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Research article

Unequal wealth of nations: Evidence from the World Bank wealth accounts

Cheng Li*

Institute of Economics, Chinese Academy of Social Sciences, Beijing 100836, P. R. China

***Correspondence:** Email: licheng@cass.org.cn.

Abstract: Using the World Bank's Changing Wealth of Nations database, this paper provides novel evidence on the cross-country inequality of wealth from 1995 to 2018. Overall, judging by both the top/middle/bottom shares and coefficients of variation, the analysis found that inequality in wealth per capita decreased prior to the 2008 global financial crisis and has remained stable since then. Adopting a before-after approach, this study further showed that different components of national wealth, including human capital, produced capital, natural capital, and net foreign assets, have heterogeneous impacts on between-country wealth inequality. In addition, we introduced a rank-based correlation analysis to explore wealth mobility across nations, revealing extremely low and decreasing mobility over time. Unlike most existing studies that exclude some major components of wealth, this study relied on a more comprehensive accounting of wealth and thus offers new insights into the dynamics of global per capita wealth inequality, the impact of the 2008 financial crisis, and the component-level contributions to wealth disparities. These findings have significant implications for understanding global challenges, including the North-South divide, climate change, and the distributive consequences of globalization.

Keywords: national wealth accounts; wealth distribution; wealth mobility; decomposition analysis

JEL Codes: D31, E21, F62

1. Introduction

Although worldwide economic inequality has long been at the center of public attention, related policy and academic debates have largely focused on income disparity across nations (see Bourguignon and Morrisson, 2002; Anand and Segal, 2017). Consequently, the literature typically addresses this

topic in terms of "convergence" or "catch-up" in gross domestic product (GDP) per capita (Barro, 2015). In contrast, the distributive patterns and structural transformation of national wealth—defined as accumulated flows of income net of consumption—have been mostly ignored[1].

Unfortunately, this lack of a stock perspective prevents us from understanding how the existing accumulation of production factors, including human and non-human ones, is allocated across nations to produce different economic outcomes. Indeed, this question is central to modern economics, as inaugurated in *The Wealth of Nations*. Additionally, turning to the other side of the balance sheet, the liabilities held by private agents or public sectors also pertain to a notion of stock. It is quite intuitive that their distribution and the associated well-being and risk implications cannot be properly addressed without a closer look at the corresponding assets or wealth.

Thanks to the Changing Wealth of Nations (CWON) database developed by the World Bank (2021), which provides data on national wealth and its components for 146 countries (or regions) from 1995 to 2018, we can quantitatively investigate the disparity and composition of wealth per capita across nations. Such statistical analysis is expected to shed light on a broad range of substantial and intractable challenges facing today's unequal but changing world, including the North-South divide, the asymmetric impacts of climate change, and the distributive consequences of globalization.

Specifically, adopting a macro-perspective, this paper is among the first studies to analyze inter-country wealth inequality on a genuinely global scale, with a notion of "comprehensive wealth" referring to the aggregation of all kinds of production factors owned by a nation. Unlike household-level data, which are commonly used in the relevant literature, the CWON's conceptual framework is preferred since it directly links nationwide production of economic well-being and the accumulation of wealth stock and thus improves our insights into their interactions. Moreover, the CWON data also distinguish themselves from other influential wealth research, as will be reviewed below, by their more comprehensive accounting of public wealth, human capital, and natural capital. Ignoring them may result in a biased description of how world wealth is accumulated and distributed, potentially leading to inappropriate prescriptions.

Drawing on the advantages of the World Bank's wealth concept, this study attempts to make two additional contributions to existing research. First, the capital classification provided in CWON allows for the examination of the impacts of different asset classes on the inequality of wealth per capita among countries. This analysis will help us gain a better understanding of one of the most fundamental forces driving disparate development performance across nations—they might simply be endowed with heterogeneous economic resources, which manifest different productivities and sustainability due to asset-specific factors. Second, leveraging the time dimension in CWON data, this study also aims to explore the dynamics of international rankings in terms of wealth per capita, namely wealth mobility over time. This is a topic that is even more rarely discussed but greatly needed for taking stock of the major distributive consequences of globalization and other worldwide challenges.

The remainder of this paper is structured as follows. The next section provides a review of the literature on international or regional wealth distribution. Section 3 outlines the accounting framework of CWON, highlighting its conceptual differences from other global wealth statistics. From the perspective of top/middle/bottom wealth shares, it also provides descriptive statistics for the general trends in the international distribution of wealth per capita. Section 4 compares the observed and

[1] Somewhat ironically, in their recent review paper entitled "What Remains of Cross-country Convergence?", Johnson and Papageorgiou (2020) entirely neglected the dimension of wealth.

counterfactual distributions measured by wealth share or coefficient of variation, analyzing the component contributions to overall wealth inequality. With the help of rank-based correlation analysis, Section 5 further addresses how national positions in wealth ranking change over time. It also examines the extent to which the movements of component-level ranks contribute to the mobility of total wealth. The final section summarizes the main results and offers concluding remarks.

2. Literature review

As previously noted, the literature on international wealth distribution is highly limited. Overall, it was not until the outbreak of the global financial crisis in 2008 that concerns over international wealth disparity were heightened. For example, drawing on household balance sheet statistics, survey data, and regression-based estimates, Davies et al. (2009, 2011), in one of the first studies of its kind, provided descriptive evidence for the level and distribution of global wealth. In particular, by combining intra-country and inter-country inequalities, they found that the wealth share of the top decile adults was as high as 70.7% in 2000, the benchmark year in their research. Following the same perspective, Davies et al. (2017) extended this work to cover the period from 2000 to 2014, with significant improvements in data quality and regression procedures. Starting from 2010, the above studies have been structured in the *Global Wealth Report* (GWR), an annual report regularly published by the Credit Suisse Research Institute (2022). It should, however, be emphasized that their focus is exclusively on non-human wealth held by private agents, namely households. Thus, as will be discussed below, their data conceptually differ from the national wealth series of CWON.

In a way, the accounting and distribution of wealth are more systematically documented by Thomas Piketty, the author of the phenomenal book *Capital in the Twenty-first Century* (2014), and his fellow researchers at the World Inequality Lab. Methodologically, they have developed an innovative accounting system for measuring wealth/income inequality, known as the Distributional National Accounts (DINA, see World Inequality Lab, 2021), which allows for a more comprehensive and harmonized description of the distributive characteristics of private wealth for most economies around the world. Interestingly, they show in their latest annual report that the average private wealth in the global top 10% group reached about US$ 550,900 (in Purchasing Power Parity terms) in 2021, which is nearly 190 times the average of the bottom half (Chancel et al., 2021). Nevertheless, the conceptual framework of DINA can essentially be viewed as a micro-perspective, with the individual or adult as the basic unit of observation. In this regard, their data, collected in the World Inequality Database (WID), share similar features and limitations to those made available by the Credit Suisse bank[2].

Furthermore, a collaborative effort has also been advanced by the United Nations Environment Programme (UNEP), the International Human Dimensions Programme on Global Environmental Change (IHDP), and individual researchers from other affiliations. In a series of studies (see Managi and Kumar, 2018), they propose a statistical framework for "inclusive wealth", which has the same capital components as those in the World Bank's CWON, except for excluding net foreign assets. Focusing on the assessment of the sustainability of human well-being, their framework exhibits a distinctive feature: the inclusive wealth stock is calculated by considering carbon damages, oil capital gains, and total factor productivity dynamics. Unfortunately, although this wealth accounting

[2] Although WID also collects official data or provides estimates of public wealth for certain countries or regions, this aspect is generally overlooked in their analysis of wealth distribution.

also proceeds on a global scale, there is still a lack of a systematic and comprehensive release of relevant data.

Aside from these genuine global perspectives, some studies focus on smaller samples. For instance, drawing on the Luxembourg Wealth Study (LWS) data, Cowell et al. (2018) assessed the determinants of household wealth inequality across five advanced economies, namely Finland, Italy, Sweden, the United Kingdom, and the United States of America. Their counterfactual decomposition analysis showed that a large share of the cross-country differences in wealth inequality could not be attributed to different household-level characteristics, such as age, working status, household structure, educational attainment, and current income. Instead, according to them, various country-specific factors, such as personal preferences for holding specific types of assets, which are further shaped by cultural and historical conditions, may help explain these results. More recently, Pfeffer and Waitkus (2021) also applied a decomposition approach to wealth inequality across 15 developed countries included in the LWS. They showed that personal wealth position is greatly determined by housing assets. To a large extent, this finding explains why, as previously documented by Cowell et al. (2018), in many cases, the distribution of wealth differs considerably from that of income. At a regional level, Brzezinski and Sałach (2021) pursued similar questions in the context of five Central and Eastern European countries. Using the Oaxaca–Blinder decomposition method, they found that different homeownership rates explain a substantial part of cross-country disparities in wealth inequality, thus further confirming the predominant role of housing assets in the rich-poor dynamics.

To summarize, although the research reviewed above offers some promising insights into wealth inequality across nations and highlights critical policy implications, relying solely on incomplete wealth data provides a partial, or even problematic, picture of national wealth. Additionally, while both the Credit Suisse Research Institute (2022) and Chancel et al. (2021), among others, have shed fresh light on worldwide inequality, their primary emphasis was on the distribution of wealth *between individuals* across the globe, thus encompassing *within-country inequality* and *inter-country inequality*[3]. Nevertheless, it is quite evident that the causes and solutions of these two kinds of inequality differ greatly (see Bourguignon, 2015). In fact, to a large extent, the aforementioned North-South divide and other international development issues require nation-level action more than individual-level action. Therefore, examining inter-country inequality has its own justifications and is even more important in certain contexts.

3. Overview of wealth distribution dynamics

3.1. Wealth concepts and related accounting issues

Being compatible with the well-accepted System of National Accounts (SNA) and System of Environmental-Economic Accounting (SEEA), the CWON wealth series comprises four main types of assets: human capital, produced capital, natural capital, and net foreign assets. Clearly, these categories of capital contribute to a nation's economic growth and wealth accumulation through different mechanisms. For example, the accumulation of human capital has a direct impact on productivity progress, thereby influencing long-term economic growth (Barro, 2001). Produced capital, primarily

[3] It is in the same spirit of Bourguignon and Morrisson (2002), which work on the global income distribution among the world citizens.

consisting of the accumulated flows of physical capital formation, can be viewed both as a cause and a result of industrialization and urbanization. However, it typically suffers from the law of diminishing marginal returns and thus cannot serve as a sustainable driver of economic growth (Solow, 1956). Natural capital is another type of asset that is constrained by sustainability concerns. Moreover, with less involvement of advanced technology or sophisticated processes in their development or production, the value of natural resources is vulnerable to fluctuations in commodity markets (van der Ploeg, 2011). Lastly, regarding net foreign assets, nations can be distinguished as either net creditors or net debtors, reflecting their opposite roles in international financial relations (Broner and Ventura, 2016).

More specifically, human capital in CWON is treated as the total present value of lifetime labor income. The latter, as the widely used Mincer earning function suggests, is mainly determined by educational attainment, demographic profile, and other labor market conditions. It occupies on average about 60% of the total national wealth, thus being the most important wealth component. However, human capital is completely ignored in both the GWR and WID datasets. In particular, with regard to the latter, Piketty once defended his focus on non-human capital by arguing "The most obvious is that human capital cannot be owned by another person or traded on a market (not permanently, at any rate)" (Piketty, 2014, p.46). Admittedly, it may hold merit when solely examining personal wealth. However, at the national level, the nonpermanent tradability of human capital no longer appears to be an issue (for criticisms of Piketty's exclusion of human capital, see Weil, 2015).

Ranking second in share, produced capital includes structures, machinery, equipment, and urban land, accounting for approximately one-third of total national wealth. For most countries, the data for the first three items are sourced from the Penn World Table 9.1, which largely relies on the commonly used perpetual inventory method. Based on a strong hypothesis, built-up urban land is calculated as a fixed proportion (namely 24%) of the sum of structures, machinery, and equipment. It is important to note that produced capital in CWON has much broader coverage than those in the GWR and WID datasets. Since both of them solely focus on the private sector, their accounting frameworks largely attribute produced capital to the nonfinancial assets of households, with dwellings constituting the majority.

Next, in comparison to the GWR and WID datasets, in which natural resources are given less emphasis or simply overlooked[4], the CWON offers a more comprehensive assessment of natural capital, including a set of renewable (for example, cropland and forests) and non-renewable resources (fossil fuels, metals, and minerals). Despite representing only around 7% of the full sample, the international distribution of natural capital appears to be highly uneven. Generally speaking, it represents a significant proportion of national wealth in low-income countries (26% in 2018) and high-income countries that are not members of the Organization for Economic Cooperation and Development (OECD; 31% in 2018). The latter group includes some major energy exporters.

Finally, net foreign assets, which refer to the difference between national holdings of foreign assets and foreign holdings of national assets, make up only a trivial proportion of wealth for most countries, albeit being important for the non-OECD high-income group (12.4% in 2018). Because of its nature as a financial claim, this wealth component has an important conceptual implication: By definition, net foreign assets would cancel each other out across countries when taking the world as a closed economy. Except for some minor discrepancies, the CWON data conforms to this feature by

[4] However, the World Inequality Lab researchers note in their methodological guidelines that as an aim, natural resources will be progressively accounted for in WID dataset (World Inequality Lab, 2021, p.71).

construction. As a result, this type of capital does not contribute to consolidated global wealth but to national-level wealth. This also means that the per capita values of net foreign assets across countries do not sum to zero unless they are evenly distributed.

Furthermore, the World Bank wealth accounts take the individual country as the unit of observation and thus consolidate private and public wealth. In contrast, public wealth is neither included in Credit Suisse's report nor is it a focus in WID-based analysis. That may bring about systematically biased assessments of the economic resources in the ultimate possession of the citizens of a country, largely depending on its development stage and factor endowment. Specifically, as indicated in Equations (1.1)–(1.3) and based on the accounting identities underlying the national balance sheet, net domestic financial assets should be zero. This is because, by construction, domestic financial assets equal domestic financial liabilities. Therefore, logically, net domestic financial assets held by the private sector, as claims on the public sector's resources, would cancel each other out when consolidating the national balance sheet (Goldsmith, 1982). Loosely speaking, the mechanism implies that households accumulate their financial wealth (net) at the expense of indebting the government. Obviously, when public sector holds a large negative position in net domestic financial assets, as is often the case for many developed countries such as the USA[5], focusing only on private agents would lead to a dramatic overestimation of national wealth.

$$\begin{aligned} &private\ domestic\ financial\ assets - private\ domestic\ financial\ liabilities \\ &= net\ private\ domestic\ financial\ assets \end{aligned} \tag{1.1}$$

$$\begin{aligned} &public\ domestic\ financial\ assets - public\ domestic\ financial\ liabilities \\ &= net\ public\ domestic\ financial\ assets \end{aligned} \tag{1.2}$$

$$net\ private\ domestic\ financial\ assets + net\ public\ domestic\ financial\ assets = 0 \tag{1.3}$$

On the other hand, in some countries, especially developing economies or major exporters, public sectors also have large holdings of nonfinancial assets (positive by construction) and positive net foreign assets, mainly in the form of currency reserves. For instance, Piketty et al. (2019) shows that despite declining during market reform, public wealth's share in China's total remains as high as 30% in 2015. Hence, conversely, omitting public wealth would result in a considerable underestimation of the resources available to a country of this kind.

3.2. General trends in wealth share dynamics

To conceptualize our approach, consider a global community where each individual represents a country. In this community, wealth disparities manifest in various forms of capital holdings—from intangible human capital to tangible produced and natural assets, as well as net foreign assets. This analogy helps frame our investigation into how wealth per capita is distributed among nations, what factors contribute to wealth differences, and how relative wealth positions change over time.

[5] For instance, according to the Integrated Macroeconomic Accounts released by the Bureau of Economic Analysis, the federal government's net financial assets (including the trivial net public foreign assets) amount to US$ 24.47 trillion in 2021, which is even greater in its absolute value than the national GDP in the same year.

Using this imagination, we first examine inter-country inequality in terms of wealth per capita by applying a widely used measurement of inequality, which involves calculating the different percentile shares of wealth or income. In our case, we focus on three groups of *individuals* (country representatives), namely the top 10%, the middle 40%, and the bottom half.

As shown in Figure 1, the share of the top 10% wealthy-country representatives (namely 15 out of 146) accounts for about half of the total wealth. It appears to be larger than the share of GDP replacing wealth[6]. This observation is consistent with the main results obtained in the existing literature on inequality: As a well-established fact, income tends to be more equally distributed than wealth (see Chancel et al., 2021). Moreover, from a dynamic perspective, the top wealth share in this imaginary community experienced a noticeable decline over the pre-2008 period. However, it has remained relatively stable since then.

To further explore the different implications of private and public wealth for inequality, we also calculate the top decile share using the per adult private wealth series offered in the GWR database (namely top 17 out of 171; data available since 2000). As also illustrated in Figure 1, this alternative measure points out a similar trend in top wealth shares. However, without exception, it reveals that the level of private wealth concentration in this country representatives' world surpasses that of the broad-gauged wealth defined in CWON over the sample of reference. This result can be read as indicative of the fact that private wealth is more unequally distributed than public wealth, which exerts a certain counter-balancing effect against wealth concentration.

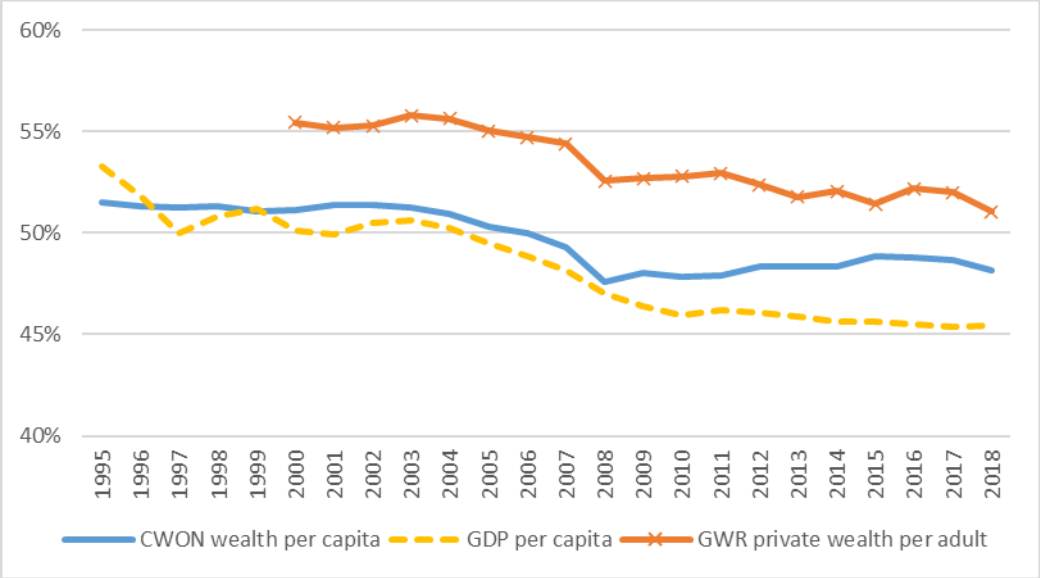

Figure 1. Top 10% shares over 1995–2018. Sources: CWON, WDI, Credit Suisse's GWR, and author's calculations.

Next, we turn to examining the country-representatives situated in the middle 40% of wealth or income distribution. As can be seen from Figure 2, their wealth shares are generally smaller than the middle shares in terms of GDP, but larger than the corresponding private wealth shares based on GWR data. Regarding their trends, it is also found that the 2008 crisis had some immediate and lasting

[6] The data of GDP per capita are sourced from World Development Indicators (WDI), World Bank.

adverse impact on this middle spectrum, which greatly benefited from worldwide economic prosperity before this dramatic shock. However, looking at the full sampled period, they still experienced an increase in both wealth and income shares.

To some extent, these descriptions imply a quite successful catch-up of the latecomers of industrial development, such as China, which has graduated from the bottom half (ranked 83rd in 1995 in wealth per capita) and joined the upper-middle club (ranked 41st in 2018). Nevertheless, compared to their more outstanding performance in income growth, their wealth accumulation appears to be less efficient. Arguably, this can be attributed to typical middle-stage industrialization challenges that hinder sustainable wealth accumulation, such as excessive and wasteful investment, substantial environmental degradation, and limited global financial clout (see Mahtaney, 2021; Zhang, 2024). Moreover, the results also show that, in relative terms, the middle wealth countries have more public wealth than the top ones (see Figure 1), as the aforementioned example of China suggests.

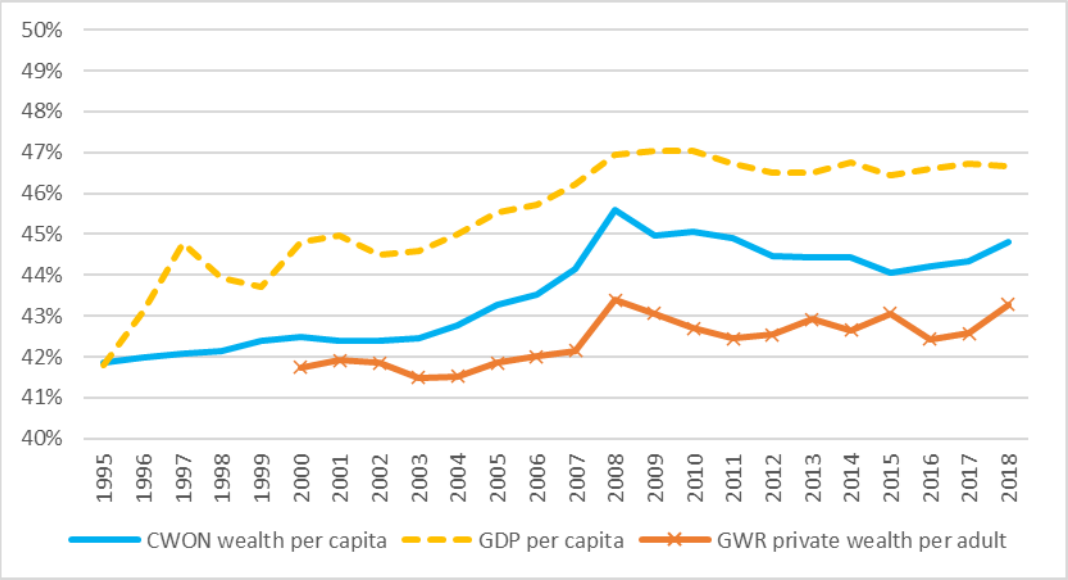

Figure 2. Middle 40% shares over 1995−2018. Sources: CWON, WDI, Credit Suisse's GWR, and author's calculations.

As illustrated in Figure 3, approximately 7% of total wealth is held by the bottom half of country representatives, a proportion similar to that of income. However, their shares in private wealth always appear smaller, suggesting that public wealth holdings are particularly important in less wealthy countries. Furthermore, in terms of dynamics, the bottom share of total wealth has slightly increased since the beginning of the new century without being largely impacted by the global financial turmoil. Comparatively, the upward trend in the bottom income share is more pronounced, indicating faster catch-up of less-developed countries in income than in wealth. The bottom share in private wealth has also expanded rapidly, reflecting the substantial rise of private economies in those countries.

In summary, our findings suggest an increasingly equitable world, which may have been slowed or even inverted by the Great Recession. In this regard, it is believed that the rise and fall of globalization during those years constitute one of the major factors explaining this phenomenon. For example, as documented in Bourguignon (2015), a high wave of globalization helps reduce between-country income gaps as some emerging market economies, like China and India, significantly improve their economic

efficiency through engaging in international labor division. Characterized by the decrease or slowing down of world trade and investment flows, deglobalization or the so-called "slowbalization" in the aftermath of the global financial crisis brings about substantial changes in the pattern of economic convergence across nations (see van Bergeijk, 2019). However, given space limitations, this topic of great importance is left for future research.

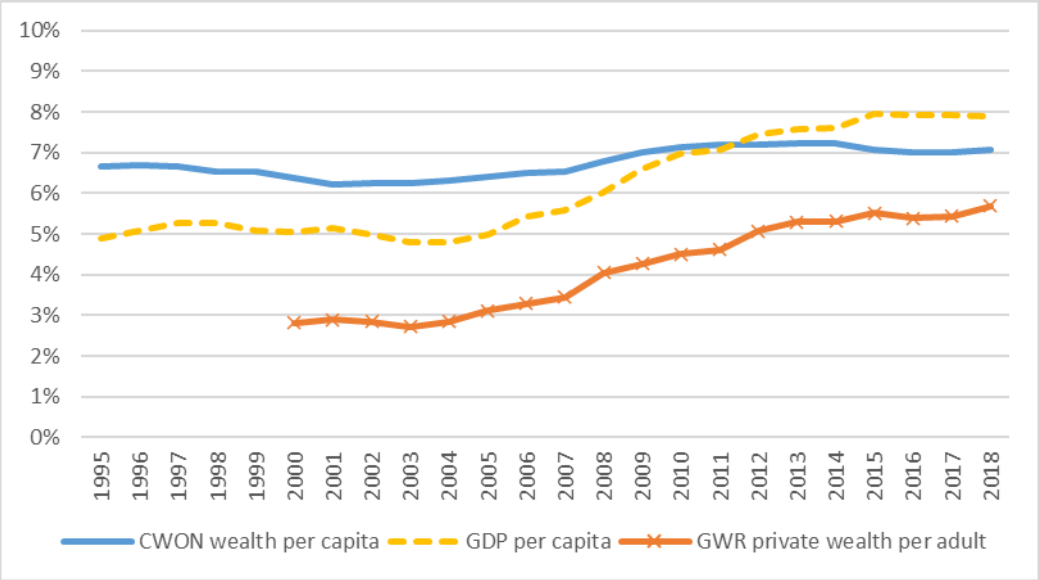

Figure 3. Bottom 50% shares over 1995−2018. Sources: CWON, WDI, Credit Suisse's GWR, and author's calculations.

4. Wealth inequality decomposition and counterfactual analysis

4.1. Analysis based on wealth shares

To assess the impacts of different asset types on the inter-country disparity of wealth per capita, we draw again on the imaginary community of country representatives and perform a simple but informative decomposition analysis based on the so-called "before-after approach". It involves comparing the observed levels of wealth distribution with the hypothetical levels under some counterfactual assumptions.

Specifically, each wealth component is first subtracted from the top, middle, or bottom shares in the overall wealth, creating a counterfactual distribution series as if there were no such component in the composition. Thus, comparing the wealth shares before and after the subtraction would serve to measure the *ceteris paribus* contribution, whether positive or negative, of the individual component to overall wealth inequality.

It should be noted that this counterfactual analysis is subject to potential issues such as the behavioral effect. For instance, if a specific type of capital is derived from the total wealth, then the behavior of using other types of capital might change accordingly. This necessitates a closer look at the real-world wealth composition and distribution, which undoubtedly is a crucial topic for future research. Despite this, the before-after approach has clear advantages compared to others. In particular, as pointed out by Cancian and Reed (1998), thanks to a well-defined counterfactual reference distribution, it results

in a meaningful measurement of the component contribution to overall inequality. In contrast, this is not the case for a widely used decomposition approach pioneered by Shorrocks (1982) and Lerman and Yitzhaki (1985), which involves partitioning the inequality measures of the total income or wealth (for example, Gini coefficient or top share) into the addictive contribution of each component. Besides, since there is a large number of negative-value observations in net foreign assets, the before-after approach has another advantage in that it avoids calculating the component-specific Gini coefficient or wealth shares, which are, at least in its conventional form, ill-defined.

Using this approach, we calculate the new top wealth shares excluding human capital, produced capital, natural capital, and net foreign assets. The results are displayed in Figure 4, where the observed top share in total wealth per capita is also illustrated for the sake of comparison. Overall, the effects of human capital and natural capital on the top wealth shares appear to be small and unstable, while the exclusion of the former tends to significantly increase the top wealth shares over the last few sampled years. Such an effect is also found for produced capital, but it holds instead for the entire sample period with a larger magnitude. Specifically, as summarized in Table 1, excluding this factor would, on average, increase the top shares by 1.58% in the sample from 1995 to 2018. Since the produced capital can be roughly viewed as industrial and urban assets, this outcome may imply that the intertwined processes of industrialization and urbanization play a role as *equalizer* in favor of the less wealthy economies. By contrast, net foreign assets manifest, however, as a major driving force for wealth concentration. In its absence, the shares of the top decile would shrink by 1.63% on average, suggesting that international financial claims tend to benefit more the top countries than others. Notably, as can be seen from the figure, such a gap narrowed before the 2008 crisis (especially over 2001–2007) and has become wider again since then, except for a temporary narrowing in 2011.

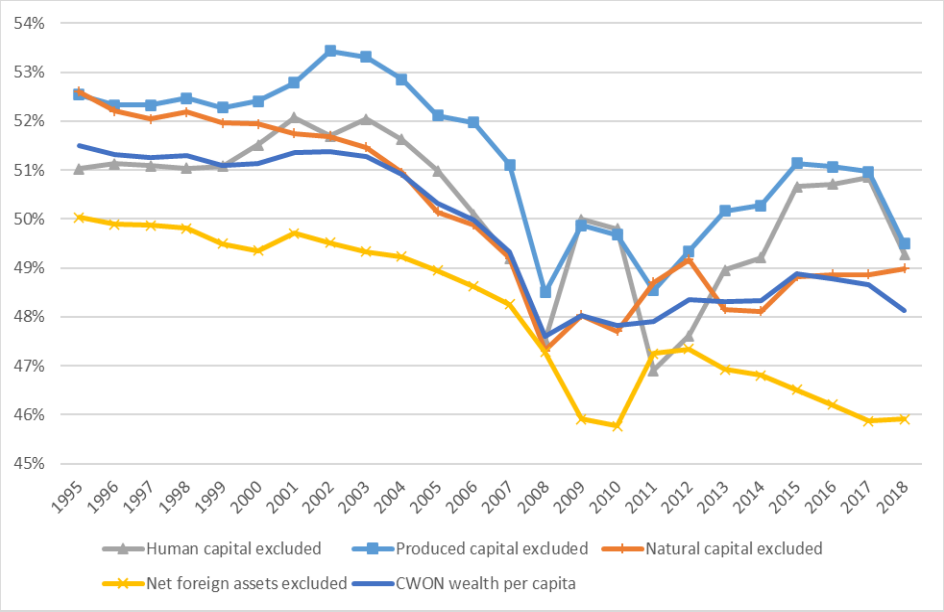

Figure 4. Counterfactual decomposition analysis on top 10% wealth. Sources: CWON and author's calculations.

Table 1. Wealth component contributions to overall wealth inequality: average for 1995–2018.

Shares/Capital classes	Human capital	Produced capital	Natural capital	Net foreign assets	Overall wealth (observed)
Top 10%	-	-	-	-	49.71%
In the absence of:	50.25%	51.29%	50.03%	48.08%	-
Counterfactual deviations	0.55%	1.58%	0.32%	-1.63%	-
Middle 40%	-	-	-	-	43.55%
In the absence of:	42.37%	41.75%	44.20%	44.75%	-
Counterfactual deviations	-1.18%	-1.80%	0.65%	1.20%	-
Bottom 50%	-	-	-	-	6.74%
In the absence of:	7.37%	6.96%	5.77%	7.17%	-
Counterfactual deviations	0.63%	0.22%	-0.97%	0.43%	-

Note: Counterfactual deviations = shares in the absence of the corresponding component – observed shares in overall wealth.

Next, as illustrated in Figure 5, the representatives of countries situated in the middle 40% of the wealth distribution differ from that of the top group. Specifically, as reported in Table 1, without human capital and produced capital, the share of the middle-wealthy countries would decrease by 1.18% and 1.80%, respectively. Given the definitions of both capital classes presented previously, the results can be interpreted to show that education and employment and, to a greater extent, the joint processes of industrialization and urbanization contribute significantly to the accumulation of wealth held by the middle-wealthy representatives of countries. In contrast, the counterfactual shares in the absence of natural capital and net financial assets are both greater than the observed shares, indicating their negative role in the wealth accumulation of the middle group.

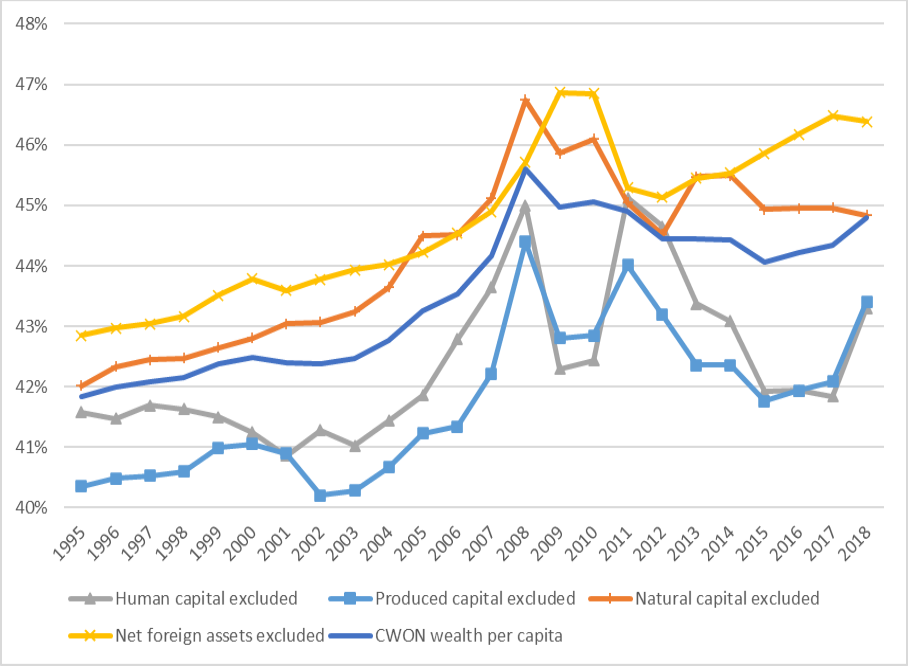

Figure 5. Counterfactual decomposition analysis on middle 40% wealth. Sources: CWON and author's calculations.

As displayed in Figure 6, the component effects on the bottom 50% wealth shares exhibit a distinct pattern compared to the middle shares. Except for the net foreign assets, which still disadvantage less wealthy countries as they do for the middle group, all other asset types appear to have switched their roles in wealth distribution. In particular, it seems that the group of the least wealthy country representatives benefits greatly from possessing natural capital, which constitutes the most impactful component for them. Indeed, as presented in Table 1, the observed counterfactual deviation associated with the item reaches nearly −1% on average. Conversely, the bottom wealth share would be substantially enlarged without human capital, suggesting that the rich-poor gap in terms of this education-related asset class appears to be larger than that in non-human capital. Taken together with the results obtained above, this leads us to reflect on the still-limited role of education, among other factors, in the economic development of the less wealthy countries, which, instead, heavily depends on natural resources.

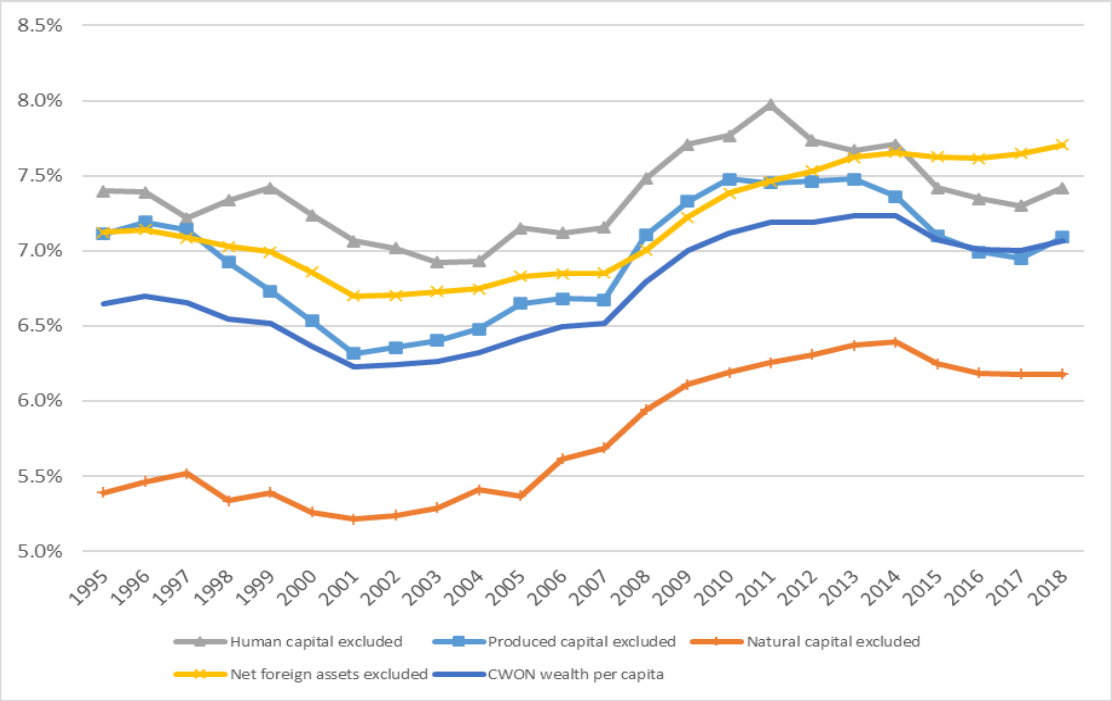

Figure 6. Counterfactual decomposition analysis on bottom 50% wealth. Sources: CWON and author's calculations.

4.2. Analysis based on the coefficient of variation

Another way to measure the inequality of wealth is through the coefficient of variation (*cv*), which is defined as the ratio of the standard deviation to the mean (see Shorrocks, 1982; Cancian and Reed, 1998). Unlike wealth shares, it is a *distribution-wide* measure to gauge the overall level of inequality among the units of observation. By using it, we can also break down inequality into its individual components and examine their individual contributions. In our case, this can be undertaken through a four-component decomposition equation as follows:

$$\begin{aligned} \mathrm{cv}^2_{total} = s^2_{hc}cv^2_{hc} + s^2_{pk}cv^2_{pk} + s^2_{nk}cv^2_{nk} + s^2_{nfa}cv^2_{nfa} + 2\rho_{hc,pk}s_{hc}s_{pk}cv_{hc}cv_{pk} \\ +2\rho_{hc,nk}s_{hc}s_{nk}cv_{hc}cv_{nk} + 2\rho_{hc,nfa}s_{hc}s_{nfa}cv_{hc}cv_{nfa} + 2\rho_{pk,nk}s_{pk}s_{nk}cv_{pk}cv_{nk} \\ +2\rho_{pk,nfa}s_{pk}s_{nfa}cv_{pk}cv_{nfa} + 2\rho_{nk,nfa}s_{nk}s_{nfa}cv_{nk}cv_{nfa} \end{aligned} \quad (2)$$

where s represents the component share in the total wealth of the 146 country representatives[7], and ρ is the correlation coefficient between any two components. The subscripts *total*, *hc*, *pk*, *nk*, and *nfa*, denote total wealth, human capital, produced capital, natural capital, and net foreign assets, respectively.

In the same vein as the previous before-after analysis regarding the wealth shares, we compare the observed level of coefficient of variation with its counterfactual level in the absence of a specific component. According to Equation (2), it is equivalent to setting the corresponding *s* equal to 0, holding the component variations and pairwise correlations unchanged. For instance, the *cv* of total wealth if there were no human capital, denoted as *cv_nohc,* can be written as:

$$\begin{aligned} \mathrm{cv}^2_{nohc} = \tilde{s}^2_{pk}cv^2_{pk} + \tilde{s}^2_{nk}cv^2_{nk} + \tilde{s}^2_{nfa}cv^2_{nfa} + 2\rho_{pk,nk}\tilde{s}_{pk}\tilde{s}_{nk}cv_{pk}cv_{nk} \\ +2\rho_{pk,nfa}\tilde{s}_{pk}\tilde{s}_{nfa}cv_{pk}cv_{nfa} + 2\rho_{nk,nfa}s\tilde{s}_{nk}\tilde{s}_{nfa}cv_{nk}cv_{nfa} \end{aligned} \quad (3)$$

where $\tilde{s}$ represents the new component share in the total wealth without factoring in human capital.

In Figure 7, we show the percentage changes in the coefficient of variation of wealth series before and after excluding human capital, produced capital, natural capital, and net foreign assets.

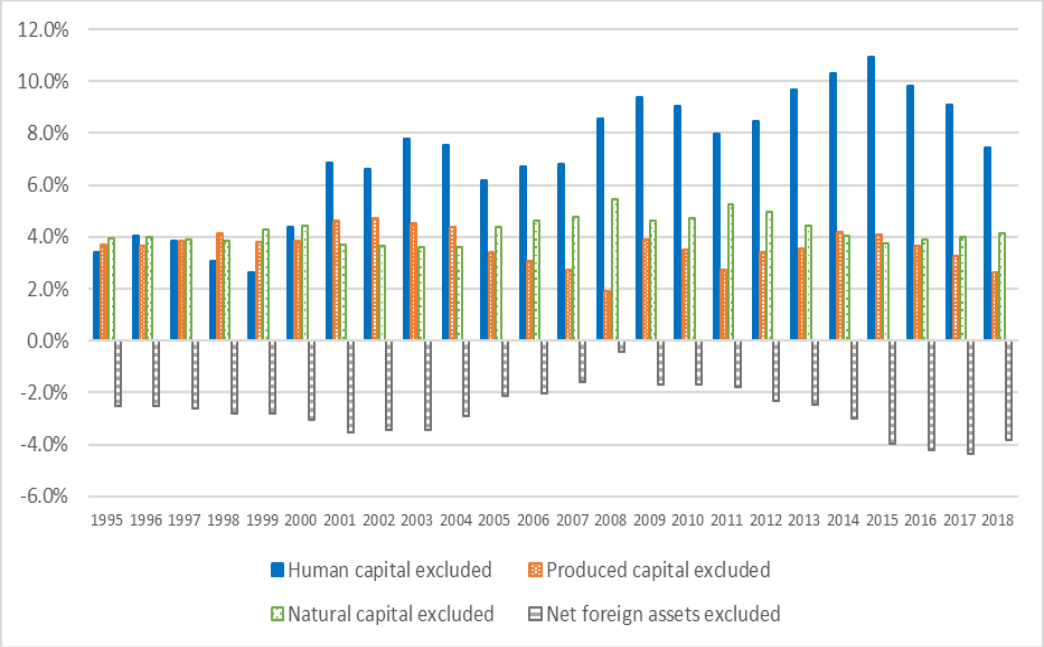

Figure 7. Percentage changes in coefficient of variation (*cv*) before and after excluding a component. Sources: CWON and author's calculations. Note: For example, the deviation

[7] In other words, *s* represents the component share in the sum of the wealth per capita of the sampled countries.

in *cv* regarding human capital = (coefficient of variation of the counterfactual wealth in the absence of human capital – coefficient of variation of the observed wealth)/coefficient of variation of the observed wealth. Sources: CWON and author's calculations.

At first glance, human capital appears to have the most significant equalizing effect, especially during the post–Great Recession era. In its absence, the coefficient of variation of wealth per capita would have increased by 7.1% on average from 1995 to 2018, and by 9.2% between 2008 and 2018. This suggests that education and employment have played vital and increasing roles in the convergence of wealth per capita across nations. Natural capital and produced capital follow as the next most important *equalizing* assets, with their average counterfactual changes being 4.3% and 3.6%, respectively. According to these results, less wealthy countries appear to benefit more from the accumulation of natural resources and urban/industrial assets. It is also worth noting that in 2008, the counterfactual-observed deviation for natural capital reached its peak over the sample period at 5.5%, while the deviation for produced capital was at its lowest at 1.9%. Arguably, these diverging performances imply that amidst the severe financial turmoil, the natural capital played a crucial role in maintaining the wealth levels of the less developed countries, while the equalizing effect of the produced capital weakened. By contrast, holdings of net foreign assets tend to always worsen wealth inequality; in their absence, the coefficient of variation of wealth per capita would decrease by an average of 2.7%. Interestingly, the contribution of this capital class to inequality thus measured also peaked in 2008 (−0.4%) and has decreased almost continuously since then. The results indicate that although the sudden and synchronized collapse of international trade and investment during the financial tsunami temporarily attenuated its disequalizing effect, holdings of foreign assets primarily benefit the wealthy countries as the world economy recovers.

5. Rank mobility of wealth per capita

In this section, we assess the yearly mobility of wealth per capita across nations, which obviously cannot be grasped by solely examining the international wealth dispersion (Kearl and Pope, 1984). Admittedly, as another important aspect of inequality, wealth mobility has been extensively studied at the micro-level, with a primary focus on the intergenerational correlation of wealth (see Hansen, 2014; Clark and Cummins, 2015; Adermon et al., 2018; Elinder et al., 2018; Fisher and Johnson, 2022). However, little attention has been given by both academia and policymakers to macro-level mobility and related questions, such as "to what extent do the international rankings of wealth per capita persist throughout time?". In addition, there has been even less discussion on how much the individual wealth components contribute to overall mobility. Addressing these questions is key to better understanding, from a stock perspective, the economic convergence or divergence among countries worldwide.

We employ the Spearman's correlation coefficient, a rank-based measure, to compare a nation's global wealth per capita ranking over time. Higher mobility corresponds to a lower rank correlation, indicating that a nation's current wealth ranking is less dependent on its past ranking. This measure, widely used in relevant literature (Chetty et al., 2014; Nybom and Stuhler, 2017; Elinder et al., 2018), is robust against certain measurement issues in short-run series and does not assume linearity in rank relationships (Deutscher and Mazumder, 2023).

Figure 8 displays the two-year rolling correlation results for the observed ranks in total wealth per capita, GDP per capita, and private wealth per adult from Credit Suisse's GWR dataset. First,

somewhat surprisingly, the national rankings in terms of CWON's total wealth per capita exhibit high persistence over time, as suggested by the large estimated coefficients close to 1. In addition, wealth mobility is significantly lower than the mobility of income measured by GDP[8]. In a certain sense, our findings can also be interpreted in a way such that the international convergence in wealth has achieved less success compared to income, a feature rarely discussed in the relevant literature. Moreover, private wealth displays the lowest mobility among the three measures. As previously discussed, it is believed that public wealth may exert some counter-balancing influence on the changes in private wealth.

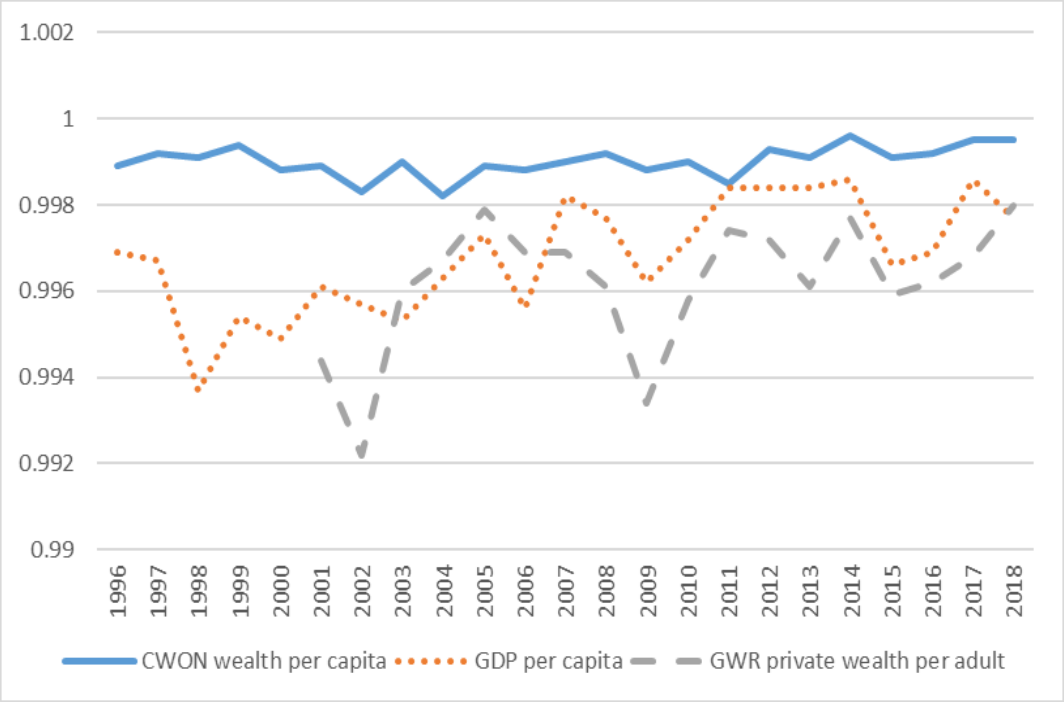

Figure 8. Spearman's correlation coefficients of wealth/income on a two-year rolling window. Sources: CWON, WDI, Credit Suisse's GWR, and author's calculations. Note: All correlation coefficients are statistically significant at 1% level (bootstrapped). Sources: CWON, WDI, Credit Suisse, and author's calculations.

The trends in wealth or income mobility are also of note. As shown in the figure, all three indexes fluctuate over time but broadly move upward. This implies that international rankings in both wealth and income have become increasingly persistent during the sampled period.

As already argued, the CWON's wealth series consists of four components with heterogeneous distribution characteristics. This leads to the question of how much the mobility of each component contributes to the overall mobility. To address this, we utilize the before-after approach again, which involves, in the first step, calculating the two-year rolling Spearman's correlation for the counterfactual case where a specific component is derived from the total wealth series. The estimated coefficients are then compared with the observed correlation, and the deviations between them can be used to measure the marginal impact of the corresponding component on wealth mobility.

[8] Notably, our macro-based results align with those from several micro-level studies recently documented in Fisher and Johnson (2022), namely the income mobility generally being higher than wealth mobility.

The results are shown in Figure 9. First, concerning human capital, it is important to note that, for clarity, the counterfactual correlation estimates for 2008–2011 are not included in the figure. This exclusion is due to the Spearman's rank correlations being exceptionally unstable during those years, which were affected by the financial crash and substantial fluctuations in global labor market conditions[9]. Nevertheless, this partial curve suggests that the Spearman coefficient would decrease in the absence of this type of asset, indicating that international mobility could increase without the influence of education and employment-based capital. This finding appears counterintuitive and should be interpreted with caution. Various factors, such as the quality of education (Hanushek, 2013), types of educational investments (Viaene and Zilcha, 2009), broader social networks and institutions (Adermon et al., 2021), and the interactions between human capital and other production factors (Erosa et al., 2010), may undermine the widely held view that human capital, particularly education, benefits less wealthy countries. Indeed, some research, such as Peet et al. (2015), indicates that the return on education is not systematically higher in developing countries than in developed countries. Therefore, a more nuanced understanding of human capital's role in wealth inequality across countries and its dynamics, especially when considering relevant socio-economic conditions, is necessary for future research

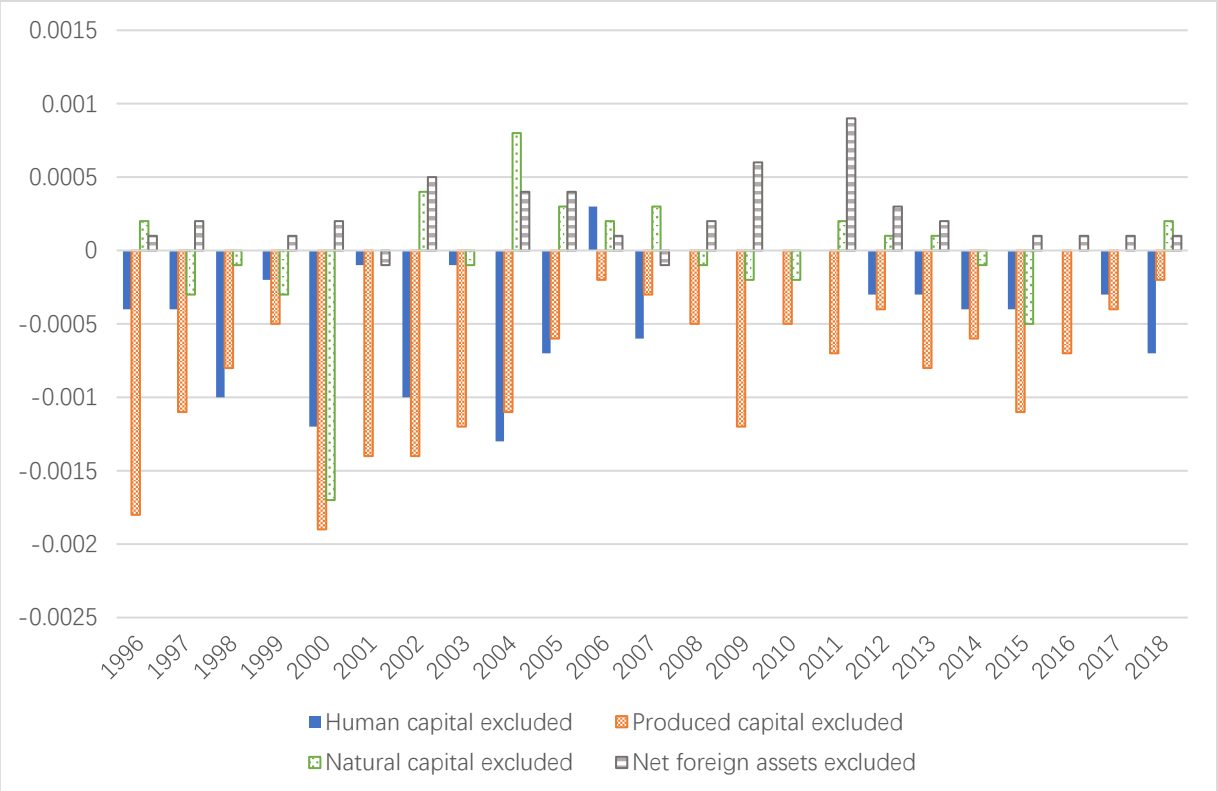

Figure 9. Counterfactual deviation of Spearman's correlation coefficients by wealth components. Note: All correlation coefficients are statistically significant at 1% level (bootstrapped). Sources: CWON and author's calculations.

[9] The correlation coefficients for the year pairs of 2007–2008, 2008–2009, 2009–2010, and 2010–2011 are 0.9948, 0.9812, 0.9989, and 0.9802, respectively.

Likewise, with negative counterfactual deviations, produced capital also exerts a significant counterforce to mobility. Indeed, its adverse impacts on mobility generally exceed those of human capital for most year-pairs. This result indicates that the inequality in per capita industrial and urban assets is remarkably persistent as well. Importantly, it has special implications for developing countries; their catching-up in the accumulation of produced capital appears to be more difficult than that of other aspects. While the existing development literature offers limited exploration of this topic, it does provide suggestive arguments related to the complex relationships among industrialization, urbanization, economic growth, and wealth accumulation. For instance, Fay and Opal (2000) point out that many African countries have experienced continuous and sometimes quite rapid urbanization but without substantial economic growth since the 1960s—a phenomenon further documented by Glaeser (2013) as "the rise of poor country urbanization". In addition, Gollin et al. (2016) argue that industrialization and urbanization are not necessarily correlated, especially when the latter is led by natural resource booms.

Next, natural capital's contribution to wealth mobility fluctuates greatly over time due to its high sensitivity to fluctuating commodity prices. However, when considered on average, its impact is negligible, implying that it cannot sustainably drive a country's movement, either upward or downward, in international wealth rankings. Obviously, this can be interpreted within the extensive literature on the role of natural resources—whether as a blessing or a curse—in economic development (see van der Ploeg, 2011). Nevertheless, when combined with our findings shown in Section 4 that the least wealthy countries depend heavily on natural capital in their wealth composition, one may reach an interesting conclusion that existing studies rarely highlight: Even if natural capital could be a blessing for poor countries, it is unlikely to drive them sustainably to higher levels of wealth. In some ways, this result is also consistent with the findings of Gollin et al. (2016) mentioned above, which reveal that the exploitation and export of natural resources may lead to urbanization without an increase in industrial productivity. The latter, clearly constitutes the most important engine for long-term economic development and sustainable wealth accumulation, as argued in the neoclassical theory of economic growth (Solow, 1956).

Finally, net foreign assets typically have a positive impact on wealth mobility, with few exceptions. However, given the prior findings indicating that this specific capital class leads to more unequal wealth distribution, caution is needed when interpreting these results. On the one hand, what we found in the previous section suggests that the liberalization of international capital flows tends to particularly benefit the wealthier countries, which, in general, possess more of this type of capital. On the other hand, the liberalization of international trade and investment, which leads to frequent capital movements worldwide, can easily cause shifts in the global rankings of wealth per capita. Together, these findings reveal two distinct yet not inconsistent aspects of wealth inequality across nations, offering insights into financial globalization, which—as widely documented—creates both winners and losers, depending greatly on the economic structural characteristics and the quality of institutions and policies (see Kose et al., 2009; Broner and Ventura, 2016).

In the following analysis, we explore the rank correlations of wealth per capita across different year-pairs and components. The results are presented in Table 2. Despite a decline in Spearman's coefficient with increasing time spans, the correlations remain strong, whether with a 12-year interval or a 24-year interval. Notably, although the total wealth and its components (except for produced capital) display higher correlation coefficients from 2007 to 2018 than those from 1995 to 2006, the Chi-squared statistics indicate that the coefficients between the two sub-periods are not significantly

different. This holds true not only for the overall correlation but also for all the component-level correlations, suggesting that the global financial crisis has not had a systemic impact on the mobility of international rankings in wealth per capita.

Table 2. Spearman's correlations by different year-pairs and components.

Year-pairs/variables	Total wealth	Human capital	Produced capital	Natural capital	Net foreign assets
1995&2018	0.9594	0.9568	0.9525	0.8717	0.3562
	(0.0095)***	(0.0099)***	(0.0122)***	(0.0263)***	(0.0915)***
1995&2006	0.9803	0.9754	0.9874	0.9190	0.5835
	(0.0059)***	(0.0065)***	(0.0036)***	(0.0201)***	(0.0792)***
2007&2018	0.9887	0.9840	0.9848	0.9479	0.6470
	(0.0029)***	(0.0039)***	(0.0055)***	(0.0176)***	(0.0752)***
Chi-squared statistics for equality of the two coefficients above	0.34	0.22	0.06	0.52	0.34

Note: Bootstrap standard errors in parentheses, with *** representing significance at the 1% level.

Further examination of the component-level features reveals that individual components also differ in mobility and thus provide some explanation for the prior results from the decomposition analysis. With the smallest rank correlations, net foreign assets display the highest mobility over time. Natural capital follows behind, exhibiting relatively low persistence in rankings as well. In contrast, both human and produced capital show high rank correlations, indicating a greater degree of persistence. In other words, they constitute the two most important stabilizers of wealth ranking across nations, whether for the rich or for the poor.

Next, we explore the mobility by groups of different wealth levels. To address the issue, the total sample is divided into five subsamples of 30 countries according to their positions in the ranking of 2018. This creates five quintiles ranging from the richest to the poorest in terms of wealth per capita, denoted as *top*, *upper middle*, *middle*, *lower middle*, and *bottom*, respectively. We then regress their ranks in 2018 on those in 1995, and the corresponding equation is shown below. In a similar vein as Spearman's correlation, the estimated slope coefficient, β, serves as an inverse measure of mobility[10].

$$rank2018_i = \alpha + \beta \times rank1995_i + \varepsilon_i \quad (4)$$

As presented in Table 3, these rank-based regressions by quintile all produce statistically significant coefficients. In particular, with an estimate of 0.7933, the ranks of the top 20% in 2018 are highly correlated with their positions from 24 years ago. To a lesser extent, the rank correlation is also strong for the bottom group, while the three quintiles in the middle (representing the middle 60%) are associated with the lowest coefficients[11]. Essentially, this suggests that middle-wealthy groups tend to maintain their wealth status despite notable mobility within the middle strata, while it remains difficult for lower-wealth groups to escape poverty. Additionally, we estimate the rank correlations for GDP per

[10] Because some countries change their quintiles during 1995–2018, the Spearman's correlation cannot be directly applied in this case.

[11] It is noteworthy that the rank correlations by quintile can also be assessed using the coefficient of determination, namely the adjusted R-squared. As shown in Table 3, this alternative method yields similar results to those presented in the text.

capita and present the results in Table 4. Compared to wealth ranks, income ranks generally exhibit higher mobility, but the quintile characteristics are largely similar.

The findings above align with, or at least do not contradict, two heated but inconclusive arguments in development literature, namely the so-called "middle-income trap" and "poverty trap" (see Eichengreen et al., 2013; Barrett et al., 2018). More interestingly, our study suggests that when focusing on wealth, rather than income, those *trapped* countries would face more serious challenges to escape from the awkward situations.

Table 3. Rank-rank regressions for wealth per capita between 1995 and 2018, by quintile in 2018.

Variable/Quintile	Top	Upper middle	Middle	Lower middle	Bottom
Rank in 1995	0.7933	0.3777	0.1793	0.1913	0.4645
	(0.0883)***	(0.1198)***	(0.0859)**	(0.1025)*	(0.0799)***
R-squared adjusted	0.7713	0.3534	0.0995	0.0873	0.3809

Notes: Every quintile is set to include 30 economies. Bootstrap standard errors in parentheses, with ***, **, and * representing significance at the 1%, 5%, and 10% level, respectively. All regressions are run with a constant.

Table 4. Rank-rank regressions for GDP per capita between 1995 and 2018, by quintile in 2018.

Variable/Quintile	Top	Upper middle	Middle	Lower middle	Bottom
Rank in 1995	0.6458	0.2389	0.1970	0.2721	0.3439
	(0.1329)***	(0.0671)***	(0.0512)***	(0.0846)***	(0.1008)***
R-squared adjusted	0.4513	0.1920	0.2507	0.2572	0.2905

Note: See Table 3.

Before concluding, we also examine the relationship between wealth per capita mobility and the size of the economies in question. As shown in Table 5, when size is measured by total national wealth, medium-sized nations have a higher rank coefficient than either small or large nations, indicating that they may be less well positioned to achieve higher mobility in wealth per capita. Arguably, medium-sized economies may experience fewer structural shocks than small ones, while benefiting less from economies of scale and a comprehensive industrial structure compared to large ones. This in-between position might lead them to maintain their international status in wealth per capita.

Table 5. Rank-rank regressions for wealth per capita between 1995 and 2018, by size of national wealth in 2018.

Variable/Quintile	Small	Medium	Large
Rank in 1995	0.8669 (0.0495)***	0.9589 (0.0411)***	0.8592 (0.0490)***
R-squared adjusted	0.8301	0.9137	0.9035

Notes: The economies are categorized as small, medium, and large based on their levels of national wealth, with each category containing 50 economies. For other notes, see Table 3.

6. Concluding remarks

Using World Bank's CWON data, this study provides descriptive evidence for the inter-country inequality of wealth on a per capita basis. Specifically, by mimicking the share-based distribution

within an economy, we first describe the top/middle/bottom shares in the wealth of an imaginary world composed of 146 country representatives. Overall, it is found that the wealth inequality thus measured decreased before the 2008 global financial crisis and has remained stable since then. Relying on the before-after approach, we then compare the observed wealth shares with the counterfactual shares, namely the top/middle/bottom shares if one specific wealth component is excluded. The main results of the share-based decomposition analysis can be summarized by component. First, human capital tends to reduce the wealth shares of the top and bottom country representatives, while significantly favoring the middle-wealthy group. Second, produced capital plays a similar role as human capital, but its impacts on the top and middle groups appear to be more pronounced. Third, natural capital accumulates in favor of the bottom half, while its contributions to the wealth shares of the other two strata are negative. Fourth and last, net foreign assets significantly increase the wealth share of the top decile—the sole beneficiary from holding this capital class. Alternatively, the distribution-wide analysis based on the coefficient of variation produces consistent results on wealth disparity and its component-level properties.

Through the lens of rank-rank correlations, the paper also explores the mobility of national ranking in terms of wealth per capita. The Spearman's pairwise correlations for ranks in different years suggest that wealth mobility appears extremely low and even decreases over the sample period. To a greater extent, it is also true for the mobility of GDP and private wealth. Next, counterfactual decomposition analysis shows that first, both human and produced capital tend to solidify the wealth ranking of nations globally. Second, natural capital's influence on mobility remains highly varying over time but negligible if the period average is taken. Third and finally, net foreign assets appear to consistently increase the overall wealth mobility. In relating the mobility of wealth to its distribution, further research shows that the top quintile and bottom quintile of wealth have the strongest rank correlations between 1995 and 2018. This indicates low mobility within these two extreme groups, respectively.

In conclusion, by examining the worldwide distribution and mobility of wealth per capita, this study sheds light on the reasons behind worldwide wealth inequality and the resulting global conflicts. In particular, as demonstrated in our investigation, the changes in global wealth inequality can be better understood and thus addressed by examining the changing composition of national wealth. This composition varies significantly across countries and affects how economies respond to worldwide challenges such as accelerating climate change and volatile globalization. For instance, countries that depend heavily on natural resources are more susceptible to adverse impacts from global warming, natural disasters, and commodity market fluctuations; on the other hand, countries with fewer foreign assets tend to have a less favorable attitude toward international trade and investment. In addition, the paper also offers a novel perspective on assessing the impacts of the global financial crisis on worldwide wealth inequality and composition. Overall, our findings hold important implications for international organizations, national policymakers, and academics in promoting balanced and sustainable development of the global economy. Looking ahead, this study can serve as a valuable starting point for future research on the issue, especially in understanding the mechanisms underlying the changes in national wealth and its composition, and their interaction with cross-country inequality in a globalized context. Furthermore, since a complex interplay may exist among inequality, the 2008 crisis, and globalization, new academic efforts are required to fully unravel the ways by which the three elements are connected.

Use of AI tools declaration

The author declares he has not used Artificial Intelligence (AI) tools in the creation of this article.

Conflict of interest

The author declares no conflict of interest in this paper.

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