a log-scale. The 45-degree black line denotes parity – i.e., wealth is the same when measured in both MERs and PPPs, such as for the United States. Countries above the line have wealth greater when valued in PPPs than MERs, with the opposite for countries below the line.

Figure 6. Total wealth per capita, MER-based and PPP-based, 2018 (2018 US\$)



Source: Authors' calculations

All low- and middle-income countries lie above the black line, with PPP-based wealth higher than in MER. The countries with the lowest total wealth per capita tend to be furthest from the 45-degree line, with movement towards and eventually crossing the line as wealth increases. Table 2 lists the ten countries with the lowest price level ratio (PPP conversion factor to MER, US = 1), or the greatest increase in PPP-based wealth per capita compared to MER. Egypt had the lowest price level ratio at 0.196 in 2018; its total wealth per capita jumps from \$18,271 in MER to \$93,317 when valued in PPPs. Of this group of countries with the lowest price level ratios, Ukraine and Belarus stick out as relatively wealthier lower and upper middle income countries.

Table 2. Countries with the greatest increase in PPP-based wealth per capita compared to MER, 2018

Economy	Income Group	Region	Total wealth per capita (2018 US\$)		Price level ratio (PPP conversion factor to MER)
			MER-based	PPP-based	
Egypt, Arab Rep.	Lower middle income	Middle East & North Africa	18,271	93,317	0.196
Ukraine	Lower middle income	Europe & Central Asia	55,272	247,367	0.223
Tajikistan	Low income	Europe & Central Asia	24,668	107,095	0.230
Kyrgyz Republic	Lower middle income	Europe & Central Asia	15,328	65,953	0.232
Azerbaijan	Upper middle income	Europe & Central Asia	36,315	146,583	0.248

Belarus	Upper middle income	Europe & Central Asia	77,516	294,580	0.263
Tunisia	Lower middle income	Middle East & North Africa	28,858	104,367	0.277
India	Lower middle income	South Asia	24,102	86,841	0.278
Nepal	Low income	South Asia	15,280	54,941	0.278
Sierra Leone	Low income	Sub-Saharan Africa	9,171	32,695	0.280

On the other end of the spectrum, table 3 lists the eight countries with the highest price level ratio in 2018 and where PPP-based wealth per capita is lower than in MER; these are the countries that lie below the black line in figure 6 and are all high income European countries, except for Australia. These results are not surprising, as prices and living costs are well-known to be much higher in these wealthy countries.

Table 3. Countries with lower PPP-based wealth per capita compared to MER, 2018

Economy	Income Group	Region	Total wealth per capita (2018 US\$)		Price level ratio (PPP conversion factor to MER)
			MER-based	PPP-based	
Iceland	High income: OECD	Europe & Central Asia	987,021	719,302	1.372
Switzerland	High income: OECD	Europe & Central Asia	1,280,371	967,508	1.323
Norway	High income: OECD	Europe & Central Asia	1,185,533	980,739	1.209
Luxembourg	High income: OECD	Europe & Central Asia	898,547	793,984	1.132
Denmark	High income: OECD	Europe & Central Asia	842,148	753,244	1.118
Australia	High income: OECD	East Asia & Pacific	827,510	764,827	1.082
Ireland	High income: OECD	Europe & Central Asia	472,814	444,029	1.065
Sweden	High income: OECD	Europe & Central Asia	748,540	713,695	1.049

Future work

A natural progression at this point of the analysis would be to assess how PPP-based wealth per capita changes over time from 1995 to 2018, compared to in MER. However, the current approach to valuing wealth in PPPs does not change a country's relative growth over time compared to in MER, only the absolute level; therefore, the analysis at this stage focuses on cross-country comparisons in 2018. Future work could dive deeper into constructing an appropriate PPP-based wealth time series, paying careful attention to price deflators and interpreting the results.

Valuing comprehensive wealth using PPPs is a new work area and is currently at an experimental stage. There are some conceptual and empirical challenges that are not rigorously addressed in this paper due to the aim of providing an easily implementable approach to valuing wealth in PPPs and having a clear comparison to the MER-based wealth published in the CWON 2021 core accounts.

The PPPs used in this work reflect the underlying approach that wealth embodies potential consumption of a country, and therefore consumption-based PPPs are used to convert wealth. But there is a greater

conceptual debate on how to use PPPs and how to interpret the PPP results, and additional research and expert consultations are required.

Careful consideration is also needed on the assumption of future relative prices of assets. PPPs are likely to change in the future, but PPPs' current application to wealth assumes they remain constant over the asset's lifetime. Further work is needed to assess this assumption's impact and whether a scenario approach can be designed to understand the implications of this assumption better.

This paper used AIC-level PPPs as a substitute measure for a total consumption-level PPP. Going forward, ideally, the total consumption PPP would be published and made available for this work.

Lastly, there are several empirical challenges when trying to estimate PPP-based wealth for all countries included in the CWON database. While many countries participate in the ICP and construct PPPs, a number do not, especially small countries with limited resources to carry out the necessary data collection. CWON uses a variety of gap-filling approaches for other assets. Designing an appropriate gap-filling method for PPPs would allow CWON to include the largest possible number of countries in the database.

Conclusion

This background paper demonstrates that valuing the wealth accounts in PPP is a useful complement to wealth in MER for understanding how wealth and economic well-being vary across countries and aggregate groups. Compared to the MER-based wealth data published in the CWON 2021 core accounts, PPP-based wealth shifts the global distribution of wealth more towards lower income countries and reduces the apparent disparities among nations. While the broad aggregate trends yield expected results, some country-level figures provide unexpected results that warrant further examination. While this work provides proof of concept, methodological issues and data concerns should be addressed in future work.

Annex 1. Using purchasing power parities in national wealth accounting³

To date, the Changing Wealth of Nations (CWON 2011, 2018, 2021) has been using market exchange rates (MERs) to value a broad range of assets, including produced, natural, human, and financial capital, across countries in a single currency (US\$). In addition to the US\$ valuation, these asset series have been converted from current series into constant series using price deflators, namely, consumer price indices (CPIs), gross domestic product (GDP) deflators, and capital asset-level price deflators, where available.

An alternative approach entails using purchasing power parities (PPPs) to calculate wealth estimates expressed in a single currency across countries. PPPs are similar to MERs in that they convert national currencies into a common currency, most often to the US\$. However, PPPs differ from MERs because they control for differences in price levels between economies and equalize the various currencies' purchasing power. In doing so, PPPs enable cross-country comparisons of GDP and its expenditure components, which reflect only differences in the volume of economic outputs, unlike MER-based comparisons, which reflect both volume and price differences. Price levels vary considerably between higher- and lower-income economies. Thus, MER-based comparisons overstate the size of economic output where price levels are high and understate economic output where price levels are low. Furthermore, the volatility of MERs, and their possible decoupling from relative prices, may result in fluctuating estimates.

Using PPPs in the context of wealth accounts involves several considerations, none of which have been exhaustively addressed at this stage. These include, first and foremost, whether using PPPs is conceptually appropriate for this purpose, which level(s) of PPPs should be used, and how the constant asset series should be constructed when PPPs are being used.

The fundamental conceptual question is for what purpose PPPs are being used in wealth accounting. One approach to CWON's wealth accounts is to consider wealth to measure future consumption possibility instead of a productivity measure. Furthermore, in addition to measuring wealth over time for a particular country, wealth accounting attempts to compare wealth across countries. In principle, the main motivation for using PPPs for wealth accounting is similar to the objective of the International Comparison Program (ICP) to provide comparable international volume measures of GDP and its expenditure components, namely, to construct comparable cross-country estimates of wealth, which are not impacted by the different price levels between the countries or the volatility of MERs. However, several further considerations should be taken into account, as outlined below.

The ICP publishes global PPPs (US \$ = 1) for a total of 44 expenditure components, in line with the System of National Accounts (SNA) framework, where GDP is measured from the expenditure side. The main aggregates in the ICP classification of final expenditure on GDP are outlined in Table A1 below.

³ This annex was written by Marko Rissanen from the ICP Global Office at the World Bank based on various discussions between selected experts in the fields of national accounts, price statistics and index numbers.

Table A1. Structure of the ICP Expenditure Classification, ICP 2017⁴

Main aggregates	Categories	Groups	Classes	Basic headings
11. Individual consumption expenditure by households	13	44	91	110
12. Individual consumption expenditure by nonprofit institutions serving households (NPISHs)	5	5	5	5
13. Individual consumption expenditure by government	5	7	16	21
14. Collective consumption expenditure by government	1	1	5	5
15. Gross capital formation	3	5	8	12
16. Balance of exports and imports	1	1	1	2
GDP	26	63	126	155

Source: ICP, <http://icp.worldbank.org>

A full set of PPPs covering the noted 44 components are published for ICP reference years, of which the two most recent are 2017 and 2011. A limited set of PPPs is published for the intervening years 2012 to 2016. In addition, the World Bank’s World Development Indicators (WDI) publishes GDP and household consumption level PPPs beyond the most recent ICP reference year using extrapolation⁵.

Each PPP is estimated based on prices for goods and services that make up a particular expenditure component in the national accounts. For instance, PPPs for Food are estimated based on prices and expenditures for food-related elementary headings. In contrast, PPPs for Construction are estimated based on prices and expenditures for construction-related elementary headings, and so forth.

A question to consider when using PPPs in the context of wealth accounting is how PPPs should be used to convert “nominal,” that is, local currency unit-based, wealth estimates into “real” wealth estimates, that is, PPP-based estimates. It should be first noted that ICP PPPs are estimated based on the SNA framework and the expenditure side of GDP, and, as such, ICP PPPs do not directly align with the various CWON asset groups. Nevertheless, should PPPs be used for this purpose, one question is whether wealth accounting should use different expenditure component levels of PPPs for each asset group or apply a single level to total wealth. A related consideration is that ICP PPPs are not additive. This lack of additivity means that the PPP-based expenditures at higher aggregation levels are not equal to the sum of their components’ PPP-based expenditures. Additivity can be considered an important feature of real expenditures. However, in practice, it is not possible to maintain the additivity of the expenditure component aggregates within PPP-based GDP without having PPP-based GDP expenditures that are significantly biased between low- and high-income economies (referred to as the Gerschenkron effect).

When using PPPs at a single level, investment and international trade-related PPPs should be excluded, as the aim is to assess future consumption possibilities. Furthermore, consideration should be given to what portion of the government sector to include: the entire government sector; the part of the

⁴ For more details, see Appendix C of *Purchasing Power Parities and the Size of World Economies: Results from the 2017 International Comparison Program*.

<https://openknowledge.worldbank.org/bitstream/handle/10986/33623/9781464815300.pdf>

⁵ For details, see <https://datahelpdesk.worldbank.org/knowledgebase/articles/665452-how-do-you-extrapolate-the-ppp-conversion-factors/>.

government sector that provides services directly benefitting the household sector; or whether to exclude the government sector entirely. In ICP terms, the first option would entail PPPs at the level of *Total Consumption*⁶; the second, PPPs at the level of *Actual Individual Consumption*; and the third, PPPs at the level of *Household Consumption*.

Finally, consideration should be given to how the constant nominal series of wealth should be constructed when PPPs are used. Currently, a combination of different price indices is used to construct the constant nominal wealth series. However, when PPPs are used, consideration should be given to whether the nominal series is constructed using a single price index, such as CPIs, especially if a single consumption level PPP is being used to convert nominal wealth estimates into “real” wealth estimates. Furthermore, as the ICP only publishes PPPs for certain reference years, PPPs may need to be extrapolated to CWON reference years, which requires price indices to be used. For instance, the World Bank’s WDI extrapolates GDP-level PPPs using GDP deflators and household consumption-level PPPs using CPIs.

Given these considerations, the experimental PPP-based wealth estimates published in this volume are constructed by summing the national wealth assets expressed in local currency units and deflating these totals by *Actual Individual Consumption*-level PPPs. In addition, the PPPs used in this exercise have been extrapolated from 2017 to 2018 using CPIs. Furthermore, the current wealth asset series are converted to constant series using the same set of price indices, as in MER-based wealth estimates, allowing users to clearly isolate and measure the impact of using PPPs, instead of MERs, in this exercise.

⁶ To date, the ICP has not published this level, however, it may be introduced during the ICP 2021 cycle and, retroactively, for the ICP 2017 cycle. The closest currently published heading is *Actual Individual Consumption*, which covers household, NPISH and individual government consumption expenditures, while it excludes collective government consumption expenditures.

Annex 2. Data and Methodology

Total wealth based in purchasing power parities (PPPs) is calculated by dividing total wealth in constant 2018 US\$ at market exchange rates (MER) – already estimated in the CWON 2021 core accounts – by the price level ratio of the 2018 actual individual consumption (AIC) PPP conversion factor to market exchange rates. The following sections detail the data sources and additional calculations required.

Actual individual consumption-level PPPs

OECD publishes annual data on AIC-level PPPs (in national currency per US dollar) for OECD and selected non-OECD countries. This analysis uses the 2018 AIC-level PPPs and MERs for OECD countries as well as Russian Federation, Colombia, and Costa Rica.

Eurostat also publishes annual data on AIC-level PPPs for Eurostat countries. This analysis uses the 2018 AIC-level PPPs for the non-OECD Eurostat countries (e.g., Eastern Europe) and rebases the PPPs to the US dollar.

International Comparison Program (ICP) 2017 publishes a global dataset on AIC-level PPPs, with the latest data available for the year 2017. The 2018 AIC-level PPP is extrapolated from the 2017 value, using the country's consumer price index (CPI) relative to the United States, shown in the following equation for country A in the year 2018:

$$PPP_{A,2018} = PPP_{A,2017} \times \left\{ \left(\frac{CPI_{A,2018}}{CPI_{A,2017}} \right) / \left(\frac{CPI_{USA,2018}}{CPI_{USA,2017}} \right) \right\}$$

Data on MERs from the World Bank's World Development Indicators (WDI) are also used, with special exchange rate-related adjustments made to the PPPs for Liberia, Mauritania, and West Banka and Gaza to reconcile the methodology between WDI and ICP 2017.

Consumer price index

Data on the consumer price index is obtained from WDI primarily, with missing data filled for a few countries from the IMF ("Consumer Price Index (CPI) dataset" under the [IMF's Macroeconomic & Financial data database](#)). Where CPI data are missing for 2017 and 2018 from both WDI and the IMF, the GDP deflator from WDI is used as a proxy measure.

GDP-level PPPs

The CWON 2021 dataset includes a few countries not covered in ICP 2017: Lebanon, Papua New Guinea, Solomon Islands, and Turkmenistan. For these countries, WDI publishes imputed PPP values at the GDP and private consumption levels (not AIC). After assessing that AIC-level PPPs are closer to GDP-level PPPs for comparator countries, the GDP-level PPPs were used to gap-fill for these four countries.

Finally, 2017 AIC-level PPPs are not available for Venezuela and Yemen; without a proper gap-filling protocol to follow, these countries were excluded from this analysis.

Annex 3. Total Wealth Per Capita in 2018

This data annex provides total wealth per capita in 2018 for MER- and PPP-based wealth and the associated price level ratio, for the countries included in *The Changing Wealth of Nations 2021* dataset (except for Venezuela and Yemen), as well as their aggregate group averages. Note that the ICP 2017 report has PPP data for additional countries that are not included in this analysis due to missing wealth data over the 1995-2018 time period.

Table A3.1. Total wealth per capita in 2018, MER-based and PPP-based (2018 US\$), and price level ratio (PPP conversion factor to MER), by country

Economy	Income group	Region	Total wealth per capita (2018 US\$)		Price-level ratio (PPP conversion factor to MER)
			MER-based	PPP-based	
Albania	Upper middle income	Europe & Central Asia	64,335	166,119	0.387
Argentina	Upper middle income	Latin America & Caribbean	121,187	262,292	0.462
Armenia	Upper middle income	Europe & Central Asia	48,031	159,677	0.301
Australia	High income: OECD	East Asia & Pacific	827,510	764,827	1.082
Austria	High income: OECD	Europe & Central Asia	633,748	690,472	0.918
Azerbaijan	Upper middle income	Europe & Central Asia	36,315	146,583	0.248
Bahrain	High income: non-OECD	Middle East & North Africa	211,797	417,964	0.507
Bangladesh	Lower middle income	South Asia	19,265	55,669	0.346
Belarus	Upper middle income	Europe & Central Asia	77,516	294,580	0.263
Belgium	High income: OECD	Europe & Central Asia	571,179	623,713	0.916
Belize	Upper middle income	Latin America & Caribbean	38,206	56,907	0.671
Benin	Low income	Sub-Saharan Africa	20,598	57,889	0.356
Bolivia	Lower middle income	Latin America & Caribbean	41,592	114,821	0.362
Bosnia and Herzegovina	Upper middle income	Europe & Central Asia	46,718	116,243	0.402
Botswana	Upper middle income	Sub-Saharan Africa	80,602	177,516	0.454
Brazil	Upper middle income	Latin America & Caribbean	117,206	195,232	0.600
Bulgaria	Upper middle income	Europe & Central Asia	94,484	253,253	0.373
Burkina Faso	Low income	Sub-Saharan Africa	8,487	25,363	0.335
Burundi	Low income	Sub-Saharan Africa	4,594	14,464	0.318
Cambodia	Lower middle income	East Asia & Pacific	18,397	54,280	0.339
Cameroon	Lower middle income	Sub-Saharan Africa	23,656	61,847	0.383
Canada	High income: OECD	North America	822,373	893,714	0.920
Central African Republic	Low income	Sub-Saharan Africa	8,958	18,061	0.496
Chad	Low income	Sub-Saharan Africa	10,746	26,475	0.406
Chile	High income: OECD	Latin America & Caribbean	191,983	292,666	0.656
China	Upper middle income	East Asia & Pacific	174,365	286,128	0.609

Economy	Income group	Region	Total wealth per capita (2018 US\$)		Price-level ratio (PPP conversion factor to MER)
			MER-based	PPP-based	
Colombia	Upper middle income	Latin America & Caribbean	83,065	198,034	0.419
Comoros	Lower middle income	Sub-Saharan Africa	18,698	41,754	0.448
Congo, Dem. Rep.	Low income	Sub-Saharan Africa	9,017	19,801	0.455
Congo, Rep.	Lower middle income	Sub-Saharan Africa	44,125	96,202	0.459
Costa Rica	Upper middle income	Latin America & Caribbean	158,035	269,233	0.587
Cote d'Ivoire	Lower middle income	Sub-Saharan Africa	19,324	46,759	0.413
Croatia	High income: non-OECD	Europe & Central Asia	148,289	285,143	0.520
Czech Republic	High income: OECD	Europe & Central Asia	275,897	518,650	0.532
Denmark	High income: OECD	Europe & Central Asia	842,148	753,244	1.118
Djibouti	Lower middle income	Middle East & North Africa	18,933	35,181	0.538
Dominican Republic	Upper middle income	Latin America & Caribbean	77,101	171,962	0.448
Ecuador	Upper middle income	Latin America & Caribbean	107,013	203,975	0.525
Egypt, Arab Rep.	Lower middle income	Middle East & North Africa	18,271	93,317	0.196
El Salvador	Lower middle income	Latin America & Caribbean	35,793	75,423	0.475
Estonia	High income: OECD	Europe & Central Asia	263,969	420,669	0.627
Eswatini	Lower middle income	Sub-Saharan Africa	47,505	107,191	0.443
Ethiopia	Low income	Sub-Saharan Africa	10,790	32,667	0.330
Finland	High income: OECD	Europe & Central Asia	614,630	621,362	0.989
France	High income: OECD	Europe & Central Asia	565,959	652,057	0.868
Gabon	Upper middle income	Sub-Saharan Africa	68,567	130,318	0.526
Gambia, The	Low income	Sub-Saharan Africa	7,853	26,155	0.300
Georgia	Upper middle income	Europe & Central Asia	38,510	120,310	0.320
Germany	High income: OECD	Europe & Central Asia	672,408	806,413	0.834
Ghana	Lower middle income	Sub-Saharan Africa	31,861	86,916	0.367
Greece	High income: OECD	Europe & Central Asia	194,266	295,069	0.658
Guatemala	Upper middle income	Latin America & Caribbean	38,376	71,355	0.538
Guinea	Low income	Sub-Saharan Africa	8,057	23,132	0.348
Guyana	Upper middle income	Latin America & Caribbean	62,740	125,561	0.500
Haiti	Low income	Latin America & Caribbean	11,703	24,390	0.480
Honduras	Lower middle income	Latin America & Caribbean	30,157	68,116	0.443
Hungary	High income: OECD	Europe & Central Asia	174,761	356,981	0.490
Iceland	High income: OECD	Europe & Central Asia	987,021	719,302	1.372
India	Lower middle income	South Asia	24,102	86,841	0.278
Indonesia	Lower middle income	East Asia & Pacific	48,046	144,303	0.333
Iran, Islamic Rep.	Upper middle income	Middle East & North Africa	84,546	245,588	0.344
Iraq	Upper middle income	Middle East & North Africa	80,875	184,624	0.438

Economy	Income group	Region	Total wealth per capita (2018 US\$)		Price-level ratio (PPP conversion factor to MER)
			MER-based	PPP-based	
Ireland	High income: OECD	Europe & Central Asia	472,814	444,029	1.065
Italy	High income: OECD	Europe & Central Asia	375,541	459,548	0.817
Jamaica	Upper middle income	Latin America & Caribbean	67,740	133,040	0.509
Japan	High income: OECD	East Asia & Pacific	559,259	617,287	0.906
Jordan	Upper middle income	Middle East & North Africa	32,304	74,681	0.433
Kazakhstan	Upper middle income	Europe & Central Asia	109,074	341,297	0.320
Kenya	Lower middle income	Sub-Saharan Africa	22,055	57,139	0.386
Korea, Rep.	High income: OECD	East Asia & Pacific	356,619	455,538	0.783
Kuwait	High income: non-OECD	Middle East & North Africa	748,480	1,228,643	0.609
Kyrgyz Republic	Lower middle income	Europe & Central Asia	15,328	65,953	0.232
Lao PDR	Lower middle income	East Asia & Pacific	38,079	116,511	0.327
Latvia	High income: OECD	Europe & Central Asia	233,600	411,743	0.567
Lebanon	Upper middle income	Middle East & North Africa	51,673	102,383	0.505
Lesotho	Lower middle income	Sub-Saharan Africa	16,712	43,229	0.387
Liberia	Low income	Sub-Saharan Africa	11,891	25,281	0.470
Lithuania	High income: OECD	Europe & Central Asia	191,787	385,759	0.497
Luxembourg	High income: OECD	Europe & Central Asia	898,547	793,984	1.132
Madagascar	Low income	Sub-Saharan Africa	8,375	29,823	0.281
Malawi	Low income	Sub-Saharan Africa	7,876	23,487	0.335
Malaysia	Upper middle income	East Asia & Pacific	167,365	420,520	0.398
Maldives	Upper middle income	South Asia	50,795	89,676	0.566
Mali	Low income	Sub-Saharan Africa	10,061	29,913	0.336
Malta	High income: non-OECD	Middle East & North Africa	296,649	435,943	0.680
Mauritania	Lower middle income	Sub-Saharan Africa	18,501	58,252	0.318
Mauritius	Upper middle income	Sub-Saharan Africa	99,108	200,086	0.495
Mexico	Upper middle income	Latin America & Caribbean	98,664	210,942	0.468
Moldova	Lower middle income	Europe & Central Asia	31,608	100,767	0.314
Mongolia	Lower middle income	East Asia & Pacific	46,734	146,239	0.320
Morocco	Lower middle income	Middle East & North Africa	30,731	70,857	0.434
Mozambique	Low income	Sub-Saharan Africa	6,505	18,480	0.352
Namibia	Upper middle income	Sub-Saharan Africa	66,120	131,697	0.502
Nepal	Low income	South Asia	15,280	54,941	0.278
Netherlands	High income: OECD	Europe & Central Asia	690,432	749,906	0.921
Nicaragua	Lower middle income	Latin America & Caribbean	26,024	77,402	0.336
Niger	Low income	Sub-Saharan Africa	7,507	17,864	0.420
Nigeria	Lower middle income	Sub-Saharan Africa	28,621	81,347	0.352
North Macedonia	Upper middle income	Europe & Central Asia	54,085	153,348	0.353

Economy	Income group	Region	Total wealth per capita (2018 US\$)		Price-level ratio (PPP conversion factor to MER)
			MER-based	PPP-based	
Norway	High income: OECD	Europe & Central Asia	1,185,533	980,739	1.209
Oman	High income: non-OECD	Middle East & North Africa	165,669	312,064	0.531
Pakistan	Lower middle income	South Asia	16,380	55,569	0.295
Panama	High income: non-OECD	Latin America & Caribbean	129,946	282,994	0.459
Papua New Guinea	Lower middle income	East Asia & Pacific	33,011	53,075	0.622
Paraguay	Upper middle income	Latin America & Caribbean	81,869	197,387	0.415
Peru	Upper middle income	Latin America & Caribbean	79,464	151,570	0.524
Philippines	Lower middle income	East Asia & Pacific	35,135	97,862	0.359
Poland	High income: OECD	Europe & Central Asia	139,208	315,093	0.442
Portugal	High income: OECD	Europe & Central Asia	251,045	372,442	0.674
Qatar	High income: non-OECD	Middle East & North Africa	902,740	1,222,565	0.738
Romania	Upper middle income	Europe & Central Asia	118,397	297,280	0.398
Russian Federation	Upper middle income	Europe & Central Asia	173,394	501,565	0.346
Rwanda	Low income	Sub-Saharan Africa	11,314	36,768	0.308
Saudi Arabia	High income: non-OECD	Middle East & North Africa	324,194	726,435	0.446
Senegal	Lower middle income	Sub-Saharan Africa	15,217	38,798	0.392
Sierra Leone	Low income	Sub-Saharan Africa	9,171	32,695	0.280
Singapore	High income: non-OECD	East Asia & Pacific	817,846	1,092,628	0.749
Slovak Republic	High income: OECD	Europe & Central Asia	200,594	330,279	0.607
Slovenia	High income: OECD	Europe & Central Asia	331,087	489,111	0.677
Solomon Islands	Lower middle income	East Asia & Pacific	38,937	44,423	0.877
South Africa	Upper middle income	Sub-Saharan Africa	64,366	135,416	0.475
Spain	High income: OECD	Europe & Central Asia	328,253	431,793	0.760
Sri Lanka	Upper middle income	South Asia	29,972	102,480	0.292
Suriname	Upper middle income	Latin America & Caribbean	92,740	256,841	0.361
Sweden	High income: OECD	Europe & Central Asia	748,540	713,695	1.049
Switzerland	High income: OECD	Europe & Central Asia	1,280,371	967,508	1.323
Tajikistan	Low income	Europe & Central Asia	24,668	107,095	0.230
Tanzania	Low income	Sub-Saharan Africa	15,378	47,514	0.324
Thailand	Upper middle income	East Asia & Pacific	78,216	207,437	0.377
Togo	Low income	Sub-Saharan Africa	13,612	33,897	0.402
Trinidad and Tobago	High income: non-OECD	Latin America & Caribbean	117,979	202,816	0.582
Tunisia	Lower middle income	Middle East & North Africa	28,858	104,367	0.277
Turkey	Upper middle income	Europe & Central Asia	43,071	138,397	0.311
Turkmenistan	Upper middle income	Europe & Central Asia	102,707	224,207	0.458
Uganda	Low income	Sub-Saharan Africa	10,407	34,364	0.303

Economy	Income group	Region	Total wealth per capita (2018 US\$)		Price-level ratio (PPP conversion factor to MER)
			MER-based	PPP-based	
Ukraine	Lower middle income	Europe & Central Asia	55,272	247,367	0.223
United Arab Emirates	High income: non-OECD	Middle East & North Africa	614,419	827,760	0.742
United Kingdom	High income: OECD	Europe & Central Asia	493,795	518,827	0.952
United States	High income: OECD	North America	872,400	872,400	1.000
Uruguay	High income: non-OECD	Latin America & Caribbean	222,279	283,251	0.785
Vietnam	Lower middle income	East Asia & Pacific	34,084	107,716	0.316
West Bank and Gaza	Lower middle income	Middle East & North Africa	26,451	51,420	0.514
Zambia	Lower middle income	Sub-Saharan Africa	28,154	71,812	0.392
Zimbabwe	Lower middle income	Sub-Saharan Africa	23,319	50,528	0.462

Table A3.2. Total wealth per capita in 2018, MER-based and PPP-based (2018 US\$), and price level ratio (PPP conversion factor to MER), by aggregate group

Aggregate Group	Total wealth per capita (2018 US\$)		Price level ratio (PPP conversion factor to MER)
	MER-based	PPP-based	
Low income	10,781	32,072	0.336
Lower middle income	27,108	89,497	0.303
Upper middle income	140,719	264,460	0.532
High income: non-OECD	400,891	699,548	0.573
High income: OECD	621,278	673,663	0.922
East Asia & Pacific	176,125	278,549	0.632
Europe & Central Asia	322,739	461,130	0.700
Latin America & Caribbean	101,430	192,979	0.526
Middle East & North Africa	109,352	246,311	0.444
North America	867,304	874,572	0.992
South Asia	22,680	79,961	0.284
Sub-Saharan Africa	20,473	53,720	0.381
World	160,437	242,516	0.662