



Augmented Human Development Index

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Concept, Sources and Procedures

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CONCEPT

Augmented Human Development Index¹

Human wellbeing is widely viewed as a multidimensional phenomenon, in which income is only one facet. Human development, originally defined as a process of enlarging people's choices, namely, enjoying a healthy life, acquiring knowledge and achieving a decent standard of living, provides a multidimensional measure of wellbeing.

These achievements provide individuals with freedom to choose and the opportunity to lead their own lives. Thus, human development can be depicted as positive freedom by which individuals are granted access to resources, including property, that allow them to develop their personal potential.

Dimensions of Augmented Human Development

In order to provide a synthetic measure of augmented human development, its different dimensions are expressed in index form,

- life expectancy at birth as a proxy for a healthy life,
- years of schooling as a proxy for access to knowledge,
- liberal democracy as a proxy for freedom,
- and discounted GDP per head as a surrogate for wellbeing dimensions other than education and health.

Life expectancy is defined as the average number of years of life which would remain for males and females reaching the ages specified if they continued to be subjected to the same mortality experienced in the year(s) to which these life expectancies refer. Education attainment is measured by the average years of total schooling (primary, secondary, and tertiary) for population aged 15 and over.

The Liberal Democracy Index combines the electoral democracy index and the liberal component index. The former incorporates indices of freedom of association, expression, suffrage, and clean elections. The latter includes indices of equality before the law and individual liberty, judicial constraints on the executive, and legislative constraints on the executive. GDP per head is expressed in 1990 dollars adjusted for its purchasing power adjusted , that it, for the difference in price level across countries (the so-called Geary-Khamis [G-K] 1990 \$).

As social variables (longevity and education) have upper and lower bounds (unlike GDP per head that has not known upper bound), they are transformed non-linearly in order to allow for two main facts: that increases of the same absolute size represent greater achievements the higher the level at which they take place; and that quality improvements are associated to increases in quantity. Thus,

I=f(x,Mo,M)=(log(M-Mo)-log(M-x))/log(M-Mo),

Where I is the dimension index, x is an indicator of a country's standard of living, M and Mo are the maximum and minimum values, respectively, or goalposts, that facilitate comparisons over time and log stands for the natural logarithm. The index for each dimension ranges between 0 and 1.

In the case of Liberal Democracy Index, as it measures both quantity and quality changes, a linear transformation has been accepted. Thus,

I = (x - Mo) / (M - Mo)

^{1.} The Augmented Human Development Index (AHDI) is inspired in and adapts from a long run perspective The United Nations Development Programme's Human Development Index (HDI) (UNDP, 2022). A detailed explanation of the concept, computation procedures, and analysis of the results is provided in Prados de la Escosura (2021).

For GDP per head, as it is intended as crude proxy for those dimensions of wellbeing other than education and health, logarithmic transformation has been introduced. The log transformation implies that, in terms of human development, returns of per capita income decline as it reaches higher levels. Given its non-bounded nature, without this transformation, GDP per head would dominate the human development index rendering it redundant. In order to get the income index I have used the same formula used for liberal democracy, except that x, M, and Mo are expressed in logs.

Goalposts are set for human development's different dimensions. For life expectancy at birth, the maximum and the minimum values were established at 85 and 20 years, respectively. For years of schooling, maximum and minimum values were set at 15 and 0. In the case of liberal democracy, as it was already in index form, 1 and 0 were accepted as the goalposts. Lastly, for per capita GDP, the maximum and minimum values over 1870-2020 were G-K 1990 \$47,000 and \$100, respectively.

The Augmented Human Development Index

The indices for each dimension are, then, combined using equal weights into an index of human development.

In an attempt to reduce the substitutability between its different dimensions –namely, to avoid that a high achievement in one dimension linearly compensates for a low achievement in another–, the indices for each dimension are combined into a historical index of human development using a geometric average.

If we denote the non-linearly transformed values of life expectancy and education as LEB and EDU, LD to represent those of liberal democracy, and the adjusted per capita income as UNY, the historical index of human development can be expressed as, **Time and Spatial Coverage**

As regards the time span considered, the initial date, 1870, has been as the starting point because it is when large scale improvements in health, helped by the diffusion of the germ theory of disease since the 1880s, and mass education began in Western Europe and the European Offshoots. It is also in the late nineteenth century when, along the advance in medical knowledge, social spending started expanding in Western Europe and its offshoots.

Over the entire time span, 1870-2020, 115 countries are considered, and its number rises up to 121, 146, 161, and 162 countries for the samples starting in 1913, 1950, 1980, and 1990, respectively. These samples represent above 90 per cent of the world population (and practically 100 per cent after 1950).

References

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Prados de la Escosura, L. (2022), Human Development and the Path to Freedom. From 1870 to the Present, Cambridge: Cambridge University Press.

United Nations Development Programme (UNDP) (2022), *Human Development Report* 2021/2022, New York: United Nations Development Programme.

Alert: measuring changes in the index

By how much did human development improve over the long run? Given the way in which the index has been computed, the conventional logarithmic rate of variation (as in the case of GDP per head) can be used.

 $AHDI = LEB^{1/4} EDU^{1/4} LD^{1/4} UNY^{1/4}$

SOURCES AND PROCEDURES

Life Expectancy at birth

Life expectancy is defined as "the average number of years of life which would remain for males and females reaching the ages specified if they continued to be subjected to the same mortality experienced in the year(s) to which these life expectancies refer" (United Nations, 2000). Most data for the period 1980-2020 come from the Human Development Reports (UNDP, 2010, 2016, 2021-22) while the World Bank (World Development Indicators) provides data for 1960-1975 (exceptionally completed with data from UNESCO) and the United Nations" Demographic Yearbook Historical Supplement (United Nations, 2000) for the 1950s. Pre-1950 estimates come mostly from Riley (2005b), Flora (1983), and the OxLAD database for Latin America (Astorga et al., 2003), completed with the national sources listed below. Nonetheless, for Most OECD countries (namely, Europe, the European Offshoots -Australia, Canada, New Zealand-, plus Israel, Japan, Korea, and Taiwan), the Human Mortality Dataset https://www.mortality.org/ (HMD hereafter) has been preferred, completed with the Clio-Infra Dataset https://www.clio-infra.eu/.

Occasionally, dearth of data has forced me to introduce some assumptions for the period before the epidemiological or health transition that, in developing regions, particularly those of South Asia and Sub-Saharan Africa, often started during the Interwar years (Omran, 1971; Riley 2005b, 2005c). In particular, I have accepted Riley's (2005a, p. 539) assumption that "the average of all life expectancy estimates of acceptable quality for countries in a region provides the best available gauge of the pretransition average for the entire region".

Maximum and the minimum values for the life expectancy index were established at 85 and 20 years, respectively. A "floor" of 25 years has been accepted as the minimum historical value for life expectancy at birth. Such a "floor" precludes a zero value for the transformed life expectancy index and, consequently, for the AHDI.

Africa

North. Algeria, 1913-1925, and 1938, Clio-Infra. 1900-1929, inferred from the infant survival rate (ISR, that is, 400 –as the maximum infant mortality rate per thousand- less the country's infant mortality rate (Prados de la Escosura, 2013). Egypt, 1929-1938, from Fargues (1986); 1913, assumed to be as Tunisia's; and 1900, as Algeria's. Libya, 1900-1938, assumed to be identical to Egypt's. Morocco, 1900-1938, assumed to be as Algeria's, except 1913, as Tunisia's. Tunisia, 1900, 1929, assumed to be the same as Algeria. 1913, 1925, Conté (1973), cited in Riley (2005); 1930s, Clio-Infra.

Central. Estimates for CAR, Chad, Congo, Congo D.R., and Gabon over 1870-1929, and for Cameroon (1870-1913)inferred from heights (Prados de la Escosura, 2013).

West. Figures for 1938 are backwards projected with estimates inferred from heights and infant survival rates (ISR) (Prados de la Escosura, 2013), for Benin, Burkina Faso, Côte d'Ivoire, Gambia, Ghana (but for 1913), Guinea, Guinea-Bissau, Liberia, Mali, Nigeria (but for 1929, from Ayeni 1976), Senegal (but for 1929), and Sierra Leone (but for 1929). Mauritania's and Niger's assumed to identical to Mali's. Togo's assumed to be as Benin's, but Benin in 1913, as Ghana's.

East. Data for 1938 backwards projected with estimates inferred from heights and ISR, for Burundi, Ethiopia, Rwanda, Somalia, and Tanzania. Djibouti's assumed to be as Ethiopia's (Prados de la Escosura, 2013). Riley (2005b) provides estimates of 23.9 years for Kenya and Uganda in the 1930s, so I assigned the minimum historical value of 25 years to these countries over 1870-1929. Sudan's was assumed to be as Kenya's.

Southern. Data for 1938 backwards projected with estimates inferred from heights and ISR, for Angola, Botswana (1913), Malawi, Mauritius (1870-1913), Namibia (1870-1880), South Africa (1870), Swaziland (1929), and Zambia. Namibia, 1890-1900, assumed to be the same as for blacks in Cape Colony, from Simkins et al. (1989); 1929-1938, from Notkola et al. (2000), estimated from Northern Namibia's figures adjusted with the ratio all Namibia to Northern Namibia c. 1960. South Africa, 1880-1913, estimates from Simkins et al. (1989). For Zimbabwe, Riley (2005b), following Condé (1973), assigned 26.4 to the 1930s, so I have assigned the minimum goalpost over 1870-1929. Botswana's (but for 1913), Lesotho's, and Swaziland's (but for

1929), were assumed to be identical to Namibia's. Madagascar's, assumed to as Mauritius's and Mozambique's as Malawi's. Mauritius, 1930s, Clio-Infra.

Americas

For Latin America, most data come from Arriaga (1968) and the **MOxLAD** database (Astorga et al. 2003) (supplemented with the working sheets prepared by Shane and Barbara Hunt which have been kindly provided by Pablo Astorga). In addition, national sources used are:

Argentina, 1870-1890, Recchini de Lattes and Lattes (1975).

Chile, 1890-1900, assumed to have evolved along Argentina; 1913, 1930s, Clio-Infra; 1950-2005, Díaz, Lüders, and Wagner (2016). Uruguay, 1870-1900, assumed to have evolved along Argentina; 1900-1938, Ministeriode Salud Pública (2001), Life expectancy for Colombia, 1870-1900, Cuba, 1870-1900, Panama, 1880-1900, Honduras, 1890-1900, Puerto Rico, 1870-1890, and Venezuela, 1880-1900, has been assumed to evolve along Costa Rica. Ecuador, 1925-1938, assumed to evolve along Paraguay. Peru, 1913-1933, assumed to evolve along Bolivia. Puerto Rico, 1870-1890, assumed it evolves along Costa Rica; 1890, Riley (2005b); 1900-1938, UN (1993). Jamaica, 1870-1880, assumed it evolves along Costa Rica; 1880-1955, Riley (2005a: 198).

Trinidad-Tobago, 1870-1900, assumed to evolve along Jamaica.

Bahamas and Belize, 1870-1938, assumed to evolve along Jamaica.

Barbados, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, and Surinam, 1870-1938, assumed to evolve along Trinidad and Tobago. St. Kitts and Nevis, 1950-1975, assumed to evolve as Surinam.

Canada, 1870-1890, Clio-Infra; 1925-2010, HMD.

U.S.A., 1870-1890, Haines (1994); 1913-1929, Clio-Infra; 1933-2015, HMD.

In the absence of life expectancy estimates for early years projecting the available figures with infant survival rates (ISR) has derived them for Panama, 1900-1929 and Guyana, 1950-1960. Such a procedure was also used to distribute the average life expectancy estimate for Argentina, 1869-1894.

Asia

Most pre-1950 estimates come from Riley (2005b) who claims that the earliest health transition started in the 1870/1890s when mean and median values were 27.5 and 25.1 years, respectively. Lower bound estimates for 1950 or 1940s levels were used for 1938. In the absence data, pre-1929 life expectancy at birth was assumed to be 25 years. Bahrain, Oman, Qatar, UAR, and Yemen, 1913-1938, assumed to evolve along Kuwait. Brunei Darussalam, 1929-1938, assumed to evolve as Malaysia. Cambodia, 1925-1929, assumed it evolved along China as they had similar levels in 1938; 1938, Siampos (1970), cited in Riley (2005b). China, 1929, Caldwell et al. (1986), cited in Lavely and Wong (1998); 1930s, Clio-Infra. Hong Kong SAR, 1900-1938, assumed to evolve along Taiwan. India, 1880-1938, Clio-Infra; extrapolated to 1870 with Visaria and Visaria (1982); 1900 and 1925, McAlpin (1983). Indonesia, 1929, Riley (2005b); 1930s, Clio-Infra. 1950-1980, Clio-Infra; 1985-2010, Israel, HMD. 1870, 1880, Japan, Riley (2005b); Janetta and Preston (1991); 1890-1900, Johansson and Mosk (1987); 1950-2015, HMD. Jordan, 1929-1938, assumed to evolve as Syria's. 1913-2000, Clio-Infra; 2005-2015, Korea, HMD. 1929, assumed to evolve as Vietnam. Laos, Lebanon, 1870-1938, assumed to evolve along Cyprus. Malaysia, 1929-1938, obtained by projecting 1950 level backwards with the infant survival rate. Nepal, 1925-1933, assumed to evolve as India. Singapore, 1929-1938, obtained by projecting 1950 level backwards with the infant survival rate. 1890-1913, 1938, Langford Sri Lanka, and Storey (1993); 1929, Sarkar (1951) Taiwan, 1890-1938, Cha and Wu (2002). The level assumed for 1890 by Cha and Wu, 25 years, accepted for 1870-1880. 1950, Glass and Grebenik (1967); 1955, Taiwan Official statistics; 1970-2010, HMD. 1938, Vallin Thailand, (1976). 1870-1900 1925-1933 Turkey, and assumed evolve 1913, as Greece's; Pamuk to (2007); 1938, Shorter and Macura (1982).

Europe

Albania, 1870-1890, assumed to evolve along Greece; 1900-1933, assumed to evolve along Bulgaria. Austria, 1870-1929, Clio-Infra; 1950-2010, HMD. Belgium, 1870-2015, HMD.

Belarus, 1950s, Clio-Infra; 1960-2015, HMD.

Bulgaria, 1870-1890, assumed to move along Greece; 1913-1938, Clio-Infra; 1950-2010, HMD.

Croatia, 2005-2015, HMD.

Cyprus, 1870-1880, assumed to be identical to Greece; 1890, Riley (2005b); 1900-1938, Clio-Infra. Czechoslovakia/Czechia, 1870-1938, Sbr (1962); 1890, Riley (2005b); 1950-2015, HMD. Denmark, 1870-2015, HMD.

Estonia, 1938-1955, Clio-Infra; 1960-2015, HMD. Finland, 1870, Kannisto et al. (1999); 1880-2015, HMD. France, 1870-2015, HMD.

Germany (only Federal Republic, 1950-1985), 1870-1890, Flora (1983); 1950s, Clio-Infra; 1960-2015, HMD. Greece, 1870-1913, Valaoras (1960), 1933-1980, Clio-Infra; 1985-2015, HMD. Hungary, 1870-1890, assumed to evolve along Austria; 1950-2015, HMD.

Iceland, 1870-2015, HMD.

Ireland, 1850-1890, assumed to evolve along the U.K.; 1950-2015, HMD

Italy, 1870, Felice et al. (2016); 1880-2010, HMD.

Latvia and Lithuania, 1925-1955, Clio-Infra; 1960-2010, HMD.

Luxembourg, 1913-1955, Clio-Infra; 1960-2010, HMD. Netherlands, 1870-2015, HMD.

Norway, 1870-2015, HMD.

Poland, 1870-1913, assuming it evolved as

Czechoslovakia; 1950-2010, HMD. Portugal, 1850-1913, Leite (2005); 1925 (interpolated) and 1933, Valério (2001; I); 1929, Veiga (2005); 1938, United

Nations (1993); 1950-2015, HMD.

Romania, 1870-1880, assumed to evolve along Greece, 1890-1890, and along Bulgaria, 1890-1929. Russia, Pressat (1985) for European Russia, 1870-1913, and European Soviet Union, 1929-1938; 1950s, Clio-Infra; 1960-2015, HMD.

Slovakia, 1925, Clio-Infra; 1929-1938, Sbr (1962); 1950-2015, HMD.

Slovenia, 1950-1980, Clio-Infra; 1985-2015, HMD. Spain, 1870-1890, Felice et al. (2016); 1900, Dopico and Reher (1998); 1913-2015, HMD.

Sweden, 1870-2010, HMD.

Switzerland, 1870, Flora (1983); 1880-2010, HMD. Ukraine, 1900, Mazur (1969); 1925-1955, Clio-Infra; 1960-2010, HMD. United Kingdom, 1850-1900, Floud and Harris (1997); 1925-2015, HMD.

Yugoslavia, assumed to evolve along Greece, 1870-1880, and along Bulgaria, 1890-1929. For 1929 and 1938 life expectancy was estimated by projecting the available figures with infant survival rates for 1950.

Oceania

Australia, 1870-1900, Whitwell et al. (1997); 1925-2015, HMD.

New Zealand (adjusted for Maori population up to 1950), 1870, Riley (2005b); 1880-1890, Glass and Grebenik (1967); 1950-2010, HMD.

Average Years of Education

Education attainment is measured by the average years of total schooling (primary, secondary, and tertiary) for population aged 15 and over. Most figures for 2010-2020 derive from the Human Development Reports (UNDP, 2013, 2016, 2021-22). For 1870-2010, the most comprehensive database is the Clio-Infra dataset (https://www.clio-infra.eu/Indicators/ AverageYearsofEducation.html) put together by Bas van Leeuwen, Jieli van Leeuwen-Li, and Péter Földvári in 2013, which provides decadal figures (years ending in 0). These figures come from historical reconstructions derived from national statistical offices for the post-1960 and the authors' own estimates through the perpetual inventory method up to 1950. Clio-Infra database relies on Morrisson and Murtin (2009) dataset for 78 countries at 10- year intervals.

I completed the dataset with estimates for years ending in 5 between 1915 and 2005 from Földvári and van Leeuwen (2014) for Europe, while for the rest of the world have interpolated them on the basis of Barro and Lee (2013, version 2.2, updated on June 2018) average years of schooling for population aged 15 and over for 1950-2010, and Lee and Lee (2016) dataset for years of schooling for population aged 15-64, for 1915-1935. Specifically, for, say, 2005, the formula used is

$\Upsilon_{_{2005}} = ((2^*\!X_{_{2005}}) / (X_{_{2000}} + X_{_{2010}})) * (\Upsilon_{_{2000}} + \Upsilon_{_{2010}}),$

where Y represents the Clio-Infra values and X those of Barro and Lee (2013, v. 2.2).

I have assigned the values for 1915, 1930, 1935, and 1940 to my 1913, 1929, 1933, and 1938 benchmarks, respectively.

I have filled missing values for earlier years in Clio-Infra by projecting its levels with Lee and Lee (2016) estimates. This was the case for Barbados, Colombia, and Ecuador (1870); Cyprus and Serbia (1870-1880); Czechia and Romania (1870-1890); Iceland, Poland, Gambia, and Zambia (1870-1913); Haiti and Togo (1870-1925); D.R. Congo, Lesotho, Liberia, Libya, Swaziland, Afghanistan, Cambodia, and Jordan (1870-1938).

I have also filled Clio-Infra missing values by projecting its levels with Barro and Lee (2013, 2018) for Estonia, Latvia, Lithuania, Ukraine, Burundi, Central African Republic (C.A.R.), Gabon, Armenia, and Nepal (1950-1955); and Moldova, Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan (1950-1965).

Lack of Clio-Infra 1950-2010 estimates for Belize, Albania, Croatia, Malta, Slovenia, Sudan, Bahrain, Brunei Darussalam, Hong Kong, Indonesia, Kuwait, Mongolia, Qatar, Taiwan, United Arab Emirates (U.A.E.), and Yemen led me to use Barro and Lee's (2013, v. 2.2) figures for these countries. For Belize, Albania, Malta, Sudan, Hong Kong, Kuwait, Taiwan, and Yemen, Barro and Lee's figures for 1950 were projected backwards to 1870 with Lee and Lee's (2016) years of schooling. Lastly, missing values for some countries before 1950 have been estimated by assuming they evolved along their neighbours:

Africa

Botswana, 1870-1913, and Namibia, 1870-1938, assumed to evolve as Lesotho; pre-1960 Burkina Faso, Chad, and Guinea, as Mali, Niger, and Sierra Leone, respectively; pre-1950 Burundi and Rwanda, as Uganda; pre-1950 CAR, Congo, and Gabon, as Cameroon; pre-1950 Mauritania as Senegal; pre-1950 Tanzania as Kenya; Seychelles, 1870-1913, as Mauritius. Guinea-Bissau, 1870-2010, was assumed to evolve as Guinea.

Americas

Bahamas, 1870-1990, assumed to evolve along Barbados and St. Kitts and Nevis and St. Vincent and the Grenadines, 1870-2005, as Trinidad-Tobago.

Asia

It has been assumed that pre-1929 Lebanon evolved as Cyprus; pre-1950 Laos as Cambodia; and pre-1950 Bahrain, Brunei-Darussalam, Qatar, Saudi Arabia, and United Arab Emirates (U.A.E.) as Kuwait.

Maximum and the minimum values are established at 15 and 0 years, respectively. However, the lowest historical value was set at 0.1 years of education. Such a 'floor' precludes a zero value for the transformed education index and, consequently, for the HIHD.

Europe

Germany, 1950-1985, only the Federal Republic.

Liberal Democracy Index

Varieties of Democracy [V-Dem.12] provides the Liberal Democracy Index (Coppedge et al., 2022). It combines the Electoral Democracy Index and the Liberal Index. The former incorporates indices of freedom of association, expression, suffrage, and clean elections. The latter includes indices of equality before the law and individual liberty, judicial constraints on the executive, and legislative constraints on the executive.

The index ranges between 0, low, and 1, high. As for other dimensions of human development I have adopted a 'floor' level that in this case is 0.01.

In the absence of data for the Liberal it Democracy Index was assumed the index evolved as the Liberal Index or, alternatively, as the Electoral Democracy Index.

Missing values for some countries (mostly) before 1900, have been derived by assuming that they evolved along their neighbours and, exceptionally, were assigned the same values. When values for 1900 or 1913 were very low, I assigned the 'floor' value of 0.01 for previous benchmark years, unless the level was above 0.02, in which case I subtracted 0.01 for each previous decadal benchmark successively until reaching the 'floor' value.

Africa

Lacking estimates for most countries in Sub Saharan Africa over 1870-1890, except for Ethiopia, Liberia, Madagascar, and Tanzania, I have assigned the 'floor' value of 0.01; when the level in 1900 was above 0.02, I followed the procedure descried above. These assumptions are consistent with the low values for 1913. In the case of South Africa, I assumed it evolved along the Orange Free State in Polity 2 (Polity 4 database) (Marshall et al., 2018). Algeria, 1870-1890 assumed to evolve as Tunisia. Cameroon, 1920-1960, assumed to evolve as Gabon.

Americas

Jamaica, 1870-1890, assumed to evolve along Cuba. The Bahamas and Belize, 1950-2020, assumed to have the same values as Jamaica. St. Kitts, St. Lucia, and St. Vincent and the Grenadines, 1950-2020, same values as Barbados.

Asia

Bangladesh, 1950-1970, as it was part of Pakistan, the latter's values were accepted. Brunei Darussalam,

1950-2020, same values as Malaysia.

Cambodia and Laos, 1870-1890, assumed to evolve along Vietnam.

Kuwait and Qatar, 1870-1900, and Iraq, Jordan,

Lebanon, and Syria, 1870-1913, assumed to evolve as Turkey.

Hong-Kong and Taiwan, 1870-1900, assumed to evolve along China.

Malaysia, 1870-1890, assumed to evolve as Singapore Philippines, 1870-1890, assumed to evolve as Cuba, another Spanish colony.

Qatar, 1870-1890, assume to evolve as Oman. Sri Lanka, 1870-1890, assumed to evolve as India. United Arab Emirates, 1870-1970, assumed to evolve as Qatar.

Yemen, 1870-1985, was the average of North and South Yemen.

Iran and Oman, 1870-1890, were assigned the 'floor' value (0.01).

Europe

1870-1900, Albania, as an Ottoman colony, same values as Turkey. Czechoslovakia, 1870-1913, as it was part of Austria-Hungary, I used the average value of Austria and Hungary. Czechia and Slovakia, 1990, as part of Czechoslovakia, were assigned its values. Germany, only the Federal Republic, 1950-1985. Ireland, 1870-1913, as it was part of the United Kingdom, I accepted the UK values. Poland, 1870-1913, as it was part of Russia I used the latter's values. Belarus, Estonia, Latvia, Lithuania, Moldova, Ukraine, Armenia, Azerbaijan, Georgia, Kyrgyzstan, Tajikistan, and Uzbekistan, 1980-1985, and Kazakhstan, 1980-1990, as part of the USSR, received its average values. Serbia, Croatia, 1980-1990, and Slovenia, 1980-1985, as part of Yugoslavia, were assigned its values.

Per Capita GDP

GDP per head is expressed in 1990 Geary-Khamis dollars. GDP per head data come from the Maddison Project Database (2013, 2018) [MPD 2013, MPD2018], completed with Maddison (2006, 2010), and the World Bank's World Development Indicators., CEPAL (2009) and (2017) http://interwp.cepal.org/ provide most of the data for Latin America since 1950. For China since 1950, Conference Board (2016) "alternative" series have been accepted. Otherwise, as shown below, per capita GDP levels for (usually) 1950 have been projected backwards with volume indices of real per capita GDP taken from historical national accounts.

I have assumed a lower bound for per capita GDP that has been set at \$ 300, which represents a basic level of physiological subsistence (Sagar and Najam, 1998; Milanovic et al., 2011), below both the World Bank's extreme poverty threshold of \$1 per day/person and Maddison's (2006) \$400 per capita.

Africa

Most pre-1950 estimates come by projecting MDP2018 level for 1950 with Prados de la Escosura (2012) estimates. For North Africa, 1870-1950, estimates come from Maddison (2006: 577-580) completed with interpolations on the basis of my own indirect estimates. For Algeria, I interpolated the levels for 1890 and 1900. For Tunisia, I accepted Maddison estimates for 1913 and interpolated the rest of the benchmarks. In the case of Morocco, I found Maddison's level for 1913 too low relative to Tunisia's, and used my own estimates. For Egypt, Maddison figures were also used but re-scaled by accepting Pamuk (2006) level for 1950. In the case of South Africa, I deflated Stadler (1963) nominal GDP estimates for 1913-1950 with Alvaredo and Atkinson (2010) price index, and used population figures from Feinstein (2005: 257-8) to derive per capita GDP. Then, the 1913 level was projected backwards to 1870 with my own indirect estimates.

Further assumptions were needed to fill missing values of GDP per head for some Sub-Saharan countries. Following Maddison's approach, I assumed that growth trends for missing countries were similar to those of their neighbours. Thus, in the case of French Equatorial Africa (CAR, Congo, Gabon, and Chad), 1870-1929, I assumed they grew as similar countries (coastal or landlocked, resource abundant or scarce) in French West Africa. Similarly, during the same period, Cameroon, Guinea-Bissau, and Togo were assumed to grow at the same rate of similar countries in West French Africa. Liberia was assumed to evolve as Sierra Leone over 1900-1913. I assumed The Gambia (1870-1913) and Sierra Leone (1870-1900) evolved alongside Ghana. In East Africa, I accepted Uganda's pace of growth for Rwanda and Burundi (1913-1929) while Kenya's pace of growth during 1870-1913 was assumed to be similar to Tanzania's. Also, Ethiopia and Sudan were assumed to evolve as Egypt over 1870-1913. In southern Africa, Mozambique was accepted to evolve as Angola (1870-1900), and Zambia and Malawi (1913-1929) as Zimbabwe. Lastly, in the cases of Botswana and Lesotho (1913-1938), Namibia (1870-1929), and Swaziland (1870-1938), I accepted the growth rate for South Africa.

Americas

For 1950-2020, MPD2018 benchmark for 1990 has been projected back and forth with CEPAL (2009, 2020) <u>http://interwp.cepal.org/</u>, and <u>https://statistics.</u> <u>cepal.org/portal/cepalstat/index.html?lang=en</u> except for Cuba, 1950-1990.For the pre-1950 period, per capita GDP volumes derive from MPD2018, MPD2103, Astorga and Fitzgerald (1998) and MOxLAD database (Astorga et al. 2003). Otherwise the following national sources have been used. Argentina, Della Paolera et al. (2003), 1884-1950. The resulting level for 1884 was projected backwards 1875 with Cortés Conde (1997) growth rate and assumed the level of 1870 to be equal to that of 1875. Brazil, 1870-1950, Goldsmith (1986). Bolivia, 1870-1950, Herranz-Loncán and Peres Cajías (2016). Figures for 1870 and 1880 interpolated from those for 1850 and 1883. Chile, 1870-1950, Díaz, Lüders and Wagner (2016). Colombia, 1870-1905, Kalmanovitz Krauter and López Rivera (2009) and data kindly provided by Salomon Kalmanovitz (private communication); 1905-1950, GRECO (2002). Cuba, up to 1902, Santamaría (2005); 1902-1958, Ward and Devereux (2012); 1958-1990, MDP2018; 1990-2020, CEPAL (2017). An important caveat: neither the MPD2018 (nor Maddison's 2006, 2010) benchmark level for 1990 has been accepted. The reason is that, given the lack of PPPs for Cuba in 1990, Maddison (2006: 192) assumed Cuban per capita GDP was 15 per cent below the Latin American average. Since this is an arbitrary assumption, I started from Brundenius and Zimbalist's (1989) estimate of Cuba's GDP per head relative to six major Latin American countries (Argentina, Brazil, Chile, Colombia, Mexico, and Venezuela, LA6) in 1980 (provided in Astorga and Fitzgerald, 1998) and applied this ratio to the average per capita income of LA6 in 1980 Geary-Khamis dollars to derive Cuba's level in 1980. Then, following Maddison (1995: 166), I derived the level for 1990 with the growth rate of real per capita GDP at national prices over 1980-1990 and reflated the result with the US implicit GDP deflator in order to arrive to an estimate of per capita GDP in 1990 at 1990 Geary-Khamis dollars. Interestingly, Cuba's position relative to the US in 1929 and 1955 is very close to the one Ward and Devereux (2012) estimated using a different approach. Jamaica, 1870-1929, Eisner (1961). Mexico, 1870-1900, Coatsworth 41); 1896-1950, (1989: INEGI (1995) Puerto Rico, 1900-1940, Devereux (2017); 1940-1950, Anuario Estadístico de Puerto Rico (1955). 1870-1950, Peru, Seminario (2012). 1870-1950, Bértola (2016). Uruguay, Venezuela, 1870-1950, Batista (1997). Central America (Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua), I derived the level for 1913 by assuming the growth over 1913-20 was identical to that of 1920-25, the latter derived from OxLAD database (Astorga et al. 2003). Caribbean. Bahamas, Barbados, Belize, Guyana, since 1950, Trinidad-Tobago, 1950-1970, and St. Kitts and Nevis, St. Vincent and the Grenadines, from 1990, Maddison (2006, 2010), Conference Board (2016), and Bulmer-Thomas (kindly provided in private communication)

Asia

Middle East (Iran, Iraq, Jordan, Lebanon, Palestine (Israel), Saudi Arabia, Syria, Yemen, and the Gulf (Bahrain, Kuwait, Oman, Qatar, UAE), 1870-1913, Pamuk (2006) Cambodia and Laos were assumed to evolve alongside Vietnam, 1870-1938.

Korea, 1870-1913, MPD2013; 1913-1938, Cha and Kim (2006). I obtained the figures for 1880-1900 through log-linear interpolation. Myanmar, 1880-1890, assumed to evolve along India. Malaysia, 1870-1913, assumed to evolve along Indonesia. Philippines, 1890, Bourguignon and Morrisson (2002). Turkey, MPD2013. 1880, Altug et al. (2009) with 1890-1900 figures log-linearly interpolated. 1890-1900, Taiwan, assumed to evolve 1900, Cha Wu (2002). as China's; and For the Middle East, Indochina (Cambodia, Laos, and Vietnam), and Hong Kong, I interpolated log-linearly the values for 1880-1900 and 1935-1938.

Europe

1870-1913, (2010)Austria, Maddison level for 1913 backwards with projected Schulze (2000) estimates for Imperial Austria under the assumption that real output per head in Modern Austria moved along Imperial Austria's. Belgium, 1870-1913, Horlings (1997); 1929-1938, average of GDP estimates of income and expenditure approachesinBuyst(1997), and output in Horlings(1997). Bulgaria, 1890-1913, Maddison (2010). 1880, interpolated. Czechoslovakia, 1880, computed with Good (1994) ratio of 1880 GDP per head to the average GDP per head of 1870 and 1890 applied to MPD2018 average levels for 1870 and 1890. Cyprus, 1913-1950, Apostolides (2011). I assumed the level for 1913 was identical to that for 1921. 1870-1950, France, Toutain (1997). Germany, Republic, 1950-1985. only Federal Greece, 1870-1938, **Kostelenos** et (2007)al. moving base series. 1870-1913, Schulze (2000)Hungary, estimates for Imperial Hungary. Ireland, 1880-1900, applying the ratio Ireland/ UK in 1913 to UK real per capita GDP. Malta, 1913-1950, Apostolides (2011). assumed the level for 1913 was identical to that for 1921. 1850-1913, (2006). Portugal, Lains

Romania, MPD2013. 1880, computed with Good (1994) ratio of 1880 GDP per head to the average GDP per head of 1870 and 1890 applied to MPD2013 average levels for 1870 and 1890. Russia, 1870-1885, Imperial Russia, Goldsmith (1961), agriculturalandindustrialoutputweightedwithGregory (1982) weights for 1883-87; 1885-1913, Gregory (1982, Table 3.1); 1913-1928, Markevich and Harrison (2011). Spain, 1870-2020, Prados de la Escosura (2017, updated). United Kingdom, 1850-1913, MPD2013. Yugoslavia, 1880, computed with Good (1994) ratio of 1880 GDP per head to the average GDP per head of 1870 and 1890 applied to MPD2018 average levels for 1870 and 1890.

Oceania

New Zealand, 1870-1990, kindly provided by Les Oxley in private communication.

Population

All figures are adjusted to refer to mid-year and to take into account the territorial changes and are derived from the World Bank's World Development Indicators and UNESCO, http://data.uis.unesco.org/, for 1960-2020, Maddison (2010), and Mitchell (2003a, 2003b, 2003c), completed for Latin America and the Caribbean with CEPAL (2009 and 2016), 1950-2015, and OxLAD database (Astorga et al., 2003), 1900-1938. Otherwise, national sources were used. Czechoslovakia/Czechia, population of the territory Czechoslovakia over 1870-1985. of Germany, includes the Democratic Republic (1950-1985). Serbia/Yugoslavia. 1870-1975, population of the territory of Yugoslavia; 1980-2020, population Croatia Yugoslavia except and Slovenia. of Russia. 1870-1913, Russia Empire; 1925-1975, USSR; 1980-2020, Russian Federation. 1929-1938, Cyprus, Apostolides (2011). Spain, 1870-2020, Prados de la Escosura (2017, updated). Turkey, 1870-1913, Pamuk (2006,2007). Algeria and Tunisia, 1870-1950, Fargues (1986). 1870-2000, South Africa, Feinstein (2005). Sub-Saharan Africa, 1910-1950 data come from Smits (private communication), completed with Banks (2010), for Ethiopia, Liberia, Malawi, and Sierra Leone. Missing observations for Sub-Saharan African countries in the late 19th century were filled by assuming the average growth rate for countries in the region.

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