

## Introduction

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What can economic analysis teach us about the “long period”, those times whose duration is such that nothing (or almost nothing) can be treated as a constant – neither population, nor knowledge, nor political and economic institutions? What concepts and tools can allow economists to think about the movements of the economy over a horizon of several centuries, or even millennia?

Because of the specificity of the time spans under consideration, the long period requires its own analytical tools. We are very far here from the relatively short time horizons usually studied by economists. The time for transactions between agents – that is of the adjustment of allocations – is limited to a few moments. The time for price adjustment, in order to level out supply and demand for goods and services, is generally not much longer. The time for the movement of capital from one sector of the economy to another – a movement that tends to level out profit rates between sectors – has for its part greatly diminished in the last decades.

An economic analysis of the long period examines much longer time spans, the spans needed to adjust the entire economy: adjustments in population, technologies, institutions. Ideally, adopting a long-period perspective means that nothing is taken as a given, neither the number of individuals, nor their level of knowledge, nor their production techniques, nor the institutions within which they operate. From the perspective of the long period, the theoretical framework should only include our planet – Earth and its resources – its inhabitants (men and women), as well as a stock of knowledge; and it should study the relationships between these elements over time. It would be a study of the *rhythms* at which humans, their techniques and resources accumulate.

Do humans “accumulate” too fast in relation to knowledge, thus threatening the population with the plights of poverty and misery? Or, conversely, does knowledge accumulate more rapidly than humans, thus creating prospects for lasting prosperity? These accumulation processes cannot be dissociated from the institutional frameworks in which they take place (the State, the market), which leads us to another fundamental question: namely the links that exist between these rhythms of accumulation and institutional dynamics. Does the improvement in the institutions provide a necessary condition, or even a sufficient condition, for economic take-off? Finally, the environmental damage caused by human activities (global warming, threats to biodiversity) give rise to many questions, such as: are population growth and economic growth sustainable on a finite planet?

The purpose of this book is to provide answers to these complex questions by exposing the recent developments of the economic theory of the long period.

## Unified Growth Theory

The economic analysis of the long period has undergone a major theoretical revolution in the twenty-first century, with the development of “Unified Growth Theory”. We owe this theoretical revolution to Oded Galor and his co-authors, as well as to an increasing number of economists of the “long period”.

Unified Growth Theory is a class of varied dynamic models, whose common denominator is to *formalise the economic development processes (population, technology, output per capita) as a whole in one analytical framework*, hence the term “unified” growth.<sup>1</sup>

More specifically, Unified Growth Theory aims to account for the different phases of the economic development process – phases labelled as “economic regimes” – as well as the mechanisms of transition between these regimes.<sup>2</sup> It theorises the existence and succession, over the centuries, of different economic regimes, with the transition between regimes explained from *within* the model.

From the perspective of the long period, one major stylised fact is the birth of an era of output per capita growth, which occurred at the time of the industrial revolution, after millennia of economic activity experiencing a trend of (near) stagnation.

Each of these phases of history – stagnation and growth – can be explained or “rationalised” by economic thought. In his *An Essay on the Principle of Population* (1798), Malthus affirmed that no social progress was sustainable: improving living conditions necessarily led to demographic pressure, thus cancelling any possibility of lasting expansion, hence stagnation. More recently, modern growth theory – as exemplified by Solow’s (1956) model – sees output per capita growth in the nineteenth and twentieth centuries as the result of the increase in capital intensity (the amount of capital (machines, tools) per worker). Each theory helps, in its own way, to shed light on a part of history, *but only on a part*: the Malthusian doctrine could not foresee the emergence of sustainable growth, and Solow’s model cannot explain the long pre-industrial era of (near) stagnation preceding the phase of growth.

Whereas these analytical frameworks can be mobilised separately to account for the economic dynamics of distinct segments of history, Unified Growth Theory offers a *single* theoretical system to explain the shift from an economic regime of stagnation – as analysed, notably by Malthus – to a regime of output per capita growth – which Solow analysed. Within this unified analytical framework, the transition from one

<sup>1</sup> This is the very definition proposed by Galor (see Galor 2011, p. 5). Other presentations of Unified Growth Theory can be found in Galor (2005, 2010). The unified growth models include, in particular, those of Galor and Weil (1999, 2000) and of Galor and Moav (2002, 2005).

<sup>2</sup> This second definition, which emphasises the endogenous nature of the transition between regimes, is also proposed by Galor (2011, p. xvi of the Preface).

economic regime to another is not caused by some “exogenous” shock, but rather results from latent mechanisms present in the economy (“latent dynamics”). The expression “unified growth” is used to name this theoretical attempt to gather, within a single model, several distinct economic regimes, with each regime characterised by its own laws or regularities.

The theory of unified growth is presented in detail in *Unified Growth Theory* (Galor, 2011). That book is more of a treatise than it is a textbook, in so far as it presents this theory at a level of detail comparable to that of specialised journals. Galor studies a dynamic system with four dimensions (physical capital, size of population, technology and human capital), a system that enables him to account for the shift from a “Malthusian” regime (stagnation of output per capita and lack of education) to a “post-Malthusian” regime (in which output per capita grows slightly, while education remains absent) to, finally, the “modern” regime (high growth driven by mass education).<sup>3</sup>

## The Objectives of This Book

This book offers an introduction to Unified Growth Theory and to the concepts and tools that this theory mobilises in thinking about the long period. It aims to make Unified Growth Theory more accessible and, in so doing, this book adds to the “classical” textbooks on economic growth, such as Barro and Sala-I-Martin (1996), Jones (1998), Foley and Michl (1999), de la Croix and Michel (2002), Weil (2005) and Acemoglu (2009), books which do not touch upon Unified Growth Theory, or only do so in passing.

The audience for this book is wide: it includes undergraduate students in economics and social sciences who are interested in the dynamics of human societies over the long period, as well as more advanced students in a master’s program.

This book aims to familiarise students with the fundamental concepts of Unified Growth Theory, that is, mainly;

- the notion of economic regime;
- the notions of quantitative change and qualitative change;
- the notion of critical threshold;
- the notion of latent dynamics.

This book also aims to familiarise students with modelling:

- microeconomic mechanisms that lead to the existence of distinct economic regimes;
- microeconomic mechanisms at the root of the transition from one economic regime to another.

<sup>3</sup> The stylised facts covered by *Unified Growth Theory* also include other stylised facts, such as the demographic transition and the emergence of mass education.

There is an obvious contradiction between, on the one hand, trying to analyse the long period using Unified Growth Theory and, on the other hand, the demands of simplicity expected from an “introduction”. Since Unified Growth Theory is the most advanced form of analysing the long period, it can hardly be simple. It is that very challenge which this book takes on: how to make Unified Growth Theory accessible to as many people as possible, including undergraduate and graduate students from economics and the other social sciences. The demands of simplicity are the reason why this book focuses on what we could call “reduced-form models”, that is, modelling that has been pared down in relation to the works of Galor (2005, 2010, 2011). Simplification revolved around two aspects. First, in order to remain within a one-dimensional dynamic system, we have simplified the hypotheses regarding accumulation processes. Second, the book studies phenomena of size or scale and leaves out problems related to the structure of economies (production structures, population structures, etc.).<sup>4</sup>

The need for simplicity has another consequence: this book does not aim to cover all of the possible applications of Unified Growth Theory. We now have access to a wealth of statistical data: new “stylised facts” or “empirical regularities” are discovered every day in economics, in sociology, in demography, etc. Each one of these stylised facts could be considered from the perspective of a different theory. This book does not provide an overview of the various different applications of Unified Growth Theory, but rather tries to present its principal concepts and tools. To that end, this book focuses on the “core variables”, such as total production, size of population, output per capita and technological progress; then, in a second step, widens the analytical framework to other aspects, such as institutions and natural environment.

### **Layout of the book**

The book is organised in three parts. An undergraduate course could only cover Parts I and II (the first six chapters). A master’s level course should ideally cover Part I, Part II (Chapters 3 and 4) and Part III.

Part I offers a few reference points by way of a contextual introduction, both theoretically and empirically, that help set milestones in the wide field of the economic analysis of the long period.

Chapter 1 mobilises fragments from the history of economic thought in order to sketch out a few of the influential theories of the long period: those of Malthus, Marx, Marshall, Kondratiev, Rostow and Solow. This initial perspective enables us to situate

<sup>4</sup> This is a broad simplification: Rostow (1960) considers that growth is inseparable from changes in the sectoral structure of the economy. Ignoring the age structure of the population deprives us of a potential determinant of economic take-off: the demographic transition. For an analysis of interactions between age structure and growth, see Challier and Michel (1996) and de la Croix and Michel (2002).

Unified Growth Theory in relation to its “ancestors” and to identify some of its inherited theoretical traits. Chapter 2 studies the evolution over the last two millennia of total production, population size and output per capita. It shows that the growth of output per capita is a recent phenomenon on the scale of human history. This structural break is the main stylised fact that we will attempt to explain in the rest of this book.

Part II presents the major concepts of Unified Growth Theory: economic regime, quantitative and qualitative change, latent dynamics and critical threshold. To that end, we will study reduced-form models that do not include microeconomic foundations, but do make it possible to “rationalise” the stylised facts of Part I.

Chapter 3 models an economic regime of output-per-capita stagnation. This stagnation is Malthusian in nature, that is, it is linked to an excessive reactivity of the population size to productivity gains, which prevents a sustained growth of the output per capita. This model accounts for the stagnation in living conditions during the pre-industrial era. Chapter 4 studies, by using a variant of Kremer’s model (1993), the transition from a stagnation regime to a growth regime. Population size, which was the cause of stagnation according to Malthus, constitutes for Kremer the variable that leads, beyond a certain threshold, to an acceleration of technological progress (thanks to scale effects) and, therefore, offers a way out of stagnation. Chapter 5 analyses the relationships between economic dynamics and the institutional framework. It explores the role played by institutions in the transition from a stagnation regime to a growth regime and studies the links between inequalities and the occurrence of revolutions. Chapter 6 examines one of the major limitations to economic expansion: the natural environment (the finite dimensions of Earth). This leads to adding to the two above-studied regimes – stagnation and growth – three more regimes: those of congestion, non-regeneration and depopulation.

Part III mobilises the concepts introduced previously in order to construct unified growth models that explain, *based on assumptions about individual behaviours*, the transition from one economic regime to another. The use of microeconomic foundations enables the critical thresholds that determine changes in regime to become endogenous: the evolution of the macroeconomic environment encourages individuals to modify their behaviours, thus leading to regime change.

Chapter 7 develops a model that explains, from individual decisions of investing in education, the transition from a stagnation regime (in which the population is uneducated) to a growth regime (in which the population is educated). Introducing microeconomic foundations makes it possible to analyse the two-way interactions between individuals and the macroeconomic environment. Chapter 8 presents a microeconomic theory of the emergence of new institutions. It highlights the influence of citizen participation on the improvement of the institutional framework, an improvement that is the prerequisite for economic take-off. Chapter 9 re-examines the issue of limits to growth, by modelling how lifestyles adapt to environmental damage. These analyses result in the existence of an intermediate regime, the adaptation regime, which, by slowing the growth of pollution, pushes back the depopulation regime further into the future.

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This book is the result of a decade of teaching the economic analysis of the long period. Therefore, it indirectly has been enriched by multiple interactions with students, notably with the students who participated in the courses *Economic Demography*, later called *Population Economics*, of the Master in APE – Economic and Political Analysis – of the École des Hautes Études en Sciences Sociales (2008–2019).

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