

Text 1 – Oded Galor (2022), *The journey of Humanity. The origins of wealth and inequality*, Dutton, Penguin House (selected pages from chapters 1 to 3; edited).¹

0 – Introduction

Imagine that some residents in Jerusalem 2,000 years ago, were to step into a time machine and travel to the Ottoman-ruled Jerusalem of 1800. They would undoubtedly be impressed by the magnificent new city wall, the considerable population growth, and the adoption of new innovations. But although nineteenth-century Jerusalem was quite different from its Roman predecessor, our time travellers would adjust with relative ease to their new surroundings. Admittedly, they would adapt their behaviour to the new cultural norms, but they would be able to maintain the trades they had practised at the dawn of the first century and sustain themselves easily enough, since the knowledge and skills acquired in ancient Jerusalem would still be pertinent at the turn of the nineteenth century. They would also find themselves vulnerable to similar perils, illnesses, and natural hazards as those endured in the Roman period, and their life expectancies would hardly alter.

Envision, however, the experience of our time travellers if they were whisked away in our time machine again, just another two hundred years ahead, to early-twenty-first-century Jerusalem. They would be utterly astounded. Their skills would now be obsolete, formal education would be a prerequisite for most occupations, and technologies that might seem like witchcraft would be daily necessities. Furthermore, as numerous fatal diseases of the past would have been eradicated, their life expectancy would instantly double, requiring an entirely different mindset and longer-term approach to life.

The gulf between these eras makes it difficult to conceive the world we left behind not so long ago. As the seventeenth-century English philosopher Thomas Hobbes put it bluntly, human life was nasty, brutish, and short.[1] At the time, a quarter of new-borns died of cold, hunger and assorted illnesses before reaching their first birthday, women often perished during childbirth, and life expectancy rarely exceeded forty. It was a place where women, men and children devoted long hours to ferrying water to their homes, washed infrequently, and spent the winter months in smoke-filled homes. A time in which most people lived in far-flung rural villages, rarely ventured from their birthplace, survived on paltry and monotonous diets, and could neither read nor write. A dismal era when an economic crisis did not simply demand belt-tightening, but rather led to mass starvation and death. Many of the daily hurdles that concern individuals in the present-day pale in comparison to the hardships and tragedies faced by our not-so- distant forebears.

It has long been the prevailing wisdom that living standards have risen incrementally over the entire course of human history. This is a distortion. While the evolution of technology has indeed been a largely gradual process, accelerating over time, it has not resulted in a corresponding improvement in living conditions. The astounding ascent in the quality of life in the past centuries has in fact been the product of an abrupt transformation. [...]

Since the dawn of the nineteenth century, a split second compared to the span of human existence, life expectancy has more than doubled, and per capita incomes have soared twenty-fold in the

¹ For the sake of a concise reading, quotations have been erased from this summary. Figures referred to in the text are inserted at the end of the document and their original number has been respected.

most developed regions of the world, and fourteen-fold on Planet Earth as a whole (Fig. 1).[2] This continuing improvement has been so radical, in fact, that we often lose sight of just how exceptional this period is in relation to the rest of our history. What explains this Mystery of Growth – the scarcely conceivable transformation in the quality of life of the last few centuries, in terms of health, wealth and education, which dwarf any other changes in these dimensions since the emergence of Homo sapiens?

(...) Intriguingly, when prosperity skyrocketed in recent centuries, it did so only in some parts of the world, triggering a second major transformation unique to our species: the emergence of immense inequality across societies. One might suppose that this phenomenon occurred primarily because the escape from the epoch of stagnation has occurred at different times across the globe. Western European countries and some of their offshoots in North America and Oceania experienced the remarkable leap in living conditions as early as the nineteenth century, while this ascent was delayed in most regions of Asia, Africa and Latin America until the latter half of the twentieth century (Fig. 2). [...]

1. The Malthusian regime

In 1798, the English scholar Thomas Malthus offered a plausible theory for the mechanism that had caused living standards to remain stagnant, effectively trapping societies in poverty, since time immemorial. He argued that whenever societies managed to bring about a food surplus through technological innovation, the resulting boost in living standards could only ever be temporary as it would lead inevitably to a corresponding rise in birth rates and a reduction in mortality rates. It was just a matter of time, therefore, before the ensuing population growth would deplete the food surpluses, and thus living conditions would revert to subsistence levels, leaving societies as poor as they had been before the innovation.

Indeed, during the period known as the Malthusian epoch – which is to say, the entirety of human history up until the recent dramatic leap forward – the fruits of technological advancements were channelled primarily towards larger and denser populations and had only a glacial impact on their long- term prosperity. Populations grew while living conditions stagnated and remained near subsistence. Variations between regions in terms of the sophistication of their technology and the productivity of their land were reflected in differing population densities, but the effects they had on living conditions were largely transitory. Ironically, however, just as Malthus completed his treatise and pronounced that this ‘poverty trap’ would endure indefinitely, the mechanism that he had identified suddenly subsided and the metamorphosis from stagnation to growth took place.

Like other species, over most of their existence, humans were caught in a trap of hardship and privation, near the subsistence level.

Despite some regional differences, income per capita and wages for unskilled labourers in different civilisations fluctuated within only a very narrow band for thousands of years. In particular, estimates suggest that wages for a workday were the equivalent of seven kilograms of wheat grains in Babylon and five kilograms in the Assyrian Empire more than three thousand years ago, eleven to fifteen kilograms in Athens more than two thousand years ago, and four kilograms in Egypt under the Roman Empire. In fact, even on the eve of their Industrial Revolution, wages in Western European countries remained in this narrow range: ten kilograms of wheat in Amsterdam, five in Paris, and three to four in Madrid, Naples and assorted cities in Italy and Spain.[21]

Moreover, skeletal remains across various tribes and civilisations over the past 20,000 years indicate that despite some regional and temporary differences, life expectancy (at birth) oscillated within a very narrow band. [22] Remains uncovered in Mesolithic sites in North Africa and the Fertile Crescent suggest that life expectancy was nearly thirty years. During the subsequent Agricultural Revolution it did not change significantly in most regions, though it dropped in some.[23] In particular, skeletons exhumed from burial sites dating from the early stages of the Neolithic Revolution, 4,000 to 10,000 years ago, suggest that life expectancy was about thirty to thirty-five at Çatalhöyük (Turkey) and Nea Nikomedeia (Greece), twenty at Khirokitia (Cyprus), and thirty near the towns of Karataş (Turkey) and Lerna (Greece). Two and a half thousand years ago, life expectancy reached about forty years in Athens and Corinth, but headstones from the Roman Empire indicate yet again an age at death in the range of twenty to thirty.[24] More recent evidence points to fluctuations in life expectancy in the range of thirty to forty years in England from the mid-sixteenth to nineteenth centuries,[25] and comparable values were recorded in pre-industrial France,[26] Sweden[27] and Finland.[28]

For nearly 300,000 years after the emergence of *Homo sapiens*, per capita incomes were scarcely higher than the minimum necessary for survival, plagues and famines were abundant, a quarter of babies did not reach their first birthday, women commonly perished during childbirth, and life expectancy rarely exceeded forty years.

In 1798 [...] Malthus published *An Essay on the Principle of Population*, in which he expressed his profound scepticism about these prevailing and, to his mind, naive views. He advanced the gloomy thesis that in the long run humanity could never prosper because any gains it made would ultimately be depleted by population growth [...]

In retrospect, Malthus's description of the world as it existed in the past was entirely accurate. It was his pessimistic predictions about the future of humanity that turned out to be utterly mistaken.

Imagine a village in the pre-industrial age where the inhabitants devise a more efficient method to grow wheat using iron ploughs, considerably increasing their ability to produce bread. At first, the villagers' diets would improve and, trading some of the surplus, their living conditions would rise. The abundance of food might even enable them to reduce their work and enjoy some leisure. But critically, Malthus argued, this surplus would allow them to sustain more surviving children, and accordingly the village's population would grow over time. And since the land available for wheat cultivation within the village is necessarily limited, this population growth would gradually lead to a reduction in each villager's bread ration. Living standards would begin to drop after the initial rise and would only stop falling once the ratio of loaves per villager returned to its original level. Painfully, their technological progress would lead to a larger but not a richer population in the long run.

This trap has had all living beings in its clutches. Consider a pack of wolves on an island. Global cooling causes sea levels to drop and uncovers a land bridge to another island, which is home to a peaceful population of rabbits. The wolves gain new hunting grounds, the availability of additional prey boosts their living standard, and more cubs survive to reach maturity, leading to an explosion of the wolf population. However, as more wolves must share a limited amount of rabbits, the wolves' living standard gradually reverts to the pre-cooling level, while the wolf population stabilises at a larger size. Access to more resources does not make the wolves better off in the long run.

The Malthusian hypothesis is based on two fundamental building blocks. The first is that a rise in resources (agricultural yields, fishing hauls, and hunting and gathering bounties) leads populations to have more surviving offspring, driven by the biological, cultural and religious predisposition to reproduce, and the decline in child mortality that accompanies better nourishment. The second building block is that population growth engenders a decline in living conditions whenever living

space is limited. According to Malthus, the size of any population will adapt to the available resources via two mechanisms: the positive check – a rise in mortality rates due to the increased frequency of famine, disease and war over resources in societies whose populations have outgrown their food production; and the preventative check – a drop in birth rates during periods of scarcity through delayed marriage and the use of contraception.

Did technological advancements in the pre-industrial era lead to larger but not richer populations as implied by the Malthusian thesis? The evidence is clear that technological sophistication and population size were indeed positively associated in this era, but the existence of this relationship does not in itself indicate an impact of technology on population. In fact, technological advancements during this period were partly the result of larger populations because sizeable societies produced both more potential inventors and greater demand for their inventions. Besides, it may be that other independent factors – cultural, institutional or environmental – contributed to the growth of both technology and population, thus accounting for the positive correlation between the two. In other words, this correlation cannot in itself be taken as evidence of Malthusian forces.

Fortunately, the Neolithic Revolution provides us with an intriguing way to test the validity of the Malthusian thesis. [...] We can therefore infer a region's level of technological advancement from our knowledge of when it underwent the Neolithic Revolution (or from the number of domesticable species of plants and animals in the region). Put another way, at any single point in time, regions that had undergone the Neolithic Revolution earlier would be expected to have higher levels of technological sophistication. Thus, all other factors being equal, if a region that underwent the Neolithic Revolution earlier is also larger or richer, we can confidently conclude that this has been caused by its level of technological advancement. Using this approach, we can indeed observe the Malthusian mechanism at work prior to the industrial era. In 1500 cE, for instance, higher technological level, as inferred from an earlier onset of the Neolithic Revolution, did indeed lead to greater population density, whereas the impact on per capita income was negligible (Fig. 4).[2]

Separate evidence, meanwhile, shows that fertile soil also contributed to higher population density but not to higher living standards. And examining even earlier eras through the same lens reveals an impressively consistent pattern – technological advancements and higher land productivity led primarily to larger but not richer populations, implying that prior to the Industrial Revolution, people across the world enjoyed largely similar standards of living.

2. The Wheels of Change

What, then, propelled humanity out of the gravitational forces of the Malthusian equilibrium? How did the world wrench itself out of this economic black hole?

In search of the catalyst of the transition from stagnation to growth, one may argue that the Industrial Revolution is the force that gave the world an abrupt external shock that jolted it into the modern phase of growth. However, evidence from the eighteenth and nineteenth centuries when the Industrial Revolution occurred suggests that there was no 'jolt' at any point during this period. While the transition was rapid when compared with the timespan of human history, the productivity gains experienced during this period increased gradually. Indeed, when the Industrial Revolution first transpired, since technological change was incremental, populations spiked but average incomes increased only very modestly, just as would be predicted by the Malthusian theory. Yet, at a certain point, nearly a century later, the Malthusian equilibrium quite mysteriously

vanished and tremendous growth ensued. The conceptual framework I devised in the past few decades to address this conundrum was inspired by insights from the mathematical field of bifurcation theory, which demonstrate how, beyond a certain threshold, minor alterations in a single factor may generate a sudden and dramatic transformation in the behaviour of complex dynamical systems (as is the case when heat crosses a threshold and transforms water from liquid to gas).[3] In particular, this research has focused on identifying the cogs that were whirring invisibly beneath the surface, wheels of change that were turning relentlessly throughout the epoch of the Malthusian equilibrium but which ultimately broke its hold and led to the emergence of modern growth – much like the rising temperatures in the kettle.

What are those mysterious wheels of change that operated persistently during the Malthusian epoch and ultimately triggered the dramatic metamorphosis in living standards in the past two centuries?

One of these wheels of change was population size. At the eve of the Neolithic Revolution, in the year 10,000 BCE, an estimated 2.4 million human beings roamed the Earth. Yet, by the year 1 CE, as the Roman Empire and the Mayan civilisation approached their height, the world's population had multiplied seventy-eight-fold, and soared to 188 million. A millennium later, when the Vikings raided the coasts of Northern Europe and the Chinese first used gunpowder in combat, humanity stood at 295 million individuals. World population had risen to nearly half a billion by the year 1500, at the time when Columbus was in the midst of his expeditions to the Americas, and at the turn of the nineteenth century, in the early phases of industrialisation, the human population nearly crossed the one billion mark (Fig. 6).

The relationship between population size and technological change is a reciprocal one – just as technological advancements during the Malthusian epoch enabled populations to densify and grow 400-fold within a 12,000- year period, so had the size of these human populations contributed to an acceleration in the pace of innovation. As noted above, larger populations were more likely to generate both a greater demand for new goods, tools and practices, as well as exceptional individuals capable of inventing them. Moreover, sizeable societies benefited from more extensive specialisation and expertise, and greater exchange of ideas through trade, further accelerating the spread and penetration of new technologies.[5] As we have seen, this self-reinforcing, positive feedback loop emerged at the very dawn of the human species and it has been operating ever since.

This impact of population size on the technological level is apparent across cultures and regions throughout the historical record. Regions that experienced an earlier onset of the Neolithic Revolution, such as the Fertile Crescent, gave rise to the largest prehistoric settlements and enjoyed a persistent technological head start [...] Larger populations were not only more conducive to technological development, but they also prevented the kind of technological decline that is a common feature of smaller communities, such as that experienced by the Polar Inuit of north-west Greenland in the 1820s. This society was hit by an epidemic that decimated its adult population, who were the store for the tribe's priceless technological knowledge, such as for kayak construction. In its aftermath, the young survivors could not restore this lost technological know-how, since even the possessions of the old were buried with them, and experienced an extreme technological regression, which drastically eroded their hunting and fishing capabilities. Their population began to dwindle and would surely have continued to wane had they not eventually encountered another Inuit community, who reintroduced them to this lost knowledge a few decades later.[7] Acute technological regression among isolated communities had been experienced by other small communities, such as Aboriginal Tasmanian tribes after the loss of their land bridge with Australia. In contrast, technological regression is much rarer in larger populations which tend to have trading links with other groups, spread their knowledge across society, and enjoy regular infusions of new inventions.

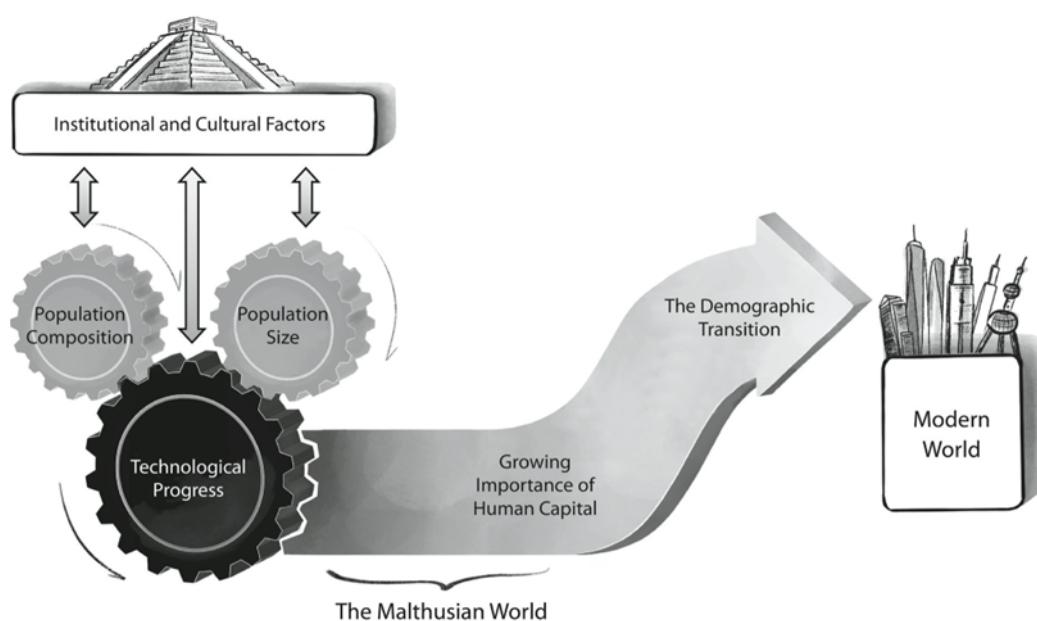
As will become apparent, this reinforcing cycle – technological development sustaining larger populations, while larger populations reinforce technological development – which has operated throughout most of our existence, gradually but continuously intensified until ultimately the rate of innovations reached a critical threshold. This was one of the sparks for the phase transition that hoisted humanity out of the epoch of stagnation.[8]

Population size operated in tandem with another wheel of change – population composition. [...] During the Malthusian epoch, it is reasonable to suppose that cultural traits that were complementary to the technological environment would have generated higher income, and thus a larger number of surviving offspring, leading therefore to a gradual increase in the prevalence of these traits in the population. And because these traits would in turn reinforce that pace of technological change, they would have contributed to the pace of the development process from stagnation towards growth. As we will see, among the most growth-enhancing of these cultural traits would have been norms, attitudes and customs associated with placing a high value on education, having a ‘future-oriented’ mindset and embracing what we might call an ‘entrepreneurial spirit’.

This process is epitomised by the evolution of the cultural inclination for parental investment in ‘human capital’ – factors that influence worker productivity, such as education, training and skill, along with health and longevity.

This mechanism suggests that in societies where technological innovation offers economic opportunity and thus where reproductive success is enhanced by the investment in human capital that allows one to seize it, a positive feedback loop will lead groups with higher stocks of human capital to dominate the population in the long run: their increasing dominance will foster technological progress, while technological progress will increase their in the population.

These, then, were the wheels of change that have been whirring beneath the surface for the entire course of human existence: technological innovations sustained larger populations and triggered the adaptation of the human population to their ecological and technological environments; larger and more adapted populations fostered in turn the ability of humankind to design new technologies and gain increasing control of their environment. Taken together, it was these wheels of change that led ultimately to a spectacular explosion of innovations on a scale never seen before in human history – the Industrial Revolution.



[...] Yet, a major puzzle remains unresolved: why did the cultures and institutions that were particularly conducive to technological development emerge in certain societies and not others?

Figures quoted in the text

Figure 1. The Mystery of Growth

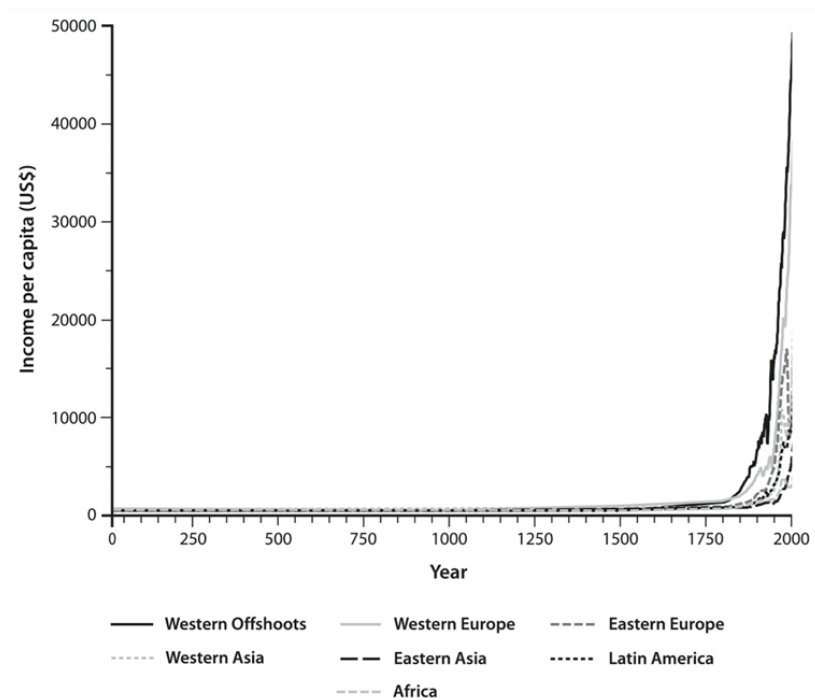


Figure 2. The Mystery of Inequality

The divergence in per capita income across world regions in the past two centuries

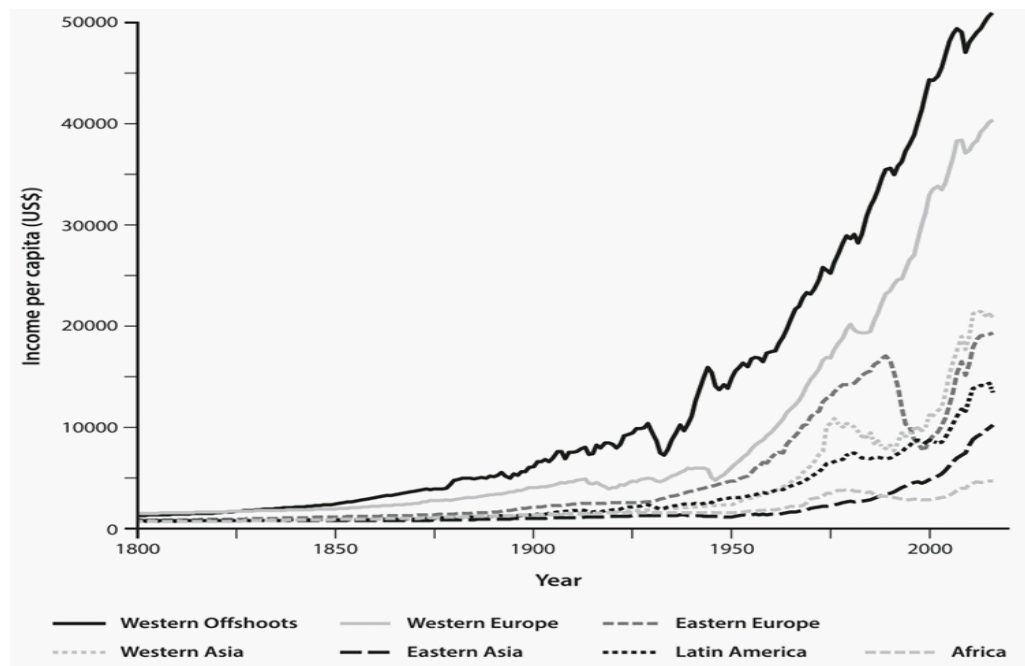


Figure 4. Effects of Technology Level on Population Density and Per Capita Income across Countries in the Year 1500

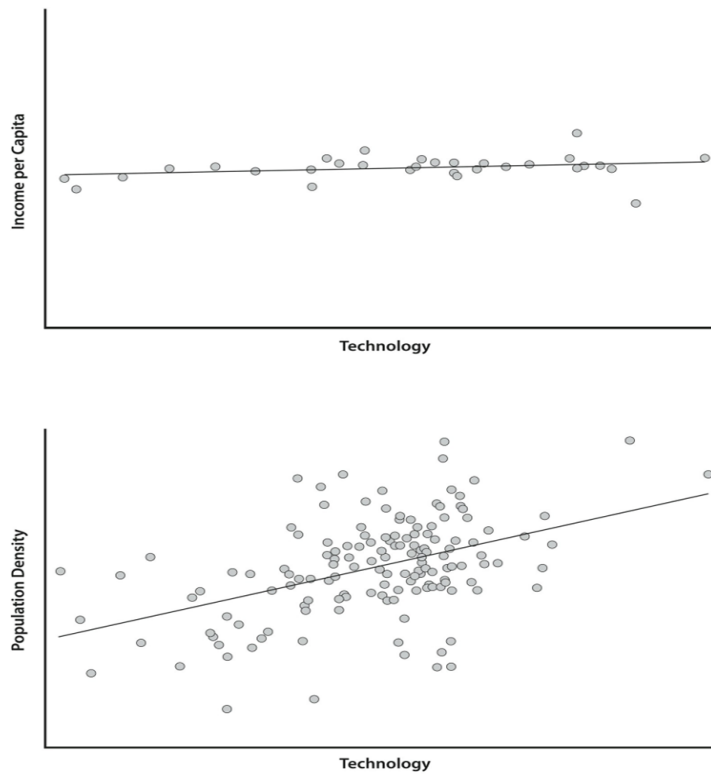


Figure 6. Human Population Growth during the Malthusian Epoch[\[4\]](#)

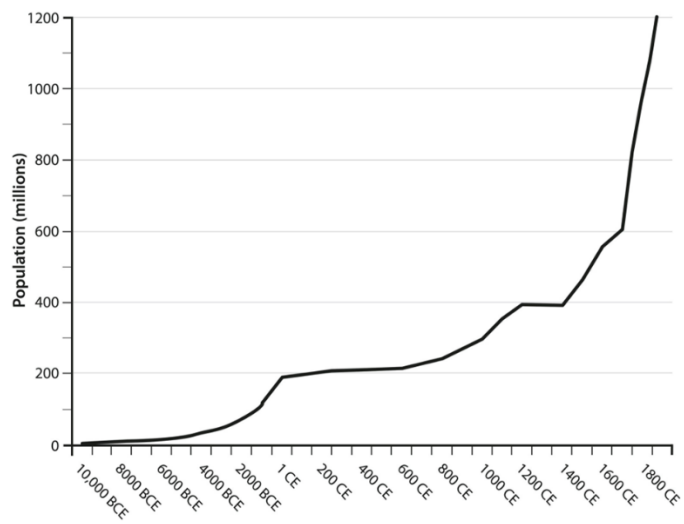


Figure 10. Evolution of Life Expectancy (at birth) across theGlobe, 1613–2013[\[2\]](#)

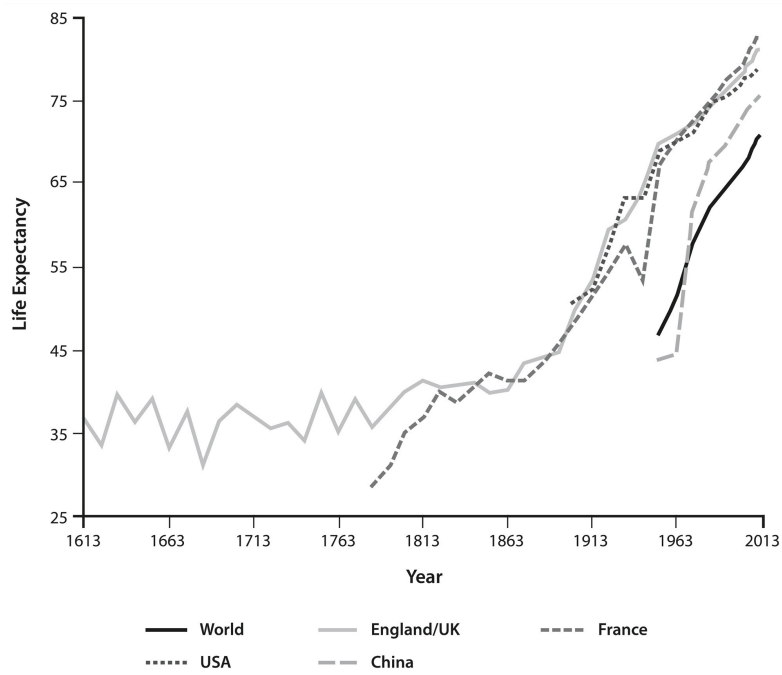


Figure 14. Income Per Capita in US Dollars, 2017[3]

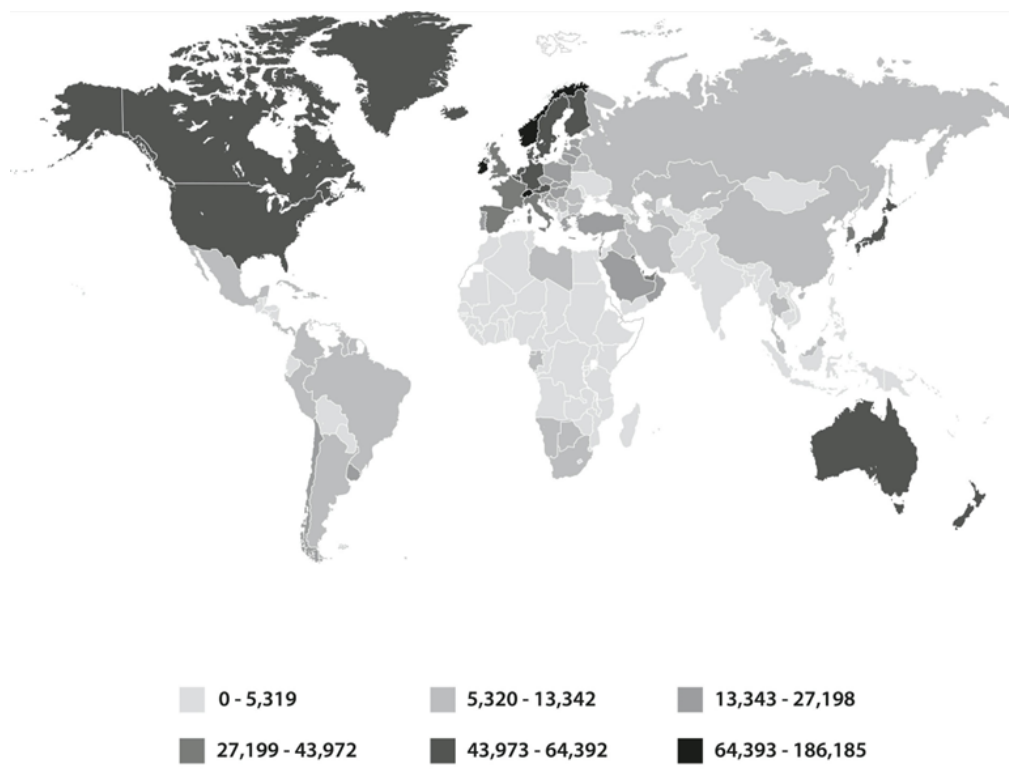


Figure 15. Evolution of Per Capita Income across Countries, 1850-2016[6]

