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Abstract

The number of people is one of the most basic information about any society but it is difficult to know it. The data are missing for most of human history and scarce and/or hardly reliable for advanced countries until the early 19th century and for the rest of the world until the mid-20th century. Yet, historical demographers have tried hard and often successfully to estimate population in the past, but their results have often been neglected in the most common general historical data-bases. Thus, we do not have a continuous series of world population at least until World War One if not until 1950. In this paper we fill this gap by re-estimating series of population for all polities from 1800 to 1938 using first-hand sources and country-specific literature. We use our series to address two issues which have attracted some attention by economist and economic historians in the last years, the start of the demographic transition and the impact of major demographic crises such as the Tai'ping civil war, World War One and the Spanish flu.

JEL: I10, J11, J13

Keywords: World population dataset. Demographic transition

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How many people on earth? World population 1800 1938

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1. Introduction

The number of people is one of the most basic information about any society. Rulers have tried to know it for taxing or drafting their subjects since 4000 years BC and scholars have started to guesstimate the total world population since the 17th century. In more recent years, historical demographers have produced series of population by country painstakingly collecting and, when necessary correcting, official data and any available information. Unfortunately, many of their results have not trickled down in data-sets which are most commonly used in quantitative historical analysis (Guinnaine 2021). The scientific data-bases by McEvedy-Jones 1978 and Maddison 1995 do not take into account more recent work and provide only benchmarks for most countries, while on-line data-bases, such as Gapminder, build on the same data-bases to build yearly series with hardly transparent method.

Thus, there is a major gap in our knowledge and this paper fills it. We estimate series of population at current borders for all polities from 1800 to 1938, then we sum them to get the continent and world total(s). When possible, we use official statistics or the work by demographic historians and we fill gaps with interpolations or extrapolations, taking into account whenever possible the population movement in neighboring or otherwise comparable polities. Needless to say, our figures are of widely different quality, ranging from the almost perfect for Scandinavian countries to the mere guesswork for Sub-Saharian Africa. The amount of guesswork is the greater the less capable the administration was, and thus as a rule earlier data are less reliable than more recent ones. Most of the figures of the first half of the 19th century are highly conjectural and we have been unable to find enough sources to push the analysis before 1800.

We use our series to advance the conversation on two issues which are now attracting much interest among economic historians and economists, the demographic transition and the severity of demographic shocks. The pattern demographic transition has long been studied by demographers and economic historians (Chesnais 1992, Riley 2005 a and b, Lee 2003, Alter and Clark 2010, Camps and Engermann 2014, Crombach et al 2021 Davenport and Saito 2021) but it has enjoyed a revival of interest among economist, because it features prominently in unified growth theory models. Recent work focuses on the causes of decline in fertility and/or mortality (Riley 2001, Cutler et al 2006, Guinnaine 2011, Murtin 2013, Jetter et al 2019, Delventhal et al 2021, Perrin 2022, Prados de la Escosura 2022, Spolaore and Wacziarg 2022) and on the relations between long-term life expectancy and GDP growth (cf. e.g. Acemoglu and Johnson 2007, Cervellati and Sunde 2011). More recently, the interest in demographic shock, such as the Spanish flu, has been rekindled by the COVID 19 epidemics (Beach et al 2022).

This conventional wisdom is only partially supported by hard evidence. The number of deaths during the Spanish flu is still uncertain and the information on other crises are scarce, imprecise and scattered in a very large historical literature. Reliable data on vital statistics are available only for about a fifth of the country/year observations from 1800 to 1938 and thus attempts to trace the transition have relied on informed guesses (Riley 2005b) or, more recently, on statistical inferences (Delventhal et al 2021). Yearly series of population can be useful to address both issues: they measure directly the impact of demographic shocks, while variations in the rates of change can be used to date different stages of transition (Chesnais 1992).

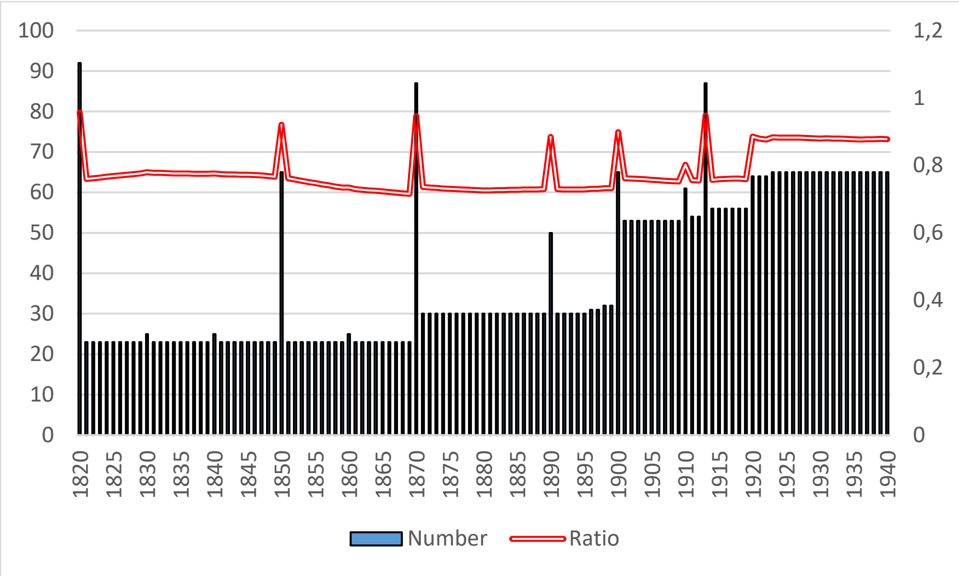
The next section surveys the available estimates of world population, Section Three discusses in general our sources and Section Four sketches out our strategy of estimation, with details by polity in Appendix I. Section Five outlines the long-term population trends and compare them with previous estimates. In a nutshell, we find that the natural rate of increase has been growing, as more and more countries started the demographic transition, but the overall growth has been temporarily reversed by two major exogenous shocks (plus minor local ones), the Tai'Ping civil war in China in the 1850s-early 1860s and the late 1910s world crisis (the combination of World War One, Spanish flu and Russian civil war and famine). Section Six tests the conventional wisdom about the decline in volatility and analyses the frequency and severity of demographic crises. Section Seven exploits our data to put forward a tentative dating of the start and early stages of transition, contrasting it with other recent estimates. Section Eight explores the robustness of our series. We estimate the likely margins of errors of the aggregate series, on the basis of an assessment of the reliability of polity-specific observations, and we deal with the impact of linear interpolations on the volatility of our series and with the size of the biases in the measurement of demographic transition from the omission of migration flows. Section Nine concludes, arguing that our results make it necessary a reconsideration of the conventional wisdom on demographic transition.

2) What we (pretend to) know

In 1661, the Italian Jesuit Riccioli estimated, for the first time, world population at at 'less than one billion' (Korenjak 2018) and since then many scholars have followed his example. In the introduction to his own estimate, the American demographer Willcox (1940) lists 68 benchmark estimates of world population plus an almost yearly series from 1851 to 1927 in the various editions of Hubner's *Geographical Atlas.* He obtained a world total with a top-down approach, by selecting and summing the most plausible figures about population by continent. His work has been highly influential in all the following literature (Caldwell and Schindlmayr 2002). His method has been replicated by quite a few authors, starting with Carr-Saunders (1936). In contrast, bottom up estimates, as sum of data by polity, are more rare. The Statistical Yearbook of the League of Nations, the forerunner of the current UN population data (United Nations 2019), published figures for 1913 and series from 1925 to 1938, relying on all official statistics, supplemented with crude estimates for missing countries. In the 1990s A. Maddison (1995) published the (then) available population series from 1820 onwards as part of his research on modern economic growth. His sample included about 20 countries before 1870, progressively rising to 60 on the eve of World War Two (Figure 1 blue bars, left axis) [1]. Maddison added guesstimates for missing countries (or groups of them) in five benchmark years (1820, 1870, 1913, 1920 and 1940) and thus obtained figures for the world population. The available country series account for about two thirds of world total population (red line, right axis) for most of the period, with an increase to about 85% in the 1930s.

[1] Here we use Maddison's original data-set, as detailed in Maddison 1995 and 2010. The most recent version of the Maddison project website reports the country data for three benchmarks only (1820, 1870 and 1913). The number of series is bound to differ between Maddison's and our data-base because the former is at current and the latter at 1995 borders and because Maddison reports aggregate data for groups of small polities (e.g. 21 Caribbean). We compute Maddison's yearly series of world population (the denominator of the ratio in Figure 1) by interpolating linearly his benchmark estimates.

Figure 1
Maddison's world population data-base



Country-level population series before 1950 are available in the specialized historical web-site CLIO-INFRA ((Van Vleuten and Kok 2014) and two general-interest ones, the environmental data-base HYDE 3.1 (Klein Goldewijk et al 2010) and the educational data-base Gapminder (https://www.gapminder.org/data/, accessed February 2022) [2]. All three sources boast a much wider coverage, in time and space, than either the League of Nations or Maddison – respectively data at ten year intervals from 1500 onwards for up to 170 polities (in 1820), at ten-year intervals since 8000 years BC for 237 polities and yearly series for 197 polities from 1800 onwards. However, they do not explain how these data have been obtained, quoting standard sources such as Maddison (2010) or Mc Evedy and Jones (1978) without any further detail [3].

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[2] Other sources, including statistical yearbooks of European states (e.g Statistical yearbook France, Statistical Yearbook Germany) and other contemporary statistical collections (e.g. the Statesman's yearbook) collect series by country but do not sum fill gaps nor compute the world total. Etemad (2007 Appendix D) provides figures for all colonies in 1760, 1830, 1880, 1913 and 1938 without detailing his sources.

[3] The CLIO-Infra project (https://clio-infra.eu/Indicators/TotalPopulation.html; accessed Sept 5 2021) states that 'this dataset is a slightly revised version of the one produced by Filipa Ribeiro da Silva for the CLIO Infra Project in December 2012' (which is apparently no longer available on the website) and hints to the revisions (e.g. using Frankema and Jerven 2014 for Africa). The HYDE 3.1 writes in the source file 'Historical population numbers of McEvedy and Jones (1978), Livi-Bacci (2007), and Maddison (2003), Denevan (1992) form the basis of our national historical population estimates. Supplemented with the sub-national population numbers of Populstat (Lahmeyer, 2004, pers. comm.; who provides data for several time periods varying per country), time series were constructed for each province or state of every country of the world'. An earlier version of the same HYDE data-base (Klein Goldewijk et al 1995) used a transparent, albeit highly questionable, statistical interpolation method. They assume a logistic curve between the earliest available data from Mitchell's International Historical statistics and the start of United Nations population series in 1950, with some adjustments. Gapminder v6 states in its explicative note (https://www.gapminder.org/data/documentation/gd003/ - accessed 5 Sept 2021) 'We use Maddison population data improved by CLIO INFRA in April 2015 and Gapminder v3 documented in greater detail by Mattias Lindgren. The main source of v3 was Angus Maddison's data which is maintained and improved by CLIO Infra Project'. Gapminder's sources for series of crude birth and death rates, used by Jetter et al (2019) are equally obscure.

In Table 1 we sum up this literature, reporting the original estimates – i.e. works which have introduced relevant changes in estimates by continent and (hence) for the total [4].

[4] Cf for the corresponding data by continent Statistical Appendix Table ?? We omit estimates which simply quote some other work – a likely incomplete list includes about twenty additional references.

Table 1
Estimates of world population

	1800	1820	1850	1870	1890	1900	1910	1913	1920	1930	1935	1940	1950
Hubner*			1055a	1300	1514	1551	1568	1652	1712	2029b			
Willcox (1940)	919		1091			1571					1995		
Carr-Saunders (1936)	906		1171			1608					2057c		
Swaroop (1951)	906					1171							2378d
Bennett (1954)	919		1163			1555							2368d
Clark (1967)	890					1668							
McEvedy and Jones (1978)	900		1200			1625							2500
Biraben (1979)	954		1241			1633							2520
Klein Goldewijk and Battjes (1995)					1532	1638	1767		1914	2084		2281	2511
League of Nations/UN									1834	2008		2216	2532
United Nations (1999)	980		1260			1650	1750		1860	2070		2300	2520
Maddison (2010)		1042		1276		1563		1792	1863			2299	2528
Klein et al (2010)	990		1263			1654	1777		1912	2092		2307	2545
Gapminder	984	1022	1092	1166	1224	1278	1301	1347	1384	1425	1535	1646	2532

*quoted by Willcox (1940); a 1951;b 1929; c 1933; d 1949

All estimates tell a similar story, with an accelerating growth throughout the period, but differences between them are substantial, especially in the first half of the 19th century. The worldwide rates of growth for the 19th century range from 0.51% (Klein Goldewijk et al 2010) to 0.63% (Swaroop 1951) – a difference by almost a quarter. The ratio between the highest and the lowest growth rates range from a minimum of 1.20 for Europe to 3.4 for Africa – from 0.50% according to Klein Goldewijk et al 2010 to 0.11% according to Clark (1967). The world-wide differences are much smaller in the first hlf of the 20th century (rates between 0.80% and 0.85%) but remain substantial for Africa[5].

3) Our sources

An ideal annual series of population relies on two set of data, a register of deaths, births and migrations for yearly movements and (at least one) census to anchor the levels. This ideal has been attained for the first time in late 18th century Scandinavian countries and is not yet reached in several poor countries. Data on total population, although imperfect, are quite abundant in history. Rulers have always shown interest in knowing the number of their subjects, as potential taxpayers and/or soldiers, since the early antiquity. The first counts of population may date back 4000 years BC Babylonia and all great empires, including Rome and China, followed suit. However, the first 'modern' censuses, with detailed information for all individuals, were taken in the early 19th century (Shryock et al 1971, Thorvaldsen 2018). In 1855-1864 only 24 sovereign countries had taken a census, and the number rose to 49 in 1925-1934 (Shryock et al 1971 tab 2.1), plus 18 colonies (Kuczynski 1937). The number jumped to 150 in 1955-1964, after the strong prodding by the United Nations. Population registers started later. In Europe, the Catholic local clergy started to collect these data in the Middle Ages (the earliest surviving French register dates back to 1303). In the 16th century the compilation of these registers was made compulsory by several states (e.g. England in 1538, France in 1539) and by the Catholic church with the Council of Trento (1563/1614). Following the pioneering work by Henry, historical demographers have used parish registers to produce series of local population. Wrigley and Schofield have used 404 such registers to estimate a yearly series from 1541 onwards in their path-breaking *Population history of England* (1989). They have been imitated by scholars for other countries, such as Northern Italy (Galloway 1994) and Germany (Pfister and Fertig 2010). Unfortunately, there is no guarantee that the surviving registers yield a representative sample of parishes (Spagnoli 1977). The pioneer in state-wide registration of population was the Qing empire. It set up a state registration system, the bao-jia system, as early as 1741 was overhauled in 1776 and collapsed at the outbreak of the Tai'ping war in the 1850s (Ho 1959:36-50 and 68-73). European states started to collect parish data in the 18th century and set up centralized population registers in the early decades of the 19th century (Wilke 2004, Poulain and Herm 2013). By 1833, state-managed registers covered about 10% of world population and the share rose slowly to a half one century later (Chesnais 1992 p.47).

This quick overview suggests that the quality of demographic data is loosely related to the level of development, but there were some relevant exceptions. The most relevant are the United States. State-wide registration of birth and death had started in Massachusetts in 1842, but a federal system, covering only ten states, was set up in 1900 and registration was made mandatory for all states only in 1933 (Haines 2000). The United States did take censuses after independence, as mandated by the constitution, but there is a

[5] The ratio between maximum and minimum figures range from 1.14 for Asia to 1.83 for Africa – in the latter case between 0.68% (Swaroop 1951) and 1.25% (Mc Evedy Jones 1978). Our computation excludes the two estimates by Willcox (1940) and Carr-Saunders (1936), which refer to 1935. Including them the difference among rates of growth would be much larger.

strong suspicious that the 19th and early 20th century censuses undercounted population (Coale and Zelnick 1963, Coale and Rives 1973, Shryock et al 1971, Steckel 1991Thorvaldsen 2018 pp.98-100). The bias could have been as large as 10-15% in fast growing cities (Parkerson 1991). So far, no scholar has put forward a corrected series for the whole period and the Population Section of the Millennial version of the Historical Statistics United States (2006) mostly reproduces the official data.

The doubts on the reliability of censuses are, unsurprisingly, more serious for poor countries and colonies, especially for large mainland territories, while counting people was easier in small islands. Ultimately, the quality of the data depended on the capabilities of the civil service, and especially of its native staff. In many cases, such as the Dutch East Indies (Boomgaard and Gooszen 1991), the accuracy of official sources has been improving over time thanks to the increase in resources and to learning by doing. In India the geographical coverage of British-organized censuses was progressively extended to native states (Davis 1968). These improvements are a mixed blessing as they might bias (usually upwards) the rate of growth of population if they reduce the gap between counted and real population.

In Sub-Saharian Africa most colonial 'censuses' were a mix of information from village chiefs and guesswork by colonial administrators and thus are generally deemed useless (Kuczynski 1937, 1948-1953). Table 2 tests this claim by comparing the results of censuses with the estimates for the same polities/years by Frankema and Jerven (2014) [6].

Table 2
The reliability of colonial censuses

Number	British	French	Italian	Total
Total	24	12	6	42
ratio <0.9	14	7	3	24
ratio>1.05	4	3	1	8
Average ratio				
Total	86.1	87.7	95.8	96.0
ratio <1	77.5	80.9	67.8	77.2
ratio>1	112.0	140.4	127.5	122.6

The results are somewhat better than expected: only about a half of censuses are seriously undervalued (ratio census/estimate less than 0.9), while a fifth are overvalued (ratios over 1.05). The (unweighted) average ratio implies a very low undervaluation. Unfortunately, these reassuring results do not help much our work, as almost all the colonial censuses were taken in the 1920s and 1930s. Before World War One censuses were taken only in islands such as the Mauritius.

Historical demographers have integrated the missing or defective official data with (variants of) three methods, the use of 'experts' estimates, the backward projection and the forward projection

[6] The French and Italian data refer to 'censuses' as reported respectively from Statistical Yearbook France and Statistical Yearbook Italy while for British colonies we rely on the list by Kuczynski (1948- 1953). We include only colony-wide censuses, dropping area-specific enumerations (e.g. for the capital city and its surroundings), approximate counts or guesstimates.

i) 'Experts' were (usually Western) explorers, missionaries or diplomats, who put forward population estimates in books, travel accounts, memories, official dispatches and the like. These figures have been widely used, but have to be handled with caution. Most 'experts' had personal experience of limited areas only and applied their knowledge to the whole territories of interest. E.g. the early navigators inferred the population of Oceania islands by looking at coasts, or at tracts of them, with wild speculations on the population of the (unobserved) interior. As a result, the population figures varied a lot: for instance, the members of the Cook expedition estimated the population of Hawaii to range between 240 and 400K (Nordyke 1989:13). Furthermore, 'experts' were not necessarily impartial: in the Ottoman Balkans the size of different religious communities as heatedly disputed and thus figures 'strongly reflect the political biases of the writers or of their informants and worst of all, in some of them the statistics were blatantly manipulated or falsified outright' (Karpat 1985 p.4).

ii) The backward projection method starts from an allegedly reliable data and extrapolate it in the past with hypotheses about the rates of change. In his pioneering work on Africa, Manning (1988, 2010) started with population according to 1950 censuses, in spite of some doubts about their reliability, and extrapolated them with the decadal rate of growth of Indian population (Davis 1968), suitably adjusted to take into account the evolution of each African macro-area (e.g. the size of slave exports).[7] Frankema and Jerven (2014) have replicated the exercise by polity, taking into account the rates of change in Indonesia and the Philippines, as land-abundant areas closer to the (West African) factor endowment, and tailoring the adjustment coefficients to country specific shocks. In a still unfinished work, Manning and Nickleach (2014) have further refined the backward projection method for the period 1650-1890, with a sophisticated model which takes into account also the age and composition of the population and the slave trade within Africa.

iii) the forward projection method has been used to estimate the population of Pacific islands, from the first settlement onwards (Kirch and Rallu 2007). The projection starts from the (assumed) date of the arrival of an (assumed) number of people and unfolds to the earliest reliable data with hypotheses about the rate of change of the population, which depends on the natural increase, on further migration flows after the initial settlement and the frequency and impact of demographic shock. Forward projections are thus highly speculative [8]. Whenever possible, authors have tried to support the results with hard archeological evidence on the number and size of occupied sites or on agricultural land use. This evidence must be used with caution. From one hand, the excavated sites might be only a fraction of the populated ones but on the other they might have not been inhabited regularly for the whole period. The estimates of carrying capacity from the extension of and use might overstate total population if part of the output was appropriated as surplus by the élites.

[7] Frankema and Jerven (2014) discuss at length the shortcomings of African post-war censuses and reckon that they undervalued population by about 8% (221.7 million vs 240 million). Yanez et al (2012) argue that also the Latin American post-war censuses were undervalued and they use their own estimate of the biases (on average 6%) to correct all pre-war censuses, as far back in time as 1817 for Cuba, with a polity-specific constant coefficient (on average about 6%). The assumption of a constant bias contrasts with the results of an earlier comparison between censuses and other demographic sources by Collver (1965).

[8] Just to give an idea of the range of possible outcomes, if 100 people had arrived in the year 1000 AD, in 1800 population would have been 295000 individuals with an yearly rate of 1%, 5500 with a 0.5% rate an only 2500 if population had been growing at 0.5% per year with a crisis every century killing (or forcing to emigrate) a tenth of inhabitants.

4) The construction of our data base

We have estimated population for a total of 21815 polity/year observations for 174 polities at their historical borders. We detail the sources and methods of estimation in Appendix I, while here we discuss only the general criteria.

First and foremost, the data base includes all polities, even if there are no solid data on population but only guesstimates or nothing at all. Some polities existed only for part of the period and their series are correspondingly shorter (we report the start and end dates of these series in Appendix I). For instance, our data-base includes a series for Austria-Hungary until the dissolution of the empire in 1918 and then separate series for the successor states, Austria, Hungary, Poland, Czechoslovakia and the Kingdom of Serbs, Croats and Slovenians (later Yugoslavia), while Tyrol and Dalmatia are included in the Italian population. Referring to present-day (or 1995) borders would be a-historical and would need additional information (and often guesses) on the regional population, increasing the risk of errors. Our estimates refer to the whole population, including native people, whom official sources often counted separately, as in Australia (Smith 1980), or omitted altogether, as in the United States censuses before 1890. Their omission would severely bias the results, as the share of natives on total population collapsed for the joint effect of the decrease in their absolute number and of immigration of white settlers (e.g. natives accounted for over 90% of the Australian population until 1825, a third in 1850 and a mere 2% on the eve of World War One). The series for white settlers only are bound to underestimate total population at any specific moment in time and to overestimate its growth. Following most historical and present-day censuses (Thorvaldsen 2018 p.156), we prefer to estimate present (de facto) rather than resident (de jure) population because it minimizes the distortions from imperfect registration of domestic and international migrations [9]. When possible, we compute mid-year population as average of two consecutive end-year figures.

We apply these criteria with some flexibility. We have no information about the population of pre-colonial Sub-Saharian African polities and thus we simply extrapolate backwards to 1800 the population at colonial borders. We simplify the complex changes in political map of Europe by ignoring the ephemeral polities of the Napoleonic period (e.g. the Confederation of the Rhine, or Congress Poland) and referring, as a rule, to the situation after the congress of Vienna. We ignore the political division of Italy before 1861 and Germany before 1870 and the short-lived union of Belgium and Netherlands from 1815 to 1830. In some cases, we estimate series for specific areas and then we sum them up for the publication in the data-base. We aggregate 13 independent series for pacific archipelagos in three geographical divisions (Melanesia, Polynesia and Micronesia, plus Hawaii). We treat formally Ottoman territories in North Africa (e.g. Algeria and Tunisia before French conquest) as separate polities and we estimate separate series for European and Asian territories broadly corresponding to post-Ottoman polities which we aggregate in two separate series before 1913 (Ottoman Europe and Ottoman Asia) to get homogenous continent-wise series for the whole period.

For each polity, we have chosen the series or, when not available, the benchmark year figures which seem more solid. Whenever possible, we use country specific sources or population and area specific data-sets such as Rothenbacher 2002 for Western Europe and 2013 for Central and Eastern Europe and Bulmer-

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[9] In Imperial Russia, former peasants resisted cancellation from the registers of village population as this entailed the loss of their right to access to common land. This effect caused official series to be overstated by about 5% of the population - i.e. by about 8.5 million (Markevich and Harrison 2011 Appendix tab A8).

Thomas (2012) for the Caribbean[10]. We have filled gaps between benchmark years with linear interpolation, correcting them with the available data on demographic crises, such as famines or epidemics. In particular, we have used the information on deaths from the Spanish flu from country-specific sources and from the recent papers by Athukorala and Athukorala (2020) and Barro et al (2020) [11]. In many cases, there are no information on population for the early 19th century and for quite a few countries the series start only in 1950 (United Nations 2019). In these cases, we have extrapolated backwards the series from the earliest available figure to 1800 with rates of growth in the following period, taking into account trends in neighboring or otherwise comparable polities and for the same polity in different periods. When necessary to extend series in the 1930s, we take into account the implicit rate of growth from 1938 to 1950 and in the 1950s. These latter can be considered, given the pattern of demographic transition, an upper bound of rates in the pre-war period (cf. Section Seven). We assume the United Nations post-war data to be accurate, although many of them are estimates from partial and incomplete evidence.

Our series for Africa, the Arabian peninsula and Oceania need some further comments. We have been able to find polity-specific sources only for the six North African countries, eight small islands and South Africa after 1910. The population of the other 31 polities must be estimated with backward extrapolation. Table 3 reports the estimates by Manning and Nickleach (2014) and Frankema and Jerven (2014) for selected benchmark years.[12]

Table 3
Estimate of African population, 1800-1950 (millions)

		Northern	Northeast	Central	West	East	South	Total
Manning and Nickleach 2014	1800	24.9	21.1	18.7	47	31.8	7.8	151.3
Manning and Nickleach 2014	1850	27	20.8	16.1	46.2	30.9	8.3	149.3
Frankema and Jerven 2014	1850	12.8	28.5	20.8	25.9	22.1	4.1	114.1

[10] Actually the most comprehensive source on historical population used to be the data-base POPULSTAT by J.Lahmeyer, which however seems to be off-line as of March 2021. It reported figures for total population at current borders, without attempting to fill gaps nor, a fortiori, to compute world-wide totals. The references list included official country sources and contemporary reference works (e.g. world atlases, Statesman Yearbooks or the Almanach of Gotha), while the author seemed unaware of historical data-base such as Mitchell and Maddison (2010) and of the country-specific historical literature. Thus, we do not use it

[11] As a rule, we allocate the excess deaths to 1918 and/or 1919 with information of timing of the epidemic and we estimate population change until 1917 extrapolating previous rates of growth and then we interpolate linearly to the next available figure

[12] In this table, following Manning and Nickleach 2014 Map 1.1, West Africa includes French West Africa (present- day Mauritania, Senegal, Guinee, Ivory Coast, Dahomey, Niger, Upper Volta, Mali), Togo, Liberia, Guinea Bissau, Gambia, Nigeria, Ghana (Gold Coast) and Sierra Leone, Central Africa includes, Cameroon, French Equatorial Africa (present-day Central African Republic, Chad, Gabon, Congo-Brazzaville), Equatorial Guinea, Angola, Belgian Congo, Malawi (Nyasaland) and Zambia (Northern Rhodesia), Northern Africa includes Morocco, Western (Spanish) Sahara, Algeria, Tunisia, Lybia and Egypt, North-East Africa Somalia, Djibouti, Eritrea, and Sudan, East Africa includes British East Africa (Kenya and Uganda), Mozambique, Madagascar, Tanganyka, Rwanda-Burundi and Southern Africa includes South Africa, Namibia (German South-West Africa), Botswana (Bechuanaland), Lesotho (Basutoland) and Zimbabwe (Southern Rhodesia).

Manning and Nickleach 2014	1890	28.2	20.7	15.6	46.4	29.8	8.7	149.4
Frankema and Jerven 2014	1890	19.4	28.2	24.4	31.8	24.4	6.2	134.4
Frankema and Jerven 2014	1950	44.3	31.1	31.3	64.0	34.1	17.1	221.8

We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards [13] The Manning-Nickleach (2014) estimates refer to areas rather than polities, are still provisional and their very sophisticated modelling strategy needs a lot of assumptions about unknown parameters, such as life expectancy, rates of survival of slaves after capture and the allocation of surviving captives as slaves between overseas countries and other African areas. Their main projection assumes the number of captured people in each sub-region remained as high as at the peak of transatlantic trade until 1890. This assumption seems questionable as it implies that the loss of the American market did not affect the slave trade. If in contrast total captures decreased by the size of transatlantic trade, the Manning and Nickleach (2014) hypothesis would cause the total population of Africa to be underestimated [14]. On top of this, the Frankema and Jerven (2014) series refer to post-war polities which can be easily matched to colonial ones, while the rates by Manning and Nickleach (2014) need further assumptions about trends in the distribution of population within each area.

We use backward extrapolation also for the Arabian peninsula, where official sources are available only for British colony of Aden and estimates are scarce, partial and/or wide off the mark. We extrapolate backwards the 1950 UN figures by hypothesizing that the population grew roughly as much as neighbouring Middle East countries – i.e. by 0.3% yearly from 1800 to 1870, 0.6% from 1870 to 1914 and by 1.3% yearly from 1914 onwards.

The case of Oceania is somewhat different. The data are fairly abundant and reliable since the second half of the 19th centuries. The missionaries started early to the population to assess the size of their flock and the number of potential converts and most colonial administrations imitated them later for more mundane purposes such as taxation. These results of these counts are deemed reasonably accurate and indeed in most cases they tally well with the United Nations data after 1950. In contrast, the movements in the early 19th century are very controversial. The backward extrapolation method is not really suitable, given the evidence about the collapse of native population after the contact with European diseases. Thus, historical demographers have relied on estimates from 'experts', selecting the figures closer to the late 19th century ones (McArthur 1967, Campbell 2006). Some scholars have argued that this cautious approach tend to downplay the catastrophic collapse in native population and have used the forward projection method to get much higher figures. The most controversial case is the population of the Hawaii at contact (1778). The consensus among historical demographers settled for a population around 300K, in the middle range of the estimates by members of the Cook expedition, even if Schmitt (1972) argued strongly for an even lower

[13] We have re-computed the Frankema-Jerven (2014) series for Ethiopia, because the website by mistake reports a constant population. We do not discuss separately these series in Appendix one, unless, as for Congo or South Africa, there are alternative modern sources.

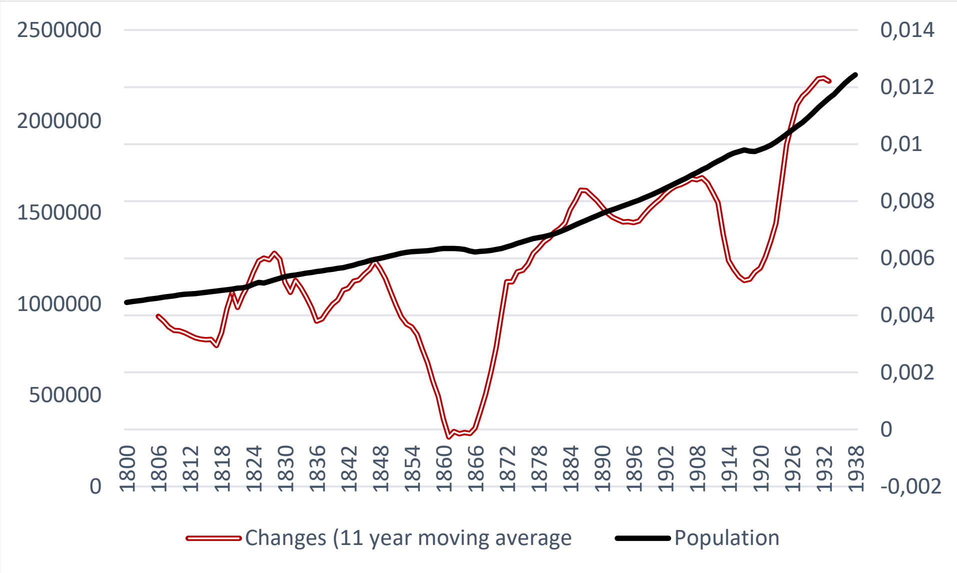
[14] The Manning-Nickleach hypothesis of constant slave trade implies that the total African population was lower by the number of additional deaths in capture and of missing births from difference in fertility between freed and captive population. It also implies a different distribution on population fewer people in slave-exporting areas, more in slave-receiving ones. Frankema and Jerven (2014) do not quote the slave trade after 1850 and we assume that they take it into account in the adjustment of reference rates.

figure. In contrast, Stannard (1989), with the forward projection method, suggested a range of 0.8-1 million (double the population in 1940) hypothesizing the arrival of about 100 people in the first century AD and a 0.52% yearly rate of population growth from then onwards. Later work has used so-called Dye-Tomori model, which relies on changes in the charcoal quantities in archeological sites to build an index of population movements (Kirch 2007). A backward extrapolation of the earliest reliable figures with this index yields a population at contact close to the lower bound of the historical demographers' estimated range. In our estimation, unless we have additional polity-specific evidence (e.g. on major epidemics or on civil wars), we have adopted a conservative view. We have assumed that population were stable before the start of substantial interactions with Europeans (which in most cases began later than the first contact) and that it declined after it at different rates, not exceeding 2% per year.

5) The results: world population in the long run

Overall, the world population increased from just above 1 billion in 1800 to 2.2 billion, which corresponds to a log rate of 0.54%. A visual inspection (Figure 2, left axis) suggests an almost linear increase but the joint TS/DS model by Razzaque et al. (2007) fails to return a significant rate[15]. Indeed, the yearly changes, even when smoothed with a 11 year moving average (Figure 2, right axis) show two massive crises, in the mid-19th century and in the second half of the 1910s.

Figure 2
World population and its yearly change 1800-1938 (11-years moving averages)



A Bai-Perron (2003) test singles out breaks in 1819, 1842 and 1867 but not in the early 20th century, possibly because the [16]. Thus, in Table 4 we report rates of change for the corresponding intervals (left-hand column)

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[15] The regression is Δ lnPOP=α+β TIME+ψ lnPOP$_{t-1}$+ ϕln Δ lnPOP$_{t-1}$ +ε and the rate of growth is computed as -β/ψ=0.

[16] We use the Stata xtbreak command (Ditzen et al 2021) which sets a minimum to the length of each segment of series as share of its total length (or 'trimming'). In the text we quote results with a trimming 0.10, which implies in the case at hand a minimum of fourteen years –i.e. the first break cannot be earlier than 1813 and the last later than 1925. Using a 0.05 trimming increases the

but also for a historical periodization which highlights the short-term impact of World War One and of the Spanish flu.

Table 4

Rates of change, world population, 1800-1938

	Short term °		Medium-term
1800-1819	0.33***	**1800-1850**	0.50***
1820-1842	0.50***	**1850-1870**	0.08**
1843-1867	0.27***	**1871-1913**	0.84***
1867-1938	0.89***	**1913-1920**	0.04**
		1920-1938	1.16***

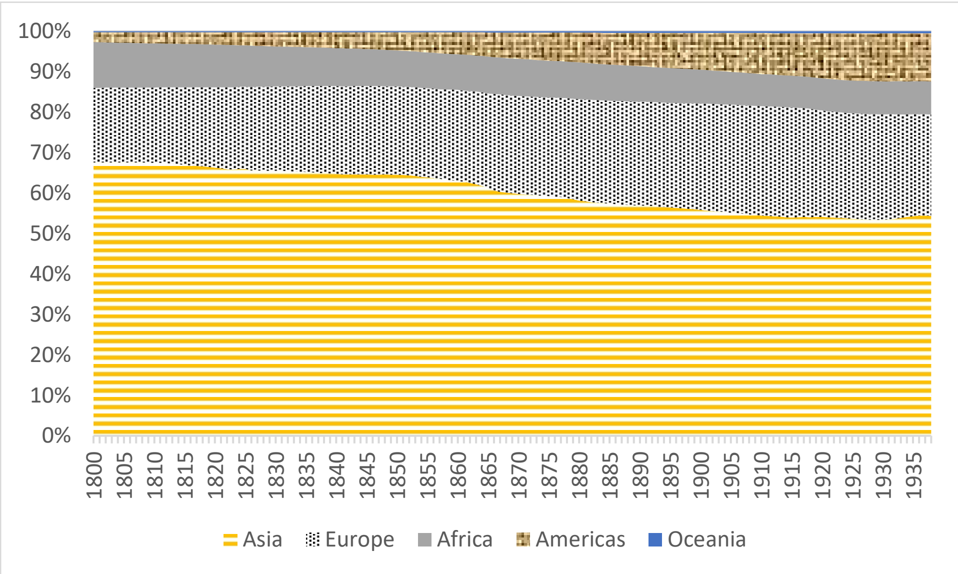
* significant at 10%; ** significant at 5%: *** significant at 1%; underlined log linear

World population grew slowly in the first half of the 19th century, consistently with the 18th century trends according to the (extremely tentative) available guesstimates[17]. The growth slowed down markedly around mid- century, resumed in the 1870s and accelerated, in spite of a short-lived but massive setback in the late 1910s.

The distribution by continent (Fig.3) shows substantial changes, which reflect differences in the impact of demographic shocks (Section Six) and in timing of the demographic transition (Section Seven).

Figure 3

The distribution of world population by continent, 1800-1938



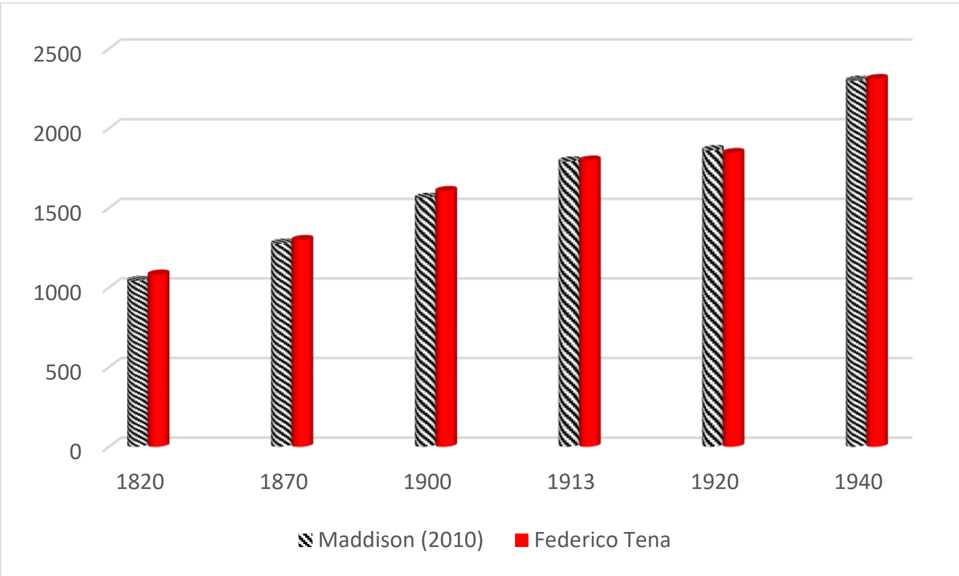
minimum length of each period to seven years but results are qualitatively similar. The routine detects five breaks in the 19th century (1815, 1831, 1847, 1863 and 1881) but still none in the 20th century.

[17] The rates for the 18th century hover around 0.4% per year, ranging from 0.33% for Clark (1967) to 0.46% for Maddison (until 1820) and to 0.48% according to HYDE 3.1 (Klein Goldewijk et al 2010). This latter suggests a slowdown in growth from 0.57% in 1700-1750 to 0.39% in 1750-1800, but it is an exception. All other estimates report higher rates in the second half of the century - e.g. McEvedy Jones (1978) has 0.33% in 1700-1750 and 0.45% in 1750-1800. Cf for the (better documented) increase in the European countries Section Seven and for China Deng 2004 and Deng and Shun 2019.

In relative terms, population declined in Africa and Asia, increased in Europe (here including the whole of Russia) and boomed in the Americas and Oceania. The changes were already massive by 1870 and were mostly over on the eve of World War One. Indeed, trends slowed down or even reversed in interwar years, but total changes were small in comparison with pre-war ones. The African share of world population fell by a fifth in the first half of the 19th century, from 11.3% to 8.9%, slid by a further percentage point to 7.8% in 1913 and in 1938 was roughly at the level of the mid-1900s. The Asian share declined over the whole period by 13 points, from 67% to 55% and a third of the change was cumulated in the 1850s and 1860s. Likewise, two thirds of the relative rise of Europe from 18% in 1800 to 27% in 1913 were cumulated before 1870. The European share fell during the war by one point and continued to decline afterwards. In contrast, the American share rose almost as fast from 1870 to 1913 (from 6.5% to 10.4%) than in the first seventy years of the century (from 2.5% to 6.5%) and rose further to 11.9% on the eve of World War One.

We will return to the contribution of shocks and demographic transition to these changes in the next sections. Before that, we need to ask to what extent our results modify the conventional wisdom about long term trends. We start by comparing population at the relevant benchmark years with Maddison's estimate, the linchpin of all modern estimates (Figure 4). [18]

Figure 4
World population, 1820-1940: a comparison with Maddison



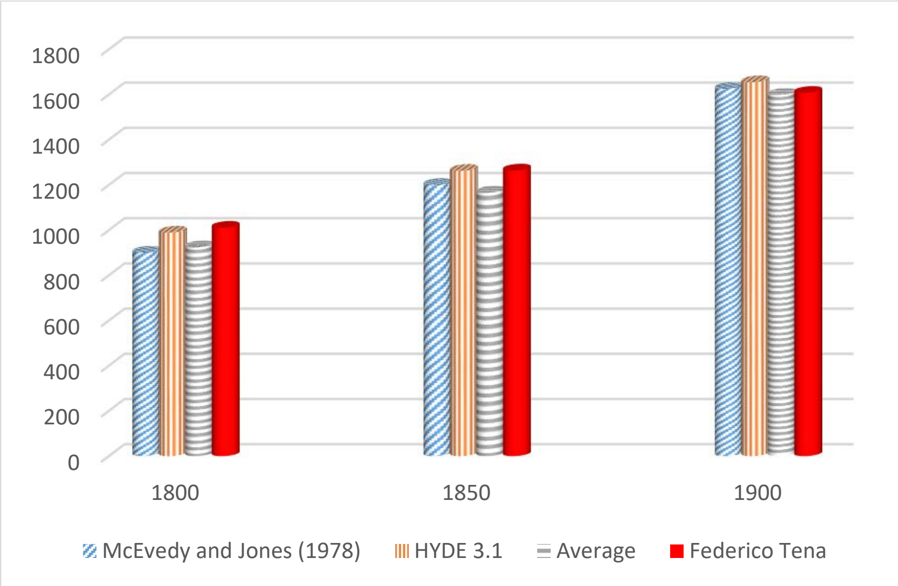
The differences in long-run rates of growth before1940 (0.63% the present estimate, 0.66% Maddison) are small and the Root Mean Square Error for the common yearly series, which however refer mostly to advanced countries with good sources, is quite low – around 10%.. Interestingly, the differences concentrate in the

[18] For the purpose of this comparison, we compute the population in 1940 by extrapolating our estimate of population in 1938 with the growth rate for the previous five years (1.3% for Asia and Africa, 1.2% for Americas and world population, 1.1% for Europe and Oceania). Thus, it might be slightly overstated as it does not include an adjustment for war-time losses.

thirteen years before World War One: our estimate is 2.7% higher in 1900 and only 0.39% higher in 1913, and its rate of growth is correspondingly lower (0.87% per year vs 1.05%)

In Figure 5 we compare our results with the widely quotes estimates by McEvedy and Jones (1978) and HYDE 3.1 (Klein et al 2010) and with an average of other major independent ones.[19]

Figure 5
World population, 1800-1900: a comparison with other estimates



The differences between our estimates and other series are somewhat greater, at least in the 19th century: our estimate is higher than all others in 1800 (up to 14% higher than Clark 1967) and it grows more slowly.[20]

As expected, differences by continent are greater (Table 5), and they are clearly related to the quality of sources [21]. They are fairly small for Europe (without Russia), and quite large for Oceania and Africa. These latter would have been larger if we had used the Manning-Nickleach (2014) estimates also for the period 1850-1890 (cf. Table 2).

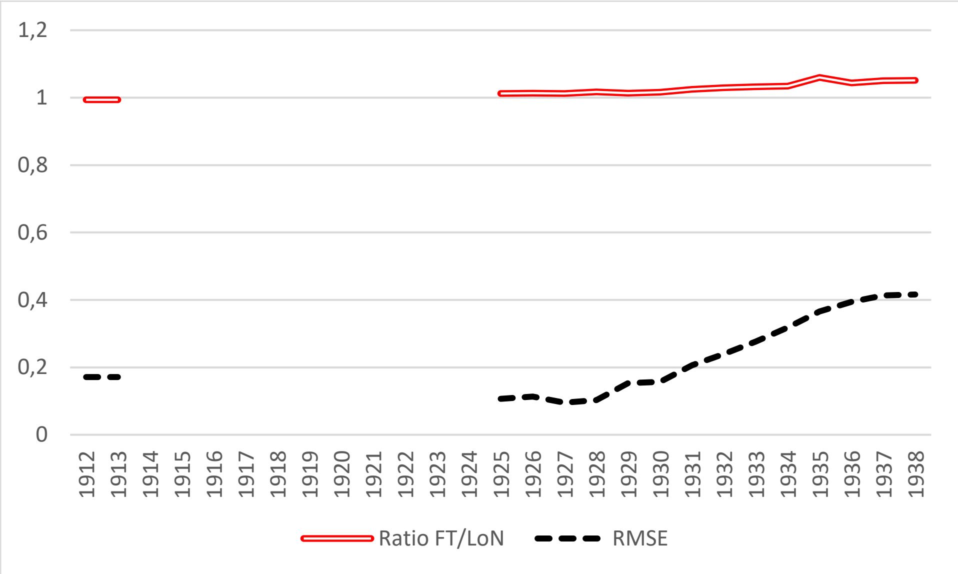
[19] The average is computed on seven sources common to all three benchmarks, Willcox (1940), Carr-Saunders (1936), Swaroop (1951), Bennett (1954), Durand (1967), Biraben (1979) and United Nations (1999). We add Clark (1967) in 1800 and 1900 and Hubner's *Geographical Atlas* (as quoted by Willcox 1940) in 1851 and 1900. We do not add a bar for the late 1930s because the available estimates refer to different benchmark years. CLIO-Infra does not report a total, and we compare our estimate with Gapminder in Figure 6b.
[20] Our estimate implies an annual rate of growth 0.46% 1800-1900 vs 0.51% for HYDE 3.1, 0.59% according to McEvedy and Jones (1978) and 0.55% for the average, with a maximum of 0.63% according to Durand (1967).
[21] In the columns for the average of estimates, the cells 'Europe' (excluding Russia) and 'Russia' are empty because the sources treat differently Russia, sometimes reporting separate figures and sometime including in Europe.

Table 5
Comparison with other estimates, ratios by continent

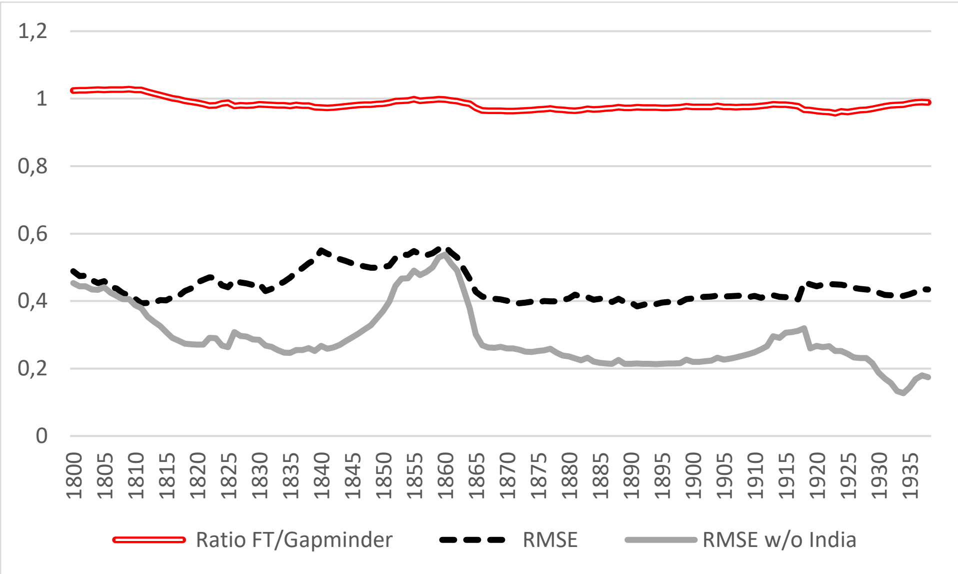
	McEvedy-Jones (1978)			HYDE 3.1			Average 'core' estimates			Maddison		
	1800	1850	1900	1800	1850	1900	1800	1850	1900	1820	1900	1940
Africa	1.63	1.39	1.22	1.33	1.09	0.95	1.16	1.11	1.03	1.53	1.22	1.09
America	1.01	0.97	1.01	0.88	0.95	0.99	0.89	0.95	0.93	1.01	1.00	1.00
Asia	1.11	1.04	0.95	1.00	0.99	0.96	1.11	1.08	0.98	1.01	1.03	0.97
Europe	1.01	0.99	0.99	0.98	0.97	0.96				0.96	0.94	1.03
Russia	0.89	0.93	1.08	0.88	1.03	1.11				0.89	1.08	0.91
Oceania	1.23	1.11	0.97	3.61	1.95	1.25	1.41	1.33	1.10	6.32	1.45	1.33

Last but not least, Figure 6 plots the differences in total population and in polity series (as measured respectively by the ratio and by the Root Mean Square Error) between our series and the two yearly ones, by the League of Nations and Gapminder.

Figure 6
Comparison with yearly series
a) League of Nations



b) Gapminder



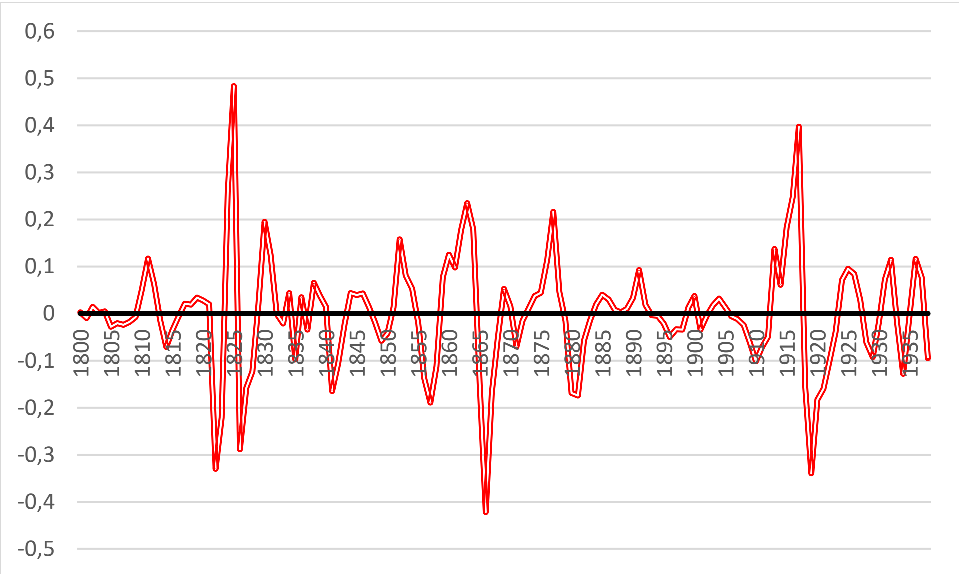
The differences with the League of Nations (Figure 6a) are small in 1913 and in the 1920s but widen substantially in the 1930s because of differences over China. According to the 'approximate estimate' of the League of Nations, the Chinese population remained constant at 450 million throughout the period while it rose from 454 in 1925 to 530 million in 1938 according to our estimate, which is consistent with the first post war census in 1953. The case of Gapminder is different. From one hand, the aggregate ratio is quite close to one and the long run growth rates are almost identical (0.56% vs 0.54%, both with a log-linear specification). This outcome is not really surprising as Gapminder relies heavily on Maddison's estimate. From the other, short term movements differ a lot: the correlation between the cyclical components from Hodrick-Prescott filter is a mere 0.13. Furthermore, differences in yearly movement of polity series (especially India) are very large, as shown by the RMSE [22]. In all fairness, Gapminder does not claim any historical accuracy. In their website they stress their educational role, stating that 'our data is more consistent over time and space than most other sources, because we dare to fill all the gaps in the sources. We dare this because our purpose is to show people the big picture, and they won't understand it if its full of holes'.

These comparisons show that the so far available benchmark data capture fairly well the long run trends, with differences within the likely margin of error of estimates. In contrast, yearly series by polity are often missing or of questionable reliability and this has made so far very difficult a scientific analysis of short- term movements in world population.

6) The results: volatility and demographic shocks

A visual inspection of the normalized residuals from a Hodrick-Prescott filter (Figure 7) do not confirm the conventional wisdom about a decline in population volatility

Figure 7
Volatility of population, 1800-1938



[22] We compute the RMSE on a set of comparable polities to avoid bias results upwards, but the omitted polities account for a very small share of total (less than 5%). The sum of population of Pakistan, India, Bangladesh and Myanmar according to Gapminder always exceeds our estimate for British India by a substantial margin, fluctuating between 12% and 23%. Our series is based on censuses, as re-worked by Davis (1968) and endorsed by Maddison (1995) and Sivasubramonian (2000). As said, Gapminder does not specific its sources a mystery.

Volatility seems stable and, again in contrast to the conventional wisdom, it was slightly higher in the core countries (8.8%) than in the peripheral ones (8.5%)[23]. We test this impression by estimating rates of change in volatility with a (log-linear) regression, adding as a control the share of linearly interpolated series on total population (cf. Section Eight) [24].

Table 6

Rates of change in volatility of population series, 1800-1938

a) Hodrick-Prescott filter

	1800-1938		1800-1913		1800-1938		
	Time	Share	Time	Share	Time	Share	Dummy 1910s
Africa	2.62***	-0.18	2.94***	0.01	2.24***	-0.20	2.77**
America	-0.46	-1.07**	-1.85**	-1.76	-1.23**	-1.41**	4.46***
Asia	-0.40	-0.13	-0.77	0.26	-0.30	-0.02	2.19
Europe	2.13***	0.00	2.17**	0.02	1.65**	-0.04	2.22*
Oceania	-0.56	-0.15	-0.50	-0.12	-1.47*	-0.25	5.06***
Core	-0.54	0.01	-0.94	-0.01	-1.12	-0.06	3.83**
Periphery	-0.81	-0.85**	-1.80**	-0.79**	-0.97	-0.86	1.11
World	-0.83	-0.96**	-2.34**	-1.22**	-1.21*	-0.96**	3.01***

b) Hamilton measure

	1800-1938		1800-1913		1800-1938		
	Time	Share	Time	Share	Time	Share	Dummy 1910s
Africa	7.46***	-0.29	8.07***	-0.23**	7.62***	-0.28	-1.19
America	-0.21**	-0.13	0.28**	-0.01	-0.17*	-0.11*	-0.24
Asia	1.13*	-0.26*	0.83	-0.29	1.09	-0.30**	-0.90
Europe	-0.19	-0.08**	1.04***	0.01	0.10	-0.06	-1.32***
Oceania	2.53***	-0.63***	4.59***	-0.37**	2.75***	-0.60**	-1.25
Core	-0.31**	-0.09	0.55***	0.08	-0.43***	-0.29	-0.71***
Periphery	2.14***	0.29*	1.74***	-0.05	2.28***	0.30	-1.02*
World	2.02***	0.30***	1.41***	-0.18	2.14***	0.30*	-0.93**

* significant at 10%; ** significant at 5%: *** significant at 1%

[23] The core includes North America (United States and Canada), North Western Europe (France, Germany, Scandinavia, Belgium and Netherlands), Australia and New Zealand. The ratio between absolute deviation and trend component over the whole period is 3.3% in Africa 7.1% in the Americas, 10.9% in Asia, 9.1% in Europe and 8.1% in Oceania.

[24] The dependent variables are computed as the logs of the ratios of squared numerator and denominator (e.g. the residuals and the trend component of the Hodrick-Prescott filters).

The time trend coefficients in the baseline estimate are mostly negative but not significant. Volatility rose in Africa, in Eastern Europe and in the Balkans, while it remained constant in Western and Central Europe and declined in Mediterranean countries. Overall, pre-war world was in stark contrast with the fast decline of volatility after 1950 (-5.7% yearly, significant at 1%). As a robustness check, we run the same specification with a different measure of volatility, suggested by Hamilton (2018) for yearly series, the ratio of five-year differences between observations divided by the initial population. The results (Table 6b) are even farther from the conventional wisdom, with increasing volatility as the norm. One might surmise that the results depended on the exceptional level of shocks of the 1910s. Thus, we re-run the regressions twice, excluding the whole period 1914-1938 and adding a dummy for the crisis years 1914-1919. Results are somewhat with mixed. From one hand, in the baseline estimation, the negative coefficients for Americas and (weakly) the world become significant and the dummy for the 1910s is positive and significant as expected. From the other, using the Hamilton measure, the upward trend in volatility is even stronger and, contrary to expectations, the 1910s dummy is not significant and negative [25].

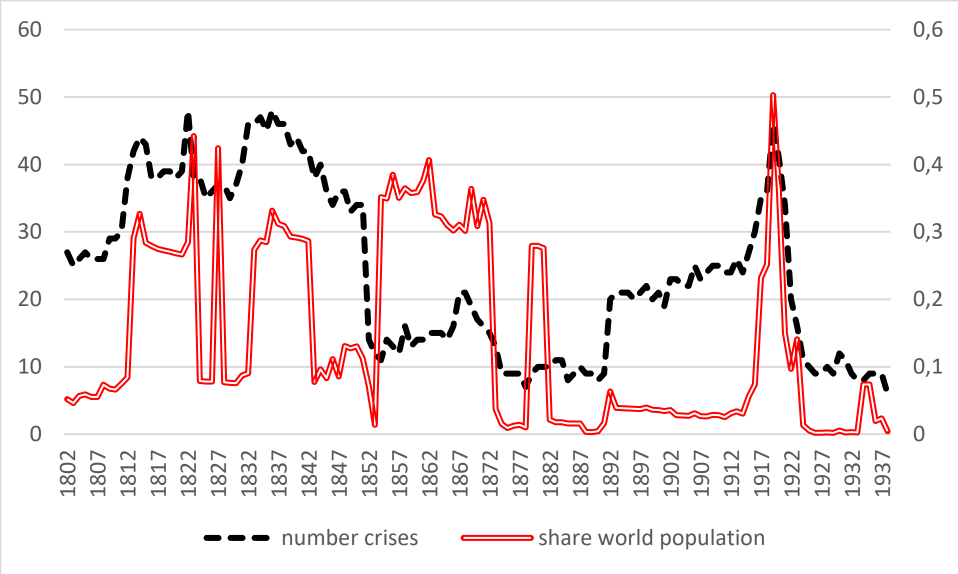
A quasi-constant volatility implies that the frequency and/or severity of demographic crises has not changed [26]. In theory, one should define a demographic crisis any year when death rates above the normal by a significant margin but this computation is very difficult without good vital statistics. Thus, we prefer a more stringent definition of demographic crisis as an absolute decline in population. These crises were widespread and frequent. They affected more than two thirds of polities (121 out of 174) and about a sixth of the years (3324 years out of 21641). This may be an undervaluation. Short-term crises are missed by definition in upward linearly interpolated trends and in all likelihood death rates exceeded the normal also in the 811 years of missing population growth [27]. The distribution in time of crises (Fig 8 red line) shows a sharp drop in the second half of the 19th century, followed by a rise which started around 1895 and peaked, predictably, in 1918 with 48 instances of decline.

[25] We have also re-run the regression with a dummy for the years 1910 to 1923 which include at least one war year in the computation of the an 'Hamilton' volatility measure. Results are almost identical.

[26] The other main source of large variation in population from one year to another are boundary changes. We control for them in the following analysis of crises by omitting 13 polities subject to massive territorial losses – the Ottoman Balkans in 1830, 1859, 1879, 1881, 1897 and 1912, France in 1871, Germany in 1919, Greece in 1924, Hungary in 1923, Russia in 1919 and Turkey in 1919. We interpolate the series for Figure 8 by assuming that in those years population changed as much as in the average of the two neighbouring years.

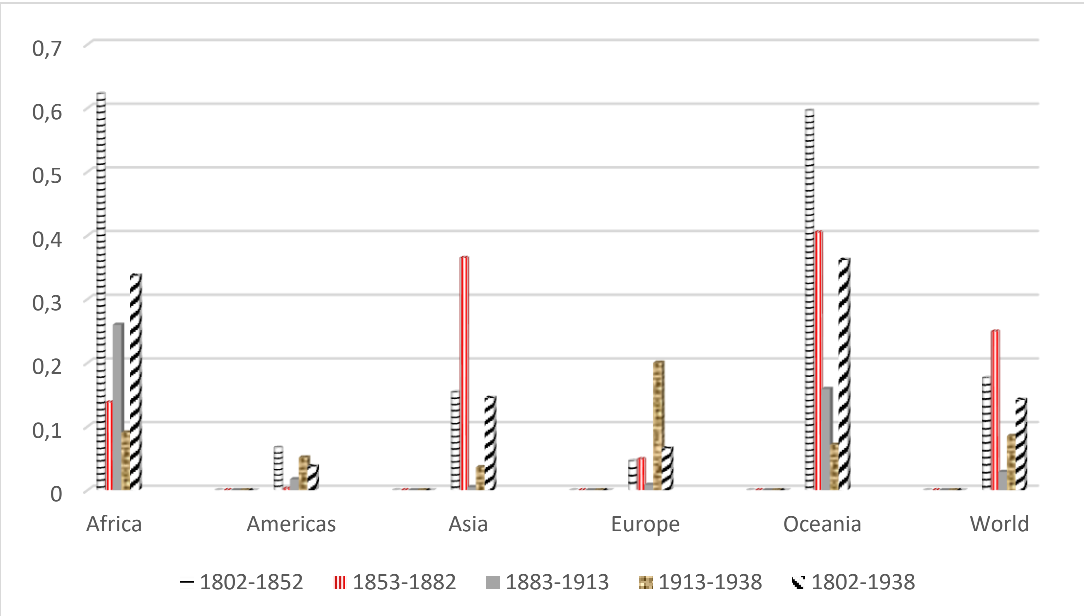
[27] The upward trends account for 69% of total interpolation and anyway the undervaluation effect of linear interpolations could be compensated by the omission of years of population growth in downward trends

Figure 8
Number of countries affected by demographic crises and their share of world population



The impact of crises appears somewhat smaller if one considers the number of people rather than the - number of polities. The share of population in affected polities (Fig 8, red line) was lower (13.8% vs. 14.5%) and their distribution by period/continent (Figure 9) differed. In the first half of the century, crises affected mostly Africa and Oceania, around mid-century Asia (or more precisely China during the Tai'Ping civil war) and in the early 20th century Europe. In the thirty years before World War One, the heyday of first globalization, crises were very rare outside Africa.

Figure 9
Share of population affected by demographic crises, by period/continent



Not all crises were equal, as it can be shown by a simple classification according to their length (Table 7).

Table 7
Duration and severity of demographic crises

	Short term (1 to 3 years)	Medium term (4 to 9 years	Long term (over ten years)	All crises
Number crises	210	53	101	365
Number years of crises	310	301	2700	3311
Average length of crises	1.5	6	27	9
Average rate of yearly decrease	-2.2	-1.2	-0.6	-0.6
Shares years of crisis on world total				
Africa	14.5	8.6	56.3	48.0
Americas	18.7	31.9	26.8	26.5
Asia	16.8	31.9	5.3	8.8
Europe	44.8	25.7	1.2	7.5
Oceania	5.2	13.8	10.4	10.2

Short crises (1-3 years) were typically determined by famines or epidemics, which caused a sharp drop in population [28] The worst case was the tiny island of Cabo Verde, which, in spite of its name, was subject to disastrous droughts. In was hit by five such crises, and in the worst one, in 1831-1833, population collapsed from 76K to 47K – i.e. by 45%. The devastating famine of North China 1877-1878 claimed between 9 and 13 million lives (Aird 1968 p.265) and the worst affected province, Shanxi, lost 5.5 million lives, about 15% of its population. Some of the medium-length crises were determined by exceptionally long famines, such as the Irish one, with related diseases and emigration. The population of the island collapsed from 8.3 million in 1845 to 6.3 in 1852 (Mitchell 1988), causing the population of the Kingdom to decline for five years in a row, in spite of the fast rise in the rest of the country, from 28.0 in 1846 to 27.4 million in 1851. Other medium-length crises were determined by wars. Paraguay lost about a quarter of its population, from 350K to 276K, in the 1864-1870 war against Brazil and Argentine. About sixth of medium-length crises years concentrated in the period 1914-1921, when effects of war were worsened by the Spanish flu (cf. Table 8).

Long term crises accounted for most total observations and, even if the yearly rate of decline was low, also for most cumulated losses. In Asia, Europe and South America there were few such crises, and none of them lasted more than twenty years. Four fifths of really long term crises affected Africa (35 out of 42 cases, with a median length of 41 years) and the rest happened in Oceania (5 out of 7, 51 years) and the Caribbean (11 out of 36, 31 years). According to the estimates by Bulmer Thomas (2012), the population of the Danish Virgin island (since 1917 US Virgin Islands) declined in 91 years out of 139 – i.e. in all years but the initial ones (1800-1835), the final ones (1930-1938) and a short period of stagnation from 1846 to 1850. The exact timing, speed and duration of these long crises is highly uncertain as the estimates for these continents are, at best, informed guesses. The linear interpolation assumes a steady decline rather than a succession of collapses and modest rebounds, and thus it may overestimate the number of crisis years and underestimate the yearly

[28] There is no good independent source on demographic shocks. The EMDAT data-base (https://www.emdat.be/) covers only natural disasters since 1900 and it seems to underestimate the number of deaths. It lists 387 events, but in only eight cases the death toll exceeds one million people.

losses [29]. The existence of long term crises is beyond doubt. According to Manning and Nickleach (2014), in the first half of the 19th century, slave trade reduced the population of SubSaharian Africa (except its Southern tip) by about 4%, or by 0.07% per year [30]. This decline accounted for about 60% of observations of long term crises in the continent (890 out of and for about a quarter of the total). The other concentrated in the last decades of the 19th century, when Africa was hit by a series of calamities, including droughts, locust, the European conquest and the rinderpest, which killed a large proportion of cattle and disrupted the livelihood of large swathes of the population (Sunseri 2018) [31]. In other continents long term crises were determined by European infectious diseases which natives had little or no immunity against. By 1800, the collapse of native population had already happened in South America and in Mexico, was on-going in North America and had just started in Oceania. The size of the decline depended on nature of diseases (some were more lethal than others) and on the patterns of transmission, which in turn depended on location and population density. The length of trips from Europe to Oceania might have prevented some transmission of some diseases (Bushnell 1993) and the wide spaces of North America reduced contacts between infected native groups (Thornton 2000). Yet, our source suggests a 62% decline of native population of North America 1800 to 1890 (Thornton and Marsh-Thornton 1981). In Oceania the decline of the native population was as large as in the Americas and there was very little or no rebound before World War Two. According to the best estimates, the total aboriginal population of Australia collapsed from 575K in 1815 to 74K in 1933 (i.e. by 87%).

These demographic catastrophes were terrible for the affected people, but their impact on world population was small and sometimes negligible. Deaths during the 1878-79 Chinese famine were equivalent to a third of the population of the United Kingdom but accounted for only 0.6-0.9% of world population. If the native population had been growing at 0.5% yearly since 1800 rather than declining, the population of Oceania would have been 2.3 million higher in 1938 and the world total only 0.1% greater. [32] In the extreme and somewhat implausible case that the 1800 native population were ten times the historical minimum, as hypothesized by Stannard (1989) for Hawaii the world population in 1938 would have been only 0.5% higher. The world population decreased only eight years out of 139, in 1826, 1862-1866, in 1918-19. The first of these falls is somewhat puzzling. It was determined by a sudden fall in Chinese population, from 392 to 385 million, which however does not coincide with any known catastrophe. Also the next world crisis was

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[29] As said, the overestimation might compensate the underestimation from the omission of crisis years during periods of linearly interpolated population growth. However, this case would not change the overall assessment of the demographic conditions of the country and anyway linearly interpolated downward trends account for 10.6%% of all crises. The share is high (and thus the issue potentially relevant) only in Africa, where they account for 22.2% of crisis observations in the whole period and for 51.4% in the first half of the century.

[30] Population declined from 1800 to 1850 by 1.7% (0.03% per year) in West Africa and by 14% in Central Africa (0.3% per year), from 1810 to 1850 in East Africa by 3.7% (0.1% per year), from 1820 to 1850 by 1.4% in NorthEast Africa (0.05% per year). Rates are computed between benchmarks. Cf. for a list of the polities included Fn 31

[31] Rinderpest appeared in 1887 and ravaged the continent until the 1930s. From 1891 (the first benchmark year in Frankema and Jerven 2014) onwards, 12 polities experienced long term decline, for a total of 330 (a tenth of the world total) years and an average rate 0.65%

[32] For Australia and New Zealand we compute our counterfactual series as sum of natives and white population with data from Historical Statistics Australia and Historical Statistics New Zealand. For Hawaii we rely on data from Schmitt (1968 tab 16 and 26). We estimate the counterfactual series for full-blood natives only, while we include 'part Hawaiians in the series for 'others' (mostly Japanese immigrants), assuming there were 100 'others' in 1800. For other islands the sources do not distinguish between natives and immigrants, who anyway were much fewer than in Hawaii or, a fortiori, Australia and New Zealand. Thus, we implicitly assume that all population was native-born and we select for the counterfactual the period of absolute decline -i.e. 1800-1885 for Polynesia (a total decline of 50%), in Micronesia 1830-1913 (37%) in 1820-1901 Melanesia, without Papua New Guinea (-29%). We extrapolate the population in the final year of the period with the actual growth rate.

exclusively a Chinese affair, as it coincided with the most intense period of the Tai'ping civil war, which affected negatively population of the country from 1852 to 1871, when the last Tai'ping army was defeated [33]. From 1862 to 1866, population fell from 410 to 365 million in China and increased from 899 to 915, at an healthy 0.7% rate. In contrast, the 1917-1919 crisis affected the whole world, as the cumulated outcome of three different shocks, the Great War, and the Spanish flu and the Russian post revolution troubles (the civil war, war communism and famine). Population declined in 42 polities out of 143, by an average of 1.3%. Table 8 compares the actual population changes in the most affected areas with a crude estimate of excess mortality, including missing births [34]. We also report the available data on deaths in the last year of World War One and from Spanish flu [35]. These latter show how uncertain is the total death toll from the pandemic, even for countries with good demographic data.

[33] Overall, for the joint effect of civil war and other rebellion, famines and diseases, the Chinese population declined from 438.9 million in 1852 to 357.8 in 1871 – i.e. by almost a fifth. Extrapolating the initial figure to 1871 with the growth rate of the late 1840s (0.4% year) yields a total excess death, including missing births, up to 110 million. The figure is higher than standard estimates of war losses (Aird 1965 p.265) but not much higher than some independent Chinese estimates (Platt 2012 p.308).

[34] We compute excess mortality as the difference between actual and counterfactual population in 1918 and 1919. We estimate this latter by extrapolating the actual population with the 'normal' rate of change, as proxied by the 1909-1913 rate. The population of Russia in 1919 at pre-war borders is computed by extrapolating the figure for 1918 with the rate of change for Russia at interwar borders (without Finland and Congress Poland) from Markevitch and Harrison (2011 Appendix tab A8 and A9). The estimates for Spanish flu exclude the deaths from the third (and minor) wave in 1920.

[35] The figure include the war deaths suffered by countries not included in the table, such as Ottoman Empire and Balkans countries Greece, Japan, Portugal, South Africa and Turkey, but not civilian deaths. We also assume that civil war in Russia caused 1.5 million deaths in 1919.

Table 8
Population changes 1917-1919 (thousands)

	Actual change		Excess mortality		War losses 1918	Spanish flu
	1917 to 1918	1918-1919	1917 to 1918	1918-1919		
China	1404 (0.32%)	761 (0.17%)	-1147 (0.26%)	-1800(0.41%)		4000-9500
India	-7328 (2.36%)	-1431(0.45%)	-8965(2.77%)	-3031(0.93%)	44	6200-18500
Indonesia	-1072 (1.97%)	523(0.98%)	-1690 (3.11%)	-82(0.15%)	-	450-4300
Russia	-811(0.85%)	-2023(1.21%)	-4275 (2.56%)	-5470(3.20%)	584	450-2760
European belligerents *	-1903 (0.78%)		-3917 (1.60%)		2596	1300-2440
Western offshoots **	118(0.10%)	1759(1.50%)	-2147(1.83%)	-508(0.42%)	202	233-716
World	-6255(0.34%)	1259(0.07)	-23309(1.27%)	-15736(0.84%)		

* Austria-Hungary, France, Germany, Italy and United Kingdom: ** Australia, Canada, New Zealand and United States

Sources: war deaths (military) estimated as deaths 1914-1918 from War office (1922) and Becker (1999:90) times the share in 1917-1918 from Barro et al (2020) Tab. 2; Spanish flu maximum and minimum from Johnson and Mueller (2002) Authokorala and Authokorala (2020), Barro et al (2020) Tab. 1, plus country specific sources for India and Indonesia (cf. Appendix I)

The difference between excess deaths and war losses (35 million) is our best guess of deaths for the Spanish flu. There is some suspect that the figure is underestimated. The series for about sixty polities, accounting for 5-6% of world population, are estimated with linear interpolation, and thus assume by construction the impact of the flu to have ben nil [36]. On top of this, the number of excess deaths in China, where anyway the flu might have been more benign than elsewhere (Chen and Leung 2007), is lower than all available estimates. On the other hand, the figures for war-related losses are very conservative, as they refer to lower bounds of ranges and exclude civilians. Factoring both biases, it seems highly unlikely that the total world losses from Spanish flu reached 40 million. This latter figure is close to the upper bound of the range of the scientific estimates, from 17-24 million (Spreeunwenberg et al 2018) to 35-44 million deaths (Athukorala and Athukorala 2020), leaving aside the unsubstantiated guesses of a total toll up to 100 million which circulate in the historical literature[37]. Our estimate implies that the Tai'ping civil war, or more in general the mid-19th century Chinese crisis, was the largest demographic shock in the whole period. Total losses were comparable to deaths in World War Two, when world population was double a century earlier.

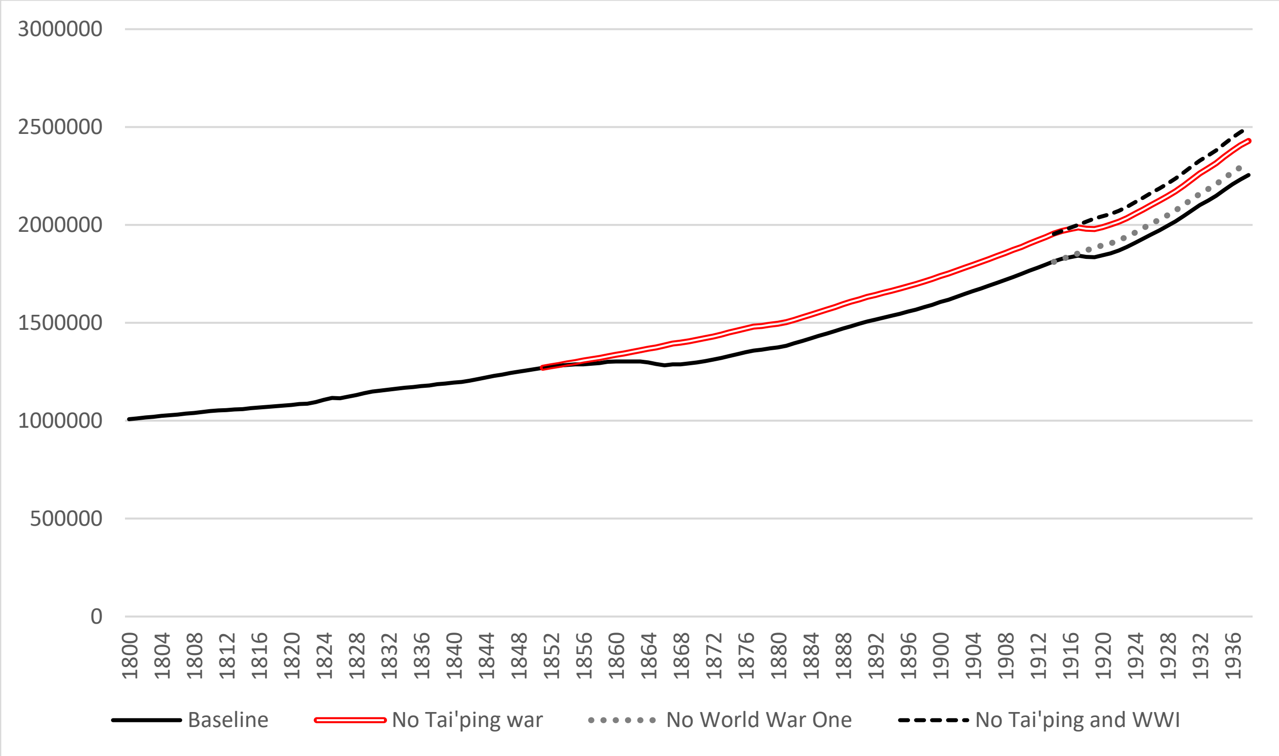
The impact of these two world-wide crises can be measured with a simple back of the envelope counterfactual exercise. We compute no-crisis population series assuming that the Chinese population had been growing from 1851 to 1871 as fast as in 1830-1850 and that the world population had been growing from 1914 to 1919 as fast as in 1890-1914 [38]. Figure 10 plots the three resulting counterfactual series of world population, with Tai'ping war only, with the 1917-19 crisis only or with both.

[36] Our estimates of excess mortality are not totally independent from the figures on death losses, as some population series incorporate the best guess estimates of losses from the flu.

[37] This figure, which is often quoted in the historical literature, is a speculative guess by Johnson and Mueller (2002). The sum of their country estimates yield a total of 33-43 million, but they increase it to 50 million, and add that even this figure 'may be substantially lower than the real toll, perhaps as much as 100% understated' (p.115)..

[38] We extrapolate the post crisis trend with the actual rate, which in theory could exceed the steady state one to compensate for the losses. However, there is no much evidence of such an acceleration. The rates for China were marginally higher in the mid-1870s than in the 1840s but the increase was short lived. As said, the worldwide rate of growth rose gradually from 1921 to the eve of World war rather than jumping after the end of crisis and then returning to the normal.

Figure 10
Counterfactual, no-crisis series of world population



Clearly, the Tai'ping war affected world population much more than the late 1910s one: world population in 1938 would have been 2429 million, rather than 2254 million (or 7.7% greater) without the civil war and 2137 without the late 1910s crisis (2.8% greater). Without both major crises, the population in 1938 would have been about 244 million greater (10.8%): if one factors in also the 'minor crises' the total missed growth might well have exceeded 300 million.

7) The results: dating the beginning of the demographic transition

According to the textbook models (Kirby 1996, Lee 2003), during the demographic transition the rate of natural increase, the difference between crude birth and death rates, follows an inverted U pattern. it is zero or very low in the equilibrium before the transition, starts to rise when mortality declines while fertility remain high, declines when fertility adjusts to lower mortality and eventually returns to a very low (or zero) level in the second stage, when fertility and mortality rate converge. Thus the series of natural increase is bound to show at least two breaks, when the gap between birth and death rates begins to widen ('start') or when it closes or stabilizes at a low level ('end'), and possibly more. There could be a third break when the start of decline in fertility slows down the population rise and others if the changes in birth and death rates are not linear. Trends in natural increase would be perfectly mirrored in the series of population in a closed economy, but the two series would diverge by the size of (net0 migrations.

Net migrations are by definition zero on a world scale and thus our aggregate results (Section five) are a measured on natural increase. Transition was already on-going somewhere in the 1800s and it has been gaining speed throughout the period (but for event-related setbacks), reaching the maximum speed after World War Two. In the early 1950s, the rate of natural increase were already higher than its pre-war peak (17‰ vs. 13‰ in 1929-1933) and grew up to a historical maximum of 20‰ in 1965-1970, in spite of a modest decrease in crude birth rates (from 36.4‰ to 34‰) because the crude death rate fell by a third, from 19.1‰ to 13.5‰ . Since then, the rate of growth in world population has declined to 1.1‰ in 2015-2020, with a birth rate 18.5‰ and death rate 7.5‰. In 2015-2020, the rate of natural increase was negative in 24 countries, all in Europe except Puerto Rico, and was positive but below 5‰ in 39 others. Changes in the distribution of world population (cf. Figure 3) imply that the process developed different across continents. Given the dearth of data on vital statistics for most of the world before 1960, as said in the introduction, we date the beginning and early stages of transition by searching for structural breaks in the series of rate of change of population. Our method cannot be applied to the short series of post 1918 polities and it is likely to give spurious results in many other cases, for the joint effect of border changes, short-range migrations, linear interpolations and other errors (cf. Section Seven). Thus, we consider separately only British India and China, the two most populous countries, which were not affected by boundary changes and experienced limited migrations flows relative to their population. We group all other polities in 16 macro-areas, taking into account their geographical location, the level of development and the size of migration flows [39]. For eight of these macro-areas, we can double check the results with counterfactual series of population net of migration (cf. details on computation Section Eight). Furthermore, we have been able to build series of population for Western and Southern Europe since the mid-17th century, albeit with an incomplete geographical coverage [40]

As a first step, we let the routine find as many breaks as possible ('unconstrained' estimates). [41] This test returns a total of 117 breaks, with ten area series featuring nine breaks, the maximum set by the 0.10 trimming percentage. However, quite a few of these breaks feature implausibly large intervals of confidence at 95%. Thus, we re-run the routine in order to identify as precisely as possible the dates of meaningful changes. We constrain the number of breaks to be equal to the number with featuring an interval of confidence no larger than two-three years ('precise' estimate) and in any case not to exceed five ('constrained' estimates). Finally, we select among the 'precise' (and possibly 'constrained') estimates the most plausible dates for the beginning transition, with very prudential criteria in order to avoid false inferences. We exclude breaks before or after major demographic crises if they seem to be determined by short-run Malthusian reactions rather than by the (long-run) process of demographic transition. As a second

[39] We divide America between North, Caribbean, South American immigration areas (Brazil, Argentina and Uruguay) and other South American countries Oceania between Immigration countries (Australia and New Zealand) and the rest (Micronesia, Melanesia and Polynesia), Africa between North and Sub-Saharian, Asia between Middle East, China, India, South East Asia (Indonesia etc), East Asia (Japan and Korea). Europe between North Western (United Kingdom, France, Scandinavia etc.), Central (Germany, Austria-Hungary and successor states), Southern (Italy, Spain, Portugal), Eastern (Russia and Poland after 1918) and Balkans.

[40] The series for Western Europe starts in 1660 to 1800 and include England (Broadberry et al 2015), France (Dupaquier 1992 and Henry and Blayo 1975) and Sweden (Schon and Krantz 2012). The series for Southern Europe begins in 1650 and features Centre-North Italy (Galloway 1994),Portugal (Palma and Reis 2019) and Spain (Prados de la Escosura et al 2022). The series account respectively for 74% and 72% of the total population of the areas in 1800.

[41] The Xtbreak command (Ditzen et al 2021) adopts a sequential approach – i.e. it tests progressively from the null of one break vs zero breaks to the null of nine vs eight breaks by splitting each interval. It also reports an interval of confidence (in years) for each break and the minimum number of breaks, which we take into account while selecting our 'precise' estimate.

step, we estimate the rates of change of population for each period with Razzaque et al (2007) model as our preferred choice. We compute a log-linear trend when the number of observations is too small or when the Razzaque specification yields not significant results [42].

We report In Table 9 we report only breaks and rates which imply strongly significant changes in the rate of growth in population and cannot be explained by known events. For instance, the 'unconstrained' estimate for North Africa yields nine breaks, which the 'precise' estimate whittles to two breaks, in 1830 and 1876. The rate of growth for 1831-1876 is high (0.96%) but not significant and the null of equal rate to 1800-1831 is rejected only at 10%. Furthermore, early data are highly uncertain and the year 1830 coincides with the French invasion of Algeria. So, in this case we prefer to play safe and consider the transition to have started only in 1876.

[42] We signal these cases by underlining the rates in Table 9. Almost all log-linear series features auto-correlated residuals, partly for the nature of population change and partly by construction (cf. Section Eight). We prefer not to correct in order to avoid further distortions, given that autocorrelated residuals do not bias the coefficient of trend variable, the result of interest and that t-statistics are very high.

Table 9

Dating demographic transition: yearly rates of growth 1800-1938

a) total population	All period		Early trend		After first break		After second break	
North Africa	1800-1938	0.64***	1800-1876	-0.13	1876-1938	1.15***		
Sub-Saharian Africa	1800-1938	0.23***	1800-1920	0.27***	1920-1938	1.36***		
North America	1800-1938	3.28***	1800-1845	2.78***	1845-1912	1.99***	1912-1938	1.24***
Caribbean	1800-1938	2.08**	1800-1830	0.87***	1830-1881	1.25***	1881-1938	1.85***
Immigration Latin America	1800-1938	2.28***	1800-1853	1.60***	1853-1938	2.30***		
Latin America	1800-1938	1.16***	1800-1891	0.99***	1891-1938	1.27***		
Middle East	1800-1938	0.49***	1800-1830	0.19***	1830-1922	0.55***	1922-1938	1.63***
India	1800-1938	0.62***	1800-1873	0.37***	1873-1920	0.47***	1920-1938	1.11***
China	1800-1938	0.15***	1800-1925	0.12	1925-1938	1.47***		
South-East Asia	1800-1938	0.80***	1800-1844	0.85***	1844-1938	0.74***		
Far East	1800-1938	0.39***	1800-1860	0.03	1860-1938	1.64***		
Western Europe	1800-1938	0.52***		No breaks				
Southern Europe	1800-1938	0.80***	1800-1862	0.68***	1863-1920	0.87***	1920-1938	1.03***
Central Europe	1800-1938	0.46*	1800-1923	0.84***	1923-1938	0.56***		
Balkans	1800-1938	1.59**	1800-1829	0.44***	1829-1920	0.63***	1920-1938	1.39***
Eastern Europe	1800-1938	1.27***	1800-1857	1.08***	1857-1909	1.55***	1909-1938	0.98***
Australia New Zealand	1800-1938	2.70***	1800-1831	-1.57**	1831-1892	3.77***	1892-1938	1.73***
Pacific Islands	1800-1938	-0.01	1800-1920	-0.38**	1920-1938	1.46***		
b) no immigration/natural increase								
North America	1820-1938	1.66***	1800-1867	2.20***	1867-1927	1.32***	1927-1938	0.84***
Immigration Latin America	1800-1938	1.48***	1800-1852	0.94***	1852-1912	1.74***	1912-1938	1.40***
Caribbean	1800-1938	5.02	1800-1858	1.03***	1859-1938	2.15***		
Western Europe	1838-1938	0.89***		No breaks				

Central Europe	1817-1913	0.45		No breaks					
Southern Europe	1862-1938	0.95***	1863-1921	0.91***	1921-1938	1.06***			
Eastern Europe	1867-1914	1.65***		No breaks					
Australia New Zealand	1852-1938	1.80***	1800-1892	2.02***	1892-1938	1.71***			

Sources: own elaborations on population series; * significant at 10%; ** significant at 5%: *** significant at 1%; underlined rates estimates with log-linear specification.

Table 9 highlights four stylized facts:
i) over the whole period 1800-1938, the population increased in all areas but the islands of the Pacific, ravaged in the early 19th by European diseases. As expected, the highest rates of growth are registered in the areas of destination of European immigration, followed by the Caribbean, where population growth was boosted by the inflow of slaves and indentured servants. The rates for the counterfactual no-migration series are, as expected, lower in the Americas and higher in Southern Europe, the major area of origin of migrants. Differences are large and significant, but they do not change qualitatively the main story (cf. for a more detailed comparison for all areas Section Eight), but not change qualitatively the results.
ii) we are able to single out at least one break (and thus two different trends in Table 9) in all areas but Western Europe [43]. This fact is consistent with the increase in world population and suggests that some transition have been going on in all areas before 1938. We fail to find a break in Western Europe because population had already started to grow in the 18th century [44]
iii) In contrast with the stylized model of demographic transition, stagnation before the first break is the exception, not the rule. The population grew significantly in the majority of areas and in quite a few cases the rates exceed 5‰ (which in a century corresponds to an increase by two thirds). This stylized fact reflects two quite different cases. In Southern and possibly Central Europe the transition may have started in the 18th century, as in Western Europe, although the reasons are not so clear [45]. Population in Russia was growing very fast in the same period (Broadberry and Korchmina 2022) and this probably likely for other land-abundant areas such as the Americas and possibly South-East Asia because fertility was high and Malthusian positive checks were not working.
iv) the first break, as expected, was followed in most areas by a significant increase in the rate of growth and in some cases, such as India, Southern Europe and the Balkans, by a further increase after a second break. In these cases, transition featured a gradual acceleration, which may be explained by a faster decline in mortality, still within the first stage of transition. In contrast the second break marked a reduction in the rate of growth as expected in the second stage of the process, in North America, Australia/New Zealand and also Eastern Europe. In this latter case might be determined by war and the loss of territory and collectivization/famine rather than by the start second phase of transition [46]. We would conclude from this analysis that by 1938 transition had started all over the world, but nowhere it had ended.

The case of Eastern Europe highlights a more general issue with our long-term statistical analysis. The results may be affected by major shocks such as the two world wars and the Spanish flu in two different ways. First, it is possible that the late 1910s shocks prevent to detect the start of transition started in the late 19th century

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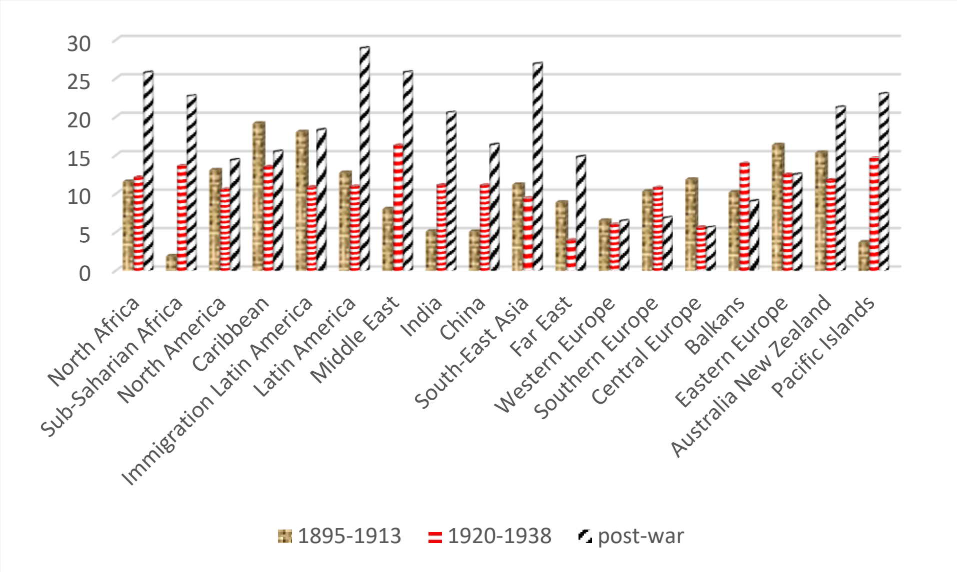
[43] The counterfactual series for Central and Eastern Europe shows no breaks as well, but this not sufficient evidence. In-fact neither includes the year of detected break. The former ends in 1913 and the latter begins in 1867.
[44] The series shows breaks in 1745 and 1769 and this latter coincides with a sizable increase in the rate of growth, from 0.2% to 0.43% -i.e. 0.1 points less than the rate after 1800 (rates significantly different at 5%).
[45] The series for Southern Europe shows breaks in 1684 and 1767 – this latter corresponds to a statistically significant increase in rates from 0.28% to 0.38%. This latter is significantly lower than the rate 1800-1920, which in turn is lower than the rate in interwar years -i.e. the population history of Southern Europe is characterized by an acceleration. The data for Central Europe are incomplete but Pfister and Fertig (2010, 2020) find evidence of an 'early and hesitant' decline in mortality in Germany since 1740 and of the final demise of the Malthusian regime in the first decade of the 19th century
[46] Rate of natural increase for the Soviet Union was quite high in the 1920s (rebound after crisis late 1910s) but then sharp slowdown (Rothenbacher 2002 tab. ??). Adding a dummy for 1919 in the regression lowers the growth rate to 0.93% and the difference is not significant.

and force the statistical analysis to return the year 1920 (or later) as a starting point. Second, the interruption of series from 1938 to 1950 might cause to miss relevant changes in rates of growth, either upwards (i.e. acceleration of population growth) or downwards (the start of the second stage). We address these issues by comparing rates of population growth in 1895-1913, interwar years and also in the period between 1950 and the first break in the post-war series to 2020 (Figure 11) [47]

Figure 11
Rates of population growth in the 20th century



The first question can be more precisely re-stated as whether interwar trends from Table 9 (defined as starting in 1920 or later, until 1938) can be considered really new relative to pre-war trends. There are eight cases - all rates are significantly different at 1% and in the three instances, China, SSA, Pacific islands where 1920 selected as start transition ('after first break') absolute differences are substantial. This case also in the other four cases, which anyway capture changes in rate of transition rather the start of the process. The only exception is the no migration counterfactual series for Southern Europe, which is almost identical in 1895-1913 and 1920-1938, but as argued before, transition had started much earlier in that area[48]. The comparison between 1920-1938 and post-war trends confirms the acceleration of growth in all peripheral areas, with large and significant increases in rates, while strongly downplays the size of the so called baby boom of the 1950s and 1960s in advanced countries.

The first column in Table 10 wraps up the analysis, putting forward our best guess on the beginning of transition. We use whenever available the no immigration series and we add brackets to the more tentative dates. The other columns report the dates for same areas from the Riley (2005b) and Delventhal et al (2021).

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[47] We have used the population series from United Nations (2019), aggregating countries to match as well as possible the pre-war areas. For the sake of consistency, in Figure 11 we plot the series of total population rather than the countnatural increase. The 0.10 trimming correspond to six years – i.e. the routine can detect the earliest break in 1957.

[48] A parallel exception is Central Europe, where the rate of growth in interwar years was significantly lower than in 1895-1913. Arguably transition had started 18th century and after

Riley (2005b) suggests as the most plausible period for each country one (or more, up to four for Mexico) decade and we simply report the mid-point of the period. Delventhal et al (2021) collect series of crude birth and death rates from as early 1541, for England (Wrigley and Schofield 1989) to 2016, fill the gaps with interpolation and then model the transition as a linear downward trend between two periods of constant rates [49]. They single out with a grid search procedure the initial and final date of the trend, separately for birth and death rates. In the majority of cases (134 out of 181) their procedure finds a downward trend and the second break (i.e. the end of the transition) but not the first one -i.e. they are unable to date the start[50]. In these cases, authors project backwards the trend until the difference with the birth rate (assumed constant) hits 8.86‰ ('projected, baseline sample')[51]. Even this strategy sometimes fails, and authors reports a downward trend without a starting date ('projected extended sample'). We aggregate these three sets of starting date(s) into our eighteen series by weighting with the shares of each polity on the area population in the initial year of the transition [52]. We use the same method to compute the starting date of the world wide transition, using as weights the shares on world population in 1913. We report in Table 10 the essential information for the period 1800-1938 - the number of polities (col. 1), their share on all potential observations (col.2) and the implicit starting date of transition (col.3).[53]

[49] Their data-base (available at https://sites.google.com/view/demographic-transitions accessed June 2022) includes 181 polities, with a total of 16197 observation for CBR and 16206 for CDR. However, 34 of these polities were established after World War Two and three quarters of observations refer to 1939 and following years. There are 606 observations for crude death rates before 1800 and 3428 (2128 for European countries), plus 616 interpolated ones, from 1800 to 1938.

[50] We do not consider here the results of the dating of the start of fertility decline, which usually started later than than mortality decrease. Spolaore and Wacziarg (2022) simply ignore the issue while dating the start of fertility decline in Europe.

[51] Delventhal et al (2021) obtain the threshold as 'the average observed starting gap between CBR and CDR, 8.86 per thousand, the unweighted arithmetic mean across the 23 countries for which we observe the start of the fertility transitions and the fertility transition before 1950'

[52] In some cases, transition is hypothesized to have started at different times in territories of modern country when they belonged to a larger polity in our data-base. We aggregate them by weighting with the shares at the closest date. For instance, we get a date for Austria-Hungary by weighting the date for Austria (start of decline in 1881), Czechoslovakia (1867) and Hungary (1875) from Delventhal et al (2021) with the percentages of the three countries on the sum of their population in 1919.

[53] The number of potential observations for each polity is equal to the number of years of its existence before 1938– i.e. 139 in most cases and 20 (1919-1938) for polities established after World War One (Poland etc.).

Table 10
Alternative dating of demographic transition

	This paper	Riley 2005b	Delventhal et al 2021								
			Core sample			projected, baseline sample			projected, extended sample		
			(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
North Africa	1876	1935	1	4.0	1935	3	23.2	1922	3	23.2	1922
Sub-Saharian Africa	1920	1946	1	1.2	1963	33	22.5	1911	33	22.5	1913
North America	[before 1800 ?]	1881	2	33.5	1796	1	50.0	1701	2	79.9	1712
Caribbean	1860	1921	4	8.4	1916	10	20.3	1913	10	20.3	1914
Immigration Latin America	[before 1800 ?]	1922	3	25.7	1870	3	53.0	1860	3	53.0	1860
Latin America	[before 1800 ?]	1916	10	12.2	1910	13	34.0	1904	13	34.0	1905
Middle East	1830	1939	2	1.6	1938	8	9.7	1930	9	11.0	1932
India	1873	1932	2	21.6	1918	5	26.9	1919	5	26.9	1919
China	1925	1925	1	0.2	NA	2	9.0	NA	2	9.0	NA
South-East Asia	[1844]	1931	3	9.5	NA	7	29.0	1923	7	29.0	1923
Far East	1860	1897	1	24.1	1946	1	24.1	1947	1	24.1	1947
Western Europe	[mid 18th century]	1805	9	78.9	1765	9	79.3	1772	9	79.3	1772
Southern Europe	[mid 18th century]	1890	5	39.4	1886	5	45.2	1886	5	45.2	1886
Central Europe	[mid 18th century]	1883	5	78.2	1874	4	62.3	1878	5	79.0	1877
Balkans	1829	1921	4	47.5	1902	4	65.6	1902	4	65.6	1902
Eastern Europe	[1859]	1900	2	14.8	1892	2	18.9	1892	2	18.9	1892
Australia New Zealand	[1852]	1870	2	61.9	NA	NA		NA	2	61.9	1852
Pacific Islands	1920	1938	1	1.2	NA	3	12.0	1926	3	12.0	1928
World	1820	1910	58	16.7	NA	113	29.5	1907	118	31.3	1921

The ‘core’ sample by Delventhal et al (2021) is clearly too small and unrepresentative, with few exceptions, most notably Central and Western European countries. The ‘projected’ covers many more countries even if large gaps remain, especially in the periphery. About a third of polities of our data-base are missing altogether and the average length of projected series is only 51 years (out of 139 from 1800 to 1938). Most notably, it is impossible to compute a meaningful date for China because the projected series start in 1949 and show a downward trend since then. Overall results differ somewhat from dating by Riley (2005b), with coefficients of correlation around 0.7 between them are in the region of 0.70) but they are consistent. Both imply that mortality had started to decline at least a century after the start of growth in world population (Section four). The differences in timing between their dating of start of the transition period and the beginning of population growth are small only for Western Europe and possibly North America. The early start of transition in SubSaharian Africa is hardly credible as death rates allegedly started to decline in Sudan in 1862 (earlier than in Italy or Germany), in 1881-1882 in Ghana and Rwanda-Burundi and in 1893 in Congo-Kinshasa, while it was ruled by the infamous Congo Free state. Also the dating for Pacific Islands is dubious, as it is based on few cases and show huge differences in dates for neighbouring islands – e.g. 1862 for French Polynesia (Tahiti and minor islands) and 1954 for Samoa.

We can rule out migrations as cause of the divergence between estimates. Our hypotheses in Tab 11 are based on no migration counterfactual series for several areas and the flows into the other areas would have had to be huge to account for the gap. For instance, total immigration in the Far East should have been 2.2 times the 1860 population. Likewise, it is highly unlikely that hard data can explain the divergence. There is a residual uncertainty about differences with Riley (2005b), as his list of references was published only on line and unfortunately is no longer available on the web (as of July 2022). In contrast, a systematic comparison between the ‘core’ data in Delventhal et al (2021) and our data of natural increase (cf. Section Eight) shows limited differences, which can account only for a small proportion of the overall divergence [54]. On top of this, ‘core’ data are only the starting point for the backward projections. One would conclude that differences depends on this latter, especially on the assumption that natural increase was positive and high (8.86‰) before the start of the transition. This rate implies doubling the population every 140 years and was reached only in few non immigration areas (Table 9). Thus, the backward projection method may capture an acceleration of transition rather than its start.

8) Robustness checks: shall we trust these figures?

8.1 How reliable are our population series and thus how solid are our analyses? We assess the reliability of the series by classifying separately each year/polity observation, following the pioneering work by Durand (1977). He distinguished four classes, from A (good quality censuses or well kept yearly population records) to D (pure conjectures) but we deem more suitable, given sources, a division in five classes,

A ‘excellent’: fully trustworthy estimates, based on modern censuses and/or complete and trustworthy population registers.

[54] The number of series common to both data-bases rises from six in the 1800s (France, England and the four Scandinavian countries) to twenty since the early 1880s. For each of them, we compute the population series implicit in natural increase from Delventhal et al (2021) extrapolating our figure for population in the initial year of their series. The aggregate difference (Root Mean Square Error) is negligible in the first half of the 19th century, rises to about 10% in the 1880s and then to 20% after World War One.

B ‘good’: interpolation between modern censuses and partial or not fully reliable censuses

C ‘fair’: interpolations between not fully reliable censuses or estimates by scholars with solid evidence

D ‘poor’: interpolations of C or estimates by scholars with weak evidence

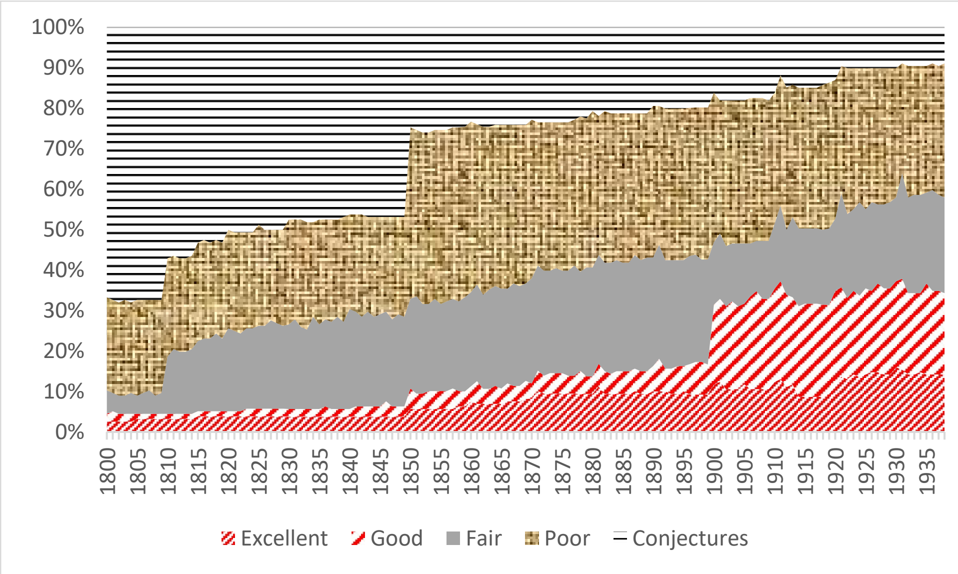
E ‘conjectures’: all other estimates, including extrapolations for periods before the earliest available estimate.

Following the current practice (Baffour et al 2013), we define ‘modern’ a census if was taken on a given date, possibly the same throughout the whole territory, counted all individuals (not just adult males and/or potential taxpayers), listed them separately with additional information (e.g. age, sex, occupation) and had data collected and elaborated by trained professional clerks rather than by local administrators or tribal chiefs. Consequently, in Appendix I we define population counts which do not meet these criteria as ‘census’ (adding brackets) or count, enumeration. Likewise, we define complete and trustworthy the population registers if they covered the whole population and were managed by states with a strong reputation for good administration. On the other side of the reliability range, we reserve E for the most tentative figures. For instance, we classify as D the estimates by Frankema and Jerven (2014) for population in Sub-Saharian Africa 1850-1938 and as E our extrapolations to 1800. In few cases the quality of data differs within the same polity (for instance, in Australia we have very good data for white settlers and guesstimates for natives.) and we classify the total population with a crude weighting.

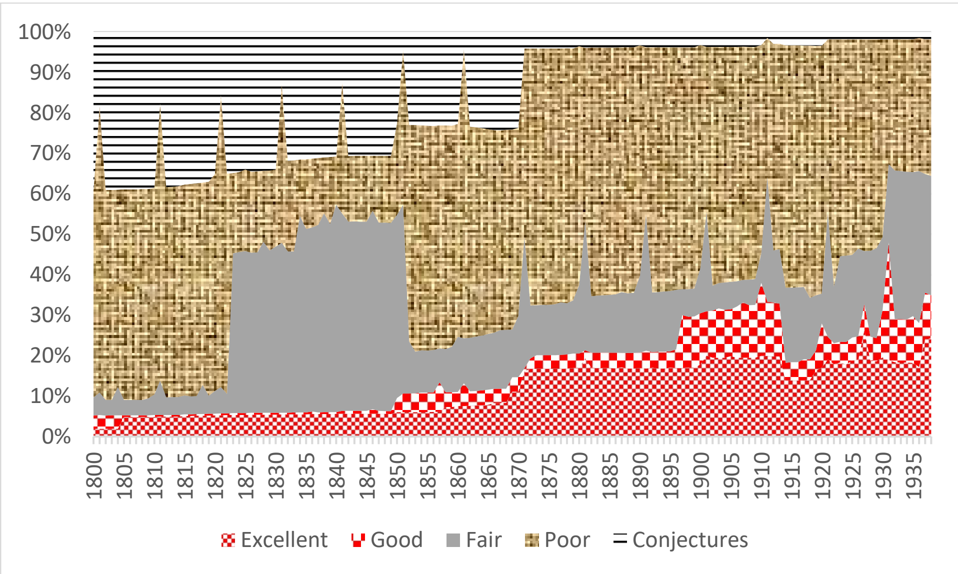
The distribution of polities by quality of data (Figure 12a) offers a quite dismal picture. For most of the period, the number of polities with A-class (‘excellent’) estimates was very small and, in spite of some growth since the 1880s, on the eve of World War Two, they hardly reached a sixth of the total. The number of E (‘conjectures’) fell drastically from two thirds to a mere tenth, but jointly with ‘poor’ estimates (D) they still accounted for two fifths of all observations in the late 1930s. However, most of these poor-quality series refer to small polities. The three most populous non-European countries, China, India and Russia, are assessed C or D in most years, few Es (India) and also some Bs (Russia). Thus, the population-weighted shares (Figure 12b) are somewhat less depressing. Most estimates were still poor but the share of ‘fair’ is higher and shows big spikes in census years. The improvement in time is larger: the A-class (‘excellent’) figures accounted for about 5% of the total in the early 19th century and for about a quarter on the eve of World War Two. By then the two top categories accounted for a third of the total, with a spike up to almost a half in 1931. On the other hand, the progress was not steady. For instance the share of population in countries with C data (‘fair’) was quite high in the 1830s and 1840s, when the bao-jia system worked fairly well in China, and more than halved in the 1850s, when the system collapsed after the outbreak of the Tai’ping war.

Figure 12
Distribution of world population by quality of data:

a) unweighted



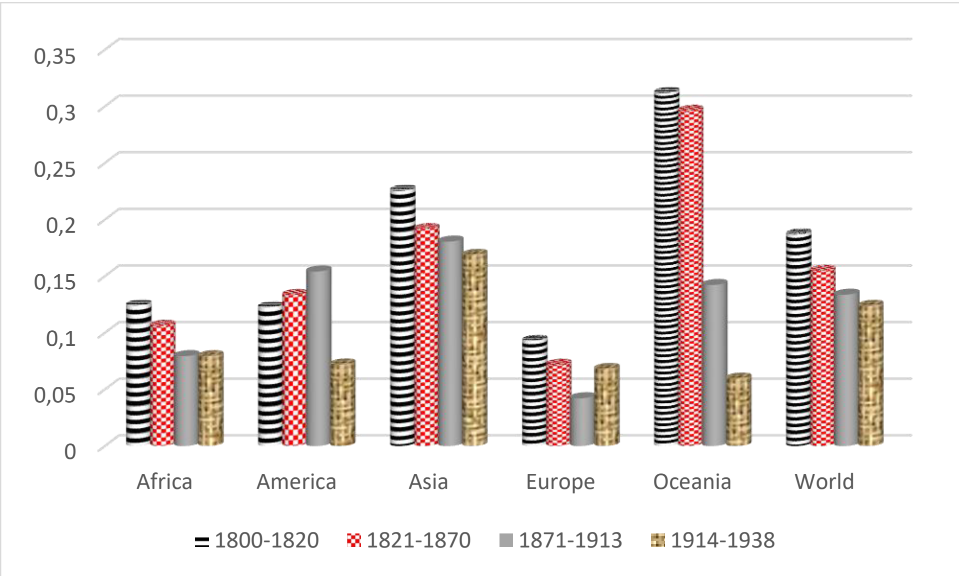
b) population-weighted



How much do errors affect the estimates? Clearly, a major mistake in a polity series might jeopardize the interpretation of the demographic history of that polity but its effect on world series depends on the size of the polity and on the possible compensating effects of mistakes in other series. It is possible to compute the aggregate margin of error of estimates, following Feinstein and Thomas (2002). We first attach a margin of error to each observation according to our assessment of its quality - 2.5% for A estimates (± 1.25% around the 'true' value), 7.5% for Bs (±3.75%), 17.5% Cs (±8.75%) 32.5% for Ds (±16.25%) and over 40% for Es (with band ±25%). Then, we compute margins by continent and world as sum of variance of polity series, under the assumption that errors of these latter are independent. This condition seems to be met in the case at hand. Almost all our population series are based on polity-specific sources, whose errors are likely to be independent. Rates of population changes in Sub-Saharian Africa, are indeed common to macro-areas, but errors would not be independent only if also the true rates of changes were equal across polities in the macro-area. Even in this case, the effect on world-wide estimates would be small as Sub-Saharian Africa accounted for only about 5% of world population.

The conventional wisdom about the quality of statistics (cf. Section Three) would suggest that the margins of error were lower for advanced countries and have been declining. These hypotheses are only partially confirmed by the movements in (normalized) standard deviation (Figure 13)

Figure 13
Standard deviation of estimates as share of population



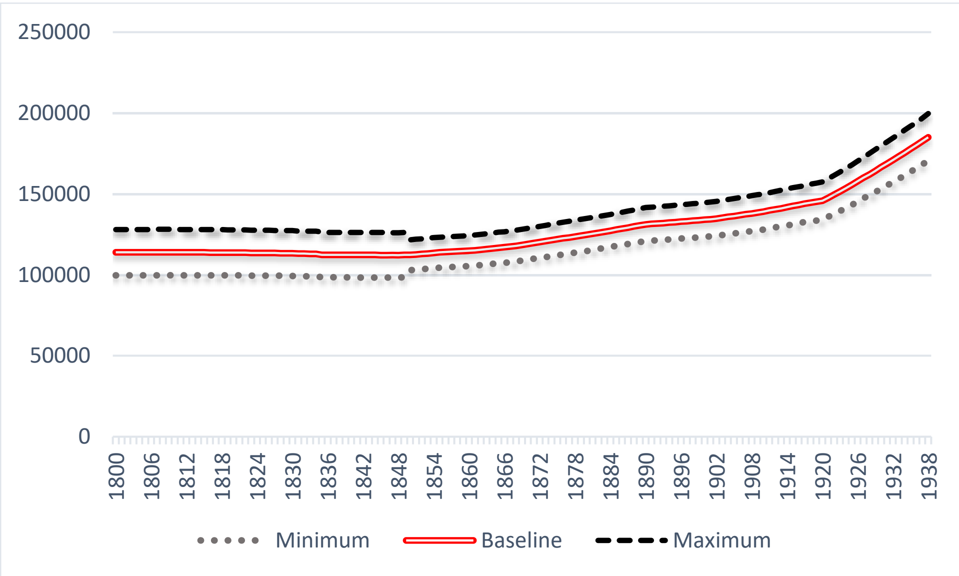
From one hand, the world data show a modest improvement in time (from an average margin of 18.7% to 12.4%) and the whole period, the error was decidedly lower error for Europe (6.5%) than for other continents.

Until the sharp improvement of Japanese statistics in the 1870s, only data for (Western) European countries can be classified as 'excellent'. From the other hand, the errors are not linearly related to the level of development and depend on political events and administrative decisions. For instance, the 1897 census boosted the quality of Russian statistics, anchoring firmly the registration data for about twenty year, but the quality deteriorated with the outbreak of the war (as in other belligerent countries) and hardly improved in interwar years, as population became a politically contentious issue in Soviet Union. The quality of data in countries of Western Settlement is not consistent with their high income. The fairly high margin of error of the Americas is the joint effect of the shortcomings in United States statistics (Section Three) and of the rise of its population, from a quarter of the continent in the early 19th century to half after the civil war [55]. The spectacular decline in the margin of error for Oceania, from 31% to 6.5%, reflects the change in composition of population – whites rising from 0.2% to 75% of the total. In spite of its low share on world population, the fall in error in Oceania accounts for half the total world decline.

Figure 14 plots the corresponding error band in absolute numbers, with different vertical axis to make readable

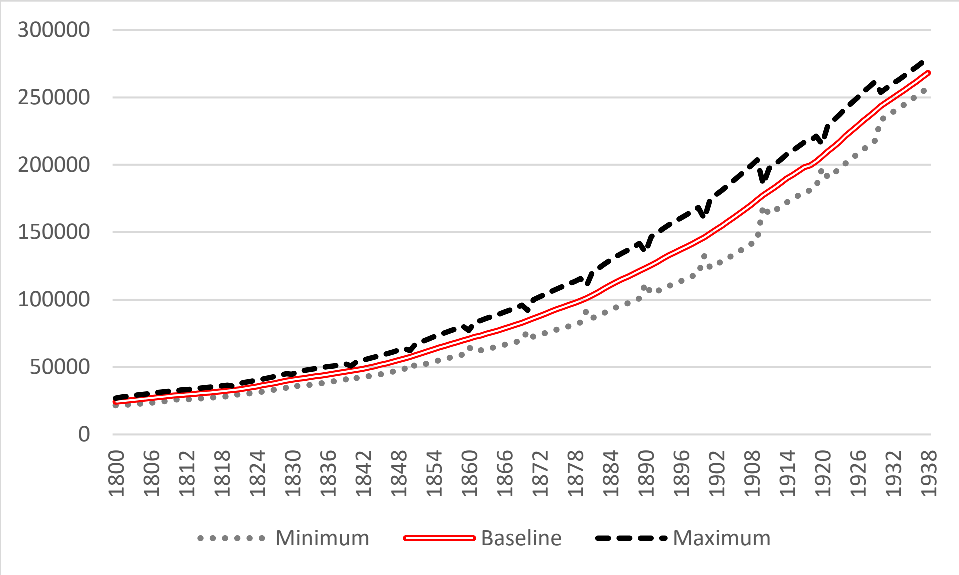
Figure 14
Interval of confidence of estimates (000)

a) Africa

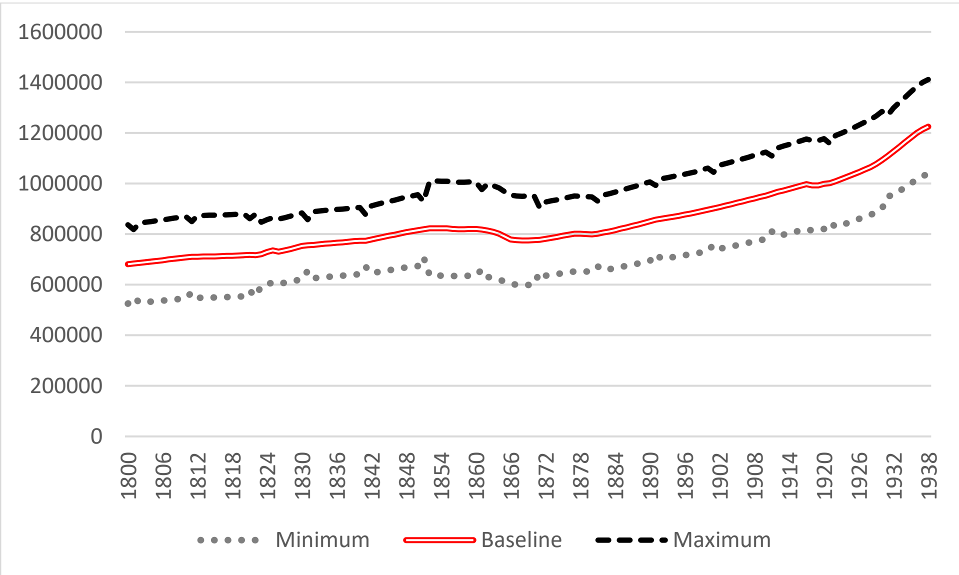


[55] The Canadian censuses are fairly good after 1851 and very good in the 20th century but the official sources estimate intercensal population with linear interpolation.

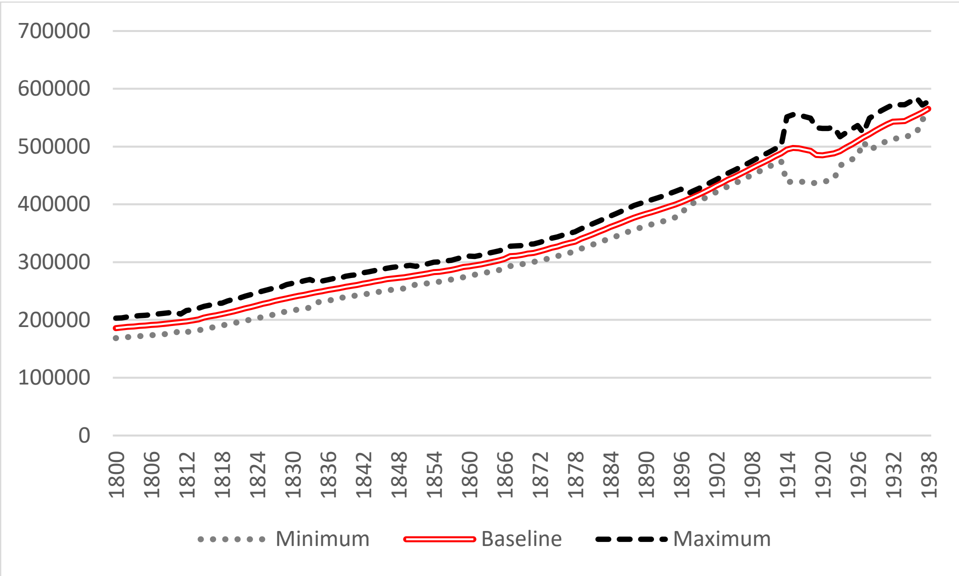
b) Americas



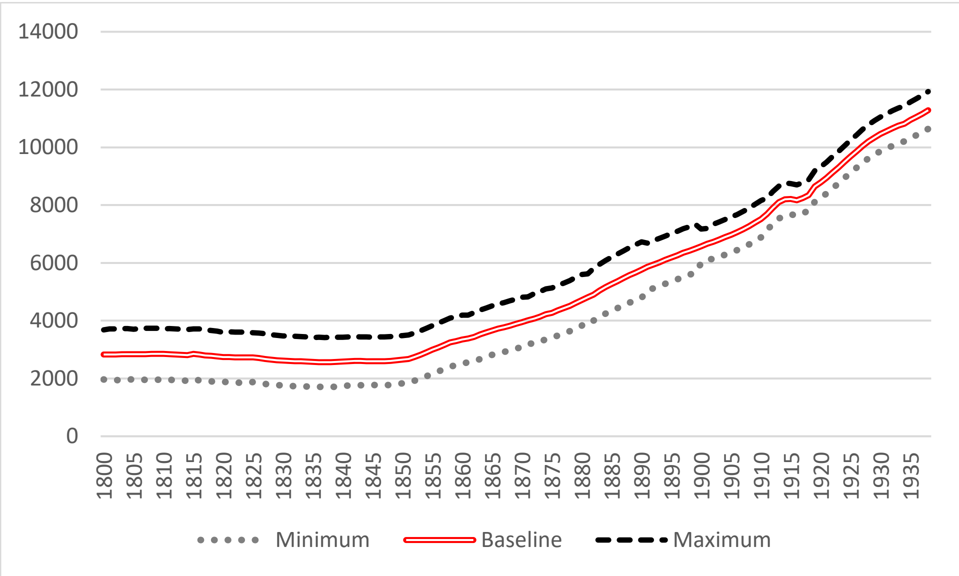
c) Asia



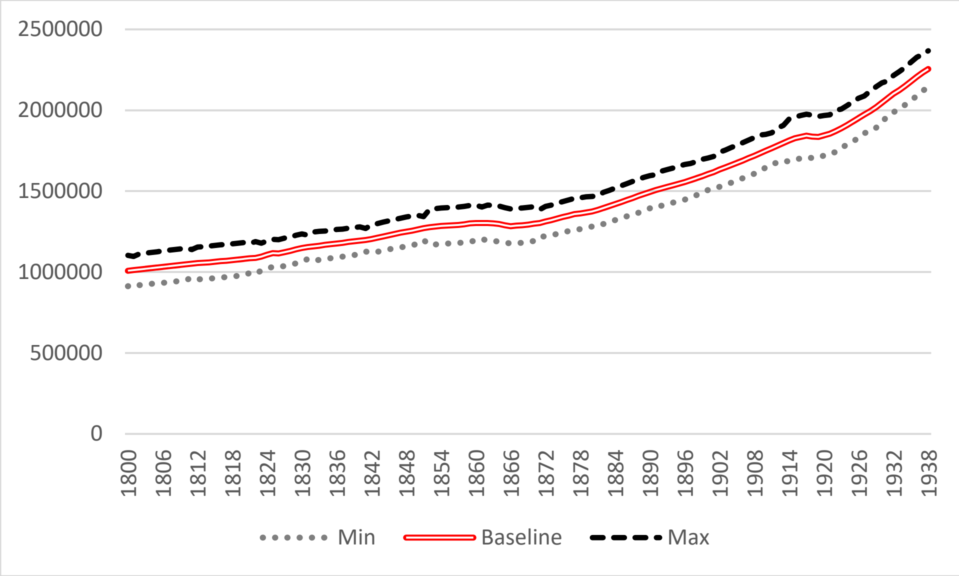
d) Europe



e) Oceania



f) World



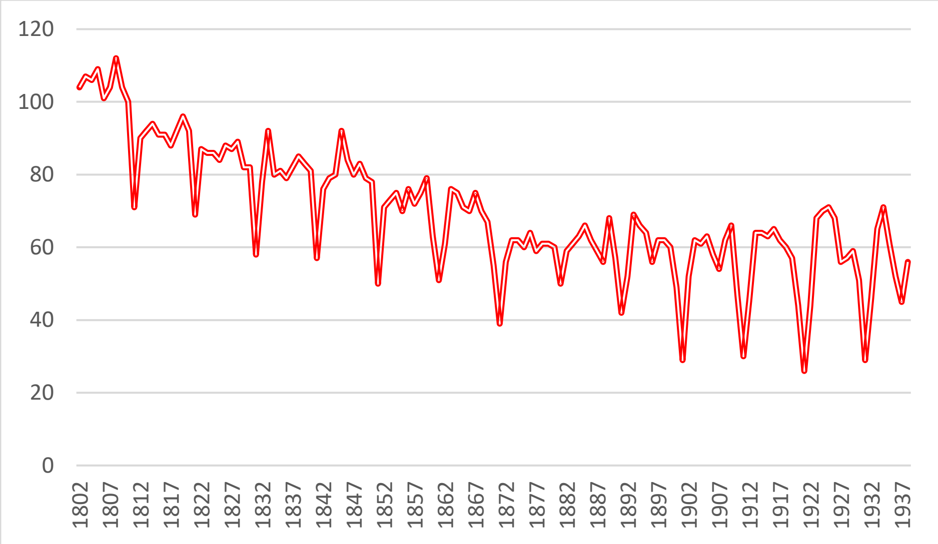
The figures add some relevant pieces of information. The bulge for Europe in the late 1910s shows the effect of World War One and its aftermath on the quality: the margin of error shot up 4.3 times, from 2.6% 1909-1913 to 11.3% 1914-1918. The spikes in the series for the Americas correspond to US censuses, while the error band for Oceania shrank because of the decline of the native population. World-wide, the modest reduction in the margin of error (Figure 13) is compensated by the increase in total population, so that the confidence interval of the estimate fluctuates around 200 million people, with a minimum of 141 million in 1841, a census year, and a maximum of 265 in 1917. It is possible to compute, given the yearly band, the maximum possible error in long-term trends as the differences between the lower (upper) bound in 1800 and the upper (lower) bound in 1938. Our baseline estimate yields a 123.7 % increase in world population, from 1008 to 2254 million, while the alternatives range from a minimum of 94.1% (from 1103 to 2142 million) to a maximum of 159.5% (from 912 to 2367 million). The corresponding long-run rates of change differ by 0.2 points (0.48% vs 0.69%). The differences by continent are wider, but still the maxima, for Asia and Oceania, are about 0.5 percentage points (cf. Statistical Appendix Table II). In a nutshell, even in the worst case, errors are highly unlikely to alter the basic narrative.

8.2 Linear interpolations is a potential problem for the analysis of demographic transition as it makes the search for breaks less precise and, above all, biases downward volatility and thus downplays the impact of crises. We have been forced to use it in about two fifths of observations (9157 out of 21509 cases) [56].

---

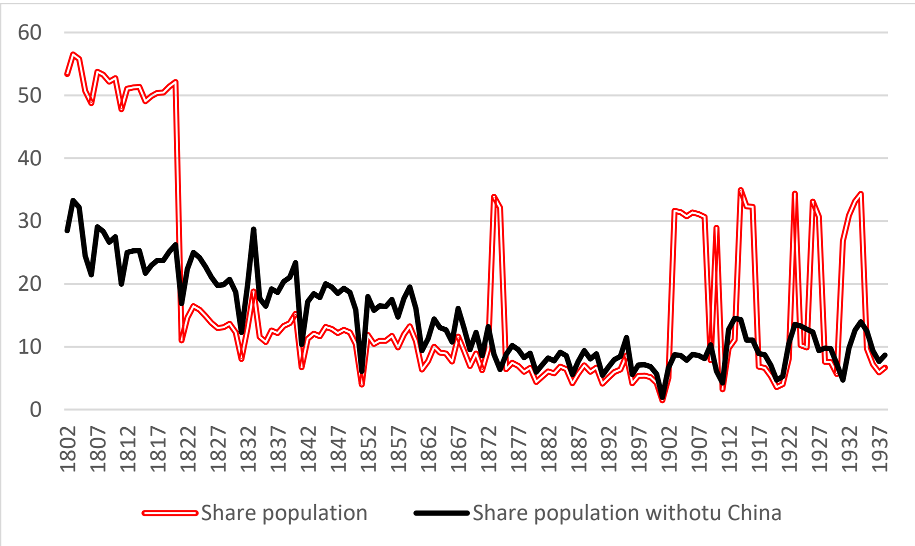
[56] We define as linearly interpolated any observation such as $(P_t-P_{t-1})/P_{t-1}=(P_{t-1}-P_{t-2})/P_{t-1}$. Of course, this definition covers cases of zero change, which usually are outcome of assumption as well. It might also capture cases when population did not change or differences in rates of change were so small not to be detectable – and thus the method can overestimate the extent of linear interpolation. The number of cases is smaller than the total because we lose the two initial observations of each series.

Figure 15
Number of polities with linearly interpolated population by year



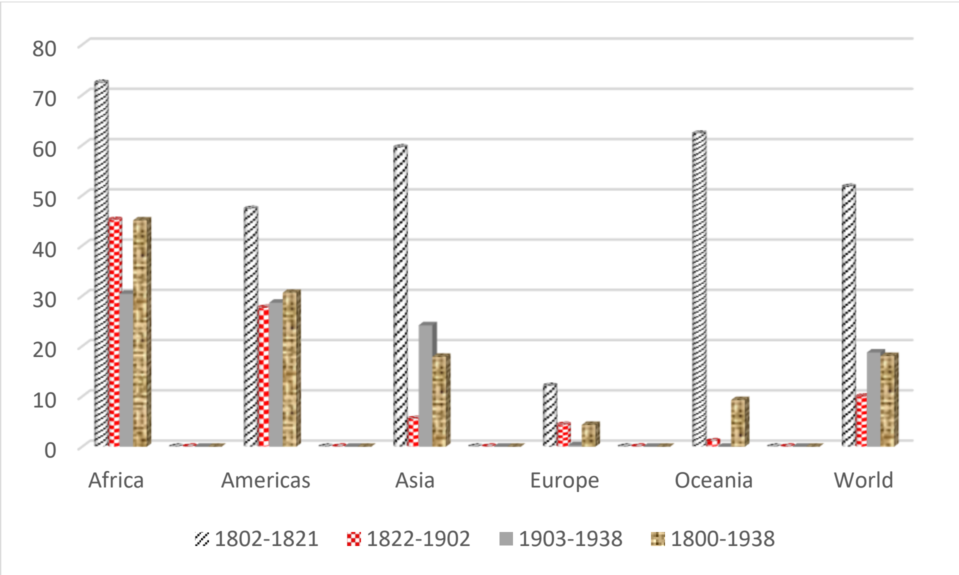
The distribution in time (Figure 15) shows the expected downward spikes in the census years, which very often entail change from one rate of interpolation to another, and a sizable decline in the first decades of the 19th century. Since the 1870s, the yearly number of linearly interpolated observations in non-census years remains stable around 60 – i.e. about a half. Most of these observations refers to thinly-populated African or Middle Eastern polities. Indeed, the size of the potential bias is more than halved if it is measured with the share on population rather than with the percentage of observations (over the whole period, 18% vs 43% for the percentage of observations). The series (Figure 16) shows a decline declined in the 19th century, down to a minimum of 1.5% in 1901 (a year of censuses and of change in hypothesized rates in Sub-Saharian Africa) and then rebounded, close to the early 19th century maxima.

Figure 16
Share of world population estimated with linear Interpolation by year



The green line in Figure 16 shows that the increase in the 20th century is almost exclusively determined by China. The percentage in the rest of the world remains below 10% on average in interwar years, even if there is a small increase also in other continents (Figure 17).

Figure 17
Linear interpolations as share of population, by continent/period



Summing up, the bias from linear interpolation seems to be a serious issue for Africa and for the America at the beginning of the 19th century. This is consistent with the not significant coefficient of the share in most of the volatility regressions in Table 6.

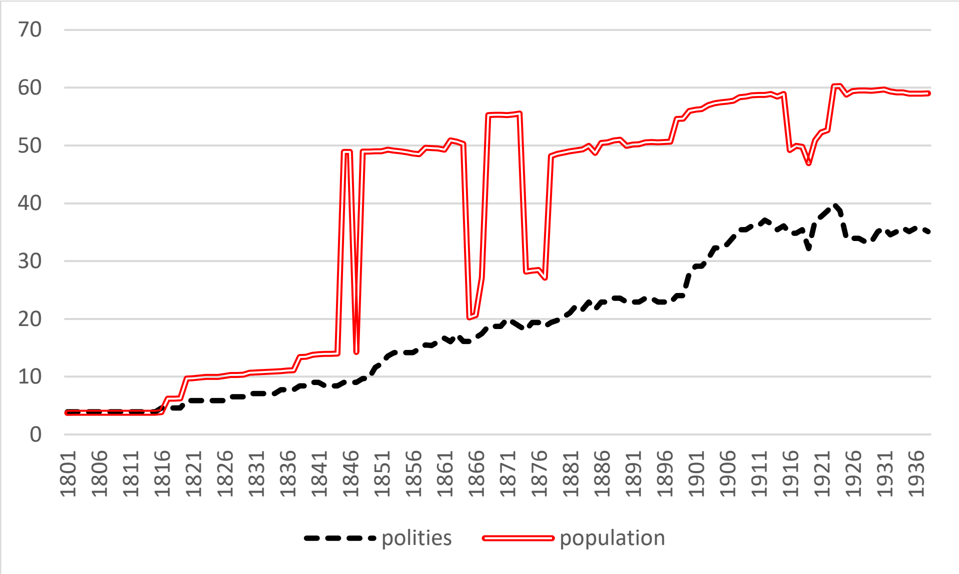
8.3 We test the size of the bias from migrations with a newly compiled data-set of no migration changes in population natural rates of increase. Whenever possible, we have collected data on birth and death rates from sources such as Mitchell' s International Historical statistics and Rothenbacher (2002 and 2013) [57]. When vital statistics are not available, we have crudely estimated the natural increase as the difference between absolute population growth and the number of disembarked slaves from the Eltis data-base (https://www.slavevoyages.org/voyage/database accessed May 2022) or of free migrants (Ferenczi Willcox 1929). In theory, the gap between total and natural increase is equal to net migration flows but several available series, including the United State one before 1870, refer to gross flows and thus they overstate the gap[58].

[57] We use country-specific sources for Italy (ISTAT on line, table 2.3), Russia before 1926 (Kumo 2017 tab 2.1) Brazil (Historical statistics Brazil p.16) and Serbia before 1911 (Historical statistics Serbia). The series for United Kingdom from 1800 to 1838 refers to England only (Mitchell 1988 pp.40 and 52)

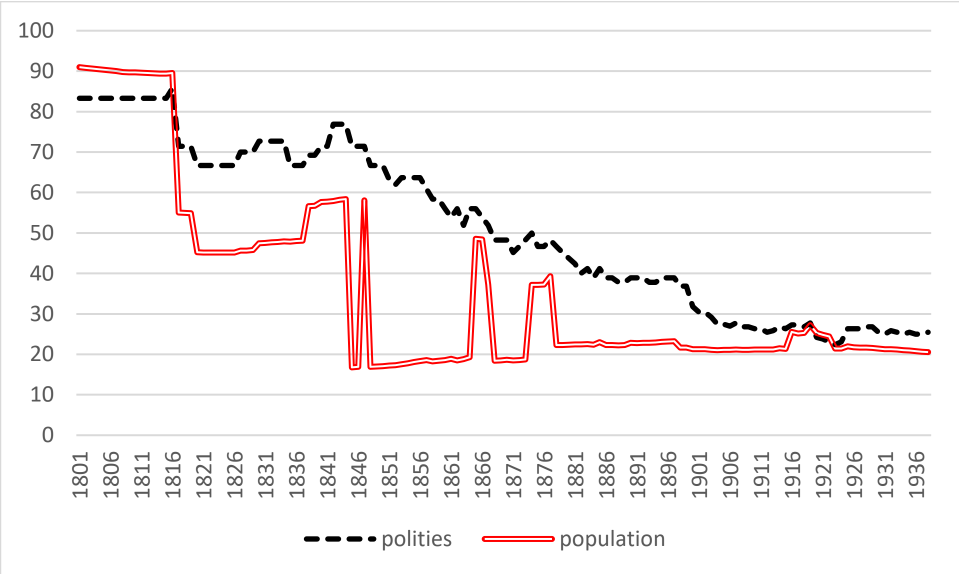
[58] Furthermore, we implicitly assume that birth and death rates for migrants were the same as the present population. This assumption may not be correct. Migrants were typically young adult people, with lower death rates and thus they reduced the death rates in destination countries and increased them in origin countries, amplifying the effect of the flow. The effect on birth rates depends on the composition of migrants: the migration of whole (young) couples

Overall, we have been able to collect 3401 data and to estimate 757 additional observations – i.e. 4158 observations for 83 countries out of a total of 21394 (Figure 18)

Figure 18
The available data on natural increase
a) share on world population



b) share of advanced countries on data for natural increase



increased the birth rate in destination countries and decreased it in orgin countries, while the migration of males would reduce birth rates (and thus population growth, ceteris paribus, in both origin and destination countries)

The number of polities in the natural increase data-base (Figure 17a, blue line) has been steadily increasing over time, while the share on world population (red line) jumped in the mid-19th century, when the series for China by Ferenczi and Willcox (1929 pp.148-153) enters the data-base. The series is somewhat dubious, with several missing years and gaps in coverage of ports of origin, but its inclusion reduces substantially the share of advanced countries in the sample (Figure 17b).

Overall, the polity coverage in the data-set is quite random, with a comparatively few long series, and all of them (but Brazil) for advanced countries. However, for shorter periods and with some approximations it is possible to build counterfactual series of population net of migration (natural increase) for seven areas out of eighteen, including the three main destination areas, North America (USA and Canada), Latin America (Brazil Argentina and Uruguay) and Australia/New Zealand, and for the largest area of origin, Southern Europe [59].

Table 11
Long run rates of change of population, total and no migration counterfactual

	Total	Counterfactual
North America (1820-1938)	4.11***	<u>1.66***</u>
Southern Europe (1861-1938)	<u>0.78***</u>	0.95***
Australia New Zealand (1852-1938)	1.85***	1.80***
Immigration Latin America (1800-1938)	2.28***	1.48***
Caribbean (1800-1938)	2.08**	5.02
Eastern Europe (1867-1913)	1.66***	1.52***
Central Europe (1816-1913)	0.45	-0.06
Western Europe (1838-1938)	0.89***	0.54***

* significant at 10%; ** significant at 5%: *** significant at 1%; underlined estimates with log-linear specification

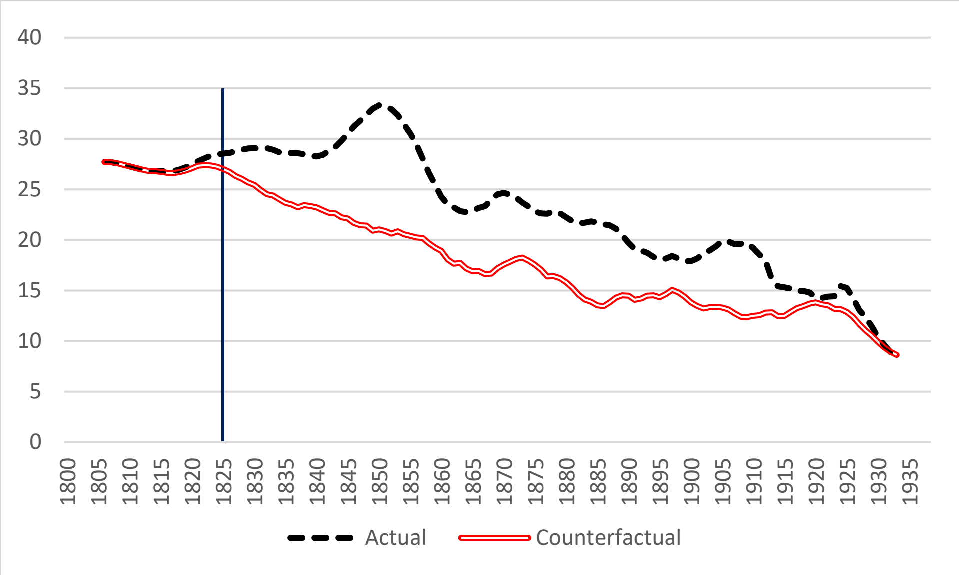
We compare rates of change for the counterfactual and total population for the same periods in Table 11. Differences are mostly significant (but for Australia/New Zealand, Eastern Europe and Central Europe) and in some cases are very large, but, as Figure 19 shows, they do not alter drastically the outcome. There, we plot the 11-years moving average series of rates of change, adding a vertical line in the first year six years after the start of the counterfactual series (i.e. when the moving average can be computed only with counterfactual data).

[59] The no migration series start in 1800 in Argentina, Brazil, Denmark, Finland, France, Norway, Sweden, United Kingdom and the Caribbean, in 1817 in Germany, in 1820 in the United States and Austria-Hungary, in 1826 in Canada, in 1830 Belgium, in 1840 in Netherlands, in 1850 in Iceland, in 1851 in Australia, in 1853 in Switzerland, in 1854 in New Zealand, in 1857 in Spain, in 1861 in Italy, in 1867 in Russia and in Portugal in 1882. We integrate the missing data (and the missing polities) with changes in total population – i.e. assuming zero migrations. The series for Central and Eastern Europe stops in 1913, given the boundary changes after the war in Germany and Russia and the dissolution of the Habsburg empire

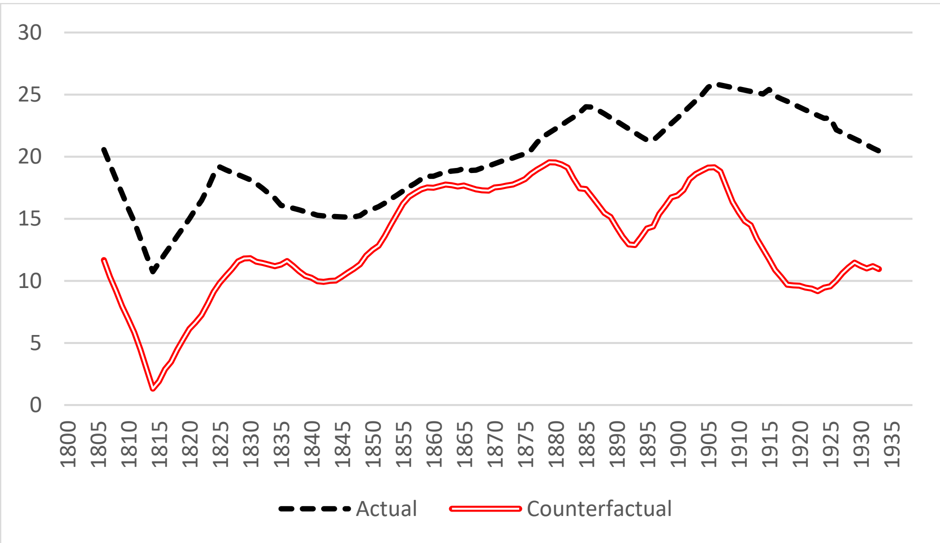
Figure 19

No migration counterfactual changes in total population, 11 years moving average

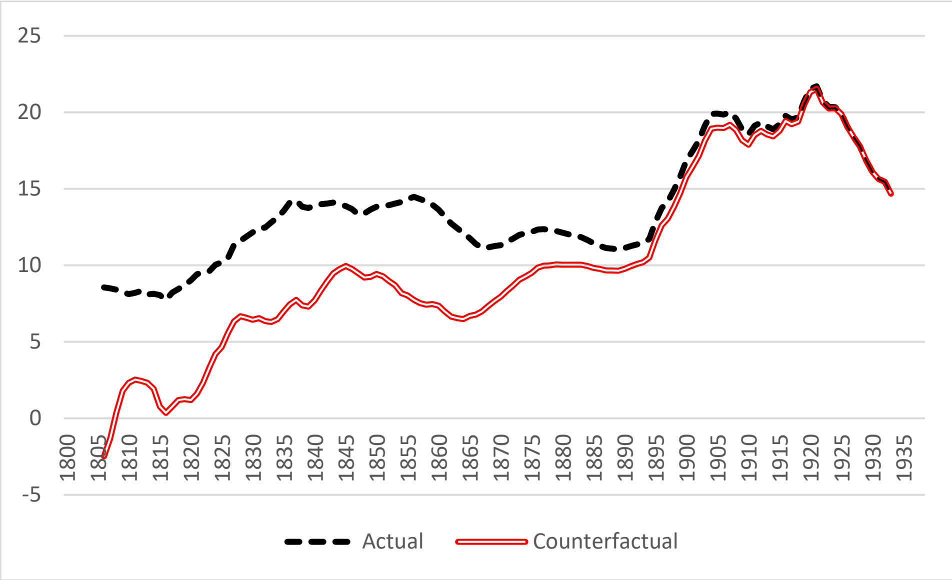
a) North America (1820-1938)



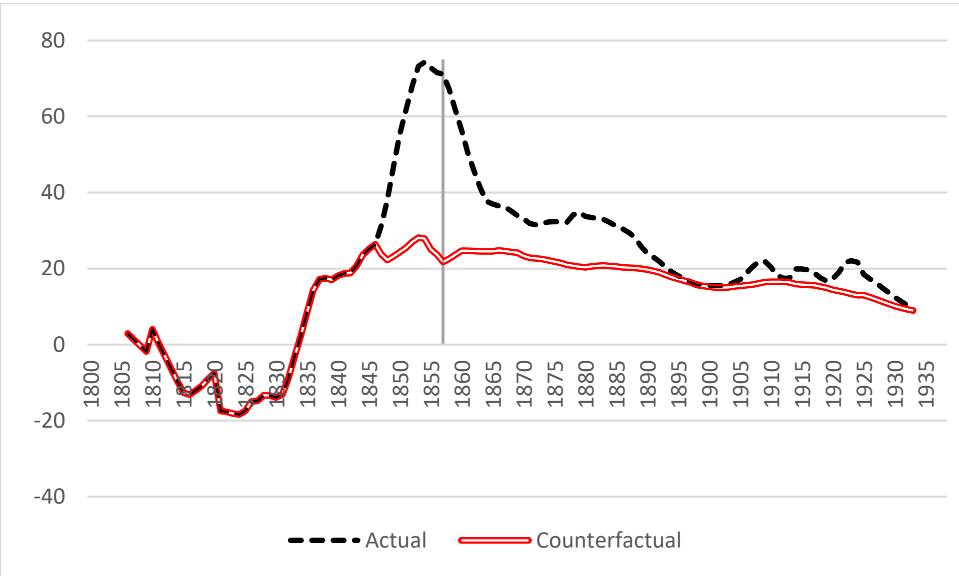
b) Immigration Latin America (1800-1938)



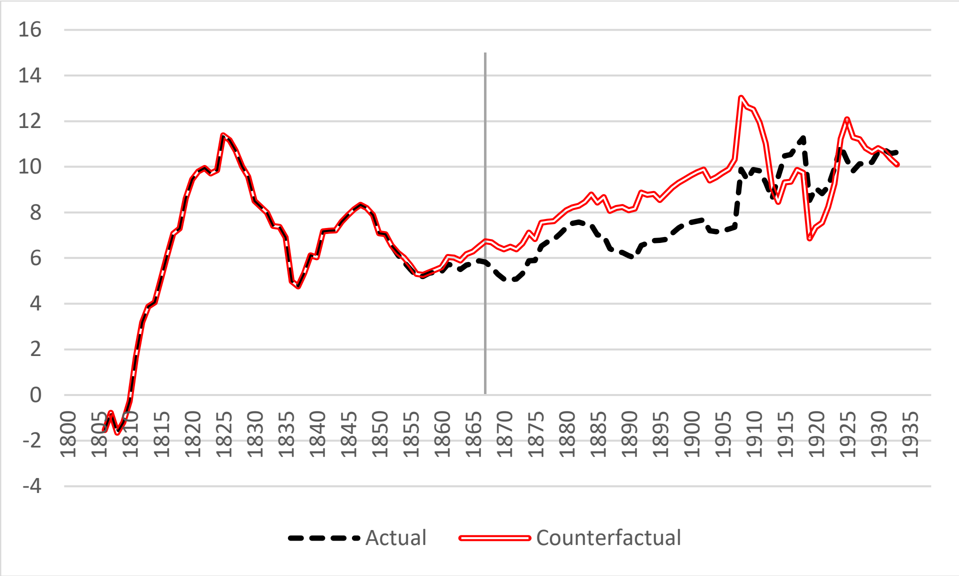
c) Caribbean (1800-1938)



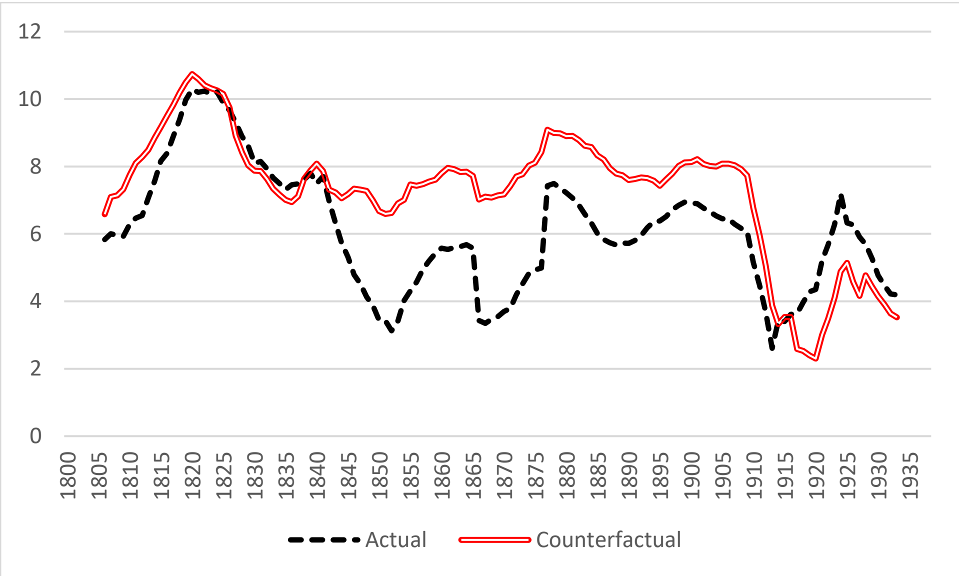
d) Australia and New Zealand (1852-1938)



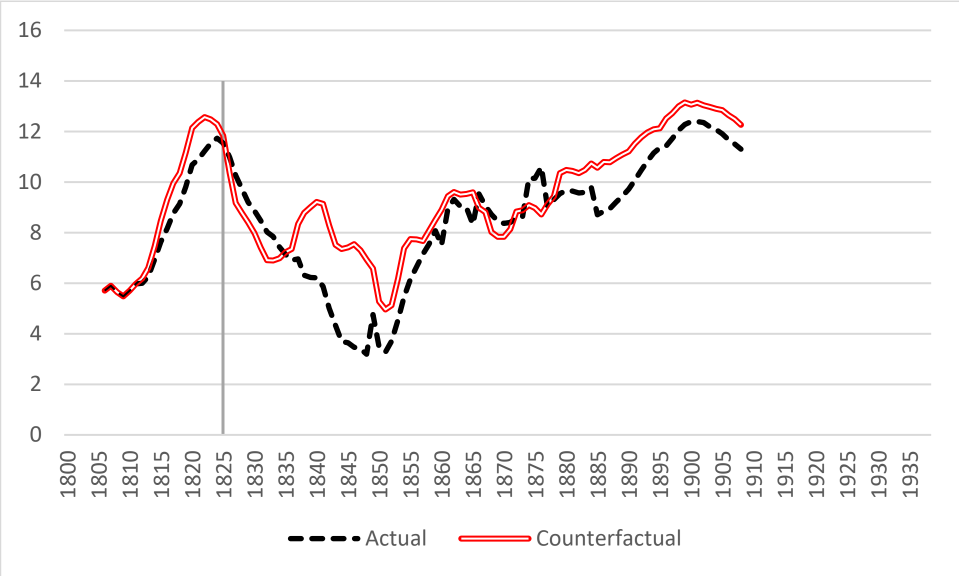
e) Southern Europe (1862-1938)



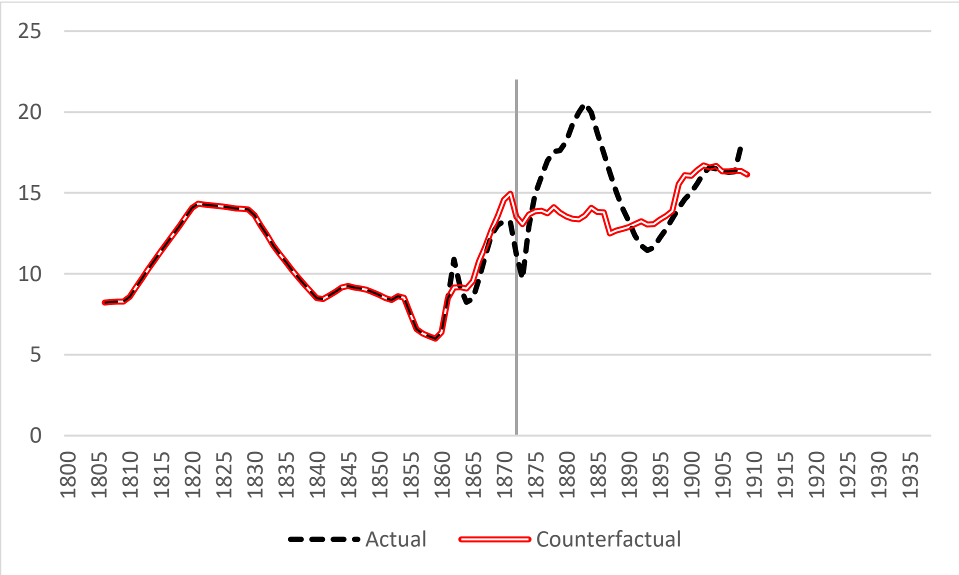
f) Western Europe (1800-1938)



g) Central Europe (1816-1914)



h) Eastern Europe (1867-1914)

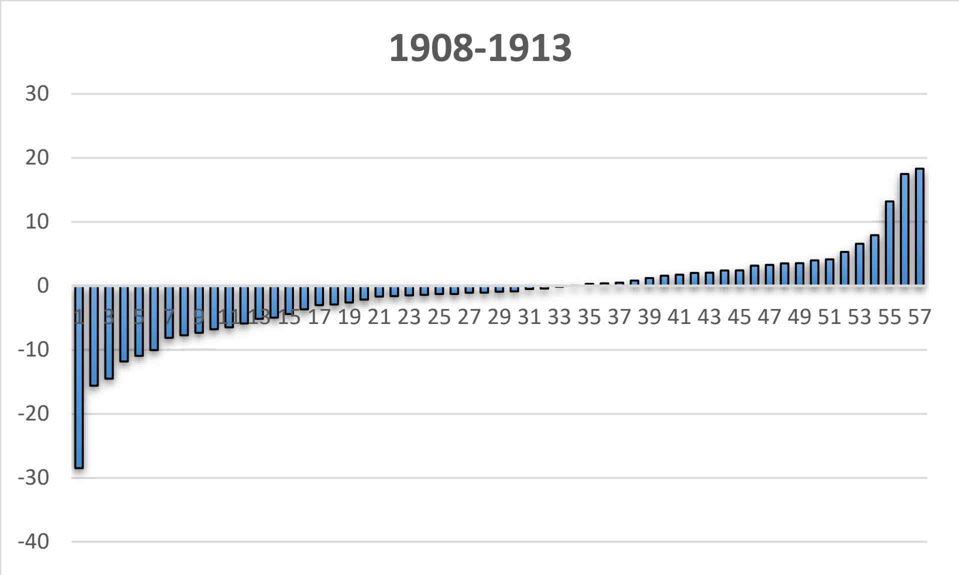


Unfortunately, the data for estimating counterfactual no migration population series are not available for about half areas. At most, it is possible to compare total and natural increase for a substantial sample of polities only in the 20th century (Figure 20).

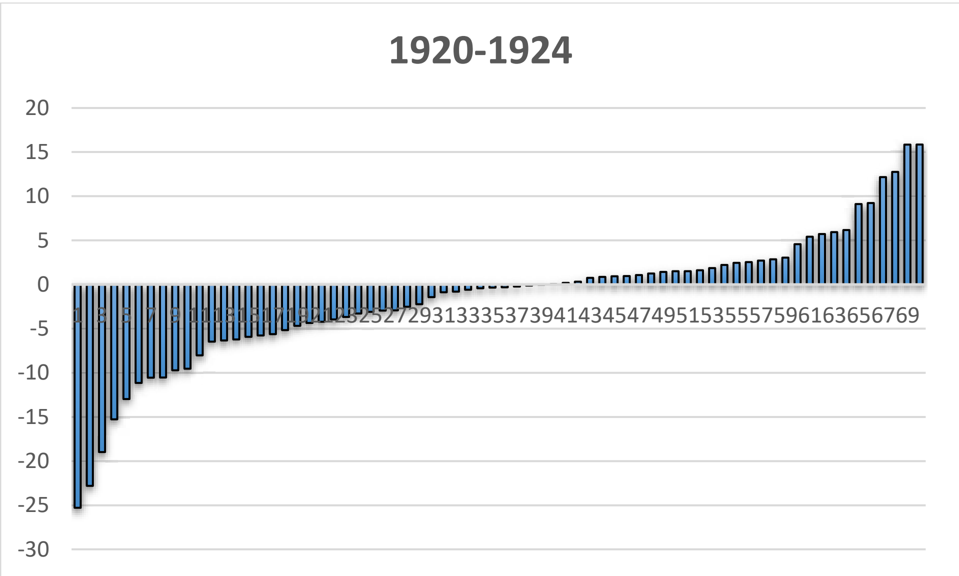
Figure 20

Differences between total and natural increase (per thousand)

a) 1908-1913 (59 polities)[60]

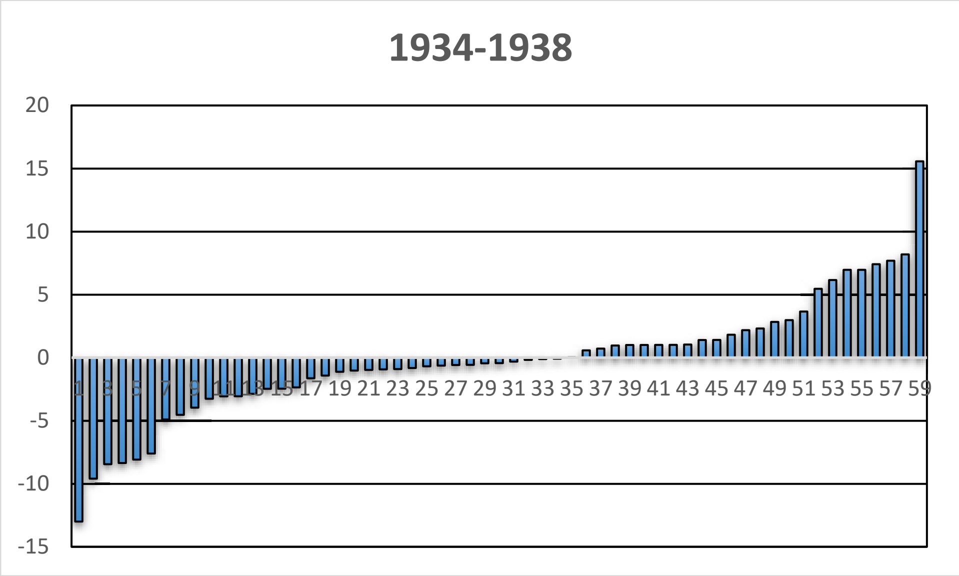


b) 1920-1924 (70 polities)



[60] We omit from the figure for 1908-1913 Hong-Kong (-100.5), Basutoland (+ 369.4) and Swaziland (+73.5) as they would distort all scale.

c) 1934-1938 (59 polities)



Some differences are quite large, but, as Table 12 shows, they refer to small polities and thus affect only a very small proportion of world population

Table 12
Biases from migration

	Shares on covered population			
	% covered	Mild (± 2‰)	Substantial (± 5‰)	Large (± 10‰)
1908-1913	58.8	80.6	19.0	2.6
1920-1924	60.4	82.7	23.4	14.3
1934-1938	59.0	61.5	20.1	0.0

Interestingly, the bias is not larger in 1908-1913, the peak of the *Age of Mass migration* (Hatton and Williamson 1998) than in interwar years, when migrations were constrained by legislation and the Great Depression. This suggests that the differences between natural increase and total population might depend not only on effect of migrations but also on errors in estimation (including the effect of linear interpolations) and/or in the data of natural increase (including the use of gross migrations instead of net migration data). In this case, they are unlikely to bias systematically upwards our estimates of natural increase.

Summing up, our analysis suggests that yearly data might be wrong, and that series might not capture short term fluctuations, but also that errors are likely to be random. Most notably for our conclusions, iIt is implausible that all series feature systematic upward bias – and even in the most extreme case, population would have been growing. The usual answer to concern about the quality of data is seek for further evidence, but unfortunately the prospects are poor. Discoveries of unexploited official sources seems unlikely: the historical demographers have done quite a good job in squeezing all data. In some cases, the series might be improved by systematic work on micro-data, such as parish registers, or by a systematic exploitation of archeological data – but these sources are plagued by substantial representativeness and interpretation issues and thus could not be a real substitute for hard modern data.

9) Conclusions and discussion

This work has confirmed the conventional wisdom about world-wide long run trends in population. It did grow in the long run and the growth accelerated in the early 20th century, as a harbinger of the post war boom. This is not the main contribution of our paper. First, we have been able to show that volatility remained fairly high and demographic crises were widespread and frequent. Second, our series show that population had been growing in high-income countries throughout the period and that it had started to rise in the periphery at least in the 20th century and in many areas much earlier.

These results raise doubt about the interpretation of population trends as determined by the demographic transition, as defined in the standard model. As said in the introduction, it assumes that the process started with a decline in mortality, which pushed, with some delay, people to reduce the number of children and to invest more in each of them along the quantity/quality trade-off. Some recent research has questioned the role of mortality decline (and more broadly of cost-benefits analysis) in determining trends in fertility. Most attention on France, which pioneered demographic transition with a pattern very different from the standard model. Death and birth rates declined almost in parallel since the late 18th century (Henry and Blayo 1975). Economic incentives accounted for at most a third of the trends in fertility (de la Croix and Perrin 2018), the rest being explained by cultural factors (Perrin 2022), fostered by internal migrations (Daudine et al 2019). The cultural proximity to France affected heavily the pattern of fertility decline all over Europe (Spolaore and Waczjarg 2022). In contrast, cultural factors were in all likelihood hardly relevant for death rates. Scholars have long debated the relative contribution of progress in medicine and modern economic growth to the decline in mortality (Cutler et al 2006). Modern economic growth reduced mortality directly in several ways. First, technical progress in agriculture increased the quantity and quality of food supply per capita in normal years and have reduced likelihood of failures (Federico 2005). Second, market integration have made it possible to fill food deficiencies after crop failures (e.g. O' Grada and Chevet 2002, Burgess and Donaldson 2011). Last but not least, modern economic growth made possible to pay for health-fostering improvements. Medical science made some progress in the 19th and early 20th century but it did not achieve any breakthrough comparable to sulfa or antibiotics (Riley 2001, Acemoglu and Johnson 2007 Jayachandran et al 2011). The major success was the vaccination against smallpox (Crosby 2008 Kotar and Gessler 2013). It was made compulsory in some German states in the early 19th century, and its early introduction boosted the population of Java relative to islands (Bosma 2015), but on aggregate the effect showed up only in the second half of the 19th century. Epidemic of smallpox hit London (Guy 1882) and Germany (Kotar and Gessler 2017 175-179) as late as the 1870s. Mortality was reduced by the spread of good hygiene practices, which reduced the impact of infectious diseases, including cholera (Prados de la Escosura 2022). However, the adoption of good sanitary practices needed clean running water and waste disposals and massive investments in aqueducts and sewers were made feasible by growth in income (Haines 2000, Kesztenbaum and Rosenthal 2017, Alsan and Goldin 2019, Chapman 2019, Chaudhary and Lindert 2021 Aidt et al forthcoming). Indeed, Murtin (2013) finds that infant or total mortality were strongly negatively correlated with GDP per worker and years of schooling, as proxy for the diffusion of good hygiene practices. However, most observations in his sample refer to the period after 1950 and his long-run balanced sample covers only 16 advanced countries and only after 1870.

Even without formal testing, it seems clear that these improvements were too late and/or too geographically limited to account for the early stages of population growth. This latter preceded the onset of modern economic growth in all areas, including 18th century Europe, and thus all the mortality-reducing changes which growth brought about. Markets integrated in Europe and in the Atlantic economy since the early 19th century (Federico 2019), chemical fertilizers were invented in 1843 and Western cities started to invest massively in sanitation and health around the same time. On top of this, the evidence on declining heights in the early stage of modern economic growth in the United States (Komlos and A'Hearn 2017), England (Cinnirella 2008) and Western Europe (Komlos 1998) suggests that health conditions, if any, were deteriorating. Last but not least, a massive reduction of the incidence of negative shocks does not tally well with our results on volatility.

This implies that population started to grow also or exclusively because fertility increased and that mortality decline reinforced the trend later. In England growing fertility accounted for 85% of the rise in the rate of natural increase from 1652-1663 to 1814-1824, the peak of birth rate in the country history (Mitchell 1988 p.52). Thus, the increase in British fertility preceded the industrial revolution, but nevertheless it still coincided with a period of growing GDP per capita (Broadberry et al 2015), with a substantial increase in women and children employment, the so called industrious revolution (De Vries 2008). It is possible that the prospects of higher income pushed people to marry earlier and thus have more children (Birdsall 1983) and that the better nutrition reduced the share of stillbirths (Wrigley 1998). England (or Western Europe) may have been an exception. In (much of) the rest of the world, fertility might have been kept high by the abundance of land in newly opened territories without triggering Malthusian positive checks. These are only tentative suggestions, but our results highlight the need to explore population history beyond the strictures of the standard models.

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Statistical Appendix

Table I
Estimate of population by continent (Million)

	1800	1820	1850	1870	1900	1910	1913	1920	1930	1935	1940	1950
<u>Africa</u>												
Willcox (1940)	100		100		141					148		
Carr-Saunders (1936)	90		95		120							
Swaroop (1951)c	90		95		141							198
Bennett (1954) c	90		95		120							198
Clark (1967)	100				112							
McEvedy and Jones (1978)	70		81		110							205
Biraben (1979)	102		102		138							219
Klein Goldewijk and Battjes (1995)					93	108		127	150		179	199
League of Nations/UN								140	164		191	222
United Nations (1999)	107		111		133							221
Maddison (2010)		74		90	110		125	133			194	228
HYDE 3.1	86	89	103	114	141	150		165	181		201	223
United Nations (2019)												228
<u>Americas</u>												
Willcox (1940)	29		59		144					264		
Carr-Saunders (1936)	25		59		144							
Swaroop (1951) c	25		59		151							321
Bennett (1954)c	29		59		144							321
Clark (1967)	25				203							
McEvedy and Jones (1978)	24		59		145							325
Biraben (1979)	24		59		165							330

Klein Goldewijk and Battjes (1995)					143	169		199	235		279	343
League of Nations/UN								208	242		274	329
United Nations (1999)	31		64		156							339
Maddison (2010)		32		84	146		186	206			274	332
HYDE 3.1	27	36	61	85	148	178		211	251		276	339
United Nations (2019)												342
<u>Asia</u>												
Willcox (1940) a	600		664		879					1045		
Carr-Saunders (1936) a	602		749		937							
Swaroop (1951)	602		749		839							1254
Bennett (1954) b	612		743		890							1301
Clark (1967)	584				985							
McEvedy and Jones (1978)	616		781		946							1389
Biraben (1979)	631		790		903							1393
Klein Goldewijk and Battjes (1995)					975	1037		1108	1186		1277	1386
League of Nations/UN								966	1120		1244	1381
United Nations (1999) a	635		809		947							1402
Maddison (2010)		710		769	873		979	1029			1239	1385
HYDE 3.1	681	745	823	811	939	969		1052	1137		1259	1396
United Nations (2019) a												1405
<u>Europe</u>												
Willcox (1940) a	188		266		401					528		
Carr-Saunders (1936) a	187		266		401							
Swaroop (1951)c	187		266		415							593
Bennett (1954) a,c	188		266		401							548

Clark (1967)	133				284							
McEvedy and Jones (1978)	144		205		290							395
Biraben (1979)	146		209		295							395
Klein Goldewijk and Battjes (1995)					297	313		330	349		370	392
League of Nations/UN												
United Nations (1999) a	203		276		408							547
Maddison (2010)		169		241	305		341	334			388	573
HYDE 3.1	149	167	208	237	300	328		334	361		380	399
United Nations (2019) a												549
<u>Oceania</u>												
Willcox (1940)	2		2		6					10		
Carr-Saunders (1936)	2		2		6							
Swaroop (1951)c	2		2		6							12
Clark (1967)	2				6							
McEvedy and Jones (1978)	2		2		7							14
Biraben (1979)	2		2		6							13
Klein Goldewijk and Battjes (1995)					5	6		7	8		9	11
League of Nations/UN								9	20		11	
United Nations (1999)	2		2		6							13
Maddison (2010)		0		2	5		6	7			9	10
HYDE 3.1	1	1	1	3	5	6		7	9		10	11
United Nations (2019)												
<u>Russia/USSR</u>												
Clark (1967)	46				127							
McEvedy and Jones (1978)	45		74		125							181

Biraben (1979)	49		79		127							180
Klein Goldewijk and Battjes (1995)					123	133		143	155		167	180
League of Nations/UN								158	179		195	180
UN 1999												
Maddison (2010)		55		89	125		156	155			196	180
HYDE 3.1	46	51	67	82	121	146		143	153		181	177

a Includes Russia; b Includes Russia and Oceania; c 1949

Table II

World population, upper and lower growth rates (% yearly

	Minimum	Baseline	Maximum	difference
Africa	0.21	0.35	0.50	0.30
Americas	1.64	1.74	1.85	0.22
Asia	0.16	0.43	0.72	0.56
Europe	0.72	0.81	0.89	0.17
Oceania	0.77	1.00	1.31	0.54
World	0.48	0.58	0.69	0.21

SOURCES BY COUNTRIES

AFRICA

Algeria

The data on population of Algeria are non-existent before the French conquest and abundant but of varying quality thereafter. Many experts guesstimated the population around 1830, with figures ranging from 0.8 to 10 millions (Kateb 2001 p. 11-12), two quasi-official sources put forward figures of 1870K in 1830 and 3520k in 1837 (Kateb 1998) and historians suggest a range from 3 to 4 millions (Kateb 2001 p. 13-15, Tabutin et al 2001 tab 1). A first, very approximate, enumeration of population of areas under the French control in 1844-1845 yielded a total of 3 millions and the French administration took regular censuses every five years from 1856 onwards (Kateb 2001 p. ?, Negadi et al 1974). The population remained stable around 3 million until 1866, and then dropped sharply to 2416K in 1872, as the country was ravaged by diseases, famines and by the last great rebellion against the French rule in Kabylie. It recovered afterwards but the rate of growth according to the censuses from 1872 to 1886 is suspiciously high and thus probably includes the effects of improvement in census operations and of the extension of French rule [61]. Maravall-Buckwalter (2017 pp.152-159) deems censuses to have been reliable since 1906 (population 5231K). She obtains a yearly series of population from then to 1936 by combining census data with information from population registers and uses only these latter to extrapolate the 1906 level to 1872. Her estimate of population in 1872 (3998K) comes out 65% higher than the census result.

We use the Maravall-Buckwalter (2017) series from 1872 to 1936, extrapolating to 1938 with a growth rate of 2% per year, as in 1931-1936. We extrapolate the series to 1800 in three steps. First, we extrapolate the 1872 population to 1856 with the rates of change of the censuses. Then we assume that population remained stable from 1830 to 1856, as the natural increase was compensated by the losses caused by the French repression of native insurgence and by emigration [62]. Finally, we assume a rate of natural increase of population at 0.1% per year from 1800 to 1830, as in Tunisia and Morocco before the European conquest.

Angola (Portuguese Africa)

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

Basutoland (Lesotho)

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

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[61] The population grew at 3.3% from the 1872 to the 1886 censuses (from 2816K to 3817K) and then at 1.6% until 1906 (5231K). The French administration started a population register for the native population in 1875/1882, but the coverage remained partial until the interwar years.

[62] Our series implies that the 1844-45 enumeration underestimated the population by about a quarter – i.e. less than the later censuses. Extrapolating the pre-1830 growth rate from 1830 to 1872 yields a counterfactual population of about 4.7 million, with losses from French conquest about 0.9 million.

Bechuanaland (Botswana)

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

Belgium Congo (Zaire)

The issue of population of Belgian Congo has attracted special attention because the polity was subject to extreme extractive policies even for African standards. The area was ruled from 1885 to 1908 as Congo Free State by the International African Association, formally a private organization but in practice a figurehead for Belgian king Leopold II. Frankema-Jerven (2014) estimate the population to have declined from 9.5 million early 1880s to 8 in 1920, after the Spanish flu, and to have recovered to 10.1 million in 1938. Trends in the 1920s and 1930s are not disputed, while Loadman (2005 pp.140-141) argues that the collapse was much greater as before the conquest the population was around 20 million [63]. However, this latter figure corresponds to a density of 8.6 inhabitants/square km, substantially higher than in Cameroon (6.9), Angola (2.4) and French Congo (1.73). We thus refrain from correcting the Frankema and Jerven (2014) figure.

British East Africa (Kenia & Uganda)

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

Cabo Verde

Carreira (1985 p.42) reports figures since 1827, boasting them to have been the most accurate of the whole continent. We fill the gaps with linear interpolation, taking into account the information about the repeated famines, which struck the island (O'Grada 2009 p.22)[64]. We assume a constant population from 1800 to 1807.

Cameroon

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.10-11 of this WP).

Ceuta Y Melilla

The Historical statistics Spain reports data from censuses on the population of these two Spanish cities on the African coast for 1842 (Ceuta only) 1877, 1887, 1897, 1900, 1910, 1920, 1930 and 1940. Overall, they

[63] The projection by Manning (2010) shows no decline at all. In his book on the Kuba Kingdom, Vansina (2010 p.146) agrees with Frankema-Jerven on the size of the fall from the pre-colonial period to the late 1910s but argues that it was not steady. The population remained stable or even increased until the turn of the century, thanks to immigration and slave trade, and collapsed after 1900.

[64] For instance, let's consider the 1830-1833 famine, which reduced population by 40%. Carreira reports figures of 74000 in 1827 and 60000 in 1832. We hypothesize population to have peaked in 1830 at 76000 (yearly growth rate 1% annum), and to have declined to a minimum of 46000 in 1833.

show a very fast growth, with a surprisingly high rate in the first decade of the 20th century [65]. However, we have no solid ground to correct and thus we linearly interpolate, assuming the population to have increased from 1800 to 1877 at % per year

Comoros and Mayotte

The French conquered the Comoros islands in the 1880s but the French Statistical Yearbook reports only an evaluation of the number of inhabitants in 1906 and the results of the 1911 census. Both returned a population of about 100K. We simple assume that population grew as much as Madagascar, of which the island were a part since 1912, at rates 0.2% from 1800 to 1911 and 1% from 1911 to 1938.

Egypt

The issue of the size of Egyptian population has fascinated Western experts throughout the 19th century. Jomard, a member of the Napoleon expedition, put forward an estimate of 2.5 million in 1800, which inspired the conventional wisdom for decades. The first actual enumeration by Mohammad Ali government, for fiscal and military purposes, yielded a total of 4476K people in 1846-1848, while a second one, in 1868, covered only part of the country (Alleaume and Fargues 1998, Cuno and Reimer 1997, Saleh 2013). The British took another census in 1882, at the beginning of their protectorate, and then censuses were held at ten-year intervals from 1897 onwards[66]. The conventional wisdom deems these latter censuses quite reliable while the 1882 figures has been regarded as undervalued since the pioneering work by Craig (1917)[67]. There is no consensus about the accuracy of the 1848 census, while it is clear that the whole curve since 1800 must be shifted upwards, disregarding the Jomard figures [68]. McCarthy (1976) has estimated a yearly series, endorsing the 1846-48 census, revising upwards the 1882 one and taking into account the demographic shocks, such as the 1855 and 1865 epidemics. The series grows very slowly in the first half of the century (about 0.6% in normal years and 0.3% overall) and then accelerates sharply to 1.65% from 1846 to 1882. This rate seems too high, as population growth would exceed any other intercensal period before World War Two. Thus, we reduce the growth rate from 1848 to 1882 to 1.2% in normal years and ultimately to 1.1% factoring in the crises as listed by McCarthy (1976). We extrapolate the series to 1800, following McCarthy (1976). From 1882 to 1907 we use the series by McCarthy (1976) and afterwards we interpolate linearly between censuses[69].

Equatorial Guinea (Spanish)

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[65] The rates were 3.5% in 1842-1877 (Ceuta only), 5.1% 1877-1887, 2% 1887-1897, 1.3% 1897-1900, 9.4% 1900-1910, 3.1% 1910-1920, 2.9% 1920-1930 and 1.2% after 1930.

[66] The registration of birth and death rates was mandated in cities in 1838 but was never fully extended to rural areas (Alleaume-Fargues 1998).

[67] The 1882 census yielded a total population around 6800K people (the exact figure differs slightly across sources), while the alternative estimates revisions range from 7440K Wendell (1936), to 7550 (Craig 1917), 7840 (McCarthy 1976) and to 8000 (Panzac 1986). Corresponding growth rates from 1882 to 1897 vary between 1.3% and 1.8%, vs. 2.4% according to the censuses (and 1.48% in 1897-1907).

[68] Alleaume and Fargues (1998), McCarthy (1976) and, implicitly, Cuno and Reimer (1997) trust the results of the 1848 census, while Craig (1917) reduces the population to 4230K, under his hypothesis of steady growth (at 1.65% yearly) throughout the century and Panzac (1987) argues for a massive revision upward to 5.4 millions. Saleh (2013) points out that some district data are missing, but implicitly endorses the total population.

[69] The rates of growth is 1.46% from 1882 to 1907, declines to 1.28% in 1907-1917 and to 1.08% in 1917-1927 (possibly for the effect of the Spanish flu) and then recovers slightly to 1.16% in 1927-1937. The rate jumps to 2.31% in 1937-1950. The jump may seem too sharp, but the rate in the 1950s was even higher (2.6%).

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

Eritrea

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

Ethiopia

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

French Equatorial Africa-Congo-Final

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

French Somalia

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

French West Africa

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

Gambia

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

German East Africa (Tanganyka)

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

German South West Africa (Namibia)

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

German West Africa (Togo)
The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

Ghana-Gold Coast
The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

Guinea Bissau (Portuguese Africa)
The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

Italian Libia Cyrenaica) (Libia)
The Ottoman regime never counted the population of its provinces of Tripolitania and Cyrenaica, so the figures by Morsa (1984 tab 1.3), 750K 1800 and 800K a century later, are pure guesstimates. The Italians conquered the country and re-named Libya in 1911, reckoning population to be around 775K in the early 1920s (Statistical Yearbook Italy 1922-1925:374). The first count after the 'pacification' of the country (i.e. the violent repression of the Senussi rebellion) in 1931 yielded a total of 655K inhabitants, which grew to 866K according to the following one, in 1936. The high rate of growth in the 1930s (4.1% for the whole population and 2.7% for native only) are plausible, as the native population was recovering from the losses of the Italian repression and the total population was swelled by the massive immigration of Italian colonists. We thus accept the figures from Italian sources in interwar years [1]. Without any further evidence, we hypothesize that population increased at 0.1% yearly before 1911 (yielding a total 694K in 1800 and 767K in 1900) and that it remained constant in the 1910s for the joint effect of the Italian conquest and of the Spanish flu.

Italia Somalia
The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

Liberia
The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.19-11 of this WP).

Madagascar
The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

Malawi
The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

Mauritius

The population data for the island are among the oldest and most detailed in the colonial world: the number of slaves was registered since 1753, that of free inhabitants since 1786 and censuses were taken at ten year intervals since 1797 (Kuczinsky 1951 pp.708-715, Lutz and Wills 1994 tab 4.1). However some of these data are not totally reliable (e.g. slave owners were reluctant to disclose the number of their slaves) and there are inconsistencies between censuses and yearly registration. Kuczinsky (1951 pp. 743-898) has analyzed and corrected the data: we reproduce his best guess series, computing mid-year population as average of two consecutive Dec 31 figures and interpolating linearly to fill the gaps.

Morocco

The sources on population of independent Morocco (before 1912) are almost not existent. Morsy (1984 tab 1.3) ventures to suggest population to have remained stable at four million for most of the 19th century and Tabutin et al (2002) quote an estimate of 4.8 million in 1900. In 1912 the country was divided between a French protectorate in the South and a Spanish one in the North, leaving Tangier under international control. The French counted the population in 1926, 1931 and 1936, and the Spaniards in 1930 and 1935 – for a total of 6200K in 1931 and 7100 in 1936[70]. The total of about 7150K (inclusive of Tangier) is very close to the estimate of 7040K (excluding Tangier) by Baddou (1974 tab.I.2) and implies a 2% increase to 1950, as in other North African countries. He raises strong doubts on the reliability of results of all previous French 'censuses' because they returned rates of growth around 4% We discard the other French censuses and we extrapolate backward to 1800 by hypothesizing, very tentatively, yearly growth rates of 0.1% from 1800 to 1870, 0.5% from 1870 to 1890, 1% from 1890 to 1910 and 1.2% from 1910 onwards.

Mozambique (Portuguese Africa)

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

Nigeria

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

Northern Rhodesia (Zambia)

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

[70] The French 'censuses' yielded a population of 4299K without military, in 1926, 5405K in 1931 and 6296 in 1936K, (Historical Statistics France). Baddou (1974) and Fargues (1986 tab 1) report a figure of 3533K (or 3372 for natives only) for 1921 French which is not quoted by the Historical Statistics France. The Spanish enumerations yielded a population of 700 in 1930, 795 in 1935 and 992 in 1940 (Historical statistics Spanish colonies 1949-50). Adjusting for the different dates (assuming a 1% growth rate) the population would be 6200K in 1931 and 7200K in 1936, with a growth rate 2.9%. The Statistical Yearbook League of Nations published separate yearly series for the two areas which fluctuate widely and somewhat implausibly: the cumulated population was 5000K in 1912-1913, declined to 4230 in 1926, returned to 5000 in 1927-1930 rose to 5500 in 1931-1934, jumped to 6280 and eventually rose to 6500 in 1938.

Reunion

The Statistical Yearbook France reports a guesstimate of the population of the Reunion islands for 1906 and the results of the enumerations by the French colonial administration from 1911 onwards. Population remained broadly constant until 1921 and then started to rise at about 1% per year. We interpolate linearly between all other French data and we extrapolate backward to 1800 assuming a steady growth 0.7% until 1870, when island prospered and attracted manpower, and a stagnation thereafter, when the opening of the Suez Canal caused the island to lose its role as a stopover in the route to India.

Rwanda and Burundi

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

St. Helena

The International historical statistics (Africa tab A.1) reports official British figures for 1854, 1861 and then at ten-year intervals, while the Statistical abstract colonies estimate population in 1938. Population declined from ca 6K 1854 to 3.3K 1901 because of the economic decline of the island after the opening of the Suez Canal and then rebounded slightly to 4.415K in 1938. We assume constant population in the first half of the century and afterwards we interpolate linearly between the official data.

S.Tome e Principe (Portuguess Africa)

According to the available data (Statistical Yearbook League of Nations and Mitchell 1998 tab A.1) the population of the Portuguese colony increased very slowly from 56K in 1921 to 61K in 1940, and indeed it started to grow only in the late 1960s. Thus, we interpolate linearly and we extrapolate backwards to 1800 assuming a 0.2% yearly rate to take into account the development of cocoa plantation with immigrant workers in the 19th century.

Seychelles

The British enumerated the population of Seychelles in 1827 and counted it regularly from 1851 onwards. Kuczynski (1949 pp.911-922) collects several benchmark estimates of population of from 1803 to 1845 as well as an yearly series 1932 onwards. We use his series, interpolating linearly to fill the remaining gaps.

Sierra Leone

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

South Africa

The white settlers in Cape province had been counted as early as 1660, but the first census of population for the whole (newly established) dominion was taken in 1911 and repeated in 1926 and 1936 (Christopher 2011)

[71]. The Historical Statistic South Africa (Table A-8) reports a yearly series from 1910 onwards estimating yearly changes[72]. We extrapolate backwards the 1910 figure, as for other African countries, with the series by Frankema-Jerven (2014) and Manning and Nickleach (2014).

Southern Rhodesia (Zimbabwe)

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

Spanish Sahara

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

Sudan (Anglo-Egyptian Sudan)

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

Swaziland

The population is estimated with backward extrapolation. We use the area rates by Manning and Nickleach (2014) for the first half of the 19th century and the polity-specific ones by Frankema and Jerven (2014) from 1950 onwards (See pp.9-11 of this WP).

Tunisia

As for other North African countries, the information on population before 1881, the year of French conquest, highly uncertain. Western 'experts' suggested figures ranging from 0.8 to 5 million (Ganiange 1966, Valensi 1977 pp.13-14, Morsa 1984 tab 1.3, Fargues 1986), without any clear trend. Ganiage (1966) puts forward tentatively a total of 1100K in 1856-1857, as four times the number of adult male taxpayers, and his figure is widely accepted (Seklani 1974, Valensi 1977, Issawi 1982). Fargues (1986 Tab 1), in his list of North African 'censuses' reports a figure for 1881 which is quoted by other sources. In fact,The French Statistical Yearbook published 'evaluations' for 1907 and 1911 and the results of colonial 'censuses' from 1921 onwards, at five-year intervals[73]. However, Seklani (1974) points out that the rate of growth between 1926 and 1931 (2.2%) is too high relative to those in the previous (0.6%) and successive (1.6%) five-year period. Likewise, the growth between 1856-1857 and 1906 (1% per year) seems a bit too high in comparison with Algeria.

Thus we hypothesize that Tunisian population grew at 0.1% per year from 1800 to 1850, when the country was hit by epidemics and plagued by recurrent famines (Valensi 1977 pp.281-287), at 0.5% per year from 1850 to 1880 and at 0.8% from 1880 to 1906. Thereafter, we accept the French data, but, following Seklani

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[71] The censuses for 1918, 1921 and 1931 counted only white people. It is possible to compute the population series from 1870 to 1909 implicit in the GDP estimate for the provinces of Cape and Natal by Magee et al (2016). However, the series grows implausibly fast (4.2% over the whole period) and these provinces may not be representative of the whole country.

[72] The series implies 157K excess deaths from the Spanish flu in 1919 – a decidedly lower figure than estimates by Athukorala and Athukorala 2020 (300K) and Barro et al 2020 (227K).

[73] Curiously, Seklani (1974) and Tabutin et al (2002) report data (for natives only) different from the original ones without any explanation

(1974), we correct the figures for 1926 and 1931 (from 2160K to 2200K and from 2411 to 2350K) to get a more plausible accelerating trend.[74].

Zanzibar Island

The Statistical yearbook British colonies published data on population of the island at ten-year intervals since 1891, but figures for 1891 and 1901 are simply guesstimates (Kuczynski 1949 p. 650-700) and the latter seems too high relative to 1891 and 1911. The Statistical Yearbook League of Nations provides an estimate for 1913 and an yearly series since 1924, which however shows somewhat implausible movements, with a 7% jump from 1929 to 1930. Finally, Kuczynski (1949 p. 650-700) has estimated a series from 1931 onwards, taking migrations into account. We hypothesize that population grew slowly, at 0.2% per year from, 1800 to 1891 and thereafter we interpolate linearly between the British 'censuses', discarding the 1901 figure. After 1931 we rely on the Kuczynski (1949 p. 650-700) series.

AMERICAS

Anguilla (Leward Island)

We use Bulmer Thomas (2012, Table A.1) data for 1810, 1819, 1829, 1842, 1881, 1891,1900 and Table C.1 for 1911, 1921, 1931, 1946, 1950 interpolated. We extrapolate backwards to 1800 with the 1820-1830 growth rates. Data for 1950 is in coincidence with annual data from UN (2019) for 1950. We add Anguila to Leward Island series.

Antigua and Barbuda (Leward Island)

We use Bulmer Thomas (2012, Table A.1) data for 1810, 1819,1829,1832, 1842, 1861, 1871, 1881, 1891, and Table C.1 for 1900, 1911, 1921, 1931, 1946, 1950 interpolated. We extrapolate backwards to 1800 with the 1810-1819. From 1900 to 1950 we use annual data also from Bulmer-Thomas (2012, Table C.1), that is in coincidence with annual data from UN (2019) for 1950. We add Antigua and Barbuda to Leward Island series.

Argentina

We use data from Perez-Brignoli (2010) from 1800-1949. Perez-Brignoli offer an estimation for the year 1800 based on Maeder, E. (1969) that is much lower that the one offer by Ferreres (2010), Bulmer and Thomas and Yañez et.al (2010). We consider that it is more consistent with literature considerations for Argentine population in colonial times, and that imply a more rapid increase of Argentine population between 1800-1850 (2,4% annual rate for Perez-Brignoli and 1,7 for Ferreres) with a slow convergence of population levels afterwards. From 1900 on both data offer the same figures and coincidence with UN data for 1950.

Bahamas

We use Bulmer Thomas (2012, Table A.1 and Table C.1) data for 1810, 1822-1832, 1836-40, 1842, 1845, 1850, 1853-54, 1861, 1871, 1881, 1891, 1900-01, 1911 1921, 1931, 1943, 1950 interpolated that is consistent with annual data from UN (2019) since 1950 onwards.

Barbados

[74] Our series feature a population 18% higher than the estimate by Ganiage (1301K vs 1100K) in 1856 and almost identical (1486K vs 1519K) to a 'census' in 1881 of uncertain source reported by Fargues (1986 tab 1)

We use Lahmeyer (2004) 1800-19, interpolated 1801-04; 1806-09; 1811-14 and 1816 and Bulmer Thomas (2012) 1820-1938, interpolated 1821-29; 1831-39; 1841-49; 1851-59; 1861-69; 1871-79; 1881-89; 1891-99. Since 1900 to 1950 annual data also from Bulmer-Thomas (2012, Table C.1), that is in coincidence with 1950 UN data.

Bermuda

We have used census data for 1811 (Colonial Secretary's Office, February 4th, 1812). We extrapolate backwards to 1800 with the 1811-1843 growth rates. We found data for 1843 and 1850 in The Bermuda Almanack and Year Book, 1858, and Marsden (1958). Then we interpolate linearly using census data for: 1861, 1871, 1881, 1891, 1901 and 1911 (found in Mitchell (2010). For 1913, 1921 and 1924-1938, we use League of Nation estimation that are in coincidence with Mitchell (2010) census data. From 1938-1950 we interpolate with UN annual data for 1950.

Bolivia

We use Perez-Brignoli from 1800 to 1846. He offers an estimation for 1800 and follows the official census of 1825, 1846 that are the most reliable according to literature (especially that of 1846, see Herranz & Perez-Cajias (2016 p.7). For 1870 we accept the Maddison estimation and later 1900-1940 we follow CELADE (1971). CELADE offers for 1900 an estimation 4% higher than the Bolivian official census is consistent with the UN (2019) data for 1950.

Brasil

We use the for 1800 the growth rates between 1776 (1.9 millons) and 1808 (4 millons), estimated by Istituto Brasileiro de Geografia e Estatistica (1941). From 1808 the same official publication offers an estimation for the years 1808,1819, 1829,1854, and annually from 1872-1900. We interpolate between years. Figures are lower but very close to those offer by Bulmer Thomas (2014), Tombolo (2013) and Yañez et al (2012) for the years 1820-1900. From 1900 we use CELADE (1971) estimation (the same initial data than Instituto Brasileiro) estimations for 1900, 1920,1930,1940 interpolated also with 1950 UN data.

British Guiana

We use Bulmer Thomas (2012 Table A.1 and Table C.1) that offers census data for 1810, 1820, 1829, 1842-43, 1851, 1861, 1891, 1900, 1911, 1921, 1940-50.

British Honduras (Belize)

We use Bulmer Thomas (2012 Table A.1 and Table C.1) census data for the years 1816, 1823, 1829, 1841, 1845, 1857, 1861, 1871, 1881, 1891, 1900, 1911, 1921, 1931, 1946, 1950. This annual figures are in coincidence with the census data interpolated offered by Kucynsky (1948) Vol.III. p.4 (census figures for 1901, 1911, 1921. 1931, 1946) and UN 1950.

British Virgin islands (Leward Islands)

We use Bulmer Thomas (2012 Table A.1 and Table C.1) census data for 1816, 1818, 1829, 1835, 1838, 1841, 1861, 1871, 1881, 1891, 1900-01, 1911, 1921, 1931, 1946,1950 interpolated. This data is consistent with UN 1950 data.

Cayman Islands

We use Bulmer Thomas (2012), Table A.1 and Table C.1), data for 1810, 1820, 1827, 1830, 1844, 1880, 1891, 1901, 1911, 1921, 1931, 1943, 1950 interpolated. To estimate data for 1800 we follow backwards 1820-1830 growth rates. Bulmer-Thomas data is consistent with UN 1950 data.

Canada

Canada had a very long census tradition, which had started as early as 1665 in Quebec, for white settlers only (Thorvaldsen 2018 p.17). In the first half of the 19th century all (settled) provinces took censuses at different dates (Kalbach and Mcvey 1979). Mcinnis (2000 Tab 9.1) uses these data to estimate European population at ten years intervals from 1761 onwards. The Historical Statistics Canada provide figures for the whole country from the first almost simultaneous provincial censuses of 1851 and 1861 (Tab A2) and then a series from 1867 onwards (Table A1). These data include native Americans (cf Statistical Yearbook of Canada 1894 pp.132-136). We use the official series after 1851, interpolating linearly, when necessary, while for the first half of the century we sum European and native population. We estimate the former as a linear interpolation of McInnis' data and the latter by interpolating linearly from 1800 to 1851. Thornton (2000 p.24) put forward a tentative estimate of 150K native Americans in 1800, while we compute the population in 1851 (96K) as the difference between the figures for total population according to Historical Statistics Canada (inclusive of native Americans) and McInnis, who exclude them.

Chile

We use data from Perez-Brignoli (2010) from 1800-1940. Data is interpolated for 1800, 1854, 1865,1875, 1885, 1895,1907, 1920, 1930, 1940. Diaz et al. (2016) offer the same data than Perez-Brignoli only for the years 1865 and 1875 and 1950. For the rest of the years Diaz et al (2016) follow the estimations of CELADE(1971) and not official census. We extrapolate Perez-Brignoli since 1940 and UN 1950 data.

Colombia

We use Perez-Brignoli (2010) estimations with interpolations for the years 1780, 1835, 1843, and 1870 that exclude Panama and CELADE (1971) for 1900, 1920, 1930, 1940 that makes separate estimation for Panama for 1900 onwards. CELADE data for 1900 is 4,2% lower than Perez-Brignoli (that offer census data for 1905, assuming that 1905 census underestimates population according to Collver 1965) and we make consistent with UN 1950 population data.

Costa Rica

Costa Rica official series are plenty of mistakes according to Collver (1965) and other specialists. We use the new estimation by the inverse projection method offered by the Costa Rican demographer Perez-Brignoli (2010, Table 2, p. 19) for the years 1797, 1802, 1807, 1812, 1817, 1822, 1827, 1832, 1837, 1842, 1847,1852, 1857,1862,1867, 1872, 1877, 1882, 1887, 1891, 1897, 1902, 1907, 19012, 1917, 1922, 1927, 1932, 1937, 1942, 1947 with interpolation with UN 1950. This estimation offers lower levels and higher rates of population growth than the Census data offer for Yañez et al (2012), in the first half of the 19th century (1,9% versus 1,35%). On the contrary, a slower growth for the second half (1,7% versus 2,1%) and a similar growth for the first half of the 20th century (2,3% versus 2,4%).

Cuba

We follow the data offered by the Cuban official census for the years 1792, 1817,1827, 1841, 1861, 1877, 1887, 1899 (see US Census Bureau (1909 p.131)). The reliability of this Census before 1900 is confirmed by different specialist as Perez-Brignoli (2010). for 1792 to estimate the year 1800 following growth rates from that year to 1817 official census. Onwards to 1900 we interpolate data of the official census. From 1900-1960 we follow annual population estimation of Santamaria (2000) Appendix pp.542-545. Santamaria´s estimation takes into account net migration and reduce the over-valued increments of the official Census data until 1931, 1934, 1943 y 1953. This estimation is consistent with UN 1950 population year.

Danish (later US) Virgin Island

We use Bulmer Thomas (2012, Table A.1 and Table C.1), data for 1815, 1835, 1841, 1846, 1850, 1860, 1870, 1880, 1890, 1901, 1911 interpolated and annual data from 1917-1950. To estimate data for 1800 we follow since 1815 backwards 1820-1830 growth rates). Bulmer-Thomas previous figures is consistent with UN 1950 population data.

Dominica (Leward Island)

We use Bulmer Thomas (2012, Table A.1 and Table C.1), data for 1810, 1821, 1829, 1832-33, 1840, 1844, 1861, 1871, 1881, 1891, 1900, 1911, 1921, 1931, 1946, 1950 interpolated. To estimate data for 1800 we follow since 1810 backwards 1820-1830 growth rates. Bulmer-Thomas previous figures is consistent with UN 1950 population data. We add Dominica to Leward Island series.

Dominican Republic

We use Bulmer Thomas (2012, Table A.1 and Table C.1), data for 1810, 1815, 1820, 1830, 1840, 1850, 1860, 1870, 1880, 1890, 1920, 1935-1950 interpolated. To estimate data for 1800 we follow since 1810 backwards 1820-1830 growth rates. UN 1950 data is 2% higher than Bulmer-Thomas but we don’t adjust the figures backwards.

Dutch Antilles

UN (2019) annual data offers data for Aruba, Bonaire, Sint Eustatius, Saba, Curaçao, Sint Maarten (Dutch part). For the Dutch Antilles historical figures we use Bulmer-Thomas (2012, Table A.1, Table C.1) offer aggregate data for the Dutch Antilles (Bulmer Thomas (2012, p,28) quote the same six island mentioned by UN) for the years 1815, 1833, 1850, 1860, 1870, 1880, 1890, 1900, 1901, 1902, 1904, 1908, 19010, 1918, 1928, 1938, 1941, 1946-50 interpolated. To estimate data for 1800 we follow, since 1815 backwards, 1820-1830 growth rates. From 1950 to 2020 we use UN (2019) annual data for the six islands mentioned. Despite the sources mentioned UN data in 1950 is 10,7% lower than the Bulmer-Thomas historical series. We adjust this difference in favor of UN data backwards.

Ecuador

We use data from Perez-Brignoli (2010) from 1800-1907. Data is interpolated between 1780, 1825, 1839, 1857, 1873, 1886, 1905, 1865,1875, 1885, 1895,1907. Them we interpolate with 1920 data CELADE (1971) and from 1927 to 1949 we use annual data offered by Banco Central de Ecuador (2018). This estimation is consistent with UN 1950 onwards.

El Salvador

We use data for 1810-1899 from Yanez et al (2012). We interpolate backwards to 1800 with rates of growth 1810-20. Yañez et al (2012) use census data with Baron Castro (1942) corrections. From 1900 to 1940 we use data from Mitchell (2010) that is apparently estimated from census and we interpolate to 1950 UN data.

Falkland Islands

We use Mitchell (2010) data for 1850,1861,1871, 1881, 1891, 1901, 1911, 1921,1931. With interpolation between years and with UN data for 1950. For 1800 to 1849 we use the rate of growth of the years 1850 to 1861 backwards.

French Guiana

We use Bulmer Thomas (2012, Table A.1 and Table C.1) data for 1814, 1819-1848, 1850, 1855, 1860, 1868, 1872, 1876, 1880, 1887, 1891, 1895 and 1901-1946. For 1800 to 1814 we use the rate of growth of the years 1820 to 1830 backwards. Since 1946 we interpolate with the year UN 1950 data.

Granada (Winward Island)

We use Bulmer Thomas (2012, Table A.1 and Table C.1) data for, 1810, 1827, 1829, 1832, 1834, 1837, 1842, 1851, 1861, 1871, 1881, 1891, 1900-1950. For 1800 to 1814 we use the rate of growth of the years 1820 to 1830 backwards. This estimation is consistent with UN 1950 onwards .

Guadalupe

We use Bulmer Thomas (2012, Table A.1 and Table C.1) data for 1816-1824, 1826, 1831-38, 1852, 1861, 1867, 1876, 1883, 1888, 1893, 1900-1950. For 1800 to 1816 we use the rate of growth of the years 1820 to 1830 backwards. Bulmer Thomas (2012, p.475) mention that the numbers for St Barthelemy for the years after 1878 (the year the island was transferred back to France) in Table A.1 have been deducted from the figures found for Guadalupe until 1900 in Table A.1 but not later. Bulmer Thomas figure for 1950 is only 1.8% superior to the same year of UN 1950 data.

Guatemala

We use data from Guatemala Censos de población (1950) that offer census figures with correction of goverment for the years 1776, 1880, 1893, 1921, 1950. Correction goverment of the census of 1940 is nor acepted and criticed by officials of the 1950 census. We use instead data of CELADE (1971) for 1940. The ofical and Census figure of 1950 used is 10,4% lower than UN figure for 1950 and we correct backward the serie to be consistent with UN data onwards.

Haiti

We use Bulmer Thomas (2012, Table A.1 and Table C.1) data for 1810, 1815, 1820, 1830, 1840, 1850, 1860, 1900-1950. For 1800 to 1810 we use the rate of growth of the years 1820 to 1830 backwards. Data for 1950 is equal 1950 UN data.

Honduras

We use oficial census data from : Historia General por Censo de Honduras

VBP (Biblioteca Virtual de Población: Centro Centroamericano de Población) for the most realible years years : 1791, 1801, 1881, 1887, 1895, 1905, 1910, 1916, 1926, 1930, 1935, 1940, 1950. According to literatures the official census before 1930 underestimated 6-10% (Collver 1965).

The ofical and Census of 1950 used is 11,5% lower than UN data for 1950 and we correct backward the serie to be consistent with UN data onwards.

Jamaica

We use Bulmer Thomas (2012, Table A.1 and Table C.1) data for 1810, 1820, 1830, 1844, 1850, 1860, 1871, 1881, 1891, 1900-1950. For 1800 to 1810 we use the rate of growth of the years 1820 to 1830 backwards. Data for 1950 is equal to the data from UN.

Leeward Island (Anguila, Antigua, Dominica, L.I St.Christopher, L.I Montserrat, L.I St Kits&Nevis, L.I Virgin Island)

We use Bulmer Thomas (2012, Table A.1 and Table C.1, that sum L.I St.Christopher, L.I Montserrat, L.I St Kits&Nevis, L.I Virgin Island, and we add data from Anguila, Antigua, Dominica to compose the Leward Island agregate.

Martinique (French Colonies)

We use Bulmer Thomas (2012, Table A.1 and Table C.1) data for 1815, 1826, 1831-38, 1862, 1864-65, 1867, 1876, 1886, 1894, 1900-1950. For 1800 to 1815 we use the rate of growth of the years 1820 to 1830 backwards. Data for 1950 is equal to the data from UN.

Mexico

We have used the Information on official Census, historical and recent secondary estimation offered Tab 1.1 of Mexican Historical Statistics (2015). We have chosen the estimations and Census years accepted by others scholars (Bulmer-Thomas (2014), Perez-Brignoli (2010 and Yañez et al. (2012) as reliable. The years interpolated are: 1790, 1810, 1820, 1830, 1842, 1850, 1854, 1862, 1869, 1872, 1878, 1882, 1885, 1895, 1900, 1910, 1921, 1930, 1940. Mexico population territorial changes is assumed to be real from 1836 Texas revolution. Although Mexico did not recognize Texas independence until 1845, Texas consolidated its status as an independent republic and received official recognition from Britain, France, and the United States in 1836. Data used seems to cover Mexican the facto current territory and show a population lost of 14% from the estimation of Burkhardt for 1830 and the government estimation of Brantz Mayer in 1842. We connect official census of 1940, that is used also by CELADE (1971), with UN annual data for 1950 without corrections that we use onwards.

New Foundland

The Historical Statistics Canada has collected estimates from various sources from 1790 to 1832, and the Historical Statistics Newfoundland and Labrador report the results of censuses from 1836 onwards. We interpolate linearly.

Nicaragua

We use census data offered in the *Anuario Estadistico de Nicaragua 2005* (p.55) for the years 1778, 1867, 1906,1920, 1940, 1950. The ofical and census of 1950 used is 18,9% lower than UN data for 1950 and we correct backward the serie to be consistent with UN data onwards. As a result our data for Nicaragua is very similar to that offred by Yanez et al (2012) with a little lower growth of our data for the years 1800-1850 (1,0% versus 1,3%).

Panama

Our estimation of Colombia population excludes Panama from 1800. We use Census data for Panama offered by Médica (1973, Cuadro1, p.5) for the years 1789, 1835, 1851, 1871, 1896 and CELADE estimations for 1900, 1920,1930, 1940 interpolated with UN 1950 data.

Paraguay

We use Perez-Brignoli (2010) for the years 1792, 1846 1864, 1870 and 1899. The number of people who died in the Paraguayan War (1864–1870) is unknown. Perez-Brignoli offer a loss of 21% of population in those years that is impressive but lower than most of the literature proxies that talked about 80%. We assume it represents an upper-bound estimation in relation with the famous controversial Reber (1988, p.290) article that estimated a population lost between 7 and 18.5 percent of its pre-war population. For the years 1920, 1930, 1940 we use CELADE (1971) data interpolated that is consistent with Perez-Brignoli and with UN data for 1950 that we use onwards.

Peru

We use Seminario (2015, Tab I. p.44) from 1800-1949 (Tab I p.49). This data seems more consistent with colonial times and UN post- 1950 data than the other alternative series. On one hand, Seminario (2005, Tab I p.49) data for 1800 is 12% higher than Perez-Brignoli (2010), but almost identical than Perez Perez-Brignoli(2010) and Bulmer-Thomas (2010) for 1820, 1850 and 1876. On the other hand, Seminario population growth rates between 1876 and 1900 are higher, and between 1900 and 1913 lower than those offered by the mentioned authors.

Puerto Rico

We follow official censuses from 1800 to 1950. From 1765 to 1887 census were provided by the Spanish government. We estimate the year 1800 following growth rates from 1775 to 1815 census data. The census from 1899 onwards was taken by the War Ministry of the United States. Since 1910 Puerto Rico has been included in every decennial census taken by the United States. U.S. census Bureau (1953, pp.51-54). We interpolate data between census that is consistent with UN data from 1950.

St. Barthelemy (1800-1900)

St. Barthelemy remained an independent polity (first as Swedish and then as French colony) until 1900, when it became an administrative dependency ot the Island population started to be included in Guadalupe an all its dependence later. We use Bulmer Thomas (2012) Table A.1 for the years 1812, 1819, 1826, 1836, 1843, 1847, 1860, 1872, 1878, 1889, 1900. We interpolate and for 1800 to 1815 we use the rate of growth of the years 1820 to 1830 backwards. Bulmer Thomas (2012, p.475) mention that the figures for St Barthelemy for the years after 1878 (the year the island was transferred back to France) in Table A.1 have been deducted from the figures found for Guadalupe in the sources listed above (see Guadalupe).

St Kitts & Nevis (Leward Island)

We sum St Kitts a Nevi Islands population different series offered by Bulmer Thomas (2012, Table A.1 and Table C.1) for the years 1810, 1829, 1832, 1836, 1838, 1840, 1844, 1853, 1861, 1871, 1881, 1891, 1900. For 1800 to 1810 we use the rate of growth of the years 1820 to 1830 backwards. and the aggregated series for the years 1901, 1911, 1921, 1931, 1946, 1950. This data is consistent with the UN data from 1950 onwards. We include St Kitts & Nevis in Leward Island series.

St.Lucia (Winward Island)

We use by Bulmer Thomas (2012, Table A.1 and Table C.1) data for the years 1810, 1829, 1832, 1836, 1839, 1850-54, 1861, 1871, 1881, 1891, 1900-01, 1911, 1921, 1931, 1946, 1950, interpolated. For 1800 to 1810 we use the rate of growth of the years 1820 to 1830 backwards. This data is consistent with the UN data from 1950 onwards.

St.Pierre e Miquelon

The Statistical Yearbook France reports population for several benchmark years from 1864 to 1936, which we interpolate linearly. We extrapolate the series to 1800 with the movements of the series for Newfoundland.

St. Vicente (Winward Island)

We use by Bulmer Thomas (2012, Table A.1 and Table C.1) data for the years 1810, 1812, 1825, 1829, 1832, 1842, 1851, 1861, 1871, 1881, 1891, 1900-01, 1911, 1921, 1931, 1946, 1950, interpolated. For 1800 to 1810 we use the rate of growth of the years 1820 to 1830 backwards. This data is consistent with the UN data from 1950 onwards.

Suriname (Dutch Guayana)

We use Bulmer Thomas (2012, Table A.1 and Table C.1) data for the years 1811, 1815, 1831, 1850, 1863, 1880, 1890, 1900, 1910, 1914, 1921-1950. For 1800 to 1811 we use the rate of growth of the years 1820 to 1830 backwards. This data is consistent with the UN 1950 data onwards.

46. Trinidad & Tobago (Winward Island)

We use the sum of Bulmer Thomas (2012, Table A.1 and Table C.1) data for Trinidad and for Tobago separately for the years 1810, 1820, 1829, 1832, 1842, 1851, 1853, 1861, 1871, 1881, 1891, 1894-1900. From 1900 B-T provide data for Both Island together for 1900-1911, 1921, and 1931-1950. 52. For 1800 to 1810 we use the rate of growth of the years 1820 to 1830 backwards. Bulmer Thomas figure for 1950 is only 1.6% superior to the same year of UN 1950 data.

Turk and Caicos Islands

We use Bulmer Thomas (2012, Table A.1 and Table C.1) data for the years 1810, 1822-32, 1836-39, 1850, 1861, 1871, 1881, 1891, 1900-01,1911, 1921, 1931, 1943, 1950. For 1800 to 1810 we use the rate of growth of the years 1820 to 1830 backwards. Bulmer Thomas figure for 1950 is only 27.5% superior to the same year of UN (2019), we decide to correct backward the serie to be consistent with UN 1950 data.

United States

The United States took their first census in 1790 and continued regularly at ten-year intervals. The Historical Statistics United States (2006 series Aa9) estimates the intercensal movements using the (incomplete) data from vital population registers and the (accurate) data on immigration. The source increases the total population in the 1870 by adding 1260K, to correct for the implausible rates of change in Southern (African-American) population. This is the only correction, in spite of the substantial evidence of undercounting in other censuses. Unfortunately, the nationwide estimates of the bias (Coale and Zelnick 1963, Coale and Rives 1973) cover only the censuses after 1880, while the local studies yield quite different, but in general higher, biases (Steckel 1991 tab.1) [75]. The bias was greater in cities and among immigrants (Haines 2000) and thus one might surmise to have been smaller in the first half of the 19th century.

Given this uncertainty, we have thus decided to reproduce the series from the Historical statistics without further corrections. The Censuses excluded native Americans living in reserves before 1890 and the inhabitants of Alaska and Hawaii until 1950. However, the census Bureau counted separately the population of Alaska since 1880 and of Hawaii since 1900 (HS 2006 Aa 97). We consider Hawaii as a separate polity in Oceania, while we get a series for Alaska by assuming population to have been stable until 1880 and by interpolating between census data.[76] Likewise, we obtain a series of the native American population before 1890 by interpolating linearly the estimates from War Bureau and then Commissioner Indian Affairs from 1800 onwards (Thornton and Marsh Thornton 1981 Tab 2).

Uruguay

We use Bulmer-Thomas (2014) data from Tab.3.1 for the years 1820-1910. For 1800-1820 we use Bulmer-Thomas growth rates 1820-1830 backwards. The data for 1800 (30mil) is in coincide with the estimation of Perez-Brignoli (2010) for the same year. From 1910 to 1940 we use the data estimated by CELADE (1971) for 1920,1930,1940 and UN for 1950.

Venezuela

We use Perez-Brignoli (2010) for the estimation of Venezuela data for 1800. Population reduced during the Independence war decade. Perez-Brignoli data for 1825 is considerable low. We prefer the use of the Bulmer-Thomas (2014) data for 1820 that is a little bit higher and that present an annual estimation for 1820 -1913. We use this annual data that is lower and more consistent than the official census figures presented for Babtista (1997, Cuadro F1) for 1823, 1838, 1847, 1873, 1881, 1891, because we assume that Venezuela official census

[75] These estimates use a backward projection method, with data on age distribution of population from later censuses and assumptions about birth and death rates. The authors have estimated the bias for (native-born) whites in 1880-1950 (Coale and Zelnick 1963 tabs. 16 and 17) and for African-American for 1880-1970 (Coale and Rives 1973). The total amounts to about 7% of the censed population from 1880 to 1920 (rising from 3.2 to 7.5 mil) and then declines to 5% in the 1930 and 1940 censuses (slightly less then 7 millions).

[76] Population jumped from 32K in 1890 to 63.6K in 1890. We assume that all this growth was concentrated in 1899 when the discovery of gold attracted a wave of immigrants.

overestimates population according to Collver (1965). Bulmer´s data is also consistent with CELADE (1971) data for 1920, 1930, 1940 and UN 1950 that we interpolate.

ASIA

Aden and Socotra

The British conquered Aden in 1840 and started to take censuses of its population in 1891, while they never counted the population of Socotra (a protectorate since 1886). Population 1871 22.5K (Indian census 1871 p.5) The Statistical yearbook British colonies estimates the population of the archipelago to have remained constant at 12K in 1911, 1921 and 1931. We assume that the population of Aden remained constant at 2K from 1800 to 1840, rose to 10K in 1865, to 22.5 1871 and we interpolate linearly to and then, after the opening of the Suez canal to 40 in 1875. We interpolate the results of British censuses from 1891 to 1931 and we assume that population rose to 65K in 1938, as reported by the Statistical Yearbook League of Nations [77] The figure for Socotra is not inconsistent with the estimate for Yemen and thus we accept it for 1931, while we extrapolate to 1800 and to 1938 with the rates for Yemen[78].

Afghanistan

'The demography of Afghanistan is one of the least known in the world, owing to the lack of a complete census' (http://www.iranicaonline.org/articles/demography#pt2 accessed May 2021). A British envoy, Curzon, reckoned population to have been around 5 millions in 1895 (Lieberman 1980), while the Statistical Yearbook League of Nations published a much higher figure for 1913-1924 (12 million) but reduced it to 7 millions from 1925 onwards. Maddison, following McEvedy and Jones (1978:156), assumes population to have been half the Iranian one – i.e. 3.3 million in 1820, 4.2 1870 and 5.7 in 1913. We extrapolate backwards the 1950 (not so solid) UN data with the series for Iran: the results are consistent with the Curzon/Maddison view.

Arabian Penissula

See Otoman Empire

Bahrein

See Otoman Empire

Bhutan

The Statistical Yearbook League of Nations reports a population constant from 1913 to 1938 with the level almost a half higher than the Unite Nations data for 1950 (250 vs 175). This difference cannot be explained by

[77] The 1946 census yielded a total of 82K, but it is likely that population was swelled during the war for the key role of the port in the route to India.
[78] The British estimate implies that the population of Socotra was about 0.6% of our estimate of mainland Yemen. Its share was 0.20% in 2013 (https://en.wikipedia.org/wiki/Governorates_of_Yemen accessed October 2021).

any known historical event. We thus simply extrapolate backwards the 1950 population according to the United Nations with the series for Nepal.[79]

British Malaya (Malaysia and Singapore)

The British settled in Singapore in 1819, in the three nearby cities, known as Strait Settlements, in 1826 and extended progressively their control on the peninsula from 1874 onwards. They took the first census in Singapore as early as 1824, and started to count population of the other areas as soon as native states entered in their sphere of influence - since 1881 in Penang and Malacca, since 1891 in the Federated Malay states (Perak, Selangor, Negri Sembilan and Pahang), and since 1911 in the Unfederated states (Johore, Kedah, Kelantan, Trengganu and Perlis). The British data have been used for the reconstruction of series of population from 1900 onwards as part of the project of the economic history of Malaya (Nazrin Shah 2016 Tab 1). The sources for the pre-colonial period are more uncertain. However, many travelers and British diplomats had put forward estimates of population in the Malaysian peninsula, and one of them, Newbold, collected systematically different sources to get an estimate for the 1830s (Dogde 1980). Pierre van der Eng (personal communication, April 2017) suggests quite fast growth for the total population, thanks to immigration – i.e. 2.29% from 1800 to 1901 and 2.20% from 1835 to 1901. This latter order of magnitude is confirmed by a comparison of the population in ten states out of eleven according to Newbold for the 1830s and by Nazrin Shah (2016 tab 4) for 1901. The rates range from 1.1% to 4%, their unweighted average is 2.25% [80]. Thus, without any solid evidence of changes in rates in the 19th century, we assume a 2.2% growth from 1800 to 1901. From 1900 onwards, we use the series by Nazrin Shah (2016 Tab 1). The series grows at 2.26% per year 1901-1938, with plausible fluctuations, including a fall in 1918-1919 for the Spanish flu. Last but not least we add the population of Singapore. Following van der Eng, we assume it to have been constant (at 1K) until the British conquest and to have risen linearly to 11K in 1824. Thereafter, the interpolate between censuses, which are widely deemed reliable. (Saw 2012 Chap.1).

British North Borneo (Sabah)

The British administration extended to Sabah the empire censuses since 1891 but the first three enumerations covered only some areas and thus undervalued the population (Lee 1962, Jones 1966). Jones has put forward some extremely tentative estimates since 1878, which converge to the census data in 1911 [81]. We interpret his fairly vague wording to hypothesize the population to have been 160K in 1878, 180K in 1891, 200 in 1901 and 220 in 1911. These figures imply growth rates around 1%, which we use also to extrapolate to 1800.

Brunei

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[79] We modify slightly the results in the first half of the 1910s, omitting the slowdown for the recruitment of Gurkhas soldiers. We assume that population was growing at 0.9% as in the first years of the decade.

[80] The yearly rates of increase of population between censuses were 1.41% for Penang and Malacca in 1881-1891, and 0.46% for these latter and for the Federated States in 1891-1901. Dodge (1980 tables D and E) extrapolates backward the Malay population from the earliest available British census assuming rates either 0.3% or 1%. The highest of the two implies that the Malay population in 1800 was about 396K. Even assuming no other nationality, the rate of growth total population to 1901 could not exceed 1.46%.

[81] Jones (1966) suggests about 150K in 1878, at least as many in 1891 (vs 67K from the census), at least 160K in 1901 (vs 104K) and somewhat more than 208 (the figure from the census) in 1911. Van der Eng (personal communication) puts forward a total of 175K in 1901, which seems too low.

Brunei became a British protectorate in 1884 and population was counted for the first time in 1911. Jones (1966 p.20) deems these enumerations reliable and free from undercount and adds estimates for 1809 (15K), 1889 (12-15K) and 1906 (10K). This latter figure is about half the population at the enumeration, just five years later, and thus we discard it. Following Jones, we hypothesize population to have remained constant from 1800 to 1889 at 15K and then we link with linear interpolation to the 1911 'census' (22K) and to following ones.

Ceylon (Sri Lanka)

The British colonial administration enumerated the population as early as 1814 and again in 1827, and then took censuses regularly since 1871 (Karunatilake 1986/87). However, historians reckon that results underestimated population, with a bias declining from about 40% in the early 19th century to about 10% on the eve of World War Two (Sarkar 1957, Peebles 1982). They have revised correspondingly upwards the population series from 1814 onwards, with linear interpolation between benchmarks. Pierre van der Eng (personal communication April 2017) has revised their work by taking into account the yearly net immigration of Indian (Tamil) workers since 1827. We use his series, extrapolating it backwards to 1800 with the population of India.

China

China deserves a special attention as it accounted for 22% of world population in 1950 according to the United Nations. Indeed its demographic history from 1800 to the revolution has attracted much interest, but there is still a lot of uncertainty about short and medium term movements of population. The period can be neatly divided in two periods, with the Tai'ping war (1851-1864) as a watershed. The war not only claimed a huge number of lives and accelerated the decline of the Heavenly Empire, but caused a dramatic worsening in the quality of demographic data. Since the mid 18th century yearly population series had been collected via neighbourhood organizations (bao-jia) system. The collection formally continued after the war, to be abolished in 1902, but it worked only in few provinces, while all governmental efforts to take censuses failed to return plausible nationwide results. Thus, we will split our discussion in two sections, China before 1851 and China after 1851. In this latter section, we will also discuss the (small) impact of territorial losses since the late 19th century.

China before the Tai'ping war

China counted its population for the first time in 2 AD under the Han dynasty and repeated the exercise 104 times from then to 1911 (Deng 2004). In 1740, the emperor stripped the population statistics of the fiscal purposes and mandated to keep an yearly updated count of households and population in the whole empire, including Manchuria, Sinkiang and Taiwan (Ho 1959, Durand 1959-60, Teubner and Wang 1960, Bielestein 1987). The data should be collected by local household associations (bao-jia), validated by county officilas and eventually sent to the central government in Bejing. The early data covered only part of the country, and the collection did not work very well, until the issuing of more clear instructions in 1774-1775.

There is no doubt that the system was not comparable to a modern population register and thus that yearly figures were hardly accurate. However, the size of the divergence from the actual population is still controversial. Some authors (Tuebner-Wang 1960, Aird 1968 and Skinner 1986) are highly critical. Skinner (1987) analyzes in depth the statistics for the Sichuan province and concludes that only the figures for 1812-1813 were obtained with an actual enumeration, while for later years the county officials repeated the absolute change of the previous year adding or deducting one or two units. He estimates an alternative series, which in 1851 yields a population of 28 million, about three fifths of the official figure (44 million). On the other side, Deng (Deng 2004 and Deng and Shenming 2019) is particularly sanguine about the efficiency of the Chinese bureaucracy and deems the census-based series 'fundamentally sound' (2004). The opinion of the majority of scholar is midway between these two extremes. They trust the official data as at least partially reliable. Durand (1959-60) defines 'worthless' the year-to-year changes, but shows 'a certain amount of confidence' in long-run trends. Ho (1959) singles out data for some provinces (Guangdong, Sichuan) and years as likely wrong and concludes that 'the population of China could only have been somewhat under-registered and not inflated'. Perkins (1968) deems long-term trends plausible for all provinces but three, including Sichuan, and correspondingly reduces the 1851 total Chinese population by 5%. Bielenstein (1987) deems the data 'more reasonable' after the 1774 reform but warns that 'all semblance of honest reporting was abandoned' after 1845.

The yearly series of Chinese population are reported by two separate sources, the nationwide summaries, known as veritable records (Tung-hua lu), used in early work by Ho (1959) and Durand (1959-1960), and the provincial summaries (or yellow registers), which Bielenstein (1987 pp.101-103) has extracted from Beijing archives[82]. We report the data for some benchmarks, alongside some other recent estimates, in Table 1 [83]

Table 1
Estimates of Chinese population in the first half of the 19th century

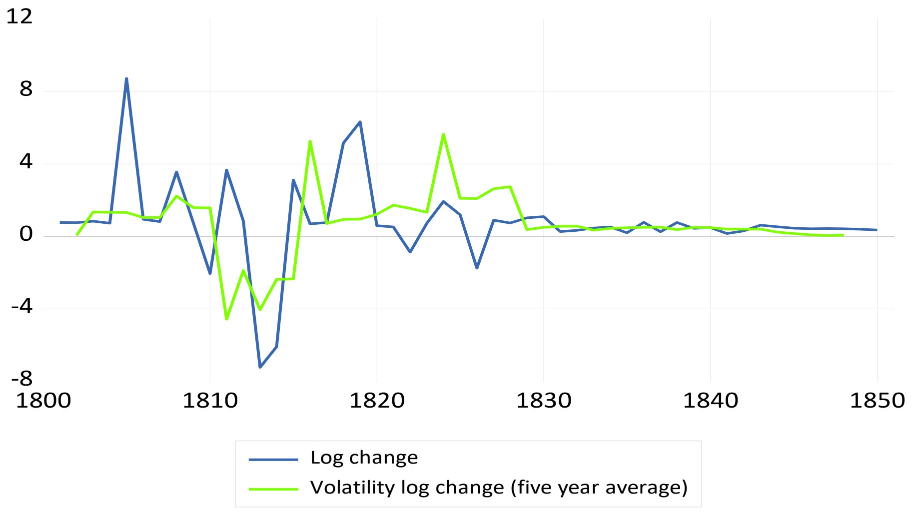
	Official series	Cao (2000)	Liu/Hwang 1979 tab A.1	Maddison 2007 tab D.1	Deng 2004 App 2	Yi et al (2016)
1800	295		295	341		
1810	345		345	361	362a	369a
1820	354	383	354	381		
1840	412		412	412	399b	
1850	430	437	430	430		436

a 1812; b 1833

We test the Skinner-Bielenstein hypothesis about the updating of population registers by computing the yearly log change in the official series of population and the change in its volatility, measured as the coefficient of variation for five year moving averages (Figure 1).

Figure 1
Yearly change in population in China in the first half of the 19th century

[82] The differences in the nationwide total are minimal in all years but 1819-21. The Bielenstein (1987) series anticipates to 1819 an increase by about 20 millions which appears in 1822 in the Durand-Ho ones. In the following, we use Bielenstein series as base, filling the gaps in 1803 and 1805-1806 with the data from Durand (1959-60), and label the result as 'official series'.
[83] Maddison (2007) endorses the figures by Liu and Hwang (1979) after 1820, but he corrects those for 1800 and 1810 (as well as previous ones) because he deems implausible any growth of population in pre-industrial societies above 20% per decade. His series have been used in the recent estimates of Chinese GDP by Broadberry et al (2018) and Ma and de Jong (2019).



A visual inspection rules out the extreme Skinner version but lends some support to the more moderate Bielenstein criticism about the data of the 1830s and 1840s[84]. On the other hand, some of the fluctuations before 1819 are not supported by the historical records. The population allegedly jumped by 32 million in 1805 and by a further 5 in 1808, declined by 45 million people in 1812-1814 and then recovered in 1819 according to the yellow registers or in 1822 according to the veritable records (Durand 1959-60). Ho (1959:62) hypothesizes that the 1805 increase reflects an extension of geographical coverage of the registration, but he has no explanation for the 1813-14 collapse. Indeed those years featured no major event, and anyway the alleged recovery in five or ten years beggars belief [85].

We start our reconstruction with population in 1851. The official statistics report a total of 430 million in the whole Qing territory, including Mongolia, Tibet and Taiwan. As said, Skinner strongly criticizes this figure, arguing that the official statistics overvalued the population not only in Sichuan but also in seven other provinces (Fujian, Guangdong and five ones in the Yangzi basin), and concludes tentatively that the total was something closer to 380 million' (1987 p.75). He thus finds insufficient the correction by Perkins (1969 tab.A5), who reduces the total of Fujian, Guangdong and Sichuan by 21.3 million and the total for the empire to 410 millions (Table A6 and A7). On the other hand, the recent estimate by Cao (2000) compensates the downward correction for four provinces (the three already quoted plus Hubei, in the Jangtzi basin) with increases in North and North-West China and in outlying areas – so that he reckons the population of the empire to have totaled 437 million people in 1851. We extrapolate backwards this figure to 1820 with the official series. It is highly likely that the series underestimates fluctuation after 1830, but here is no strong evidence that the rate of change (0.49% per year) is wrong [86]. The result for 1820 is just 1.2% lower than the total by Cao (379 vs. 383 million). As said, the movements of the official series between 1812 and 1820 are totally implausible, but the

[84] The combination between the initial size of the population and its rate of growth makes it very difficult to discriminate between the two alternative versions of the linear increase of population – constant absolute increase (as in Skinner 1987) or constant rate of growth in the period of interest (1830-1850). Starting from a population of about 400 millions in 1830 a constant 0.5 rate of growth would yield a total of 444 million inhabitants, while a constant addition of two millions (0.5% of the 1830 population) a total of 442.

[85] Skinner (1987) argues that the 1813-1814 figures for population of Sichuan were the product a careful revision of the results of the 1812 enumeration, which in turn had been stimulated by the 1810 edict of the Jiaqing emperor.

[86] We have estimate the rate according to the specification by Razzaque et al (2007); the coefficient is significantly different from zero at 1 %. The rates from 1820 to 1850 were 0.65% according to Liu-Hwang (1979), 0.40% Maddison (2007) and 0.44% Cao (2000). The series in the early 1820s is somewhat suspicious, as it rises from 380 million in 1823 to 392 in 1825 and then falls to 385 the next year.

1812 figure, as the result of a renewed effort to measurement, seems fairly trustworthy. Thus, we extrapolate backward the 1820 estimate to 1800 with the rate of change between 1812 and 1820 (0.4% per year). Our estimate for 1800 comes out 18% higher than the official series (250 vs 295) and this bias tally well with the difference between Cao (2000) and the official series in 1776 (312 vs 268 – or 16% higher).

China after the Tai'Ping war

After 1851, the bao-jia system worked only in few provinces, and thus the nationwide data after 1851 are useless (Ho 1959 pp.68-73). The dying empire tried to count the population, setting up a statistical department in 1908 and mandating the police to collect data on the number of households. The operation was continued in 1912 by the newly established republic. After its victory in 1927, the nationalist government tried again to count the population in 1928-1929 and in 1934 even resurrected the bao-jia system (Chen 1931, Ho 1959 Durand 1960). Bielestein (1987 p.134) calls these efforts 'a failure', echoing the widespread skepticism among scholars about all official data of the 1930s (Ho 1959 p. 86, Durand 1960). He also raises doubts about the post-war censuses under the Communist regime, but most authors reckon the 1953 census to be reliable enough and use its results to estimate long-run trends (Durand 1959-60, Aird 1968 p.246 Ho 1959 p.87, Liu-Yeh 1965, Schran 1978). Actually, one might argue that real problem for the pre-war censuses is their incomplete geographical coverage rather than errors in the published figures. The 1912 census returned a total of 331 million for Inner China, with three missing provinces, and the 1928 one a total of 190, with eleven missing ones: both figures are broadly consistent with the number of people in the same provinces according to Cao (2000) and Perkins (1968), respectively 338 and 194 million. However, this somewhat more sanguine view of the results of censuses results does not help much if one wants to get a figure for the whole empire.

Table 2 reports a selection of the benchmark estimates from most recent research, which are aligned an internally consistent pattern of change. [87]

Table 2

	Liu and Hwang 1979	Wu	Other sources	Inner China§	Rates	Other source
1851	412000	436299	437323	427569		Cao (2000)
1870	358000	358226	348700		-1.04	Perkins 1968 Tab A5*&
1880	368000	365961	364339	350862	0.21	Cao (2000)
1893	385969	387531	386531	361921	0.44	Yi et al 2018 Tab 1
1910	423000	422130	433107	407631	0.50	Cao (2000)#
1933	500000	499737	503100	445300	0.73	Perkins 1968 Tab A5&
1953	581930	584599	583931	528274	0.78	Cao (2000) #

& omits (Inner) Mongolia, Manchuria, Xinjiang and Tibet ° computed on estimates by Wu; *1873; & source University of Nanking; # excluding Taiwan

[87] There are some exceptions to this consensus worth quoting. First, some scholars, including the American demographers Rockhill and Willcox, argued that the population before World War One was much smaller – with figures ranging from 311 to 386 (Chen 1931 Liu-Yeh 1965). Second, Deng (2004), relying on official sources, suggests that population never fully recovered from the Tai'ping War, totaling 378 million in 1887 (vs 399 in 1833) and only 368 in 1911. On the other end of the range Shi (2020 Appendix A.1) rises the figure to 436 in 1887 and 1911 population

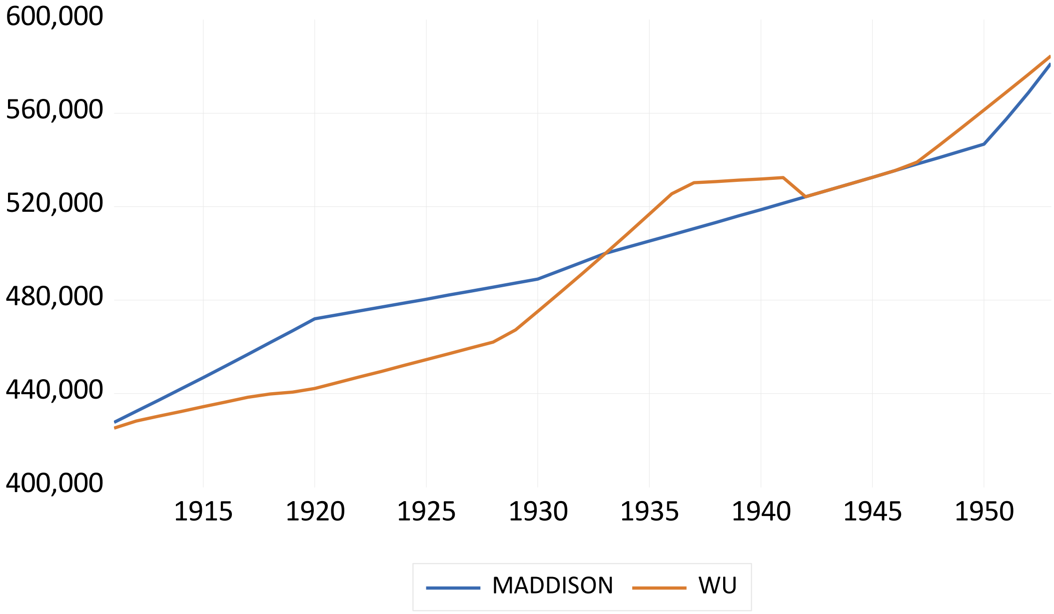
The estimates are broadly consistent with the (quasi-independent) evidence on the population losses (excess deaths and missing births) as consequence of wars and other natural disasters which marred the history of China in those years [88]. The most devastating of all, the Tai'Ping war (1851-1864), caused 57 million of excess deaths in the most affected provinces and at least 70 in the whole empire, plus 30-40 million missing births, while the North China famine 1877-1878 9 to 13 million deaths and the Japanese invasion, World War Two and the civil war between 10 and 20 million.[89] Assuming missing births to have been half the excess deaths, these figures would be consistent with the benchmark estimates of Table 2 if the disaster free population growth rate had been 0.4% in the 1850s and 1860s, 0.6% to 0.75% in the 1870s and 0.9%-1% from 1933 to 1953. The fairly high rate of the 1870s relative to the pre-war one is plausible in a country recovering from a massive demographic shock, while the estimates for the 20th century can be interpreted as the start of the demographic transition. From 1950 to 1958, between the end of the revolution and the Great Leap Forward, the population grew at the high rate of 1.85% (United Nations).

Two authors have estimated yearly series of population from 1871 onwards. Maddison (1995) has interpolated linearly the eighteen benchmark estimates by Liu and Hwang (1979) for the period 1871-1953 and Wu (personal communication) has built a yearly series, with a mix of annual changes and linear interpolation. The two series are almost identical for the late imperial period and diverge quite markedly after 1910 (Figure 2)

Figure 2
Estimates of population movements in China, 1910-1938

[88] See the list, with crude estimates of the number of excess deaths, in Aird 1968 and also the information in https://disasterhistory.org, https://public.emdat.be. Schran (1978) estimates population by deducting the losses from implicit population, assuming a 0.5% natural rate of growth. There is no evidence to support that specific figure and he gets results quite far from the conventional wisdom (e.g. he gets a population around 550 million in 1933).

[89] Cf. for estimates of losses Platt 2012 p.308. The war affected mostly four provinces of South Central China (Hubei, Jiangxi, Zhejiang and Anhui), while other rebellions developed elseewhere, the Muslim or Panthay (1856-1873) and Miao (1854-1861) in the South (Yunnan and Guizhou) and the Nian (1851-1868) in the Centre North (Hebei, Shandong, Henan). There are no provincial data for 1870, but in 1880 the population of the four provinces most affected by the Tai'ping war was 40% lower than in 1851, while the population in the rest of the country 'only' 13% lower (Cao 2000).



Overall, we prefer the series by Wu as it relies less on interpolations before 1910 and, above all, because seems more historically plausible. Population grew very slowly during the periods of political turmoil, the warlord era (1916-1928) and after the Japanese invasion (1936), and recovered during the relatively peaceful period of the Kuomintang rule [90]. We correct the figures of the 1870s to take into account the effects of the North China famine: we assume that population grew at 0.7% yearly rate from 358 million in 1870 to 373 in 1877 and then fell to 366, with 12 million excess deaths.

Territorial losses in the 19th century

'China in Qing territory' around 1820 (i.e. the empire at its greatest extension) did not include Macau (a Portuguese colony since 1557) but it did include other territories which were lost later. Hong Kong became a British colony in 1842, Taiwan a Japanese one in 1896, and the empire granted concessions of some cities to Western powers in 1896-1898 [91]. Tibet and Outer Mongolia become independent in 1911 and Manchuria in 1931, although in practice it was ruled by the Japanese. China claimed back all these territories (except Outer Mongolia) and it succeeded to retake most of them after World War Two. Thus, all territorial changes affected the series after 1851, as Hong-Kong under the Chinese rule was almost uninhabited. Unfortunately, most sources are not very precise about the territorial coverage [92]. However, it is possible to infer that the Wu series refers to a constant area as it shows no downward jump in 1896 and 1911 [93]. We conservatively assume it

[90] The Spanish flu appears only as a modest slow-down of growth from 0.5% per year in before 1917 to only 0.17% in 1919, corresponding to 3 million excess deaths. The figure is substantially lower than independent estimates – i.e. 4-9.5 million according to Athurokala and Athurokala (2020 tab. 1) and 6.3 million according to Barro et al (2020 tab.1).

[91] Kiachow was a German concession from 1896 to 1914, Kwang-Chou-Wan a French oner 1898-1945, Kwantung a Russian and then Japanese one 1898 -1945 and Wei-Hai-Wei a British one 1898-1930.

[92] The only exception is Cao (2000). His benchmark estimates always include Manchuria (the provinces of Liaoning and Heilonjang), Taiwan (in the Fujian province), Tibet and Inner Mongolia, while they exclude Outer Mongolia.

[93] Population increased in 1895/6 as much as in 1894/1895 and faster in 1910/1911 than in 1909/1910. The population of Taiwan was according to Cao (2000) 2664K in 1880 and 3253 in 1910 and according to Ho (1968 tab A11) 3123 in 1905. The first available enumeration of population of Outer Mongolia, in 1918, returned a total of 648K.

included Manchuria, Tibet, Inner Mongolia and Taiwan and the European concessions, but not (Outer) Mongolia, Macau and Hong Kong. We estimate separately the population of these latter territories.

Duth East India (Indonesia)

The Dutch East Indies Company had got footholds in Java and in other islands since the 17th century and, after a short period of British rule (1811-1816), the Dutch government gradually extended its control to the archipelago in the 19th century. The Dutch tried to count the population of Java since the early 19th century and thus sources for the Javanese demographic history are quite rich, although not wholly reliable (Boomgaard and Goszens 1991). In contrast, the data for the the rest of the country ('outer islands') are partial and unreliable until the 20th century. Our series relies heavily on the unpublished estimates by Pierre van der Eng as part of his on-going research on Indonesian GDP within the Asian historical statistics project at the Hitotsubashi University. We extend his series to 1800 separately for Java and the 'Outer islands'.

There are several guesstimates of the population of Java for the late 18th and the British administration, under the governor Raffles, organized a 'census' as early as 1815 (Nitisastro 1970). Since 1823 the Dutch district administrators (residenten) had to include a figure for the population in their yearly reports on the conditions of their district. Table 3 report the total for some benchmark years, with corresponding reats of change, alongside with some recent estimates

Table 3
Population of Java, 1800-1870 (000)

	i)	Rate	ii)	iii)	iv)	v)	estimate
1800			3650			7500	9400
1815			4615	4520			11350
1820					9990		12100
1830	7200				10765		13700
1840	8480	1.64			11160		15500
1845	9380	2.02	9460				16500
1850	9450	0.15	9570	9450		14000	16700
1855	10730	2.54	10920				18000
1860	12720	3.40	12720	12510			19500
1865	13960	1.86	14170				21000
1870	16230	3.01	16450		16720		22700

Cols i) colonial reports AV (Boomgard-Goszens 1991) ii) Nitisastro 1970 tab. 1 and 11; col iii) Boomgard 1989; col iv) Maddison 1989; col v) 'best guess' Boomgard-Goszens 1991 p.82

Unfortunately, the Dutch statistics severely underestimated the population (Boomgard 1989, Boomgard and Gooszens 1991). The nomadic tribes escaped the enumeration and the data on settled population were systematically reduced by village chiefs for fear of taxation and forced consignments under the so-called Cultivation system. Indeed the total population in 1870 is about one third lower than the estimate by van der Eng (22.7 millions) [94]. Furthermore, the jumps in the rate of change (col ii) are not justified by known demographic events: for instance, the rate of growth increased sharply in the 1850s, in spite of cholera

The Western concessions totalled about 1 million people in 1913 and 2 in 1938(Statistical Yearbook League of Nations).

[94] The gap is shrinking with the improvement of statistics to 22% in 1840 and to 9% in 1905, to disappear with the 1930 census.

outbreak in 1852 (Pollitzer 1954). Boomgard and Gooszens (1991) reckon that population of the island grew at 1.25% yearly in the first half of the 19th century and at 1.55% in the second half. These rates seem a bit high, but could be justified by the still large endowment of virgin land in the island. On the other hand, there is no solid evidence for any alternative and thus we use these rates to extrapolate backwards to 1800 the van der Eng's 1870 figure (Tab.3, Col. 'estimate')

There are several guesstimates of the population of the 'Outer islands' in the 19th century, which imply widely different ratios to the population of Java [95]. The most recent of these contributions (Bosma 2015), after a detailed analysis of sources by islands, concludes that the total population almost stagnated in the first half of the 19th century (7.1 million in 1820 and 7.7 in 1852), for the joint effect of an 'inchoate and haphazard' policy of vaccination against smallpox, other epidemics and slave raids, and grew slowly to 9.1 in 1882. The official sources were even less reliable than for Java (Bosma 2015) until the 1920 census, which anyway Boomgard and Gooszens (1991) call 'a rehearsal for the 1930 census'. They deem this latter as fairly accurate, although the population of New Guinea was estimated rather than counted, and may have been underestimated by some hundred thousands. According to this census, the Outer Islands totaled about 19 million people and van der Eng adjusts this figure upwards to 19.6 million. His estimate of population for 1882, 11.1 million, is about 25% higher than the figure by Bosma (2015) for the same year. We compute our series for the 'Outer islands' from 1800 to 1870 by extrapolating backwards the estimate by van der Eng for 1870 (10 million) with the rates of change by Bosma (2015) -i.e 0.22% for 1820-1852 and 0.55% for 1852-1882.

After 1870, we reproduce the series by van der Eng, with one adjustment. The series grows at around 1% per year until 1920 and then an acceleration, with peak pre-war rates around 2%. The impact of the Spanish flu is quite modest, with about half a million excess death in 1918. This figure seems decidedly too low: Chandra (2013) estimate a total excess death as high as 4.3 million in Java only, but most scholars reckon that the tally was substantially lower, around 1.5-1.6 million for the whole country (Athukorala and Athukorala 2020, Barro 2020). We revise the series by estimating population in 1917 with 1.6 (rather than 0.5) million excess deaths in 1918, and spreading the difference in the years from 1910 to 1917 [96]

East Timor

The island was a Portuguese colony. Since 1882, we use an estimate by van der Eng (personal communication), which we extrapolate to 1800 with the series for 'Outer islands' of Dutch east indies.

French India

The French sources reports figures on French India as early as 1842, first (until 1881) in the Tableau colonial and then, with some gaps, in the Statistical Yearbook France. They do not specify the procedures of collection of the 19th century data, while the 20th ones, from 1906 onwards, are obtained as part of the colonial 'censuses'. We interpolate linearly between the available benchmarks for 1842-1938, adjusting for the impact of the Spanish flu and we extrapolate backwards the resulting series to 1800 with the series for British India [97]

[95] The population in 1800 was 6.4 million (vs. 5 in Java) according to Reid (1987 Table 2) and 8.3 (vs. 5 to 10 in Java) according to Hugo (1987) and in 1820 5 million vs. 10 in Java according to Marks and Van Zanden (2012 p.113). Maddison (1989) hypothesizes a slow growth from 6.3 million in 1820 (vs. 9.9 in Java) to 7 in 1840 (11.1) and then an acceleration to 9.5 (16. 7) in 1870. Finally, Nitisastro (1970) collects hugely different figures (10.5 million in 1850, 5 in 1855, 3 in 1860 and 1865 and 4.2 in 1870) and concludes that they are 'insufficiently reliable to be of any use' (p.60)

[96] This correction implies a modest increase in the yearly rate of growth of the population from 1.048% in the original estimate to 1.18%.

[97] We assume the rate(s) of growth to have been 0.3% until 1917 (as in 1901-1911) and 0.5% in 1919-21 as in 1921-1926. This corresponds to an excess death of 25K – i.e. 8.7% of the 1917 population.

French Indochina

The official sources are quite poor. The French administration started to count the population of Cochinchina (South Vietnam) since the 1870s and reported data in the Statistical Yearbook France at irregular intervals, while for the rest of Vietnam (Annam and Tokin), Laos and Cambodia. Unfortunately, the results were not good: the original data, collected by village headmen, were clearly undervalued and the administrators adjusted them upwards according to their own assessment (French Indochina 1945, Zelinsky 1950). The published data show some dubious movements (e.g. the rate for Laos is negative in 1906-1911, jumps to 2.6% in 1911-1921 and falls to 0.8% in 1921-1926) and an unrealistically fast population growth between the 1936 'census' and 1950, in spite of the war and the 1944-1945 famine in Vietnam [98]. J.P. Bassino (personal communication) has produced an alternative series of Vietnamese population from 1800 onwards, which shows a fairly steady growth until World War Two[99]. We use this series also to estimate the population of Cambodia and Laos. First, we compute the population in 1938 by assuming a steady growth at 0.8% per year from 1938 to 1950 (as much as hypothesized for Vietnam in non-famine years) and then we extrapolate backwards to 1800 with the Vietnamese series.

Hong-Kong

The British settled in Hong Kong in 1841 and took 'censuses' in 1850 and from 1861 onwards at ten year intervals. We assume a token constant population of 1K until 1840 and we estimate the population from 1841 to 1850 by extrapolating the rate of growth from 1850 to 1861 International historical statistics Asia tab A.1) We interpolate linearly the data from British censuses from 1850 to 1921 and since 1924, we reproduce the series of the League of Nations.

India

Before World War Two, the Indian Subcontinent was divided between British India, including Burma, the native Indian states, French India (Pundicherry and four minor cities), Portuguese India (Goa and two minor cities) and the archipelago of Maldives, a British protectorate since 1887.The native rulers in India and Burma had enumerated their subjects for fiscal purposes and the number of people was among the information that the East India company tried to collect during its rule of Bengal in the first half of the 19th century (Burney 1842, Ghosh et al 1999, Guha 2003). After the Mutiny, the British administration extended the enquiries to other areas of the subcontinent and took the first 'census' of all British India in 1869-1872 (Indian Census 1871). Since then, 'censuses' were held every ten years, extending progressively the geographical coverage to cover the native states, up to a full one since 1931[100]. For instance, the 1871 and 1881 'censuses' were limited to Lower Burma, the 1891 covered also (part of) Upper Burma and the 1911 and 1921 ones still omitted some districts (Richell 2006 table 1.1).

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[98] The population allegedly grew from 3046K to 4433K in Cambodia (3.6% per year), from 1012K to 1682K in Laos (2.7%) and from 18972K to 24810K in Vietnam (1.9%).

[99] The Vietnamese population grew from 24714K in 1938 to 25348K in 1950, but it declined by 771K from 1943 to 1945. With a 0.8% yearly growth (vs 1.2% in 1928-1938), this implies 1.2 million excess deaths, consistently with the current estimates of the death toll from the famine (Huff 2019). In contrast, the Bassino series shows no effect of the Spanish flu, but it is impossible to correct because there are no data on losses in Vietnam in the standard sources. The population in 1800 comes out very similar to estimates by Reid (1987 tab 2) - 7.2 million instead of 7 million inhabitants.

[100] We get the data of population of the Maldives from Mitchell (?) but the source is unclear. The dates (1911, 1921, 1931) coincide with the Indian censuses, but the Report does not quote them, unlike other islands, among the covered areas outside the Indian peninsula (Census 1921), and the Statistical Abstract colonies does not quote them either among colonies or protectorates.

British India and native states

The literature on Indian censuses focuses on the classification by caste, paying very little or with no attention to the reliability of total figures (cf. e.g. Peabody 2001 Gottschalk 2012 pp.183-222) . Even the results of the 1869-72 'census' are considered reliable enough and this a fortiori holds true for later ones. The only issue was the changes in area coverage: in a pioneering work, Davis (1968 tab 7) addressed it by estimating the population of missing native states assuming it to have changed as much as in the neighboring enumerated areas. Later Malahanobis and Bhattycharia (1976) extrapolated the 1871 figure from British India to 1801. They used the available data by areas and filled the (large) gaps by assuming that population grew as much as in the 1880s or 1890s, with adjustments for demographic crises. Finally, in his estimate of Indian national accounts Sivasubramonian (2000 p.12) has estimated a new annual series of population of British India, changing slightly the Davis figures for census years and adjusting yearly changes.

We interpolate linearly the estimates by Malahanobis and Bhattycharia (1976) for 1800-1871 and Davis (1951) for 1871-1900, and we reproduce the Sivasubramonian series from 1900 onwards. By their nature, the linear interpolations cannot capture precisely the impact of the famines, which plagued India in the second half of the 19th century. However, the fluctuations in intercensal rates of change are consistent with the timing of major famines, and thus, given the uncertainty of the number of deaths, unlike for China, we prefer not to correct the series [101]. In contrast, we adjust the series for the effects of the Spanish flu They do not show up in the Sivasubramonian series, which grows very slowly from 1911 to 1921. The 1921 Census (Indian Census 1921 p.13) put forward a total of 8.5 million registered deaths, as a 'substantial underestimate', and indeed Davis (1951 App B) estimated a total of 18.5-20 million by comparing actual to projected population rise between 1911 and 1921. More recent research reduces the number of death to 16.7-18.5 (Athukorala and Athukorala 2020), 16 (Barro 2020), 14 (Murray et al 2002, Chandra et al 2012) or even to 6.2 million (Spreeunwenberg et al 2018). We adopt a conservative hypothesis of 10 million excess deaths (8.5 in 1918 and 1.5 in 1919) and we assume a natural increase in population at 0.45% per year, a bit slwer than in 1901-1911 (0.55%) for the effects of war.

Burma

Davis has estimated a series of population of Burma (1968: 235-236) by extrapolating backward the 1931 all country total first to 1901 with the available district-level data and then to 1871 assuming a steady 1% growth rate. We report his results in Table 4, col.a), alongside with estimates by Richell (2006) in col. b) and by van der Eng (personal communication), for Lower Burma (col. c), Upper Burma (col.d) and the whole country (col.e).

Table 4
Population of Burma at 1913 (thousands)

	a)	b)	c)	d)	e)
1783		4200			
1802					4380
1812					3635
1826		4000			4712
1830					4000
1852			1440		

[101] Our series grows at 0.90% per year in the 1840s, 0.50% in the 1850s, 0.44% in the 1860s (the decade of the Orissa famine in 1865, with up to 5 million deaths, and of the Rajputana famine in 1869, causing ca 1.5 million deaths), 0.08% in the 1870s (the Southern India famine 1878-1879 claiming between 6 and 10 million lives), 0.91% in the 1880s and 0.11% in the 1890s (the 1896-1897 and 1899-1900 famines in causing respectively up to 10 and 15 million deaths). Cf. for a detailed list of famines (without figures on losses) India Census 1951, for the 1878-79 famine in the South Lardinois 1985 and for famines in the Bombay presidency McAlpine 1983 Chap 2.

1855					5061
1861			1898		
1871	8007		2642*		
1881	9129				
1891	9778		4659		
1901	10866	10491		5047&	
1911	12288	12115	6212	5903	12115
1921	13295	13212	6862	6350	13212
1931	14667	14648	7786	6882	14667
1941	16824	16824	8918	7906	16824

* benchmarks 1869 2425, 1870 2500 and 1872; & 1900

The available data on population in the first decades of the 19th century are very uncertain. The enumerations for 'proper Burma' (i.e. Lower Burma) returned an almost identical population in 1783 and 1826 (respectively 2279K and 2330K) and Burney guesstimates the whole population of the kingdom to have been likewise stable (4209K in 1783 and 4230K in 1826). We thus assume population of Burma to have remained constant at 4.2 million from 1800 to 1830 [102]. We accept the estimate by van der Eng for 1855 and we interpolate linearly to 1901, the first 'census' based estimate by Davis (1968). After 1901, we interpolate linearly between the estimates by Davis (1968). We correct for Spanish flu assuming a total loss of 450K in 1918-1919 (a 3.5% of the population, as in British India) and an underlying rate of growth of 1.3%, slightly higher than in the previous decade.

Iraq

See Ottoman Empire

Japan

Japan had counted population since 86 BC and, after a long pause, resumed this tradition in 1721 (Historical Statistics Japan 1987 vol I pp. 46-49). It took 'censuses' at six year intervals until 1804, and then in 1834, 1846 and 1852. These enumerations did not cover the Hokkaido island and omitted samurai, beggars and vagrants -possibly 10-15% of the population (Ishii 1937 pp.12-13, Taeuber 1958) or even 20% (Bassino et al 2019). After the Meiji restoration, the population was counted again in 1872, without exceptions, and the total was updated with registration of birth and deaths until the first modern census in 1920. These latter were repeated every five years and were coordinated with the population registers.

The Statistics Japan (1987 vol I tab.2.1) reports a continuous series from 1872 onwards, joining the register-based and the census-based ones in 1920. The difference in that year is very small (55473K vs 55963K -i.e. 0.8% higher according to the census), confirming the reliability of the population registers. We use this latter series to extrapolate backwards the 1920 population to 1871, and then the rates of change from the pre-Meiji enumerations to extrapolate the series to 1800 (Ishii 1937 tab II)[103].

[102] We do not use the estimates by van der Eng as they imply wide fluctuation in the rates of change, with a decline in 1802-1812 (-1.87% yearly) and almost identical rebound from 1812 to 1826 (+1.85%) and a collapse in the second half of the 1820s (-4.10% 1812-1826).

[103] The population grew only by about 10% from 1800 to 1870, with a decline in the 1830s because of the Tenpo famine in 1833-1837 (Bowman 1992).

Khiva and Bukhara (Uzbekistán)

See Russian Empire

Korea

Under the Yi dynasty, changes in population were recorded in registers, which covered only about a half of the population (Kwon 1975 p.1). After the conquest, in 1910, the Japanese extended the registration to the whole population, and took a first census in 1925, repeating it every five year to 1940. The censuses pinned down the level of population and thus from 1925 onwards we accept the official data as reported by Suh (1978 tab 13). In contrast, the population registers are clearly incomplete, as they would imply an implausibly high rate of population growth from 1910 to 1925. Suh (1978) reckons the real population to have been 12% higher than the registered one in 1910, but this correction seems still insufficient [104]. Kwon et al (1975) suggest a substantially greater correction, which yields a more plausible pattern of slowly accelerating growth of population after 1915.

For the period 1800-1910 we rely on the estimated by Kwon and Shih (1977) who extrapolate the 1910 figure to 1392 according to the population registers. After 1910, we interpolate linearly between the revised census data by Kwon et al (1975), with a correction for the Spanish flu[105].

Kuwait

See Ottoman Empire

Macau

International historical statistics (Asia tab A.1) reports population data, from Portuguese sources, in 1900, 1910, 1920,1927 and 1940. We assume that population grew steadily at 0.5% yearly in the 19th century and we interpolate between the available benchmarks afterwards.

Maldive

See India footnote 100

Mongolia

The new formally independent Mongolian government counted the population of the country in 1918, 1935 and 1944 (Spoorenberg (2015 Table 1). The enumerations show a sharp decline in the growth rate, from 0.78% to 0.3%, which were caused by the massive purges in 1937-1939 (Spoorenberg 2015 fn 3). We assume population to have grown from 1800 to 1918 at 0.5% per year, as much as China in the peaceful periods (before 1851 and in 1880-1911). We interpolate linearly between 1918 and 1935 and we hypothesize that population grew from 738K in 1935 to 750 in 1937 and then declined to 740 the next year.

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[104] The original figures (13.1 million in 1910, 19 in 1925) imply a 2.5% yearly growth of population, which the correction by Suh to 14.6 millions (1978) cuts to 1.7%.

[105] We assume that the Spanish flu caused 140K deaths in 1918 and 45K in 1919 (Lim 2011 table 2) and that the natural rate of growth was 0.65% per year, vs 0.22% in 1910-1915 and 1.01% in 1920-1925.

Nepal

After some partial enumerations for limited areas, the Nepalese government took censuses in 1911, 1920, 1930 and 1941-42, for different practical aims, such as counting taxpayers, or slaves or potential recruits for the army (Census Nepal 2011 pp. 1-3, Pant 1983 tab 2.1). The 1911 census is deemed fairly reliable, but the results of the successive ones are questionable. They show a drop from 5639 in 1911 to 5574 in 1920, which can be explained by the joint effect of the recruitment of Gurkhas in the British Army during World War One and of the Spanish flu, but no recover in the 1920s. Indeed in 1930 the population was 'grossly undercounted because of the fear of compulsory recruitment in the army' (Census Nepal 2011 p.3). Population started to grow in the 1930s (1.15% per year) and the growth accelerated, somewhat implausibly from 1941 to 1952-1954 +2.45% yearly. Yet the 1952-1954 census, in spite of the technical help from the United Nations, still undercounted the population by a tenth (a total 8235K vs 8982K according to the United Nations).

Our estimate assumes the 1911 figure to be approximately true and extrapolates backward the 1950 United Nations figure with plausible rates of change, given the available information. We assume population to have increased steadily at 0.4% in the 19th century (roughly as much as India, but without the fluctuations determined by famines) and to have accelerated to 0.7% in 1900-1911 and to 0.9% in 1911-1915. We take into account the recruitment of soldiers by reducing the rate of growth in 1915-1919 to 0.3%, with a further fall by 200K in 1918-1919 for the Spanish flu (about 3.5% of the population, as in India). Then we assume the rate of growth to have been 1% from 1920 to 1938 and 1.15% from 1938 to 1950.

North Yemen

See Otoman Empire

Oman
See Ottoman Empire

Ottoman Empire

The empire and its boundary changes

At the beginning of the 19th century, the Ottoman empire formally owned the whole North Africa except Morocco, the Balkans, Crete, Cyprus and the Aegean islands, the Middle East and the Arabian peninsula. However, Egypt, Montenegro and a substantial part of the Arabian peninsula, Bahrein, Kuwait, Oman, Qatar and the so called Trucial States (present day United Arab emirates) were de facto independent, and the Ottoman control on Yemen was very tenuous, in spite of repeated military campaigns. In the next century, the Empire lost almost all its territories in Africa and in the Balkans. The British conquered the bay of Aden in 1839, France seized Algeria in 1830 and Tunisia in 1881 and Italy occupied Tripolitania and Cyrenaica (renaming them Lybia) in 1912. Serbia remained independent (de facto) after a first uprising, from 1804 to 1813, and again since 1817, and the Empire recognized the status quo in 1830. Greece started her war of independence in 1821 and won it definitely in 1830. The principalties of Moldavia and Valacchia had gained a very large autonomy under the Russian protectorate until 1810, became de facto independent in 1859 and gained full international recognition, as Kingdom of Romania, in 1879. The Berlin treaty (1878) sanctioned the independence of Bulgaria and the transfer of Bosnia-Herzegovina to the Habsburg empire (first as a protectorate and then as a province in 1908). The Empire retained Albania, part of Macedonia, the area around Salonika, Thessaly and part of Thrace. It lost Thessaly to Greece in 1881, and all the rest, except the vilayet of Edirne, at the end of the first Balkan war in 1912. The Ottoman districts (vilayet) of Kosova, Iskodra and Manastir were divided between Serbia, Montenegro and the independent Albania, Selanik and Yanya was annexed to Greece, and part of Thrace (from the Edirne vilayet) to Bulgaria. Losses in other areas were comparatively small: the United Kingdom conquered Aden (by then a small village) in 1840 and Cyprus in 1879, and Italy the Dodecanese, a group of twelve islands, the major being Rhodes, in 1912. Crete was a semi-independent state, under international protection, from 1897 to 1913, and was annexed to Greece in 1913. The Empire collapsed in 1918 at the end of World War One. The Anatolian peninsula was renamed Turkey, the Middle East was divided between France (Syria and Lebanon) and the United Kingdom (Palestine and Iraq), formally under mandate of the League of Nations, while former territories in the Arabian peninsula were divided among several tribal polities which were later unified in Yemen and Saudi Arabia.

We estimate separately the population of all these territories and we present our estimates roughly according to the strength and duration of Ottoman rule. In this Section we deal with Turkey, Middle East, the Arabian peninsula (including quasi-independent polities) and with the territories left to the empire after the treaty of Berlin and the Balkan wars (under the generic name of Post 1878 European territories). In contrast, we describe the series for all the European and North African polities, Aden and Aegean islands (Cyprus, Crete and the Dodecanese) in separate entries and we include Bosnia in the estimate for Austria-Hungary from 1878 to 1918 and in the series for Yugoslavia thereafter [106]. This approach makes it possible to compute series of the population of the Ottoman empire before 1918 at current borders, further distinguishing between its European and Asian parts.

General remarks on sources

The Ottoman Empire never took a modern proper, Western style, census for all its territories (Shaw 1978, Karpat 1985, McCarthy 1993 Appendix 2 and McCarthy 2002). It tried to count its (male) population several times for military purposes since 1831 (Issawi 1980 pp. 19-22, Thorvaldsen 2018). Since the 1870s, it kept a register of population, first for males only and then for all the population, in its European territories, in Anatolia and in the coastal provinces of the Middle East, but not in present-day Iraq, in the Arabian peninsula and in Tripolitania and Cirenaica. Some of these data have been published, by provincial authorities in their yearbooks (or salnam) and, less frequently, by the central government and additional data have been found in archives. Karpat (1985 Tabs I.2 and I.6) quotes three estimates of population of the empire by Ubicini, possibly relying on data from a now lost enumeration, for the mid 1840s, by Salaheddin Bey in the mid 1860s and by Ritter zu Heller von Samo (the Austrian military attaché), in 1872 for European territories and 1874 for the Asian territories[107]. They cover different areas in the empire with quite a few differences in denomination and possibly in boundaries, especially for the Asian part of the empire [108]. Thus we will use them only for specific areas.

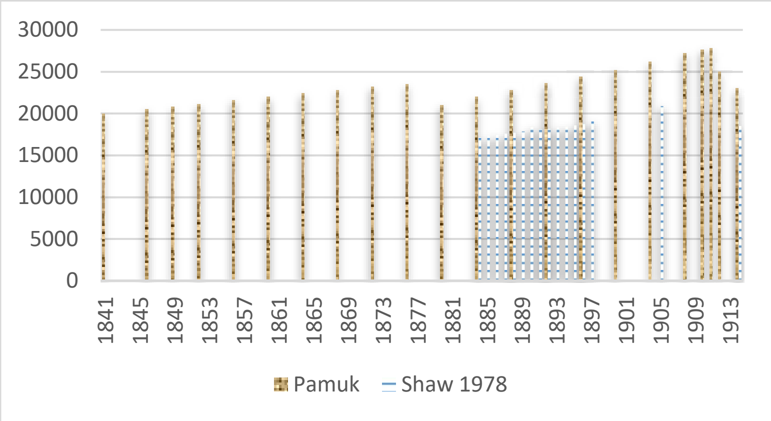
The reliability of the Ottoman enumeration improved since the 1880s, but they still tended to undercount females and children, and there are doubts about the reference year of some figures. Indeed, as figure 3 shows, even in those years the population of the Empire according to the enumerations (Shaw 1978 tab 2) is decidedly lower than the best guess by Sevket Pamuk (personal communication, Oct 2013).

[106] We treat Montenegro as an independent country since 1800. Our approach implies that the Aegean islands other than the Dodecanese are included in the Greek or Ottoman/Turkish statistics. This assumption is confirmed for the Greek islands by the Statistical Yearbook Greece 1930 p.27.

[107] Karpat (1985 pp.25-26) assesses quite favourably the work by Ritter zu Heller von Samo (‘some of the best of its kind, not only for its critical handling of the data in the *salmans* and other sources but also for its broad understanding of the Ottoman administration and peoples’) while he finds the figures by Salaheddin Bey for Europe ‘somewhat inflated’. He also points out that these data (or some of them) have been widely reproduced in Western sources.

[108] Ubicini refers to ‘Middle East’ (4450K), Salaheddin to ‘Syria and Iraq’ (2750K) and Ritter zu Heller von Samo to ‘Syria and Halep’ (1512)

Figure 3
Population of the Ottoman empire, 1840-1918



After independence, all new Balkan states (Serbia, Greece etc.) set up their own central statistical offices, took 'reasonably reliable' regular censuses (Palairet 1997: 14) and, in some cases, kept registers of yearly movement of population. Sources are fairly abundant also for Turkey after 1918 and for Palestine under the British mandate, scarce and sometimes contradictory for Iraq, Lebanon and Syria and not existent for the Arabic peninsula, except Aden.

<u>Anatolia (Turkey)</u>

Pamuk (2018 tab.2.4) estimates population of Anatolia at twenty-year intervals from 1820 onwards, which coincide quite well with the last figures in the long-run reconstruction of movements in population by Basihos (2018)[109]. Following this latter, we assume population to have been stable from 1785 to 1820, and then we interpolate linearly between Pamuk's estimates[110]. On the eve of World War One, the region had 16.5 million inhabitants, but population declined sharply in the following ten years, for the combined effect of World War One and Armenian genocide, the Spanish flu, the Greek-Turkish war and the exchange of population after the Treaty of Lausanne. The first post-war census by the Republic of Turkey, in 1927, returned a total population of 13560K people (Gormez and Yigit 2014 tab. TR6E), which unlike the following one, in 1935 (Pallis 1938 p.441), is believed to be undercounted n. The estimates of the gap range from 1.4% (Shorter 1985) to 5% by McCarthy (1983 p. 150-153), while Pamuk's figure for 1927 (2018 tab. 2.4) implies a mid-range undervaluation by 2.5%. We assume that in the four peaceful years from 1923 to 1927 population grew at 2%, slightly faster than in the next intercensal period. This yields a total of 12840K people in 1913 – i.e. 3700K lower than in 1914. McCarthy (1995) suggest a total of 500K war casualties and 300K losses among the Muslim civilian

[109] Basihos (2018) is quite economical about details of her estimation but dates (1831, 1874,, 1881-1884 and 1897) suggest they are based on Ottoman sources. The two series overlap only in 1820 (9400K Pamuk, 9325K Basihos, a difference of 0.8%), while in other years the interpolations of Basihos' estimates are slightly higher - by 2.9% in 1840, 6.2% in 1860, 0.8% in 1880 and 1.8% in 1900.

[110] We add the benchmark for 1910 (16430K) from Basihos (2018) linearly interpolating from Pamuk's estimate for 1900 (14800K). We then extrapolate the growth rate (1%) to get a population of 16750K in 1912, on the eve of Balkan wars. The loss of (part of) the Edirne vilayet caused population to shrink to 16350 in the following year.

population from 1914 to 1918, and we conservatively hypothesize 1000K million deaths among Armenians in the first phase of the genocide in 1915-1916[111]. Our very tentative computation implies a further decline by about 2400 K from 1918 to 1923. We extrapolate linearly from 1927 (revised) to 1935 and then we extend the series to 1938 following Gormez and Yigit (2014 tab. TR6E).

Arabian peninsula

Unfortunately, neither the empire nor any of the quasi-independent states succeeded to count the population of the Arabian peninsula. [112]. Ubicini and Ritter von Helle zu Samo estimated population of Hejaz, the North-Western part of the peninsula, with the holy cities of Medina and Mecca, to have been 900 K in the mid-1840s and 1130 in 1872-1874 (Karpat 1985 tab I.2 and I.6). Pamuk (personal communication) puts forward very tentatively estimates for 'Ottoman Territories in Arabia and Yemen', which imply a steady growth at 0.3% per year, up to 3800K in 1914. The United Nations report a total population of 8.6 million in the whole peninsula in 1950 – 4661 in Yemen (including Aden), 3121 in Saudi Arabia, and the rest in the other polities. Pamuk's estimate implies a 2% growth rate of the population since 1914 – as fast as in the 1950s[113]. We deem this rate implausibly high, also because there is no historical evidence for a major discontinuity in population trends. We extrapolate backwards the 1950 UN figures for all polities in the peninsula (except Aden) by hypothesizing that their population grew by 0.3% yearly from 1800 to 1870, 0.6% from 1870 to 1914 and by 1.3% yearly from 1914 onwards.

Iraq (1919-1938)

The available information on population of Iraq is scarce and contradictory, as Table 6 shows

Table 6
Sources on population of Iraq

Year	Pop (000)	Rate	Source	Year	Pop (000)	Rate	Source
1820	1100		Pamuk				
1860	1500	0.78	Pamuk	1872	2200		Karpat 1985 I.6*
1880	1700	1.25	Pamuk				
1905	2250		Hasan 1958	1908	3429	1.17	McCarthy 2002 pp.220-223
1914	2200	0.76	Pamuk	1914	3650	1.04	McCarthy 2002 pp.220-223
1919	2848	5.16	Hasan 1958				
1935	3605	1.47	Hasan 1958				
1950	5719	3.08	UN		5719	1.25	UN

* estimate by Ritter von Heller zu Samo

[111] We assume that Muslim losses were equally distributed in the four years and we factor in a natural increase of population at 0.3% per year, half the pre-war rate.
[112] The first ever census in the region was taken in Bahrein in 1941. The only historical source with some extremely crude data seems to be a British military handbook (Admiralty War Staff 1916). It reports guesstimates of population for most coastal states, the Hejaz and Asir, for a total of about 4 million plus scattered information on the size and the military strength of Beduin tribes. McEvedy-Jones (1978 p.168) quote it to support their figure of 5 million in 1800 and 6 million in 1900 for the whole area, which is then quoted by Maddison (2001). The Statistical Yearbook League of Nations reports population for Bahrain 100K 1910, 104K 1913 and 120K (constant) 1925-1938, with no source. The population of Bahrain was 115K in 1950.
[113] The rate of growth would be lower if Pamuk's figure exclude the tribal areas outside the Ottoman control.

The estimates are arranged on two columns because they imply substantially different size of the population, even if rates of growth do not differ that much. Neither column is really convincing. The right-hand one, from Ottoman sources, features ultimately only two observations [114]. The left-hand column is more complete and the level is consistent with the data by the Statistical Yearbook League of Nations (for the 1930s) and by Maddison, who relies on McEvedy-Jones (1978 p. 149-151). Unfortunately, it is not consistent with the UN post-war data: a population of 2200 in 1914 implies a growth rate of 2.65% per year to 1950, well above the 1950s rate. Thus, we obtain our series by interpolating linearly between the three benchmarks for 1872, 1908 and 1914. The rate of growth in those years is slightly lower than in neighboring Syria and Lebanon so we adopt the same assumptions for the first decades of the century (0.3% growth rate 1800 to 1850 and 0.6% from 1850 to 1872). We extrapolate the 1914 population to 1938 assuming very slow growth in war years (0.01%) and 1.5% growth thereafter (as in Syria and Lebanon).

Palestine (1919-1938)

The sources on the demographic history of pre-war Palestine (present-day Israel, the West Bank and Jordan) are fairly rich for the standards of the region. Bachi (1974 p.32) supplies benchmark estimates for 1800, 1890 and 1914 and McCarthy (1990 tab 1.4D) figures for 1850 and 1860 and a yearly series from 1877-78 to 1914. We use this series as baseline and we extend it to 1800 interpolating between the benchmark estimates. The British counted the population of Palesine in 1922 and in 1931, and also set up a population register. However, the 1922 'census' was a 'rather summary and rudimentary one', largely based on statements by the village heads (Bachi 1974 p. 378) and the second still undercounted the beduin population. McCarthy (1990 tab 2.14 and 2.15) revises upwards the original data and estimates population in 1918 by extrapolating backwards the 1922 figure. We fill the gaps between 1914 and 1918 and 1918 and 1922 with linear interpolation [115].

Post Berlin European territories (1800-1912)

Table 7 reports the available data on population of areas left to the Empire after the Berlin conference and lost in 1912. The column total, by Pamuk (personal communication) refers to the whole area, while the others aggregate the Ottoman vilayet to correspond as much as possible to the successor states[116].

Table 7
Population of Ottoman Balkans 1879-1911

	Total	**By Ottoman vilayet**				
	Pamuk	Edirne	Selanik and Yanya	Kosovo, Iskodra, Manastir	Total	Source
1820	2200					
1860	2600					
1872-1874		1304	1947	1427	4678	Karpat 1985 tab I.6
1880	2900					
1885		967	1626	1648	4241	Palairet 1997 Tab I.4

[114] McCarthy (2002) estimates population in 1908 by summing up the results of enumerations for Mosul and Basra in that year and for Baghdad in 1898, suitably extrapolated. Then extrapolates to 1914 assuming growth rate 1.1% per year.
[115] This procedure yields an increase during the war years, from 717 to 748K, rather than a decrease, from 798K to 748K as posited by Mc Carthy (1990 Table 2.3). He does not explain the difference between his two estimates of pre-war population.
[116] McCarthy (2002) and Palairet (1997) corrected the original figures from Ottoman censuses (Karpat 1985). The row 1872-1874 is the estimate by Ritter zu Heller von Samo

1897		1131	1680	1730	4541	Palairet 1997 Tab I.4
1906		1496	1606	1840	4942	Palairet 1997 Tab I.4
1911	3600	1426	1909	2017	5352	McCarthy 2002 pp.118-125

The total population of the lost vilayets (Selanik, Yanya, Kosovo, Iskodra, Manastir and part of Edirne) according to McCarthy (last row) is broadly consistent with the estimates of gains in population at the end of Balkan wars according to the country-specific sources in the successor states[117]. The total, about 4.7 million, exceeds by about a million Pamuk's estimate, but the rates of change are similar. Pamuk' series implies an acceleration from 0.40% in 1820-1860 to 0.55% in 1860-1880 to 0.70% in 1880-1911, while according to Palairet and McCarthy between 1885 and 1911 the rates were 0.89% with and 0.70% without Edirne. Therefore, we use the rates suggested by Pamuk to extrapolate to 1800 the 1911 population of lost areas, adjusting upward the series before 1881 to account for the loss of Thessaly (population 300K) to Greece.

Syria and Lebanon (1919-1938)

McCarthy (2002 pp.182, 187 and 200) has produced separate series for the Ottoman vilayets of Beyrut and Suriye (1878-1913) and Halep (1880 to 1908, with substantial gaps) correcting the original sources for the underreporting of women and children. We produce series from 1878 to 1918 filling gaps with linear interpolation[118]. The population movements before 1878 are highly uncertain. McCarthy (2002 p.208) argues that population had remained stable around 2 million, with huge fluctuations because of epidemics, from the time of Ottoman conquest onwards. In contrast, Pamuk estimates the population of Greater Syria, including Palestine, to have grown slowly from 1820 to 1860 (0.37% yearly) and somewhat faster in the next three decades (0.7%). Without any information, even anecdotal, about the demographic trends in Syria and Lebanon in that period, we assume population to have grown slightly less than in Palestine – i.e. at 0.3% in the first half of the century and at 0.6% from 1850 to 1878 [119]. These figures yield a total population for Greater Syria of about 1896K in 1820 and 2205K in 1860.

The French counted the population of Syria and Lebanon, respectively in 1925, 1938 and 1942, and 1922, 1925, 1932 and 1942, but results were rather disappointing. The censuses of the 1920s,based on headcount by village chiefs, and the 1932 Lebanese census massively underestimated the population (Courbage and Fargues 1974, McCarthy 2002). The 1938 and 1942 censuses were more careful, although still somewhat plagued by underreporting. McCarthy (2002 pp. 220 and 223) has built series of population projecting backwards the 1938 census for Syria and his own estimate for Lebanon, with assumptions on births and deaths and on migrations. Both series refer to smaller areas than the Ottoman vilayets, and thus we use them to extrapolate the 1913 figure for Syria and Lebanon. The population comes out 5% lower in 1938 than in 1950: the implicit rate of growth (0.2%) seems a bit on the low side, but this is not compelling evidence for a downward revision of McCarthy's series

Persia (Iran)

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[117] Greece gained 2100K additional inhabitants, Serbia 860K, Montenegro and the newly independent Albania 950 – a total of 4200K people vs 3930K in the five lost vilayets. Bulgaria and Romania jointly increased their population by 580K – i.e. roughly as much as the difference in population of the Edirne vilayet between 1426 in 1911 (cf Tab.7) and 605 in 1914 (Karpat 1985 Table I.17B)..

[118] We extrapolate the missing series for Halep from 1909 to 1913 with the available one for Beyrut and Suriye and both series from 1913 and 1918 by assuming that the population grew at 1% (as in the previous decade) until 1917, up to 3258K. This implies that the 1917 famine killed about 100K people, a conservative estimate relative to the figures put forward by some Western observers (Antonius 1939 p.241)

[119] The population of Greater Syria comes out about a tenth lower than Pamuk's estimate in 1880 (2527K vs 2700) and consequently also in 1820 (1868 vs 2100) and 1860 (2173K vs 2500K), while it is almost identical in 1913 (3838K vs 3800K).

The data on population of Iran are extremely scarce. After several failed attempts, the first census was held only in 1956, and the consensus is that it undercounted population (Benham and Amani 1974).[120] For the 19th century, there are only estimates (Table 8).

Table 8
Estimates of population of Iran, 1800-1914, 000K

1800			**6000 a**	**Pinkerton**
1812	5000 a	Belmont		
1838	6000 a	Belmont		
1858	5000 a	Belmont		
1868			4400 a	Thomson
1884			7654 a	Houtum-Schneider
1888			6000 a	Zolotarev
1891			9000 a b	Curzon
1894	7500 a	Belmont		
1903			6000 b	Chirol
1910	8000 a	Belmont	10000 a	Medvedev
1912			12000 b	Shuster
1914			10000 b	Neligan

Sources a Issawi 1971 pp.26-33: b Bharier 1972 Figure 1

Bharier (1968) and Amani (1972) have extrapolated backwards the 1956 census, respectively to 1900 (9860K) and, for benchmark years only, to 1880 (10302). They agree on growth to have been quite fast from 1926 onwards (1.4% in the next decade and 1.8% over the whole period to 1956), while they disagree on previous trends. Amani (1972) suggests a very slow growth (around 0.2% per year), with a very sharp discontinuity in the mid-1920s. In contrast, according Bharier (1968) in the first quarter of the 20th century, Iranian population grew at 0.6-07% per year and thus the discontinuity around 1926 was less steep. These years coincided with a change of dynasty (from the Qajar to the Pahlavi) and the start of a modernization program, but it is doubtful that this latter had such a big effect on population, a seven-times increase. Thus, we use the series by Bharier to extrapolate backward the 1950 population according to the United Nations to 1900. Our result (9630K) is consistent with the least uncertain figure from Table 1, Curzon's estimate for 1891, with a plausible rate of growth of 0.75% per year. The available estimates for earlier period imply sharp changes in trends, which are not supported by enough evidence, in spite of the hints to frequent epidemics and to a major famine in 1871-1872, which claimed half million lives (Issawi 1971 p.23). Thus, we simply extrapolate backwards Curzon's figure to 1800 by assuming a linear growth at 0.45% from 1872 to 1891 and at 0.2% from 1800 to 1871, adding 500K to the figure for 1872.

Philippines

The population of Philippines was counted three times by the Spanish administration, in 1877, 1887 and 1897 and three times by the American one in 1903, 1919 and 1939 (Conception 1977). The 1897 census, held during the rebellion to Spanish rule, is clearly incomplete, while Perez Serrano (1998) deems the 1877 and especially 1887 ones. In contrast, Van der Eng (personal communication) argues they are undervalued, while he endorses the American ones[121]. His series shows a very high growth rate since the beginning of the

[120] The census returned a total of 18.95 million people, which is adjusted upwards to 19.3 by Amani (1972), to 19.9 in the UN data-base (with 17.4 million in 1950) and to 20.4 by Bharier (1968 Table 1).

[121] According to the censuses, the Philippine population totaled 7635K in 1903, 10314 in 1918 and 16000 in 1939 (Conception 1977), while the Historical statistics USA (2006) series Aa 99 report slightly different figures for decadal benchmarks (7189 in 1900, 8785 in 1910,10754 in 1920, 13255 in 1930 and 16338 in 1940).

19th century, which makes Philippine to stand out among poor countries but is confirmed by all other estimates.[122]

Portuguese India

The population of Portuguese India has been estimated for 1900, 1921, 1931 and 1940 by the Indian statistical office (Census India 2011).[123] We interpolate these benchmark figures, adjusting in the 1910s for the Spanish flu and we extrapolate backwards the resulting series to 1800 with the series for British India.[124]

Qatar

See Ottoman Empire.

Sarawak

As a protectorate, Sarawak was not included in the empire censuses until a first enumeration in 1939 for allocating food rations (Jones 1966). The Statistical yearbook 1914 put forward a tentative estimate of half a million people and the Statistical Yearbook League of Nations increases it to 600K in the interwar years. However, the 1939 enumeration yielded only 491K people, and Jones (1966) hints to a possible overestimation to get more food. Without any further information, we extrapolate backwards the 1939 figure to 1800 with the series for the neighbouring Sabah.

Siam (Thailand)

There are no official sources on population of Siam in the 19th century, as the data collected for the corvee statistics since the 13th century have been lost (Bunnang et al 2012). The estimates of foreign observers differed widely, from 3 (in 1839) to 10 million (in 1899), although most of them concentrate between 5 and 7 million (Skinner 1957 Table 3, Grabowsky 1996 tab 1). Skinner (1957 p. 69) has used them to put forward tentative estimates of population for benchmark years from 1825 to 1917. The kingdom of Siam took a first partial census in 1904, with data on 12 districts, and then regular ones in 1911, 1919, 1929 and 1937 (National Social and economic board 1974). These latter censuses are deemed broadly reliable, with a slight underestimation (Grabowsky 1996). The Thai national accounts (Manarungsan 1989 tab 1.1) endorse the Skinner figures for the 19th century, correct slightly the census figures and add some other benchmarks for

[122] According to van der Eng, population grew from 2654K 1800 to 6975K in 1887 and to 7635 in 1903 – a long term growth rate by 1.2%. Population according to the Spanish sources, as quoted by Perez Serrano (1998 tab 1) grew very fast (1.74% per year) from 1792 to 1850, somewhat slower from 1850 to 1887 (1.22%) and then accelerated again from 1887 to 1903 (1.51%), in spite of the likely losses during the revolt and the American-Philippino war. The clear slowdown of population growth in 1919-1920 corresponds to about 200K excess deaths, in line with the estimates of mortality of Spanish flu in the country (Murray et al 2006, Barro et al 2020).

[123] The Statistical Yearbook League of Nations provides data for 1910, 1913, 1921 and from 1925 onwards. The figures are consistently higher than the Indian estimates and the movements of the series are somewhat erratic. It increases from 537K in 1910 to 550K in 1913, then declines to 532K in 1921 (a plausible effect of the Spanish flu), jumps to 600K in 1925 and remains stable thereafter.

[124] We assume the rate(s) of growth to have been 0.25% until 1917 (as in 1901-1911) and 0.8% as in 1921-1936. This corresponds to an excess death of 35K – i.e. 6.7% of the 1917 population.

1922, 1927 and 1932. We interpolate between benchmarks and extrapolate the 1825 benchmark to 1800 with the rate of growth from 1825 to 1850 [125].

Syria and Lebanon

See Ottoman Empire.

United Arab Emirates

See Ottoman Empire.

EUROPE

Aegean Islands

Cyprus (1879-1938)

The information on population of Aegean Islands under the Ottoman domination is scarce and suspect of being politically biased. St John-Jones (1983 p.31) and Verropolou (1997 pp.25-27) have collected estimates of population Cyprus from different sources, including an Ottoman enumeration in 1841 but the first solid data were produced by the British in 1881, two year after their conquest. The British enumerated the population of Cyprus at ten years intervals from 1881 to 1931 and the League of Nations extends the series to 1938 with the informal estimates from Statistical Abstract colonies we interpolate linearly between the available figures [126]. The resulting series for Cyprus shows a very fast, and thus somewhat implausible, growth in some periods (the 1830s, the 1870s) but we have refrained from adjusting it without additional evidence.

Crete (1897-1913)

As for Cyprus, we rely on a collection of benchmark estimates since 1821 from Encyclopedia Britannica 1911, which include including Ottoman 'censuses' (in all likelihood salnams) for 1881 and 1902 [127]. The benchmark estimates are broadly consistent with the official data on the population of the island just after the annexation to Greece (Historical Statistic Greece 1930 p.24). They imply that population halved in the 1820s and stagnated in n the 1860s. These movements can be explained by the human losses during the failed rebellions against the Turks and by massive emigration to the mainland in the 1820s, but the collapse in the 1820s and early 1820s seems too large. We assume population to have grown at 0.5% per year from 1821 and we interpolate between benchmarks afterwards, adjusting upwards the 1836 figure[128]

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[125] We adjust the figures for 1918 and 1919 to take into account the 80K losses during the Spanish flu (Athurokala and Athurokala 2020 Tab. A-1).

[126] The series for Cyprus is based on benchmarks for 1801 (60K), 1815 (70K), 1829 (84K), 1841 (108K), 1873 (144K) and 1881 (186K)- dropping an estimate of 100K for 1821 which is a clear outlier.

[127] Cf. https://en.wikisource.org/wiki/1911_Encyclopædia_Britannica/Crete accessed Oct 12 2021

[128] The estimate refer to 1821 (260K), 1865 (210K), 1873 (210K), 1881 (279K) and 1900 (302K). We drop an estimate of to 130K in 1836, but we account for the demographic crisis by hypothesizing a minimum of 180K in 1831, at the beginning of the Egyptian rule of the island, which restored order.

Dodecanese (1912-1938)

There are no data for Dodecanese until the Italian censuses in 1931 and 1936 (Historical statistics Italy 1934 p.241 and 1939 p.361). Total population grew quite fast (from 131 to 141K – i.e. at 1.5%) mostly thanks to the rise in the number of Italians: the native population increased only from 117K to 121K (0.6%). Accordingly, we hypothesize that native population grew steadily at 0.5% and that movements in total population depended on the immigration [129]

Albania (1913-1938)

The available data on population of Albania after independence are somewhat dubious. The new state took censuses in 1923, 1927 and 1930 Rothenbacher (2012 tab. AL1) and the Italian official sources report estimates for 1937 and 1939 (Statistical Yearbook Italy 1939 p.367 and 1940 p. 109). Boldrini (1940) adds figures for 1876, 1890 and 1902, without quoting the source. These sources imply that population declined in the politically troubled early 20th century (825-830K in 1902, 817K in 1923), recovered somewhat in early 1920s (to 833 in 1927), jumped by a fifth in three years to 1003 in 1930 and then increased slowly until the war (to 1038 on Dec 31st, 1937). Boldrini (1940) deems the 1930 and 1937 censuses broadly reliable, while is very sceptical about the sudden jump in the late 1920s. Thus, we extrapolate backward the 1930 figure to 1920 with the same rate of growth of the 1930s (0.5% yearly) and we assume population to have been constant from 1913 to 1920[130]

.

Andorra

The League of Nations reports data for 1910, 1913, 1920 and 1924-1938 which imply a constant population. We assume that population remained constant also before 1910.[131]

Austria

See Austria-Hungary

Austria-Hungary (1800-1918) and successor states

The Habsburg empire was a pioneer in the collection of demographic data as it had started to compile 'charters of souls' since the mid 18th century (Kovacsics 1965, Helczmanovski 1979). The tradition continued in the early 19th century in its Austrian part, or Cisleithania, while it seems to have been disconnected in the Hungarian one, or Transleithania, because of the opposition of the ruling elite, from 1787 to 1857 (Helczmanovszki 1979 p.30) [132]. The first modern census was taken only in 1869 and was repeated every ten years until 1910 (Helczmanovszki 1979). The two parts of the empire differed also in registration of population vital statistics, which started in 1819 in Austria and in 1865 in Hungary (Rothenbacher 2002 pp.89 and 344). Bosnia-

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[129] We hypothesize that there were 4K non-natives in 1921 and that their number grew at 5% per year in the first period of Italian domination, to 6.2 in 1921, and we interpolate linearly from 1921 to 14K in 1931.

[130] Maddison computes his series, reproduced by Pisha et al (2014 p.370), assuming a linear increase at 0.5% from 1913 to 1940, while Rothenbacher (2012 tab AL4B) trusts the 1927 census, ignores the 1930 one and gets 2.2% growth rate in the 1930s, double the rate for other Balkan countries. The Statistical Yearbook League of Nations reproduces the official figures with some crude adjustments.

[131] The data for 1924 and 1925 are out of line and thus we reduce them to the long term average.

[132] Rothenbacher (2002 p.344) quotes enumerations also in 1801, 1806, 1821, 1826, 1831, 1841 and 1846 without any further information, and they seem not to have been used to produce the series of Hungarian population in the Statistical Yearbook Austria-Hungary (cf. the discussion in the 1841 issue)

Hercegovina was ruled by the Habsburg since 1878, first as protectorate and then, after 1909, as a territory, but it was never integrated in either part of the empire and censuses were taken at different years (Helczmanovski 1979 tab 1.3). Thus, we estimate separate series for Austria (Cisleithania), Hungary (Translethania) and Bosnia until 1918 and then for Austria, Hungary and Czechoslovakia in their post-1918 borders.

Austria (Cisleithania)

We estimate the population of Cisleithania in the first twenty years of the 19th century by interpolating the figures from the 1787 and 1818 censuses as reported by Helczmanovszki 1979 (Tab I.2) [133]. The Statistical yearbook Austria-Hungary provides a yearly series of population at beginning of the year from 1818 onwards. We fill the gaps in 1845 and 1849 with linear interpolation and we compute mid-year population as average of two consecutive years. From 1850 to 1913 we get the data from Rothenbacher (2002 Tab A4A) [134]. We extend the series to 1918 with the Rothenbacher (2002) series for Hungary.

Hungary (Transleithania)

The sources for Hungarian population are not as good as for Austria, especially in the first half of the 19th century. The Statistical Yearbook Austria-Hungary divides Transleithania in three areas, Siebenburg (Transylvania), Militargranze (Military Zone - the areas close to the Ottoman border) and Ungarn, the latter accounting for over three quarters of the population. The first two series show a reasonably steady increase, while the third exhibits a fall by over 1.5 million people in 1840-1841, as result of a rectification by the central statistical office[135]. The results of the first enumeration in 1857 are consistent with the rectified figures for the early 1840s and imply a long-run growth of population since 1786 at the yearly rate of 0.58% yearly, roughly as much as in Cisleithania in the same period. It seems plausible that the overall pattern was similar: consequently, we extrapolate the 1786 population of the whole Transleithania to 1818 assuming a 0.30% rate and then we interpolate linearly from 1818 to 1857. From 1857 to 1865, we retrieve the figures from the Statistic Yearbook Austria-Hungary, which are consistent with the results of the 1857 and 1869 censuses, and we close the gap to 1869 with linear interpolation. The series by Rothenbacher (2002 tab H4A) runs from 1870-1918 as for Austria, but they seems to omit Transylvania [136]. Thus, we compute the series of population implicit

[133] The empire boundaries in 1818 included Western Galicia and Dalmatia, which had been annexed in 1815, but Helczmanovski (1979 tab 6.1) reports separately only the population of Dalmatia. We omit it from the computation and we reduce the rate of growth from 0.32% to 0.3% to account for the upward bias from the inclusion of former Polish territories. All the series do not include Lombardy and Venetia.

[134] It is possible to compute an alternative implicit series of population as ratio of estimates of total and per-capita GDP from Schulze (2000 tab A1) from 1870 to 1913. The coefficient of correlation with the Rothenbacher (2002) series is as high as 0.999.

[135] As explained in Statistical Yearbook Austria-Hungary 1841, the series in previous years had been computed extrapolating the population rise from 1786 to 1787. This method yielded a total population of 12 million in 1840, which was reduced to 10.5 in 1841 (and following three years), quoting several independent estimates. According to later issues of the Yearbook, population of Ungarn was about 11 million in 1846-1848 and again 10.1 in 1850. Helczmanovski (1979 tab 1.3) reports the official estimates for 1818, 1828, 1838 and 1851 without comments.

[136] Helczmanovski (1979 tab 1.3) quotes a total population of 15509K for 1869 and 15738K for 1880K as obtained from a secondary source while Rothenbacher (2002 tab. H1) reports 13728K for 1880 (and no figure for 1869) as result of the census. Both authors agree on a population of 19254K at the next census, in 1890, but the Rothenbacher series (tab H4) reports a much lower figure (15262K). The share of the difference (2200K or 12.6%) coincides almost perfectly with percentage of population of Erdelyi/Kyralhagon area (the Hungarian name of Transylvania). Indeed, the coefficient of correlation with the Schulze (2000) series is 0.998.

in the reconstruction of national accounts by Schulze (2000 tab A2) which are identical to censuses. This series ends in 1913 and thus we extend it to 1918 with the series by Rothenbacher

Bosnia- Herzegovina

Table 9 reports the available figures on population of Bosnia under Ottoman rule. The two columns on the right report the sources, including Ottoman salnames (provincial yearbook, in Italic in the table used by Palairet (1997) and his best guess. The other columns reproduce the figures for Bosnia in the three general estimates of the population of the empire, and an estimate of population of the (smaller) area of the post 1879 Austrian protectorate based on salnames

Table 8
Population of Bosnia-Herzegovina, 1820-1879 (thousands)

	Palairet 1997		Ottoman	
	Sources	estimate	general	Salnam
1820		720		
1844			1100	
1851	*1058*	1110		916
1860	1150	1220		
1865		1250a	1100b	1279
1867			1100	
1870	*1242*	1260		1042d
1876	*1264*	1300	1242c	1054

a 1864 b 1867 c 1873 d1871

Sources: Palairet 1997 Tables 1,2, 1.3 and 1.9, Ottoman general Karpat 1985 Table 1.2, 2.6 and 1.6 salnams Tanovic et al 2014 Tab.1

The local figures of the last thirty years are broadly consistent, with the exception of the 1865 salname[137]. The estimate for 1820 is admittedly tentative, as it is based on a very partial tax source, and it implies a fast growth of the population in the following thirty years (1.4%). We thus discard it and we assume that population in the first half century grew at 1%. From 1851 to 1875 we interpolate between Palairet's estimates, which imply a sharp fall in the rate of growth of population from 1.15% in the 1850s to 0.4%. We extrapolate for the last four years of the Ottoman domination with the rate of change from 1870 to 1875.

Bosnia-Herzegovina was never included in imperial statistics (Rothenbacher 2002 p.91). in spite of the great reputation for thoroughness of Austrian bureaucracy, the results were 'quite incomplete and uncertain' (Tanovic et al 2014 p.242). Indeed, the successive census, in 1885, yielded a population 15% greater (1158K vs 1336K) – an implausibly high growth. Thus, we increase the 1879 population to 1250K and we linearly interpolate with results of 1885 and 1895 censuses (1336K and 1568) from Rothenbacher 2012 tab BOS1[138].

[137] The comparison between the original figures (Table 4, col. sources, in Italic) and the Pejanovic estimates (col salnam) shows that these latter are reduced by about 15%. This coefficient implies that the original 1865 salnam returned a total of 1522. Tanovic et al (2014) attributes the fall between 1865 and 1870 to the plague, but there is no similar decrease in the population of Serbia.

[138] This figure implies that population of the areas transferred to Montenegro was about 70K. Helczmanovski (1979 tab 1.2) reports slightly different figures for the census years 1591K for 1895 and 1932K for 1910, while Palairet (1997

The same author provides a series from 1900 to 1915, which we extrapolate to 1918 with the series by Rothenbacher (2002) for Hungary.

Austrian Republic (1919-1938)

We use the series by Rothenbacher (2002 tab A4B), who interpolates and extrapolates the available censuses for 1923 and 1934.

Czechoslowakia (1919-1938)

We use the series by Rothenbacher (2002 tab CS4), who interpolates and extrapolates the available censuses for 1921 and 1930.

Hungary (1919-1938)

We use the series by Rothenbacher (2002 tab H4B), who interpolates and extrapolates the available censuses for 1920, 1930 and 1941.

Belgium

See Belgium and Luxembourg

Belgium and Luxembourg

The early political history of Belgium and Luxembourg was rather troubled. They constituted the Austrian Southern Netherlands province until 1794, were part of France until 1815 and were transferred to the Netherlands after the Congress of Wien. Belgium regained de facto independence with the 1830 revolution, but it was sanctioned only in the treaty of London 1839, jointly with independence of Luxembourg. Deprez (1979 Tab. 6.1) estimates the population of Belgium in its 1839 borders for 1786, 1815, 1829, 1846 and 1856 and we add the data for 1831, 1834, 1840 and 1850 from Statistical Yearbook Belgium (1871 p.38) [139]. We interpolate linearly and we extrapolate the 1815 figure to 1800 with the 1784-1815 rate (0.4%),We extract benchmark data for population of Luxemburg in 1831 and 1834 from Statistical Yearbook Belgium (1871 p.38) and in 1843, 1846, 1850 from Mitchell 2003. We interpolate linearly from 1831 to 1850 and we extrapolate to 1800 following trends in Belgium. After 1850, we reproduce the series by Rothenbacher (2002) for Belgium (tab B4) and Luxembourg (Tab L4).

Bulgaria (1879-1938)

The information on the population of the Kingdom of Bulgaria under the Ottoman rule is scarce but helpfully rather consistent[140]. Pamuk (personal communication Oct 2013) reckons population to have totaled 2 million

tab.1.9) adds different benchmarks (1186 for 1880, 1447 for 1890, 1671 for 1900). Using these data would change only marginally the series

[139] The population data in 1831 and 1834 refers to Belgium in extended borders, including grand duchy of Luxemburg (with the districts of Diekirch and Grevenmahcer) and the Eastern Limburg (Ruremonde and Maastricht) which was transferred to Netherlands with the treaty of London. Thus, we deduct the population of these areas a total of 377K in 1831 and 370 in 1834.

[140] If not otherwise specified, we refer to Bulgaria in her 1912 boundaries. It included (most of) the Ottoman Danube vilayet, which had become independent after the Berlin conference in 1878, and the Eastern Rumelia or Northern Thrace, which remained formally under Ottoman rule until 1885.

in 1820, 2.6 in 1860 and 2.75 in 1870, Palairet (1997 Tab. I.9) 2769K in 1870 and 2824K in 1880[141]. Independent Bulgaria had quite good demographic data, with regular censuses at five year intervals and a register of vital statistics since 1881 (Rothenbacker 2014 p.331). The first census in 1881 covered only Northern Bulgaria, while the population of Eastern Rumelia, which formally still belonged to the Ottoman Empire until 1885, was counted in December 1884 (Rothenbacker 2013 tab BG1). Dimitrova and Ivanov (2014 tab. BG 6_A) and Rothenbacher (2013 tab BG4A) provide two series of Bulgarian population from 1881 onwards, from Bulgarian statistical yearbooks. The two series are almost identical in the long run (a coefficient of correlation) but diverge somewhat in the initial year. They estimate the population of Bulgaria in her 1884 borders respectively as 2190K and 2880K: we prefer the Dimitrova and Ivanov estimate because it implies a lower rate of population growth in the early 1880s [142].

We assume a 0.5% rate of growth of population the first twenty years of the century, as in the non-Ottoman Balkan areas (Palairet 1997 p.19) and we interpolate the Pamuk figures between 1820 and 1870. We take into account the demographic shock of the war and of the emigration of Muslim after independence by assuming that total population grew at 0.8% per year from 2750K in 1870 to 2930K in 1878 and then remained constant at 2910 in the three following years [143]. Since 1881 we reproduce the series by Dimitrova-Ivanov, with an adjustment for the increase in population from territorial gains from the Balkan wars [144]

Crete (Aegean Islands)

See Aegean Island

Cyprus(Aegean Islands)

See Aegean Island

Czechoslowakia

See Austria-Hungary

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[141] The higher figures by Ubicini and Ritter von Heller zu Samo (Karpat 1985 tabs I.2 and I.6), respectively 3 millions in the 1840s and 3.3 millions in the 1870s refer to the whole Danube Vilayet. Part of it was annexed to Serbia.

[142] The difference in growth rates from 1881 to 1888, the date of the next Bulgarian censuses, is small for the whole country (1.37% according to Rothenbacher and 1.32% to Dimitrova-Ivanov) but substantial for Eastern Rumelia. The population of the area can be computed as the total estimated Bulgarian population in 1881 less the population of Northern Bulgaria according to the census. This yields a total of 879K according to Rothenbacher and 901 to Dimitrova-Ivanov – with growth rates respectively of 2.3% and 1.2%.

[143] A similar effect can be detected in the years 1884-1885, when Bulgaria annexed Eastern Rumelia: population remained constant according to Dimitrova-Ivanov and declined by 14K according to Rothenbacher. In both cases, the population loss relative to no-emigration counterfactual is equivalent to the natural increase of population – i.e. 90K in 1879-1880 and 35 in 1884. Thus, emigrants accounted for about 4% of the total population of the affected areas (all country in 1879-1880 and Eastern Rumelia in 1884) and for a higher proportion of Muslims (10-15%). McCarthy (1995 p.91) estimates a total Muslim migration of 568K - i.e. about a fifth of the whole Bulgarian population. This figure is clearly exaggerated. He compares the Muslim population in the whole Danube vilayet with the Muslim population in the (smaller) Bulgaria according to the second census 1887 and ignores the natural increase.

[144] The population increased, according to the series, from 4530K in 1913 to 4880K in 1914. The natural increase of population, assumed at 1.5% per year as in previous years, accounted for about 70K of this rise and thus the difference (280K) can be attributed to net territorial gains (the annexation of former Ottoman territories in the South being partially compensated by losses in the North to Romania). We add them to the figure for 1913.

Denmark

Denmark, as other Scandinavian countries, had exceptionally good demographic statistics: it started to collect the data from parish registrs in 1736, enumerated the population in 1769 and took a nominative census in 1787, repeating it in 1800 and then at regular intervals since 1834 (Rothenbacher 2002 p.178, Thorvaldsen 2018 pp.31-38). We get the 1800 figure from Denmark Statistical Yearbook 1913 Table 1 and a continuous series from 1815 onwards from Historical statistics Denmark (1985 Tab. 1.3). This series clearly excludes the Duchies of Schleswig-Holstein (lost to Germany in 1866) and in all likelihood also the population of Greenland and Faroer islands [145] We get series of population for these latter by interpolating linearly benchmark data on Faroer islands from the website of the Statistik Faroer (series IB08010 Population, historical figures https://hagstova.fo/fo accessed Feb 2022) and for Greenland from Statistic Yearbook Denmark 1913 tab I and the website of Statistk Greenland (series BEESAT http://stat.gl accessed February 3 2022).

Dodecanese Is.

See Aegean Is

Estonia (1919-1938)

Estonia became independent from Russia in 1919. It took censuses in 1922 and 1934 and had a registration of population changes. Somewhat strangely, the series from Rothenbacher (2013 tab. EST4A) ends in 1928 and thus for 1929-1938 we reproduce the (almost identical) data from the Statistical Yearbook League of Nations.

Finland

The Grand-Duchy of Finland was transferred from Sweden to Russia, as a personal property of the czar, in 1809, but the demographic statistics continued to follow the Swedish (and broadly Scandinavian) model, with regular censuses since the 18th century (Rothenbacher 2002 p.209). We get our data from Voutilainen et al 2020. They estimate a new series of the population before 1850 with an innovative use of parish registers, while afterwards they reproduce the official data (Statistical Yearbook Russia:1913 p.122, Hjerrpe 1996 Tab. 1)

France

The French population sources are among the best in Europe. The revolutionary government established a state-managed population register, enumerated population in 1791-1792 and took censuses at regular intervals since 1801 (Henry-Blayo 1975, Rothenbacher 2002 p.241, Thorvaldsen 2018 pp.45-48). The demographic data of the early 19th century are however incomplete or questionable. Henry and Blayo (1975 tab.14) have used the death rates data to estimate population of France at five year intervals from 1740 onwards at 1861 boundaries. The results diverge sizeably from the official series of population (Statistical Yearbook France 1951 pp.37*-39*) in 1800-1805 as they show a substantial stagnation rather than an increase

[145] The Duchies were formally an independent polity, ruled by the King of Denmark and were annexed to Prussia in 1864. The population was about one million people (Mitchell 2003 p.10), but the Danish series does not show any downward jump in that year. The population from Historical Statistics Denmark are very close to the figures for population of Denmark proper in Statistical yearbook Denmark 1913

[146]. We deem the latter more plausible, given the population losses from wars and emigrations (Henry and Blayo 1975 tab 21). From 1805 to 1860 the differences in five-years rates of change between the two sources are minimal – less than a fifth of a percentage point, without any pattern. Thus we estimate a series by combining the total population at benchmarks from Henry and Blayo (1975) and the yearly changes from the Statistical Yearbook France. From 1861 onwards, we reproduce the official series, with two minor adjustments, to include Alsace-Lorraine in 1869-1870 and the occupied territories in 1914-1918. We replace the 1869-1870 figures with data from Rothenbacher (2002 tab. F4), while we estimate the population in 1914-1918 inclusive of war losses [147].

Monaco

The League of Nations Yearbook provides data on population since 1913. We assume that population was 3K in 1860 and we interpolate linearly to 1913 and extrapolate to 1800 with trends of the Alps Maritimes

Germany/Zollverein

Germany was divided until 1871 in several states, which took separate censuses until 1834, when the need of population data to distribute the revenues from trade duties imposed a co-ordination among polities of the Zollverein (Rothenbacher 2002 pp.277-279). Similarly, several states collected vital statistics since the early 19th century and the empire extended them to all its territory after 1871. Thus, data are quite abundant and of good quality but the reconstruction of long-term movements is complicated by changes in boundaries. There are two main series, with different coverage. Pfister and Fertig (2020) have estimated population from 1730 to 1870 for an extended version of present-day Germany, with a population about a fifth lower than Imperial Germany. Hoffmann et al (1965 Tab 1) provide series for this latter in its 1871 boundaries, including Alsace-Lorraine, before 1913 and in the Versailles boundaries (plus Saarland) from 1922 to 1988[148]. Two other sources add information: Rothenbacher (2002 tab D.4) reproduces the Hoffmann series filling the gap during World War One but omits Saarland until 1935. Last but not least, Kolmann had estimated a series without Alsace-Lorraine from 1817 to 1870, with some gaps in the first fifteen years (Table A.01.1, https://histat.gesis.org/, accessed February 25, 2021). We use this latter, filling the gaps with a TRAMO interpolation, for the period 1817-1870 and we extrapolate backward from 1800 to 1817 with the Pfister-Fertig

[146] A direct comparison of population levels is not possible because the territorial coverage of official series in the first years in uncertain. They are officially at current borders, and indeed they show the effect of annexation of Nice and Savoy in 1861 and of the loss of Alsace Lorraine in 1870. The rise in 1801-1805 might in theory reflect the territorial expansion in Italy, but the series shows no decrease in 1815, when France returned to her 1791 boundaries. From 1800 to 1805, French population grew by 5.7% according to the Statistical Yearbook France and by 1.3% according to Henry and Blayo (1975).

[147] First, we estimate the movement of total population for the whole France by extrapolating the 1913 figure with yearly changes in the population (in non-occupied departments) from of the series by Rothenbacher (2002 tab F4). We assume zero change of population in 1914, hypothesizing that the natural increase was balanced by war deaths (ca 360K in that year). We do not include separately war losses (1375K over the whole war) even if Rothenbacher (2002 p.252 fn2) states that there are not included. Deducting them from the series would yield a population of 35643K in 1918, which seems to low relative to the 1919 one (38700). It would imply a 3.1% natural increase, net of the rise from the annexation of Alsace-Lorraine (4.36% of French population in 1921 according to Rothenbacher 2002 Table F2) and of the losses from the Spanish flu (ca 240K according to Athurokala and Athurokala 2020 tab A1). On the other hand, a similar computation with rates of change from the Statistical Yearbook France, even including the war losses, would yield a population of 37936 in 1918, which is clearly too high.

[148] The movements of these series are quite similar, when overlapping (1817-1870) – with coefficient of correlation 0.998 between Pfister-Fertig (2020) and Hoffmann (1965)

(2020) series. From 1871 onwards, we reproduce the series by Hoffmann et al (1965), integrating the missing data for 1914-1921 from Rothenbacher (2002 tab D4) with an adjustment for his omission of Saarland[149].

Gibraltar

We interpolate linearly between data for 1850 1861, 1869, 1871, 1881, 1891, 1901, 1911 from UK Imperial Territories and for 1923, 1929 and 1945 from League of Nations. We extrapolated backwards to 1800 assuming a rate of growth 0.8% yearly

Greece (1830-1938)

The not yet internationally recognized Greek government counted its population in 1828 (Statistical Yearbook Greece 1930 pp.23-24). The same source reports a retrospective estimate of population in 1821, at the beginning of the war, which was about a fifth higher (953K vs 753K). The difference reflects, and possibly overstates, the human losses during the independence war. Without any further evidence, we interpolate linearly between these two data. We extrapolate the 1821 figure backwards to 1800 assuming a 0.3% yearly rate of growth and we compute population in 1829, formally the last year of Ottoman rule, as the average between 1828 and 1830. Greece took its second 'census', as a fully independent country, in 1838 and continued to count population almost yearly. Since 1861, it took censuses at a more common ten-year intervals, and it held a population register from 1860 to 1884 and after 1925 (Rothenbacher 2002 p.312-313). The first issue of the Statistical yearbook Greece (1930 pp.23-24) published the results of the enumeration and 1828 and a continuous series since 1838, which features upwards shifts in 1864 (the annexation of Ionian Islands from Britain), 1881 (the annexation of Thessaly from the Ottoman empire), 1913 (the annexation of Salonika and Ioanina after the Balkan wars) and in 1920-1922 (the exchange of territories and population with Turkey after the treaties of Neuilly and Lausanne). This series has been copied, with small differences due to rounding (and larger ones in 1920-1922), by Lazaretou (2014 tab GR6G_A) since 1833 and by Rothenbacher (2002GR4A) since 1850. We fill the gap between the first Greek enumeration in 1828 and the first year of the Lazaretou series with a double extrapolation, which concur on 1830 as the historical trough of Greek population for emigration of Muslims [150] . From 1833 onwards we reproduce the original official series.

<u>Ionian islands (1800-1863)</u>

The islands were a British protectorate from 1799 to 1864, when they were ceded to Greece. Palairet has collected some estimates from Western sources and has organized them in a set of benchmarks from 1800 to 1860 (1997 tab 1.7 and 1.9). His last benchmark seems to be on the high side if compared with the increase in Greek population in 1864 (Statistical yearbook Greece 1930 pp.23-24)[151]. We thus compute our series by linearly interpolating Palairet's benchmarks to 1860 and reducing the result by 5%

[149] The population of Saargebiet was 590K in 1919 and 671 in 1925 (Statistical Yearbook Germany). We compute the ratios to the Rothenbacher series (0.95% and 1.1%), we interpolate linearly and we adjust upwards the series accordingly. The Rothenbacher series takes into account further boundary changes after the plebiscites of 1921

[150] The 1828 and 1838 censuses returned a very similar population – 753K in 1828 and 752 in 1838, while the series by Lazaretou (2014) starts at 720K in 1833 and rises at about 1.3% per year in the next four years. One can estimate the population at independence either extrapolating backwards this rate to 1830 or extrapolating forward the 1821-1828 rate of change (a 3.2% yearly decline). Reassuringly, both methods yield a population around 700K (respectively 693 and 702K), which imply a loss of about 250K during the wars.

[151] The two figures, 232K in 1860 according to Palairet (1997 tab 1.9) and 234K in 1864 according to the Greek Statistical yearbook (1930 p.24) are deceptively similar. In fact extrapolating the population of the islands and of the mainland respectively from 1860 and from 1863 with the 0.8% yearly rate of growth, as in 1853-1862, yields a total population of 239 for the islands and a natural increase of 10K for the mainland. This latter reduces the additional contribution of the islands to the population growth to 224K. The difference is slightly above 5% of the population of

Hungary

See Austria-Hungary

Iceland

As other Scandinavian countries, Iceland held regular censuses since the 18th century and kept regular population registers (Rothenbacher 2002 p. 375). The series is reproduced from Historical Statistics Ireland (tab. 2.2).

Ionian islands

See Greece

Ireland (Eire)

See United Kingdom

Italy

Italy had been divided since the fall of the Roman empire and it remained so until its unification in March 1861 [152]. All the pre-unification states enumerated their population and collected vital statistics, even if the quality of the data is sometimes questionable (Censimento 1861 pp.IV-IX). The new state took its first census on December 31 1861, extended the registration of population to the whole peninsula and continued to collect demographic statistics ever since at ten-year intervals ever since, with the exception of 1891 and 1941 censuses. The official data have been used by several authors, including, most recently Chilosi and Ciccarelli (2021) and Mariella (2020), to estimate Italian population before unification and by the Italian statistical office to produce a series since 1861 (ISTAT 1965 tab. 1.1) [153]. We use the data by Mariella (2021) for 1801, 1821, 1831, 1841 and 1851, which refer to Italy in her 1911 borders. It thus includes Veneto (annexed in 1866) and Rome (annexed in 1870) but not Nice and Savoy, which belonged to Piedmont until 1861, nor the so called 'terre irredente' (Trentino-Alto Adige, Friuli, Trieste and part of Dalmatia), which were Austrian until 1918. From 1821 to 1861 we assume a linear growth of population, but we deem this assumption implausible for the previous period. Both the Galloway (1994) series for Centre-North and the Fusco (2013) series for South show

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the island. Interestingly, the population of the islands declined (to 198K) in the following decade, possibly because of emigration towards the mainland.

[152] In 1859, at the beginning of the series of wars which ended with unification, the peninsula was divided in seven states, the Kingdom of Sardinia (including Piedmont and Liguria), the Duchies of Parma and Modena, the Granduchy of Tuscany, the Papal States and the Kingdom of Two Sicilies (Continental South and Sicily proper), plus the Lombardy and Venetia. These latter were for all practical purposes an Austrian province, but formally they were an independent Kingdom, belonging to the Austrian emperor. Their population is not included in our estimate of Austrian population.

[153] Cf. SVIMEZ (1961), Romani (1982), who collects the results from the Archivio Economico dell'Unificazione Italiana, a research group of the 1950s, and Fusco (2013), who collects data for the South, from a variety of different sources. Last but not least, Galloway (1994) has estimated a yearly series for Centre-North, with an inverse population method with data from parish registers, from 1650 to 1881.

rates of growth of population after the end of Napoleonic wars about double the war-time ones[154]. We thus assume population to have been growing at 0.5% in the peaceful years 1815 to 1821 and we interpolate linearly from 1801 to 1815 (from 18171 to 18397 at only 0.17 % yearly rise). We estimate the rise in population from 1861 to 1871 by extrapolating the 1861 data by Mariella, inclusive of Veneto and Latium, with the yearly growth from ISTAT (1965 tab 1.1) [155]. Last but not lease, from 1872 onwards, we compute a mid-year present population series at current borders by averaging two consecutive years [156].

Latvia (1919-1938)

Latvia became independent in 1919. It took censuses in 1920, 1925, 1930 1935 and had a registration of vital statistics. We reproduce the series by Rothenbacher (2013 tab. LR4A) from 1920 to 1925 and we extrapolate it to 1919 with the population change in Estonia and from 1926 to 1938 with Statistical Yearbook League of Nations. We prefer this latter series to Rothenbacher (2013 tab. LR4A) as it takes into account the yearly movement of population

Lithuania (1919-1938)

Lithuania became independent from Russia in 1919. It took one only census, in 1923, but it had a registration of population changes. Rothenbacher (2013 tab. LT4A) publishes a series from 1923 to 1938, which we extrapolate to 1919 with the series for Estonia.

Luxembourg

See Belgium- Luxembourg

Malta

We extract a series from Statistical Yearbook Malta from 1823 to 1938. We extrapolate backwards to 1800 assuming a yearly growth 0.7% (in 1823-1832 it was 0.9%) and we fill the gaps with linear interpolation

Monaco

See France

Montenegro

See Serbia/Yugoslavia

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[154] The rates were respectively 0.17% and 0.33% for Centre-North (overall 1801-1821 0.22%) and 0.14% and 0.43% for the South (overall 0.23%)

[155] The ISTAT series jumps by 12.5% in 1866 for the annexation of Veneto and by 4% in 1871 for the annexation of Rome. We assume a natural increase 0.7% in both years.

[156] The newly annexed territories of Trentino-Alto Adige and Friuli Venezia Giulia are included in the ISTAT (1965) series only since 1921. We correct the figure in 1919-1921 by increasing the population by 4.12% (the share of these territories according to the 1921 census).

Netherlands

Netherlands took censuses in 1795 and from 1830 onwards and started to collect data on vital statistics in 1804, although these were published consistently only since the 1870s (Rothenbacher 2002 p.500). Smits et al (2000 Tab A1) have produced population series for the country in its post 1839 borders (including the former Belgian territories of Eastern Limburg) as part of their reconstruction of Dutch national accounts from 1700 to 1913. These series when overlapping, are almost identical to the data by Rothenbacher (2002 tab NL.4), which we use to extend the Dutch series to 1938 [157].

Norway

Norway was a quasi-independent territory of the crown of Denmark until 1815 and of the crown of Sweden from 1815 to 1905. Thus, it shared the very good Scandinavian statistics, with the first enumeration of the population in 1769 (and then at regular intervals since 1801) and collection of vital statistics since the 18th century (Rothenbacher 2002 p. 529, Thorvaldsen 2018 pp.49-51, 111-117). We get the series from Historical Statistics Norway 1968 tab 20, computing the missing figure for 1800 as the average of 1799 and 1800.

Ottoman Balkans

See Ottoman Empire (Asia)

Poland

See Russia Empire

Portugal

Palma et al (2020) have estimated a series of population of mainland Portugal from 1530 to 1864 combining parish data and results of different population counts, including censuses in 1801, 1849 and 1864. After 1864, the Historical statistics Portugal reports yearly data for the whole territory of Portugal, including the islands of Madeira and the Azores. Thus, we adjust upwards the Palma et al series before 1864 by assuming a constant ratio of the population of the islands to the population of mainland [158].

Romania (1859-1938)

Until World War One, the territory of present-day Romania were divided between Transylvania, in the Habsburg empire, and the principalities of Moldavia and Wallachia. These latter belonged formally to the Ottoman empire but enjoyed a substantial autonomy, which was eventually transformed in full independence at the Berlin Congress in 1878. The principalities enumerated the population several times since 1810, but the results were never published (Mateescu 2013), while the Ottoman sources supply only tentative estimate wide

[157] The coefficients of correlation all exceed 0.999 and the average ratios differ by about half a percentage point.

[158] The islands accounted for a declining share of total Portuguese population, from 8.57% in 1878 to 6.81% 1920 (Rothenbacher 2002 tab P2), but we prefer not to make unsupported hypotheses on the ratio before 1864. The 1801, 1811 and 1831 censuses (Historical Statistics Portugal Tab 2A) covered only the mainland.

off the mark [159]. The results of the 1859 nationwide census were published in 1899 census and yearly data on vital statistics were published since 1884 (Rothenbacher 2013 p.822). Thus, Axenciuc (1996 vol ii pp.20-21), Rothenbacher (2013 tab RO4A) and Stoenescu et al (2014 tab. RO6F_A) publish slightly different series, respectively from 1859, 1861 and 1880, with a gap for war years 1914-1919. We use the Axenciuc (1996) series, which are part of his reconstruction of national accounts, and we fill the war-time gap by simply assuming that population remained constant. We extrapolate it backwards to 1800 with the series for Bulgaria.

Russia Empire/Soviet Union

Imperial Russia started to count (partially) her population in 1724, after an edict by Peter the Great in 1718, and established a statistical section of the ministry of Interior as early as 1834 (Lorimer 1946, Beskrovny et al 1965, Bruk and Kabuzan 1989, Kumo 2016, Thorvaldsen 2018). The first, partial, enumeration ('revitzia' or revision) was produced in 1724 but it counted only taxable males, excluding the army, and initially it covered only part of the empire in its 1913 boundaries,. The tenth and last revision was performed in 1859, while the first, and only modern census, only 38 years later, in 1897. In the meanwhile, the Statistical section of the Ministry of Interior had started to collect data on births and deaths from Orthodox Church parish registers and from police offices and produced series of the yearly movement of population at least since 1867. The Statistics Yearbook Russia (1916 p.86) reports a series of population at January 1st for the empire (without Finland) from 1800 to 1916, which appears to be obtained by interpolating the available data from 'revisions' before 1834 and by using some yearly data afterwards. We use this series as our baseline, with three adjustments.

First, we correct the early figures to take into account the territorial conquests of the early 1810s, Bessarabia (most of present-day Moldova) in 1813 after the Russo-Turkish war, some Caucasic areas (Georgia, Dagestan, part of Azerbaijan) in 1814 after the war with Persia and (Congress) Poland in 1815 after the Congress of Wien. The additional population was included in the series of the Statistical Yearbook, but apparently not in the revisions [160]. We thus extrapolate backward the population in 1815 to 1811 assuming a rate of increase 0.8% and then to 1800 following the yearly changes of Statistical yearbook 1916. Second, the official figures for the 20th century overestimate population, as domestic migrants were registered twice, both in the village of origin and in cities of destination (Markevitch and Harrison 2011 Appendix p.3). We correct the series until 1913 by extrapolating the 1897 census data with the revised series by Sifman 1977. Lastly, we compute the total population at mid year as the simple average of the data for two consecutive years.

The outbreak of the war disrupted the whole system of demographic statistics. A new census had been planned for December 1915, but eventually population was counted in rural areas in 1916 and again in 1917 (Bruk and Kabuzan 1989). The new Soviet regime tried to count population in 1920 but the census covered only the areas of European Russia under its control[161]. The registration system collapsed, while population was reduced by civil war, diseases and emigration (Wheatcroft and Davies 1993). Thus, there is considerable uncertainty about population trends from 1913 to the Soviet census in 1927. The results are deemed accurate enough, but the later movements become a hot political issue (Wheatcroft and Davies 1993, Davies et al

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[159] Ubicini and Ritter Zu Helle von Samo reckoned the population to have been 4 million in 1844-1845 and 4.5 in 1872-1874 (Karpat 1985 tab.I.2 and 1.6). The population of Romania reached 4 million only in the mid 1860s.

[160] The series of the Statistical yearbook 1916 increases by a tenth from 1811 to 1815, with jumps in 1813 (866), 1814 (1166K) and in 1815 (1818K). It is possible to estimate the population of conquered territories by extrapolating the 1811 population to 1815. The population in 1811 was 41010K according to the Statistical yearbook 1916, 41095 according to Kabuzan (1963 pp.156-159) and 41805 according to Rashin (1956 p. 27), while The rate of growth of Russian population was 0.69% from the 1795 to the 1811 revision according to Kabuzan (1963 pp.156-159) and 0.80% from 1800 to 1811 according to the Statistical yearbook 1916. Thus the 1815 population of Russia in her 1811 borders could range from 42449K to 43511 and the population of new territories from a minimum of 1699K to a maximum of 2768K. A high figure seems more plausible as in 1858 the population of the Privislinskii krai (the official name of Congress Poland after the failed uprising of 1861-1863) totalled 4764K people.

[161] Rothenbacher 2013 tab. SU1 reports total population for Soviet Union in post-war boundaries respectively of 143.5 and 136 million. The difference with our estimate is not that large.

2018). The results of 1937 census showed the demographic collapse caused by collectivization and thus were never published. A new census was taken in 1939.

Our estimate for the early years of the Soviet Union relies mostly on the work by Markevitch and Harrison (2011 Appendix tab A8 and A9) who select the best available estimates in the Russian literature. They supply series for Imperial Russia, without Poland and Finland, from 1913 to 1918 and for post-war Soviet Union, including Khiva, Kokand and Bukhara, from 1913 to 1924. As for other countries, our series refers to pre-war boundaries until 1918 and to post-war boundaries afterwards. Before 1918, we simply extrapolate the 1913 population with the Markevitch-Harrison series to keep the geographical coverage constant [162]. From 1919 onwards, following Harrison-Markevitch, we rely on the estimates by Andreev et al (1993), converting the data from first of January to mid year by averaging two consecutive years.

Khiva, Kokand and Bukhara (1800-1919)

The Emirate of Bukhara and the Khanates of Khiva and Kokand became Russian protectorates, after a series of military defeats, respectively in 1867, 1876 and 1873, were conquered in 1920 and formally annexed to Soviet Union in 1924-1925. The imperial statistics include Samarcanda and its territory, which Russia conquered in 1866 but not the formally independent polities. Markevich and Harrison (2011 tab.B-2) estimate the total population in 1913-1918 and we build a series for 1800-1913 by extrapolating backward their figure for 1913 (2259K). We assume a rate of growth 1% in 1800-1880, 1.5% 1880-1900 and 1.8% in 1900-1913 (this latter as suggested by Harrison-Markevich) and we add a crude estimate of the population of the areas annexed to Russia in 1866-1867 [163].

Poland (1918-1938)

The residual territories of the Polish-Lituanian commonwealth after the two first partitions remained a formally independent polity until the Congress of Wien, but there are no sources on its population. We thus include its territories in our estimates for Austria-Hungary, Prussia and Russia. Poland regained its independence regained its independence in 1919. It took censuses in 1921 and 1931 and set up a registration system for vital statistics in the 1920s (Rothenbacher 2002 p.560). We use the series by Rothenbacher (2002 tab PL4) for 1919-1938.

Serbia/Yugoslavia (1830-1929)

The population of Serbia was enumerated several times in the first decades of the 19th century, but results were systematically undervalued to reduce the tributes to the Sublime Porte (Historical Statistics Serbia p.42). Serbia took its first census in 1834 and continued at short (but irregular) intervals until 1910, although the

[162] We prefer not to use the rates for 1914-1915 and 1915-1916 from the Statistical Yearbook 1916 as they seem implausibly high. This method assumes that both the ratio of population of Russian Poland to the population of the rest of the empire and the number of unregistered migrants to cities remained constant on pre-war levels. Both assumptions are likely wrong: during war, a substantial number people from Western regions fled to Russia and many city-dwellers returned to their villages (Wheatcroft and Davies 1993). However, the two bias would compensate each other, the former reducing and the second increasing population relative to our estimate. Bruk and Kabuzan (1989), integrating the census results with policy data, estimate a population of 172 million in 1917 for the whole empire – i.e. about 3 millions higher than our figure for the same year. The difference reflects a lower adjustment for the unaccounted domestic migrations - 5600K in 1917 vs 8500K in 1913 while it ignores the potential bias from losses of Polish population.

[163] We estimate the population as the excess increase in population in 1866 and 1867 (respectively 2700K and 1100K) relative to the assumed 1% rate of growth.

results were not fully reliable before 1866 [164]. The Historical Statistics Serbia (Tab. 3.2) reports upward revised estimates of population of ‘uprising Serbia’ n 1803, 1813, 1815 and 1821 and Sundhaussen 1989 tab.2) the results of the eight censuses from 1834 to 1866. We interpolate linearly and we continue to 1911 with the yearly series from 1866 to 1878 (Historical Statistics Serbia Tab. 3.10) and from 1879 to 1910 (Historical Statistics Serbia Tab 3.15), referring respectively to the territory before and after the Treaty of Berlin [165]. Serbia gained Kosovo at the end of the first Balkan war in 1913, with a population of 767K in 1921, equivalent to about a third of the population in its pre-war territory in the same year (Historical statistics Serbia tab 3.1). Thus we adjust the 1913 population accordingly and we extrapolate the level to 1918 with the series by Hinic et al (2104 tab SE6D), which clearly refers to the country in pre-war borders. From 1919 onwards, the series refer to post-war Kingdom of Serbs, Croat and Slovenians (renamed Yugoslavia in 1929). The Kingdom took censuses in 1921 and 1931 and collected vital statistics since 1919 (Rothenbacher 2013 pp.1282-1283). Yearly series of population have been published by Hinic et al (2014 tab YU6I_A) since 1921 and by Rothenbacher (2013 tab.YU4A) since 1921. The two series are correlated at 0.999 but the former is higher by 0.75% on average. We prefer the series by Hinic et al (2014) because it supplies two additional years.

Montenegro

Montenegro gained territory in 1852, 1878, when the Treaty of Berlin recognized it as an independent state, and again at the end of the first Balkan war (1913) while was annexed to Yugoslavia in 1918. There is indirect evidence of enumeration of population but results were never published, possibly because the government wanted to inflate the country population for political motivations (Palairet 1997 p.14, Rothenbacher 2013 p. 763). Thus, we use the estimates of population at ten year intervals from 1800 to 1910 by Palairet (1997 tab. 1.7), and the figure for 1913 in the Statistical Yearbook League of Nations, which refers to the post-war territory. We interpolate linearly between benchmark years and we extrapolate population from 1913 to 1918 hypothesizing it declined as much as the Serbian one[166].

Spain

Spain started to count population quite early, in but the tradition was interrupted in the troubled first half of the 19th century and was resumed only after 1857 (Rothenbacher 2002 p.618. Thorvaldsen 2018 pp.118-119). Vital statistics were collected since 1855, with a gap in 1874-1886. Several authors have used these sources to estimate series of Spanish population since 1850 and recently Alvarez Nogal et al have estimated a series of population until 1850 as part of their reconstruction of long-term national accounts (2020, Data Appendix) which we splice the data underlying Prados (2016). We prefer this latter to series in Historical Statistics Spain (2005 quadro 2.5) and Rothenbacher (2002 tab E.4) which start in 1858[167]

[164] Rothenbacher (2013 p.950) quotes also a collection of vital statistics since 1834, but he does not provide any further information (nor data). The official series starts in 1862, after the establishment of the Central statistical Office (Historical Statistical Serbia p.45 and tab. 3.10).

[165] We extend the series to 1912 assuming an increase by 1,5%.

[166] We correct for border changes in 1852 and 1878 by splitting the ten-year interval between estimates by Palairet (1997) in two periods, before and after the expansion, and by extrapolating the rates of growth respectively with the rates in the previous and successive ten-year interval. Thus, for instance, population growth from 1870 to 1878 is computed extrapolating the 1860-1870 rate and we obtain the 1879 figure by extrapolating backward the 1880 estimate with the 1880-1890 rate.

[167] The differences between these series are minimal, with coefficients of correlation over 0.995. All these series include the Canary and Balearic island (Historical Statistics Spain 2005 p.127, Rothenbacher 2002 tab E2)

Sweden

As all Scandinavian countries, Sweden has very good demographic sources, with censuses and vital statistics since the mid-18th century (Rothenbacher 2002 p. 649). We use the population series from the Lund University Macroeconomic and Demographic Database (https://www.ekh.lu.se/en/research/economic-history-data/lu-madd/population Accessed February 2021). The series refers to Sweden in her current borders, excluding Finland and Norway.

Switzerland

Swiss cantons had a long tradition of collecting demographic data but the federal population series start only in 1850, with a first census and vital statistics from 1851 onwards (Rothenbacher 2002 p. 682). Thus, the Historical Statistics Switzerland 1996 report benchmark data by canton from 1671 to 1844 and a nationwide series since 1850. We copy this latter (table B.42), while from 1800 to 1850 we interpolate the available data by canton from table B.01 [168].

United Kingdom

The United Kingdom enumerated its population for the first time in 1801 and then continued at ten year intervals, with an increasing accuracy and amount of detail (Rothenbacher 2002 p. 713-714) Thorvaldsen pp.50-52, 71-78). Official statistics of the movement population started to be published in England from 1838/39, Scotland from 1855 and Northern Ireland only from 1922, but birth and death rates for England have been estimated since 1541 in the pioneering work by Wrigley and Schofield (1989). Historical statistics United Kingdom (pp. 11-12) report population separately for England and Wales, Scotland and Ireland (the whole island before 1921 and only the Northern counties since 1922) from 1801 onwards. We extrapolate to 1801 with the change in population from Broadberry et al (2015 Appendix 5.3) and we compute total population as sum of the three regions in all subsequent years but 1915-1920. The Mitchell series excludes the (male) military personnel during World War One, which was not counted by French statistics. Thus for those years, we use the data from the national account estimates by Feinstein (1972 T 120)[169].

<u>Eire (Ireland 1922-1938)</u>

Until 1921, the population of Southern Ireland counties is included in the series for the United Kingdom. After independence, Eire kept the registration system of Great Britain and took censuses in 1926, 1936 and 1946 (Rothenbacher 2002 p. 407). We get the series from Rothenbacher 2002 (tab IRL 4)

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[168] Full country enumerations were held in 1798, after the French invasion, and in 1836 and partial ones in 1808-12 (9 cantons), 1815-17 (21), 1821-1824 (15), 1827-29 (17) 1833-34 (7) and 1844 (6). The table reports nationwide totals for 1798 and 1836, plus estimates (for all cantons) for 1818 and 1828. We have added observations for the available cantons in 1808-12 (centred in 1810), 1821-24 (1823) and 1833-34 (1833). We do not use the original data for 1815-1817, which the source uses as basis for the estimation of population in 1818.

[169] The two series are equal in all other years. The gap was quite large in 1915-18 (on average 2901 K – i.e.6.7% of total population of the kingdom according to Mitchell) and then declined with de-mobilization of the army to 1935K in 1919 and 438K in 1920).

OCEANIA

Australia

The Australian historical sources treat differently white settler and natives (aborigens). The former were counted with precision since the times of Australia as a penal colony and the series is available in Historical statistics Australia Tab 1.1. In contrast, the aboriginal population was estimated very imperfectly until the 1930s. To be sure, the nomadic lifestyle made counting natives difficult and the task was made harder still by changes in the classification of mixed-blood individuals. The government of South Australia tried to count them as early 1851, other states followed suit in the following years and the federal government included them in the first all-Australian census of 1911 (Smith 1980). From 1924 to 1941, the government took yearly separate censuses and natives were included in Australian population series only since 1961.

The number of native at contact (1788) is highly uncertain, with estimates ranging from 314 to about one million and a so-called Mulvaney consensus around three quarters of million (Hunter and Carmody 2015). As all over Oceania, the arrival of European diseases caused a collapse, but the nature of the most deadly disease (smallpox, chickenpox) and the timing of the collapse is uncertain for total lack of data. After a careful review of the alternative hypotheses, Hunter and Carmody (2015) put forward a 'plausible back-cast of Aboriginal population' at ten year intervals, which halves from 540K in 1800 to 211K fifty years later. Smith has collected all available sources and, after revision, has estimated the total population at ten year intervals from 1861 onwards (1980 tab 8.2.5)[170]. We obtain our series for native population by linearly interpolation and we sum it to the population of white settlers

Hawaii

Hawaii is an exception in Third World for the wealth of its demographic sources (Schmitt 1968). Western missionaries organized extensive enumerations, managed by school teachers, in 1831/32 and again in 1835/36. The kingdom tried to count the population since the late 1840s and, after some initial troubles, succeeded to produce nine increasingly reliable censuses from 1848 to 1896. After the American annexation in 1898, the US Bureau of the Census included the Hawaii in the American censuses. In contrast, trends in the first decades of the 19th century are uncertain, as they depend on the population at contact (1778-1779), which is, as usual, highly uncertain and, as anticipated in the text, unusually controversial. Cook and his officers estimated population ranging from 200K to 400K and the conventional wisdom settled on 300K. Population declined slowly to 260K in 1804-1805 but then collapsed to about 150k because of a devastating pandemic and further declined slowly to 90K mid-century. This conventional wisdom has been contested by Schmitt (1972), who argued for the lower bound in 1778 (200k), discarded the available estimates for 1804-5 and 1823 and, downplaying the impact of the early 19th century pandemic, suggested a steady decline from 1779 to 1848. As a compromise, we follow Schmitt about the population at contact but we accept the two intermediate estimates for 1804-1805 (150K) and 1823 (140K), as well as the two enumerations for 1831/32 (130K) and 1835/36 (109). We linearly interpolate between these benchmarks until 1848, the year of the first census. From 1848 to 1938 we reproduce the yearly series by Nordyke (1989 tab 8), which integrates the earlier work by Schmitt (1968 tab 83) by adding the military personnel.

New Zealand

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[170] Smith (1980) adopts a consistent definition of aborigens as individual of sure descent and thus implicitly we assume that other mixed-descent people were included in the series for white population. His series differs somewhat from the official sources in the 1920s. The aboriginal census returned a modest growth from 71K in 1921 to 80K in 1933, while Smith reckons population to have remained stable (75.6K in 1921, 73.8K in 1933). However, we use the censuses to extrapolate from 1933 to 1938, rather than relying on Smith's estimate for 1947.

New Zealand had been discovered in 1642 and was frequently visited by Western ships in the late 18th century but white colonists started to settle it in the early 19th century. The Historical Statistics New Zealand (Tab.A.1.1) provide a continuous and reliable series of white population from official sources since 1840, when they were about 2K, to 1922. The Maori population was counted since the 1874 census and the Historical Statistics New Zealand publishes series of total population thereafter. However, the implicit series for the Maori population shows implausible jumps in coincidence of the censuses and the foremost expert in Maori demography, Pool (1977, 1997), reckons that some of the censuses undercounted the population. He thus corrects the figures and puts forward tentative estimates of native population in 1840 (70-90K) and 1857-58 (59.8K) and of its decline in the first forty years of the century[171]. We use his hypotheses to build a series of Maori Population from 1800 (115K) to 1922 (53K) and thus of the whole population of the country. After 1922 we reproduce the series of total population from Historical Statistics New Zealand

[171] The rates are -0.3% 1800-1815, -0.7% 1815-1830 and -1,2% 1830-1840 (Pool 1997 p.56). For the interpolation, we use mid-range estimate for 1840 (80K) and we compute the Maori population for 1922 from Historical Statistics New Zealand.

Melanesia

Fiji:

Westerners had extensive contacts with the islands since the late 18th century and started to settle in the 1830s. The island became a British colony in 1874 and the population was enumerated, with quite primitive methods five years later. The census was repeated in 1881 and then regularly at ten-year intervals throughout the period (Mc Arthur 1968 pp.2-26). We interpolate linearly the results from 1881 onwards, taking into account the information about deaths from diseases in the 1880s (5.5K in total) and about from the Spanish flu in 1918 (about 5K deaths). We extrapolate backwards the population from 1881 to 1800 by assuming that it remained stable from 1800 to 1820, declined at 1.5% from 1820 to 1875 and dropped by a quarter as a consequence of the 1875 measles epidemic (McArthur 1968:2-10)[172].

New Caledonia

Cook discovered the main island of the archipelago, the Grande Terre, in 1774 but Westerners started to settle in substantial numbers in the 1840s with the start of exports of sandalwood. The islands became a French colony in 1853 and was used as a penal colony from 1864 to 1924. The French produced data on population, both European and native, since 1866, and took censuses at ten (later five) year intervals since 1906 (Brou 1980, Rallu 1985). Predictably, the quality of these data differs: they are quite reliable for the European population and more controversial for the native one. Thus, we build a series of European population by interpolating the French data from Rallu (1985 tab. I), starting from an arbitrary figure of 0.5K in 1853 and taking into account the arrival of former fighters from the Paris Commune in 1872 [173].

The size of the native population in the 19th century is rather controversial. The few estimates of Western observers for the first half of the century clustered around a total of 50K and the French source reports slightly lower figure for 1866 (40-45K) and 1885 (42.5). In contrast, the 1906 enumeration returned only 28.6K and such a late collapse is somewhat implausible. Indeed, Sand et al (2007) dismisses the 1885 figure as pure guesswork and argue that the remains of extensive irrigation systems imply a much higher population mid-century - at least 80-100K if not more. We assume that native population remained stable from 1800 to 1830 at 72K, declined at 1.5% per year to 42K in 1866 and at 1% from 1866 to 1906. From 1906 onwards we interpolate the French data for total population (Rallu 1985 tab.I)[174].

New Hebrides (Vanutu)

European started to settle for wood trade and forced recruitment of natives since the 1840s, but the colonial regime started only in 1906, with a very unusual joint French-British administration. This solution may have hampered the collection of data. The Statistical Yearbook League of Nations reports a figure of 67K in 1913 and then it relies on the 'evaluations' from Statistical Yearbook France -i.e. 60K in 1921 and 1931 and 50K in 1936. The historical research has added some information on population of the tiny island of Aneityum (Spriggs 2007). It declined slowly (ca 0.7%-1.1% per year) from 1830 to the mid-1850s and then collapsed, for a series of epidemics, from 3.5K to only about 200 souls in the 1940s. Such a collapse seems an outlier in the whole Oceania and cannot be extended to the whole archipelago. We thus re-start from the French figure for 1936 which exceeds slightly the population in 1950 according to the United Nations. We discard the figure for 1931,

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[172] The 1881 census returned a native population of 115K, as many as the 1879 after taking into account the omission of natives not present in villages. The population in 1881 was swelled by the immigration of Europeans and Indian works and by the annexation of another island.

[173] There were 1.1K Europeans in 1866 and 18.7K ten years later. We assume that about 5K convicts arrived in 1872 and that in other years European population increased by 25% each year

[174] We correct for a material mistake in reporting the data. The figures in the row 'total' are shifted by one benchmark year – i.e. the sum of different categories in 1921 is reported in the cell for 1911..

as we deem a 15-20% collapse in population in the 1930s implausible. We extrapolate the population to 1800 assuming that it remained stable from 1800 (57K) to 1830, to have declined by 1% a year from 1830 to 1860 (43K), to have remained stable again from 1860 to 1920 and then to have increase at 1% per year from 1936 to 1938.

New Guinea:

The island was first spotted by Western explorers in the 17th century, but colonization started with the annexation of its Western part to the Dutch East Indies in 1828 (as one of the Outer Islands), while the Eastern part was divided between the British and the Germans only in 1884-1888 [175]. Both colonial administrations tried to guess the number of their subjects, with decidedly poor results [176]. Indeed, the total population in 1938 (950K) would be barely a half the population of the same area in 1950 according to the United Nations (1674K), with an implicit rate of 4.7%. We arbitrarily assume that the population remained constant from 1800 to 1920 and increased at 1% per year from 1920 to 1950 [177]

Solomon Islands:

The islands were discovered in the 17th century and were visited several times by European ships, but missionaries started to settle only in the mid-19th century. Germany (since 1886) and the United Kingdom (since 1893) claimed the sovereignty on different island but in 1899 they agreed to transfer the whole archipelago to Great Britain (1893). Unfortunately, the British did not count the population until 1931, publishing in the Statistical Yearbook British empire only estimates for 1911 and 1921 (150K). The 1931 enumeration returned a total of 94K, slightly above the number of inhabitants in 1950 according to the UN. This decline is not implausible, given the fierce fighting in the islands during World War Two, and thus we accept the figure. The figures for 1911 and 1921 seem too high as a 50% fall in the 1920s would have attracted the attention of the colonial authorities. Without any hard evidence, we assume that population remained constant until 1850, declined at 1.5% from 1850 to 1900, remained stable from 1900 to 1920 and then grew at 1% until 1938

Micronesia

Guam

Guam has a distinctive story as it was a Spanish colony since the 16th century and an important stopover for the Manilla galleons which transported American silver to Asia. It is thus likely that the post-contact collapse preceded the period we are dealing with, although the island was hit by a devastating smallpox epidemic in 1856 (Rogers 2011). The Spaniards enumerated the population in 1816 and the then governor put forward another estimate in 1886. After the annexation of the island in 1899, the American took censuses in 1901, 1920, 1930 and 1940 (Historical Statistics United States Aa101). We interpolate linearly among these

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[175] The British New Guinea was moved to Australian administration and re-named Territory of Papua in 1906. In 1914, Australia were mandated the administration of the former German colony, under the name of Papua.

[176] The sources for the former German part report a decline in the early century and then a rise, with some hardly plausible jumps (380K in 1903-1905, 300K in 1906-11 and 531K in 1912-13 according to Statistical Yearbook Germany, 233k in 1924-25, about 450K in 1926-1928, 520-540K in 1929-1933, and 670K in 1934-38). Trends the population of the British part are even less plausible, as the Statistical Yearbook British Empire reports 350K in 1891 and 1901 and 380K in 1911, and the Statistical Yearbook League of Nations a much lower and broadly constant population (250 in 1913 and 1925 and 280K from 1927 to 1938).

[177] The assumption of constant population is justified by the frequent tribal wars and the diffusion of diseases after the contact, which however might have had a smaller impact than in other Pacific islands given the size of New Guinea. The population grew at 1.8% per annum in the 1950s.

benchmarks, taking into account the deaths from smallpox epidemics (allegedly 60% of the population) and from the Spanish flu (ca 10% of the population in 1918).

Gilbert and Ellice Islands (Kiribati and Tuvalu):

The islands had extensive contact with Westerner whalers since the 1820s but they became a British protectorate (later colony) only in 1892. The earliest Western estimate date to the 1840s, with estimates as high as 60K-80K – i.e. more than double the population in 1950 (MacDonald 1982 p.5). Mc Donald, in his history of the islands, deems more plausible a population of 30-35K in the mid-1850s and quotes an estimate of 26K at the beginning of British rule. The 1901 British census returned a population of 35.5K which remained broadly stable according to the next three censuses. We interpolate linearly among these benchmarks and we extend the series to 1938 with the figures from the Statistical Yearbook League of Nations. We assume that the population remained stable in the first three decades of the century, when contacts with Westerners were limited, and declined at 1.5% per year from 1830 to 1855.

German colonies

The available sources consider jointly Palau, Nauru and the Caroline, Marshall and Northern Mariana islands. They had been formally Spanish colonies, but Spain had made few concrete moves to occupy them and sold al them to Germany in 1885 and 1898. The Statistical Yearbook Germany reports guesstimates of the total population since 1903 and the series is continued by the Statistical Yearbook League of Nations from 1925 to 1938 with data from the Japanese mandate administration. Without any additional information, we interpolate among these benchmark estimates. We guess-estimate population in the 19th century by assuming the population to have been constant but for a decline at 1.5% per year during the whaling boom from 1830 to 1860.

Polynesia

Cook Islands

After some sightings by Spanish ships, the islands were re-discovered by Cook himself and since the 1820s were frequently visited by whaling ships, while early missions were established in 1821 and a British protectorate in 1888. The first available estimate suggested a population of 14-16K in the late 1820s but in 1845, after a disastrous epidemic in 1830, the missionaries found ca 10K inhabitants in the Northern islands and perhaps 12K in the whole archipelago (McArthur 1967 pp.164-196). Population further declined to 8.7K in 1870, for the joint effect of diseases and forced recruitment of workers, and then to 8K according to the British census of 1901. The islands were transferred to the New Zealand colony in 1901, and the population were enumerated in the New Zealand censuses since 1906. The available figures, although scattered in time and somewhat uncertain, seem plausible given the information on the history of the islands. We thus compute our series interpolating linearly between them and we assume population to have remained constant from 1800 to mid 1820s.

Tonga:

At the end of the 18th century the archipelago was divided in different polities, which were re-unified in 1845 into a kingdom which became a British protectorate in 1900. We rely on the detailed analysis by McArthur (1967 pp.72-84), who lists the available estimates from 1840 (18.5K) to the first official enumeration in 1891 (19.2). Since then, the British counted population quite frequently and Mc Arthur (1967) deems the results quite reliable. We thus interpolate linearly between the available figures, adjusting for the omission of non-natives when necessary. The population remained constant until the 1920s and then rose quite quickly. This time pattern implies an early collapse, which was worsened by civil wars: we assume a 2% per year decline from 1800 to 1840.

French Polynesia: Tahiti and Morea

Tahiti was first sighted by Spanish ships in the 17th century and had repeated contacts with the British and the French since the mid 18th century. The British and the French vied for influence upon the warring clans and eventually the latter won, establishing a protectorate on Tahiti in 1842. As a result, there are very many estimates of its population, starting from an extravagant figure of 200K attributed to Cook in 1774 (Schmitt 1967, McArthur 1968 pp. 235-260 Rallu 1991). The (British) missionaries enumerated the natives in Tahiti in 1829-1830 (a total of 8.7K) and the French administration counted the whole population quite frequently since 1848. The results of these enumerations are not controversial In contrast, there are two views about population in the first half of the century. Rallu (1991 and 2007 Fig 2.2) argues that epidemics caused a collapse from 35K in 1800 (and 77K in 1774), while McArthur (1967 p. 235), after a careful selection among available estimates, suggests a population around 16K in 1800. Overall, we find the latter more plausible, as it implies a decline 'only' at 1% per year vs 2.6%. Thus we hypothesize a population of around 16K in 1800, 10.5K in 1829-1830 (as in missionaries count) and 10 in 1848 (as in French enumeration)[178]. We obtain our final series with linear interpolation between these benchmarks and the later French data[179].

French Polynesia: Marquesas

The case of Marquesas is different. They started to have extensive contacts with Westerners whale-hunters later, in the early 19th century and became French colony only in 1870. Thus, there are much fewer data in the first part of the 19th century, but the French kept population registers since 1886 (a unique case for Oceania). On the other hand, the available data from McArthur (1968 tab 54) and Rallu (1991) are quite consistent and imply a collapse from about 20K in the early 1840s to 4.6K in 1886.We interpolate linearly between these estimates and we reproduce the official yearly series from Rallu (1991) to 1938. We extrapolate backwards the series to 1800 assuming that the population remained constant in the first two decades of the century and declined at 2% per year from 1820 to 1840

French Polynesia: other islands

The sources do not report separate data for the other islands (Tuamotus, Gambier, and Austral islands) before 1902, when French included them in their count of population of French Polynesia colony. We extrapolate backward this figure to 1800 with the sum of population of Tahiti/Morea and the Marquesas and the compute the series from 1902 to 1938 with linear interpolation.

Samoa

Although some islands had been visited by European ships since the 18th century, the contacts between Europeans and natives started only in the mid 1820s. After decades of civil war between different tribal clans, supported by Western powers, in 1899, the United States and Germany agreed on a division of the archipelago. The United States got the Eastern islands and Germany the Western ones, which after the war were transferred to New Zealand under a League of Nations mandate

There are no sources, even tentative estimates by Western observers, on the population in the first decades of the 19th century (McArthur 1967 pp. 101-103). The sources are more abundant for the second half of the century, with first missionary enumeration in 1853 (population 33K) and several independent estimates, which suggest a population fluctuating around 35-40K. Since 1900 the United States and Germany (later New Zealand) counted regularly the population of their territories and Germany also set up a population register in 1905 (Mc Arthur 1968 p.122 Historical Statistics United States series Aa102).

[178] We increase by 20% the total of the missionary count 1829-1830 to take into account Morea and the non-native population in Tahiti. Our estimate implies a substantial decline in 1800-1830 (1.4% per year), as in other islands, and a quasi-stagnation in 1830-1848, as the further decrease in native population was compensated by immigration. Note that our estimate does not rule out a collapse after the contact.

[179] The population according to the 1936 French census (44K) is consistent with the UN figure for 1950 (60K): the implicit growth rate is only marginally higher than the rate 1931-1936 (2.2% vs. 1.9%).

Population trends before 1850 are quite controversial. Diseases reduced population in the 1840s, but the impact was fairly modest according to Mc Arthur (1967) and much more devastating according to Green (2007). Green estimates population in the early 1840s to have been about 47K and hypothesizes, following Pirie (Davidson 1969) that it could have been as high as 80K in 1800. We accept his figure for the 1840s but we extrapolate it backward to 1800 by assuming that population declined fast (2% yearly) in the 1830s, after having remained constant from 1800 to 1830. After 1853 we interpolate linearly between the available figures, including the from American and German/New Zealander enumerations, separately for the two parts of the archipelago [180].

Minor islands

We have been unable to find data on the population of minor Polynesian islands (Niue, Tokelau, and Wallis and Futuna). Thus we estimate it as a 7% of the population of the other islands (the share in 1950-1955)

[180] We increase the figures for 1900 and 1902 in Western Samoa by 10% and we adjust the series to take into account the 20% fall in population caused by the Spanish flu (https://nzhistory.govt.nz/culture/influenza-pandemic-1918 accessed February 2022).

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