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Introduction

PLINY'S *NATURAL History* with its 20,000 “things worth knowing” was meant to be a useful repository of ancient Mediterranean knowledge and, consequently, is the obvious text to analyze for Roman imperial attitudes toward discovery and innovation. As such, it can shed light on the question of whether the Roman imperial economy experienced *sustainable* growth through the Pax Romana of the first two centuries CE. Archaeological research leaves no doubt that productivity improved and the standard of living was enriched over the millennium from the early Iron Age to the height of the empire.¹ My question is more specific: Did the institutions that Rome forcibly imposed around the Mediterranean—notably, peace, laws, and infrastructure—support *continued* economic growth until external forces such as the Antonine Plague of the later 160s CE brought it to a halt? The lack of statistics for the economy makes this question impossible to answer with empirical certainty, leaving scholars to formulate indirect arguments for growth based on proxy data or models or contemporary economic theory. This book argues that the proxy data are inconclusive and, consequently, that the textual evidence for values and attitudes related to production should be taken into account. Pliny's *Natural History* is the primary text to examine for economic attitudes on account of its wide-ranging subject matter, scope, and avowed purpose of “utility” (*utilitas*).

A century ago, the naturalist E. W. Gudger labeled Pliny's *Natural History* “the most popular Natural History ever published.”² The past three decades have witnessed a steady stream of books and articles about the *Natural History*. Why write another, and in

particular, a study of Pliny's economic reasoning and observations? My main argument is prompted by recent works by economic historians of early modern Europe who have made the case for a link between encyclopedias of the eighteenth century and the values and attitudes that together formed a culture of growth and innovation, laying the groundwork for the "Great Enrichment."³ Diderot and D'Alembert's famous *Encyclopédie* (published 1751–72) aimed to disseminate *useful* knowledge for productive growth and was one of the most visible contributions to what Joel Mokyr has described as a culture that encouraged a feedback loop between scientific discovery, technical breakthroughs, and economic growth.⁴ And indeed, the *Encyclopédie's* geographical circulation has been shown to correlate with the cities experiencing the fastest economic growth.⁵

What insights does the *Natural History* provide regarding Roman values and attitudes about economic production during the Pax Romana and in particular about innovation based on new knowledge? And what does the answer to that question tell us about the potential for *sustained* growth? Pliny's *Natural History* as a vast compendium of useful knowledge was the acknowledged ancestor of the early modern encyclopedias, even if "encyclopedia" had yet to be conceived as a genre.⁶ Did Pliny's monumental work intend in the same way to disseminate useful knowledge and to foster technical advances? What observations and reasoning that we today might categorize as "economic" can be found in the work? Over the past thirty years Plinian scholarship has sought to interpret the *Natural History* as a coherent whole by considering various themes: Pliny's view of Nature, Pliny's scientific thought, Pliny's ideology of empire, among others.⁷ To my knowledge, there is no comparable effort to probe Pliny's economic views as a whole, his reasoning and assumptions.⁸ To be sure, certain passages of the *Natural History* have been repeatedly cited—for example, the cost of trade with India, or the praise of empire, or Seneca's costly purchase of a rehabilitated farm, or the history of Roman coinage.⁹ And the *Natural History* is by far the most

excerpted work in *Greek and Roman Technology: A Sourcebook*, which suggests that it should be the most promising text to examine for Roman attitudes about the technology that enabled the economy to produce and the innovation that supported growth.¹⁰

The *Natural History* provides evidence both for the potential of Roman imperialism to expand economic resources and for the limits on technical innovation that might have nurtured sustained growth in productivity. The answer to the question of how Pliny's great book could have affected economic growth matters because the question of just how much the Roman economy was growing during the Pax Romana and when the growth stopped remains unclear. There has been a concerted effort in recent decades to find proxies to measure and explain the growth and decline of the empire's economic performance. Explanations are deduced from the timing of the growth and/or decline. For the most part, the proxies have been used to argue that the Roman economy was growing until the onset of the Antonine Plague in 165 CE. The most well-placed, well-cited, and thoroughly discussed papers and books in the last decade have claimed, on the basis of these proxies, that the Roman economy enjoyed *sustained* growth on account of its institutions, growth that was stopped only by the exogenous shock of the Antonine Plague of the late 160s CE.¹¹ Chapter 1 will offer a critique of those proxies, arguing that at this point none is reliable enough to justify neglecting our aristocratic authors, with their first-person (if admittedly limited) point of view. I argue that we can learn something important about Roman cultural values affecting the economy from reading the *Natural History* as a whole.

The task of sifting Pliny's economic ideas out of the 37 books of the *Natural History* and then summarizing them has turned out to be more challenging than I anticipated for reasons having to do with the (loose) organization of the work, to be described in chapter 2. Trevor Murphy's phrase "referential dizziness" describes my personal reading experience better than I could have.¹² Chapter 2 will go over the familiar ground of Pliny's purpose, audience, method, and organization and point out both the economic implications and

some internal inconsistencies. Though Pliny claimed to be assembling practical “things worth knowing” (*res dignae*) for the use of artisans and farmers, in reality this audience could not have afforded the 37 books and would have had a difficult time locating any practical information they might have wanted if they were literate enough to read it.

Chapter 3 seeks to draw on scholarship describing Pliny’s attitude to Mother Nature as influenced by Stoic thought of his day. This attitude formed the basis for Pliny’s moral thinking about useful knowledge of Nature, with major implications (at least in Pliny’s view) for the economic consequences of empire. Pliny held profoundly ambivalent ideas about the economic benefits and vices of empire. The benefits came almost entirely from what could be described as an argument that anticipated Adam Smith by seventeen centuries to the effect that Rome’s expansion opened the way to the discovery of new and varied natural resources from the conquered lands, and Roman rule promoted the exchange of these resources through trade during the Pax Romana. On the other hand, Pliny believed that Roman attitudes and power also promoted the misuse, abuse, and even violation of Nature, most egregiously in mining and quarrying. The language in which Pliny describes the abuse is worth noting, particularly the vocabulary of honor and shame. To Pliny, what we might count as economic growth and improvement of living standards cannot be value free—and at the heart of those moral values is the emotional and spiritual devotion to Mother Nature.

Chapter 4 focuses on Pliny’s ideas about invention and innovation, the foundations of sustained growth. It starts from David Hume’s observation in 1742 that “it is more easy to account for the rise and progress of commerce in any kingdom, than for that of learning.” Pliny generalizes about increases in knowledge in a similar vein, and in addition he attests to inventions and discoveries throughout Greek and Roman history. Chapter 4 examines the inventions reported in the *Natural History*, Pliny’s understanding of the process of discovery and its motives in the context of the

Pax Romana. Mokyr describes a “culture of growth” in early modern Europe in which a positive feedback loop between scientific research and practical applications fueled sustained increases in productivity. What light does Pliny shed on an ancient culture of growth as manifested in his list of great inventions and his choice of heroes celebrated in Roman culture? What did Romans assume about the sources for amassing wealth, at least as revealed in the *Natural History*? Overall, Pliny believed that discovery, innovation, and enrichment were the results of accident or divine intervention, not of Romans’ intentional research. It is striking that Pliny’s list of 136 great innovations at the end of Book 7 includes not a single Roman technical innovation.

Scattered throughout the *Natural History* are economic observations and instances of financial reasoning. They do not add up to a coherent theory, but they do provide insights into Pliny’s views about different forms of production and commerce, about labor and agency, about price formation and profitability, about investment and consumption, and about trust and fraud. Some of the views have a heavy moralizing overlay, but others do not and so give us limited evidence of Pliny’s economic reasoning. Chapter 5 aims to gather and to analyze the examples of Pliny’s economic thinking.

Chapter 6 turns to the question at the heart of this book: Did the *Natural History* aim to foster a culture nurturing increases in useful knowledge for succeeding generations to improve productivity? How did readers of the late antique and medieval eras make use of Pliny’s work, which for many centuries was among the most frequently copied, quoted, and excerpted classical texts? The reception of the *Natural History* during this millennium provides insights into the limitations on its practical value. And then in the early modern period, given their shared purpose of “usefulness,” what is revealed by a comparison of Pliny’s *Natural History* and the eighteenth-century encyclopedias that played a part in the culture of growth during the Great Enrichment?¹³ The massive French *Encyclopédie* was modeled on much less noticed English predecessors:

John Harris's *Lexicon Technicum* (1704) and Ephraim Chambers's *Cyclopaedia* (1728). Because these earlier encyclopedias *predated* the beginning of the Industrial Revolution and because they were produced in the country that led the way in the growth of the eighteenth century, they may offer a more interesting comparison. The purpose, tone, organization, and content of these monumental works show similarities with the *Natural History* and also telling contrasts.

My aim is not to demonstrate the obvious point that Pliny came before the beginning of the “Scientific Revolution” and Harris and Chambers came after. Rather, my aim is to use the contrast to sensitize historians to some qualities of the *Natural History* that bear on values and attitudes with consequences for the Roman economy. Whereas Pliny intended his *Natural History* to be a treasure chest to prevent the loss of ancient wisdom, Harris and Chambers intended their encyclopedias to serve as up-to-date springboards for future discoveries that were not even thought possible—that is, the *Natural History* was backward-looking, in contrast to Harris's and Chambers's forward-looking optimism. The fundamental values underlying the culture of growth to be found in the *Lexicon Technicum* and *Cyclopaedia* are largely absent in Pliny's monumental work. The effects of this difference of attitude on the imperial economy cannot be quantified but should be taken into account in explaining why, despite its extraordinary duration and size, the Pax Romana generated few major technical breakthroughs, *as Pliny himself lamented*. The fact of Pliny's lament is important and needs to be stressed because the modern-day historian's observation of a scarcity of major technical breakthroughs is sometimes criticized as teleological or a modern anachronism, *but it is in fact Pliny's own insight*. And in the absence of continuing breakthroughs, economists would not expect *sustained* growth.

One last disclaimer: Aude Doody's *Pliny's Encyclopedia: The Reception of the Natural History* makes the appropriate point that it would be anachronistic to blame Pliny for not meeting the standards of modern science.¹⁴ I agree. My aim here is not to *blame*

Pliny or the Romans for failure to develop modern science and a modern economy but to *understand* Pliny's purpose and methods through comparison with early modern encyclopedias, and then to explore the consequences of those differences for the performance of the Roman economy.

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