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ORIGINS OF PROSPERITY AND SEEDS OF INEQUALITY

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ABSTRACT

What ignited humanity's momentous ascent from millennia of stagnation to an era of sustained economic growth? And what are the roots of the vast disparities in the wealth of nations? These enduring mysteries, which have preoccupied scholars across generations, lie at the core of Unified Growth Theory. This encompassing framework captures the evolution of societies over the entire course of human history and identifies the universal wheels of change that governed humanity's long journey, propelled the growth process, and shaped inequality across the globe. The theory uncovers the forces underlying the dramatic transformation in living standards over the past two centuries, emerging from an economic ice age of near stagnation, while highlighting the enduring historical roots of the immense divergence in the prosperity of nations. It suggests that forces set in motion in the distant past played a pivotal role in shaping development across the globe and remain essential for the design of effective policies that foster economic progress and mitigate inequality in the wealth of nations.

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"…connect together the otherwise [seemingly]
disjointed and discordant phaenomena of nature."

— Adam Smith,
History of Astronomy, IV.76

1. Introduction

The transition from millennia of stagnation to an era of sustained growth marks one of the most significant transformations in the course of human existence. In the wake of an epoch in which the arc of human progress crept forward at a glacial pace, the past two centuries have witnessed a profound metamorphosis, as global per capita income surged fourteen-fold.

As prosperity skyrocketed in recent centuries, it triggered a second major transformation: the emergence of immense inequality across societies. Western European countries and some of their offshoots experienced this remarkable leap in living conditions in the nineteenth century, while this ascent was delayed in most other regions until the latter half of the twentieth century, generating stark disparities across world regions.

What explains the extraordinary transformation in living standards over the last few centuries, following an economic ice age that had defined most of human history since the emergence of Homo sapiens? What lies behind the origins of the vast disparity in the wealth of nations and the pronounced inequality that has emerged across regions? And why has the transition to modern growth proven so elusive for much of the developing world?

The transformation in societal well-being and the rise of global inequality have been shaped primarily by the onset and timing of the transition from stagnation to modern growth across societies, rather than by differences in their growth trajectories since the modern growth regime has emerged. Deep-rooted factors, operating over the course of human history, governed the timing of this transformation and played a pivotal role in the remarkable leap in human prosperity and the emergence of profound inequality among nations.

2. Unified Growth Theory

2.1. Conceptual Foundations

Modern growth theory has been central in elucidating the role of physical and human capital accumulation and technological progress in the development process, sustaining prosperity and inducing convergence in living standards across nations.[1] Yet, by centering exclusively on the modern growth regime, these models have been inherently ill-equipped to confront the deeper origins of growth and inequality. In particular, they do not shed light on the forces that precipitated the transition from stagnation to sustained economic growth, and they largely abstract from the pivotal role that demographic patterns have played over the course of human history—factors essential for understanding the growth process, the hurdles faced by developing nations in reaching the modern growth regime, and the origins of inequality among nations.[2]

In light of growing evidence on the persistent impact of historical and prehistorical forces on the process of development, the preoccupation of modern growth theory with societies that are 'parachuted' into the modern growth regime has become increasingly harder to defend. It has become evident that as long as growth theory relies on distinct and disconnected models to characterize separately the development process during the epoch of stagnation and the modern growth regime, our understanding of the contemporary growth process and the roots of inequality will remain limited and potentially distorted.

This methodological challenge mirrors the scientific struggle faced by Nicolaus Copernicus, the Renaissance-era astronomer who transformed humanity's understanding of the cosmos. Copernicus argued that without a unified framework governing celestial motion, scientific knowledge would remain fragmented. "[I]t is as though an artist were to gather the

[1] The pioneering contributions to this earlier strand of growth theory include Solow (1956); Lucas (1988); Romer (1990); Grossman and Helpman (1991); Aghion and Howitt (1992). While convergence is a central implication of many models in this tradition, initial conditions may still play a significant role, particularly in the presence of credit market imperfections and non-convexities (Galor & Zeira 1993; Galor 1996).

[2] Failure to account for demographic forces led to predictions that are inconsistent with key historical phases: (i) during the Malthusian Epoch, capital accumulation and technological progress was largely offset by population growth, resulting in negligible effects on the long-term level and growth rate of income per capita, and (ii) the fertility decline in the course of the demographic transition played a pivotal role in facilitating the transition to modern growth.

hands, feet, head and other members for his images from diverse models, each part excellently drawn, but not related to a single body, and since they in no way match each other, the result would be a monster rather than a man" (Kuhn 1957, p. 137). By organizing the motion of the celestial bodies within a single coherent system, Copernicus revealed an underlying order that reconciled previously disjointed phenomena. As Adam Smith later observed, the scientific task is not merely to represent isolated phenomena, but to "connect together the otherwise [seemingly] disjointed and discordant phaenomena of nature" (Smith, 1980, p. 33). It is this principle of unification—central to Smith's philosophy—that motivates the quest for a unified theory of economic growth.

Analogous attempts at unification have emerged in the physical sciences. In recent decades, physicists have sought a "theory of everything"—a single framework capable of reconciling quantum mechanics with Einstein's theory of general relativity, while accounting for the fundamental interactions governing gravitational, electromagnetic, weak nuclear, and strong nuclear forces. This endeavor reflects the conviction that a coherent understanding of the universe cannot rest on separate conceptual systems, but instead requires a unified framework able to account simultaneously for all known physical phenomena.

The development of unified growth theory is rooted in a parallel conviction that understanding the growth process and the roots of inequality would remain incomplete and fragile unless growth theory encompassed the principal engines of growth over the entire course of human history. The theory emerged from the realization that frameworks that view the modern era of economic growth and the epoch of stagnation as distinct phenomena rather than interconnected parts of a unified whole are inherently limited in their ability to explain the overarching historical forces that have shaped the contemporary growth process and the vast global disparities in the wealth of nations.

Unified Growth Theory confronts these challenges by formulating an analytical framework that captures the evolution of societies over the long arc of human existence, linking the historical engines of growth with contemporary prosperity and inequality (Galor, 2005, 2010, 2011, 2022, 2025). The theory uncovers the universal 'wheels of change' that have governed the journey of humanity across successive stages of development and world regions, echoing Adam Smith's depiction of "an immense system…uniting the most discordant phaenomena" (Smith, 1980, p.

31). Unified Growth Theory identifies the forces that constrained the human species to an epoch of subsistence-oriented existence and traces the manner in which their evolution ultimately gave rise to the onset of the transformative transition to sustained economic growth, setting in motion the divergence in the wealth of nations.

This unified analytical framework captures the joint evolution of technology, the size and composition of the human population, and income per capita over the long arc of human existence. Rather than examining the stages of the development process in isolation, the framework unifies the central features of long-run development within a single analytical structure. In particular, it incorporates: (i) the prolonged epoch of economic stagnation that characterized most of human existence; (ii) the eventual escape from Malthusian constraints; (iii) the rise of human capital formation as a central engine of economic expansion; (iv) the forces underlying the onset of fertility decline during the demographic transition; (v) the emergence of the modern regime of sustained economic growth; and (vi) the divergence in prosperity across nations in recent centuries.[3]

The unifying structure of the framework derives its strength from the coherence it seeks, mirroring Adam Smith's characterization of scientific progress as striving for "complete, and almost perfect coherence" (Smith, 1980, pp. 65–66). The theory reveals the fundamental forces that have governed the journey of humanity and ultimately triggered the transition from stagnation to growth, illuminating the central mechanisms underlying the growth processes of both developed and developing societies. Moreover, it highlights the enduring impact of historical and prehistorical factors in shaping the emergence of pronounced inequality in the wealth of nations over the past two centuries.

[3]In light of its philosophical foundations, the term *Unified Growth Theory*, introduced by Galor (2005), refers to growth models that integrate the entire growth process into a unified framework, capturing: (i) the endogenous evolution of technology, population, and income per capita throughout human history; (ii) the era of Malthusian stagnation; (iii) the endogenous transition out of the Malthusian trap; (iv) the onset of the demographic transition; and (v) the emergence of sustained economic growth. Some models capture segments of the broader process (e.g., Fernandez-Villaverde 2001; Cervellati & Sunde 2005; Voigtländer & Voth 2006; Boucekkine et al. 2007; de la Croix & Licandro 2013; and Dalgaard & Strulik 2015), while others rely on exogenously specified demographic trends and technological trajectories (Hansen & Prescott 2002; Parente & Prescott 2005) or external shocks (Lagerlöf 2003).

The distinctive strength of Unified Growth Theory lies in its capacity to provide analytical coherence to the complex and often chaotic currents of history, uncovering the fundamental forces that have universally shaped human development across the globe. Human history is rich with countless fascinating details: mighty civilizations that rose and fell, charismatic emperors who led armies to sweeping conquests and defeats, artists who created captivating cultural treasures, and philosophers and scientists who advanced our understanding of the universe. It is easy to become adrift in this ocean of details, pounded by the waves and unaware of the mighty currents beneath the surface.

Rather, Unified Growth Theory explores the underlying forces that have shaped the journey of humanity. It reveals how technological progress and population growth reinforced one another throughout the prolonged economic ice age, gradually building momentum while exerting only limited effects on income per capita. Technological advances sustained larger populations, while population growth in turn fostered innovation, yet productivity gains were largely absorbed by population expansion, leaving income per capita near subsistence in the long run. Once technological progress accelerated and eventually surpassed a critical threshold during the Industrial Revolution, literacy and numeracy became essential for coping with a rapidly changing economic landscape. As the returns to human capital gradually increased in response to further technological progress, parental investment progressively shifted toward human capital formation, and productivityowth began to outpace population growth, leading to higher income per capita. Ultimately, the continuing rise in demand for human capital triggered a sharp decline in fertility rates, freeing the growth process from the counterbalancing effects of population expansion and paving the path toward sustained improvements in living standards.

The quest to discern an underlying pattern in the trajectory of human history predates modern economic thought. From Plato through Hegel and Marx, influential thinkers advanced the view that history is governed by universal laws, leaving limited scope for societies to shape their own destinies (Popper 1945). Unified Growth Theory departs from such teleological perspectives. It does not presume that the evolution of human societies unfolds along a predetermined path toward either utopian or dystopian end states, nor does it purport to offer normative judgments about the desirability of historical trajectories or their consequences. Instead, it seeks to construct

a scientifically grounded framework that accounts for the evolution of societies across the long arc of human existence.

2.2. Patterns and Puzzles of Long-Run Development

2.2.1. Phases of Development

The Malthusian Epoch: Stagnation in Living Standards. For the vast majority of human existence, economic development unfolded under Malthusian constraints.[4] Improvements in technology or territorial expansion raised birth rates and reduced mortality, transforming gains in productive capacity primarily into population growth rather than sustained increases in income per capita (Figure 1). Cross-societal differences in technological capability and land productivity therefore manifested primarily in variations in population density, and their effects on living standards were only short-lived.[5]

Merely a few centuries ago, the human condition was commonly harsh and precarious, famously described as "nasty, brutish, and short" (Hobbes 1651). People subsisted on sparse, repetitive diets. Nearly one quarter of infants failed to survive their first year, succumbing to cold, hunger, or illness. Maternal mortality during childbirth was widespread, and life expectancy therefore seldom exceeded forty years. Amid these grim realities, economic downturns were not merely periods of austerity; they often precipitated famine, social breakdown, and large-scale loss of life.

[4] Termed after Thomas Malthus (1798), who identified the demographic feedback linking technological progress to population growth, confining living standards to subsistence levels for millennia.

[5] Empirical investigations rooted in the framework of Unified Growth Theory lend credence to the validity of Malthusian dynamics and the phenomenon of Malthusian stagnation. These findings are based on (a) cross-country evidence from 1–1500 CE (Ashraf & Galor 2011), (b) time-series data for 17 countries spanning 900–1870 CE (Madsen et al. 2019), (c) quantitative analysis of pre-industrial European societies from 1300–1800 CE (Lagerlöf 2019), and (d) within-country studies of pre-industrial societies, including (i) China (Chen & Kung 2016), (ii) England (Klemp 2012; Møller & Sharp 2014; Attar, 2023), (iii) Germany (Pfister & Fertig 2020), (iv) Italy (Fernihough 2013), (v) Spain (Chaney & Hornbeck 2016), (vi) Sweden (Lagerlöf 2015), and (vii) Denmark, Sweden, and Norway (Klemp & Møller 2016).

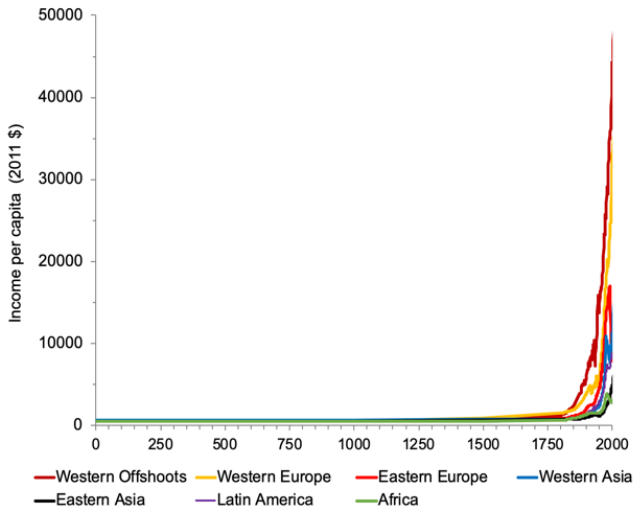

Figure 1. From Stagnation to Growth

The dramatic spike in income per capita across world regions over the past two centuries, emerging from thousands of years of near stagnation. 'Western Offshoots' are Australia, New Zealand, Canada, United States (as originally labelled by Maddison).[6]

The Malthusian Epoch: Reinforcing Population–Technology Feedback. This reinforcing interaction between population and technology emerged at the dawn of humanity and persisted for millennia. Technological advances enabled larger populations to be sustained, while increases in population size spurred faster innovation. Larger populations raised the likelihood of generating inventive individuals capable of developing new tools, goods, and practices, while the pressures they placed on existing resources—and the greater scope for specialization and idea exchange they enabled—accelerated the adoption and diffusion of these innovations (Boserup 1965; Simon 1977; Kremer 1993, Galor 2022). Nevertheless, technological progress was repeatedly absorbed by population expansion, preventing sustained increases in income per capita and keeping living standards close to subsistence over the long run.

The Escape from Stagnation and the Uneven Transition to Growth. Ironically, just as Malthus (1798) characterized the poverty trap as an immutable and enduring feature of the human

[6] Extrapolated based on data from Maddison Project Database 2010, 2013, 2018 (Bolt & van Zanden 2014; Bolt et al. 2018).

condition, the underlying forces he identified began to evolve, setting in motion an escape from an epoch of stagnation (Figure 1). Over the past few centuries, many world regions escaped Malthusian constraints, achieving sustained improvements in living standards. A sharp deceleration in population growth during the demographic transition weakened the traditional Malthusian mechanism, relieving the growth process of the offsetting effects of population expansion. As demographic constraints weakened, technological progress and the accumulation of human capital could be channeled into lasting economic advancement. This transformation, however, unfolded unevenly, occurring earlier in some regions than in others and giving rise to pronounced inequality across societies (Figure 2).

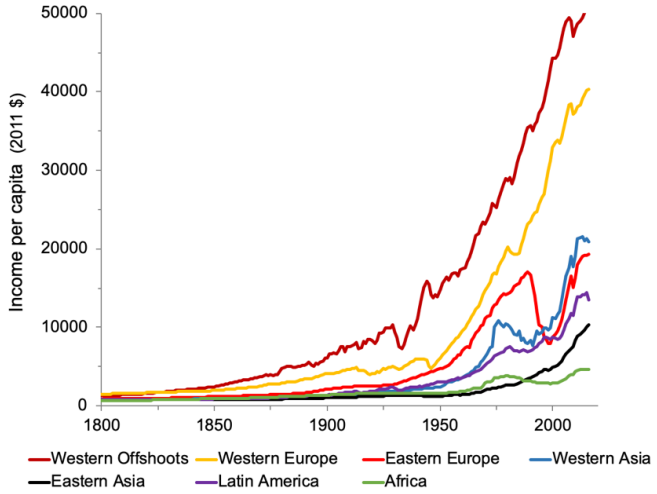

Figure 2. The Emergence of Inequality in the Wealth of Nations

The divergence in per capita income across world regions in the past two centuries. 'Western Offshoots' are Australia, New Zealand, Canada, United States (as originally labelled by Maddison).

2.2.2. Fundamental Historical Puzzles

In the aftermath of these sweeping transformations, a set of fundamental questions emerges. What sustained the epoch of economic stagnation that dominated much of human existence? What propelled humanity out of the grip of this poverty trap? And could these forces lie at the root of uneven development across the globe?

Unified Growth Theory identifies the principal forces that gave rise to and sustained the Malthusian trap, illuminating the mechanisms that confined humanity to a subsistence-oriented equilibrium. What sustained the prolonged epoch of economic stagnation that dominated much of human existence? Why did population growth repeatedly offset the potential gains from technological advances? Why did episodes of technological progress in the pre-industrial era fail to generate sustained increases in income per capita?

The theory elucidates the forces that drove the transition from stagnation to sustained economic growth, shedding light on the mechanisms underlying this far-reaching transformation. What accounts for the pronounced rise in income per capita over the past few centuries? What forces underlie the reversal of the positive association between income per capita and population growth that had prevailed throughout most of human existence? Would the emergence of sustained economic growth have been possible in the absence of the sharp fertility decline during the demographic transition? What obstacles confront less-developed economies in their efforts to enter a regime of sustained growth?

Relatedly, Unified Growth Theory provides a distinct perspective on the origins of the widening divergence in economic outcomes between developed and developing regions over the past two centuries. Why did some countries experience an early and rapid transition from stagnation to growth, while others remained trapped in prolonged stagnation? Why has the demographic transition unfolded more than a century earlier in some economies than in others? Did the transition to sustained economic growth in advanced economies hinder the development prospects of poorer regions? What role have deeply rooted institutional, cultural, and societal forces played in shaping the divergence in the wealth of nations? Are societies constrained by the geographical environments in which they emerged? Have historical and prehistorical conditions left an enduring imprint on global patterns of economic development?

2.3 Theoretical Challenges and their Resolution

Constructing a unified analytical framework that encompasses the distinct phases of development while permitting a seamless, endogenous transition across these regimes demanded substantial conceptual and methodological innovation. These advances were essential for establishing a dynamical system capable of resolving two of the most fundamental puzzles that earlier growth models were unable to capture: (i) an endogenous escape from the globally stable Malthusian equilibrium, which prevailed throughout much of human existence, driven by the internal interaction between demographic and technological dynamics; and (ii) an endogenous onset of the reversal in the universal positive association between parental resources and reproductive success, which characterizes all species, culminating in a pronounced fertility decline that released the growth process from the absorbing effects of population expansion, thereby permitting sustained improvements in living standards.

2.3.1 Designing an Escape from a Stable Malthusian Equilibrium

Across the epoch of stagnation, departures from the long-run level of income per capita, arising from technological advances, territorial expansion, and institutional or epidemiological changes, elicited a demographic response that repeatedly returned income per capita to its historical benchmark. What forces, then, enabled humanity to escape the confines of the Malthusian equilibrium? How did economies ultimately break free from a stable equilibrium that persistently pulled income back toward subsistence?

In seeking to uncover the forces governing the transition from stagnation to sustained growth, one might be tempted to interpret the Industrial Revolution as a shock that abruptly lifted economies out of the gravitational pull of the Malthusian equilibrium and shifted them into the modern growth regime. However, historical evidence from the eighteenth and nineteenth centuries points to a different pattern: productivity improvements during this period accumulated gradually, rather than materializing as a sudden, transformative break (Crafts & Harley 1992). In the early phases of industrialization, technological advances were incremental in nature, eliciting pronounced population responses alongside only limited gains in income per capita. It was not until nearly a century later that Malthusian forces weakened, population growth decelerated, and the conditions emerged for a sustained rise in living standards.

This gradual yet consequential transition from stagnation to growth poses a fundamental theoretical challenge. Since invoking a major shock within a dynamical system characterized by multiple locally stable equilibria cannot account for the observed take-off, a unified theory of economic growth necessitates a dynamical system that allows economies to transition both gradually and decisively away from a stable Malthusian equilibrium. Yet this condition appears at odds with the very notion of stability, since the attractive forces that define a stable equilibrium would ordinarily prevent a gradual escape.

Unified Growth Theory establishes a dynamic framework that resolves this conundrum, enabling a spontaneous escape from the stable Malthusian equilibrium that prevailed over most of human existence. At the heart of the theory is the foundational insight that the gradual evolution of the rate of technological progress, while exerting only limited effects on income per capita, eventually crosses a critical threshold and induces a sudden and profound transformation in the qualitative structure of the dynamical system, eliminating the previously stable Malthusian equilibrium and giving rise to the modern growth regime. This threshold crossing, which accounts for the transition from stagnation to sustained growth, is analogous to a phase transition from liquid to gas, as gradual heating produces only modest discernible effects below the boiling point but generates a sudden and profound transformation once that threshold is reached (Figure 3).[7]

In particular, the feedback between the *rate* of technological progress and the *size and composition* of the population operated throughout history, gradually accelerating the pace of technological progress. Nevertheless, for most of human history, this interaction had a negligible long-term impact on income per capita. Eventually, however, as technological change accelerated beyond a threshold, education became indispensable for coping with an increasingly complex technological environment, prompting parents to redirect scarce resources toward their children's human capital. Although technological progress expanded parental resources and

[7] For an early application of insights from bifurcation theory – the mathematical study of how systems undergo qualitative changes as parameters shift – to the analysis of long-run economic growth and regime transitions, see Galor (1996, 2007).

supported further population growth,[8] the growing emphasis on child quality ultimately caused population expansion to trail technological progress, thereby initiating the early phase of sustained economic growth.

Figure 3: Phase Transition

Illustrator: Ally Zhu

Yet, as long as the gains in income per capita remained largely restrained by population expansion, further improvements in living standards could not take hold without a reduction in population growth. The offsetting effects of population growth were neutralized only after fertility declined sharply, thereby enabling the transition to modern economic growth**.** What, then, generated the

[8] Formally**,** individuals face a subsistence-level consumption threshold below which survival cannot be sustained**.** As wages rise, parents can devote less effort to meeting basic subsistence needs**,** freeing time for childrearing and thereby increasing fertility.

puzzling reversal of the positive link between parental resources and reproductive success—a regularity observed across species?

2.3.2 Accounting for Fertility Decline amid Rising Income

During the Post-Malthusian regime, a transitional phase between the Malthusian epoch and sustained modern growth, technological progress exerted opposing effects on fertility behavior. Rising income relaxed subsistence consumption constraints, enabling households to devote additional resources to childrearing—an income effect. At the same time, the still-limited demand for human capital induced a partial reallocation of resources toward child quality—a substitution effect. Because the substitution effect remained modest at this stage, the income effect dominated, allowing households to expand both the quantity and the quality of their children.

The empirically grounded mechanism that ultimately reversed the positive relationship between parental resources and reproductive success lies in the central role of human capital in adapting to an increasingly dynamic technological environment. As technological acceleration persisted, the returns to investment in education rose sharply, strengthening the substitution effect despite ongoing income growth. Households therefore redirected resources toward child quality, leading to a sustained decline in fertility and overturning the long-standing positive association between income and reproductive success.

3. The Wheels of Change

What were the forces—the *wheels of change*—that operated persistently during the Malthusian epoch and ultimately brought about the escape from the Malthusian trap, the emergence of human capital as a central engine of growth, the reversal of the positive association between income and reproductive success, and the profound transformation in living standards over the past two centuries?

Although these forces were initially subtle and scarcely perceptible, they intensified gradually, analogous to a physical system approaching a critical threshold at which its qualitative structure

changes abruptly. The transition from stagnation to growth over the past two centuries reflected the culmination of such long-running processes that had been gathering momentum beneath the surface since the dawn of humanity. While the shift itself was rapid and dramatic, the forces that produced it were formed and strengthened over the course of the Malthusian epoch. What, then, set this phase transition in motion?

3.1. Technology−Population Size Coevolution

For most of human history, the joint evolution of population and technology shaped a mutually reinforcing process along the grand arc of development. Over the 12,000 years from the Neolithic Revolution to the onset of the industrial era, technological advances expanded the capacity of societies to sustain ever larger populations, permitting a several-hundredfold expansion in the human population. This growing population, in turn, broadened the pool of potential innovators and intensified the exchange of ideas, gradually extending the technological frontier from stone tools in the early stages of development to steam-based innovations that defined the initial phases of the Industrial Revolution.

In the pre-industrial era, advancements in farming techniques and cultivation methods translated primarily into demographic expansion rather than sustained material improvement. Greater food availability raised survival prospects, spurring population growth through higher fertility and lower mortality. However, as arable land grew scarcer, the expanding population placed increasing pressure on a finite land base, reducing the per capita share of crops and causing living standards to gravitate back toward their historical benchmark, stabilizing only once population growth had fully absorbed the productivity gains. Thus, while technological progress altered the scale of human societies, it failed to generate persistent improvements in living standards.

This relationship between population scale and technological advancement is evident across cultures and regions.[9] Regions that experienced an earlier transition to agriculture, such as the

[9] The coevolutionary relationship between population and technology during the Malthusian and Post-Malthusian eras is supported by a wide body of historical evidence, including illustrative historical accounts (Boserup 1965; Simon 1977; Kremer 1993; Galor 2022) as well as formal time-series analyses (Madsen et al. 2010).

Fertile Crescent, grave rise to the emergence of the largest prehistoric settlements and sustained a persistent technological advantage. Similarly, areas with land more suitable for cultivation, and thus capable of supporting higher population densities, were more likely to develop and adopt advanced technologies (Diamond 1997).

The mutually reinforcing relationship between technological progress and population size gradually accelerated the pace of innovation over the course of human history, until it eventually crossed a critical threshold, triggering a phase transition. As technological change intensified, human capital became indispensable for navigating the rapidly evolving economic landscape.[10] The rising demand for human capital induced parents to allocate their limited resources toward the education of fewer children.[11] This fertility decline weakened the counterbalancing effects of population growth, enabling the emergence of sustained economic growth.[12]

This interaction between two central wheels of change—technological progress and population size—was among the forces that precipitated the historic phase transition through which humanity emerged from an epoch of stagnation (Galor & Weil 2000; Lagerlöf 2006).

3.2. Technology–Population Composition Coevolution

The interaction between the composition of the population and technological progress generated an additional coevolutionary dynamic throughout the Malthusian era. As technological advances periodically alleviated Malthusian pressures, they not only expanded the population but also altered its internal composition. Individuals whose intergenerationally transmitted traits were better aligned with the evolving technological landscape achieved higher incomes and, during the Malthusian epoch, experienced greater reproductive success, leading to the increasing prevalence

[10] Technology–skill complementarity underpins related studies (e.g., Galor and Tsiddon 1997; Galor & Moav, 2000, 2004, 2006; Hassler and Rodríguez Mora 2000; Galor et al. 2009) and is documented in the early phases of industrialization in England, France, and Germany (De Pleijt et al. 2020; Squicciarini and Voigtländer 2015; Becker et al. 2011; Madsen and Murtin 2017).
[11] Impacts of rising returns to human capital on fertility decline is documented in the United States (Bleakly and Lange 2009; Ager and Cinnirella 2020), Germany (Becker et al. 2010), France (Murphy 2015; Bignon and García-Peñalosa 2021), Ireland (Fernihough 2017), China (Shiue 2017), England (Klemp and Weisdorf 2019), and Nigeria (Okoye and Pongou 2024), as well as in cross-country analyses (Galor and Mountford 2008; Vogl 2016; Madsen and Strulik 2023).
[12] The pivotal role of fertility decline in the rise of economic growth is supported by quantitative and long-run time-series evidence (Cervellati and Sunde 2015; Madsen et al. 2020).

of these traits in the population. The progressive accumulation of these complementary traits further reinforced technological progress and induced additional changes in population composition, ultimately laying the groundwork for the transition from stagnation to sustained growth.[13]

The Malthusian environment fostered the gradual emergence of growth-enhancing traits and cultural norms, including a predisposition toward investment in human capital, a future-oriented mindset, and an entrepreneurial spirit (Galor & Moav 2002; Galor & Michalopoulos 2012; Galor & Özak 2016; Galor et al., 2025). As these traits spread over time, they contributed to a faster pace of technological advance, establishing a coevolutionary process that would ultimately underpin a transformative rise in human prosperity.

One salient manifestation of this process is the evolution of parental predisposition toward child quality. The Neolithic Revolution expanded the scope for division of labor and fostered trade among individuals and communities, increasing the complexity of social interaction and raising the returns to human capital. Individuals born to parents with a stronger inclination toward investing in offspring quality attained higher incomes and, during the Malthusian epoch—when reproductive success rose with aggregate resources—produced a larger number of surviving offspring. Consequently, a greater predisposition toward child quality conferred an evolutionary advantage, gradually increasing its prevalence within the population. As this trait spread, it further accelerated technological progress, ultimately facilitating the transition from stagnation to sustained growth (Galor & Moav 2002).[14]

The extensive genealogical records of nearly half a million descendants of European settlers in Quebec between 1608 and 1800 provide a unique demographic laboratory for examining this mechanism. Tracking the descendants of the founding population over four generations reveals a

[13] The distribution of traits within populations can adjust on relatively short timescales. Following the Neolithic Revolution, for example, populations exposed to new ecological conditions experienced changes in the prevalence of traits related to disease resistance, dietary metabolism (such as the ability to digest lactose in societies that domesticated cattle, goats, or sheep), and physiological adaptation to sustained high-altitude environments. Moreover, cultural traits, transmitted through learning and social interaction, can evolve even more rapidly, allowing populations to adjust behavior, norms, and skills within relatively few generations (Galor 2022).

[14] Indeed, a predisposition toward educational attainment has increased gradually over the past 9,000 years, since the Neolithic Revolution, among populations in Western Asia and Europe (Akbari et al. 2024).

striking pattern: the largest dynasties emerged from settlers with intermediate fertility, which mechanically implied greater investment in each child's human capital. In contrast, highly fertile founders, who raised larger families, invested less in each child and left fewer descendants after several generations. Overall, the evidence indicates that a moderate family size was associated with greater long-run lineage expansion, reflecting the positive effects of smaller families on children's survival, marriage prospects, literacy acquisition, and subsequent reproductive success (Galor & Klemp 2019).[15]

This coevolutionary process can be viewed equivalently as a gradual adaptation of the human population to an evolving technological environment, operating through changes in population composition. The mutually reinforcing interaction between technological progress and human adaptation throughout history progressively reshaped the composition of the human population, increasing the prevalence of growth-enhancing traits. This transformation accelerated innovation until it crossed a critical threshold, triggering a phase transition. As technology advanced at an unprecedented pace, human capital became indispensable for effective participation in an increasingly complex economic environment. The rising return to education induced parents, regardless of their initial predisposition toward education, to reduce fertility and devote a greater share of their limited resources to investment in their children's human capital. This fertility decline weakened the counterbalancing effects of population growth, allowing sustained improvements in economic growth.

The interaction between these two wheels of change—technological progress and human adaptation—thus constituted an additional force behind the phase transition that lifted humanity out of its prolonged epoch of stagnation (Galor & Moav 2002).[16]

3.3. Uneven Rotation of the Wheels of Change Across Societies

[15] This evidence from England between 1541 and 1851 reveals a comparable pattern: families that allocated greater resources toward their children's human capital saw a higher number of their offspring survive into adulthood (de la Croix et al., 2019).
[16] For a quantitative analysis of this model, refer to Collins et al. (2014).

The wheels of change operated throughout human history in all world regions, but their rotation was neither uniform nor synchronized. Technological innovations expanded productive possibilities and reshaped the economic environment, enabling population growth and eliciting gradual adaptation to increasing technological complexity. In turn, larger, increasingly adapted populations enhanced humanity's capacity to generate, refine, and disseminate new technologies, extending control over natural constraints. Over time, the cumulative interaction of these forces propelled societies toward a critical juncture, culminating in a phase transition that released humanity from the persistent grip of the Malthusian trap. This transformation marked the onset of sustained technological acceleration, fostered human capital formation, induced a pronounced fertility decline, and generated unprecedented improvements in living standards.

Yet, the speed and intensity with which technological progress interacted with population size and population composition differed markedly across societies. Institutional frameworks, cultural orientations, geographic endowments, social structures, and colonial legacy shaped the pace of these self-reinforcing processes and produced distinct historical trajectories toward the modern growth regime. Societies that secured property rights, cultivated forward-looking attitudes, and facilitated the diffusion of knowledge amplified these dynamics more rapidly and transitioned earlier from stagnation to sustained growth (Galor 2010, 2011, 2022). In this respect, these historical conditions did not alter the underlying mechanics of development, but governed the speed at which societies moved from stagnation toward sustained growth.

These divergences were further magnified in an increasingly interconnected world. In particular, the expansion of international trade during the colonial era played a central role in shaping cross-country differences in the timing of demographic transitions, thereby reconfiguring the global distribution of population and widening disparities in income per capita (Galor & Mountford 2006, 2008). As trade expanded, early-industrializing economies increasingly specialized in skill-intensive production, raising the demand for educated labor and strengthening incentives to invest in human capital, which accelerated fertility decline and hastened the transition to the modern growth regime. In contrast, economies specializing in unskilled labor–intensive activities faced

weaker incentives for human capital accumulation. This diminished demand for education delayed demographic transitions and prolonged exposure to the forces of economic stagnation.[17]

4. Human History Through the Lens of Unified Growth Theory

4.1. The Malthusian Epoch: Progress in the Absence of Enduring Prosperity

Human history unfolded along a trajectory unlike that of any other species. Armed with powerful cognitive abilities and the capacity for social cooperation and communication, humans gradually developed increasingly sophisticated technologies, improving their effectiveness in hunting and gathering, adapting to diverse habitats, and expanding their material base. This resource expansion supported sustained population growth and coincided with a growing presence of individuals whose skills, behaviors, and practices enhanced their ability to develop, adopt, and effectively employ new technologies. This process gave rise to *Homo technologicus*: humans with dexterous hands suited for tool-making and food preparation, arms capable of skilled projectile use, and cognitive and social capacities that supported innovation, strategic coordination, and cooperation.

Across long stretches of human history, the reciprocal interaction between technological advances and adaptive social practices progressively expanded humanity's capacity to operate in diverse and changing environments. As human groups grew in number and capabilities, they moved beyond their original habitats, dispersing out of Africa and gradually settling across a wide range of ecological settings. They developed ways to cope with climatic variability, refined subsistence strategies suited to local conditions, and continuously adjusted hunting and gathering practices—processes that reinforced population expansion and geographic spread.

Nearly 12,000 years ago, humanity experienced its first major structural transformation—the Neolithic Revolution—which fundamentally redirected the course of human development. Within a relatively short historical interval, large segments of the human population shifted away from

[17] Drawing on a panel of 223 countries covering the years 1962–2019, Ekanayake et al. (2023) document empirical support for the heterogeneous impact of trade on fertility and educational investment. Beyond trade, the diffusion of technology constitutes another key force shaping comparative development in an increasingly interconnected world (Cervellati et al. 2023).

nomadic foraging toward sedentary modes of life, centered on the systematic cultivation of land and the domestication of animals such as cattle, sheep, and goats. Advances in agricultural practices, including irrigation and improved farming techniques, raised productivity and enabled societies to support increasingly dense populations. As populations expanded, occupational specialization deepened, giving rise to groups engaged in governance, artistic expression, and early scientific inquiry—developments that further stimulated technological progress and generated persistent advantages for societies that adopted these changes early.

The human landscape was progressively reshaped as dispersed farms coalesced into villages, and villages grew into towns and fortified cities. These urban centers became sites of concentrated political authority and religious life, marked by palaces, temples, and defensive structures that enabled elites to organize armies and engage in recurrent conflicts over territory, status, and control.

For most of human history, technological progress, population growth, and cultural adaptation interacted in a mutually reinforcing manner. Improvements in technology expanded productive capacity and supported population growth, while larger populations and evolving cultural practices increased both the supply of potential innovators as well as the demand for new techniques. This reciprocal dynamic sustained the gradual accumulation and diffusion of technologies, reinforcing population expansion and perpetuating a long-run process of technological advancement across societies.

Despite this persistent dynamism, one central feature of human existence remained largely stable: living standards. For much of human history, technological improvements did not translate into lasting gains in material well-being. Instead, increases in productivity and resource availability were largely absorbed by population growth, dispersing their benefits across a growing number of people. Short-lived episodes of rising prosperity occasionally followed major innovations, but these gains were repeatedly eroded as population pressures reasserted themselves, drawing living conditions back toward subsistence. Regions endowed with fertile land and characterized by prolonged political stability—such as ancient China, Egypt, Greece, Persia, and Rome—periodically achieved higher levels of material comfort, as new technologies and organizational

forms spread. Yet these advances proved transient, as demographic expansion ultimately offset their effects.

4.2. The Onset of Sustained Growth

Eventually, however, the accelerating interaction of the wheels of change propelled the pace of technological advancement beyond a tipping point. The rapid innovations of the Industrial Revolution, which emerged in regions of northern Europe during the eighteenth and nineteenth centuries, created demand for a novel resource: the skills and knowledge necessary for workers to navigate an ever-evolving technological landscape.

The increasing demand for educated workers capable of navigating the rapidly evolving technological landscape contributed significantly to the formation of human capital. As a growing number of occupations in manufacturing, trade, and services required literacy, numeracy, arithmetic, and a range of mechanical abilities, parents were incentivized to invest in their children's education. With parental resources gradually channeled toward human capital formation, the rate of population growth began to lag behind technological progress, contributing to rising income per capita as well as population growth rates. Ultimately, however, the intensification of the demand for human capital forced parents to dramatically reduce their fertility rates so as to permit further investment in the education of children, leading to the sharp decline in fertility that characterized the demographic transition (Galor & Weil 2000; Galor & Moav 2002; Galor & Mountford 2008).[18] The surge in life expectancy, the reduction in child mortality, and the decline in child labor extended the period over which returns to education could be realized, further enhancing the incentive to invest in human capital and reduce fertility rates (Galor & Weil 1999; Cervellati & Sunde 2005). Moreover, the impact of technology-skill complementarity on narrowing the gender wage gap increased the opportunity cost of child-rearing, further promoting smaller family sizes (Galor & Weil 1996). These combined forces ignited the demographic

[18] Cultural factors have played a pivotal role in shaping the onset of declining fertility rates (Spolaore & Wacziarg 2016). The early decline in fertility in mid-18th century France—nearly a century ahead of other Western European countries—is widely attributed to cultural influences (Blanc 2024). However, the pronounced decline observed in France after 1870 is largely attributed to economic forces driven by technological acceleration.

transition, breaking the longstanding positive relationship between economic growth and birth rates.

This significant decline in fertility freed the development process from the counterbalancing pressures of population growth, allowing technological advancements to generate enduring prosperity rather than temporary gains. With an increasingly skilled workforce and greater investment in human capital, technological progress further accelerated, enhancing human prosperity and delivering sustained growth in per capita income.

4.2. The Onset of Sustained Growth

As the interaction of the wheels of change intensified, technological progress crossed a qualitative threshold. The innovations of the Industrial Revolution, emerging in northern Europe during the eighteenth and nineteenth centuries, gave rise to sustained demand for the skills and knowledge required to function in an increasingly complex technological environment.

The rising demand for educated workers capable of operating amid this evolving technological environment fostered the accumulation of human capital. As technological change spread across manufacturing, trade, and services, a growing share of occupations began to require literacy, numeracy, and a range of cognitive and mechanical skills. In response, parents increasingly devoted resources to the education of their children. As parental investment shifted toward human capital, population growth began to decelerate relative to technological progress, allowing productivity gains to translate into rising income per capita and population growth rates. Yet, ultimately, the intensification of demand for human capital prompted parents to reduce fertility in order to sustain greater investment in education, initiating the demographic transition (Galor and Weil 2000; Galor and Moav 2002; Galor and Mountford 2008).[19]

[19] Cultural factors have played a pivotal role in shaping the onset of declining fertility rates (Spolaore & Wacziarg 2016). The early decline in fertility in mid-18th century France—nearly a century ahead of other Western European countries—is widely attributed to cultural influences (Blanc 2024). However, the pronounced decline observed in France after 1870 is largely attributed to economic forces driven by technological acceleration.

This shift was further reinforced by complementary demographic and labor market developments. Improvements in life expectancy extended the horizon over which investments in education could yield returns, strengthening incentives to prioritize child quality over quantity (Galor and Weil 1999; Cervellati and Sunde 2005). In parallel, technology-skill complementarity contributed to a narrowing of the gender wage gap, increasing the opportunity cost of child rearing and reinforcing the move toward smaller families (Galor and Weil 1996). Collectively, these forces propelled the demographic transition, breaking the long-standing link between economic progress and population growth.

This pronounced decline in fertility released the development process from the offsetting pressures of population expansion, allowing technological progress to translate into lasting improvements in living standards rather than transient gains. As investment in education deepened, technological advance accelerated further, sustaining growth in income per capita.

4.3. The Uneven Road to Modern Growth and Global Inequality

Much like the diffusion of the Neolithic Revolution millennia earlier, the transition to modern economic growth was not a simultaneous global event. The Industrial Revolution and the demographic transition emerged first in Western Europe and gradually spread across the world over the course of the nineteenth and twentieth centuries. Wherever this phase transition occurred, it generated sustained improvements in living standards. Yet its staggered timing across societies gave rise to the Great Divergence: persistent differences in income per capita between societies that entered the modern growth regime early and those that remained trapped in stagnation for longer.

The uneven timing of the transition from stagnation to growth reflects the interaction of institutional, cultural, societal, and geographical forces, along with the impact of colonialism. The emergence of inclusive institutions in some societies and extractive institutions in others steered societies onto distinct growth trajectories, contributing to divergence over time (North 1990; Acemoglu and Robinson 2012). Similarly, the uneven diffusion of growth enhancing cultural

norms, such as future orientation, trust, and cooperation, contributed to persistent cross societal differences in economic performance (Guiso et al. 2006; Spolaore and Wacziarg 2013).

Institutional reforms at critical junctures in the course of human history, as well as the emergence of distinct cultural characteristics, have occasionally placed societies on diverging growth trajectories over time. Nevertheless, random events—dramatic and substantial as they often appear—have tended to play a transitory and limited role in the long-run progression of humanity as a whole and are unlikely to account for the persistent divergence in economic prosperity across countries and regions over the past few centuries. It is not a coincidence that the first great civilizations arose in fertile lands around major rivers, such as the Euphrates, Tigris, Nile, Yangtze, and Ganges. Nor could random historical or institutional developments alone have sustained the emergence of major ancient cities far from reliable sources of water or generated transformative agricultural technologies in the frostbitten forests of Siberia or the heart of the Sahara Desert.

Institutional and cultural arrangements typically operated as key intermediating mechanisms, shaped by deeper historical forces and mediating the influence of external forces on long-run development outcomes. They channeled deep historical conditions and shaped more recent trends into diverging development trajectories.

At the outer layer of the roots of inequality, globalization and colonization amplified pre-existing disparities. These processes accelerated industrialization among Western European societies while delaying the escape from the Malthusian trap in less-developed regions. In particular, the persistence of extractive colonial institutions, designed to perpetuate existing economic and political inequalities, further exacerbated the gap in the wealth of nations. Yet, these forces of domination, exploitation, and asymmetric trade during the colonial age were predicated on forces that contributed to uneven development prior to the colonial era and persisted beyond it.

At a deeper layer, geographical conditions shaped the emergence of growth-enhancing cultural traits, such as a future-oriented mindset, social cooperation, as well as institutions and effective state capacity.[20] Biodiversity facilitated an early transition to sedentary agricultural communities,

[20] Talhelm et al. 2014; Galor & Özak 2016; Galor et al. 2026; and Mayshar et al. 2022.

raising population density and amplifying the benefits from cooperation and property rights, laying the foundations for political centralization and growth-enhancing cultural norms. Differences in land fragmentation further influenced institutional trajectories: fragmented landscapes, as in much of Europe, tended to foster political competition and the emergence of more inclusive institutions, whereas high land connectivity, as in imperial China, facilitated political centralization and the persistence of more extractive institutional arrangements (Jones 1995). Land suitability for large plantation in Central America favored emergence and persistence of extractive political and educational institutions, fostering inequality and limited investment in human capital (Engerman & Sokoloff 1997; Galor, et al. 2009). Finally, harsh disease environments, in regions such as such as sub-Saharan Africa, limited agricultural and labor productivity and constrained political centralization, with persistent consequences for long-run prosperity.

These geographical influences extend further back to the dawn of the Agricultural Revolution. Variation in biodiversity, the availability of domesticable plant and animal species, and continental orientation shaped the timing of the transition from hunter-gatherer societies to sedentary agriculture across regions (Diamond 1997). Societies that experienced an earlier agricultural transition enjoyed a technological and organizational head start that persisted throughout the pre-industrial era, supporting higher population density and more complex economic structures. Yet this early advantage gradually dissipated with the onset of industrialization. As economies entered a globalizing world in which comparative advantage in agriculture limited technological spillovers and slowed urbanization, early agricultural specialization no longer conferred a lasting edge. Consequently, societies that transitioned to agriculture first were not predestined to become the most prosperous in the modern era (Galor 2022).

Some of the roots of contemporary inequality in the wealth of nations lie still further in the past, during the prehistoric dispersal of modern humans from the cradle of humanity in Africa. As human populations dispersed across the globe, successive migratory bottlenecks shaped the degree of population diversity within societies. This variation in diversity exerted a lasting influence on economic performance across historical epochs. Societies characterized by intermediate levels of diversity benefited from a balance between innovation-enhancing cross-fertilization and social cohesion, fostering technological progress and long-run prosperity (Ashraf and Galor 2013). This

diversity channel operated throughout history, influencing development in the pre-industrial era and continuing to shape both aggregate prosperity and the degree of inequality within societies today.[21]

Despite the long shadow of history, the fate of nations has not been carved in stone. Understanding how deep-rooted geographical, institutional, and cultural forces have shaped the development process can guide the design of strategies that mitigate the legacy of the past, while respecting the distinct historical and societal contexts of individual nations. As the great cogs that have governed the journey of humanity continue to turn, measures that enhance future oriented mindset, gender equality, and pluralism, and adaptable education hold the key to expanding the frontier of shared prosperity.

5. Reflecting on the Invisible Chains of Development

The journey of humanity is woven with captivating passages. It is easy to drift in this ocean of details, buffeted by the waves and unaware of the mighty current underneath. Unified Growth Theory reveals these deeper currents and clarifies how their interaction governed the engines of economic growth and the evolution of inequality in the wealth of nations. It provides a coherent framework for decoding the long arc of human development, illuminating the forces that shaped technological progress, population dynamics, and the forces behind growth and inequality in the wealth of nations, as well as the constraints and opportunities that lie ahead. In its absence, the history of human development would be reduced to a mere chronology of events—an incomprehensible wilderness of rising and falling civilizations. Revealing the forces that turn the wheels of change over the course of human history, Unified Growth Theory transforms development from scattered episodes into an integrated evolutionary process—reflecting Adam Smith's perspective on the essence of theory, uncovering "the invisible chains which bind together all these disjointed objects" (Smith, 1980, p. 33).

[21] Arbatlı et al. (2020); Ashraf et al. (2021); and Galor et al. (2023, 2026).

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