Fraser Murison Smith

Economics of a Crowded Planet

palgrave macmillan

Economics of a Crowded Planet

Fraser Murison Smith

Economics of a Crowded Planet

palgrave
macmillan

Fraser Murison Smith
San Rafael, CA, USA

ISBN 978-3-030-31797-3 ISBN 978-3-030-31798-0 (eBook)
https://doi.org/10.1007/978-3-030-31798-0

This Palgrave Macmillan imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Dedicated to the memory of Prof. Ian W.M. Smith: inspirational scientist, dear father and latecomer to the life sciences;

And to my wife, Pilar, whose beauty and love, strength and patience, intelligence and insight, and inspiring motherhood are a constant joy and the foundations for this book.

Preface

This book asks a simple question: given that today's economy is locked into a coevolution with nature, how would its future economics look if one started with a blank sheet of paper? This question begs a related question, which is what should the economy itself be aiming for? If a future economy in harmony with Earth's natural systems were different from today's—which obviously it would be—then its economics also would be different. How? And how might economics evolve in that direction?

These two questions are the subject of two books. The companion volume to this one, *A Planetary Economy*,[1] describes a future, stable economy in alignment with natural systems, having widespread prosperity. It outlines prevailing social norms, institutions, policies and economic instruments for that future state to exist. It is a prescriptive undertaking. The present book describes the kind of economics needed to help bring that future economy into existence. It is methodological in nature.

For decades, a disconnection has existed between economics as a discipline and various conceptions of the future. Mainstream economists preferred to leave 'the future' to policymakers, advising them instead on the potential effects of any particular policy upon the market. That methodological narrowness might have been acceptable in a world having a small economy whose effects upon natural processes were insignificant.

[1] Murison Smith (2020).

Not so in a large one. On a crowded planet such as ours, economics perforce becomes primarily a normative undertaking, part of the conversation about a concrete perception of the future.

Mainstream economic training until now has not given the student the tools they need to deal with the consequences of economic policy. A resolution of this problem will come not from standard economic training but instead from a new economics—and a new economic training—beginning not from the self-maximizing rational actor but from the self-regulating natural system. The economic actor, who may, in turns, be selfish or altruistic, rational or impulsive, operates within this system, yet they also are bound by biophysical reality, and influenced by it. Any economics having these characteristics would be an economics of a crowded planet.

The work had a long, somewhat episodic gestation. As a graduate student in theoretical biology at Oxford University during the early 1990s, I was part of a research group studying species extinction rates.[2] It became very quickly apparent that present-day species extinctions, most of which are anthropogenic, are not really a biological problem but a social one. So I began looking around for social science work acknowledging this. It took little time at all to find the emerging field of ecological economics. Some ecological economists were natural scientists who had undertaken the same interdisciplinary exploration I was beginning. The majority were social scientists who had become disaffected with the narrowness of conventional environmental economics. Compared to the mainstreams of their respective disciplines, their numbers were tiny.

Hoping for a synthesis of ecological and economic theory, and wanting to be part of it, I jumped in, collaborating and publishing with others in the field for a few years. However, toward the end of the 1990s, I parted ways with it. The theoretical synthesis I had hoped for never materialized. Ecological economists were working on a variety of useful problems, such as the valuation of natural services, sustainable harvesting of natural resources, and economic development, to name a few, but that collective effort did not yield a body of economic theory to go toe-to-toe with the mainstream orthodoxy, or to be presented to policymakers as a foundation for legislation and regulation. It was all a little piecemeal, not really systemic. My frustration with mainstream economics, which had hijacked economic policy, was matched only by my frustration with ecological economics, which had failed to liberate it.

[2]Smith et al. (1993).

Around the same time, though, a related field of inquiry emerged, the science of complex systems. With the ready availability of computing power—on a mainframe or, later, on the desktop—biologists acquired an ability to simulate ecological and evolutionary dynamics, whether at the scale of a whole ecosystem or at the level of individual behavior. Financial analysts, too, could model the complexity of markets. An initially small but growing number of renegade social scientists, natural scientists and mathematicians, had in their hands a tool allowing them to develop a general theory of complex, evolutionary systems, instances of which are ecological systems, climate systems and markets.

During the 2000s, while pursuing other ventures, an idea continued to bubble away in the back of my mind that a theoretical integration of systems science and economics ought to produce a foundation from which the human social system could seek realignment with nature. In graduate school, I had read Herman Daly's *Steady State Economics* which, while an inspiring thesis, seemed also an unfinished project. Daly advocated for a theoretical reconfiguration of economics to account for material throughput. He also noted that a textbook of such a new economics would be radically different from the standard introductory textbooks, both in content and organization. Yet he produced neither. When I revisited his work twenty years later, no-one else had either.

This, perhaps, was the time to speak up. As a young natural scientist trying to learn about economics during the early 1990s, my reservations about the tenets of mainstream economics were tempered by an acute awareness of how much I did not know. I was not equipped to lead a theoretical synthesis of ecology and economics. In any case, such a synthesis would have been dismissed by mainstream economists as "not the right way to think about it." Although my instincts told me it was the right way to think about it, I was unable at the time to articulate why.

Years later, with the benefit of hindsight, it became clear that such an undertaking might have fallen prey to the 'equivalence' trap: a temptation to identify equivalent entities and processes between ecological and economic systems. It would not have led to a theory with practical use; this much Daly already understood. I needed to think less like an ecologist and to obtain a firm grasp on the historical, philosophical and normative underpinnings of mainstream economic thought, so as to articulate why mainstream economists view the world the way they do and write their textbooks accordingly.

Of course, there is no universally 'right' way to think about any problem in science. Thomas Kuhn, Deirdre McCloskey, Michael Polanyi and others showed that science is conversational and consensus-based. "People should not discriminate against propositions on the basis of epistemological origin," wrote McCloskey.[3] Polanyi emphasized the need for scientists to be aware of the ways their attitudes and knowledge interact with the problems they investigate.[4]

Neither this book nor *A Planetary Economy* take an overtly environmentalist point of view or a free-market one. We do not need to 'save the planet', only our foolish selves. Yet I do not subscribe to the fallacy that for everything there exists a market solution. This book offers a kind of *syncresis* of two apparently antithetical belief systems. The market is the principal engine by which the economy ultimately will realign itself with natural processes, acknowledging also that such a realignment will be driven by the nonmonetary markets of ideas, norms and policies. Its economics will recognize prosperity as encompassing many essential social processes, themselves operating through nonmonetary markets.

This book attempts to identify a framework within which professionals having a background in conventional economics can collaborate productively with those having a background in natural sciences, and with policy professionals. The intent is to establish a formalism that broadens the scope of economics, so that it interdigitates with the sciences of nature. An ontology and epistemology of the economy and nature as coupled systems provides a common basis for professionals trained under distinct epistemologies to collaborate. Collaboration and innovation among economists, natural scientists and policy professionals is essential as society and the economy come to grips with the scale and implications of the economy's coevolution with Earth's natural systems. There is no time to talk at cross-purposes any more. If we are to develop a 'circular' economy, we must have a circular economics.

I will make a case that a significant opportunity lies ahead for economics to develop as the science of the economy as it actually exists within the world, rather than some imaginary facsimile of the market. Policymakers are going to demand frameworks from social and natural scientists for making sound policy judgments to deal with the coevolution between the economy and nature. They cannot do this when presented with two fundamentally different epistemological frameworks that wobble and clank against one another. They need advice in a common language. This means that economics must integrate scientific thinking

[3]McCloskey (1998, p. 177).

[4]Polanyi (1946, 1958).

and, by the same token, the sciences of nature must incorporate an understanding of the workings of social systems. That both natural and social systems are instances of adaptive, agent-based complex systems presents a natural starting-point.

This book is more technical than its companion volume. It incorporates simulation models and a few other technical concepts for which familiarity with some simple mathematics is helpful. For the professional economist, and probably for the natural scientist, there will be plenty with which to quibble. This is in the nature of the inquiry, which, being wide-ranging, cannot possibly be comprehensive. The core question articulated above can have only an illustrative answer at this point. Many others are possible. It is hoped a few new ones will be stimulated by it.

As Milton Friedman once quipped, when revolutions take place they tend to use the ideas that happen to be lying around at the time.[5] A greater sense of urgency is needed in both the social and natural sciences to collaborate on a common basis to catalyze tangible change in the real economy. This book combines ideas lying around today with new perspectives on the relationship between the economy and nature into a framework providing such a common basis. It aims to encourage both social and natural scientists out of our old comfort zones to begin dismantling boundaries that are both artificial and anachronistic. It articulates the scale of an opportunity for new, integrated sciences to lead society toward a more stable, prosperous future, giving science itself new relevance and purpose when it is most needed.

San Rafael, USA Fraser Murison Smith

References

McCloskey, D.N. 1998. *The Rhetoric of Economics*, 2nd ed. Madison, WI: University of Wisconsin Press.

Murison Smith, F.D. 2020. *A Planetary Economy*. In prep.

Polanyi, M. 1946. *Science, Faith and Society*. Oxford: University of Chicago Press.

Polanyi, M. 1958. *Personal Knowledge*. Chicago: Chicago University Press.

Smith, F.D.M., et al. 1993. Estimating Extinction Rates. *Nature* 364: 494–496.

[5] Quoted in Barnes (2014) p. 119.

Contents

Abbreviations

ACE	Agent-based Computational Economics
DSGE	Dynamic, Stochastic General Equilibrium
GDP	Gross Domestic Product
GGP	Gross Global Product
GNP	Gross National Product
GRUMP	Global Rural-Urban Mapping Project
NIMBY	'Not In My Back Yard'
NPP	Net Primary Production
OECD	Organization for Economics Co-operation and Development
UN	United Nations
USGCRP	United States Global Climate Research Program

List of Figures

List of Tables

CHAPTER 1

Introduction

This book frames an economics of a crowded planet as the study of a materially large economy in stable alignment with nature and as the engine of economic policy. That economics is compared and contrasted with the current state of the field as it exists early in the twenty-first century. The book concludes with a discussion of ways economics might evolve from here to there. The set of ideas that emerges from this discussion is tentatively labeled 'market planetarianism' for reasons to be discussed. A formal theory of market planetarianism remains an opportunity for future development.

The perspective is deliberately from outside the economy looking in. It is from the point of view of the whole planet as a unitary entity, as distinct from the social perspective, which by definition is from the inside, occasionally looking out.

Is Planet Earth Finite or Are Resources Unlimited?

The appearance of a large human economy on planet Earth was so sudden on natural timescales that it appeared like a chemical state-change. Over the past ten thousand years, Earth's biota has undergone significant changes due to the spread of people, but humanity's appropriation of natural

F. Murison Smith, *Economics of a Crowded Planet*,
https://doi.org/10.1007/978-3-030-31798-0_1

resources and its discharge of wastes—its material intensity—has increased by orders of magnitude only within the last thousand years or so.[1]

One of the great misunderstandings between natural scientists and economists has revolved around the question of whether resources for the economy are limited. This question has arisen during the last few decades when it became apparent that the economy was becoming globally interconnected, both internally and with major planetary processes. The misunderstanding is significant because it reveals parties' distinct ways of thinking about the economy and nature.

Early human societies considered resources finite. They lived directly off natural resources, whose abundance was limited by solar flux. Hunter-gatherers and early agricultural societies understood the perils of taking more at any one time than nature could offer. As society diversified, however, an increasing number of people no longer lived directly off the land. This physical dissociation from nature sowed the seeds for a psychological one. In Europe during the so-called 'Renaissance,' the psychological dissociation evolved into a presumption of dominance over nature. At that time, the global population and its total material intensity still were relatively small. The world seemed vast, and natural resources effectively limitless.

Then, late in the eighteenth century, the economy began to industrialize. It began living off stored solar flux in the form of fossil fuels. The population swelled as living standards improved. Material throughput mushroomed. It did not take long for some, whose profession was to study the natural world, to raise concerns about the growing material intensity of economic activity. Some authors have recently begun to refer to this new resource-intense era as the 'Anthropocene': an evolutionary period in which for the first time the activities of a single species—human beings—have measurable effects upon natural processes.[2]

Natural scientists measure such processes in terms of physical quantities: mass, velocity and pressure, for instance. To the natural scientist, planet Earth is finite, in a strictly material sense. It is materially closed, because all available material for human use is contained on Earth, the

[1] Diamond (1991).

[2] Scientists consider the 'Anthropocene' to begin following the end of the last ice age about ten thousand years ago (Kolbert 2014, pp. 107–110), even though it has only recently reached its full manifestation. At the time of writing, the term has yet to be officially adopted.

odd meteorite notwithstanding. Yet Earth is energetically open, receiving a constant flow of energy from the sun. If the economy ingests ever more stuff from nature, and ejects ever greater amounts of effluent back to nature, then this becomes a problem. It is not a sustainable enterprise. Not only are fundamental material limits in place but also Earth's physical and biological systems form a complex of human life-support, which, if sufficiently destabilized, could bring societal collapse.

Economists, traditionally, study human choice. They measure preferences and values, which are nonmaterial measures. Since the economy incorporates a circulation of money, this money represents a convenient proxy for many kinds of value. To the economist, industrialization is a triumph of human technology. It adds value to the economy and increases living standards. If the scale of material intensity presents a long-term problem to the economy then, the conventional economist argues, the very technological brilliance that gave us industrialization in the first place surely can solve that problem as well. Provided the incentives operating within the economy are set up right, they will stimulate the necessary technological development.

Since Earth is materially closed, the resource-intensity problem can be solved if, and only if, it is vastly reduced. The conventional economic assumption of a triumph of technology therefore is a tacit admission of this fundamental biophysical limit. Resources for the economy may become 'essentially unlimited' only if technology enables the economy to recirculate them. Energy for this recirculation must come mostly from current solar flux; otherwise, given current technologies, there will be fuel wastes.

There is very little prior evidence to suggest that technology actually will triumph in redirecting resource flows within the economy rather than through it, although, as Chapter 2 mentions, some recent evidence points to an incipient decoupling of economic growth and material intensity. In any case, for a large economy on a crowded planet to persist within the confines of natural capacity, such technology will have to be developed.

What Is Economics For?

For much of the twentieth century, most economists steadfastly maintained that, as the science of choice, economics did not need to consider all the other messy, bothersome problems outside the study of markets.

Specifically, if the economy as a whole was becoming embroiled in coevolution with natural systems, then it was not for the economist to address this coevolution but the policymaker. The economist could only advise the policymaker on the possible effects of any relevant legislation or regulation upon the markets.

That position is reasonable only in a world having a small economy, one materially insignificant relative to natural processes. In a large economy on a crowded planet, economics becomes a different kind of practice. This is because the purpose of the economy itself in such a world is no longer merely to serve consumer sovereignty but primarily to ensure its own persistence in long-term alignment with nature. The purpose of economics is inexplicably bound up with the assumed purpose of the economy. On a crowded planet, the scope, relevance and importance of economics expand to more closely resemble the original meaning of the term. The term 'economics,' came into use late in the nineteenth century as an outgrowth of the term 'political economy' originating with such early nineteenth-century authors as David Ricardo and John Stuart Mill. It has Greek roots: from *oikonomia*, whose parts are *oikos* for house and *nomos* for custom or law. *Oikonomia* is 'how we run our house,' or 'housekeeping' in modern parlance. 'Economics' came into use to describe the study of households' allocation of scarce resources to satisfy wants. This etymological origin was understood all too well by former British prime minister Margaret Thatcher who, in defending her painful economic reforms of the early 1980s, referred to them as 'good housekeeping.'

Two popular textbook definitions of economics during the twentieth century were provided by Lionel Robbins and Paul Samuelson. Robbins defined economics as "the science which studies human behavior as a relationship between ends and scarce means which have alternative uses."[3] Samuelson defined it as "how … we choose to use scarce productive resources with alternative uses, to meet prescribed ends…"[4]

These definitions are almost as widely held early in the twenty-first century as when they were coined. They are sufficiently broad to encompass just about any definition of 'productive resources' and 'prescribed ends'. However, they may have arisen as a product of the particular,

[3] Robbins (1932, p. 15).

[4] Samuelson (1970, p. 13), quoted in Galbraith (1973, p. 4).

mechanical mathematics employed by early economists. As Nicholas Georgescu-Roegen argued, "any system that involves a conservation principle (given means) and a maximization rule (optimal satisfaction) is a mechanical analogue."[5] If a different kind of mathematics were employed to model the economy, such as one describing a historical trajectory through event-space, then it could have a profound effect upon the perceived identity and purpose of economics.

On a crowded planet, one having a high population, the end in question is the long-term persistence of the economy. That end sometimes might be at odds with an individual's prescribed ends, unless that individual's goal alsowere 'harmony' (however defined) with nature. The 'productive resources' in Samuelson's definition are the inputs to the economy from nature and nature's capacity to process outputs from the economy.

Although Robbins and Samuelsons' definitions seem, on the face of it, to cover all the bases, economists, natural scientists, policymakers and even the general public end up talking at cross-purposes because they cannot agree upon a definition of the means and the ends, nor indeed on which 'productive resources' are most important. A deeper problem lies within these definitions, which is that they convey the impression of a field of study devoted exclusively to the analysis of economic actors within markets, devoid of any broader societal goal. On a crowded planet, where the scale of the economy is large enough to affect natural systems over less than a human lifetime, such cloistered analysis is an unaffordable luxury if one wants to have any markets to study at all.

Attempts to redefine economics have been under way for a while, albeit mainly around the fringes. The ecological economist Robert Costanza, for instance, defines economics in normative terms, as a field of study whose purpose is "to sustain human well-being."[6] This kind of normative definition has yet to touch the core of the field.

Costanza's definition does not explicitly acknowledge the material finiteness of planet Earth, although "human well-being" could equally be collective as well as individual. A more explicit definition is offered here. On a planet whose economy is engaged in a measurable, material coevolution with natural processes, economics becomes *the study of the allocation of natural capacity to ensure the long-term persistence of the*

[5] Georgescu-Roegen (1971, pp. 318–319).

[6] Costanza (2010).

economy, and the allocation of natural and social resources to meet human wants and needs within this constraint.

This definition contains elements of the existing textbook definition, yet it is enveloped within an explicit planetary context. It is a bipartite definition: the study of the whole within the container, and the study of the parts within the whole. Both parts of the definition are needed to ensure that the parts act in such a way as to preserve the whole within the constraints set by the container. This definition of economics turns out to be very similar to the standard textbook definition of ecology, which is the study of organisms in relation to one another and to their environment. The similarity is no accident: it will resurface as we add degrees of specificity to the initial conception.

Necessary for an economics of a crowded planet will be an extension of its underlying system of thought. As the economist Stephen Marglin argued, with a witty allusion to Adam Smith, "we are led as if by an invisible hand to consider the foundational assumptions."[7] It is not necessary to tear down the whole edifice of economics but, in extending it, some walls will have to be knocked out here and there. Some parts of the core foundation will have to be demolished to make way for an extended foundation allowing the edifice to integrate with its surroundings.

Following the housekeeping metaphor, think of the existing global economy as a building largely closed off from its surroundings, having a hole for inputs, such as food, water and energy, and a hole for waste outputs. Because the building does not have any other doors or windows, anyone inside would not be able to see where the inputs come from, nor where the waste outputs go: they would simply be taken as given. However, the waste outputs recently have started to pile up around the building to such an extent that they are affecting the quality and quantity of the inputs necessary to maintain whatever is going on inside.

At some point, a remodel will be necessary. Systems will have to be installed to manage the flows of inputs and outputs so that they are kept to a minimum, that is, to maximize material efficiency. These systems will enable activities within the building to be accomplished with a smaller volume of inputs; also for outputs to be reused or recycled so as to minimize the volume of waste to the surroundings. These systems will require space in which to operate; hence, the building must be extended

[7] Marglin (2008, p. 281).

to accommodate them. Windows will be installed for the occupants to better observe the condition of the surroundings, and adjust their activities and systems accordingly. Finally, activities within the building that improve resource efficiency will be encouraged and activities that reduce resource efficiency will be discouraged, thereby shifting the occupants' habits toward stewardship of the surroundings.

How the occupants of this remodeled, extended building live with one another and manage their systems so as to maintain or improve their standards of living will be codified as 'housekeeping,' that is, their 'economics.' If the building were to collapse or become unlivable then hopefully a few individuals would manage to get out of it to survive as best they could on whatever the surroundings have to offer.

To limit economics to the narrow confines of the standard canon is methodologically unsustainable in an increasingly crowded world. Economics perforce will address this coevolution because the public will demand it of their elected officials. Consequently, economics will become about how society prospers and remains stable in a world of limited natural capacity. Economics must begin with an explicit treatment of norms, institutions and policies before we can even consider how the principles of supply and demand or marginal analysis might be applied to evaluate the behavior of a specific economic instrument.

A mainstream economist would counter that economics is only about how the economy, or particularly the market, would respond to this or that policy. The argument is disingenuous for two reasons. First, policymakers cannot make economic policy without economic advice. To assume economic policy is somehow created exogenously from economics is to assume away the normative basis of the field. Economic policy is a process of iterative creation, of survival, adaptation and competition among ideas. Economic policy evolves. Second, to claim economics is only about the mechanics of the market is to place all things outside the market into the category of 'externalities' which, as Tony Hill and Rob Myatt point out, "…are a pervasive problem that render the invisible hand story irrelevant as a description of the world we live in."[8] In a world whose economy is materially significant, economic analysis takes on an altogether greater significance and responsibility, far beyond the status of an intellectual toy.

[8] Hill and Myatt (2010, p. 6).

Aside from the question of whether economics is a positive or a normative undertaking, economics also is a culture, just like any other field of study. "Economics," writes Stephen Marglin, "is the formalization of the dominant worldview of the modern West" in which the market holds center stage.[9] "Modernity," he cautions, "may once have been part of the solution to scarcity, but now it is part of the problem."[10]

This outline of an economics of a crowded planet might not change minds overnight but it might seed an interactive process of selection among ideas. If the meme propagates then the social environment is a good fit for it, and some of its memetic material may find its way into a new economics. Alternately, if the human economy did not change, in whole or in part because economics did not change, then the whole show could risk, in the long term, being selected out of existence by natural forces. Life on Earth will go on either way.

Outline of the Book

Part I describes the coevolution of the economy and nature and its implications for economics. Chapter 2 outlines a biophysical context for the economy, describing how natural science understands the structure and dynamics of the natural world, as the context for the economy. The exponential increase in the scale of the economy is summarized in this chapter. The perspective on the economy is from the outside looking in, for two reasons. One is to help the social-science reader understand how and why natural scientists perceive the relationship between human activity and natural processes. The second is to provide a rationale for an economics of a crowded planet. That rationale begins with the material scale of the economy as a bounding condition for individual preference. It is predicated critically upon certain propositions about individual motivations and norms within a stable society on a crowded planet.

Chapters 3 and 4 model the relationship between nature and the economy. New terms are introduced: a concept of natural capacity and an index of economic sustainability.Chapter 3 describes a simple model consisting of a material exchange between an economy and nature.

[9] Marglin (2008, p. 247).

[10] Marglin (2008, p. 167).

Through various scenarios adjusting model parameters, a concept of material discipline emerges. Chapter 4 delves into a model economy, dividing it into three major subsystems. The model is refined to explore how the subsystems respond to signals from nature under various scenarios. Within the reality of Earth's materially closed system, the model suggests certain core characteristics of a stable economy on a crowded planet.

Chapter 5 collects the findings from the first three chapters to propose a rationale for an economics of a crowded planet. It emphasizes the normative nature of such an economics, as well as its need to collaborate with other sciences as a social undertaking. It proposes a new set of foundational assumptions.

Having established in Part I a rationale for a future economics as the study of coupled, evolutionary systems, Part II examines where economic thought is today and how it arrived there. Part II provides a basis from which to examine how economics might change into the future to support the transition toward a stable, prosperous economy. Chapter 6 summarizes major steps in the emergence of twentieth-century economic orthodoxy and traces the recent emergence of a new methodological pluralism. Chapter 7 chronicles the economics of nature as it evolved around the fringes of the mainstream, identifying elements that could serve a future economics. Chapter 8 does the same for conventional economics.

Part III discusses where economics needs to be in the service of a future large, prosperous, materially stable economy. It begins in Chapter 9 with a theoretical framework for a future economics, integrating complexity theory and hierarchy theory, discussing its ontological, epistemological and methodological implications. Chapter 10 articulates requirements for an economics of a future society, both normative and methodological. It discusses how this economics may be communicated and taught.

Conventions and Terminology

The terminology used in this book is principally scientific, based in Western thought. Distinct from Eastern, Buddhist or other holistic branches of thought, it recognizes a dichotomy between subject and object, self and other. It is useful for the present purpose of constructing an economics of a crowded planet because, at the outset, we need to