MANUFACTURING IN CLASSICAL ATHENS

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ABSTRACT

This thesis aims to show that applying contemporary economic frameworks and analyses to manufacturing in classical Athens can reveal important insights into Athenian society. This approach defies recent orthodoxy which argues that the economy was so “embedded” in ancient society that current economic concepts and, in particular, the assumption of profit-maximising behaviour cannot be applied. The thesis includes an assessment of the logic and relevance of this view.

The principal module of analysis concerns industry structure; the theory of competitive advantage is found to explain the known size of enterprises across a range of industries and to identify four Types of manufacturing business that differed in the demands they made on participants and in the rewards they offered. Demographic analysis shows how different social groups participated in different industry Types to meet their specific objectives. The widespread availability of semi-casual income-earning opportunities for citizens of modest means revealed by this analysis must have been an important enabler of the Athenian lifestyle and participatory democracy.

Three other analyses support the general proposition that there is value in applying economic analyses. They address the following questions:

- How and why did industries emerge from the oikos? (Supply and Demand Theory).
- How did Athenians think about industry as an investment opportunity? (Risk-Return Analysis).
- Why did Athens not have an Industrial Revolution? (Combining previous findings).

In each case, the thesis identifies new perspectives on ancient society and behaviour that are revealed by the microeconomic analysis. The conclusions also cast into serious doubt arguments by recent scholars that ancient behaviour in the economic sphere was not economically rational or geared to profit-maximisation. They show that Athenians largely acted in a commercially rational way but with important exceptions revealed by the analysis. The thesis concludes by suggesting other applications of this approach to historiography.
DECLARATION

This is to certify that:

i) The thesis comprises only my original work towards the Ph. D

ii) Due acknowledgement has been made in the text and in the Acknowledgements to all other material used

iii) The thesis is less than 100,000 words in length.

Peter Acton
September 2010
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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>iii</td>
</tr>
<tr>
<td>DECLARATION</td>
<td>v</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>vii</td>
</tr>
<tr>
<td>1. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Primary Sources</td>
<td>1</td>
</tr>
<tr>
<td>Literature</td>
<td>1</td>
</tr>
<tr>
<td>Archaeological and Epigraphical Evidence</td>
<td>8</td>
</tr>
<tr>
<td>Modern Perspectives</td>
<td>10</td>
</tr>
<tr>
<td>Methodology</td>
<td>17</td>
</tr>
<tr>
<td>2. THE EMBEDDEDNESS PARADIGM AND THIS THESIS</td>
<td>21</td>
</tr>
<tr>
<td>The Embeddedness Paradigm</td>
<td>21</td>
</tr>
<tr>
<td>A False Dichotomy</td>
<td>29</td>
</tr>
<tr>
<td>This Thesis and the Embeddedness Paradigm</td>
<td>35</td>
</tr>
<tr>
<td>Who Can Engage in What Transactions?</td>
<td>36</td>
</tr>
<tr>
<td>What Language is Used to Describe Economic Activity?</td>
<td>40</td>
</tr>
<tr>
<td>Was Profit Making Through Industry Socially Acceptable?</td>
<td>45</td>
</tr>
<tr>
<td>Was Profit Maximisation a Conscious Goal?</td>
<td>52</td>
</tr>
<tr>
<td>The Rationality of Economic Behaviour</td>
<td>55</td>
</tr>
<tr>
<td>3. THEORIES OF FIRM SIZE</td>
<td>57</td>
</tr>
<tr>
<td>Traditional Reasons for the Observed Scale of Athenian Enterprises</td>
<td>58</td>
</tr>
<tr>
<td>Access to Credit</td>
<td>58</td>
</tr>
<tr>
<td>Delegation</td>
<td>60</td>
</tr>
<tr>
<td>Accounting Practices</td>
<td>61</td>
</tr>
<tr>
<td>Specialisation of Labour and the Lack of Machinery</td>
<td>64</td>
</tr>
<tr>
<td>Modern Theory of Industry Structure</td>
<td>68</td>
</tr>
<tr>
<td>Competitive Advantage as the Basis for Business Success</td>
<td>68</td>
</tr>
<tr>
<td>Variations in the Extent of Advantage Achievable</td>
<td>74</td>
</tr>
<tr>
<td>Predictions for Industry Structure</td>
<td>75</td>
</tr>
<tr>
<td>4. THE POTTERY INDUSTRY</td>
<td>81</td>
</tr>
<tr>
<td>Pottery in Ancient Greece</td>
<td>81</td>
</tr>
</tbody>
</table>
The Manufacturing Process and Deployment of Labour ............................................. 90
  Fine Ware ........................................................................................................... 92
  Coarse Ware: Kiln Capacity and Labour Requirements ..................................... 93
The Potential for Profitable Growth in Coarse Ware ........................................ 99
  The Competitive Dynamics of the Pottery Industry ........................................ 99
  The Potential for Profitable Growth ................................................................. 102
  Changes in the Industry .................................................................................... 106

5. OTHER INDUSTRIES ......................................................................................... 109
  Shield Manufacture ............................................................................................ 110
  Metalworking ...................................................................................................... 115
  Textiles ................................................................................................................. 125
  Luxury Furniture .................................................................................................. 132
  Tanning .................................................................................................................. 133
  Shoemaking ......................................................................................................... 135
  Food Processing .................................................................................................. 138
  Cosmetics and Perfumes ..................................................................................... 140
  Conclusion ........................................................................................................... 143

6. INDUSTRIAL ATHENS ...................................................................................... 151
  Participation in Manufacturing .......................................................................... 151
    The Investor Class: Rich Citizens ..................................................................... 154
    Other Citizens .................................................................................................... 159
    Women ............................................................................................................... 164
    Metics ............................................................................................................... 167
    Aliens ............................................................................................................... 169
    Slaves ............................................................................................................... 169
  Towards a Quantification of Participation in Manufacturing ......................... 172
  Industrial Athens ................................................................................................. 178

7. INDUSTRY FORMATION: THE EFFECT OF SUPPLY AND DEMAND ....... 183
  Supply and Demand ............................................................................................ 184
  The Evolving Role of Craftsmen in Homer ....................................................... 187
  A Decision for the Oikos ..................................................................................... 191
  The Economics of Industry Formation ............................................................... 198
  Supply and Demand in Action .......................................................................... 200
8. THE DEMOSTHENES PARADOX: THE APPLICATION OF RISK-RETURN INVESTMENT ANALYSIS

   The Paradox ....................................................................................................................... 207
   Factory Yields ..................................................................................................................... 209
   Enterprise Structures in Athens ......................................................................................... 213
   Slaves – Current Costs ....................................................................................................... 214
   Slaves – Capital Costs ......................................................................................................... 216
   Other Costs .......................................................................................................................... 218
   Other Assets ....................................................................................................................... 218
   Revisions to the Numbers ................................................................................................. 220
   Implications for the Study of Athenian Society ................................................................. 222
   Conclusion .......................................................................................................................... 226

9. WHY ATHENS HAD NO INDUSTRIAL REVOLUTION ..................................................... 227
   A Failure of Application ...................................................................................................... 227
   Lack of Commercial Motivation ........................................................................................ 231
   Slavery .................................................................................................................................. 235
   Conclusion ............................................................................................................................ 238

10. CONCLUSIONS ............................................................................................................... 245
    Summary of Findings ........................................................................................................... 245
    Embeddedness Revisited ................................................................................................. 248
    The Role of Microeconomics in Interpreting History ....................................................... 250

BIBLIOGRAPHY .................................................................................................................. 255

APPENDICES ....................................................................................................................... 277
APPENDIX A: Pottery Item Size Data ................................................................................. 277
APPENDIX B: The Population of Classical Athens ............................................................... 281
LIST OF TABLES

2.1 Plato, Castes and the Raj ........................................................................................................50
4.1 Kiln Capacity ..........................................................................................................................93
4.2 Forming Labour Requirements to Fill a Kiln .........................................................................95
5.1 Other Industries Summary .....................................................................................................142
5.2 Barriers to Entry and Competitive Advantage ....................................................................144
6.1 Industry Participation by Social Group: Adult Males ............................................................174
6.2 Industry Participation by Social Group: Adult Females .........................................................175
6.3 Industry Participation by Social Group and Industry Type ..................................................176
7.1 Factors Determining Industry Formation .............................................................................203
8.1 Knife Factory – Revised (minae) ...........................................................................................221
8.2 Furniture Factory – Revised (minae) .......................................................................................221

LIST OF FIGURES

3.1 Competitive Economics .............................................................................................................69
3.2 Components of Competitive Advantage .................................................................................70
3.3 Price Advantage: Niche Products ............................................................................................71
3.4 Cost Advantage: Commodity Mining .......................................................................................72
3.5 Variation by Industry/Sector ...................................................................................................74
3.6 Competitive Advantage and Industry Structure (1) ...............................................................75
3.7 Impact of New Entry ................................................................................................................78
3.8 Competitive Advantage and Industry Structure (2) ...............................................................78
4.1 Impact of Exit and Entry on Industry Prices ..........................................................................99
4.2 Impact of Adding Kilns ...........................................................................................................101
4.3 New Pottery Costs and Volume .............................................................................................106
7.1 Supply and Demand ..............................................................................................................183
7.2 Increased Demand ................................................................................................................184
7.3 Cost Reduction ......................................................................................................................184
7.4 Demand-Supply Interaction ................................................................................................185
7.5 Benefits of Specialisation .....................................................................................................190
7.6 Specialist vs. Generalist Costs ...............................................................................................191
7.7 Value of Mobility ..................................................................................................................192
7.8 Benefit of Fixed Workshops ................................................................................................196
8.1 Risk and Return .....................................................................................................................210
1. INTRODUCTION

The objective of this thesis is to demonstrate that new insights can be derived from applying the tools of modern economic analysis to historical studies. This is a novel approach and one that has been explicitly condemned by recent historiographic orthodoxy in relation to the ancient world. This thesis challenges the logic of such a conclusion.

The topic chosen for analysis is manufacturing in classical Athens (roughly the fifth and fourth centuries BCE, though the nature of the sources means that most of the data points relevant to this thesis are from the fourth century). The major analytical module concerns industry structure; it shows how the size of enterprises and the nature of returns to proprietors and other participants in the manufacture of different products were determined by the potential for competitive advantage, and how these different industry structures in turn determined which social groups participated in manufacturing which products and in what capacity. Three other modules support the general proposition: supply and demand analysis explains the sequence and extent of industry formation across different products; application of the standard investment risk-return paradigm shows that Athenians placed a different value on certain assets than we would today; and simple economic logic can refute some common explanations of the limited application of technology to ancient manufacturing processes.

The remainder of this Introduction addresses primary sources and recent historiography and describes the methodologies employed for generating the information required.

Primary Sources

Literature

In this section we review references to manufacturing in Greek literature from Homer to the end of the fourth century. Although manufacturing finds a place in all forms of literature, the picture that sources present is confusing. The epic poets and tragedians show great respect for crafts and acknowledge the importance of technology in improving living standards. Others, notably the philosophers and comedians, show us a world of sole operators, some apparently part-time, some highly renowned for their skills or for the money they made or
inherited from manufacturing, and make clear that the commercial impulse is unattractive and that engagement in manufacturing is nothing for a citizen to be proud of. The orators speak of sophisticated business transactions, involving lease payments, debt, securitisation and risk management, typically conducted by citizens. It is sometimes hard to believe they are all describing the same class of activities at approximately the same period.

The early poets provide some insight into the history of specialisation in certain crafts and of itinerant practitioners. Chapter Seven explores the emergence of exchange in manufactured products and draws on Homer and Hesiod for evidence of early manufacturing arrangements, including mobile craftsmen. Although much of the manufacturing activity in Homer takes place in the divine sphere, he also describes a human society that seems quite sophisticated in its manufacturing capabilities. It has been well established that he was describing a more recent period than the Trojan Wars, although it is impossible to isolate a specific time.¹ For our purposes, all that matters is that it preceded the classical period.

Beyond this, there is little in either the epic poets or the tragedians that is specific enough for our purposes. For Homer, skill in crafts was grounds for high praise. He comments on the excellence of the manufacture of Sarpedon’s shield (Il. XII 294-7) and of the entry to Odysseus’ storeroom (Od. XXI.43-5). He praises Tychius as “skutomon och’ aristos” (Il. VII.221) and Phereclus son of Tecton “hos chersin epistato daidala panta teuchein” (Il. V.60-1). Disguising herself as a beautiful mortal, one of the characteristics Athene had to take on was being “aglaa erga iduie” (Od. XIII.289, XVI.158).² He also shows us royalty and nobility such as Nausicaa (Od. VI.57ff.) and Penelope (Od. II.100-8) engaged in productive labour.

Hesiod’s homespun wisdom, commending hard work and prudent risk-management, could find a place today on management bookshelves but gives little more to go on in respect of manufacturing activity. The Myth of Ages explicitly tracks the emergence of crafts alongside the decline from the Golden to the (present) Iron Age where “men will not cease from toil and distress by day, nor from being worn out by suffering at night” (Op.176-8). In both the Theogony and Works and Days, Hesiod introduces the Prometheus myth in which the hero’s attempt to assist mankind by giving them fire ended with an angry Zeus punishing him for an

¹ Finley (1954); Parry (1971); Snodgrass (1998)
² “Much the best leatherworker”; he understood how to make all delicate things”; “skilled in brilliant work.”
earlier and unconnected piece of impudent trickery concerning a sacrificial feast. Making a living became much harder. If not for Zeus’ wrath with Prometheus, "you would easily be able to work in just one day so as to have enough for a full year even without working; soon would you put away your rudder over the smoke, and the fields worked by ox and sturdy mule would run to waste” (Op.45-7). This theme was picked up by tragedians; crafts were central to improved living standards (Aesch. PV.109-112, 236, 448-50; Soph. Ant.365-6; echoed at Ath. Deipn.xii.511d), and were often enabled by the intervention of gods or demigods. They had their own tutelary deities who were invoked to foster success and whose image was often placed in workshops; Pallas Athene graced many potteries and Hephaestus many smithies. Generally the gods did not originate the craft themselves, but learned it from a specialised being and then helped impart it to men. Hephaestus learned metallurgy from (variously) sea nymphs (Hom. Il.XVIII.395-405), the Daktyloi (Plin. HN.VII.197), the Chalybes (Aesch. PV.715), Love (Pl. Symp.197b) and the Cyclopes (Verg. Aen.VIII.424-5); the latter “gave Zeus his thunderbolt; they were the first skilled manual workers, who taught Hephaestus and Athena all the techniques of fine workmanship such as is wrought beneath the sky” (Hes. Theog.139-41). All this provides fine prima facie evidence to rebut claims that the ancients despised all forms of manual labour, but little to analyse in depth.

Like the poets, tragedians sometimes invoked contemporary commercial imagery; when Aeschylus compares Ares to a chrysambos or money-changer, Fraenkel comments: “It is characteristic of Aeschylus that in order to heighten the effect of terrible happenings he does not borrow his imagery from the realm of the unreal and fantastic as many romantic poets do, but from the familiar processes of everyday life". The subject matter, though, is never commerce.

We might expect a more practical depiction of an important aspect of Athenian society in comedy and history, both of which focus on contemporary or recent life. In fact both prove

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3 This identification of production with divine inspiration and tutelage continues throughout ancient Greek literature. The more scientifically minded Romans looked to natural explanations for man’s learning: Lucretius implicates lightning in the discovery of fire and Vitruvius dried leaves catching alight. Lucretius also saw smelting as learned from observing an accidental fire melting ores. Later writers also developed legends around the “first discoverers” of particular technologies. Pliny, for example identifies the discovery of flint with Pyrodes, the four-wheeled cart with the Phrygians, and stone-quarrying with Cadmus (or possibly the Naxians). He offers three different versions of the origins of mining and smelting. (HN VII.191ff).

4 Fraenkel (1950) 437-8
something of a disappointment. Aristophanes brings a wide range of anonymous and representative characters onto the stage – farmers, soldiers, old men, domestic slaves, tutors, nurses, hoteliers, priests and poets, as well as Dogs, Frogs and Clouds – but the closest we come to meeting manufacturers is the chorus of rural producers and craftsmen in The Peace. The spear maker has a virtually non-speaking part. In The Knights the Market-Judge-cum-Seller-of-Strange-Things is lampooned as a typical commercial character but sadly he is not a manufacturer. Industrial connections of politicians are often referred to in order to make fun of the humble way in which they made or inherited a living, but we do not know, for example, whether all tanners became rich or just the forebears of Cleon and Anytus, or – if they were exceptions – what they were doing right. Cleon’s “Herculean valour in braving the stenches of his trade” (Pax.752-3) is an ironic metaphor for courage but tells us nothing about tanning operations that is not obvious to the most casual passerby. Menander casts a similar array of characters, but with a higher proportion of slaves, the occasional addition of prostitutes, and in Aspis some new service occupations – cook, waiter and doctor. Sadly the Epitrepontes, which has arbitration as its subject matter, does not refer to a commercial dispute, even though a good proportion of the surviving works of the orators does. Comedy is used in this thesis for its depiction of manufactured products coming to market, and for the structure of production implied by particular reselling arrangements, but contributes nothing to our knowledge of manufacturing processes.

Historians of the classical period regularly address the economic motives and underpinnings of war – the founding of trading colonies, the supply of ships and weaponry, movements of people and the provision of public funds – but these are essentially macroeconomic matters. They have little or nothing to say about the production or sales processes of such goods as they describe. This thesis draws on the scant relevant material there is. Two of Xenophon’s philosophical works, the Oeconomicus on the management of private affairs and the Vectigalia on public finance, are much more informative and are referred to frequently in later chapters.

Historians shared with philosophers an ambivalence about the role of commerce in society. Thucydides held that the acquisition of surplus wealth is acceptable – even laudable – if it is applied to living a good life, but “the desire to amass unlimited wealth…contradicts the notion of ‘the good life’.”

5 Herodotus (II.167) says the Egyptians despised trades and valued

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5 Kallett-Marx (1993) 17
warfare, and speculates as to whether Greek states learned this attitude from them; Xenophon explains that “while in other states…all men make as much money as they can”, the homoioi in Sparta were forbidden to engage in any economic activity (Lac.VII). Plutarch tells how King Agesilaus summoned a gathering of the Spartans and their allies and asked for all the artisans to stand up. All the Spartans remained seated (Ages.264-5). Other cities including Thebes, Thespia, and Epidaurus had similar, though less extreme, attitudes. The historians make clear that Athens was a less rigid society and one that tolerated, if it did not encourage, the social mobility to which manufacturing products for sale can contribute.  

The philosophers express strong views on politics and society and emphasise the moral hazard of unrestrained pursuit of material gain but regrettably they have no more to say than the other sources about manufacturing. It is simply accepted as necessary, and the profit-motive is seen as an important though dangerous element in its functioning. Plato acknowledged the value of craftsmen by giving them a place in the Republic (371e), but it was equally clear that he saw industry as a much less valuable use of time than philosophical enquiry (496d). Workers do not embody skills so much as appetites that need to be controlled (547b). Technology is of interest only to the extent it copies ideals (524d-531d). Plutarch observes that one can admire a work of art without wanting to be like its maker and that “if a work delights us because of its gracefulness, it does not necessarily follow that we should hold the man who makes it in high regard” (Per.2.1). Similar sentiments are expressed by Aristotle and, more ambivalently, by Xenophon. This elitist view that the ideal life for a citizen is one of leisure has prompted some scholars to assert that this attitude was so pervasive as to constitute a serious obstacle to economic or industrial development.  

Chapter Two shows this view is ill-founded and conflicts with numerous other data. There is plenty of evidence that “citizen investment and participation in trade and commerce was significant” and we cite numerous examples in Chapter Six.

The limited and generally abstract depiction of industry in contemporary sources is frustrating but not unexpected. The outward trappings of industry may be amusing (the smell of Cleon’s tannery for instance) but the day-to-day business of making and selling is harder

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6 In fact the economic egalitarianism of Sparta with which Athens’ social structure is often contrasted has been overstated (Hodkinson (2000)).
7 Hasebroek (1931) and Finley (1973) are the best known examples.
8 Kron (1996) xi
to get a laugh out of. We would not look to *A Midsummer Night’s Dream* for insights into how the textile or joinery industries worked at the end of the sixteenth century. Even today, comic playwrights like Alan Ayckbourne and Neil Simon mention industry in their plays as little as Shakespeare or Moliere did. Occasionally a Chaplin or a Tati will come along, but self-deprecating irony was not the basis of Attic comedy. This leads to a broader observation; it is dangerous to interpret the relative silence of the literature on the subject of manufacturing in classical Athens as evidence of the insignificance of its presence. It is difficult to think of European creative writers before Dickens and Hugo who wrote explicitly about commercial activity or conditions. This is the case even when their local environment is in the throes of revolutionary economic development: Dante only mentions merchant banking to assign punishment to some of those involved, Shakespeare seems largely oblivious to the opening up of the New World or advances in the local textile industry and Goethe ignores the extraordinary development of the Ruhr Valley. Industry was not their subject. The arch-realist Hardy only takes us inside two urban workplaces.\(^9\) Many activities on the Floss were sharply described by George Eliot but mill operations were not among them. Even when Dickens, Mrs. Gaskell and Disraeli were drawing some of their plots from industrial events and conditions, readers of Thackeray and Trollope were seldom reminded that industry existed. Byron, Tennyson and Browning’s themes were remoter still. Industry still has few creative writers – and far fewer poets or philosophers – who take it as their theme, and if we were to try to assess recent industrial development from a small and largely random sample of successful contemporary works of literature, we might come to the same minimalist conclusions as we would about classical Athens.

We are left with the orators. Their concern with the everyday realities of Greek life makes them our best source for information about commerce. Several whose speeches have been preserved were themselves directly involved in business enterprises. Lysias (xii.18-19) and Demosthenes (xxvii) both owned factories.\(^10\) Andocides was an early investor in public private partnerships who acquired (profitably) the right to collect harbour taxes for one year (i.133).\(^11\) Isocrates’ father was a flute-maker about whom we know nothing else (Plut.

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\(^9\) The printing shop in Christminster that employs Jude the Obscure; and the Mayor of Casterbridge’s brewery.

\(^10\) *Chapter Eight* is concerned exclusively with the latter speech.

\(^11\) When he supplied oars to the state, however, Andocides made a virtue of not having made a profit on them (ii.11).
Isocrates. With such involvement, these orators were not likely to adopt the philosopher’s position that business was all a bit grubby and not a pursuit worthy of a citizen; nor, of course, were their clients. Demosthenes held that earned wealth was respectable when spent on public service, but he was not above using the commonplace of snobbery to score points off opponents (xxxviii. 25-27) and makes a great deal of the fact that Aeschines had to work for a living while Demosthenes did not (xviii. 257-265).

Given the amount of factual detail in the orators and the lack of it in other literature, they are clearly a vital source for this thesis and are used extensively, especially in Chapters Five, Six and Eight, for information on firm size and profitability. In assessing their relevance and reliability, it is important to bear two facts in mind: first, the proportion of business transactions that actually ended up in court is likely to have been low. (It is difficult to imagine that a business jurisdiction could survive if the proportion was consistently high). Second, the proportion of speeches preserved for us is also low. Any attempt to downplay the level of commercial activity in Athens by admitting the recorded instances and denying the likelihood of any others is neither legitimate nor plausible. Cohen, by contrast, makes much of the concept of ‘forensic attestation’ – the idea that:

“Since such speeches were delivered to juries numbering in the hundreds, and since persuasion was a speaker’s only goal, it seems reasonable to posit …. that the presence of a general practice is confirmed by a litigant’s claim that presupposes such a practice, even if we cannot establish the truth of the particular assertion.”

This is more reasonable but must be applied with caution. Ober has made a case that public rhetoric tended to construct “alternative realities” in order to preserve democratic equilibrium, and Morris warns that “it would be a great mistake to assume that we can read away the rhetorical construction of reality to figure out how the ‘economy’ really worked.”

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12 As flutes provided much of the musical entertainment at both public and private functions, this might have been quite a big industry and Isocrates senior might have had a sizeable share of it. His son inherited a large sum but quickly lost it and turned to speech writing to restore his fortunes.

13 Cohen (1992a) 26

14 Ober (1989) 153-4

15 Morris (1999) xxxi
A principle to which this thesis tries to adhere is that with limited and defined exceptions, “all statements not supported by relevant evidence ought to be regarded with suspicion.”  

Some historians writing later in antiquity are referred to in this thesis, but their relevance is limited. Strabo is informative on trade and architecture, but not on industrial production. It was not until the late 19th century that historians started paying close attention to ancient economic activity as a subject in its own right and a vigorous debate has raged ever since, prompted at least in part by the inconsistent picture in the primary sources.

In summary, while much ancient literature provides fertile material for arguments about attitudes to commerce – discussed in Chapter Two – the only facts that can be usefully deduced about manufacturing activity relate to the initial formation of industry (Homer), the size and profit profile of various enterprises that became involved in litigation and reselling arrangements depicted in Aristophanes.

Archaeological and Epigraphical Evidence

Archaeological and epigraphical evidence is used where relevant; vase paintings and excavated production sites can tell revealing stories about workshop size, configuration and furnaces. Unlike the late Bronze Age, however, records of financial transactions are sparse and hard numerical data in Athenian epigraphy tend to relate to public finances rather than to private enterprise.

Archaeological evidence shows the locations of various ergasteria and how different areas of ancient Athens in turn became centres of manufacturing production. This evidence, largely collected by the British and American Schools at Athens and well summarised by Monaco (2000), underpins the description of the appearance and topography of Industrial Athens in Chapter Six. Deducing from the archaeological remains exactly how ergasteria were laid out and what manufacturing processes were employed presents more of a challenge. We can gain a good understanding of the part industry played in the urban landscape but have less to go on in terms of what happened indoors.

Potteries can be readily located through the excavation of ancient wells in which shards have tended to survive better than the detritus of other industries. We also find some evidence of

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16 Harris (1995) 15
furnaces that are unlikely to have been used for pottery, such as those on the Acropolis, which is a long way from the sources of water and clay that are essential to ceramic production.\textsuperscript{17} One of the best preserved sites is also one of the earliest, and provides an excellent insight into how an \textit{ergasterion} was laid out.\textsuperscript{18} Monaco describes the room, the composition and thickness of the walls, and the special features of the furnace room in enthusiastic detail.\textsuperscript{19} Intriguing though much of this is, none of it is very revealing of the details of the production process. We find walls, carbon traces, tiles and the remains of furnaces, but nothing to tell us how they were operated. Location, typically on a thoroughfare and in the shade of a wall, is commercially logical, but otherwise uninformative. All in all, the inferences we can draw from archaeology about the way manufacturing concerns operated and even about the numbers they employed – are extremely limited.

Dedications, tombstones and public records such as the manumission lists are often revealing about the prevalence of particular occupations, sometimes giving the lie to philosophers who convey the impression that certain activities are rare or non-existent or confined to non-citizens.\textsuperscript{20} Records of mining leases tell us much about investment patterns and we hear regularly of honours accorded to craftsmen, but again there is no direct information on how anyone actually set about making things.

Finds of shipwrecks containing manufactured vessels used for the transport and storage of wine, oil and grain tell us something about demand for commodity pottery but not about its manufacture. Even vase paintings of manufacturing activities scarcely help clarify the confused picture derived from literature. We see lone craftsmen, some intent on what is obviously a complex task, some doing something much simpler; people working in pairs, often perhaps a citizen of modest means with his slave; and, more rarely, quite large workshops with half-a-dozen or more working together. No wonder some scholars have been tempted to conclude that the multifaceted aspect of Athenian society that was industry cannot have reflected such a simple paradigm as capitalist economics.

\textsuperscript{17} Tschira (1972) 158-231 suggests these may have been engaged primarily in the production of building materials.

\textsuperscript{18} AXI, in which a furnace referred to above was found (AXII, dated C8 to late C7 BCE).

\textsuperscript{19} Monaco (2000) 175-6

\textsuperscript{20} Brock (1994 343) points to the number of words we find for female agricultural workers, despite Plato’s claim (\textit{Leg}.805c) that such labour was no better than servitude.
Modern Perspectives

Hordern and Purcell observe, “It is striking how much of the economic historiography of the Mediterranean has concerned itself not with production but with exchange.” Good work has been done on craftsmen by Burford (1972) and others. Bresson (2000, 2007) has addressed the role of manufacturing in the ancient Greek way of life, Harris (1995, 2002a, 2009) has paid serious attention to manufacturing in his analyses of forensic and labour activity in classical Athens and Cohen’s seminal work on banking (1992a) deals with many transactions involving manufacturing, but it is not overstating the case to say that for a comprehensive and focused attempt to describe and explain classical Athenian manufacturing in its own right, one must go back around a hundred years to the work of Glotz (1926) and Francotte (1900-01). All these works are drawn on extensively here.

One reason for this neglect is, presumably, the limited and confused nature of the sources we have described. Another is almost certainly the influence of the great historian Moses Finley. Finley held that the nature of ancient society (including, but by no means limited to, classical Athens) was so thoroughly based on non-economic values (or “embedded”) that to analyse it as if it involved anything that could be described as “an economy” in the contemporary sense is to draw a false picture. While acknowledging that a wide range of economic activity did actually take place, he denied that it resembled the commerce of a modern capitalist society. This proposition is of critical relevance to this thesis; applying contemporary economic analyses to ancient societies presupposes that their approach to transactions can be assessed by reference to economically rational behaviour. If Finley is correct, we might be wasting our time. For this reason Finley’s intellectual antecedents are explored in some detail here and the implications of his view for our approach are discussed at length in Chapter Two.

Finley’s paradigm changed the emphasis of a debate that had been raging for over a century between “primitivists” and “modernists”. Primitivists took an evolutionary view of economics; ancient society had been very different in nature from our own and evolved according to certain definable concepts into the society we have today. The historian’s job was to propose what those concepts were. The goal of scholars like Menger (1883) was to find a set of exact laws which could explain development and form the lens through which

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21 Hordern (2000) 30
22 Finley (1973) 23
empirical evidence should be viewed and understood. Understanding depended on induction from theory rather than deduction from facts. Modernists, led by Schmoller and consisting largely of professional historians, believed in the primacy of empirical research and in applying intuition and deduction to make sense of it.

In a defining work of primitivist doctrine, Bucher (1893) argued that economic activity in ancient times was not only smaller in scale than today, but qualitatively different. He based this on a progressivist typology in which the economic unit was originally the home – a “geschlossene Hauswirtschaft” or closed house of business – then in the Middle Ages became the city, and finally in the sixteenth century, the nation. This universal theory of economic development rejected Schmoller’s empiricism, but did not fully meet Menger’s aims in that it did not derive a progressive theory from the laws of classical economics; rather it described stages of society in which those laws were deemed not to apply.

Contemporary scholars took issue with Bucher: Meyer and Beloch argued that a considerable amount of economic activity did take place which could properly be described as resembling today’s. Much of Bucher’s analysis had focussed on agriculture and the quest for self-sufficiency, but Meyer drew attention to the existence of banking and an apparently high level of maritime lending, along with evidence of significant trade, free labour, entrepreneurs and self-employed craftsmen. At first, Bucher asserted he was not worried that his theory did not align with the facts – “For the central idea of my theory of development, it is altogether immaterial whether I have in every particular characterised the economy of the Greeks and Romans correctly or not” – as he was interested in “the normal, simply ignoring the accidental” – but he later admitted that multiple stages of development could coexist, an eminently sensible suggestion but one that weakened his thesis considerably. Rostovtzeff (1926, 1941) drew on the rapid growth in archaeological finds and their interpretation to show that trade over long distances was substantial and frequent, not something normally

23 Meyer (1895), Beloch (1893-1904)
24 Meyer was possibly correct when he claimed that slavery grew out of commerce and the need it created for labour, but Beloch was wrong to infer that importing slaves required the existence of large scale enterprise; we know there was a retail market in imported slaves that was not managed by or dependent on major employers.
25 Bucher (1893) 85-6
26 Beloch (1979)
associated with simple household economies and a further challenge to those describing the economies of the ancient world as qualitatively different from modern ones.

Both primitivists and modernists struggled to articulate a position that could comfortably accommodate primitive technology, small scale industrial units and expressed social distaste for money-making on the one hand, with the facts of widespread trade, increasing sophistication of credit markets and the evident importance of commerce in legal contests on the other. Nor was there a compelling case for a sudden transition from a primitive to a later state in Hellenistic times; both states seemed to coexist throughout at least the fifth and fourth centuries. Cartledge suggests that the primitivists appear to have been describing the dominant modes of exchange (perhaps 98% of activity), while modernists emphasised the remaining 2% – not a debate likely to lead to an insightful conclusion.\(^\text{27}\)

The problem had been only partially resolved by Riezler (1907) who found a compromise between primitivists and modernists by arguing that the ancient world was characterised by Bucher’s second stage – *Stadtwirtschaft* – rather than the first (*Hauswirtschaft*) to which Bucher himself had assigned it, or the third (*Volkswirtschaft*), preferred by Meyer and Beloch. Riezler drew attention to the importance of man’s inherent instincts to make money and improve his lot (“die wirtschaftliche Geist und die Zwecksetzung des Menschen”) and his struggle for survival (“streben nach grenzenlosem Erwerb”), but pointed out the political risks. The need for trade to enable a city’s self-sufficiency, and the individualism and competition for economic success that came with it, proved a massive, ultimately perhaps fatal, threat to the solidarity of the polis. This notion of inherent conflicts was taken up by Oertel (1925) who emphasised the plight of poorer citizens whose livelihood and status were threatened by the growing importance of slaves in industry and commerce. Erb (1937, 1938) brought these themes of conflict together and attributed to them the inability of Athens in the fourth century to develop wealth to replace her loss of revenues from her overseas possessions. Picking up the same theme, Vernant (1964) attributed chiefly to commerce and industry the fracture of the three identities that underpinned the ancient polis, those of city and countryside, citizen and soldier and land and wealth.\(^\text{28}\)

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\(^{27}\) Cartledge (1998) 14. Cartledge’s figures are presented as “notional and rhetorical”; this thesis suggests that the proportions were much more balanced and perhaps not as different from the proportions in modern capitalist societies as might have been thought.

\(^{28}\) Vernant (1964) 5-19
history as the result of the effect of self-seeking human instincts on societies whose institutions were based on non-economic values fits neatly with the concerns Plato and Aristotle expressed about the social damage that could stem from indulging the *chrematistike techne*. It is also consistent with the analyses presented here, although it does not necessarily distinguish Athens from other societies, including our own.

An important undercurrent to the primitivist-modernist debate was provided by political philosophers. Karl Marx was particularly influential. He argued that ancient economies shared much of their character with modern ones, being primitive versions of it: “Human anatomy contains a key to the anatomy of the ape…… The bourgeois economy thus supplies the key to the ancient.”\(^{29}\) This evolutionary view was unsettling when it came to the artwork of these primitive societies, which he admired very much despite his dislike of the capitalistic nature of the society that produced it.\(^{30}\) He concluded that economics does not determine culture. Though he did not go so far as later scholars in asserting that the converse applied, he had created an intellectual foundation for the view that a highly-developed civilisation could exist even though its economy might not resemble modern capitalism – a proposition that exercised a strong influence on Finley. A primitive economy and highly developed art were made compatible. One of Marx’s early followers, Rodbertus took the idea that capital exploits labour as his starting point for a theory of economic development, which of course posed the difficulty of finding enough growth in demand for the product among exploited workers to justify regular reinvestment and growth in production.\(^{31}\) This could, he argued, be fixed by an unavoidably complex redistributive tax system, but the problem did not arise if households continued to be self-sufficient – a state praised in much ancient literature and strongly supportive of a primitivist view.

While early economists tended to work with ideal types or abstractions, such as *Homo Economicus*, Max Weber combined these with a theory, later developed further by US sociologists like Veblen (1904) and Commons (1934), that institutions determined economic outcomes. He saw ancient society as the merger of two types of economy: the rural ‘natural’ autarkic household and an urban economy based on slave labour. Slaves could be incorporated into an *oikos* to promote its autarky in the first type or work in productive

\(^{29}\) Marx (1953) 105.111

\(^{30}\) “Marx’s Paradox” in Nafissi (2005)

\(^{31}\) Rodbertus (1850-1)
enterprise for commercial ends in the second. He held that ancient societies saw economics as a tool to further the interest of the status groups on which social structure was based, and supported this hypothesis by analysing how a slave economy developed in Ancient Rome after the massive losses of peasants in the Second Punic War. This inevitably led to economic stasis; in the slave economy there was no growth imperative for an *oikos* and therefore no normal evolution to free labour, competition and technical development. Weber in fact did not believe in evolutionary economics. He saw theoretical constructs as heuristics rather than natural laws and the *oikos* as an ideal type rather than an accurate description of the whole of ancient society. To the subsequent discomfort of some of his followers, notably Polanyi and Finley, he accepted that there were clear instances of capitalism at work in ancient economies; “slave agriculture…is of course capitalist in character from an economic point of view. That is because both land and slaves are acquired in the open market and are clearly ‘capital’. “ More generally, and to the horror of Marxists everywhere, “capitalism shaped whole periods of antiquity and indeed precisely those periods we call ‘golden ages’.” The difference from modern capitalism in Weber’s view was not that between capitalism and an alternative form of economy; it was a difference of institutions within a capitalist framework. Thus ancient political theory was more hostile to commerce than modern society and “businessmen…..were not sustained by any positive justification of the profit motive.” He went on to argue that it was only in very recent times that relationships had begun to emerge that were primarily economic. These concepts were developed further by Weber himself (1921) and picked up and applied specifically to Greece by Hasebroek (1928, 1931). In what Humphreys (1970) describes as a “masterly presentation of the primitivist case”, Hasebroek defined the ancient Greek citizen as *homo politicus* as opposed to *homo economicus*.

Polanyi, a self-professed follower of Weber, took a more direct approach to reconciling civilisation and a backward economy by arguing that in ancient times the economy was much less significant than Weber had posited: “History and ethnography…know of no economy prior to our own even approximately regulated and controlled by markets.” In three essays

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32 Weber (1891) 33 Weber (1891) 50 34 Weber (1891) 51 35 Weber (1891) 67 36 Polanyi (1944) 44
Polanyi contended that there were no real markets in the ancient world. Instead, the natural human economy rests on three other principles: reciprocity; redistribution; and “householding” (or production for family use). In recent years, capitalism had produced “a prosperity of gigantic proportions…for the whole of humankind” and “released a torrent of material wealth”, but the economic liberalism crafted by Malthus and Ricardo was flawed at its core and inevitably generated the regulatory state; *homo economicus* was a misleading fiction. Man naturally inclines to community and capitalism is an aberration or “exception” that only arose with centralised monarchies and larger territories under shared regulation. Production for gain was not natural as Adam Smith had held, but unnatural as Aristotle had. Local needs were served by local commerce and long-distance trade catered only to the wants of the rich. In an echo of Rodbertus, markets and money were “mere accessories” to otherwise self-sufficient households and constituted a major obstacle to human liberation; they destroyed the free smallholders that were the essence of ancient society and “divested man of his human shape”—a view probably confirmed by Polanyi’s move to England where he witnessed the poverty, exploitation and injustice that accompanied capitalist activity and urbanisation.

Like the primitivists before him, Polanyi’s theories tended to struggle when confronted with the findings of empirical historians. His claim that Babylon was not, as previously believed, a market economy but had all trade and prices centrally administered (1957a) was refuted by Gledhill and Larsen and, in a polite and understated way, even by his own collaborator, Oppenheim. Ignoring the evidence, Polanyi asserted that Greece could not have learned commerce from the despotic and non-commercial Near East, but he still needed to explain how it emerged in relatively free *poleis*. His approach was “ingenious, if not ultimately

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37 Carlson (2006)  
38 Polanyi (1944) 104  
39 Polanyi (1957c) 263  
40 Polanyi (1944) 243  
41 Polanyi (1944) 44  
42 Polanyi (1957b) 66  
43 Polanyi (1944) 8-60  
44 Polanyi (1944) 68  
45 I Polanyi (son of Karl) (1971)  
46 Gledhill (1982); Oppenheim (1957)
He suggested that commerce only arose in the late 4th century and then only in a very subordinate role. Polanyi called his approach ‘substantivist’ and contrasted it with ‘formalists’ who viewed ancient society through the lens of a modern economic framework. Certainly his political agenda is underpinned by a robust and normative view of human destiny, but it is also undermined by its contradiction of many historical facts; this will not be the only time we note an irony in the epithet ‘substantivist’.

An important observation of Polanyi is that no one wrote about the economy before Aristotle because there was no economy to write about. Economic transactions involving the “disembodied price setting” that we see today were absent from ancient society, and economics had only recently become a discrete, independent sphere of human activity. We discuss this in more detail as the second of four “embeddedness” propositions at the end of Chapter Two. We argue that while it was true to say (in the mid-20th century) that economics had only recently emerged as an academic discipline, it by no means followed that rational economic activity had not been taking place before that emergence, perhaps thousands of years before. The assumption of a necessary link between an activity and the ability of its agents to describe it is unwarranted. We similarly take issue with a corollary of this view: that because the ancients did not use a particular framework for discussing what they did, such a framework cannot be relevant to understanding it.

Finley’s view, referred to in this thesis as the Embeddedness Paradigm, can thus be seen as an insightful variation on a long-standing theme; the differentiation of ancient from modern economies based on a priori reasoning, rather than on observed facts about economic transactions. Finley’s novel angle was to deny the existence of a recognisable economy at all. Extrapolations of this view have dominated recent economic historiography of the ancient world to the point where many scholars have steered clear of economic matters and very few attempt to apply modern analytics. Meikle insists, that “scholars have shown empirically, over and over again, that antiquity did not have the institutions, ideas and practices which modernist claims wittingly or unwittingly attribute to it,” and takes this as evidence that transactions must have been so different they cannot be understood in modern terms. More recently scholars have produced excellent and deep analyses of the cultural

47 Nafissi (2007) 80
48 Polanyi (1957b) 65-7
49 Meikle (1995a) 235
context of transactions, emphasising the symbolic meanings of coins and exchanged objects,\textsuperscript{50} but these readings are inevitably ‘impoverished’ as they fail to incorporate human economic drives.\textsuperscript{51} While no one would deny the importance of symbolism in many transactions of the period, \textit{Chapter Two} argues that this does not necessarily mean that the decisions determining the outcomes of transactions were not economic ones. A more moderate approach would emphasise that the cultural norms of ancient Athens did have an important impact on how Athenians set about participating in and describing economic activity, but would use this observation as a heuristic rather than to cut off further debate.\textsuperscript{52}

\textit{Chapter Two} shows that the case against using modern economic concepts has not been well established. It is an error to consider societies as either economically determined or not so, since in reality all societies operate in both modes. The chapter goes on to explore different interpretations of the Embeddedness Paradigm to identify precisely what challenges they propose to the approach adopted here. The remainder of this thesis addresses the empirical evidence as to how Athenians actually operated manufacturing businesses. By looking through a contemporary lens, using tools which typically presuppose what we would describe as economically-rational decision making, we are also testing the Embeddedness Paradigm. To the extent that outcomes are consistent with those that would occur in a modern profit-maximising economy, it will be necessary to conclude that the impact of Embeddedness on real events was, at best, limited.

\textbf{Methodology}

The limitations of original sources and the negligible attention manufacturing has received from modern scholars mean that some creativity has been required to generate the information required for the analyses undertaken here. A problem-solving approach is adopted; rather than see what conclusions can be drawn from readily available facts, we identify the data required and find the most robust way of quantifying them. In addition to the sources described above and simple economic frameworks described in the text, this thesis draws upon contemporary craft experts for an understanding of production methods and infers market conditions for different products from a combination of ancient references

\textsuperscript{50} See for example von Reden (2002) and Kurke (2002)
\textsuperscript{51} Morris (2002a)
\textsuperscript{52} Cartledge (1998) 19
and common sense, any propositions that cannot be substantiated from ancient sources being clearly identified.

For the major analytical module (Chapters Three to Five), it is necessary to identify for different products the typical size of manufacturing units and the potential for achieving either a production cost advantage or a sufficient degree of product differentiation to attract customers at the expense of competitors. Establishment size is derived from textual references or, more rarely, vase paintings. Production processes and the potential for cost advantage come principally from discussions with craft experts and from research on ancient technology. Archaeological evidence on kiln size is also important. The potential for product differentiation is often hypothesised based on a consideration of the uses of the products in question, supported where possible by original references. Chapter Six, which applies the conclusions of this analysis to redefine the place of manufacturing in Athenian society, uses a wide range of sources, including archaeology and epigraphy as well as ancient texts and the work of several contemporary scholars.

Chapter Seven draws on Homer, and to a lesser extent Hesiod, to identify how manufacturing was conducted before the production of most goods emerged from the oikos and began to be principally for exchange to third parties. Using the poets to characterise a “before” stage, and original texts from classical Athens to characterise the “after”, provides enough data to test the predictive value of elementary supply and demand theory in industry formation.

Chapter Eight is concerned with a single speech of Demosthenes and examines how far the Demosthenes family’s investment preferences conform to the modern paradigm of returns being proportionate to risk. The analysis is supplemented by the work of other ancient writers, notably Xenophon, and of modern scholars on matters such as the cost of keeping slaves.

The question why Athens did not have an industrial revolution is addressed in Chapter Nine. It includes a brief overview of theories of industrial development, many of them from the last few years, and draws on the findings of earlier chapters to disprove two explanations commonly put forward as peculiar to Athens: lack of commercial motivation and slavery.

Chapter Ten summarises the results of the analyses and considers their implications both for the Embeddedness Paradigm and for historiography more generally.
Before commencing the analyses that support our hypothesis, the next Chapter explains why the Embeddedness Paradigm and its multiple interpretations, however well-founded in some respects, do not show that the approach adopted is either futile or illegitimate.
2. THE EMBEDDEDNESS PARADIGM AND THIS THESIS

“The economic language and concepts we are so familiar with, even the laymen among us, the “principles”, whether they are Alfred Marshall’s or Paul Samuelson’s, the models we employ, tend to draw us into a false account.”

Finley poses a serious challenge to our approach. This thesis sets out to prove not merely that an account based upon familiar economic principles need not be a false one, but that it can add fresh insights to the study of history that would not otherwise be available. Before proceeding with the analysis, it is important to address the logic and implications of the Embeddedness Paradigm in some detail. After a brief summary of the main elements of the Paradigm and the views of some of its critics, this chapter argues that what Finley posited as a dichotomy between social and commercial determination is more correctly seen as a spectrum, and that our own society constrains economic activity at least as much as Athens did and in surprisingly similar ways. We then examine four propositions covered by the broad brush of “Embeddedness” and their relevance to this thesis.

The Embeddedness Paradigm

Finley’s 1973 masterpiece, *The Ancient Economy*, was a bold attempt to describe the economy of the entire Greek and Roman Mediterranean over a period of almost a thousand years with a single model. The task was, of course, made easier by the fact that the model effectively precluded conscious economic activity. Finley’s central assertion – that the economy of the ancient world was not a market one – is based upon a wide range of activities or their apparent absence: mortgages and other loans were for consumption, not for productive investment; there was no manufacturing activity that we would recognise as such; there was no real credit market or credit creation; there were no real markets in land or labour; loans were made largely between friends, generally for consumption purposes, and often did not bear interest; there were few attempts to control the coinage; there were no arguments about exchange-rates; attempts to improve public finances did not take into

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1 Finley (1973) 23
account the economic effects of different choices; there were no financial crises or apparent cycles; there were no explicit investment paradigms or methods of quantifying risk (e.g: for maritime loans); no attempt was made to keep detailed statistics on important economic matters such as trade or the size of land holdings; nobody collected time-series data for economic or financial comparative analysis or target setting; even when the economic impact of wars was significant, the origins of hostilities are better explained by non-economic factors; lasting partnerships or corporations were not put together for business purposes; product sales were typically person to person; and new technical discoveries were not used to enhance productivity.\(^2\)

While some of his early works had appeared to adopt a modernist perspective and support Meyer and Rostovtzeff’s refutations of primitivism, in *The Ancient Economy* Finley found other bases for accentuating the difference between ancient society and modern capitalism;\(^3\) he made much of the lack of technical development in ancient times and noted that the division of labour advocated by Xenophon was in pursuit of quality not profit (*Cyr.* 8.2.5). He attempted to create a unified view of ancient Greece and Rome without using the *oikos* as the common factor, referring instead to such aspects as aristocratic values, static production technology, a focus on land investments, the respect for riches won in war and the role ofmetics. Unlike Hasebroek, he acknowledged widespread trade but, following Polanyi, claimed it was not commercial but aimed primarily at securing luxuries for the rich. His analysis of *horoi* revealed that they stood mainly on the properties of the wealthy, from which he concluded that there was no proper market for real estate in classical Athens.\(^4\) Importantly for our purposes, he saw the evidence of multiple manufacturing activities whose form could not easily be explained as being profit-maximising as proof that ancient manufacturing was not an activity that could be understood in today’s terms.\(^5\) The poor record of technological development he attributed to cultural factors, in particular the absence of an effective profit-maximising imperative (a theory refuted in *Chapter Nine*). By the time of *The Ancient Economy*, he had a fully developed view of a world in which art and democracy flourished but nothing similar to capitalism existed. It bore a strong resemblance to the world idealised by Thomas Jefferson’s Republican party –

\(^2\) Finley (1973) 23; 26; 116-21; 70; 139-45; 156-9; 164-9; 196-8
\(^3\) Nafissi (2005) 204-6
\(^4\) Finley (1981)
\(^5\) Finley (1973) 73-4
“a pristine and largely imaginary past in which life was rural, relationships were personal, the gentry ruled as a natural aristocracy, the main corpus of the citizenry was an honest yeomanry, commerce and craft-manufacturing existed only as handmaidens to agriculture, standing armies and privileged monopolies and fictitious paper wealth were all unknown….”

Chapter Six shows that this world was no more applicable in classical Athens than practical in the new American republic.

Although Finley claimed to be a disciple of Weber, these views are much closer to those of Polanyi. Finley liked to see Weber as a strong primitivist, but his attempts to reconcile this view with a more careful reading of Weber’s works gave him “a feeling of depression….as if under dispute were mere quantities or points along a continuum.” Nor would he have warmed to Weber’s strong individualism, his assertion that capitalism was prevalent in many places and times in the ancient world, especially the “golden ages”, and his opinion that socialist societies are strangled by bureaucracies of the type that eventually accounted for the decline of Egypt and Rome.

Finley believed the prime function of history was to spread a political message: “We….sought explanation and understanding of the present in our study of the past.” Accuracy was a necessary condition for writing good history but not a sufficient one. His theme was that the ancient world provided a model of an admirable society untainted by capitalism. He saw slavery as a key factor in ancient society, but far from the only one that affected development, since the emergence of free labour in Greece could not plausibly be

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6 McDonald (1976) 161-2  
7 Finley (1965b) 12  
8 Weber (1891) 50; 51  
9 Finley (1967) 201-2  
10 Finley (1984/5) 55  
11 This provides an interesting contrast with JM Keynes (1931) who held (erroneously, it seems) that the acquisitiveness that characterises capitalism would be dispensed with once mankind had achieved an high standard of living and “all kinds of social customs and economic practices, affecting the distribution of wealth and economic rewards and penalties, which we now maintain at all costs, however distasteful and unjust they may be in themselves, because they are tremendously useful in promoting the accumulation of capital, we shall then be free, at last, to discard.”
attributed to the bloody uprising of serfs Marxists typically held accountable. Different concerns about status explained the uncommercial approach to life. From once offering a reasonable continuum of status from lowest to highest, Athenian society had become polarised between free citizens at the top and slaves at the bottom. Transactions were based around and constrained by this dichotomy, not by the imperatives of a disembodied market. Finley interpreted Solon’s reforms as reflecting the dangers debt posed to status relationships and emphasised the words of the ancient writers that condemned banausic pursuits; Athenian citizens would only pursue ‘reputable’ ways of making money – one of which was to exploit foreigners. With Hasebroek, Finley held that low status meant little political influence (perhaps by definition) and the lowly status of such economic agents as there were itself determined and limited the nature and relevance of the activities they undertook. Economies could only really develop when this status ascription changed.

Finley derived the origins of this society from a perspective of peasant farming, in which self-sufficiency was the overriding objective and trade or exchange minimal. Slavery freed citizens from the land and enabled them to derive income from rents and taxation rather than from the sweat of their brow. This in turn enabled urban society to develop as a home for the ruling, land-owning elite, who were dependent on food imported from the countryside. Cities were consumption centres with no engagement in production; that was left to rural dwellers. He contrasted this parasitical city with the Middle Ages, when the rich lived predominantly outside towns and city-based manufacturers made a living by selling to them. In a departure from his earlier work, Finley challenged Rostovtzeff’s view that trade had become very active by 100 CE, describing the evidence as limited and anecdotal. He conceded that there was some limited exchange of goods, but insisted that there were no active markets, most households were still self-sufficient, and there was very little division of labour. He quotes with approval David Hume’s comment in his essay “Of the Populousness of Ancient Nations”: “I do not remember a passage in any ancient author, where the growth of a city is ascribed to the establishment of a manufacture.” This philosopher, “whose reading in ancient authors was wide and careful”, clearly had a narrow interpretation of Thucydides’

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12 Finley (1959/60)  
13 Finley (1973) 35-61  
14 Hume (1758) 415  
15 Finley (1973) 21
statement that it was the lack of commerce that stopped earlier generations from building cities (I.2).

Morris summarises what he sees as Finley’s five most important propositions:

- Status concepts blocked economic development
- Slavery enabled large-scale agriculture
- Most commercial dealings were undertaken by women, slaves and foreigners, albeit sometimes as agents for the elite
- Citizens looked for income mainly from exploiting non-Athenians, rather than from selling goods to one another
- This probably encouraged imperialism and conquest. ¹⁶

Several impinge on this thesis: is the story of industry in classical times to be seen in a context in which development stalled because the elite did not like it? Does the low status of economic agents prove that commerce was not a serious occupation? Were the energies that another society might devote to making money devoted instead to exploitation and military adventures abroad? These notions are addressed in the last section of this chapter.

The more robust elements of the Embeddedness Paradigm theory can be characterised as an attack on ‘formalism’, the view that the economy was a “functionally segregated and independently instituted sphere of activity with its own profit-maximising, want-satisfying, logic and rationality.”¹⁷ Finley’s “substantivist” approach by contrast holds that the economy was politically overdetermined and therefore “by the standards of neo-classical economics, conspicuously conventional, irrational and status ridden”. For Finley this mentality “not only reflect(s) but also up to a point determines economic (or other) reality.” Against this, Cartledge makes the point that aristocratic values are all very well for the elite, but perhaps not so easy to adhere to for those who had to earn a living. He usefully emphasises that the formalist-substantivist dichotomy is quite different from the preceding primitivist-modernist debate. While Finley relies heavily on evidence that the economy was underdeveloped, his conclusion is that there was effectively no proper economy at all, so to try to define its level of modernity is meaningless.

²⁶ Morris (1999) xxii-xxiii
²⁷ Cartledge (1998) 15-7
From an historical point of view, the world Finley describes is not an ideal type put forward for heuristic purposes in the way Weber did; it is supposed to represent the world the ancients lived in. Unsurprisingly, this attempt to portray the ancient world as economically quite distinct from later, capitalist, societies ran into as much trouble with the facts as the early primitivists and Polanyi had. In response, Finley argued that examples in the literature displaying rational economic activity were sparse and did not provide evidence of an economy at work, being rather a series of disconnected transactions that lacked the unifying concept of an economy:

“Of course they farmed, traded, manufactured, mined, taxed, coined, deposited and loaned money, made profits or failed in their enterprises. What they did not do, however, was to combine these particular activities conceptually into a unit, in Parsonian terms, into a differentiated sub-system of society.”

Like Polanyi, Finley claimed support for his position from the paucity of ancient writings on economic subjects, as well as from such things as the absence of guildhalls and commercial centres. The economy was so embedded in society that separate representations and symbols of it were unthinkable. The lack of ancient writings on economics was not a failure of conceptualisation – “an intellectual failing, a problem in the history of ideas in the narrow sense”, as some had suggested – but “the consequence of the structure of ancient society.”

In the last section of this chapter we argue that Finley’s point is not proven and that, even if it was, it might not have the impact he posited on how commerce was actually conducted.

Finley favoured the use of models as “they are valuable in obscuring incidental detail and in allowing fundamental aspects of reality to appear…..That this is the way to advance our understanding of the ancient economy, and not the evocation of individual ‘facts’ is clear to me.” We may infer that Finley would be comfortable with the methodology used here since it applies a conceptual framework to known facts, but he would remain concerned that our use of basic economic theory as that framework, rather than revealing new insights, will “tend to draw us into a false account.”

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18 Finley (1973) 21
19 Finley (1973) 21
20 Finley (1973) 181
21 Finley (1973) 23
activity according to a modern economic paradigm provides an opportunity to identify the extent to which social determination was actually reflected in the transactions. If Finley is correct we will find that the models simply do not work or that they need to be modified in ways that are informative about the impact of social norms and values.

Several conceptual arguments have been raised against Finley’s conclusion: it fails to distinguish Greece and Rome from other early societies; the case for inferring identical approaches to matters economic from political and cultural similarity is far from proven; and the unitary view frequently conflicts with observed evolution. Factual critiques are also plentiful: trade was more extensive and balanced than Finley had allowed for; self-sufficiency depended on it, to the point where a new economic mindset emerged in classical times; city and country were interdependent rather than one being dependent on the other; cities were major manufacturing centres; state management of the grain supply was quite sophisticated, as was the discreet use of price-fixing in otherwise free markets; states optimised their budgets; currencies were carefully controlled; some states controlled interest rates (though this does not seem to have been common practice), business associations were encouraged, and contracts were well supported by law.

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22 Finley (1973) 181
23 Finley (1973) 181
24 Finley himself acknowledged that changes occurred in economically relevant ways, as for example in the nature of slavery.
29 Bresson (2007) Ch.7
31 Loomis (1998), Bresson (2000); see also scholion to Ar. Eccl. 814 and Dem xxxiv 39; lvi 8, 10
32 Faraguna (1992)
33 Stroud (1974)
34 Inscription 2940 in Bourguet (1929) Vol.III, Fasicule 5; Athens also arranged for the state to be able to borrow from the temple of Athena at the nominal (non-market) rate of 1.2% p.a. (IG. I 2 324).
35 von Wilamowitz-Moellendorf (1965) 278

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One area sometimes claimed to have limited the development of Athenian industry is finance. Finley and scholars such as Millett (1991) and Meikle (1995b) have argued strongly that credit markets for financing productive enterprise in Athens were virtually non-existent and that this was itself a cause (or possibly an effect) of limited development. Cohen (1992a, 1992b) by contrast finds evidence of a very sophisticated banking industry. Bogaert and Harris take an intermediate approach and conclude that banking was quite developed enough for the commercial needs of Athenians. Chapter Three argues that little capital was required in most manufacturing ventures and Chapter Six finds considerable evidence of lending for productive purposes in any case.

Almost forty years after its publication, The Ancient Economy still shapes scholarly thinking about economic activity in the ancient world. For much of the intervening period, it made many historians shun economic analysis altogether. Only recently “on commence….. à admettre que les Grecs avaient une économie et que comme systeme, cette dernière merite d’être étudie pour elle-meme.” On the other hand it has led to a great deal of interesting debate and revealing case-studies about the impact of culture on commerce, some valuable new perspectives on symbolism in political discourse and commercial objects, and a better understanding of the social context of such matters as the emergence of contract law. Only a few historians seem prepared to engage with economic subjects in purely economic terms. Of most relevance to this thesis, Finley’s work has made historians especially aware of the risk of anachronism in applying contemporary economic or financial analysis to the classical period. Irrespective of their potential value as a heuristic, Finley has cast doubt on approaches that the ancients did not apply themselves.

Whatever the evidence contradicting some of Finley’s conclusions, he was working from the demonstrably true premise that the social context of commerce in the ancient world differed in important respects from that of modern capitalism. What matters is whether he was right

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37 Bogaert (1968); Harris, (1993) 102-7
38 Bresson (2007) 3
40 Bresson (2000,2007); Harris (2002a, b, 2006 a, b); Cohen (1992a, 2002); Morris (2002) are notable examples.
to conclude that this made commerce itself unrecognisably different; must societies be classed as either economically or socially determined, or are they really a blend of both?

A False Dichotomy

On 7 April 1905 the US Supreme Court overturned a New York State law that restricted the operating hours of bakeries on the grounds that government should not interfere in business arrangements. In a dissenting opinion, Justice Holmes protested that the Constitution should not “embody a particular economic theory” – in this case, *laissez-faire*. In 1911 Congress passed legislation banning cartel activity. The fuzziness and mutability of the boundary between polity and economy illustrated by this ambivalence in a proudly capitalist society points up a serious conceptual flaw in Finley’s model. Many examples detailed in the following chapters show that a careful reading of the texts suggests that the Athenian economy was by no means as divorced from commerciality as Finley makes out. The other side of the comparison – that modern society is an example of unconstrained profit-seeking – does not bear very much scrutiny either.

There are many ways in which our social values and beliefs act to constrain market-driven profit-maximisation. Among the more obvious are child-labour laws, environmental regulation, consumer protection laws, industry policy, media anti-siphoning rules, a distaste for industry among those privileged by birth, purchasing preferences, trade tariffs, agricultural protection, minimum wages, concerns about private individuals exploiting the state, anti-monopoly laws, anti-cartel laws, occupational health and safety, legislation protecting trade unions and the whole burgeoning field of Corporate Social Responsibility. As Margaret Thatcher observed, “a genuinely *laissez-faire* society has never existed anywhere on earth at any time.”

Nor would many of us want it to: a recent letter in the London Times shows that we are far from resigned to our social preferences being abandoned to a disembodied market:

“Sir, Since Margaret Thatcher’s tenure the market in the UK has become increasingly our master when it should be our servant. If Gordon Brown wishes to change the

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41 Quoted in Gilmour (2002)
country for the better, one objective must surely be to ensure that while we have a market economy we do not have a market society.”

Lanchester describes social attitudes leading up to the recent crisis as “a kind of reverse takeover, in which city values came to dominate the whole of British life.”

A review of some of these areas of social influence on economic transactions indicates that the Athenians took a very similar position on many of them to our own. Today’s antimonopoly laws are based on an economic paradigm that holds that abuse of market power can transfer wealth from consumers to producers by keeping prices artificially high. We see the same thinking behind the law referred to by Lysias in his speech that forbade anyone to buy more than a certain quantity of corn (xxii.7). Even the elitist attitude to menial activities that we find in the philosophers has a strikingly familiar ring to anyone familiar with the sentiments of the upper-middle classes of Western Europe as recently as the middle of the 20th century. State intervention too has its parallels. Athenian laws prohibiting the export of grain and ensuring the quick and effective distribution of imported product were designed to reduce the risk of food shortages in times of crisis. Management of the food supply was an important defence strategy, just as it is today in Japan and, by some accounts, an argument for continued agricultural protectionism in the European Union and the United States. Athens did not legislate to set minimum wages laws as many capitalist countries do. It did not need to; as a major employer with a transitory and casual workforce, the wages it set for working on public buildings effectively defined a price below which individual businessmen could not attract free workers. Further, this wage was set, as it is in minimum wage countries today, by painstaking calculation of what was needed to maintain a man and his family. Nor does Finley do justice to the complexity of Athenian culture. Widely (if not equally) distributed landholdings, the potential to extend the citizenship, for slaves to become rich and for women to have more say in their affairs than in, say, nineteenth century England or contemporary Dubai, all speak of a society with many modern characteristics.

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42 Times 29/06/07 (letters page)
43 Lanchester (2010) 188
44 This was also difficult for status reasons, explored in Chapter Six.
45 See for example Osborne (1992); Foxhall (2002)
Finley contrasts the classical world with Economic Man – Hasebroek’s *Homo Economicus*, the perfectly rational and self-interested actor. In Knight’s extrapolation:

“Every member of society is to act as an individual only, in entire independence of all other persons. To complete his independence, he must be free from social wants, prejudices, preferences or repulsions, or any values which are not completely manifested in market dealing. Exchange of finished goods is the only form of relation between individuals, or at least there is no other form which influences economic conduct.”

North comments that:

“from the viewpoint of the economic historian, this neoclassical formulation appears to beg all of the interesting questions. The world with which it is concerned is a frictionless one in which institutions do not exist and all change occurs through perfectly operating markets.”

Ferguson describes the unreality of this form of economic idealism in explaining the 1998 collapse of Long Term Capital Management:

“Imagine another planet – a planet without all the complicating frictions caused by subjective, sometimes irrational human beings. One where the inhabitants were omniscient and perfectly rational; where they instantly absorbed all new information and used it to maximise profits; where they never stopped trading; where markets were continuous, frictionless and completely liquid…. perhaps it is not altogether surprising that it turned out to look like Greenwich, Connecticut, one of the blandest places on earth.”

Lanchester notes “the fact that non-economists see the general assumption of rationality as self-evidently ridiculous has no effect on economists.”

Morris suggests connivance: “real

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46 Knight (1921) 78
47 North (1981) 5
48 Ferguson (2008) 321
49 Lanchester (2010) 116
people do not act in this way, and economists are perfectly well aware of it.”

Nevertheless, the model is a powerful one: “While this wonderfully lifelike dummy is in the shop window, what hope is there for the genius that is kindled by human diversity?”

The diversity that characterised ancient Athens is similarly obscured by contrasting it with the fictitious dummy.

Economic Man and his perfectly rational planet owe much to Alfred Marshall, whom Finley adduces as a practitioner of the sort of theoretical economics to which the ancient world’s thinkers could not aspire. A formative part of Marshall’s own education was the Mathematical Tripos at Cambridge which he sat in 1848; it “instantiated the late-nineteenth-century English idea of rigorous mathematical argumentation” and informed his view that mathematics “served as an exemplar of the path to truth, to constructing indubitably true arguments.”

In practical terms, Marshall understood that by making a huge number of ceteris paribus assumptions, economics (which had previously been a branch of political philosophy) could be turned into a discipline in which firm prescriptions could be drawn by mathematical deduction from these assumptions. This in turn made his students eminently employable in the British public service, probably an important objective. Economic Man turned out to be “an excuse to use calculus”, but was certainly not the last word in quantifying economic activity. The Cambridge syllabus was closer to rational mechanics than to the axiom-based theorising that continental mathematicians were developing in the late 19th century, and of course Marshall and his English contemporaries had no knowledge of the tools later economists have used to model reality such as mathematical organisation theory, game theory, dynamical theory and probability analysis.

On 10 August 2009, addressing the causes of the current financial crisis, a group of ten dissident British economists wrote to the Queen to protest that “in recent years economics has turned virtually into a branch of applied mathematics, and has become detached from real world institutions and events.” They were taking issue with a letter from two other Professors attempting to explain the financial crisis, which had failed to consider “how the preference for mathematical technique over real-world substance diverted many economists from

50 Morris (2004) 22
51 Butler (1996) 334
52 Finley (1973) 21
53 Weintraub (2002) 17,23
54 The Economist, 17/4/10, 80
looking at the vital whole.” The fact that Athens avoided this trap is scarcely proof of a non-commercial mindset.

Marshall himself recognised that economics was no more than “a subset of the socio-biology of one species of the primates”, and not necessarily a privileged one. In fact, classical economics does not claim to describe how any real society makes all its decisions; it is difficult to imagine a society in which all decisions are based solely on profit-seeking, since “homo economicus represents a special case of instrumental rationality in which income maximisation occupies a privileged place in the preference hierarchy.” The assumptions on which homo economicus is based have been disproved in theory and in practice. Kahnemann, Tversky and others have shown that our “rational” heuristics have built-in flaws. Adam Smith himself, so often unjustly portrayed as a one-eyed advocate of rational economics, admitted that man has principles “which interest him in the fortune of others, and render their happiness necessary to him though he derives nothing from it.” Christensen complicates the picture still further by observing that even if the fictitious Homo Economicus existed, he would be multifaceted, since “different definitions of economic rationalism contain different assumptions, either implicit or explicit, about values.” He concludes that a balanced reading of the evidence “suggests that fourth century Athenians were responsive to the sort of concerns associated with homo economicus, not that they were sensitive only to those concerns”. We may say the same about modern capitalist societies.

The attempt to define productive and exchange activity as either determined entirely by market forces or not at all “n’est que le réflet d’un préjugé évolutionist.” Andreau observes:

55 Open letter to Her Majesty the Queen from Professor GM Hodgson and others, University of Hertfordshire, 10/8/09
56 Quoted in Henderson (1981)
57 Christesen (2003) 32
58 Sen (1979); Frank (1985)
59 Kahnemann (1982)
60 Smith (1759 (1976)) 1
61 Christesen (2003) 32
62 Christesen (2003) 54
63 Bresson (2007) 35
“In antiquity as today, events and behaviours that are not economic influence economic life and vice versa…. The problem today is no longer one of knowing whether the cultural determines the economic…Posing the problem in this way leads to no useful result. Reciprocal implications are the real issue, involving both compatibilities and incompatibilities.”

He goes on to explain how Finley convinced himself that the ancient economy was not a market one “without envisaging any middle road in between. Either one could talk of a market economy, as for the twentieth century, or there was no market at all.” De Long illustrates the practical problems with this rigid division by describing how he employed three service providers for his family in California, a swimming instructor, a house watcher and a baby sitter. In each case the amount he paid them was determined chiefly by considerations of friendship, reciprocality, encouragement or social relativity and scarcely at all by the laws of supply and demand. This does not occur, he points out, when buying groceries. Societies can happily accommodate reliance on pure market forces for some transactions and not others. He goes on to make a balanced interpretation of what Polanyi actually argued:

“What happened in economic transactions was in large part determined and guided by sociological and political relationships, but (that) now – again painting with a very broad brush – the principal direction of influence is reversed; politics and sociology are more shaped by economics than vice-versa.”

Finley posits a dichotomy to describe what is obviously a spectrum. “It is as if historians have framed the possible views as Black and White and then proceeded with ferocious arguments against either White or Black, all the while conceding that the most probable truth is somewhere in between, in the gray.”

To maintain this exaggerated contrast, the Paradigm not only devalues the pragmatic commercialism of the ancients, but grossly exaggerates the extent to which our current

64 Andreau (2002) 128-9
65 Andreau (1995) 36
67 Saller (2002) 252
behaviours are determined by economic rationality. Recognising the overstated nature of this contrast casts further doubt on what was already a dubious inference; that the economic concepts that apply to one society cannot be informative in regard to a quite different one. This thesis argues that it is precisely by reference to these economic concepts that one can best grasp where on the economic to non-economic spectrum different aspects of Athenian practice lay; if we understand which matters appear to have been determined in a manner that is inconsistent with predictions that assume economic rationality, then we will be better able to understand the values and beliefs that informed Athenian behaviour.

**This Thesis and the Embeddedness Paradigm**

Finley adds examples to his warning about the ‘false accounts’ modern economic frameworks might lead us into:

“For example, wage rates and interest rates in the Greek and Roman worlds were both fairly stable over long periods …… so that to speak of a ‘labour market’ or a ‘money market’ is immediately to falsify the situation. For the same reason, no modern investment model is applicable to the preferences of the men who dominated ancient society.”

This thesis takes a profoundly different view. *Chapters Four* and *Five* demonstrate that in known sectors, business decision making in Athens seems to have followed much the same rules for success as it does today, and *Chapter Eight* uses a modern form of investment analysis to point up new insights into Athenians’ economic preferences.

Although Finley’s position is based on a priori sociological hypothesising rather than the analysis of outcomes that we are concerned with, in order to ensure we address the challenges

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68 Saller goes on to suggest that in truth Finley and Rostovtzeff were not far apart after all. The reason Finley broke with Polanyi was because he accepted Rostovtzeff’s arguments that showed that “the intrusion of genuine market (commercial) trade, on a very considerable scale and over very great distances, into the Graeco-Roman world had a feedback effect on peasant markets and the rest to such a degree as to render the primitive models all but useless.” His main reservation was that he could not accept that these markets were integrated into a single price-setting dynamic. Strangely enough, Rostovtzeff agreed on this point but gave a more pragmatic reason: the impact of transport costs.

69 Finley (1973) 23
of Embeddedness Paradigm, we must disaggregate the different ways in which various scholars have suggested economic activity was socially constrained. While “not even the most fervent moderniser would deny that some quite basic aspects of the Greek economy were really rather primitive”, it is important to understand which aspects and what impact their primitive state might have had on commercial activity. Versions of Embeddedness posit at least four quite different forms of social impact which might operate independently of each other and affect transactions in quite different ways:

1. **Who could engage in particular types of economic transactions**
2. **What language and concepts were used to describe economic activity**
3. **Whether profit making through industry was constrained by social values**
4. **Whether profit-maximisation was a conscious goal**

Some of these points are simply facts which must be accommodated in any assessment of ancient economic activity. There is no doubt that Athenian society differed significantly from ours on the first dimension. Finley makes much of the difference he observes on the second, though we suggest that he overstates this difference and in any case its relevance to economic conduct is unclear. A significant body of literature, notably the philosophers, suggests that Athenian society might have been quite different from ours on the third point. Scholars have ventured different opinions on the fourth, including recent work in economic geography which suggests that risk-minimisation was an important goal for the peoples of the Mediterranean basin. None of these points, however, addresses the essential matter of whether the transactions that took place under these conditions were consistent with economic rationality.

**Who Can Engage in What Transactions?**

There is undoubtedly a difference between classical and modern times in this regard. The fact that only adult male citizens had full commercial rights is indeed different from today’s approach to commerce. Women and slaves lacked property rights, even though both did a lot of buying and selling and slaves often ran workshops on behalf of absentee owners. Many of those who played a leading role in commercial activity were metics and freed slaves and

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70 Cartledge (1998) 15
therefore of inferior status and politically inconsequential. Finley, following Hasebroek, infers the insignificance of industry from the inconsequence of its practitioners.\textsuperscript{71}

The idea that “the elite… who….dominated politics… had little interest in manufacturing business or trade”,\textsuperscript{72} is contradicted by a large number of instances (Chapter Six). One must also question how much the doing of business was actually affected by the limited rights of women and non-citizens. A practical people, the Athenians found various ways of getting round legal restrictions when they had to. Slaves could use citizens to act for them, husbands could represent the interests of their wives and metics were protected from injustice as long as they paid their tax.

The legal system accommodated itself to the importance of slaves in business, giving them legal capacity in lawsuits concerning banking or trade. Athens’ characteristic commercial pragmatism came into play: laws were introduced recognising slaves’ responsibility for business debts, and slaves and metics were allowed to appear as witnesses in certain commercial cases. When Phormion took over Pasion’s bank, a number of large loans had been secured on real estate. As a slave, Phormion could not own land and therefore could not collect if the loan went bad. As a convenient solution, the loans stayed in Pasion’s name while Phormion administered them.\textsuperscript{73} Slaves living independently (\textit{khoris oikountes}) could do very well financially (\textit{(Xen.) Ath. Pol.}1.11). Pasion became rich by acting as a banker on behalf of his masters and also owned a shield factory. His wealth enabled him to undertake liturgies and gain a great reputation – as well as suspicions of corrupt dealing (\textit{Isoc.} xvii.9). Another slave, Lampis, owned and operated a large commercial trading vessel. He acted as principal in numerous banking contracts, lending substantial sums and receiving them on behalf of others (Dem. xxiv.6-23). Zenothemis, another slave involved in maritime commerce and lending, even litigated in his own name (Dem. xxxiii.4).

Similar pragmatism governed women’s role in commerce; the inability to own assets or make even modest contracts in their own name did not mean Athenian women were inactive in commerce. Cohen argues that “female and servile control of businesses was a natural consequence of an \textit{andreia} which valorised military, cultural and political pursuits, but

\textsuperscript{71} Finley (1973) 144-5
\textsuperscript{72} Engen (2007 – electronic article)
\textsuperscript{73} Harris (2006b)
feminised gainful employment." This control was facilitated by the fact that the oikos was, in reality as well as etymology, the basis of the economy. Assets were owned by the household and the senior male or kurios was seen as the steward of the household’s assets rather than their owner. The household controlled property and was accountable for tax. It was the oikos rather than the individual that undertook liturgies and managed income generation, including the production of goods for sale, and it was women who ran the oikos. Menander’s Plokion depicts a wife who knew everything and controlled everything. Assets were automatically entailed to the master’s children, so that the only purpose of wills was to ensure the survival of an oikos lacking a male heir by adopting a new kurios, often through finding suitable spouses for the widow and daughters. Women had the right to object if a will alienated assets from the oikos (Aeschin. ii.29).

Many pragmatic expedients enabled women to take the lead in some large transactions despite their legal handicap. One way for the wealthiest entrepreneurs to establish the continuity of their businesses was for their widow to marry the slave in charge of it. Phormion married Pasion’s widow Archippe who also knew all about the banking business (Dem. xxxvi.14). In theory, such a marriage was a legal nonsense. A slave or former slave was not entitled to marry the widow or daughter of a citizen. If a woman was not the widow or daughter of a citizen, she could not own the oikos. Nevertheless, the system seems to have accommodated itself to the exigencies of people like Archippe and Pasion. Diodotos was another who provided well for his widow. Before being sent out on a military venture to Ephesus in 410/409, he gave her cash and business documents and information. When he failed to return, she was able to use these to foil a plot by a relative to take over the family property (Lys. xxxii 5). Polyeuctos’ widow used one son-in-law to try to recoup a loan made out of her late husband’s estate to another son-in-law (Dem. xli). One woman organised a group of people to make an eranos loan. As lead-syndicator or plerotria, she was responsible for getting the loan back, but did not have the legal or property-owning status that would enable her to seize the secured asset. This was readily solved with the help of a male associate. A soi-disant naïve businessman Epicrates, lamented that in buying a perfume business for far more than it was worth, he was deceived by a shady Egyptian, a wily businesswoman and a slave. His motives, he solemnly assures the jurors, were purely sexual

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74 Cohen (2002) 100
75 Harris (2006b) 343
and focussed on the slave’s son. Most disturbing of all, the caddish Egyptian was a draft dodger (Hyp. iii.1-5). The pathetic complainant was acting fully in accordance with his concept of a citizen’s befitting and andreia.76 It was women, slaves and foreigners who actually did the business, even if they often required the nominal assistance of a man.

Evidence that the Athenian legal system embraced general agency arrangements is less convincing. Cohen makes a case that the Athenians used agency as a legal mechanism, and that “Athenian law… was easily able to give legal effect through representatives, even to commitments that might not be undertaken by principals.”77 Harris finds fault with all Cohen’s examples and argues that agency arrangements did not play a part in ancient life because the economy was not sufficiently developed to make them necessary: “we do not have to invent economic practices for the Greeks that they did not require to carry on business.”78 Because slaves and wives were often close to an oikos’ business arrangements – indeed often managing it on a day-to-day basis – it was important for expedients to be put into place so that their informed and legitimate decisions on asset disposition could be enforced. Matters between male citizens did not usually such pragmatic flexing of the citizenship laws, although that does not prove comparable mechanisms were not established. What matters from the point of view of commerce is that their insistence on legalising the things that would otherwise impede transactions and that contracts were binding in all circumstances (Dem. xlvi.77, lvi.48-50) meant the Athenians made sure their constitutional infrastructure accommodated the realities of doing business.

Irrespective of the evident pragmatism with which classical Athens adapted its structures to meet its needs, it cannot be denied that formal limitations of economic rights mean commerce played a different part in that society than in ours. The fact of slavery itself makes for an economy that is different in many respects, by giving labour a capital cost and employers a continuing obligation to feed and accommodate their labour force.79 Despite the expedients, commercial rights of action were more limited than today. The relatively low status of many of those involved in industry might have further impacts such as limiting the adoption of new

76 Cohen (2002)
77 Cohen (1992a) 100
78 Harris (2008)
79 In Chapter Eight we show that it is in fact the employer, not the owner (if these are different) who bears this obligation.
technology or formal disapproval of blatant profit-maximisation – matters addressed elsewhere in this thesis. We cannot however draw any conclusions from these observations about whether the transactions that took place in classical Athens were economically rational or whether economic analysis can sensibly be applied to them. It is quite conceivable that Athens had an efficiently functioning and profit-based economy, even if the structure of society meant many of the actors played different roles in it than they would today.

What Language is Used to Describe Economic Activity?

Finley makes much of the limited and naive nature of surviving ancient texts when it comes to the subject of economics. In this respect, his most widely-quoted assertion is found in the first chapter of The Ancient Economy, referring to recent developments in the discipline of economics:

“Marshall’s title (Principles of Economics) cannot be translated into Greek or Latin. Neither can the basic terms, such as labour, production, capital, investment, income, circulation, demand, entrepreneur, utility, at least not in the abstract form required for economic analysis. In stressing this I am not suggesting that the ancients were like Moliere’s M. Jourdain, who spoke prose without knowing it, but that they lacked the concept of an ‘economy’ and a fortiori they lacked the conceptual elements which together constitute what we call ‘the economy’. Of course they farmed, traded, manufactured, mined, taxed, coined, deposited and loaned money, made profits or failed in their enterprises. What they did not do, however, was to combine these particular activities conceptually into a unit, in Parsonian terms, into a differentiated sub-system of society.”^80

The first objection to this line of reasoning is that it does not do justice to the ancients. The fact that Aristotle did not write an Economics is deemed significant – a point Finley adopted from Polanyi. There are two in Aristotle’s name in Greek and one in Latin, but the attributions are palpably false. The first of the Greek pair combines the approach of Xenophon’s Oeconomicus (largely concerned with household craft, land development and agriculture), with a few sentiments borrowed from Aristotle’s Politics. The work begins with an acknowledgement that competence in commerce is an important skill, and then goes on to

^80 Finley (1973) 21
identify four types of economy – regal, satrapy, city and private – and the sources of income for each; not altogether a poor early attempt at macroeconomics, even if not by the master.

It is also contestable whether Aristotle’s own writings did overlook a discipline we would call economics, even though he did not use the word in that context. In the Politics (1258b) he describes three levels of money-making (chrematistike techne): first is exploitation of nature’s produce through agriculture. Later comes exchange or metabletike. This has three components: naukleria, the provision and conduct of a ship for a voyage; phortegia, the provision of land transport; and parastasis, taking freight to market in the destination port. The last two functions are carried out by merchants or emporoi. In between agriculture and exchange comes another stage, exploiting non-agricultural and non-pastoral resources like mines or forests. This seems a pretty good explanatory framework for economic development (even though it does seem to omit manufacturing), and one that chimes with the phrasing and categorisation of process steps we would apply today. The fact that it was not called “economics” is almost certainly attributable to the fact that that term referred to private life and Aristotle was describing public or “political” activity. He nevertheless made a strong case for compiling a compendium of the various ways in which people such as Thales of Miletus succeeded in business (Pol.1259a).

Xenophon’s Oeconomicus is harder to explain away:

“‘Well then,’ said Socrates, ‘‘economics’ appeared to us to be a branch of knowledge, and this branch of knowledge appeared to be the one which enables men to secure an increase in their household; the household seemed to be the sum total of one’s possessions; and we defined as ‘possessions’ whatever each person found useful for his life; finally we discovered that all things that could be made to serve a purpose were useful” (Xen. Oec.6.4).

Despite Finley, this seems to match Marshall’s own definition of economics rather well: it is a discipline that "examines that part of individual and social action which is most closely associated with the attainment and with the use of the material requisites of wellbeing.”

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81 Marshall (1959) 1
In Aristophanes’ *Peace*, a seller of sickles rejoices that he can now get 50 drachmae for a sickle, whereas before he couldn’t sell them at all (1198-1202). In *Knights*, we hear that sardines are now at their cheapest since the war started (644-5). Xenophon explains this phenomenon in terms of supply and demand:

“An increase in the number of coppersmiths, for example, produces a fall in the price of copper work, and the coppersmiths retire from business. The same thing happens in the iron trade. Again when corn and wine are abundant, the crops are cheap, and the profit derived from growing them disappears, so that many give up farming and set up as merchants or shopkeepers or money lenders” (Xen. *Vect. 4.6*).

Faraguna has argued that both Xenophon and the unknown author of a fragment had started attending to economic matters in response to the emergence of a monetary economy. Tandy characterises the change in extreme terms, using Finley’s phrasing: “The total disembedding of the economy is completely and utterly disruptive, for even subsistence goods move through higging-hagging, and kindred and social relationships are strained, even shattered.”\(^82\) Whether or not this is accurate, we must conclude that at least some of the ancients were capable of articulating some of the basic economic principles that governed important aspects of their lives.

That said, we are not primarily concerned here to challenge the absence of an economic vocabulary, nor even the assertion that such economic concepts as were familiar to the Athenians were not “combine(d) … conceptually into a unit.” It is a very large step from observing – even if it could be substantiated – that the Athenians did not speak in formal economic terms to concluding that therefore they had no economy. Keynes had no time for that sort of reasoning: “I do not know of passages in the ancient philosophers which explicitly point out the dependence of the duty of pursuing goods on the reasonable or probable expectation of attaining them relative to the agent’s knowledge. This means only that analysis had not disentangled the various elements in rational action, not that common sense neglected them.”\(^83\) Cartledge describes Finley’s inference here as ‘illegitimate’.\(^84\) Faraguna comments that the mere fact that they did not make use of particular conceptual tools does

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\(^82\) Faraguna (1994); Tandy (1997) 123

\(^83\) Keynes (1921) 307

\(^84\) Cartledge (1998) 15
not mean they “were incapable of some sort of understanding of, and reflection on, economic phenomena”, and he makes much of the distinction between *pragmata* (politics) and *erga* (commerce) that seems to have emerged at this time. Quite often, managers of successful businesses are themselves unable to describe (and may not even understand) what underlies their success. In the 1980s, an Australian trucking company, which had a highly profitable business in armoured cars in Australia, acquired one in the United States. This proved unsuccessful over several years, and the company, believing that making profits was a result of skilled management, kept changing the manager. This had no effect, for the simple reason that the company’s profitability in Australia was a result of very high local market shares, keeping costs per stop low by having many stops on each route and less unprofitable driving time between stops. In America, local market shares and route densities were low. The managers had got their original business model right without understanding it. Could not the Athenians have done the same? Irrespective of whether Athenians could articulate – or perhaps even conceptualise – economic theory, Athenian industry might still have operated in practice according to the same set of fundamental economic principles that we are familiar with today, and subsequent chapters show that it usually did so.

Nor should we accept that the actual behaviour of economic agents in a society can be determined accurately from what writers from the higher echelons of that society say about them. This is the “false consciousness” that Cartledge refers to and a fine illustration is provided by Andreau who shows that the picture presented in philosophical texts of *mundinae* (local markets held every nine days) is very far from the truth. They were not simple places for exchange of local product among peasants as Cicero, Varro, Columella and Seneca depict. They were also venues for reselling traded goods in transit and were regularly attended by the elite.

Cartledge summarises the position ascribed to formalists as believing that the economy was: “a functionally segregated and independently instituted sphere of activity with its own profit-maximising, want-satisfying logic and rationality, less ‘developed’ no doubt than any modern economy but nevertheless recognisably similar in kind.” The analyses that follow

85 Faraguna (1994) 552
86 Faraguna (1994) 585
88 Cartledge (1998) 15
are not concerned with definitions of what is functionally segregated or independently instituted; we simply look at what Athenians did and consider whether the decisions they made can usefully be described in economic language. Braudel said, “If you do not emerge from antiquity knowing what happened afterwards, you cannot form a history of antiquity.”

Finley did not distinguish between anachronistic assumptions and the thoughtful application of recently developed heuristics. In this sense, there is a special irony in describing his position as ‘substantivist’; the substance he seeks is one that explicitly excludes certain analyses of the substance of economic transactions on the grounds that the Athenians appear not to have considered them in economic terms. One is reminded of Plato’s cave: there is a specific transaction that takes place that is mediated at one remove by the social interaction of the participants and at a further remove by translating that interaction into a manifestation of a preconceived social paradigm. Of course Plato and Finley would equate the last with reality!

Finley’s conclusion, echoed by other scholars, that the ancient economy worked differently from a modern one because it was not “combine(d)… conceptually into a unit, in Parsonian terms into a differentiated sub-system of society,” can also be challenged. It is not clear whether economics is considered the sole sphere of human activity which only functions properly if it has achieved this (undefined) level of differentiation, or if we are supposed to apply the same logic to other spheres such as religion, sports, warfare and the arts. If the latter, surely all these other spheres were more embedded in the main current of Athenian social life and values than they are in today’s society and were at least as deeply embedded as was economic activity. Yet we do not question whether the ancients can really be said to have practised sport or whether battles can be explained in terms of military strategy or whether the modern aesthetic can relate to classical painting and drama. Instead we recognise that in any society all these spheres interact to a greater or lesser extent with each

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89 Interview in QS 24 (1986)
90 Von Reden (2002, 64) is more moderate, accepting that, however important the symbolism of the bowl pledged as security by Demos, the question of why he had to offer a high interest rate remains an interesting and legitimate one for economic historians, though she suggests that it is less important than understanding the accompanying belief system. An economist would simply assume that the reason for the high interest rate was that the venture was perceived as high risk; Aeschines had to pay 18% in similar circumstances (Lys. Fr. 38). This interpretation is consistent with the loan request being refused.
other and with the sphere of economics and are influenced to a greater or lesser extent from
time to time by society’s norms and values. Is there some reason why economic activity is
seen to have undergone a conceptual shift resulting in a complete discontinuity of practice
while other activities have not? To the extent the case rests on formal economic literacy we
have shown that it is poorly supported by the evidence and of dubious impact in any case.
Even if the Athenians’ grasp of economic concepts was as tenuous as Finley suggests, we
cannot deduce that it would have made their commercial transactions non-rational.

Was Profit Making Through Industry Socially Acceptable?

Finley acknowledged that “the ancient world is very unambiguous about wealth. Wealth is a
good thing.”\footnote{Finley (1965a) 31} It enabled you to live the good life of contemplation, friendship and civic duty.
It was an important element in how Athenians thought about their lives, for “technically
speaking, full citizenship laid on the citizen rights and duties which only the self-supporting
man could encompass.”\footnote{Burford (1972) 30-1}

Despite this overall endorsement, many activities in pursuit of wealth were condemned by
different writers at different times. Towards the end of the Roman Republic, Cicero
condemned “work which brings ill-will, like tax-collecting and lending”, work for pay,
retailing, crafts and most personal services (\textit{Off.} 1.150-1). While recognising many
exceptions in Cicero’s own circle (Brutus, a usurer; Atticus, publisher, banker and
industrialist; and himself, a professional orator), Finley takes Cicero’s words as not only
describing, but in a sense determining the actual level of economic activity in Rome and, by
extension, Greece. The essence of Finley’s thesis is that such activities were so rare among
the elite that the known instances can be ignored as unrepresentative and that in Athens
attempts to make money out of industry were confined to metics and slaves. Anyone who
could earn income in other, nobler ways would do so.

The philosophers provide some support for this view. Aristotle’s low opinion of production
workers is evident:
“The slave and his master have a common existence; whereas the artisan stands to his master in a relation far less close and participates in virtue only in so far as he participates in slavery (Pol.1260a).”

Not even agriculture is a suitable occupation for a free man, who needs leisure in order to philosophise and be a good citizen (Pol.1329a). Xenophon’s Socrates says:

“What are called the mechanical arts carry a second stigma and are rightly dishonoured in our cities. For these arts damage the bodies of those who work at them or who act as overseers by compelling them to live a sedentary life and, in some cases, to spend the whole day by the fire. This physical degeneration results also in degeneration of the soul. Furthermore, the workers at these trades simply have not got the time to perform the offices of friendship or citizenship. Consequently they are looked upon as bad friends and bad patriots and, in some cities, especially the warlike ones, it is not legal for a citizen to ply a mechanical trade” (Oec.4.2-3).94

Cohen (2002) brings out the strength of this sentiment in Athens, and suggests it is the reason why household management, including budget management and the production of goods for market, were largely entrusted to women. According to Lycurgus, real Athenian men had always preferred andreia to the acquisition of wealth (Leoc.108), and for Plato, market people were those incapable of more sophisticated and dignified pursuits (Resp.371c; Prot.347d). Turning from philosophy to fact, the evidence suggests that rich Athenian citizens did not work as artisans though poorer ones certainly did (Chapter Six). Many of the wealthy, however, made money out of the industrial labour of their slaves and it is notable that Aristophanes never attacks the aristocratic Nicias who, with his huge team of mining slaves, probably made more money out of exploiting labour than anyone else. The playwright’s mockery of those like Cleon and Cleisthenes whose wealth could be traced to manufacturing activities can be more naturally viewed as snobbish satire than a source of insight into society’s tolerance of physical labour as a source of income. De Ste. Croix drew

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94 It is not clear that this or similar passages in Plato represent their subject accurately; after all, one of the accusations against Socrates was that he encouraged youths to undertake unsuitable work.
the obvious conclusion: social stigma attached to the act of working in a craft or trade oneself, not to owning other people who did so.95

Finley’s reliance on the comments of philosophers as a major plank in his argument for the limited role of the profit motive in ancient society is open to two main criticisms: his readings are selective and they presume that the elite view of the world reflects or determines the reality of the society the philosophers inhabit. Plato and Aristotle recognised the importance of industry in a state’s economy and in daily life to a far greater extent than Finley acknowledges. Even though industry was a much less valuable use of time than philosophical enquiry and gold caused the downfall of Sparta, Plato acknowledged the value of craftsmen by giving them a place in the Republic (Resp. 496d,e; 545a-47b; 371e). Aristotle regretted that people naturally choose *kerdos* over time (Pol.1318b) and, while the world would be a much better place if everyone was self-sufficient as they were in the old days, he happily admits that exchange is useful to contribute to self-sufficiency (cf. Isoc. iv.42). He even acknowledges the role of profit-maximisation in running a home; while some scholars have suggested that the desire for self-sufficiency at both the personal level and at the level of the polis restricted the development of markets and trade, “if one reads the *Politics* carefully, one discovers that the science of *oikonomia*…was on the traditional view aimed at increasing one’s assets, which implies production for sale in the market.”96 Nor did concerns about the moral effect of money-making blur Aristotle’s recognition of its centrality to civilised life (Pol.1327a, b). He makes it quite clear that a city needs imports and exports and should be based near the sea for that reason, though only locals should be allowed to trade in markets. Becoming a maritime power is a worthy aspiration but the sailors should not be citizens. Though he agrees with Plato’s view that being close to the sea and a good harbour encourages corruption (Resp. 504d), he thinks the risk must be managed. The state must be vigilant against commercial infection. In the political sphere it is the *chrematistike techne* that leads to the downfall of timocracy and the establishment of oligarchy, and it is the poverty often accompanying commercial liberty that leads to democratic revolution. The best form of democracy is one where the votes are confined to agricultural labourers and pastoralists while merchants and craftsmen lack the franchise (Pol.1319a).97 Somewhat

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95 De Ste Croix (1981) 124
96 Harris (2009) 8
97 This of course lends strong support to the view that social prejudice against artisans was politically motivated and driven largely by fear of democratic radicalism – see Kron (1996) Ch. One.
contradictorily, he also claims that a *polis* needs a large middle class for stability (*Pol*.1296a), and that citizens should get others to do the farming work for them.

The attitude of these two philosophers to money-making is clearest in their descriptions of how societies should be governed. Both agreed that money, unless very tightly controlled, leads to all manner of evil, including waste, luxury, idleness, corruption, jealous rivalry, and, often, poverty and debt.\textsuperscript{98} Craftsmen and vendors are necessary to supply citizens with what they need but they are the men mixed with bronze catering to the gold (rulers) and silver (soldiers). The profit motive is important in motivating these ignoble but necessary beings, but the ability to get rich must not be unlimited. Plato’s *Laws* ban lending at interest (742c), deny legal status to credit sales (849e), regulate market days and hours (849b), prohibit market activity by citizens (slaves or metics must act for them), and a stipulate that only foreign craftsmen can buy in the market (849d).\textsuperscript{99} All industrial work was to be done by foreigners or freed slaves (846d). There were to be strict limits to how much one’s assets could change in value each year (850a). Plato was very far from denying the existence – even the managed utility – of the profit motive, but “à peine ce principe est-il posé, qu’il est l’objet de tant de restrictions qu’il n’en reste pour ainsi dire rien”.\textsuperscript{100} Aristotle had similar concerns about disparities of wealth and proposed many regulations to reduce them. He condemned Lycurgus’ law allowing freedom of bequest and praises that of Solon limiting land acquisition (1270). Acquiring and using money for one’s real needs (*oikonomike techne*) is natural, but to pursue the fulfilment of wants over and above these needs (*chrematistike techne*) is unnatural and greedy. War and plunder are natural and acceptable ways of securing material needs. Buying and selling human needs, such as clothing, is unnatural and not value-creating so the state needs to establish alternative means of distribution. Nevertheless, commercial development, bad for the soul though it might be, has at least brought it about that in Athens “no one is in need because of disparity of wealth (1265b).”

\textsuperscript{98} These ideas had been mooted earlier by Phaleas of Chalcedonia (Arist., *Pol.*1266a) and Hippodamus of Miletus (1267b).

\textsuperscript{99} The idea is that these craftsmen use their income to acquire things and the money ultimately ends up where it can supply the needs of citizens, though the mechanism is not very clear.

\textsuperscript{100} Francotte (1900-01) II.265
Xenophon was clear about the prevalence and impact of the profit motive: “In other states (than Sparta), I suppose, all men make as much money as they can. One is a farmer, another a shipowner, another a merchant, and others live by various handicrafts.” (Pol. Lac.VII.1.) His Socrates laments that people choose to work even if they do not need to, “I see many private individuals who, having plenty of money, consider themselves so poor that they undergo every labour and every danger in order to get more” (Symp.IV.35).

There is no doubt that in different societies at different times elites have condemned some forms of commercial activity for social reasons. Thomas Jefferson urged, “While we have land to labour then let us never wish to see our citizens occupied at a workbench.” Finley quotes Sir Keith Hanson on the Boers. “The Boers very soon convinced themselves that artisans’ work and slaves’ work were the same thing – a conviction which struck such deep root in their minds that their descendants in the nineteenth century left to British immigrants almost all the opportunities of skilled industrial employment in the expanding towns.” It is unlikely the elite in classical Athens were much more hostile to acquiring wealth through commerce than the upper classes in England at the time of the Industrial Revolution. Well into the 20th century, the sons of aristocratic Englishmen were strongly discouraged from going into “trade” – a pejorative term that encompassed pretty much every career outside the army, the Church and the rural occupations of a landed proprietor. There was a clear social division among the well-off between “old” and “new” money. Successful entrepreneurs might get knighted for their efforts but they were unlikely to get elected to a traditional gentleman’s club. Despite this, the British economy led the world in manufacturing and trade.

Even if Athenian society had been structured as Plato wished, it need not have impeded commercial development. There is a remarkable parallel between the social hierarchy posited by Plato, the Indian caste system and the structure of British society in India in the last days of the Raj, as illustrated in Table 2.1:

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101 Quoted in Rosenberg (2007) 6
102 Finley (1965a)
Table 2.1: Plato, Castes and the Raj

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>PLATO - REPUBLIC</th>
<th>INDIAN CASTES</th>
<th>BRITISH RAJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>Philosopher-rulers</td>
<td>Brahmin (Priests)</td>
<td>Indian Civil Service (“heaven-born”)</td>
</tr>
<tr>
<td>Second</td>
<td>Guardians</td>
<td>Kshatrias (Warriors)</td>
<td>British Army in India/ Indian Army</td>
</tr>
<tr>
<td>Third</td>
<td>Artisans</td>
<td>Vaisyas (Merchants, traders, craftsmen)</td>
<td>“Box-wallahs” (business people)</td>
</tr>
</tbody>
</table>

The present owner of the second largest steel business in the world, Mr Laxmhi Mittal, comes from the third and lowest of the Touchable classes. India’s wealthiest industrial family, the Tatas, are originally “metics” (Parsis from Persia), but that did not prevent Alfred Marshall from saying, “A score of Tatas might do more for India than any government, British or Indian, can accomplish.”\(^{103}\) Right to the end of empire, being an “office-wallah…was undoubtedly the most common experience of a working life in the Raj.”\(^{104}\) Of course, the Athens Plato lived in had a quite different social structure in any case; while philosophers and priests might be considered as a separate group it was not necessarily a superior one and brought little power with it. Chapter Six shows that many of the elite combined participation in government with a military career and commercial interests. It seems Pleket is right: elitist attitudes are just social matters and do not affect economic activity.\(^{105}\)

Bitros and Karayiannis suggest that there were three conditions attached to respectability in making money from commerce: first, that profits be moderate. Although this is scarcely definable, the Athenians could recognise extortion when they saw it, as we have seen in Lysias’ speech Against the Grain Traders. Similarly, compound interest was seen as sordid (Theophr. Char. 10.10). Second, that wealth be well spent. Liturgies or other activities undertaken for the public good were a vital element in the social framework whereby the rich paid for entertainments, public works, or, most expensive of all, a trireme with full crew. The

\(^{103}\) Quoted in a speech delivered on March 13, 2004 by R Gopalakrishnan, Chief Executive of the Tata Group of companies, at the Northern Regional Convention organised by Allahabad Management Association, Allahabad.

\(^{104}\) Allen (1994) 230

\(^{105}\) Pleket (1990)
noblest uses of wealth, frequently referred to by the orators, were these public services and making loans to friends, usually interest free. Finley suggests that liturgies, along with dole payments and the availability of paid work on public projects, helped overcome the gap between rich and poor.\textsuperscript{106} Third, the overall distribution of wealth should not be too unequal – a vague notion and hard to assess in practice, but, together with the expectation that the rich would act as public benefactors, it probably accounts for the substantial \textit{aphanes} economy and the difficulty historians have had in quantifying the wealth of even the best known plutocrats of the time.\textsuperscript{107} This is consistent with the evidence adduced in \textit{Chapter Six} to show that Athenians from all social strata found industry an acceptable source of income; there are no strong reasons to believe that their industrial activities were significantly constrained or deflected by any social stigma attaching to being involved in manufacturing.

It is also conceivable that social values in classical Athens resulted in different formal constraints on profit making enterprise from those that prevail in a modern capitalist society. Few examples are cited, but a common one is Andocides’ objection to Agyrrhios making a profit out of collecting harbour taxes. In fact this is more simply attributed to a desire to impress the assembly than as reflecting an official commercial policy that discouraged profiting from public works. Andocides (i.133) argued successfully that Agyrrhios had behaved inappropriately by putting in a low bid for the collection of taxes and making a 20\% (six talent) profit on the deal. To prevent this happening again, the orator put in a higher bid himself in the following year, which he also made a profit on. The issue was not that it was inappropriate to make a profit, even at the expense of the state, but whether the quantum of that profit was reasonable. This incident echoes public concerns today about the sums paid to managers, directors and owners of privatised former state enterprises. The concern is not the fact of payment but its quantum. Certainly some Athenians tried to conceal their wealth in order to avoid liturgical duties, but there is a considerable difference between trying to avoid paying one’s dues on wealth and not trying to make it in the first place.

On the evidence, the question of whether social values were a more effective deterrent to making money than in today’s society is hard to determine. A case can certainly be made that later societies developed more mechanisms for enabling enterprise (notably the concept of limited liability, together with various book-keeping techniques) but this is scarcely proof

\textsuperscript{106} Finley (1973) 152
\textsuperscript{107} Bitros (2004 – electronic article) 3-5
that the culture of the *polis* was set against deriving income from commerce. Even if money-making was publicly scorned by influential people, we cannot reasonably conclude that such transactions as did take place were not commercially rational without testing them against a relevant model.

**Was Profit Maximisation a Conscious Goal?**

Morris observes that economists assume that “the desire for gain is hard-wired into the human psyche.”\(^{108}\) This seems a reasonable assumption to make, even in respect of the ancient economy; to suggest that the human drive to self-advancement was inactive during the classical period in Athens, let alone during the ages encompassed by *The Ancient Economy*, is to defy thinkers from Plato through Adam Smith (“it is not to the benevolence of the butcher, baker and brewer that we owe our dinner, but to self-interest”) to Richard Dawkins’ selfish gene.\(^ {109}\) It is true that many of the theories and explanatory hypotheses used in this thesis must be modified if agents are striving for objectives other than profit-maximisation, the goal usually posited in classical economics. In its essence, though, economic analysis is premised on the biological truth that individuals seek self-advancement – not necessarily through maximising profits – and alternative forms of self-advancement can be substituted without violating the theory. If it turns out that economic analyses can only explain behaviour by positing goals other than profit-maximisation, then we shall have learned an important truth about the values of classical Athenians.

In fact, a case can be made that economic objectives around the Mediterranean have typically differed from those assumed by classical economics. Bresson describes how the topography of Greece influences economic activity:

- Proximity to the sea, giving rise to maritime activity and trade
- Regular earthquakes often causing extensive disruption and rebuilding, especially before the architectural arch was developed
- Mountains dividing regions, usually footed by well-watered fertile plains
- A wild but dry climate bringing very cold winters and hot summers

\(^{108}\) Morris (2002) 21

\(^{109}\) Smith, (1776 (1999)) I.119; Dawkins (1976)
• Forests soon destroyed for boatbuilding and prevented from regrowth by grazing goats
• Cyclical temperature changes which meant that the classical period in Athens was quite cold.\textsuperscript{110}

In this forbidding environment, the ancient Greeks were primarily concerned with managing risk. From similar observations, Hordern and Purcell conclude that the risks inherent in the environment meant that Greeks were often motivated more by risk-aversion strategies than by outright profit-maximisation, and that agriculture was a pragmatic pursuit in which farmers made their decisions based upon logical calculations of how to minimise risk and maximise opportunities rather than immediate returns.\textsuperscript{111} Cartledge speaks of ‘risk-buffering’ and explains: “Rather than profit-maximisation, the overall goal of most peasants was one of ‘satisficing’: enough was a good as a feast, and a lot safer in the circumstances than going for (literally) broke.”\textsuperscript{112}

They seem to have managed these risks successfully. Bresson finds evidence of significant population growth due to early age at marriage, long life and generally healthy living conditions. Cities were quick to regrow after wars, famine and plagues, probably by reducing their application of population control measures such as contraception, abortion, and infanticide. Plato and Aristotle both express concerns about a possible population explosion and there is significant archaeological evidence of population growth in Athens through the Archaic and Classical periods (Pl. Leg.740b-c; Arist. Pol.1265b).

While risk-minimisation might often have been a sensible strategy for the poor, the rich would have had different concerns, not least because money gave them an opportunity to recover quickly from setbacks; they may even have made their riches from storing goods at times of famine in the first place.\textsuperscript{113} Christesen draws attention to the beneficiation of silver ore to show that Athenian industrialists understood and responded to the profit motive.\textsuperscript{114} By applying a washing process to ore that had too low a lead content to go straight to refining but contained too much lead to treat as dross, miners could reduce processing costs from 62 to 39

\begin{footnotes}
\item[110] Bresson (2007) Ch.2
\item[111] Hordern (2000) 178-82
\item[112] Cartledge (2002) 160
\item[113] Halstead (2002)
\item[114] Christesen (2003) 41
\end{footnotes}
drachmae a ton, largely through savings in charcoal. Here we have an example of an industrial activity clearly trying to maximise profits. Chapter Six reviews a multitude of profit-seeking investments by the elite. The fourth century’s financial pressures – increased taxation and liturgy expenses, combined with a loss of income from land – forced ever wealthier citizens to seek new sources of income. Inheritance, plunder and gifts were not always available when financial needs were pressing. Even with vast incomes, Phainippos and Aristophanes could not cover their expenditure (Dem. xlii; Lys. xix). Socrates reminds the wealthy Critoboulos in no uncertain terms of his obligations to provide sacrifices, entertain overseas visitors, keep horses and choruses and stage athletic competitions – and that’s just when there is no war to be financed! (Xen. Oec.2.5-6). In Rome, public benefaction became compulsory and hereditary, sometimes even changing hands when a landed estate did. In any event we can conclude with Osborne and Cartledge that these obligations constituted a powerful incentive to profit-maximisation for the rich. While many Athenians in particular circumstances might have emphasised risk avoidance in their personal decision-making frameworks, profit objectives were far from absent and sometimes clearly dominant.

Even if we find ourselves forced to acknowledge a different attitude to risk on the part of at least some Athenians, it does not necessarily invalidate the application of analyses based upon rational economics; it merely changes the coefficients. Risk and reward are the critical components in investment decision-making and the chosen balance differs between individuals and for the same individual at different times. It can also reflect different time horizons; investment trades off current resources for future ones – the essence of agricultural risk minimisation. It is plausible, though unproven, that the ancient Athenian investment paradigm put a higher price on risk than ours would in similar circumstances but this does not change the nature of the equation, though it would change its solution. Christesen proposes a risk-return-hierarchy, based on known returns, and finds Athenian choices explicable in terms of modern investment approaches – a point illustrated further in Chapter Eight. He cites Demosthenes’ comments on the astuteness of Apollodorus in choosing a shield workshop rather than a bank, even though the bank was earning 10,000 drachmae a year and the shield factory just 6,000 (xxxvi.11). The shield enterprise is ktem’ akindunon

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116 Akerlof (2010)
while the bank produces risky revenues from other people’s money.\textsuperscript{117} Shipton (2002) has shown that richer Athenians tended to prefer mining leases to land leases because of the higher returns available, despite the higher risk. In Chapter Six, we look at the role industry played in the lives of different socio-economic groups in classical Athens and find that it constituted a logical source of income for all classes. Naturally they would have wanted to make more of this source rather than less.

The initial assumption of the economic analyses that follow is that the objective of Athenians in commercial transactions was maximising return on investment or on personal effort. If we find transactions that are inexplicable on this assumption we might be able to infer that other motivations dominated in practice as well as in theory. Without such an empirical test, any claim that people from all strata of society tended to behave irrationally by our standards must be treated with suspicion.

\textbf{The Rationality of Economic Behaviour}

None of the four propositions of Embeddedness we have discussed addresses the content of transactions themselves; when one free male citizen did a deal with another (perhaps because his wife or slave could not), did constraints imposed by social ideas of what was acceptable, the limitations of his economic vocabulary or an ancestral habit of worrying about risk before profit, make the outcome of the transaction different from what it would have been if conducted in a modern market economy, or did the same economic laws prevail despite the different context? We have acknowledged that several of the factors Finley noted probably did have some impact. Slavery made for asset investment decisions and production cost structures that are quite different from today. The status of women, slaves and metics assigned them roles in industry according to different social rules than ours. Without applying the tools of economic rationality, however, we cannot draw any conclusions about the nature of the transactions these variously restricted agents undertook. Nor can we infer their commercial know-how from their ability to describe it, any more than we can deduce a great sportsperson’s capabilities from their articulateness in the media. Perhaps the Athenians can fairly be charged with having made less striking advances in the language and concepts of economics than in other disciplines, but the evidence is mixed and the impact

\textsuperscript{117} Scholars differ as to whether there were some important bank failures in 377/6 and 371 BCE.
doubtful. Some forms of profit-making activities were more approved than others while some were severely frowned upon, but whether profit-maximisation through industry was seen as worthy in elite circles need not have determined whether some – or even many – pursued it seriously; and of course whether economic agents pursued profit-maximisation as a conscious goal does not determine whether the outcomes were consistent with such a goal – still less whether analysis based on that premise will be informative.

The notion that culture and commerce are interdependent has a strong intellectual pedigree. John Stuart Mill “saw the cultural transformation of the non-European world as inextricably linked to its economic transformation.”\textsuperscript{118} It was this linkage that Finley managed to circumvent by suggesting that classical culture (which was not in need of development) did not have to be seen to coexist with a primitive economy because there was no economy at all. While Finley and others conclude from social observations that Athenian society differed so much from our own that exchange activity must have been conducted according to quite different principles, the chapters that follow examine the direct evidence. By testing a variety of transactions and economic decisions from classical Athens against modern paradigms we can assess how far they reflect what we would recognise today as the commercial logic of rational economics, or whether outcomes differ to such an extent that transactions can only be explained in terms of a different and non-economic framework, perhaps attributable to some of the factors reviewed here.

\textsuperscript{118} Ferguson (2004) 139

56
3. THEORIES OF FIRM SIZE

This and the following two chapters offer an original explanation of the observed size of manufacturing enterprises in classical Athens. Several historians have suggested that the limited size of typical industrial enterprises in Athens is evidence that Athenians were not as concerned with profit-maximisation as industrialists are in modern capitalist societies. Humphreys speaks of “small-scale, disconnected business ventures, assessed by the security of their returns rather than their potentiality for expansion” and attributes this largely to the social behaviour of Athenians who were happier being rentiers rather than serious industrialists.¹ Hopper observes that factories were acquired by chance as a result of other financial dealings, and that there is no evidence of investments made to extend an enterprise, nor of any particular expertise or enthusiasm for efficiency on the part of owners.² All this seems to confirm that decisions about industry were not made in pursuit of the profit-motive and, a fortiori, to suggest that analyses based on the contrary assumption will be futile.

This chapter explores the best supported of the traditional explanations of small enterprise size, other than a lack of ambition: unavailability of credit, difficulties in delegation, inadequate accounting practices and limited specialization of labour, perhaps resulting from a lack of machinery. None of these theories fully account for the different size of individual enterprises in different industries. We propose instead the competitive advantage framework as a more powerful way of explaining and predicting whether large firms are likely to emerge in particular sectors. In the next chapter we test this framework in respect of the pottery industry and in Chapter Five we apply it to a number of different industries for which there is at least some primary information about the size of the typical production unit. The industry structure that the theory predicts not only defines the typical size of enterprise; it also determines the level and nature of returns to capital and labour. In Chapter Six, the form different industries took is shown to align with what is known about which social classes participated in them and on what basis.

In addressing this matter, it is important not to conflate two distinct questions: “Why did the ancient world not see the genesis of large industrial concerns?” and “Why did the ancient

¹ Humphreys (1970) 21
² Hopper (1979) Ch. 7
world fail to apply more sophisticated technology to manufacturing production?” These questions are often linked, but not necessarily so. Embeddedness gives a robust, though inadequate, explanation for the limited amount of technical development we can attest to in ancient Athens. This is examined in Chapter Nine. Here we are concerned only with differences in firm size at a given stage of technical development.

**Traditional Reasons for the Observed Scale of Athenian Enterprises**

**Access to Credit**

A factor often cited as an explanation for limited industrial development, and sometimes as evidence of a lack of interest in making money from entrepreneurship (though it can hardly be both), is limited availability of credit for productive investment. In fact, multiple examples of businesses being bought, sold, claimed and mortgaged suggest that there was an active investment market in productive enterprises, and that funds were available to industry in at least some circumstances. Loans for productive purposes were not uncommon. Aristarchus borrowed funds to acquire the raw materials for making clothes (Xen. *Mem*.2.7.11-12) and Athenogenes to buy stock for his perfumery (Hyp. iii.6.9-10). Pantainetus’ ore processing facilities and its slaves were offered as security for a loan (Dem.xxxxvii.4). Mantias and his son funded their mining interests with debt (Dem.xl.52). For his perfume business, Aeschines initially borrowed overseas at 3.5% a month, then locally, and eventually from friends at 1.5% per month (Lys.fr.38); the progression of sources and interest rates seeming to reflect a reduction in perceived risk. All of these instances pose a serious challenge to those who would suggest that Athenian commerce and industry were constrained by a lack of capital.

In addition to the fact that credit was available for manufacturing, for it to have acted as a constraint on development, two other conditions must have applied:

1. The sums required to start or expand a business must have been quite large, and

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3 Finley (1973) 197 and Millett (1990, 1991)
4 See especially Bogaert (1968)
2. They could only be financed through credit.

Neither condition prevailed.

The amount of capital needed to start up or expand a typical manufacturing concern was modest. Whenever we hear of a value being put on a business, it is ascribed either implicitly or explicitly to the labour force, with no separate identification of any value to be ascribed to fixed assets. This seems to be because tools were relatively cheap, raw materials costed separately and fixed production items such as kilns were put together from freely available raw materials by the slave force and therefore covered in their costs. Most industrial slaves seem to have cost in the order of three to four minae each, depending on period and skill levels, a little less than it would cost to feed a slave and his family in a year. Thus the funds needed for acquiring industrial slaves were roughly within the budget of any citizen who could afford to keep one. Further, few industries required a minimum scale of operations; in most cases a low investment in a slave or two would be enough to start up in a business, which, if successful, would generate funds to buy more slaves.

Even larger businesses were valued at sums that would have been within the reach of several hundred citizens—a twenty slave furniture business was mortgaged for 4,000 drachmae (Dem. xxvii.9) and a small foundry cost 1,700. Epicrates’ perfume business went for 40 minae and was apparently worth much less (Hyp. iii.8). Harris identifies thirteen horoi placed near workshops that were pledged as security. The value of eight is recorded; one was for 60 minae, one for 17 and the rest for less than ten—the latter evidently businesses employing only two or three slaves. The largest industrial valuation we hear of is of Pantainetos’ ore processing operations for just over 200 minae (Dem.xxxvii.31), so the capital needs of the largest workshop would not have been much more than the minimum amount needed to perform liturgies.

In any case there were alternatives to borrowing; slaves to start a business could be leased. Xenophon (Vect. 4.14-5) suggests that it was possible to pay leasing costs out of the margin generated by slaves’ productive efforts. This meant there were no capital barriers to entry, or,

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5 Workshop operating costs are explored in Chapter Eight.
6 Glotz (1926) 268
7 Harris (1988) 362-4
8 Harris (2002a) 81
in today’s terminology, a workshop could be 100% geared to a lessor. To the extent capital was a constraint it was less likely to have been in the requirements for labour and equipment than in working capital or raw materials. From Demosthenes xxvii we see luxury furniture required an investment in working capital which cost as much as a large team of slaves. In some industries (jewellery and perfume for example) there would be a need to carry a large range of expensive materials to be in business so this would have constituted a barrier to entry to the less well off. Once a firm became established in such a business, however, if expansion was attractive, additional inventory could be funded organically from the business’ earnings. This is a normal approach to funding expansion in today’s economy and was certainly open to Athenians. The next two chapters demonstrate that technology limitations meant there were no economies of scale or major investment steps in most industries and therefore no disadvantage to slow and incremental expansion. If, by reinvesting some of his annual earnings in his own enterprise, an owner could continue to grow future returns, the decision was his to make and not constrained by access to external finance.

To suggest that access to capital acted as a constraint on expansion presupposes that there were attractive opportunities to expand which were in fact passed up. The next chapter shows that this was not the case for the pottery industry and, by implication for others like it. In many industries, however much credit was available, an economically rational owner would not expand beyond the size we observe in literature and archaeology. Chapter Five identifies some operations, such as shield and knife manufacture, where an investor would benefit by owning a larger enterprise. In these cases, the existence of larger workshops shows that finance had not constrained them.

Delegation

Many citizen craftsmen combined manufacturing activity with civic or military duties and this might have limited their ability to grow their operations. Larger concerns were typically managed by a supervisor (slave or freedman) who paid a franchise fee or apophora to the business owner and then took the profit and loss on the business himself. This had the desired effect of ensuring a basic and low-risk return to their owner, who was relieved of management responsibility, while enabling a trusted and experienced slave to reap the rewards of success above that level.
This might not have been effective in all cases. Glotz says: “Probably personally superintended factories of small dimensions were both better supervised and cost less in supervision.”\(^9\) For some products, the selling process would have required personal involvement in selling. This is likely to have been the case for luxury and premium goods (decorated vases and jewellery, for example) and probably also when bulk deals were done for, say, a large quantity of amphorai for transporting produce. Constraints on slaves and metics owning land would have limited their ability to act as effective counterparties in any transaction involving payment on deferred terms. There were also risks involved: some slaves were tried for abusing their knowledge of their masters’ business for their own ends.

Despite these theoretical concerns, there is no real evidence that difficulties in delegation acted as a serious constraint. There are several examples, discussed in Chapter Five, of sizeable workshops owned by citizens and managed by a slave or freedman on their behalf. Chapter Six shows that citizens without the means to invest in a workshop with a large complement of slaves, or the credit-status to lease one (Aesch. i.97), would tend to work at production tasks by themselves, or perhaps with the help of a slave, in precisely those sectors in which there was no benefit in scale and no disadvantage in operating on a limited and intermittent basis. In any event, metics were not subject to the demands of citizenship, and could establish large concerns without delegation.

**Accounting Practices**

Finley argued that the ancients cannot have been concerned with profit-maximisation because they did not have the accounting methodologies needed to optimise a business’s economics. He acknowledged that the Romans:

“kept accounts, even detailed accounts, but these were aimed at tracking production, sales and expenditure – the sort of monitoring function so crucial to, and typical of, the absentee landlord. Monitoring is of course a rational strategy for the absentee landlord, but it is not the same as an analysis to identify profit rates in various parts of

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\(^9\) Glotz (1926) 104
the business operation with the aim of directing investments to the points of highest profitability.”

Finley’s point of course is not that the ancients were frustrated in any ambition to be good businessmen by a lack of accounting skill; rather that they were not sufficiently interested in being good businessmen to develop appropriate management tools.

De Ste. Croix challenged suggestions that the ancient Greeks had mastered double-entry book-keeping, which, he argues, was probably unknown before the thirteenth century CE when it was used by Italian merchants and bankers. He contended that this deficit in the ancient accounting tool-box constrained development in a variety of ways; in particular it prevented the ancients from collecting income taxes and from running businesses efficiently as they had no effective measure of the components of profitability. As he puts it in relation to imperial Rome, “it was hardly possible for a large Roman landowner who went in for different kinds of agricultural activity to tell which kinds paid best, because his inadequate accounting system did not permit separate costing.” Burford makes a similar point: “ancient methods of keeping accounts indicate that the chief concern was to check dishonesty, not to be able to see at once from the record of expenses how one might economise by running things more efficiently.”

A further argument suggests that the effective separation of ownership and management is an important element in industry and firm development and this might have been made more difficult by the absence of double-entry book keeping, although in fact the apophora system shows classical Athenians were quite good at separating ownership from management.

Macve argues that the medieval examples of more advanced accounting that de Ste Croix cites demonstrate the pragmatic approach that characterises most accounting practices, and “no particular form of accounting was required in order to make such calculations.” Even the Medici did not systematically use the double-entry method, though it was known in Genoa as early as the 1340s. That family seems to have confined themselves to three sets

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10 Summarised by Saller (2002) 255
11 De Ste Croix (1956 )
12 De Ste. Croix (1956) 38
13 Burford (1972) 58
14 Macve (1985) 248
15 Ferguson (2008) 45
of accounts: the libro secreto, a general ledger, a libro di intrata e uscita (cashflows) and a libro dei debitore e creditore, or balance sheet. Certainly financial calculations would have been easier after Fibonacci introduced Hindu-Arabic numerals and decimal calculations (as well as the world’s first Net Present Value formula!) in 1202, but that cannot be taken to demonstrate that no serious calculations were possible or attempted before then. Even today, the detailed activity-based costing that in theory should underpin most resourcing decisions is rare, costly and far from foolproof; many allocations of costs to activities are approximate at best and often arbitrary. Similar imprecision also attaches to defining what cost and revenue components should be considered marginal for particular investment decisions. Thus, Macve points out, even today’s accounting statements cannot be used for planning without great care: “the decision-maker is concerned with costs and benefits to come in the future, while the accounts present past costs and revenues…The decision-maker is concerned about marginal costs and revenues… but the accounts record and allocate all costs and revenues and so give averages based on the present level of production.”

Macve uses the example of the UK taxation system, which “‘works’ despite the fact that the Courts and accountants have been unable clearly to define the concepts of ‘capital’ and ‘income’ …I would therefore suggest that if the ancient Greeks had decided to tax ‘income’ rather than ‘capital’, then those involved in the assessment would have begun to work out something and developed conventions to meet the need.” Similarly in managing a business, “while…it would often have been difficult if not impossible to quantify formally the value or cost of resources… this does not mean that allowance could not be made for them in decision–taking. Many non-economic factors still have to be weighed up in making formal decisions even in economies such as our own.” Keynes put it more strongly: “human decisions affecting the future, whether personal or political or economic, cannot depend on strict mathematical expectation, since the basis for making such calculations does not exist.” This principle of ‘Knightian uncertainty’ recognises that most business decisions involve a step into an unknown that is to some degree unmeasurable. It is unreasonable to conclude from the fact Athenians could not achieve even the limited level of

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16 Macve (1985) 248
17 Macve (1985) 237-8
18 Macve (1985) 249
19 Keynes (1936) 162-3
20 Knight (1921)
certainty that we can, that they had no interest in making sound business decisions; better to ask with Hordern and Purcell, “how likely is it that an end to the impressionistic numeracy of the past substantially changed the behaviour of those who aspired to the accumulation of wealth and status?”

Over and above accounting techniques, the absence of limited liability in Athens is sometimes posited as a barrier to development. In fact this was not introduced by statute in Britain until 1855 and in the rest of Europe some decades later, long after the Industrial Revolution had taken effect. As with accounting practices, we suspect that if the absence of limited liability was a serious obstacle, the Athenians would have found a way round it, just as they had found ways to secure mortgages and syndicate loans. In fact there is no reason to suspect that Demosthenes or other absentee workshop-owners were at risk of losing more from operating a business than the business’ income and assets. One might also note that maritime loans offered the essential features of profit-sharing and limited liability.

**Specialisation of Labour and the Lack of Machinery**

Engels held that slavery enabled development through specialisation: “It was slavery that first made possible the division of labour between agriculture and industry, and thereby also Hellenism, the flowering of the Ancient World.” This is only partly true as many citizens and slaves participated in the harvest as well as in urban occupations, but it does draw attention to what Weber characterised as the first stage of specialization – “specification of function”, or horizontal specialisation. There is no doubt that by Homeric times there was considerable specification of function. Homer distinguished between the *chalkeus*, the *skutotomos*, the *tekon* and the *kerameus*, all working with different materials (*Il.* IV.187; VII.221; XV.411; XVIII.601). By classical times there was specialisation within metal processing with different smiths working with iron, bronze, silver and gold; many other crafts were defined by a narrow range of output, such as *artopoios* or *kranoipoios*. The titles of

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21 Hordern (2000) 293
22 Engels (1972) 121
23 Weber (1947) 225
24 Bronzeworker, leatherworker, builder and potter.
market place vendors in Aristophanes show that retailers too specialised in particular foodstuffs or garments.

The relevance of specialisation to firm size relates to Weber’s second category, *specialisation of function* or the division of tasks in producing single objects, also known as vertical specialisation and epitomised by Adam Smith’s famous pin factory. The idea is that the more tasks a production process can be divided into, the more people will be employed in it. Bresson explains the fragmented nature of Greek industry as resulting from the short length of production chains. The nature of the product and the number of discreet steps involved in making it set the limit to the benefits of task specialisation. As Burford puts it: “…the nature of the work… from the beginning dictated the number of workers, minimum and maximum that could be employed – one man per loom, last or carpenters’s bench, with an assistant or two…”.

The ancients themselves referred to the benefits of a task-based division of labour: “It is of course impossible for a man of many trades to be proficient in all of them. One man makes men’s shoes, another women’s. And in some places, one man supports himself by only stitching, another by cutting, another by only shaping the uppers, and another by doing none of this but only assembling these things” (Xen. *Cyrop.* VIII.2.5). Finley emphasises that the focus here is on quality rather than production cost, but a similar reference in Plato is clearly concerned with maximising productivity (*Resp.* 369-71). There is evidence from vase paintings that potteries were organised into separate tasks, such as throwing, painting, kiln management and even turning the wheel. Clearly any failure to organise workplaces into discrete tasks did not come from ignorance of the benefits of doing so.

While limits to specialisation might help explain firm size in certain cases, it is clearly inadequate as a general theory. No matter how much a pottery subdivided tasks, there was no point having more labour than was needed to supply the kiln. In fact the job on which the largest number of employees in a group under one owner was found in classical Athens was the least differentiated of all – mining. Nor does the theory explain why some workshops

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26 Smith (1999 (1776)) 109-113
27 Bresson (2007) Ch. 7
28 Burford (1972) 79
29 Finley (1973) 135
employed more slaves than there were process steps. While “four workers dividing the tasks can turn out more shoes than four men who do the entire job individually…. it is hard to see how eight teams of four could turn out proportionally more than a single team of four.”

The industries that Bresson cites as employing large numbers in single establishments, such as shields, knives and beds, might have had longer production chains than potteries but not by much; if this was the only factor, Lysias’ shield factory would have employed eight slaves, not one hundred and twenty (see Chapter Five). These phenomena can only be explained by more detailed analysis of the nature of competition in the manufacture of different products.

The argument that attributes small firm size to limited specialisation sometimes invokes the state of technology. Glotz suggests two reasons why industry in classical Athens did not develop large scale enterprises:

- It was difficult to control and motivate slaves who “had not the incentive of pay”
- Without machines, it was impossible to develop a useful specialisation of labour.

He acknowledges that large numbers of slaves were employed by single enterprises in transport and mining, but attributes this to the fact that these activities did not demand high skill levels:

“If complicated articles have to be manufactured in quantities, it is indispensible that each man should specialise in one operation, one motion. This is only possible with machinery, for to turn the human tool into an automatic machine, a course of training would be necessary, which would cost too much for too little result. Now, so long as society enslaves manpower, being ignorant of the use of machine power, it has such opportunity for obtaining plentiful, docile labour that it does not feel the necessity of supplementing it artificially. The absence of machinery is at once the cause, and, to a certain extent, the effect of industrial slavery.”

We examine the argument that slavery is an obstacle to technological development in Chapter Nine. Here it is enough to note that slavery and machinery are not necessarily mutually exclusive (think of Chaplin’s Modern Times) and that a preference for slavery over machines is not economically driven; the costs of acquiring and maintaining slaves would

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30 Thompson (1982) 74
31 Glotz (1926) 206
have far exceeded those of acquiring and maintaining machinery, so it would always have been profitable to replace men with machines. In any event enterprise growth is not necessarily connected to technology. The global consolidation of, for example, law firms in recent years can scarcely be attributed to the use of machinery.

Hopper expresses a similar view to Glotz: “There was, of necessity, a limit imposed on the division of labour in the ergasteria of ancient Athens, on account of the non-existence of machinery.” As we will see in our analysis of the pottery industry, he was partly right but his argument is confused. The number of people working in pottery was constrained by technology but this was because of limited kiln size rather than limited specialisation of tasks.

Glotz makes a further argument based on the absence of machinery; low investment meant that it was not necessary to expand in order to get good returns, “the head of an undertaking was not driven by the need to collect as much capital and labour as possible because he was not driven by the necessity of getting the biggest possible returns out of expensive machines, in order to diminish his general costs and to obtain a progressive increase in profits.” It is obvious that if you do not need expensive machinery, you do not need so much capital. It is far from obvious that owning expensive machinery would prompt you to employ more labour unless the machinery is underutilised. If it is at full utilisation, you would need to add more machinery to match an increase in labour. Nor does Glotz explain why owners need to make a good return on capital invested in equipment but not on capital invested in labour. In reality, as we demonstrate in Chapters Four and Five, the true mechanism of action of limited technology was through the lack of potential for cost differentiation among competitors. The feeble rate of application of technology to industrial manufacture was indeed one important cause of small firm size but it had a different impact in different industries and its effect is best understood through the lens of competitive economics.

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32 Hopper (1979) 103
33 Glotz (1926) 142
Modern Theory of Industry Structure

If none of the traditional explanations for small firm size seems convincing, perhaps a more modern approach will. Contemporary business theory predicts the structure of a given industry by determining what firm size would maximise profits in a given commercial environment. Barriers to entry and the potential for competitive advantage typically determine the level of industry concentration and the value or otherwise to individual businesses of attempting expansion at the expense of competitors. In the next chapter we apply this approach to the pottery industry and in the following one, to several others. Here we lay out the theoretical concepts involved.

Competitive Advantage as the Basis for Business Success

Business strategy, or the science of deploying assets in such a way as to maximise return on investment, is a commercial discipline that has only received serious attention in commerce and academia over the last few years. It owes much to the pioneering work of The Boston Consulting Group (BCG), founded in 1963 by the late Bruce Henderson, which introduced a number of well-known heuristics, including the Portfolio Matrix and the Experience Curve, in order to help clients to determine and implement profit maximising strategies. Today most large firms employ strategy practitioners (as opposed to planners, who typically work within narrower conceptual boundaries) and many other consulting firms offer strategic advice. Professor Michael Porter of Harvard Business School (himself the founder of a consulting firm, Monitor) has written numerous books and articles summarising the state of knowledge of competitive business theory, as have many others.\footnote{Porter (1980); Stern (1998) provides an excellent overview of the theory and Henderson (1981) is especially interesting for the analogy it draws between business competition and the Darwinian struggle for survival.} The examples that follow, while reflecting the same approach as published works of Porter, Henderson and others, are drawn from the author’s own work with BCG colleagues in preparing materials for clients and for educational programs.
Central to the discipline of business strategy is the concept of competitive advantage. Simple microeconomics tells us that in a state of equilibrium, the marginal (weakest) competitor will be making just enough profit to stay in business (defined as the cost of capital) (Fig. 3.1).  

![Figure 3.1: COMPETITIVE ECONOMICS](image)

In applying this idea to a world in which little capital was employed in industry, it needs a simple adjustment. Rather than the cost of capital, the cut-off net income below which a self-employed person will decide to cease operations is the point at which that income no longer supports an acceptable living standard. Thus if a working citizen cannot get enough income out of a productive enterprise, after paying all expenses, to support his household at a minimum acceptable standard, he will exit and look for an alternative way to spend his time. In the case of a workshop run by a slave, the owner specifies the cost of his capital in the form of the *apophora* and if this is met, so are his return objectives. If, however, the workshop is unable to cover its costs after paying the *apophora* it must either negotiate a lower *apophora* or cease operation.

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35 Figures 3.1 to 3.5 are drawn from original materials prepared by the author and his colleagues for Pappas Carter Evans and Koop Pty. Ltd., later The Boston Consulting Group in Australia and New Zealand.
To make more than the cost of capital, it is necessary to have a better set of economics than competitors – a competitive advantage. Because the maximand (return on investment) is calculated as revenues minus costs divided by investment, this competitive advantage must be reflected in higher revenues, lower costs or lower investment per unit of output (Fig. 3.2):

**Figure 3.2: COMPONENTS OF COMPETITIVE ADVANTAGE**

- Revenue
  - Price
  - Costs
  - Margin
  - Assets
  - Asset Utilisation

Return On Investment

\[
\text{Return On Investment} = \frac{\text{Revenue} \times \text{Price} - \text{Costs}}{\text{Assets} \times \text{Asset Utilisation}}
\]
Examples of each type of advantage can be readily identified. Products with a strong brand derive a *revenue advantage* through being able to command a higher price for their product than competitors even if the product superiority is only a perceived one. The brand leader may choose not to maximise price but translate some of the brand advantage into being able to sell more product at the competitor’s price point, thus gaining volume and lowering indirect costs per unit of output. Premiums for leading brands in certain industries such as wine and perfumes can be so large as to make production efficiency almost irrelevant (Fig. 3.3):

**Figure 3.3: PRICE ADVANTAGE: NICHE PRODUCTS**
In other industries, *cost advantages* determine the difference between winners and losers. Commodity mining offers no potential for superior price realisation; profit depends on how much lower a mine’s costs of extraction and transport are than those of the marginal competitor, defined as the highest cost competitor needed to fill market demand, as illustrated in the following diagram of a commodity supply curve (Fig. 3.4):  

![Diagram of a commodity supply curve](image)

Cost advantage might also come from economies of scale. Unit costs decline rapidly with volume in many process industries so that a large brewery or automotive plant, for example, will have much lower costs per unit produced than a small one. In general when economies of scale are to be found in an industry, some competitors will expand their operations to achieve them. The lower costs that result mean they can reduce prices while remaining profitable. Small competitors who want to survive need to differentiate their product so as to realise prices that make up for their higher cost structure — a task that becomes increasingly difficult as their cost disadvantage grows and they have less margin to spend on innovation or product promotion. Hence though we regularly find premium “boutique” breweries and specialty sports car manufacturers emerging, their strategic positions are seldom robust.

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36 Other forms of advantage can similarly be related to supply and demand: a price premium can be defined as reflecting a higher demand curve for one product than another and an advantage in asset turn can be expressed in the form of positioning on a supply curve of financing costs. Both can then be translated into a reduction in unit cost. For an overview of basic supply and demand analysis, see *Chapter Seven*. 

72
enough to prevent failure or takeover in the long run. In some industries, such as jet engine manufacture, the world only seems to have room for two competitors.

We should note at this point that limits to the number of people who can be employed in a single production line do not in and of themselves mean there is no economic value in scale. In some industries today, very large companies run parallel production lines (breweries, for example) or operate out of a number of small scale production units, as many companies do in businesses where transport costs are high relative to product value, such as construction materials, bulk packaging manufacture and dairy products. The value of scale in such cases is achieved through sharing corporate costs, in, for example, marketing or research and development. Therefore, even in cases where the production process itself could only accommodate a limited number of workers, our analysis needs to explore whether there would have been commercial benefits in owning multiple production units that no Athenians took advantage of.

*Advantages in investment* sometimes reflect new technical innovations allowing certain products to be made in much lower cost facilities than before, like steel mini mills, and sometimes more efficient use of assets such as working capital; Wal-Mart’s attention to the workings of its supply chain means that its investment in inventory is significantly less than that of its competitors. As a result, it is able to price its goods lower and gain further market share and a lower cost position. Minimal capital investment means we will not find this type of advantage in the Athenian context. Assets consist largely of slaves and the annual cost of maintaining slaves is greater than their asset value.\(^{37}\) Therefore an increase in labour productivity can best be considered as a form of unit cost reduction.

Different industries offer different bases for economic advantage. A successful strategy is one that delivers and exploits these advantages and turns them into superior returns to owners. Companies that do this well can earn significantly more than their minimum income needs and expand. Companies that do not, tend to struggle to survive.

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\(^{37}\) Inventory investment was high in some instances, but the analysis in *Chapter Eight* suggests it was seen as a store of value, so Athenians might not have been concerned to reduce it.
Variations in the Extent of Advantage Achievable

Not all industries offer significant scope for advantage. In some, production costs are the same for all, assets are negligible and the product is hard to differentiate. Corner shop retailing is an example as are many other service industries like hairdressing, lawn-mowing and much financial advice. In manufacturing, cost advantage is usually a function of the extent of mechanisation. In businesses where a high degree of mechanisation is possible – heavy chemicals for example, or automotive parts manufacture – significantly lower costs can come from being able to afford the latest labour-saving technology as well as from spreading the high level of fixed costs and assets over a larger volume (economies of scale). At the other end of the scale, preparing tuna for canning is still a manual process done by people with knives; all processors have the same costs and minimal assets. To make attractive returns they need to realise higher prices through effective branding and marketing. We may expect those who do not do this, for example those competing on price to supply supermarket brands, to earn no more than the cost of capital in the long term.

For the analysis that follows, we simplify what is really a spectrum into two classes of industry: those in which competitive advantage enables significant differences in profitability between competitors and those where it does not (Fig. 3.5):

**Figure 3.5: VARIATION BY INDUSTRY/SECTOR**

<table>
<thead>
<tr>
<th>Industry A</th>
<th>Industry B</th>
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<tbody>
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<td><img src="image" alt="Graph" /></td>
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Possible Reasons:

Industry A:
- Shared technology
- Few economies of scale
- Low-cost ‘backyarder’ competition

Industry B:
- Scale economies
- Resource cost advantages
- Consumer franchise gives price premiums
Predictions for Industry Structure

In 1981, BCG developed a matrix that predicts industry structure from the number of potential sources of advantage and the value of these advantages (Fig. 3.6):\textsuperscript{38}

\textbf{Figure 3.6: COMPETITIVE ADVANTAGE AND INDUSTRY STRUCTURE (1)}

<table>
<thead>
<tr>
<th>Value of Competitive Advantage</th>
<th>Sources of Advantage</th>
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<tbody>
<tr>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Few</td>
<td>Oligopoly</td>
</tr>
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<td>Many</td>
<td>Niche</td>
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<td>Low</td>
<td>Stalemate</td>
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This predicts that where there are only a few ways of getting an advantage, the industry will tend to be concentrated among a few large firms. If the advantages available are substantial (scale in brewing, for instance) the industry will consist of a limited number of competitors some of whom, as a result of their advantages, will make returns significantly in excess of those required to keep them in business. This is referred to as an Oligopoly. If the advantages are slight on the other hand (as in airlines or pulp and paper), all firms will tend to make long-run returns that are close to the cost of capital (Stalemate). When there are multiple ways of getting advantage through differentiating the product or service, the industry will contain a much larger number of competitors. If the advantages are substantial, then some will be able to make very good returns by defining and owning a profitable Niche and may become quite large; if not, then everyone will make just about enough to stay in business but will tend to remain small scale (a Fragmented industry).

\textsuperscript{38} Stern (1998) 56 – 59
This model needs to be simplified for our present purposes. First, we do not have enough information to attempt to distinguish variations in the value of competitive advantage between industries and it is sufficient to ask whether or not there is any potential for either product differentiation or a sustainable cost advantage.\textsuperscript{39} Second, the concept of the number of sources of advantage is not always an easy one to apply in practice. Instead, we will consider \textbf{barriers to entry}, which are strictly a subset of competitive advantage, but a sufficiently important determinant of industry structure to warrant special attention.

Porter contends that industry structure drives competition and profitability, as opposed to traditional management views that profit-levels are determined by such things as growth rate, the level of technology, government fiat or the provision of complementary products and services. In a recent article he enumerates “The Five Competitive Forces That Shape Strategy”: competitors, new entrants, suppliers, customers and new technology, and shows how they can affect industry structure.\textsuperscript{40}

Microeconomic theory predicts that equilibrium is reached when additional volume through new entry would reduce prices just enough to make an equivalent amount of industry capacity redundant because the costs of that capacity would then be higher than the new (lower) industry price resulting from increased supply (Fig. 3.7):

\textsuperscript{39} \textit{Chapters Four and Five} show that in classical times, product differentiation was the only source of competitive advantage available, since limited technological development meant that no sustainable competitive advantage could be achieved in unit costs or asset turn. In describing classical Athenian industry, the terms “competitive advantage” and “product differentiation” are therefore synonymous. The general term “competitive advantage” is used in this thesis to allow for the discussion in \textit{Chapters Four and Five} of subsequent developments in industry structure, many of which are attributable to the emergence of other sources of advantage.

\textsuperscript{40} Porter (2008) 78-93
For this reason, as Porter explains, incumbents are wary of being seen to make excessive returns as this will invite new competitors who might act aggressively and reduce profitability for all. The extent to which this is a serious risk depends largely on whether there are significant barriers standing in the way of new entrants. If there are, then incumbents can raise prices without fear of encouraging new entry. Typical barriers include returns to scale in processing, brand-strength, switching costs for customers, capital requirements, access to raw materials, and government restrictions or licensing. All but the first of these are relevant in classical Athens.

We may observe that all these factors can also constitute sources of competitive advantage that certain competitors might enjoy, while others do not. Their significance in this context is that in addition to their role in helping outperform current competition, these advantages either provide a block on new entry or make it evident that new entrants do so at their peril as they will not be able to compete on equal terms if they do enter. Seen in this light barriers to entry are a form of competitive advantage that involve certain economic benefits being available to some or all incumbents that are not available on the same terms to new entrants.

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As with competitive advantage, industries differ in the extent to which they offer barriers to entry. Large scale manufacture clearly provides at least a capital barrier. Businesses where brands matter (confectionery, cereals and perfume are examples) are also costly for would-be entrants. At the other extreme, it is relatively easy to set up a kebab shop or to offer one’s services as a personal trainer. In manufacturing, small-scale, job-shop operations such as cabinet-making require skills readily available in the labour market and little capital, and are therefore easier for a newcomer to enter than are manufacturing processes with a high degree of technological automation where capital and knowledge requirements can be very high.

Barriers to entry are highly relevant to the number of competitors in an industry, so we incorporate them in the industry structure framework (Fig. 3.8):

**Figure 3.8: COMPETITIVE Advantage AND Industry Structure (2)**

<table>
<thead>
<tr>
<th>Potential for Competitive Advantage</th>
<th>Barriers to Entry</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
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<tr>
<td></td>
<td>High</td>
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<td>Type Ia</td>
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<td>Low</td>
<td>Type Ib</td>
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The underlying sense of the concept is unchanged: high potential for competitive advantage combined with high barriers to entry (Ia) tends to lead to domination by a few large firms making good levels of profit. High barriers to entry with limited potential for advantage lead to a similar concentration with profitability determined by how far the barriers prevent overcapacity (Ib). The potential for advantage without barriers to entry (i.e.: the advantages are available to new entrants as much as to incumbents) mean small firms can make good returns through differentiation (IIa). Finally, sectors with limited scope for advantage and
low entry barriers tend to be characterised by many small firms, all doing well enough to survive but with none making exceptional returns (IIb).

The largest potteries we know of employed no more than a dozen slaves. Does the fact that no one built a larger enterprise lend weight to the view that the Athenians were socially or intellectually incapable of deploying profit-maximising strategies, or was it a naturally fragmented business? The next chapter shows that the relatively small size of potteries in classical Athens reflects competitive factors and need not be attributed to social conditions or attitudes or any of the other hypotheses that have been assessed here.
4. THE POTTERY INDUSTRY

This chapter applies the analytical framework developed above to the structure of the industry about which we know most, pottery manufacture, and shows that the observed small size of pottery establishments results from a lack of competitive advantage and barriers to entry. In terms of our model, it is a naturally fragmented industry.

First we review the early history of the industry and how, with its wide variety of products, pottery played a large part in ancient life, language and metaphor, and potters were among the most noted of all craftsmen. We identify the multiplicity of its products and the different product-market segments – utility, transport and decorative or fine ware – with their different economics. We summarise the limited archaeological data on manufacturing operations before analysing the manufacturing process in some detail to establish what would constitute an efficient deployment of resources around a single furnace. Based on this configuration, we assess the attractiveness or otherwise of expansion from the point of view of a participant to see if there was a compelling economic case for growth which Athenians, for whatever reason, failed to pursue. We conclude that no sensible entrepreneur would have wanted a pottery establishment larger than the observed maximum size. Finally we identify the changes in industry technology that enabled industrialists in the 18th century to establish much larger and highly profitable enterprises.

Ancient literature confirms that pottery and potters were very familiar to the ancient Greeks, but has little more to contribute to these analyses. Extensive use is made of the works of modern archaeologists and researchers into ceramics in the classical period and the expertise of contemporary craft potters.

Pottery in Ancient Greece

Pottery played a vital part in ancient Greek life. A great variety of workable clay is available in most areas of Greece whereas wood was scarce and metal little used for plates, dishes, drinking vessels or cooking utensils. It would be a long time before Juvenal described a poor man as someone whom “fictilibus cenare pudet” (III.168); everyone ate off ceramics.
Outside the kitchen and dining room, pottery was used for storage and shipment of goods and for roof and floor tiles and funeral urns.

This ubiquity is reflected in Greek mythology and literature. Sophocles was one of many to speculate on pottery’s origins: *kai proton archou pelou orgazein chersin* (Fr.438).¹ There was quite a contest over who invented the potter’s wheel, with Diodorus Siculus attributing it to a nephew of the ill-fated aeronaut Daedalus (IV.76.5), and Strabo to Anacharsis of Corinth (Geog. VII.30), even while admitting it was known centuries earlier to Homer where it is used as a metaphor for swift running (II. XVIII.599-601). Pliny gives the credit to either Anacharsis or Hyperbius of Corinth (NH. VIII.198). Of course they were all wildly wrong; the first evidence of the potters’ wheel is from Southern Iraq a little before 3000 BCE.²

Pottery had its own hymn, *Epigrammata Homerica* 14, in which the poet sings for his pots and ends up blessing or cursing the kilns and their products according to how the owners treated him. It also had its own bible – the *Geoponica* gives lengthy advice on the benefits of having potters on a farm (II.49) and some of the complexities of the manufacturing process such as firing (VI.3.1-5). One might even say it had its own slice of the Greek language. *Kerameuein* means to work very hard.³ Hesiod’s description of a fierce rivalry as being ‘potter vs. potter’ (Op.25) had clearly become part of the language by the time Aristotle refers to it (Rh.1381b). Plato twice uses the idea of starting to learn pottery by making a *pithos* to describe what we would express as learning to run before you can walk (Grg.514e; La.187b).

Corinth was the leading pottery producer until it was displaced by Athens towards the end of the sixth century BCE.⁴ In archaeological finds it is not always easy to tell exports from local imitations, but it seems from the style and skill involved in some discoveries in Etruria that Corinth also established potteries there. Andocides’ innovation in changing from black to red figure in the late sixth century helped establish Athens’ pre-eminence, which was underpinned by other innovations such as those of the vase painters Euphronios and Euthymides who competed in developing new ways of foreshortening figures. Finds from as

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¹ “And first began to work a bowl with his hands”

² Bryant (1994, 2001 –electronic article)


⁴ Except where otherwise stated, material on the history of ancient Greek pottery is drawn from Sparks (1991) and Morgan (1996).
early as the Mycenean Age demonstrate what a wide variety of shapes might be devised for the many special purposes of everyday life. Different export markets demanded different variations and the gods had special pottery shapes of their own with many items being made only for special ceremonies. By classical times the diversity of applications that characterised the industry was truly remarkable.

Some items were finely decorated and displayed with pride by the master of the house on festive occasions. They were frequently commissioned for a special event and displayed stock Attic scenes of particular relevance to the purchaser. Funeral urns could be magnificent works of art, as could decorative floor tiles. Discoveries outside Attica suggest that many fine pieces were commissioned for particular symposia and then sold to export markets. Unlike some cheap Corinthian exports, Athenian fine pottery between the eighth and fifth centuries BCE always seems to have been of top quality. The signing of fine items became very common after 540, but declined after the mid-fifth century, though it is unclear why; the quality was still good. Most painters seem to have signed only some of their work and not always the best.

As well as fine ware, every household, rich and poor, would have many vessels and dishes which never left the kitchen and would undergo rougher usage and need regular replacement. Coarse ware (cooking pots, storage jars etc) was not signed and makers did not publicise themselves in epitaphs or dedications. This is only to be expected as there was not a lot of artistic credit to be derived from producing a commodity utensil or storage jar. Regrettably it means we know even less about this important component of the industry than we do about fine ware.

In terms of volume, this commodity, undifferentiated segment of household utensils would constitute by far the largest part of the domestic market for Athens’ potters. Other undecorated product accounting for large volumes included amphorae for transport and most roof and floor tiles. Utensils were made for local purchase and use, subject only to the availability of clay, so were little traded. Fine ware was the prime pottery export, together

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5 The Panathenaic amphora and the loutrophoros water vase are examples.
6 An excellent description of the variety of Athenian pottery products is to be found in Richter (1935).
7 Burford (1972 21) draws a parallel with the fact that we know the names of many silversmiths but no bronze or iron workers.
with containers for exported agricultural products.\textsuperscript{8} In the third century BCE, following her second loss of empire, the record shows that Athens’ exports collapsed and her place was filled by workshops in Italy.

There would have been a retail intermediary trade in pottery: we know of ‘the lamps’ and ‘the cooking pots’, and a place where cooks can hire pots, and these are probably shops in the agora.\textsuperscript{9} Scholars agree that large customers would have come to the workshop. Cook notes that “the general character of Greek industry makes it very unlikely that potters themselves engaged in merchanting. Presumably they sold in the workshop to ordinary purchasers and to dealers or merchants, who in turn sold to other merchants and dealers overseas.”\textsuperscript{10} A shipper of olive-oil who regularly needed a large number of reliably robust containers would be likely to place large and regular orders with one or more individual workshops rather than risk the quality and availability of the spot market. Conversely, a large producer of utensils would probably choose to deal with a few resellers rather than whoever came along. This is supported by Johnston’s study of trademarks on vases, which indicates that the marks mostly reflected traders visiting a pottery and placing orders.\textsuperscript{11} The dispersal of the works of individual painters suggests fine ware did not involve similarly stable and well-defined wholesale relationships.\textsuperscript{12}

The wide variety of size, complexity and quality standards among the different products of Athenian potteries means that when we come to address the production process we must consider it in relation to a range of possible combinations and sizes of products. The differences in the nature of demand for fine and coarse ware also mean we should treat them separately.

**Primary Evidence on Pottery Layout and Size**

“The few literary references to pottery say nothing useful about the industry. What we know or guess comes from the pots themselves and a few inscriptions set up in public by potters.”\textsuperscript{13}

\textsuperscript{8} Isager (1975) 37-9
\textsuperscript{9} Webster (1969) 8
\textsuperscript{10} Cook (1960) 273
\textsuperscript{11} Johnston (1979)
\textsuperscript{12} Cook (1960) 273-4
\textsuperscript{13} Cook (1960) 271
Nevertheless, the durability of pottery has made it a good friend to archaeology. It is one of the oldest crafts and the easiest to trace its history. Finds of ancient ceramics show that by classical times pottery had gone through many important technical changes and product capability had gone from crude cooking utensils to the remarkable Athenian red figure ware we are familiar with. New technology in imaging and chemical analysis has led to increasing precision in defining dates, composition and, to some extent at least, production processes. To this we may add the physical remains of workshops found in some sites and evidence from shipwrecks. We examine each in this section.

Potteries can be readily located through the excavation of ancient wells in which shards have tended to survive better than the detritus of other industries. They tended to agglomerate near urban areas in order to access a larger market than would be available to a village-based workshop. Thus in Corinth we find a pottery district two miles west of the temple of Apollo that “offered (these) potters facilities and a market which they would not have had if working individually in the villages of the territory.”\textsuperscript{14} From the early Protoattic period, we find a site in the Agora with facilities for washing clay and a cleverly designed furnace base alongside residential rooms.\textsuperscript{15} This site was abandoned in the third quarter of the seventh century about the time the other side of the Agora became the main centre of production. Colonos Hippios Street featured multiple production sites, principally devoted to pottery, many of them dating from 425 BCE and later. Fringe sites, generally around the Academy, seem to have produced to a lower standard. Major pottery sites have also been found at the Cerameicon and at Demosion Sema, the latter including traces of workshops which appeared to specialise in unusual ceramic goods such as funeral urns. In one of these the letters SIS on a set of tongs might be the first part of the potter’s name.\textsuperscript{16}

Kilns often needed to have their domes rebuilt between firings. Many of the more robust ones would have been destroyed by seasonal rains, but some were more durable. The kiln in the House of the Tholos was split-level and clearly a permanent item.\textsuperscript{17} The layout of the workshops shown on vases is constrained by the size of the vase, but in general we see a covered area where the potters and decorators work and an open one for the kiln. Vase

\textsuperscript{14} Osborne (1987) 117
\textsuperscript{15} The sites identified here are from Monaco (2000).
\textsuperscript{16} Chapter Six gives more details of industrial sites in Athens.
\textsuperscript{17} Thomson (1940)
paintings show kilns were usually bee-hive shaped with a small tunnel for the fire-box. From the point of view of production economics, a central question is kiln capacity. The House of Tholos kiln was 1.33m in diameter around a central pillar supporting the upper floor and has an irregularly-shaped firing room. A black-figured pinax shows an igloo-like kiln, a little higher than the stoker’s waist, and the diameter of the kiln looks to be about the same size. Papadopoulos identifies a kiln at Torone in Chalcidice of 0.8 meters diameter, though he also notes that a rectangular one at Sindos measured 4.25 by 1.85 meters, an internal area similar to a circle of around three metres diameter. It is not clear what this was used for. Papadopoulos comments “although larger kilns are known…. the most common are small circular updrafts with a temporary dome of clay and conceivably also of turf, stone and wasters.” Arafat and Morgan analysed a number of depictions of pottery furnaces including five Corinthian pinaxes from the Staatliche Museen in Berlin. The largest is less than two metres in diameter and the rest are much smaller. Three kilns discovered in the Metapontum Kerameikos have diameters between 1.0 and 1.2 meters. Other excavations and representations seem to support a similar kiln size; this is unsurprising as it was almost certainly constrained by the ability to control temperature and moisture which becomes exponentially harder as the kiln gets bigger. For the purpose of estimating capacity in the analysis that follows, we take 1.5 metres as the maximum kiln diameter. An important observation is that there are no traces of a single pottery establishment using more than one kiln. We need to bear in mind that rebuildable kilns do not always leave clear traces, so in analysing optimum firm size we must consider whether there would have been a financial incentive for a pottery to operate more than one kiln at a time.

The earliest extant representation of an Athenian potter on a vase dates from about 530 BCE, though Corinthian depictions predate this. Vase paintings point to small enterprises making

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18 Louvre MNB 2858, in Schreiber (1999)
19 Papadopoulos (2003) 219
20 Arafat (1989) 317 The items are identified as numbers 4, 12, 21, 22 and 26 in Antike Denkmacher 1,pl.8.
21 Cracolici (2003)
22 There is some evidence that red figure workshops were a little larger than their black figure predecessors, but it is slight. (Observation made by Professor John Oakley, Director of the American School of Classical Studies at Athens, August 2007).
23 Beazley (1944)
a wide range of ceramic products. Stissi contends that fine ware came from workshops that also made coarse ware — “even tiles and terracotta statues.” Webster adds the possibility of lamps and notes that even a specialist in large vessels might have quite a broad range: “it is certainly possible that a single workshop from 570 to 500 produced Tyrrhenian amphorai, Mannerist pots, Nicosthenic amphorai and kyathoi.” Rotroff identifies a large number of different types of pots emanating from the same workshops. Twenty-nine units from the Dikeras workshop (270–260 BCE), for example, represent eighteen different types and all seven from the Shark group (275–240 BCE) differ. Arafat and Morgan believe that “certain workshops seem to have specialised in particular kinds of vessel, but this should be set against a background of diversified production.”

We can sometimes learn about production sites from inscriptions on the pottery itself. Wine amphorae from Thasos always had the potter’s name and date, most likely for tax purposes. If we had all the output of any one workshop, these data would be invaluable for estimating capacity and throughput. As it is, we can draw tentative conclusions about the relative importance of different workshops in different markets and about the number of fine ware painters that were active in Athens. For example, Cook argues that two-thirds of all pots have been assigned to one of fewer than 500 workshops (and, implicitly, painters) and that, allowing for duplication, assigning the rest would not take the total above 500. Assuming a 25 year working life, this would mean 125 painters active in each year to cover a century. Conversely, from the discovery of 40,000 red-figure vases from a period of 130 years, and an assumption that each vase takes 4 months to complete, one can derive 13,000 painter-years or 100 painters a year. These estimates seem very unlikely. There may have been far more than 40,000 red figure pieces made and they are unlikely to have taken four months each. Based on new finds of vases by painters that were already known, Oakley contends that the output of individual painters might be much higher than previously thought. More important for

24 A picture on the shoulder of a hydria in the Leagros Group (520–510 BCE) shows unpainted pithoi, suggesting the same workshop would make both decorated and undecorated ware, but workshop scenes were unsigned and may sometimes have depicted vases being produced in a different workshop.
25 Stissi, (1996)
26 Webster (1972) 296
27 Rotroff (1997) 72–77
28 Arafat (1989) 317
29 Cook (1960) 274ff
30 Oakley (1992)
our analysis, the time it took to shape and decorate a vase might have been measured in days rather than months. Cook’s errors would tend to cancel each other out, so perhaps his conclusion on total painter numbers is reasonable, though that suggests a much larger body of output from these craftsmen that has not been discovered and might never be. This would still be consistent with Snodgrass’s view that “it is doubtful whether fine pottery employed more than five hundred at its peak,” and with Francotte’s astonishment at how Athens’ reputation was founded on so small a workforce.31

Arafat and Morgan speak of the “comparative anonymity and low status of potters”, noting that, compared with sculptors, architects and painters, potters seldom appear in literature. This anonymity is reflected in the paucity of monumental decorations; only fourteen out of four hundred dedications are made by craftsmen, and potters might account for five of them.32 Such epigraphy as can be found does tell us something about the status of these craftsmen and may, if much more comes to light, provide a way of refining estimates of the numbers involved in painting fine ware, but does not reveal anything at all about what was the bulk of the industry in volume terms – coarse ware.

When it comes to those workshops that turned out the vast bulk of production – less decorated items, utensils and containers – no robust estimates seem to exist for the total number of people employed by potters or the size of the average workshop. The largest finds of coarse ware are in the form of shipwrecks containing manufactured vessels used for transport and storage of wine, oil and grain. These finds are increasing at a rapid rate and with them the volume of ancient pottery on public display, but unfortunately, while they provide valuable new insights into commodity trade, they tell us little about the industry that made the packaging.

In summary, we have an idea of kiln size, some unreliable estimates for the numbers of painters of fine ware with no clear view of how many people were engaged in supporting them in a potter’s workshop and no hard information at all on employment levels or unit size in coarse ware production. To determine typical firm size we must rely on inferences from vase paintings. In general, we do not see more than two or three workers depicted at a time, although the Leagros hydria from the end of the sixth century shows a manager, a painter, a

31 Snodgrass (1980) 128; Francotte (1900-01) 77
32 Arafat (1989) 312
craftsman shaping the pot and five assistants. A red figure hydria from about 460 BCE shows four people painting. Based on these paintings, most scholars have formed the view that pottery workshops seldom employed more than a dozen people and generally far fewer. This may be correct but the vase itself constrained the number of figures that could be shown and, to the extent paintings were likely to have concentrated on the better known workshops, they might have been depicting naturally boutique operations and not ones dedicated to churning out large volumes of commodity product.

Noble suggests there was probably a range of sizes of pottery workshops, from the sole practitioner, perhaps with an assistant to turn the wheel, to a maximum of around twelve. Four to six were typical. Arafat and Morgan describe “a system of nucleated production involving an average of some six people (sometimes fewer, sometimes more), perhaps centred on an extended family”, although in classical Athens production operated at a level above that of the householder’s immediate family. Bolkestein supports Noble’s assessment: “more than 12 or 15 labourers would never have been united in one workshop.” Webster, on the other hand, says of the eight figures on the Leagros hydria “we may think of this as a minimum” and suggests the average was between 10 and 20. It is not clear how he arrives at this conclusion. Green thought this hydria represented metal working, which we know contained some larger enterprises, including one inherited by Demosthenes with over thirty workers (xxvii.9). The lack of an image of Hephaestus on the vase casts doubt on Green’s view and most scholars think it depicts a pottery. Oakley believes that in the third century BCE, potteries may have had as many as 40 workers, but acknowledges that the evidence is not strong.

One of the reasons that definitive size estimates are difficult is probably that it was a naturally seasonal industry even for permanent establishments, both because of drying conditions and

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33 This Attic hydria by the Leagros painter is described in Noble, (1965) 72, note 2.
34 The Caputi Hydria by the Leningrad painter: (Noble (1965) 54, note 19)
35 Noble (1965) xiv
36 Arafat (1989) 323
37 Bolkestein (1958) 50
38 Webster (1972) 41
39 Green (1961)
40 Observation made to the author by Professor John Oakley, Director of the American School of Classical Studies at Athens, August 2007.
because of the demands of agriculture on the labour force; there are likely to have been many
days of operation with a labour force somewhere between the peak on the one hand and the
minimum or seasonal closure on the other. Complicating matters further, the workforce was
mobile: “on the whole shops seem to have had a steady membership of potters and painters,
but there were roving painters, and special arrangements were made for rush orders; painters
could be called in from outside and pots could be brought in from neighbouring shops for the
home painters to decorate.” 41 Signatures suggest that not all potters did their own painting or
vice versa, but some did. We also know, for example, that Euphronius turned from painter to
potter and employed at least three other painters, including Douris who was also a potter and
an innovator of shapes. In early C5 Oltos painted for at least four potters.42

In any event, there are few credible suggestions that potteries typically employed more than a
dozen workers and this small enterprise size has been taken as an indication that the
Athenians did not look to maximise profits. Of course, for some workshops, pottery would
have been a seasonal occupation, carried out only in spring and summer when there was less
agricultural work to be done and conditions were better for drying clay. To the extent pottery
was for such people part of a managed portfolio of income-generating activity, the question
as to why they chose not to expand does not need asking. It is probable, however, that
several workshops, owned by freed slaves and metics as well as by citizens with no
agricultural interests, would have operated year round, subject only to weather conditions. It
is with regard to such workshops that we pose the question “Why no bigger?”

To answer this we must first understand the production process so as to define what an
efficient deployment of labour around a single kiln might be. We then assess whether further
expansion was economically rational in respect of either fine or coarse ware.

The Manufacturing Process and Deployment
of Labour

The earliest pots extant come from Japan, China and Korea, some dating back as early as
12,000 BCE. 43 The first evidence of the potters’ wheel is from Southern Iraq a little before

41 Cook (1960) 272
42 Burford (1972) 94
43 This historical summary is based on Herrold (2003 – electronic article).
3000 BCE. It was operated by hand and useful for smooth, quick coiling but initially too light for throwing a heavy pot. Later improvements in design reduced friction and increased weight and momentum. The flywheel that governed rotation speed seems to have been introduced about 1000 years later in the Middle East and China and spread rapidly. In the Greek world, Minoans were using updraft kilns to make decorated earthenware pots from 2500 BCE onwards – a relatively primitive technology but in fact more advanced than those applied until very recently in Africa, India and among native Americans, some of whom still use open fires. By classical times the process and the products had become far more sophisticated. Coloured slips were introduced by 700 BCE for decoration, and complex firing technologies were being applied to exploit the colour changing properties of oxygen when applied to heated clay. Surfaces could be made so smooth that fine lines could be drawn with a single-hair brush.

According to Clark, the process for manufacturing pottery in ancient Athens consisted of 29 steps of which the last was attaching the handle. It is only necessary to consider the process in broad terms in order to establish the likely deployment of labour in the largest potteries. To feed a kiln of the type described in the previous section, four main steps were necessary:

1. **Preparing the Clay.** This consists largely of adding water to remove impurities, enable easy shaping and allow for shrinkage (typically 9% in throwing and 0.5% in firing).

2. **Shaping and Throwing.** Most forming was done on the potter’s wheel. Some potters might have driven the wheel themselves, although in the absence of a kick wheel it would have constrained the activity of one of their hands.

3. **Decorating.** The essence of Attic ceramic decorations was the colour changes that the addition and withdrawal of oxygen during the firing process could create through its effect on the iron oxide in the clay. Athenian potters used this in different ways to create red and black figure pottery and to lend distinctive colour and sheen to coarse ware.

4. **Firing.** This is the most scientifically complex step of all, involving precise timing and temperature control and taking about seven hours. The first or ‘oxidising’ stage

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45 In the case of some cookware, rather than using a wheel the pot wall was hammered with a paddle and anvil. This enabled thinner walls, but increased throwing time (Sparks (1970)).
takes the temperature slowly from ambient to about 350 degrees centigrade and then more quickly to 800; the second (‘reducing’) stage involves closing the vents and inserting damp wood in the furnace to reduce the quantity of free oxygen; finally, once the temperature reaches 950 degrees, it is brought down but the atmosphere kept damp (‘soaking’) until the furnace has cooled to about 800 degrees, by which time the slip has become an impervious glass film.

In considering how pottery workshops might have best been organised to conduct these process steps as efficiently as possible, it is clear that two variables will determine the productivity of a given establishment:

- The capacity and cycle time of the kiln (how many items can be fired in a working day) and
- The number of people involved in making enough product to keep the kiln full.

These variables would have differed between decorative fine ware and coarse ware.

**Fine Ware**

By definition, the output of decorative vases is the sum of the output of individual craftsmen whose decorative skills are valued in the market place. It is not clear what the typical level of output of these craftsmen might be, but it would certainly have been the main constraint on production rather than kiln size, as the painting must have taken longer than the firing. The time needed for clay preparation, shaping and throwing is also much less than likely painting time. In theory, even if the skilled artist did nothing but decorate, one clay-preparer-cum-potter and one assistant to turn the wheel and mind the fire could provide all the extra labour needed to turn out pots much faster than they could be painted. What is more, adding only two or three to this complement would enable a small pottery to service several painters, even if their works each needed to be fired individually – for instance five painters would mean a workshop of not more than about 10 people. In fact we know of no workshops employing

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46 Tonks (1908) suggests gold and silver’s melting properties are such that they might have been used for temperature control.

47 We have noted above that Cook is almost certainly incorrect in thinking painters might have produced three items a year each on average (274ff). Making the vase (which they might have done themselves) would only take a few minutes. A huge amount of care went into tracing, filling in and painting details, but the total number of brushstrokes was not huge and it is difficult to see how they could be spread out over 100 or more working days. Oakley’s analysis of recent finds (referred to above) also suggests Cook is wrong and that many vase painters produced far more, but the correct answer is not relevant to the question of workshop size.
this many painters at once. We have one vase painting showing four people engaged in decorating vases but we cannot even be certain whether these are creating highly decorated product or adding the finishing touches to a utility item.\footnote{Cracolici (2003 App. One) found fingerprint evidence that decorated vases were often handled by several people, mainly in the dipping process (as many as five in some cases) but dipping takes very little time and we certainly cannot conclude that each potter also required several dippers. The casual nature of the task would be consistent with items having multiple handlers and it is likely dipping was done by people with other primary tasks.}

The constraint on output is not kiln capacity then, as it is in the case of other ware, but the decorators themselves. The little we know about these artists suggests that they took full advantage of their celebrity and moved around the market to where the opportunity presented itself. Some had their own potteries, some were employed (though remaining mobile) and some seem to have freelanced; most moved between these modes. They probably acted as potters when there were no painting commissions around. Unsurprisingly, they did not sign up in large numbers to work for one or two employers. The question as to why there were no large workshops employing multiple noted painters is a simple matter of labour market power. The remainder of this analysis concerns the economics of coarse ware manufacture.

**Coarse Ware: Kiln Capacity and Labour Requirements**

Here kiln capacity was the overriding constraint. The maximum number of people that could usefully be engaged around a single kiln was the number of clay preparers, throwers, wheel turners, decorators and fire managers it would take to keep the kiln operating at capacity. More than this and their work would be wasted.

To determine the volume that could be put through a kiln in a day, we need to know the volume of product it could hold, how long the cycle time was, and how many hours a day the kiln operated. Archaeological evidence described above shows that a typical kiln had a diameter of 1.5 metres or less. Many were quite a bit smaller. Height was between one and one-and-a-half metres. Pottery was leather hard when it went into the kiln, and subject to scarring and distortion if two pieces were touching, so the better ware needed to be kept well apart – even to the point of the best pieces being fired alone for fear of explosions. Urns might have been stood upside down next to each other as in the kiln at the cemetery in...
Rhodes or stacked;\textsuperscript{49} plates and tiles might be stacked immediately on top of one another, perhaps with separating slips, but there is no evidence that other items were stacked on more than two levels. Stacked plates and tiles might have been pre-fired to avoid bonding.\textsuperscript{50}

We need to estimate how many pieces a typical kiln might take. This would obviously vary according to the nature of the items. In practice, more than one type of item might be involved in each kiln firing, but for simplicity we will consider batches of a single type of product. Richter suggests about fifteen items including a few small dishes was typical.\textsuperscript{51} A batch consisting entirely of small or flat items, stacked to the greatest extent possible, could clearly involve many more. To determine how many items could fit in a kiln involves the mathematical problem of ‘circle-packing’ which has no standard solutions, so estimates are derived from physical modelling applying the following methodology:

1. Identify different groups of common ceramic items with contrasting sizes and shapes (e.g: short and wide, tall and thin, medium, small ornaments, etc.)
2. Calculate the average dimensions of each group, based upon samples in a museum collection and allowing for shrinkage.\textsuperscript{52}
3. Assess by physical modelling, using coins and a pair of compasses, the number of such items that could sit together without touching each other on the floor of a kiln.\textsuperscript{53}
4. Check the reasonableness of the outcome by calculating the area of unoccupied space on the kiln floor in relation to theoretical total capacity and comparing this with expected outcomes.
5. Interpolate observations outside the range of experimental accuracy by plotting observations on logarithmic graph paper.
6. Allow for two layers (except in the case of flat items which could be stacked) There will be some loss of space efficiency in stacking; the separators themselves take up space and limited access to more than one level will reduce packing efficiency, so a

\textsuperscript{49} Papadopoulos (1992); Cracolici (2003); Hasaki (2007)
\textsuperscript{50} Pre-firing involves removing items from the kiln after taking it to 350 degrees (the slow part of the process) and replacing them later so they could be heated to 800 degrees much more quickly.
\textsuperscript{51} Richter (1923) 31; based on Plate VIII, 19b in Antike Denkmäler I
\textsuperscript{52} The Classical Collection of the Ian Potter Museum at the University of Melbourne was used. All measurements are available on the Museum’s website (accessed 05/02/2010) and are detailed in Appendix A.
\textsuperscript{53} The diameter of the circle representing the kiln floor was chosen to be in the same ratio to specific coins as the kiln floor (1.50 square metres) to the maximum diameter of the items measured.
30% reduction is allowed for on each level.\textsuperscript{54} Two is assumed to be the maximum number of levels used.\textsuperscript{55}

The results of these calculations are summarised in Table 4.1. Where estimates are involved, the intention has been to err on the side of overstating the number of items that could be accommodated in one firing so as to maximise the size of the labour force needed to fill the kiln:

**Table 4.1: Kiln Capacity**

<table>
<thead>
<tr>
<th>Shape</th>
<th>Sample size</th>
<th>Average size (cm)</th>
<th>Number of items per layer</th>
<th>Implied wastage (%)</th>
<th>Number of layers</th>
<th>Total items per firing\textsuperscript{56}</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Height</td>
<td>Width</td>
<td>Trial/ Interpolation</td>
<td>Theoretical Maximum</td>
<td></td>
</tr>
<tr>
<td>Short, squat</td>
<td>2</td>
<td>15.3</td>
<td>37.9</td>
<td>8</td>
<td>15.7</td>
<td>49</td>
</tr>
<tr>
<td>Large, wide</td>
<td>3</td>
<td>38.4</td>
<td>32.5</td>
<td>11</td>
<td>21.4</td>
<td>49</td>
</tr>
<tr>
<td>Plate</td>
<td>1</td>
<td>5.5</td>
<td>21.9</td>
<td>28</td>
<td>47</td>
<td>41</td>
</tr>
<tr>
<td>Large, tall</td>
<td>3</td>
<td>40.8</td>
<td>17.0</td>
<td>52</td>
<td>78.0</td>
<td>33</td>
</tr>
<tr>
<td>Medium</td>
<td>8</td>
<td>25.0</td>
<td>15.3</td>
<td>59</td>
<td>96.6</td>
<td>39</td>
</tr>
<tr>
<td>Small</td>
<td>12</td>
<td>10.8</td>
<td>13.2</td>
<td>74</td>
<td>128.5</td>
<td>42</td>
</tr>
<tr>
<td>Ornament</td>
<td>1</td>
<td>3.1</td>
<td>6.8</td>
<td>330</td>
<td>481.5</td>
<td>31</td>
</tr>
<tr>
<td>Tall, thin</td>
<td>10</td>
<td>16.7</td>
<td>6.1</td>
<td>440</td>
<td>596.5</td>
<td>26</td>
</tr>
</tbody>
</table>

\textsuperscript{54} In other words, two levels can hold 140% of the number of items that one level can hold

\textsuperscript{55} In fact the use of kiln supports was probably much more limited than this calculation suggests, but for the purpose of the analysis it is important to identify labour requirements at the highest practical level of kiln utilisation.

\textsuperscript{56} Stacked on two levels with 30% wastage rate (except plates).

\textsuperscript{57} Based on total area of the kiln.
It is important confirmatory evidence that the relative capacities for different items in the table above are consistent with relative prices. With small vases selling at two or three to the obol, similar revenue would be derived from a kiln full of them as from one containing just one large amphora. Red figure hydriae are worth about 30 times as much as small vases and about half a large amphora. 58

To be efficient, a workshop would need to employ enough people to keep the kiln working at capacity. A rule of thumb is that it takes about as much time to prepare the clay as to throw the pot, so for each shaper a well-specialised workshop will employ one clay preparer. There will also be someone to turn the wheel, making a total of two assistants per potter. Over and above this will be people in charge of the firing (probably two) and possibly a manager/foreman, though the latter would almost certainly be a potter as well. The optimal size of a workshop is therefore three times the number of potters required to produce enough product to fill the kiln, plus two kiln operators. The critical variable is the time a potter takes to throw a pot.

For an experienced potter, throwing a vase or dish of a particular shape is a simple task and can be done in a matter of seconds. An experienced contemporary potter can make a shaped vase in two and a half minutes and a plate in 30 seconds. 59 In January 2010, the author observed a traditional potter in Rajahstan, using a single ball of clay and with a single hand-spin of a heavy wheel, form three ornamental vases of different shapes, each about 25 centimetres high and 15 in diameter, one with a separate lid, in just over two minutes. For our estimates of how much potter’s time it would take to fill the kiln we will conservatively assume a lower degree of skill, as shown in Table 4.2. 60

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58 It might take all day to make a large amphora which had the kiln to itself. According to Amyx (1958), who combines data from a stele with graffiti to derive a price list, such an item might sell for between four and eleven drachmae; the cost of leasing and maintaining a slave, was about 1 drachma a day (see Chapter Eight) so one amphora could cover quite a few workers and raw materials and still leave a margin.

59 For much of the technical detail on pottery production, the author is indebted to Mr Ian Gregory of Ansty in Dorset, England.

60 For simpler items the potter might have chosen to use a mould, but this would not have made much difference to his rate of production (Finley (1965a) 31).
Table 4.2: Forming Labour Requirements to Fill a Kiln

<table>
<thead>
<tr>
<th>ITEMS</th>
<th>Capacity</th>
<th>Minutes per Item</th>
<th>Minutes to Fill Kiln</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short, squat</td>
<td>11</td>
<td>25</td>
<td>275</td>
</tr>
<tr>
<td>Large, wide</td>
<td>15</td>
<td>20</td>
<td>300</td>
</tr>
<tr>
<td>Plate</td>
<td>392</td>
<td>1</td>
<td>392</td>
</tr>
<tr>
<td>Large, tall</td>
<td>73</td>
<td>5</td>
<td>365</td>
</tr>
<tr>
<td>Medium</td>
<td>82</td>
<td>3</td>
<td>246</td>
</tr>
<tr>
<td>Small</td>
<td>103</td>
<td>2</td>
<td>206</td>
</tr>
<tr>
<td>Ornament</td>
<td>462</td>
<td>1</td>
<td>462</td>
</tr>
<tr>
<td>Tall, thin</td>
<td>616</td>
<td>1</td>
<td>616</td>
</tr>
</tbody>
</table>

On this basis, a potter working alone with just a clay-preparer, a wheel-turner and two furnace operatives could throw enough of most items in an eight hour day to fill the kiln: a workforce of five. Even if a workshop was able to specialise in thin items such as perfume bottles and ornaments (which seems to be counter to archaeological evidence\textsuperscript{61}), this would only mean the addition of three more workers.

It is also necessary to consider whether a pottery might do more than one firing in a day. Papadopoulos suggests that “firing took up the best part of a day or possibly longer.”\textsuperscript{62} Cycle time for a kiln from cold to removing fired items is seven to eight hours. Three to four hours were occupied in the first part of the first stage, in bringing items to bisque state at about 350 degrees C and then to 800 degrees for oxidation. “Reducing” to 950 degrees took another two hours, and soaking to 800 and cooling to 250 degrees one hour each. When the kiln had completed its first cycle of the day and cooled to about 250 degrees, any items which had

\textsuperscript{61} Rotroff (1997, 72-77). While it was certainly possible to specialise in high volume furnace products such as tall, thin \textit{unguentaria} or small ornaments and to optimise the stacking arrangements, product markets suggest that few potteries could have. It would be possible for a single kiln to supply every citizen’s household with one of these products in only a matter of weeks, so if any did specialise the business was available to very few operators. In practice, production would reflect the rate of usage, involving principally plates, bowls and large or medium-sized jugs. It seems likely that smaller objects were made in many workshops and fired with larger items, conveniently filling in gaps.

\textsuperscript{62} Papadopoulos (1993) 220-1
been prefired (taken to bisque state) could be put in and brought very quickly through the rest of the stages, making for a cycle time of around four hours. In general though, pre-firing seems to have been rare, at least for glossed items. Richter, Binns and Fraser have established that the technique used to attain the ancient Greek gloss was a single firing done in three stages. Nevertheless the technique might have been used to help production flows for coarse ware.

If a full cycle from cold takes over seven hours, it is doubtful that there was more than one full firing in a typical day. We do not hear of pottery shops working especially late hours as would be necessary to achieve two full cycles. Nor would it have fitted what we know of Athenian household arrangements. The master would have had to neglect family duties and slaves are likely to have had other work to do in the household. Nevertheless, we should allow for the possibility that, at least in summer, workshops might get in two full firings between sunrise and sunset. More likely they would manage their production in such a way as to get more than one. For example, in a twelve hour day, they might do three prefirings. On a later day the same three batches of items could all have their final firing, thus getting three batches through in two days instead of two.

Even assuming that two full firings were achieved, and the number of items fired in a day was doubled, for most products a potter working for between six and eight hours a day can throw enough ware to keep the kiln full. If it specialised in smaller items, it would need no more than two potters or a total complement of eight. Eleven would only be needed if it had completely cornered the Athenian market in narrow items.

The analysis also suggests that any single kiln workshop employing more than one or two potters must have had other tasks for them to do. It appears that even without seasonal considerations, much of the employment in potteries was of a part-time or casual nature. Thus citizen potters would have fitted in their civic duties, slaves would have been given other tasks and even full-time working metics might have spent time on other ventures, including selling their wares. In some cases potters may have spent time decorating their products – not sophisticated, high-quality painting but pretty, stylized patterning which might appeal to buyers of certain items. Simple, repetitive painting and a little relief work might

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63 Schreiber (1999) 55
64 Arafat (1989) 326-47
take an hour or so per unit, which would mean two or three potters might be fully engaged in providing enough product to keep the kiln at capacity. In this case though, with the potters occupied in decorating, no further effort is required to prepare clay or turn the wheel and these two occupations would be idle while the potters were painting. Wheel turners seem to have been young boys, probably the sons of slaves who would also have a life and an education to attend to outside the workshop. One assumes the spare time of the clay preparers was spent clearing up, fetching clay and wood, handling drying items outside the furnace and, quite possibly, doing a bit of simple decorating themselves.

Irrespective of how productively the time was spent, it is difficult to see how a single kiln operation could justify employing more than a handful of potters and some (probably smaller) number of clay preparers and wheel turners, the latter on very much a part time basis. Add a painter or two, fire controllers and a non-producing manager and twelve seems about the very largest workforce that could be kept occupied making coarse ware, given kiln limitations. We should note that, although scholars like Oakley and Noble contend that there may have been workshops with more than this number of workers, there is no strong evidence for this proposition. If there were, we must conclude that they fired round the clock and/or in more than one kiln, but there is no evidence for this. In the next section we explore whether there was an economic motivation for them to do so.

The Potential for Profitable Growth in Coarse Ware

This section addresses the question of expanding the size of potteries beyond that suggested above. We have seen why it was practically hard to do so with highly decorated fine ware. This section explains why it would have been unattractive in most circumstances to expand in coarse ware.

The Competitive Dynamics of the Pottery Industry

In making coarse ware for typical retail markets and industrial customers, there was very little potential for one pottery to achieve a competitive advantage. Prices would have been the same for all producers since products were hard to differentiate from one another. There might have been some modest premium available for simply decorated items but any
attractive margins would have been quickly competed away and the premium would simply reflect extra production effort. A merchant needing transport containers might be careful who he gave his business to, wanting to ensure a minimum quality standard and reliable delivery, but providing this standard was met, would select the supplier with the lowest prices.

Nor was it possible to achieve sustainably lower costs than one’s competitors. Everyone was applying the same processes on the same equipment; if one workshop was more efficient than another for a time, the second could always improve its operations to erase the difference. Clay, wood and other inputs were readily available to all at (presumably) the same price. Slaves were bought and sold regularly and we know from the orators that the value of special skills tended to be reflected in a premium price for the slave-asset, negating the net benefit to the employing potter. Anyone could start a pottery at home alone or with a slave or two and expand organically, and this absence of barriers to entry combined with the lack of potential for advantage would have kept prices down so that no potteries would have made large profits. Prices would tend to stabilize at a point where the craftsmen who accounted for the bulk of production found their net income worthwhile:65 in other words, it was as much as they could earn in another way that was no less congenial. Pottery in classical Athens is a perfect example of a naturally fragmented industry.

To illustrate this numerically, we will consider first the small craftsman – a citizen or metic of modest means and aspirations, supported by one or two slaves. Let us assume the net income his household needs to maintain a modest lifestyle is 8 obols a day and that if it was less than this, he might choose another occupation. Let us also assume he supports a slave and his wife at a net daily cost of 4 obols after the latter brings in income through her charms, and they make five identical ceramic objects each day and raw materials (fuel, clay and water) for these objects have a delivered cost of 3 obols. The owner-operator will need to sell his wares at 3 obols each to meet his income objectives \((3 \times 5) – 4 – 3 = 8\). Elementary economics tells us that if this example is representative, then market prices for the products will stabilize at this level. This process is illustrated in Figure 4.1:66 if additional competition (S1 to S2) forces the price below the equilibrium level (P1 to P2), potters, dissatisfied with their income, will withdraw from the industry (S2 to S1) and prices will rise until they return.

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65 See Figure 3.1
66 See also Figures 3.7 and 7.1-4
to \( P_1 \). Conversely, if the price goes above \( P_1 \), other people would see an opportunity to earn more than in their current occupations, increasing the supply until prices had fallen to their original level.

This configuration of one owner working with one or two slaves is likely to have been the most prevalent mode of pottery production but it was not the lowest cost. A pottery which employed more people, perhaps seven or eight, would have slightly lower unit costs through some limited vertical specialisation of the labour force. Even though the additional people would be carrying out tasks like managing the kiln and preparing clay rather than throwing pots, the potters would throw more units in a given time because they were not distracted by the other tasks. Where two workers doing everything between them might produce five of our notional standard pots in a day, a team of seven might produce, say, twenty. Allowing four obols per slave for maintenance and twelve for raw materials, at the price of three obols per unit, this pottery would make a surplus of 20 obols per day \((3 \times 20) - (4 \times 7) - 12\), over twice the net income of the free craftsman. The attraction of this position is balanced by some risk. It has a higher level of fixed costs to cover which means that it needs to be very sure it can sell enough product to maintain this level of income. In theory, if the larger pottery cut price to two and a half obols per unit it would drive the smaller operator out of business while remaining marginally profitable itself. The problem with this strategy is that if it maintains low prices, then its profit level falls towards the cost of capital and the benefit of the cost advantage is lost. If it allows prices to recover after driving one or more competitors
out by winning their business, these competitors will soon be replaced by new entrants. Without barriers to entry, lower cost competitors can make better returns, but the advantage is too slight to enable them to make a permanent gain in market share and thus grow their business at the expense of competitors.

In practice, the higher fixed costs and the risk that went with them might have made a larger pottery reluctant to rely on winning sporadic retail business and it might well have preferred to secure some benefit from its low cost position by doing bulk deals with resellers or shippers. It is likely that large, slightly discounted contracts for the supply of commodity product in large volumes were an important part of a dedicated pottery’s business to reduce volume risk on a day-to-day basis. These deals would make the small extra margin even smaller so that the owner of the larger, fully-staffed, labour-specialised unit would have made little more profit than the subsistence income of the smaller operator. We effectively have two segments here, the small craft shop and one with a slightly larger workforce producing greater volumes at a slightly lower cost and selling into bulk markets at slightly lower prices. With no competitive advantage, in neither segment are competitors likely to have made more than subsistence-level returns.

The Potential for Profitable Growth

Can results be improved by growing the business beyond the number of slaves required for one kiln? We have shown that a workforce of seven or eight is more than enough to keep the kiln filled for two firings with virtually any combination of products, including some simply decorated vases, which means there would be no sense in employing more than this without increasing firing capacity. Firing capacity can be added in three ways: enlarging the kiln, extending hours of operation and adding a new kiln. The first is improbable given the consistency of the evidence of kiln size, which was probably limited for reasons of firing control.67 There is no evidence from literature or archaeology that potters chose to extend their operating hours or add a second kiln, but they certainly could have and it is possible they did. We must ask then whether they would have had reason to; what are the circumstances that might have prompted such decisions?

67 The Romans developed larger, rectangular kilns, but they had greatly improved arch and flue technology under a well-supported floor (Peacock (1982) 67).
Small increments could be made by increasing hours, although flexibility is limited by the nature of the cycle so increased capacity would have come in large lumps of kiln-hours rather than in small stages. We should also remember that the throwing, wheel-turning and clay workers seem not to have been very fully employed for two firings a day. It seems that even if a pottery operator chose to increase kiln time, his current staffing complement might have been able to keep his kiln filled for two full firings without needing more labour, so this extended-hours strategy would not have increased employment levels much. To get to twenty workers or more would require more than one kiln.

Let us consider the decision facing an entrepreneur with seven workers who would seek to add a kiln. Adding a kiln doubles the number of workers, but, even if the second kiln can be kept as busy as the first one, there is scarcely any reduction in unit costs since all input costs (slaves, wood and clay) vary directly in line with output. If the second team cannot be kept as busy, then average cost per unit will increase. To keep these additional productive assets busy and unit costs as low as the first team, the workshop virtually has to double sales (Fig 4.2).68

**Figure 4.2: IMPACT OF ADDING KILNS**

![Graph showing impact of adding kilns](image)

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68 To the extent there is any cost reduction at all it will come from sharing minor indirect costs such as premises or management (which are not always explicitly costed by small businesses even today). Hence costs at full capacity decline very slightly for each new kiln added.
The owner faces the challenge of how to achieve the required increase in market share. He will need to cut price, but whoever loses the business is certain to retaliate, since, if they do not win the business back, they are left with the same costs as before but less revenue. This price war can be extremely damaging. After it, everyone, including the expander, will have made less than the usual returns in the industry by the amount the price war cost them. Nor, as we have noted, are these usual returns exceptionally attractive. Where there is a prospect of making outstanding returns from expansion, then the cost of the initial price war might be worth paying; in this case, however, because the industry offers no barriers to entry, there is no point investing in a price war in the hope of longer term benefits from eliminating competitors. Just as we saw in the case of larger potteries competing against smaller ones, even if some competitors fell by the wayside, they would soon be replaced by new entrants once prices recovered and these new entrants would ensure prices did not go above the previous equilibrium level. In theory, the surplus left to the owner-manager from adding a second kiln will be twice as great, but only if he can keep both kilns fully occupied at undiscounted prices; if they are not, he risks severe financial embarrassment.

For some large markets, however, it is quite possible that the risks of expansion could be avoided. A large oil trader, for example, who regularly placed very large orders for containers, might be happy to put all his business with one supplier. This seems to be supported by Johnstone’s work on trademarks (cited above), and by subsequent Roman arrangements. In this case, if a pottery owner saw the volume was secure (possibly guaranteed by some form of contract), – and if the buyer was prepared to trust him by placing orders that exceeded his current capacity – he could expand without risk.

69 In some cases, as we have seen, multiple operations benefit from common ownership by sharing overheads, but in Athenian potteries there were no overheads except the manager-owner. The latter was often actively engaged in production, in which case managing two workshops without doubling his own labour input might reduce overall productivity. Had there been important benefits accruing to a larger operation, presumably the two sons of Nicearchos, Tleson and Ergoteles, would have combined forces to expand their father’s workshop rather than each operating his own small one. On the basis of the second son’s name, Webster (1972 9) suggests that Nicearchos might have married the sister of another well-known potter, Ergotimos. In this case the sons might have inherited a pottery each; which further reinforces the view that they saw no advantage in achieving scale through combination.

70 Webster (1972 4) suggests that a major order would have involved fine pottery – 1300 amphorae every 4 years for the Panathenaic Games. There is no evidence, however, that such an order was placed with one pottery.
risky would be to build relationships with multiple buyers whose collective orders would keep the expanded capacity full. We know very little about reselling arrangements for household items, but have suggested that secure discounted supply arrangements could be agreed between potteries and resellers, which would also make expansion lower risk. All these arrangements are plausible, but there is no evidence of them being used to underwrite increased kiln capacity.

We conclude therefore that, except in these unusual circumstances, there was no economic incentive to expand a pottery beyond the largest observed size of perhaps seven or eight workers. It would have involved significant risk for little reward. Far from showing economic incompetence on the part of Athenian industrialists, decisions on pottery size seem consistent with a sound profit-maximising approach.

It is still conceivable that some potteries did exceed this size of around seven slaves from time to time without presold volumes and without exposing the owner to serious volume risk. Pottery has some important characteristics that make it suitable for irregular bursts of activity. It is seasonal (climate affects drying), it requires little fixed investment, different parts of the process can be separated in time and the skills for making simple ceramics were not hard to acquire. In short it was a good way for a large household to keep its slaves occupied when they were not required for other activities. A large slave workforce that has just finished the harvest needs something to do; the household needs crockery, it might bring in some income and it is not time-critical. In fact there is no real constraint on how many people might be assigned on a temporary basis to throwing pots; they could build work-in-process inventory that could be fired by one or two specialist slaves long after the potters had gone off to do something else. Large but casual *ergasteria* of this sort would probably not have been common or continuous enough to have had a major impact on the dynamics of the industry, and given the opportunistic nature of their engagement, would have been happy to take normal industry prices or rather less. It might nevertheless have been an important and rational way of balancing the activities and finances of wealthier households and would explain why there might have been more than a handful of people employed in certain potteries on occasion as some scholars suggest.
Changes in the Industry

If there was no economically sensible basis for expansion beyond the requirements of a single kiln in classical Athens, one might wonder how large manufacturers have come to be the dominant commercial form in more recent times. The answer lies in changes to production processes and in the nature of market demand that enabled competitive advantage in a way that ancient technology did not. It is informative to explore what made this industrialisation possible.

There seems to have been little development of the pottery industry before the eighteenth century. The Romans appear to have used moulds more than Athenians but they still used the simple wheel. They also had better designed (and therefore larger) kilns, which might have employed thirty to forty people. The basic size of a production unit had changed but the industry dynamics had not; we know of no major pottery entrepreneurs in Roman times either. Larger Roman potteries are known to have manufactured for defined markets in which they had a secure position. Competitively undifferentiated in other markets, expansion beyond the requirements of a single firing unit would have made no more sense to a Roman pottery owner than to an Athenian one.

It was not until the eleventh century that high temperature firing was developed in the Ruhr Valley and the sixteenth before a higher bench and a flywheel were introduced to improve the working of the wheel. Outside Europe, China and Japan, even more primitive technology prevailed. All over the world, much pottery remains a craft industry today – a largely rural activity serving local markets with utilitarian ware – though large scale enterprises have appeared since the industrial revolution. It was only in the twentieth century that one could say with any confidence that the greater part of ceramic production was industrial and it was Josiah Wedgwood and his competitors in the eighteenth century who set the pattern.

A vital element in the development of the industry in the eighteenth century was the technology of heat control. By separating the firing floor from the hovel, using under-floor

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71 Green (1986)
72 Bryant (1994, 2001 – electronic article)
fluxes and pyrometric beads for measuring heat, it was possible to operate much larger ovens than the traditional kilns. This made expansion possible without the cost penalties of multiple small kilns. It was accompanied by a number of innovations which reduced processing costs or increased productivity through speeding up the process. These included using a coal-fired slip kiln instead of drying in the sun, suspending lead oxides in a fluid so as to allow dipping instead of the application of powder, the technique of slip-casting and a string throwing wheel.⁷⁴ Power from windmills and watermills to grind flint for glazes was in general use in the early eighteenth century, soon to be replaced by steam pumping engines which reduced labour input and greatly facilitated the task of manipulating the new heavier wheel.⁷⁵

Wedgwood laid out his factory to make production flows as efficient as possible and reduced costs still further through his successful campaign for and investment in the Grand Trunk Canal which could deliver raw material for a penny and a half per ton compared with tenpence for horse transport. Wedgwood also exploited new ways to deliver quality at low cost, including the use of flock to make white glazed stone ware and cream ware, engraved copperplates and plaster of Paris moulding to make more elaborate shapes.⁷⁶ As a result he was able to supply high quality product at prices far lower than had been possible before, thus generating demand among the moderately well off that he was the best placed to supply. By using the latest technology his costs would be lower than anyone else in the industry.

Because a large factory with sophisticated equipment has a lot of fixed costs, the more he expanded, the lower his costs became. At the prevailing price level, set by the economics of low technology production, he could make large profits (Fig. 4.3):

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⁷⁴ Wedgwood learned the use of lead oxides from Spode who introduced it in 1779, four years before he did.

⁷⁵ Rempel (2006 – electronic article)

⁷⁶ Engraved copperplates were first used by John Sadler in 1750
While competitors were catching up, not only was Wedgwood able to generate cash to keep investing in growth, but his products were securing a brand following that enabled higher long-term pricing and resulted in lower marketing costs per unit sold. Further, he was building barriers to entry. Newcomers as well as current competitors had to match his capital investment and fight for market share against an established and reputable brand. Thanks to new processing technology, expansion had become an extremely attractive proposition for enterprises able to develop a high technical capability such as Wedgwood and a few other majors of the time such as Spode, Crown Derby, Royal Worcester and Royal Doulton. Technology had altered the economics of the business, providing significant competitive advantage to those who invested in productivity and product development. Those who could achieve an advantaged position made very good returns indeed and the more they grew, the better their returns – an outcome that was denied to their Athenian predecessors by the economics of the technology they used, no matter how commercially ambitious they might have wanted to be.

Competitive advantage then explains not only why Athenian potteries employed few people, but how new technology transformed the economics of the industry and made scale profitable. The next chapter applies the same approach to other manufactured products.
5. OTHER INDUSTRIES

Having established that the pottery industry was fragmented for sound economic reasons rather than through incapacity or disinterest, we can apply the same framework to other industries, especially where they are known to have contained larger firms. If the small size of pottery workshops can be attributed to industry conditions, we must ask what conditions might have led to different firm sizes, and why certain enterprises were able to employ far more people than can be explained by the opportunity to specialise by process step. For many products, the limited size of the market in Athens means that any large enterprises would have been able to produce enough to satisfy a large proportion of demand and therefore must have had high market share.\(^1\) If our hypothesis that industry structure is economically determined is valid, then we should be able to identify those factors that enabled a higher degree of concentration in particular industries by allowing some competitors to gain an advantage over others and create barriers to new entrants. This chapter reviews what we know of firm size across a range of different industries and shows that the reasons some industries were more concentrated than others are to be found in competitive forces. The resulting industry structure has implications for which Athenians were involved in which manufacturing sectors, and this is explored in Chapter Six.

Primary sources, particularly the orators, offer information on the number of slaves engaged in certain enterprises, some of which exceed the handful that is generally considered the norm. In other cases, particularly in Aristophanes, we see businesses being conducted by sole operators. The methodological challenge is to find data to explain these differences. The industries examined in this chapter are shield manufacture, metalworking, textiles, luxury furniture, tanning, shoemaking, food processing and cosmetics and perfumes. For each industry we need to develop a view on likely supply and demand conditions and these are not always easy to deduce from original evidence. Even less is known about the workings of other industries than about pottery. Few manufactured items survive and literary references seldom touch on the manufacturing process or the workshops in which products were made.

\(^1\) This restriction would not apply if Athens was exporting large quantities of manufactured product, but there is no evidence for significant exports other than ceramic containers for agricultural products and some decorated pottery. The previous chapter has explained why this did not lead to larger enterprise size.
The analysis draws as far as possible on original data to establish what is known about firm size and buyer behaviour, and combines this with technical information from craft experts and historians of ancient technology about production processes. Where needed, this is supplemented by judgment based on analogous observations. The paucity of data means the conclusions are suitably tentative, but in each case hypotheses are proposed about production processes and buyers’ decision criteria that seem likely in themselves and are consistent with known data. Further confirmation is sought where possible by identifying the factors that led to increased industry concentration in later epochs. New archaeological finds or further research might one day allow firmer conclusions to be drawn, but it would be surprising if evidence emerges that contradicts the picture put forward here.

**Shield Manufacture**

We know of two shield factories, both with a large complement of slaves. The first belonged to the orator Lysias and his brother Polemarchus. They were the sons of a very rich (*plouto diapheronta*) Cephalus of Syracuse, who, according to Lysias (xii.4), was invited to Athens by Pericles, *philon onta kai xenon*, although another tradition says he had had been banished from Sicily by the tyrant Gelon ((Plut.) *Lys.* 1). When Cephalus died, his sons fled Athens and lived in Thurii in southern Italy, but their pro-Athenian stance during the Sicilian campaign upset the locals and they returned to Athens where they got into shield making.² Their operation was a large one, and in 404 BCE when the Thirty Tyrants came to seize their goods it contained *heptakosias aspidas...kai andrapoda eikosi kai hekaton hon ta men beltista elabon* (Lys.xii.19).³ The shield operation must have been successful as Lysias and his brother could afford special expensive liturgies (xii.4), but in considering its size, we must bear in mind that Lysias was claiming compensation and had reason to exaggerate. It is quite possible that his figure included slaves employed mainly for other purposes, including domestic service, or may simply have been creatively “rounded up”. Nevertheless, for the case not to have been laughed out of court, we must infer that it was a far larger workshop

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² Murray (1990) suggests Cephalus may have been invited in order to set up a shield making business, but this relies on an interpretation of Lys. xii.4 that is not supported by Plutarch.

³ “700 shields and 120 slaves of whom they took the best.” Herodotus (III.125.3) uses the word *andropoda* to describe the new enslavement of slaves described as *douloi*. This suggests *andropoda* referred to captive slaves while *douloi* had an established place in a given society, but the meaning was clearly different by the time Lysias refers to his workforce as *andropoda*. 
than many others. We also hear of a shield workshop owned by the freed slave and banker Pasion (Dem. xxxvi.4), who must have owned it since before 380 BCE.⁴ We do not know if Pasion bought Lysias’ workshop or if this was a competitor. Nor does Demosthenes tell us the number of slaves employed, though if they did indeed bring in one talent of income a year (xxxvi.11), analogy with other examples suggests there were at least 60 of them, possibly 80 or more.⁵

The analysis that follows shows that 120 slaves would have made about 2000 shields in a year. It is interesting to consider how many such workshops there might have been in Athens. Most commentators agree that Athens at the start of the Peloponnesian War had no more than 25,000 adult male citizens, nearly all of whom at the height of the war might have been engaged in battle and would need a shield, and many of whose shields would need replacing afterwards.⁶ Some slaves and metics might also have required shields in certain campaigns. If we say each citizen bought one every five years, and male slaves and metics every ten (which seems on the high side), then even allowing for some production for other uses such as display, dramas and athletic contests, it is hard to believe peak demand would have exceeded ten thousand shields a year. If so, an establishment with 120 slaves would have had a market share of 20% or more, and, if demand was much lower than this as is likely, might even have been a monopoly. In any event, the industry must have been much more concentrated than most, and its strong, stable returns are stressed by Demosthenes (xxxvi.11). This reflects an equilibrium state of a relatively concentrated industry in which advantaged competitors can sustain good returns for a long time. We must identify what might have constituted that advantage.

In Homeric times, and for much of the archaic period, Greek shields were typically made of several layers of bull hide, usually embellished or reinforced with a metal boss and rim.⁷ By the classical period Athenians were using the hoplon, from which the word hoplite derives, more commonly known by the generic name aspis. The hoplon was made of wood, hollowed out to be deeply concave, the surface covered in bronze (often highly decorated) and with a

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⁴ Davies (1971) 430
⁵ See Chapter Eight. Based on nominal returns before depreciation of 30%, the capital value of the slaves would have been 200 minae. At three minae per slave, this implies around 67 slaves.
⁶ For population estimates, see Appendix B
⁷ For a comprehensive overview of the development of ancient Greek armour, see Snodgrass (1967).
leather or cord handgrip (*antilabe*) and bronze strap (*porpax*) on the inside. Shields were typically circular, around three feet in diameter and one to one and a half inches thick. Preferred size depended largely on the strength of the bearer’s forearm.\(^8\)

As a people with a proud track record for innovation and creative adaptation of materials, the Athenians seem to have rather let themselves down when it came to shields. The items were very cumbersome and heavy (estimated at sixteen pounds), to the point where “so great was the effort needed just to hold their equipment that when hoplites became worn out or lost concentration they instinctively dropped their shields.” Hanson may be exaggerating, but Cleonymus’ cowardice in throwing his shield away might not have been as exceptional as Aristophanes makes out (*Vesp*.19). Even though the shield was sufficiently concave for the weight to be rested on the bearer’s shoulder, it was so unwieldy that the first group of Plataeans escaping from the Spartan siege in 429 left their shields behind for the second group to bring (Thuc. III.22.3). The great weight did not provide much durability. Brasidas’ shield fell apart on impact at Amphipolis (Plut. *Mor*.219c) and Xenophon describes the battlefield at Coroneia as littered with broken shields (*Aeg*.ii.4).

Manufacturing these items was not particularly complex, but required physical strength and some skill. With today’s powered machinery, and working with glued wood prepared for turning, it takes between three and four hours to form the shape of a hoplite shield.\(^10\) The Athenians would almost certainly have worked with glued strips as well since there were few trees thick enough to form a three foot shield. Ancient gluing technology using animal proteins was very effective, some glues still remaining firm after two thousand years or more, though glues were not waterproof which is why we see pictures of hoplites protecting their shields from the elements. The time taken for turning depends significantly on whether the strips of wood have been shaped and planed in advance into approximately the right

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\(^8\) Some commentators, like Davies (2004 – *electronic article*), believe that Athenian shields all carried the letter A, but this seems unlikely, as the Athenians were unable to identify their own troops in the battle against the Thespians at Delium in 424BC (Thuc. IV.96.3). We also know something of the individual shield designs of certain generals, such as Nicias (Plut. *Nic*.28.5) and Lamachus (Ar. *Ach*.964-5, 1124, 1181). Sekunda (1986, 21) suggests that vase depictions of shields with A on them relate only to the athletic contests which those scenes represent and the A was not on shields carried into battle.

\(^9\) Hanson (1989) 67

\(^10\) Details of the production process were provided by Manning Imperial of Redan, Victoria, Australia, manufacturers of historical artefacts, including hoplite shields.
curvature for a shield. The difference is a factor of about five to one, so it is reasonable to expect that experienced shield makers in Athens would have used this technique. It would take a carpenter over an hour to shape and plane each of the thirty or so strips of wood that make up a shield. This and gluing might take five days per shield. An experienced pattern maker familiar with the hoplite shield thinks that with human power only to turn the wood, even if pre-shaped, it would take fourteen to sixteen hours, (about ten days if working from a solid block).\(^1\) Manning Imperial suggests that it would have taken at least three people to lift the wood on to the lathe and the turning power might have been supplied by four people walking in a circle on a simple carousel. Once the shield was formed, a leather or cord strap and a handgrip would be attached to bolts on the inside of the shield and the surface covered with metal. The first task was a simple one. One slave could probably cut and fit the straps for several shields in a working day. The second was a bigger task. It might take three days to create a sheet of bronze the right size and perhaps two more to hammer it into shape on the shield, including the awkward rim configuration. Finally the shield would be decorated, either by hammer-work on the bronze or with paint, perhaps both.

Translating these tasks into labour requirements, turning the wood would have been the major part of the operation, requiring four people working over two days or eight man-days. Five man-days went into shaping and planing, and perhaps another five into the bronze surface. Allowing two more days for fitting straps, decorating, materials handling and any downtime, we have at most 20 man-days per shield, which implies that, if 120 slaves were really employed in the workshop full-time, they could produce six shields a day collectively, or over 2000 in a working year. A price of 20 drachmae per shield\(^1\) suggests there might have been less than 20 man-days involved; revenue of 1 drachma per man-day would be only just enough to support the slaves and purchase raw materials, so annual output might have exceeded 2,000.\(^1\)

We may first note that the favoured explanation of many scholars that workshop size depends on the scope for division of labour is not an adequate one. We have seen how the work could be divided into five or six tasks, one of which, powering the lathe, required four people at a time. This explains why a well organised factory would operate in teams of six to eight (and

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\(^1\) Mr Kevin Beasley of Melbourne, Australia.

\(^1\) Jones (1997) 187

\(^1\) For the cost of keeping slaves, see Chapter Eight.
why we do not find individual *aspidopoioi* among Aristophanes’ tradesmen). It does not explain why Lysias’ workshop might have had twenty such teams and Pasion’s a dozen. In pottery, the absence of sustainable economic advantage and barriers to entry led to a fragmented industry structure. What, if anything, was different about making shields?

As in pottery, there was no potential for cost advantage. The capital and maintenance costs of slave labour would have been the same for all. Purchased materials (wood, bronze, cord and leather) could also be purchased by any competitor at, presumably, the same going price. All had access to the same technology and, because it was a process requiring continuous labour input, there were no economies from high throughput. A small (one team) competitor’s unit costs are likely to have been the same or very similar to those of an enterprise with multiple teams.

There was certainly a capital barrier to achieving very large scale. At three minae each, 120 slaves would cost six talents.¹⁴ To this must be added the cost of lathes, cutting tools and hammers and an investment in wood and ores as working capital. In addition, someone making this investment would have a lot of mouths to feed and could not run the risk of underutilisation while building market share. This explains why a new entrant might not have plunged in with a greenfield investment on the scale of Lysias’ or Pasion’s but it does not explain what might have deterred smaller concerns from starting up, winning some market share and then expanding organically. Their unit costs would be very similar to those of the market leader. Entrants might have been deterred by the complexity of the operation. Some skill was required in manoeuvring the heavy blocks and turning them to the right thickness, although crude callipers might have meant it was not necessary to rely entirely on an experienced eye. Combined with the need to manage the workforce in teams, especially in turning, this might have made staffing and managing such a workshop more difficult than in most industries. On the other hand, there was a market for skilled slave labour and supervision.

A more likely explanation relates to the nature of the product and demand for it. Even though shields were not very reliable, they were still intended to save your life. Despite their tendency to crack, or perhaps because of it, purchasers would be keen to buy from an

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¹⁴ This appears to have been a minimum going rate for slaves skilled in a craft. Mining slaves were much cheaper.
organisation that had a good reputation and track record. A small entrepreneur setting up on his own, even with the same technology as a large competitor, might have found it difficult to attract custom. One way would be to acquire a going concern already known to have the expertise, which is probably how Lysias and Polemarchus entered the business and Pasion and Phormion two or three decades later (it may even have been the same workshop). Lysias and Polemarchus would have had extra credibility if Murray is correct in his suggestion that Pericles brought Cephalus to Athens in order to establish a shield making business, especially if they repurchased their father’s old business; at the very least the genetic association would give customers confidence.\textsuperscript{15}

We conclude then that the reason shield making was a concentrated industry and featured large-scale enterprises was that customers’ need for quality assurance provided both scope for advantage and barriers to entry. It is not very meaningful to speculate on what factors might have led the wooden shield industry to consolidate further in later centuries, but a key factor for consolidation— a brand that consumers trust – was already in place; the introduction of power technology would have introduced scale-based cost advantages and greater capital barriers to entry as well.

**Metalworking**

Even though the application of metals in ancient Greece was limited by later standards, it was a pervasive feature of life and from early times involved manufacture for sale.\textsuperscript{16} Metals were used principally for making tools and arms together with some furniture and decorative art; they were not used in construction. Several factors determined the choice of metals, chiefly location, the discovery of new ore bodies and improvements in metallurgy.\textsuperscript{17} Gold was commonly used in Homer, but declined afterwards in favour of copper and then bronze and iron. Copper was known to Homer for its use on corslets, helmets and bits. It was moulded for utilitarian objects and hammered in relief for decorative ones. It was not found in any large quantities in Ancient Greece other than in Euboea, and the small deposits were quickly

\textsuperscript{15} Murray (1990). As we have seen, the evidence for this is not compelling and relies on an interpretation of Lys. xii.4 that is not supported by Plutarch.

\textsuperscript{16} Francotte (1900-01) I.82

\textsuperscript{17} Except where otherwise specified, descriptions of ancient metal-working technology are derived from Forbes (1964-72) VIII.
exhausted, so Greek metallurgists used to buy semi-finished product. Tin appears in the *Iliad* for decoration (XI.25), but the same word seems to have been used to refer to bronze (XXI.592). Bronze-casting was developed in Samos and iron soldering in Chios; both led to many new uses. The best bronze required 12% tin, which was hard to obtain, so the Greeks tended to use lead in bronze making. Iron was invariably in wrought form as the required temperatures for pig iron were still not attainable and the state of technology did not permit the level of precision in mixing carbon needed to make consistent quality steel. Iron replaced bronze in swords and spearheads in about 900 BCE but in few other applications before the fifth century. Body armour continued to be made of bronze. Iron was generally imported semi-finished and at the time of Dionysus, a Sicilian banker cornered the market in raw or semi-finished iron ore and made a profit of 200% (Arist. *Pol.* 1259b).

While Homer gives examples of expert metal craftsmanship, his craftsmen typically source their own ores and work in many metals. According to Finley, acquisition of ore was “the one thing that prevented full self-sufficiency.” The acquisition task “whether by trade or by raid, was a household enterprise, managed by the head, or it would be larger in scale, involving many households acting cooperatively.” Achilles’ offer of a block of ore as a prize (*Il.* XXIII.826) shows that at or before Homer’s time, smiths in some households would work with ores sourced from other parties. In the Bronze Age, ores were smelted and fabricated from a raw state. The introduction of ore processing technology changed the nature of the industry, and acquisition of raw materials became a specialised task, although even in classical times, some smiths still worked with ores they had mined themselves.

Homer’s Hephaestus not only acquires his own ores but works with a range of metals, gold, silver, bronze and tin, using the same tools for each. After Homer, metallurgy became more sophisticated, leading to a second form of specialisation as people specialised by metal, specifically bronze, copper or iron. This seems to have coincided with the advent of iron which required special heating conditions and continuity and flux to remove impurities, rather than simply removing them by hammering as with copper, and demanded more specialised skills and equipment. By classical times most workshops bought their ore from others and specialised in one metal. In Athens by classical times, while some smiths

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18 Interestingly this seems to have been achieved in Tanzania a few centuries later.

19 Finley (1954) 64, 75-6

20 Forbes (1964-72) VIII.67

21 White (1984) 36
continued to execute a broad range of commissions (like a village blacksmith up to the twentieth century), the metal trades had divided themselves into product categories: breastplates, lances, greaves and spears were all made by different people in different locations (Ar. *Pax* 1210). One of Demosthenes’ factories made knives or swords (xxvii.9) while Pistias made breastplates (Xen. *Mem*.3.10.9). We hear also of specialist makers of helmets (*kranopoioi*) and there is even a named craft of attaching the plume (*laphophoros*).22 There is some evidence in the literature of the third level of specialisation—*Arbeiterlagung* or specialisation of tasks – that Bucher denied occurred before the seventeenth century (Ar. *Av*.488-91, Poll. 1.1.49).23 In Roman times, the town of Poplonium focussed on implements and tools (Diod.Sic. V.13) while Vicus Actionum Ferrararium at Rome made helmets, shields and swords.24 Most of these operations were small. The first copperware factory of any scale was in Capua in the first century CE and it made standard products.

Along with these three levels of specialisation, by metal, product and process step, came two changes in the form of product delivery: mobile craftsmen and independent fixed workshops. The economic forces that led to these developments in the ancient world are explored in *Chapter Seven*. The remainder of this section explores the structure of the mining, metallurgy, general metalworking, bronze armour and knife manufacturing industries in classical Athens.

**Mining** was an activity in which a single owner could employ a large number of slaves. Not many places in Greece had precious metal deposits,25 and only a few sites had deposits of base metals, although iron ore was abundant. Prospecting was simple, relying on surface evidence and a “follow your lode” approach. Although galleries, roof-propping and ventilation techniques date back to the Bronze Age, much mining was open cast with short adits, the rest being in narrow shaft mines that were not very deep and could be worked with chisels and other simple tools such as iron picks and hammers. The rich trove of silver at Laureion, the leasing of which seems to have underpinned the Attic economy for many years, made for an exceptionally large and deep mine. By 350 BCE there were two thousand shafts there, some as deep as 110 meters, requiring airshafts and galleries. Timber props for these shafts led to the deforestation of Attica.

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22 Harris (2002a) App.1.88-97

23 Bucher (1893)

24 Corpus Inscriptionum Latinarum, VI.9185, 1214

25 For the history of mining in ancient times, see Healey (1978).
Leases to operate the mines at Laureion were sold by the polis and purchasers would buy or hire slaves to work them. According to Xenophon, Nicias owned such a large team of slaves for hire that he paid his overseer one talent a year. Sosias hired a thousand slaves from him. Philemonides had 300 slaves in the mines and Hipponicus 600 (Vect. 4.14-5). These numbers are not supported by anything we can find in the Attic orators or the Stelae, but a certain Epicrates was said to have made a profit of 300 talents in three years from mining (Hyp. iii.35), while Diphilos’ mining ventures brought him assets of 160 talents (Plut. Mor. 843d). In general though, mine leases appear to have been quite small and multiple ownership was rare. There would have been many investors with small claims using just one or two slaves, and perhaps even doing some of the work themselves.

The individual underground worker was the effective operating unit, whether working for himself or as part of a large team. Slave costs (purchase or lease, plus maintenance) were the same for all. They all used the same process (digging) and the same tools. The only technical innovations at Laureion, the waste-removal system and the beneficiation of silver ore through washing, were available to all operators. The success of one miner or team would have little impact on the market price of the commodity. As a result, the economics of mining were entirely independent of firm size; success depended as it does today on the quality and accessibility of the ore grade. There was no apparent limit to how many claims an individual might buy and correspondingly no limit to the size of the workforce an owner might engage. His only consideration would have been the relative attractiveness of buying a claim compared with other investment options. The economic factors that underlie the rapid global consolidation of the mining industry in the last decade or so, such as advances in exploration technology, economies of scale in further processing and the increased importance of bilateral negotiations in commodity pricing, did not apply.

The explanation for large teams of mining slaves under a single lessee coexisting with small claims operated by prospectors with one or two slaves is simple: firm size in the mining industry reflected individual investment decisions and had no effect on profitability.

Primary ore processing is a simple operation, requiring just a few slaves to wash the ore and prepare it for smelting. Transporting unprocessed ore is costly relative to the product’s value,

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26 Shipton (2002)
27 White (1984) 34; Christesen (2003) 41
so processing would have taken place near mines; many mine owners would have used their own slaves to process ores, or done it themselves, but we know Pantainetos employed 30 ore-processing slaves in one workshop (Dem.xxxvii.4, 17, 31). This shows that some miners chose to outsource this activity or, more probably, to sell their ores unprocessed. In such a business there would be a significant benefit in being first to establish an operation near a particular mining site and new entrants would find it hard to attract business once local customer relationships had been established. A logical industry structure would consist of a number of local monopolies with their boundaries roughly defined as a function of transport costs. Pricing would be constrained to the level above which customers would choose to ship the product further afield or process it themselves. Today, economies of scale in new capital-intensive refining technology and major reductions in transport costs have increased the distance from which a refiner can draw unprocessed material cost-effectively and thereby driven the global consolidation of refining and the vertical integration of miners; in classical times the economic catchment area for an ore-processor would not have been large and the workforce in a given location would have been suitably modest.

It was not until Roman times that smelting was undertaken as a separate intermediate stage in the metal processing chain. In classical Athens, smiths smelted many of the ores they worked on so that smelting and fabrication must be considered to be the same industry, even though in all representations we have, the smiths are fabricating, not smelting (and the material is always bronze!). We shall therefore consider smelting as part of the relevant fabricating industries. It is to three quite different forms of metal fabrication that we now turn.

**Smiths** (general metalworkers) were represented by various gods such as Hephaestus (the Roman Vulcan) and Poseidon and were greatly honoured, just as they are in many less developed societies today. Even so, the Greeks saw them as prone to disease and industrial accident and their disproportionate muscular development was seen as a deformity; the other gods laughed at Hephaestus. The images on vases we have of metalworking in Athens are invariably of lone smiths forging their material on an anvil and quenching it in cold water, perhaps assisted by a slave, goldsmiths and sculptors working alone, or individual minters.

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28 Oddy (1985)

29 An amphora in the Fine Arts Museum of Boston (Burford (1972) pl. 30) is a good example.
making silver into coins. It was a very fragmented industry and the reasons are not hard to find.

First we must consider whether the skills needed for certain crafts constituted a barrier to entry. This is relevant to several sectors as well as metalwork. Craft apprenticeships were of two types: for crafts such as music and rhetoric which the apprentice could not perform commercially until he was fully trained, the teacher was paid. For learning from a master craftsman in such trades the cost was high; the aspiring poor could only get in as assistants and would have found it very hard to get onto the advancement ladder. For other trades, like weaving and simple metalwork, the teaching was free and the master paid the trainee’s upkeep, recognising that the apprentice would quickly make a financial contribution to the workshop. There were no national standards; apprentices and their teachers were judged in the market place. Thus there appear to have been few restrictions placed on entry through apprenticeships. More importantly for our purposes, even if there were, the effect would be to raise prices, as Xenophon noted ( Vect. 4.6), but for this to lead to consolidation of the industry, other factors must apply, principally that products must be made for stock, rather than customised, reputation for quality can be attached to a group rather than an individual, and, in some cases, a productivity benefit can be derived from combining the efforts of individuals. The barrier of restricted apprenticeships, if indeed there was one, did not in itself create the conditions that would favour consolidation; it is therefore not a determinant of industry structure and is not considered as such in these analyses.

There are three main sources of cost advantage in manufacturing: superior technology, access to low input costs (generally labour or raw materials) and the effect of economies of scale on fixed costs and asset utilisation. Common technology, open markets for labour and materials and a low level of fixed costs and assets meant classical Athenian manufacturers could not readily achieve cost advantages and this was certainly true of metalworking. Processing consisted of smelting and hammering, using the same tools as Homer’s smiths: anvil, hammer and tongs, and a furnace slightly smaller than a typical potter’s. Materials would be bought from third parties, usually in the form of processed ore, at whatever the going price was. Much of the demand for fabricated metal was customised, making or mending specific

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30 Leocrates (Lyc. Leoc. 58 and 22-3) is a doubtful exception – see below under Bronze Armour.
31 Burford (1972) 89
32 Trinks (2003); Bamberger (1985)
purpose items, especially costume-jewellery, on demand, rather than producing standard items for stock, so each individual smith would develop his own customer base. They needed little or no extra assistance to carry out the commissions they received, so there was no benefit in several being located together. In short, for the majority of applications, metalworking was a bespoke business suited to the lone smith and offering no barriers to entry and no benefits from consolidation. It is for much the same reasons that the lone village blacksmith persisted well into the 20th century. His demise can be attributed to the ability of larger concerns to satisfy demand with more standardised products which they can supply at lower cost through the use of capital equipment, especially in materials handling, and greater purchasing power – a process accelerated by massive reductions in the costs of transporting materials and finished product. Where this is impractical, as in the case of shoeing horses, new technology has enabled farriers to become mobile again in a strange reversal of the economically-driven evolution described in Chapter Seven.

If the shield industry was concentrated as a result of customers’ need for quality assurance, one might expect similar considerations to apply to bronze armour. In fact we find no evidence of large firms and must explore why not.

Armour was another large industry, though not an easy one to define.\(^{33}\) Hoplites might wear helmets, body armour and greaves, typically of bronze, but there were multiple variations in what was worn and how. Anderson observes that after the Persian Wars “there is great variety in the body armour of hoplites depicted in works of art”,\(^{34}\) and Snodgrass comments: “for every warrior armed cap-a-pie there are several with only part of the equipment.”\(^ {35}\) This was due not least to costs; the two wealthiest ranks of citizens, hippeis and zeugetai, might be able to afford a full set of armour or “panoply”, but other citizens could not. The cuirass is a good example of variable usage: according to many surviving depictions, the bronze cuirass came to be replaced during the later part of the sixth century by a leather corslet, sometimes covered or partly covered with bronze scales. Cuirasses in such pictures tend to be worn by mythological creatures while hoplites wore corslets or nothing. Nevertheless we know that in

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\(^{33}\) Professor Emeritus AM Snodgrass notes that “in spite of the fantasies of many archaeologists, ceramics were infinitely less important than metal-working and especially armour manufacture.” (Correspondence with the author, 10/09/2008).

\(^{34}\) Anderson (1970) 21

\(^{35}\) Snodgrass (1967) 37
classical times, cuirasses were still worn by distinguished men and given as a form of military decoration (Plut. Alc.7.5). It also seems that the bronze cuirasses that did continue to be worn were becoming better fitted and less cumbersome. Similarly, the bronze helmet was originally lined with felt, but over time this was replaced by a separate felt hat (pilos). During classical times it seems many hoplites went to war with only the pilos and no bronze helmet. Other variations included decisions on whether or not to wear greaves (in some cases, it seems people might have worn just one) and the wealthy might add accoutrements such as arm protectors or ankle guards. Overall there seems to have been a trend to mobility rather than solidity in armour design.

Making this armour was a fairly time consuming occupation. The clearest depictions of bronze workshops are making statues rather than armour but they can be informative. For example a red figure vase of the early fifth century, clearly shows the use of moulds. Smelting and moulding bronze into a large plate for the front or back of a cuirass (they came in two parts, which were attached together by the wearer) might take two or three workers three to five days, using the lost wax system. There might be several dippings in a silica solution during this process. We see the delicate shaping process of helmets represented on another vase and they would probably take a similar amount of time to form and line.

Assuming an average of four man-days per item and four items in a typical set, a craftsman working full time would be able to produce not much more than around twenty full sets of armour (or pieces requiring equivalent time) in a year, even if the moulds for some pieces were re-used. Aristophanes gives some extraordinary prices for bronze work – 1000 drachmae for a breastplate, 50 for a helmet and 60 for a trumpet (Pax.1200-39). He was obviously exaggerating, but if we assume that a slave needed to generate 8 obols a day to cover his own maintenance and leasing/opportunity cost, then a breastplate might have carried more than 50 drachma of labour cost. Adding the cost of raw materials and a profit margin makes it an expensive item.

36 Anderson (1970) 31-5
37 Snodgrass (1967) 94
38 The Berlin Foundry Cup in the Staatliche Museen, Berlin F2294; Arv(2) 400 in Vulci; Beazley (1942)
39 Ashmolean Museum; Burford (1972) pl.31
40 For these estimates the author is grateful for the experience and expertise of Mr. Rodney Broad, Meridian Sculpture Founders Pty Ltd., Melbourne. See also Clark (1980).
The variations in what constituted a set of armour for different customers makes it impossible to know how many such suits were wanted in Athens, but we might imagine that in time of war it might amount to a thousand full-set equivalents a year or more. At least 500 young men would want their first armour each year, and presumably some needed replacement as it wore out or the design was superseded. We know that in 412 BCE, the Athenian production effort was able to equip 1500 Argives in hoplite armour in addition to filling domestic demand (Thuc. VIII.25). This means there must have been at least one hundred people involved in bronze armour production. Yet the only evidence for a large bronze working concern is a dubious one, and we do know of a sole operator. This might be an accident of the sources, but might also reflect different business economics from shield making. What might have caused the armour and shield industries to differ so much in structure?

We have argued that shield manufacture was concentrated because purchasers were choosy about the manufacturer's reputation, given the life-or-death importance of shield quality. Although shields varied in size according to the bearer's strength, a simple classification on the lines of small, medium or large was probably enough to meet the market need for variation. The confiscation by order of the Thirty Tyrants of 700 shields from Lysias' workshop (Lys. xii.19) suggests that shields were made for stock. Armour was more likely to be designed according to the individual's measurements and in response to particular orders. Xenophon stresses how a good fit justifies a higher price (Mem. 3.10.9). It is true that Pistias had some “well-made” thoraxes to show Socrates, but these might have been recently completed commissions awaiting collection. A team of two or three would be enough to carry out the work in response to an order and there were limited cost advantages and some utilisation risk from scaling up. A further difference is that the reputation for quality in shield manufacture would be attributed to a particular workshop, it not being easy to ascribe special virtue to one particular craftsman when the work had to be done in large teams. The passage from Xenophon suggests that in armour the individual craftsman’s contribution was much more clearly identified and it was this reputation that mattered.

The one possible exception to this fragmented picture is Leocrates, a bronze worker (Lyc. Leoc.58) who, before going into self-exile, sold a number of slaves for 3500 drachmae to his

41 The customised nature of the manufacturing process means that there would have been few or no direct exports of bronze armour, although some visitors to Athens might have taken the opportunity to commission some items for themselves.
brother-in-law who then sold them on to another brother-in-law, Timocharis (Lyc. Leoc.22-3). If these slaves were employed in bronze-work like their master, then unless they were much dearer than knife-makers, the sum represented at least ten industrial slaves and they might constitute an exception to the naturally fragmented nature of the bronze armour sector. On the other hand, there is nothing that says they were engaged in any form of production and Lycurgus does not call them chalkotupoi (bronze workers) like their master, as we might have expected him to. Even if they were engaged in production, it is not clear what they were making; if it was armour, their occupation might have been described more precisely: kranopoios, thorakopoios and laphrophoros were different job-titles. They might have been sculptors – a manufacturing process needing larger teams and with products less rigidly bound by a customer’s specification. They might also simply be a manifestation of the fact that Leocrates had a lot of domestic slaves in his house because a differentiated craft like bronze armour paid well.

One specific example we have of a large metal fabrication business is Demosthenes’ knife-making factory which employed 32 or 33 slaves (xxvii.9). These items were made of iron, smelted and wrought into shape by craftsmen with hammers and sharpening tools and then fitted with handles. It is not clear whether the product (makarioi) should properly be described as knives or swords, or, most probably, some form of dagger. They might well have had application in fighting and not just as eating utensils. In either case, quality is important and, as any culinary enthusiast knows, there is a very large difference between a good kitchen knife and a poor one. As in the case of shield manufacture, there is likely to have been a tendency for purchasers to concern themselves with perceived product quality and the manufacturer’s reputation (rather than the reputation of an individual craftsman) and this would constitute both a source of advantage for the workshop and a barrier to entry for new competitors. Again as in the case of shields, but unlike body armour, products might vary slightly but could still be made for stock rather than after receiving a customer’s order. Without the need to customise product, the same customer preferences that operated to encourage concentration in the shield industry would have shaped knife making. There may also have been a capital barrier to entry; Demosthenes appears to have had around 90 minae of raw material inventory relating to this operation (xxvii.10). The same factors of brand

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42 Harris (2002a) I 88-97. (“Helmet-maker, corslet-maker, plume-fixer.”)
43 See Chapter Eight.
preference and investment requirements would be important in increasing consolidation of cutlery and weapon manufacture in later times, especially with mechanisation of the forging, sharpening and decorative processes.

**Textiles**

The textile industry is a puzzling one. Self-sufficiency seems to have endured in textiles more than in other products and much of the activity in textile production continued to be in the home well into classical times, but we also find evidence of independent woolworkers and at least one major establishment. Clues lie in the nature of textile processing.44

Unlike metallurgy, all the process stages of textiles are very simple and were traditionally conducted within the household. Some steps were physically demanding, but the tasks were not complex.45 Women typically spun and wove, while fulling and felting involved a fair amount of heavy lifting and urine, and those tasks usually fell to men. Women often did the final dyeing, though that was not particularly pleasant either. In the Bronze Age all of these tasks were done at home, in a rich man’s home by his family and slaves and by the womenfolk in the houses of the poor. The luxury clothing that often formed a part of hospitality or friendship gifts was usually made by the women in the giver’s household, as were the garments the whole household wore (Od.XV.101-8; Il.XXIV.229-35). By classical times, things had not changed very much. Slaves and female dependants made their own clothes as well as those of their menfolk. Purchased clothing appears to have been mainly imported luxury items, made from fabrics or dyes of special quality, or high quality dress clothes. A large item such as a cloak might sell for 16 drachmae (Ar. Eccl. 413)46 – about a month’s wages – and it was possible to pay 1000 drachmae for a dress.47

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44 Except where specified, technical details on textile processes are from Forbes (1964-72) IV.
45 Techniques have hardly changed in the last 3000 years in the Eastern Mediterranean and there were certainly few innovations between Middle Kingdom Egypt and Roman times. Mechanisation, especially the use of multiple high speed spindles in a series to draw out the fibres, accelerates spinning and was introduced in India in around 500BCE, but there is little evidence that it was adopted in Greece, nor do the Greeks appear to have used the relatively simple techniques of parallel fibres or crosswise carding in their spinning operations.
46 Here Aristophanes uses the unusual term “four staters” for 16 drachmae.
47 Adesp. (unknown author) fr. 516 in Koch (1880-88)
The main textile used was wool, but garments were also made with linen from flax. There seems to have been a change in local dress after Athens conquered Aegina from Doric to Ionian (Hdt. V.88) or perhaps from wool to linen and then back again to wool (Thuc. I.6.3). Probably the first change was made by women, the second by men. In any event wool quickly regained its status as the favoured fabric; we hear of no linen industry, and temple offerings continued to be wool, which was widely available in Athens, both domestically and as a traded commodity in which a number of metics seem to have specialised. Lydia was a favoured source. There appear to have been two stages involved in the emergence of textiles into the world of traded goods. The first was based on trade in raw wool. Towns along some of the trade routes, especially on the coast of Asia Minor, took to buying wool from passing ships, fabricating garments and exporting them on the same route. Athens seems to have exported few textile products and other cities were better known for their production of wool and other textiles, notably Miletus, Cyprus, Megara and, especially, Corinth. The second stage, production for domestic markets, was much slower to emerge. Vendors of clothing in classical Athens tended to be sole operators; there was no substantial retail clothing industry until Roman times when slave clothing at least was mainly purchased. Even scouring and preparation of wool for spinning were depicted as home crafts on Greek vases and there is little or no firm evidence in classical Athens of the larger establishments for scouring and dyeing that emerged in Roman times. Nor were there any important technical improvements on Egyptian techniques until the Romans introduced the vertical loom and an improved cross-press.

Few clothes were bought in from external makers. The reason lies in the simplicity of the task and equipment and the availability of labour in the home that could carry it out. In

48 Even in later years (C6-C12CE), the town of Tinnis was totally dependent on textiles, especially linen cloth, but there was still no industrial development and the unit of production remained the individual craftsman. It seems unlikely that this was because of an embedded distaste for industrial activity as is posited as the reason for a similar failure of development in classical Athens. See Hordern (2000) 363.

49 Miletus’ wealth had prompted Cyrus to make a separate peace (Hdt. I.141, 143, 169) and made her tes Ionies proschema (V.28). Cyprus was an attractive capture for Egypt, which extracted a tribute from it (Hdt. II.182); it was later able to supply Xerxes with 150 ships (Hdt. VII. 90). Megara seems to have been known for salt (Ar. Ach. 760) and smocks (Xen, Mem. 2.7.6) and to constitute enough of a threat to Athenian production to encourage thoughts of an informal trade war (Ar. Ach. 521-528). The wide spread of Corinth’s colonies and pottery indicate they made good commercial use of the naval power Thucydides praises (I.13).

50 White (1984) 39
Homer’s day, it was assumed that all women from princesses to paupers could spin and weave and there is no reason to think this had changed very much by classical times. The image of a virtuous woman was closely linked to the goddess Athena, patroness of weaving. There were various tasks that men could do and women could not, ranging from fighting, voting, court work and attending various festivals to heavy physical tasks around the home. As a result, “weaving cloth is a perpetual occupation for all classes of Athenian women. The Archon’s wife does it while her husband presides over the court, and prostitutes do it during slack times at the brothel. Girls learn to weave and spin wool at an early age.”

Finley found the positive side: “Denied the right to a heroic way of life, to feats of prowess, competitive games, and leadership in organised activity of any kind, women worked regardless of class.” Women were the housekeepers but would have had plenty of time on their hands after buying food and preparing meals. Spinning wool and making clothes were obviously useful ways to spend that time. The women were maintained in the house anyway, so from an economic point of view, the labour that went into domestic production had a marginal cost of zero, while the labour that went into an item sold in the market would be included in its price so that the maker could live, making it very much the higher cost option. Men would presumably help with the scouring and dyeing, but the vast majority of the hours that went to manufacture a garment were costless female labour. No amount of specialisation could make outsourcing a lower cost option than an alternative where the labour cost was effectively zero. Purchasers would have tended to be the better off, looking for special fabrics or styles, perhaps supplemented by a few less wealthy households that lacked female habitants but had adequate means to be able to buy less fancy wear from others. There were sound economic reasons for individual households to manufacture more than their immediate needs, or, as Hordern and Purcell put it, “overproduction for (indefinite) storage, either for local use or for opportunistic sale”, but “par essence cet industrie était une industrie domestique”, and vendors of both spun wool and of garments seem to have been sole operators (e.g: Ar. Ran.1349-50). Many of the individual freedwomen who won their freedom under the dike apostasiou process in 332-0 BCE were described as talasiourgoi or

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51 Matyszak (2008) 25
52 Finley (1954) 78
53 Hordern (2000) 258
54 Francotte (1900-01) I. 78
woolworkers, suggesting it was a natural occupation for a lone operator. Timarchus’ shoemaking team was accompanied by a single dress-maker who appears to have been making especially fine garments (Aeschin.i.97).

Even though there seem to have been no large establishments, every stage of the production process was represented commercially. There were the specialised trades of fuller (gnapheus), dyer (bapheus) and tanner (bursodepsis), and lone garment makers identified as working in wool (talesiourgos, amorgantinos, erithios), or linen (linourgos) – cotton or ‘tree-wool’ was rarer – or as making particular types of garments (huphantikos). Washing clothes (pluntria) was another trade. Some maker-vendors combined weaving with other stages such as dress-making or tailoring, but they too were typically lone practitioners with a narrow product range. Demeas of Collytus made capes, Menon cloaks and various Megarians specialised in smocks (Xen. Mem. 2.7.6). Here we have a clear case of specialisation not leading to an increase in the size of the production unit.

Hordern and Purcell take strong exception to the notion that this fragmentation reflects a primitive economic state:

“‘Where are the cloth-halls, the Guildhalls and Bourses?’ demanded Moses Finley. When they are not forthcoming, the case for the irremediable primitiveness of the ancient economy is found proven, and variations of social organization are converted into a major qualitative difference in economic complexity. In fact, the cloth production and exchange of the Middle Ages is being described in ways which make it sound more and more like antiquity.”

Modern research shows that “to speak of ‘large scale production’ and ‘capitalist methods’ in connection with the famous cloth-making centres of Flanders and north Italy… is to give an entirely false impression of the structure of the industry.” Bresson holds that the Athenian textile industry was highly productive. In Rome market demand was higher, as slave

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55 Harris (2009) 13
56 Ar. Ran 443, 1126, Eccl. 415; Hdt IV.14; Plato Resp. 429d; Ar. Eq 44; Pl. Symp. 221e; Aeschin.i.97; Ar. Lys 735; Dem. ivii 45; Strabo, 11.2.17; Hdt. III 47; Pl. Grg 490d; Ar. Plat. 166, 514
57 Hordern (2000) 359
58 Bridbury (1982) 11
59 Bresson (2007) 198
clothing was largely purchased rather than made at home by the slaves and their families, but we still find no major weaving houses or tailoring establishments. By 132 BCE we find specialisation in the industry value chain with manufacturers focusing on certain garments while resellers carried a wide range, but manufacturing enterprises remained fragmented at the weaving level.

The reason for this continued fragmentation was the lack of potential for competitive advantage and barriers to entry in garment manufacture – the essential characteristics of a fragmented industry. With most women skilled in spinning and weaving, and equipment and fabric being readily purchasable, anyone could make products for market as well as anyone else. Combining several weavers into a single operation would not reduce unit costs or increase custom, but it would increase financial risk and management complexity. Nor was there much benefit in consolidating equipment or tools in a fixed location. Spinning and weaving machinery were inoffensive and did not take up a great deal of space. Heavier activities could be carried out in a tub or in a pit dug nearby.

There is a site of classical times at Olynthus dated to the early 4th century which suggests there were exceptions to the small enterprise/sole practitioner model for weaving and spinning. There is evidence that there were upwards of seven looms in a room in one house, possibly as many as sixteen, and perhaps three in another house. Three explanations occur: first, this might have been an early example of exploiting a labour cost advantage. Olynthus was considered a poor place and the cost of labour might have been so low that it was able to supply larger markets (like Athens) sufficiently cheaply to make it worthwhile, even if prices for textile labour were very low. This would not have created a large market in the way cheap running gear from sweatshops in the developing world has in recent years, because many households would have continued to make their own clothes, recognising the opportunity cost of the casual labour of females in the household to be zero. Low cost imports would have been able to compete effectively for the small markets that did exist, keeping prices down and providing a further reason why no Athenian would invest in a large textile manufacturing capability. A second possibility is that Olynthian textile manufacturers might have had superior access to excellent cloths or dyes, so a largish production house might establish a barrier to entry and even a premium position based on its brand or designs.

60 Cahill (2002)
61 Delian League quota-lists show Olynthus’ contribution was the lowest of all confederation members.
This would explain the situation well but there is no evidence for it. A third explanation, and the most probable, is that the number of looms reflects a large number of females in the household but not an attempt to build a large textile concern. There might have been many times or seasons when there were plenty of other things for the household women to be doing, often perhaps to do with harvesting and primary food processing, and other times when several of them might have time on their hands to turn to a loom. Capital investment was small and it would be a useful way to keep members of the oikos occupied and make a small irregular contribution to the household’s budget. This is exactly what Aristarchos was doing when he borrowed the funds to buy wool to keep his free females occupied (Xen. Mem.2.7.11).

This explanation, while little better supported than any other, is at least consistent with what we know about the typical industry structure in Athens, which seems to consist mainly of individual practitioners, and with the fact that despite the huge consumption of textiles, teams of textile slaves never feature in law suits. Like a pottery with more people at a particular point in time than were needed for efficient production, some production of textiles for sale might simply have been a casual and opportunistic extension of an existing household’s general activities rather than a purposeful allocation of investment resources to a dedicated profit-maximising enterprise.

Weaving remained small scale even after the Industrial Revolution, though spinning mills became larger. There was a major discontinuity in the industry’s costs when watermills were harnessed, Arkwright’s Spinning Jenny was developed and mechanised high speed spindles were used in series; as a result, quite unlike the ancient world, textiles were the first industry to industrialise in Massachusetts after the War of Independence when Samuel Slater brought Arkwright’s technology over from England. The low costs achieved, together with other employment opportunities for women, changed the equation for households considering whether textile making was the best use of the household’s female labour. The extent of the change in production costs can be seen in Britain’s trade policy: before mechanisation she erected trade barriers against low cost Indian textiles; once she had established her own industry she demanded free trade. Despite these innovations, textile manufacturing remains very labour intensive today. A large part of the value chain relates to the brand – either as a

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62 Rosenberg (2007) Introduction
63 Ferguson (2004) 197
general quality mark or as a fashion label – and brand owners typically seek to outsource manufacturing to low-skilled, low labour cost countries.

The heavier process steps consolidated more rapidly. Some, such as fulling and scouring were not pleasant to the eye or the nose and it was probably environmental factors as well as the more masculine nature of the tasks that increasingly led to fixed independent sites in later Greek and Roman times. There may have been some larger fulling establishments in Athens but we have no literary evidence that home producers sent their wool to specialist fullers or that wool traders offered a pre-scoured option, nor do we hear of any important owners of fulling operations. Eventually scale effects started to tell: in Italy “the work tended to move from smaller shops to larger establishments and private fulleries were possible in wealthy households only.”

Dyeing was also a very simple craft whose introduction was credited to Aphrodite; it simply involved immersing the fabric in pots using ingredients which presumably formed a standard range and could be purchased as dyes or compounded from readily purchasable materials. Forbes finds no evidence of specialist fulling or dyeing before Roman times, although more recent finds of baths used for fulling in Iron Age Philistine and murex stains at various sites around the Aegean from a similar period suggest his conclusions might be superseded by new discoveries. A further prompter of consolidation in dyeing was access to innovative ingredients and Hellenistic times saw a continuing and often successful search for cheaper synthetic substitutes for natural dyes, as described in the Baphika, a chemical text book by Bolos of Mendes. Over time, success in these applications is likely to have led to some degree of industry consolidation through intellectual property advantages and more standard and lower cost processing. How far this had occurred in classical Athens is unclear, but, despite the lack of firm archaeological evidence, there may well have been some specialist fulling and dying establishments of reasonable scale.

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64 The impact of such factors on location is well illustrated in the case of another offensive-smelling industry. – the tanning of leather (below)
65 Herodotus (IV. 14) tells of a specialist fuller in Scythia.
66 Forbes (1964-72) IV.88
67 See for instance Mazow (2010)
Luxury Furniture

Demosthenes’ second factory was a furniture making establishment which also contained more than a trivial complement of slaves, in this case twenty of them (xxvii.9). This was probably not such a large industry as others we have considered. As Rostovtzeff put it:

“House furniture was very scanty. It consisted of a few couches, chairs, tables and chests of various forms. In rich houses, couches for example….were real products of art, being adorned with bronze sculptures….inlaid with ivory and coloured glass, and covered with fine mattresses, rugs and pillows. But in the average houses, all the articles of furniture were of plain design and cheap material. Table and domestic utensils, including lamps, were mostly of clay and of comparatively few shapes and plainly made.”

It cost up to 650 drachma to furnish an average house; one rich man’s couch of the type Rostovtzeff describes might have cost the same.

Exactly what Demosthenes’ klinopoioi were making is unclear; Homer uses several words for ‘bed’, including lechos (II. I.609), lektron (Od. VIII.258), demnia (II. XXIV.644) and klintes (Od. XVIII.190), while Pollux gives a similar number of variations on ‘kline’, such as skimpous, skimpodion, askantes, krabbatos and chameune (10.32.5). Demosthenes’ list of his ‘passive’ assets included a considerable amount of ivory as well as wood (xxvii.10), so it is generally inferred that he was targeting the luxury market. His assets do not include fabrics so it seems his workshop made the frames and soft furnishings were bought elsewhere, or perhaps made in the home of the purchaser by his family and female slaves.

While the carpentry, joinery and carving tasks were probably allocated according to some form of specialisation, this does not fully explain the size of Demosthenes’ operation. Depending on the complexity of carved decoration, twenty slaves might turn out several hundred beds a year and it is conceivable that this workshop had cornered the top-end luxury couch market. Two factors were probably responsible: the funds required to purchase and hold raw material, and the importance of brand recognition for what was essentially a fashion

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68 Both Demosthenes’ workshops are explored in detail in Chapter Eight.
69 Rostovtzeff (1941) II.1203-4
70 Jones (1997) 191; Pritchett (1956)
item. Together these factors would have enabled a workshop with a reputation for good quality materials, design and workmanship to capture significant market share and make entry by any new competitor very difficult.

A few boutique furniture manufacturers survive today although their role is diminishing. By far the largest part of the market is now served with standard products by low-cost manufacturers with a strong brand and wide retail range, whose sophisticated mass-production and design make their products hard to distinguish from higher cost luxury items. True high-quality specialists like the Demosthenes enterprise are finding it increasingly difficult to achieve prices that cover their higher costs.

**Tanning**

The production of leather goods begins with the tanning of raw hides. In classical times, the process started with beating the skin to make it supple, then it was depilated and soaked in tannin-rich vegetable oils before being stretched and scraped on a beam. The work was physically demanding and the smell appalling. In Homer, tanning seems to have been chiefly a home-based industry, though there were some specialists like Tychus who made Ajax’s shield with the hides of seven bulls (*Il. VII.219-23*). The rich would have had their shoes and saddlery made at home from farmed cattle, sheep and goats, while the poor did their own tanning and made leather goods from the hides of their own animals. By classical times, commercial tanning had become quite a substantial industry. Cleon’s father owned a tannery (*Ar. Eq.44*) and left him a large inheritance. Anytos, rich enough to bribe a jury ((Arist.) *Ath.Pol.27.5*), owned a tannery (*Xen. Apol.29*) that might also have made leather goods. Specialist leatherworkers without their own tanneries also did business.

No Greek tannery has been excavated but a Roman one has been in Pompeii. It has a receival room, a pit for vegetable tanning and a workshop for preparing solutions which contains a range of implements for scraping and cutting. On the face of it, tanning and shoemaking seem to have something in common with textiles. The technology is quite simple, part of the process is dirty (and very smelly), raw materials were often sourced on farm and products were made specifically for members of the immediate household. The reason leatherwork

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71 The description of the process and archaeological finds here are from Forbes (1964-72) V.48-63.
72 Scholiast on Pl. Ap.18b, citing Theopompus Comicus fr.38 (PCP VII 735) and Archippus fr.31 (PCP II 549).
was commercialised relatively quickly while textiles were not stem from differences in the nature of the work. There were features of leatherwork which required not only skill but physical strength – cutting, piercing and stitching leather is physically demanding, as is moving soaked hides. It may have been possible for women to carry out these tasks but they were not seen as part of a woman’s education, nor as relevant to their identification with Athene. It would not have taken much time anyway; one or two people could make enough shoes for a large estate. Better for the female labour force to focus on the more diverse range of products and applications offered by textiles. If there was no need for more clothes at a particular time, they could always turn their hands to tapestry. An additional consideration in the case of tanning, as with fulling, scouring and dyeing wool, would have been amenity. An attraction of not doing your own was that you would avoid the foul smell of the process hanging around your living quarters for weeks. This is probably why tanneries in classical Athens were clustered in one district, Cydathon.

The wealth of Anytos and Cleon’s father suggests that the tanning industry was one in which either better than average margins were available or establishment size was large, probably some combination of the two. What forms of advantage or barriers to entry would produce such an outcome? Tanning is essentially a materials handling operation and costs depend entirely on handling productivity so only significant advances in materials handling technology based on the application of power would give large tanneries a worthwhile cost advantage over small ones. It is also hard to differentiate product quality, limiting any possible market advantage. Forbes suggests one source of attractive profitability might have been forward integration into shoemaking. This certainly became the pattern later, but the only real evidence for this in classical times is the scholiast to Plato’s Apology; Aristophanes’ occasional mocking association of Cleon with shoes can be explained as simple extrapolations of the basic joke about descent from a tannery-owner; the much cited reference in the Acharnians (299) to turning Cleon’s hide into shoes is more than balanced by the multiple references in the Knights which ascribe to the Paphlagonian every kind of process and product of the tanning industry but shoes (Eq.48; 59; 104; 136; 203; 315; 379; 449; 963-4). We see how easily Athenians conflated different leather-based specialities such as luchnopolai, neororraphoi and skutotomoi with bursopolai (Eq.739-40). Forbes’ economic rationale for forward integration is unconvincing; the notion that a competitive advantage can

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73 Forbes (1964-72) V. 60
be extended from one industry to an adjacent one in the supply chain through vertical integration and clever transfer pricing is a common one but simple arithmetic shows it is incorrect. If the nature of tanning was such as to allow high margins, tanners could realize them by selling to leatherworkers without entering the finished product market themselves. Conversely, if the true source of profit was in making end-products, shoemakers would do better without putting part of their investment into tanneries.

With this in mind we prefer Forbes’ other suggestion: that the unpleasantness of the work and a probable limitation on sites that could be used for tanning underpinned tanning’s profitability. This might partly reflect a lack of willing new entrants to such an unpleasant business, but the scale of operations would also be constrained by location considerations, which would have provided an important barrier to entry and possibly raised prices above a competitive level by artificially restricting supply. Throughout history, many cities have regulated where tanneries could be located and the archaeological evidence suggests that, whether by custom and popular pressure or by explicit regulation, Athens might have achieved the same result. Restricted site licences are often the source of exceptional levels of profit in certain environmentally sensitive businesses today such as waste disposal and the cleaning of chemical vessels, and a similar dynamic might well have provided a privileged position for tanneries in classical Athens.

**Shoemaking**

Shoemaking was looked on as a typical craft occupation (Ar. *Plut.* 513-4; Pl. *Resp.* 454c, 601c) and seems to have been considered a rather sedentary one (Ar. *Plut.* 162). Shoes were made to measure; a sixth century *kylix* shows a shoemaker using a half-moon knife and an amphora shows a customer standing on a table while leather is cut round his foot. Asking for a refit was seen as normal (Ar. *Lys.* 416-9). It was clearly a bespoke operation, requiring at most one craftsman and an assistant. There would not have been enough volume in particular

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74 This is probably also the reason why shoemaking in India was the preserve of the lowest caste of Untouchables.

75 Boston, Massachusetts still has a Leatherworkers District. Originally the site of tanneries (segregated from residential areas because of their smell), it became known as the hub of a large shoe manufacturing cluster.

76 The Fine Arts Museum of Boston; Ashmolean Museum – Forbes (1964-72) V. Fig.13; Burford (1972) pl.3
sizes for a wise shoemaker to make for stock. Shoemaking shares many features with bronze armour in terms of the ordering process and a lack of entry barriers, and we have seen how that tended to remain an industry of lone craftsmen, probably because the reputation of the individual armourer mattered. Evidence points to lone shoemakers as the norm, though as we have seen, Forbes suggests tanners might have forward integrated into shoemaking, and we have one example of a sizeable gang of shoemaking slaves.

Despite the fragmented nature of the segment, Aeschines describes Timarchus as owning a number of working slaves, including nine shoemakers and their overseer (i.97). How can we reconcile this large team with the bespoke nature of the craft? Perhaps within the nine some specialised in one type of shoe or other leather product and others in another. There were 82 words for footwear in classical Greece, reflecting a wide range of styles, origins and materials. On the other hand this type of specialisation would tend to attract different labels such as humantopoios (sandals), persikopoios (slippers) or neurorraphos (cobbler).

Xenophon used shoemaking to illustrate the benefits of specialisation: “One man makes men’s shoes, another women’s. And in some places, one man supports himself by only stitching, another by cutting, another by only shaping the uppers, and another by doing none of this but only assembling these things” (Cyr. 8.2.5). Commentators have often hypothesised, somewhat inaccurately, that the maximum number of workers in any activity reflects an efficient division of labour in line with Adam Smith’s best practice, but this explanation seems inadequate here. Certainly there might have been some task specialisation among the nine, but it is difficult to see how cutting and stitching layers of leather for a sole and thongs and then attaching the thongs to the sole can be divided into more than four or five different activities. Xenophon in the passage cited above only identifies four sub-tasks. It is possible that they were making other things than shoes, such as leather corslets or thongs for armour – skutotomi just means leather workers – but the same considerations apply. If anything, such products would have been still less divisible. Almost certainly, if the shoemakers were busy, several of them would have been doing the same thing at the same time and nine is not the solution to an equation optimising the division of shoemaking labour. Further, we may question just how much productivity benefit accrues from such specialisation as they might have achieved. It may be that the division of labour meant that

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77 Forbes (1964-72) V.63
nine slaves would produce more than nine times as much as one in a given period, but the
tasks were not so different that worker focus would have more than a marginal impact on
productivity. Such cost advantage as it did bring is unlikely to have been large enough to
courage smaller shoemaking concerns to risk expansion. With shoes selling at six to eight
drachmae a pair, 79 and assuming that leather accounted for a third of the final price and the
nine shoemakers and their overseer cost around a drachma a day each to maintain as well as
the payment to the owner, they would have broken even at a collective production of about
twenty pairs a day. It is unlikely they produced very much more than that. If they had,
Timarchus would surely have raised the apophora or new competition would have emerged
or, most likely, both. A lone shoemaker producing two pairs a day would have the same cost
position bar the apophora.

It is conceivable that there was some demand advantage from working together. Shoes were
made to measure and when a customer came to be measured, he would expect to collect his
shoes fairly quickly. A single shoemaker can only accommodate one customer at a time, but
once he has finished that customer's shoes, needs another order to keep going. He is likely to
have periods when he is overloaded, possibly leading to customer dissatisfaction, and other
periods when he has no work. A larger workforce is able to manage such peaks and troughs
better and will also attract custom from being known to have the capacity to respond quickly
to orders at all times. While in the famous example, ice-cream sellers tend to gather at one
end of the beach so they can steal each other’s customers, 80 another common reason for
colocation is so that customers know where to find them. An establishment where customers
can be sure to get what they want rapidly might have an advantage in attracting business
compared to a lone shoemaker – or even a specialised team of three or four.

It is no coincidence that the slaves have a particular expertise for which there was known
market demand. No one would rely on slaves for income purposes if they did not and the
foreman would be reluctant to take the risk of paying the apophora and maintaining the
slaves unless there was a predictable demand for their special skills. The woolworker that
Timarchus also earns money from is described as skilled in fine work (Aeschin. i.97).

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79 Accounts of the Epistatai of Eleusis. IG II 2 1672.105; Ar. Plut. 983
80 This is Hotelling’s Law, discussed in Chapter Six.
In recent times, shoemaking consolidation has been based on some technological advances in cutting and stitching machinery, reducing costs below those of the lone craftsman, together with a heavy investment in branding. It remains, however, like textiles, a very labour intensive industry with few economies of scale in production, with the result that leading brand owners now outsource all or most manufacturing to low labour cost countries.

**Food Processing**

Food processing is another industry in which large companies predominate today, but for which there is no evidence of large enterprises in Athens. The reasons are to be found in the domestic base of the industry. In developed economies today, food goes through several stages from paddock to plate. After harvest or slaughter, products undergo primary processing and then are shipped to manufacturers who carry out further processing and packaging before selling to retailers or food service establishments and finally to consumers. For some products such as prepared meals there can be several intermediate processing steps carried out by different companies. In classical Attica many food products reached the consumer at the primarily processed stage to be cooked or baked at home. Of the foodstuffs for sale in the agora or local markets, much was fresh (fruit, vegetables, fish), some had been simply processed (cheese, sausages, flour) and the rest was prepared for instant consumption (typically honey-cakes or biscuits). This latter ready-to-eat segment comprised both permanent establishments where one could buy wine and a snack (Ar. *Plut.* 426, 1120; *Ran.* 549ff), and retail fast food sales which seem to have been conducted opportunistically by small traders, especially around festival times, rather than as a full-time occupation. *Artopoioi* (*Xen.* Cyc. 5.3.39) would bake bread and sell it through an *artopolion* (Ar. *Ran.* 112, 857-8; *Lys.* 458; *Vesp.* 238). Vegetable vending was another common trade (Ar. *Ach.* 478; *Thesm.* 387, 456; *Ran.* 840) and there is epigraphic evidence for women selling garlic, figs, sesame, salt and honey –all minimally processed.  

Harris identifies twelve terms for people involved in food production (primary processing) and twenty terms for vendors of cooked food and raw ingredients.

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81 Cited in Brock (1994) 339  
82 Harris (2002a) App. 188-97 See also Ar.: Dicaeopolis’ food market (*Ach.* 719-27), sausage-seller (*Eq.* passim), vendor measures (*Nub.* 648).
The main purpose of **primary processing** is to reduce transport or cartage costs by disposing of parts that will not be consumed. For this reason it tends to take place near the farm and scale reflects farm output. Olive pressing is a good example. Before Hellenistic times, the efficient *trapezium* olive press was unknown, “the scale of olive pressing was relatively small, and the degree of specialisation of processing installations considerably limited.”¹⁸³ A *skyphos* from the sixth century shows a simple, labour intensive press and many of the settings in which such presses have been found appear to have been multi-purpose.¹⁸⁴ Even these limited devices were often shared between neighbouring farmers and some may have developed a profitable business operating presses or mills on behalf of a group of neighbouring farms.¹⁸⁵

As in ore processing, pricing would have been limited by the alternatives of doing it yourself and paying the extra transport costs of taking unprocessed product further afield. The massive investments in machinery and in agronomic research and development of agribusiness today provide an economic case for consolidating primary food production that simply was not there in ancient times, even if land-holding rules could have been circumvented.

**Secondary processing** was typically done in the home, working from minimally processed raw ingredients. The route snack industry remains a very fragmented one today. A good part of it has been captured in the last fifty years by fast-food chains, leveraging standardisation technology and the power of mass advertising, but every city is full of independent cafes, sandwich bars and cake shops, not altogether dissimilar to the purveyors in Aristophanes’ agora. There were no supermarkets or general grocery stores, probably because the task of sourcing fresh product encouraged resellers to specialise and difficulties in preserving food meant households would have purchased perishable foodstuffs for only one or two meals at a time. These technological limitations also meant there was no scope for supplying standard processed product in large quantities to be sold through retail outlets under a consumer brand as grocery-based food companies do today.

The reason then that there were no large processed food companies is that food production technology provided no economic basis for consolidation. Primary processing took place near or on farm and scale was limited by logistics, secondary processing was a home craft

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¹⁸³ Foxhall (2007) 177
¹⁸⁵ Foxhall (2007) 216
with no scale economies and, prior to recent developments in standardisation, portion control, cool chain technology and mass consumer promotion, food reselling both in the snack and in the grocery segments was a naturally fragmented business.

**Cosmetics and Perfumes**

The custom of using cosmetics and perfumes is generally held to have originated in the East, although recent archaeological discoveries suggest that Neanderthal man also used cosmetics. By the Bronze Age the practice was well established in Achaean palaces, as is attested by finds of containers and jars. They were products for the rich and Helen’s domestic entourage included expert preparers of perfumes and cosmetics (*Od. IV.227-32*). Although the tale that Solon forbade men to sell perfumes and ointments was probably fictitious, for the notion to have had any credibility the trade of perfume vendors or *muropoloi* (*Xen. Symp. 2.4*) must have been quite prevalent in Athens. While the average citizen and his wife could afford to adorn themselves with what might have been standard products from these vendors, there was also a high-end trade consisting of the latest ingredients freshly mixed to order by an expert – probably accompanied by mystical mumblings about the properties of the ingredients – to which only the very wealthy might aspire. This luxury segment, though small in volume, might have accounted for most of the industry’s revenue. By Alexandrian times, the perfume business had become a large-scale one making a single product for a huge market, using economies in purchasing, process (yield), quality control and expertise.

Mixing ingredients for male or female pulchrification was a complex business. A lengthy exposition by Theophrastus, *Concerning Odours*, has chapters covering a large range of technical matters ranging from mixing techniques through the medical properties of certain plants to perfumed wines. The mixing process was evidently very labour intensive and relied

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86 *Hindustani Times*, 12 January 2010 11
87 Pherecrates, Fr. 70 mentions such a decree of Solon’s; Plutarch does not – even when he is describing the actions Solon took to improve civic morality (*Sol. 21*) – and it seems contrary to observed practice.
88 This description of the industry and its technology is drawn largely from Forbes (1964-72) III.1-37.
89 Storing materials of such value in one place made it vulnerable to pilfering, as Pliny tells: “At Alexandria where frankincense is worked up for sale, good heavens! No vigilance is sufficient to safeguard the Officinæ. A seal is put upon the workmen’s aprons, they have to wear a mask or a net with a close mesh on their heads, and before they are allowed to leave the premises they have to take off all their clothes.” (*HN XII.18*).
on individual experience and judgment: “The more numerous and the more various the perfumes that are mixed, the more distinguished and the more grateful the scent will be….in perfumes of this class the aim and object is not to make the mixture smell of some one particular thing, but to produce a general scent derived from them all. That is why every day they open the vessel and remove each time that perfume whose scent is overpowering the other, adding at the same time smaller quantities of the less powerful scents, while some perfumes are added” (57). We may infer that this complexity enabled more skilled operators to differentiate their offering against less skilled ones. Mixing perfumes probably required a long apprenticeship and a *thrrata murephos* was highly valued. It might have been hard to acquire slaves that were new to it and train them. This would suggest that anyone who had one or more slaves trained to be experts should make a good margin, though we do not know how much of that margin was captured by the slaves themselves in the form of better conditions or living allowances reflecting their superior value to an owner.

Theophrastus emphasised skills but from an economic point of view he was also drawing attention to a substantial investment in inventory. The procurement process was a complex and expensive one. To be able to offer a wide range, it was necessary to carry a wide range of ingredients, for many of which a good price probably depended on acquiring much larger quantities than one household would use in a long while. Some of them would have been perishable. The high end trade was also a fashion business, so it would have been necessary to keep up to date with new ingredients and mixtures, increasing the investment required.

How would the potential to gain advantage through special skills and the barriers to entry offered both by these skills and by a substantial investment in working capital have affected industry structure? The cost and risks of acquiring and holding a variety of valuable and rare ingredients would not only constitute a barrier to entry but also an incentive to expand, as the same bulk purchase could supply multiple dispensing experts whether or not they were colocated. Keeping up with new mixtures and fashions would also be more easily achieved within a community of experts than by a sole operator working for one master. It is not certain that such a strategy would lead to complete market consolidation, as customers for special products would be often drawn to the individual expert or range or proprietary

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90 IG II.2 11688

91 Someone acquiring ready-trained slaves, rather than training them, would have to pay a price that reflected the commercial value of their skills, resulting in a standard return on that investment.
mixture rather than to an owner’s brand, and standard products would have been subject to stronger price competition, but if owning individual perfume slaves was profitable and the incremental working capital investment to supply multiple slaves negligible, we would expect to find examples of citizens employing more than one slave. At the same time, a skilled individual with a narrow range and a good sales patter could find customers too.

Manumission lists and market scenes in Aristophanes suggest sole operators offering individually prepared perfumes and cosmetics (Eccl. 841). According to a speech of Hyperides on behalf of Epicrates, written between 330 and 324, a slave, Midas, ran a perfumery for Athenogenes, and Epicrates bought the three slaves operating the business for 40 minae. This is an extraordinarily high price for slaves, however skilled, and for Epicrates to earn a “normal” return on the investment, each slave would have had to generate an apophora of four minae over and above the four or so it cost to feed him and his family – around five times the amount per slave as Demosthenes expected from his factories (xxvii). It is conceivable (and logical) that some of the amount was for stock, but this does not seem to be normal practice and stock is dealt with separately in this passage. Perhaps the high price of the slaves reflected a high level of profitability conferred by the barrier to entry and competitive differentiation provided by a large stockholding? This should not be pressed too far: Hyperides seems to base much of his case on his client’s naiveté and it is quite likely he simply paid far too much.92

The fact that this operation had three slaves and a supervisor and had provided an apophora for Athenogenes fits the hypothesis that a large investment in inventory provided a barrier to entry in at least some segments of the business that small participants could not overcome; it is likely that there were other operations of at least similar size carrying a large and costly inventory which might provide the ingredients for several reseller-dispensers, including some employed by the owner of the inventory as seems to be the case here. Aeschines appears to have borrowed funds for an operation of this nature (Lys. Fr.38). Harris argues that the existence of specialist muropoloi means there was some standardisation so that consumers knew what they were getting and perfume-makers knew that there would be a market for what they made.93 It is more likely that the products of the larger enterprises were

92 Cohen (2002) cites it as a typical example of “An Unprofitable Masculinity”; it would have been unmanly for Epicrates to have understood his own business dealings.

93 Harris (2002a) App.I.94
standardised and individuals who competed on their own account had to develop a personal reputation for their skills and the novelty of their blends. The cost of inventory would constitute a barrier to entry for the full-range and standard segments, but there were no barriers to setting up in the business in a small way with a narrow but well differentiated and promoted product range, perhaps using ingredients sourced from the same importer-wholesalers. Some of these niche competitors would have been able to charge high prices based on the originality of their mixtures. Small boutique operators would continue to play an important role in the industry for centuries, though they have become increasingly marginalized in recent years by larger companies investing heavily in research and development and in the mass media promotion of their brands.

**Conclusion**

At this stage it will be useful to summarise the explanations we have put forward on firm size and subsequent consolidation (Table 5.1):

**Table 5.1: Other Industries Summary**

<table>
<thead>
<tr>
<th>Industry</th>
<th>Observed Unit Size (Slaves)</th>
<th>Hypothesis to Explain Observed Size</th>
<th>Factors Conducive to (Subsequent) Consolidation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shield manufacture</td>
<td>120; 65 - 80</td>
<td>Shield making industry concentration cannot be explained by division of labour. Operational requirements dictated a minimum size of 6 to 8 slaves, but multiple teams in one establishment reflected customers’ need for quality assurance. Enterprises that commanded customer confidence were able to win market share and make good returns without encouraging new entry.</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Mining</td>
<td>Up to 1000</td>
<td>The structure of the mining industry reflected individual claims; enterprise size was irrelevant to returns from mining.</td>
<td>Economies of scale in exploration technology, primary processing, shipping and price negotiations.</td>
</tr>
<tr>
<td>Ore processing</td>
<td>Up to 30</td>
<td>There was probably a handful of ore processing specialists located near clusters of mine sites and the first to establish themselves in a location would make good but not spectacular returns.</td>
<td></td>
</tr>
</tbody>
</table>

143
<table>
<thead>
<tr>
<th>Industry</th>
<th>Observed Unit Size (Slaves)</th>
<th>Hypothesis to Explain Observed Size</th>
<th>Factors Conducive to (Subsequent) Consolidation</th>
</tr>
</thead>
<tbody>
<tr>
<td>General metal work</td>
<td>Small (one or two)</td>
<td>For the majority of applications, metalworking was a bespoke business suited to the lone smith and offering no benefits from or incentive to consolidation.</td>
<td>Product standardisation, economies of scale in materials handling technology, reduced transport costs.</td>
</tr>
<tr>
<td>Bronze armour</td>
<td>Small</td>
<td>Armour manufacture was also bespoke, but considered a more specialised craft industry where quality assurance mattered more.</td>
<td></td>
</tr>
<tr>
<td>Knives or swords</td>
<td>32-33</td>
<td>Knives could be made for stock and manufacture tended to be concentrated as a result of customers’ need for quality assurance, along with a requirement to invest heavily in raw materials.</td>
<td></td>
</tr>
<tr>
<td>Spinning, weaving</td>
<td>Small</td>
<td>Spinning and weaving involved common skills and little equipment, meaning there were no barriers to entry or scope for competitive advantage – the essential characteristics of a fragmented industry.</td>
<td>Economies of scale in new machinery (mills, Spinning Jenny). (Limited; the industry remains very labour intensive).</td>
</tr>
<tr>
<td>Other textile operations</td>
<td>(?)</td>
<td>Other (heavier, dirtier) stages in the textile value chain are likely to have consolidated progressively.</td>
<td>Branding (standard products or fashion labels).</td>
</tr>
<tr>
<td>Fine Textiles</td>
<td>Small</td>
<td>A few individuals might make good profits importing and/or finishing luxury cloth or garments, but there was no value in combining forces.</td>
<td>Boutique fashion houses continue to thrive alongside giants.</td>
</tr>
<tr>
<td>Tanning</td>
<td>Unknown, but probably quite large</td>
<td>Tanning was a profitable industry as a result of barriers to entry in access to sites, and possibly because of the unpleasantness of the work.</td>
<td>Economies of scale in material handling technology.</td>
</tr>
<tr>
<td>Shoemaking</td>
<td>1-10</td>
<td>Most shoemakers were sole operators with one or two assistants. It was a craft that lent itself to investment.</td>
<td>Cutting and stitching mechanisation. (Limited; the industry remains very labour intensive). Branding (standard products or fashion labels).</td>
</tr>
<tr>
<td>Luxury furniture</td>
<td>20</td>
<td>Concentration in luxury furniture manufacturing was due to consumer fashion/brand preference and high raw material costs.</td>
<td>Product standardisation, economies of scale in manufacturing, branding.</td>
</tr>
<tr>
<td>Industry</td>
<td>Observed Unit Size (Slaves)</td>
<td>Hypothesis to Explain Observed Size</td>
<td>Factors Conducive to (Subsequent) Consolidation</td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------------------</td>
<td>------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Primary food processing</td>
<td>Small</td>
<td>Primary food processing reflected the scale of farming units in a given area.</td>
<td>High cost agricultural machinery, scale in agronomic research and development.</td>
</tr>
<tr>
<td>Secondary food processing and sales</td>
<td>Small</td>
<td>In the absence of standardising and handling technologies and mass advertising, the selling of further processed items was a naturally fragmented industry, largely done from the home or by specialist vendors. Preservation technology did not enable large scale in food reselling.</td>
<td>Economies of scale in materials handling and processing technology. Product standardisation; branding.</td>
</tr>
<tr>
<td>Cosmetics, Perfumes</td>
<td>2-10?</td>
<td>It would be rational for operations offering a wide product range to employ or supply more than one or two slaves, but there was still room for small operators with a narrow range to make special products with high margins.</td>
<td>Economies of scale in research and development. Branding.</td>
</tr>
</tbody>
</table>

We can now frame these conclusions in terms of Barriers to Entry and Competitive Advantage, which form the basis for testing our theory of industry structure. The scarcity of data means that several conclusions have been based on the author’s experience and judgment, rather than primary evidence; to help the reader form a view as to how far the analysis rests on unsubstantiated assumptions, and whether alternative assumptions might be more plausible, sources for each conclusion are identified in Table 5.2:
Table 5.2: Barriers to Entry and Competitive Advantage

<table>
<thead>
<tr>
<th>Industry</th>
<th>Barriers to Entry (Against New Entrants)</th>
<th>Competitive Advantage (Against Current Competitors)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shield-making</td>
<td>Minimum size of around 8 slaves</td>
<td>Strength of reputation</td>
</tr>
<tr>
<td></td>
<td><em>Reputation of workshop based on importance of quality</em></td>
<td></td>
</tr>
<tr>
<td>Mining</td>
<td>Investment required</td>
<td>-</td>
</tr>
<tr>
<td>Ore processing</td>
<td>First mover pre-empts</td>
<td>(Relative firm size and profit depend on size of catchment area)</td>
</tr>
<tr>
<td>General metalwork</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bronze armour</td>
<td>-</td>
<td>Skills</td>
</tr>
<tr>
<td></td>
<td><em>Reputation for quality</em></td>
<td></td>
</tr>
<tr>
<td>Knives</td>
<td><strong>Raw material investment</strong></td>
<td>Reputations</td>
</tr>
<tr>
<td></td>
<td><em>Reputation for quality</em></td>
<td></td>
</tr>
<tr>
<td>Textiles</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Luxury furniture</td>
<td><strong>Investment in Raw Materials</strong></td>
<td>Reputation (fashion brand)</td>
</tr>
<tr>
<td></td>
<td><em>Reputation (fashion brand)</em></td>
<td></td>
</tr>
<tr>
<td>Tanning</td>
<td>Site availability</td>
<td>-</td>
</tr>
<tr>
<td>Shoemaking</td>
<td>-</td>
<td>Skills/reputation</td>
</tr>
<tr>
<td>Primary Food Processing</td>
<td>First mover/ incumbent pre-empts</td>
<td>-</td>
</tr>
<tr>
<td>Secondary Food Processing</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cosmetics /Perfumes</td>
<td><strong>Investment in inventory</strong></td>
<td>Skills/reputation</td>
</tr>
</tbody>
</table>

**Bold** indicates primary sources have been adduced in support of the proposition. “Normal type” means that the conclusion was based on some combination of technical expertise (sourced from experts or from texts, as footnoted), analogy to modern practice, and common sense. The reader is invited to consider alternative interpretations. **Italics** indicate assumptions.

The examples cover a broad array of barriers to entry and potential for cost advantage. Assumptions all relate to the importance of establishing a reputation in businesses where one would expect product quality to have been of particular importance to purchasers. We have
found no industries in which it is possible to achieve a cost advantage. As noted earlier in this chapter, this is a result of three factors:

- The common application of identical low technology process, which means that productivity is purely a function of labour output and therefore, subject to competent management, the same for all ergasteria.
- Low levels of assets and fixed costs, which make scale economies irrelevant to cost position.
- Open markets for labour and raw materials so that input unit costs are the same for all.

The first point is especially important in understanding the contribution of technology to firm size and industry concentration. Low technology industries such as mining included very large teams of workers, so the absence of technology per se is not the determining factor. Nor is its effect on the divisibility of labour tasks – otherwise Lysias would have only had one shield-making team. Rather it was the absence of the economies of scale and the barriers to entry that investment technology brings that made it uneconomic for firms without other advantages to expand, as is evident from the fact that when technology changed in many of the industries examined, optimal firm size changed too.

In the absence of cost or asset advantages, any basis for winning high market share and building a larger operation must come from an ability to differentiate one’s product so that it is preferred by customers to other offerings at the same price level. In cases where the sought after brand was seen as the product of a whole workshop with the right skills and raw materials (shields, knives, luxury furniture) the industry would tend to consolidate and take on the characteristics of an oligopoly, especially if product is made for stock and raw material costs are high. Where the product is customised and the quality sought is attributable to an individual craftsman (sometimes with assistants) the industry will consist of small players (bronze armour, fine textiles, boutique cosmetics and perfumes). The operation of a famous potter or a respected bespoke armour manufacturer is limited to the output of the one person, so we would not expect large firms in this type of manufacturing, and competitive advantage would be realised in the form of return on personal labour. Thus painters would have earned good incomes while non-decorating potters, lacking a basis for differentiating their output, would not.
The analysis also sheds new light on the question of capital requirements. In the absence of major production equipment, capital was only needed for raw materials and labour. We have already suggested how the cost of raw materials constituted a barrier to entry for industries like broad-range cosmetics and perfumes and luxury furniture, but there is also evidence that it was possible to borrow against working capital,\(^{94}\) so some were able to circumvent this barrier without ready cash. As for labour, the only industries in which it made sense to employ a workforce larger than a slave or two (and therefore required more capital than the average citizen could readily lay his hands on), were protected by other barriers and advantages against competitive entry. It would have been a brave person indeed to set up a new shield factory with no track-record, whether or not he found the capital requirement easy to meet.

In the framework of competitive advantage and barriers to entry, we have four distinct types of operation as shown in Figure 5.1:\(^{95}\)

\[\text{Figure 5.1: Competitive Advantage and Industry Structure}\]

<table>
<thead>
<tr>
<th>Potential for Competitive Advantage</th>
<th>Barriers to Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Type Ia: Shields</td>
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<td></td>
<td>Knives</td>
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<td></td>
<td>Luxury furniture</td>
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<td></td>
<td>Cosmetics &amp; Perfumes</td>
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<tr>
<td>Low</td>
<td>Low</td>
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<tr>
<td></td>
<td>Type Ila: Bronze armour</td>
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<tr>
<td></td>
<td>Fine textiles</td>
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<td></td>
<td>Shoemaking</td>
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<tr>
<td></td>
<td>Decorative pottery</td>
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<tr>
<td></td>
<td>Shoemaking</td>
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<tr>
<td></td>
<td>General metal work</td>
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<tr>
<td></td>
<td>Secondary food processing</td>
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<tr>
<td></td>
<td>Basic textiles</td>
</tr>
</tbody>
</table>

- **Type I** businesses (those with barriers to entry) can involve large enterprise size based on barriers to entry and are of two types, depending on whether some competitors can achieve an advantage over others. We may identify:

\(^{94}\) Athenogenes and Midias (Hyp., iii.6.9-10); Aristarchus (Xen. *Mem.* II.7.11-12)

\(^{95}\) See Figure 3.8 above.
- **Type Ia**: High levels of market share, consistent demand and premium pricing based on a reputation for product quality.

- **Type Ib**: Consistent returns but growth restricted by location factors or low-cost access to delivered product.

- **Type II** businesses consist of small units as there are no barriers to entry. Profit levels depend upon whether they can achieve a competitive advantage through product differentiation:
  
  - **Type IIa**: Differentiated products in which individual craftsmen with skills that are in demand can make a good income
  
  - **Type IIb**: Undifferentiated products not requiring a high degree of skill, in which anyone at any time can earn a very modest return on their labour, and in which large teams can be deployed opportunistically but will not make large profits.

It is consistent with our framework that the businesses that are known to have been larger than the minimum size required to do the job possess identifiable barriers to entry. There are just a few examples which do not seem to fit quite so neatly within this paradigm: the large textile operation at Olynthus and the (unproven) possibility of potteries with more than around 10 workers can be explained as an opportunistic way of putting slave labour to use at times when it would otherwise be idle. Leocrates’ bronze workers and Timarchus’ shoemakers also seem to defy the natural fragmentation of their respective industries; the first reference is dubious and the second might be a rational way to compete in an otherwise fragmented craft. It is significant that the only Type II operations we know of that paid an *apophora* to an investor – Timarchus’ shoemakers and his fine woolworker – are IIa. Undifferentiated IIb business would have been unreliable generators of income to an investor and would have had no margin to spare in any case.

In the interests of verbal felicity, rather than continue to refer only to “Types”, for the remainder of this thesis, Type I businesses will also be referred to as “industries”, since they include firms of some size, made consistent returns and generally separated ownership from management, while Type II businesses will be termed “crafts”. The distinction between Types a and b will be expressed as differentiated and undifferentiated. Thus:

- **Type Ia**: differentiated industry
- Type Ib: undifferentiated industry
- Type IIa: differentiated craft
- Type IIb: undifferentiated craft

This typology fits neatly with what is known about the place of manufacturing in Athens. It also suggests that scholarly debate about whether manufacturing was a serious profit-maximising activity in Athens arises because manufacturing was multifaceted. Any characterisation of it needs to accommodate more than one form of engagement by participants. Importantly, by identifying the economic parameters of each industry, the typology establishes a framework that explains which groups of Athenians participated in which industries and how, enabling us to paint a more realistic picture of Athens as an industrial city. This is the subject of the next chapter.
6. INDUSTRIAL ATHENS

In the two preceding chapters we identified the characteristics of different manufacturing businesses that determined the size of typical establishments and the nature of returns to owners and operators. Here we relate these findings to the needs and aspirations of different social groups and show that they form a consistent and revealing picture of who participated in what forms of manufacturing and on what basis. The chapter ends by drawing on relevant archaeological and demographic data to paint a word-picture of Athens as an industrial city.

Participation in Manufacturing

Rostovtzeff noted that “Greek art of the archaic and classical periods never neglects representation of the crafts.”¹ One of the best known examples is a vase from 515 BCE that shows “an old man with long white hair, dressed in a cloak, and holding no ordinary walking stick, but a goodly sceptre-like staff.”² This dignified gentleman has been identified as a master of some craft. There is a sculpted bronze figure from Laconia similarly equipped who would have been a foundry master. Around the seventh century BCE, craftsmen ceased to be anonymous and started to claim credit for fine works. Crafts often reflected strong family traditions: Antenor the sculptor had a father, a brother and possibly two nephews, Critios and Nesiotes, who were also sculptors. Other sculptors included Myron and his son Lycius. Cephisodotos and the great Praxiteles were probably brothers, and their sons (including Praxiteles II) and other descendants followed the same art. Artisans were often adept at more than one craft. Pheidias the sculptor might have started as a painter and became expert in bronze casting and architecture as well.³

Pseudo-Aristotle (Ath.Pol.xix.3) and Plutarch (Th.25.2-3) were almost certainly guilty of anachronism in relating how Theseus divided the people of Athens into agricultural labourers and artisans and, in Plutarch at least, found the artisans more numerous than the nobles and the “useful” (agricultural labourers). There would have been few artisans in the city at the

¹ Rostovtzeff (1941) 1200
² Beazley (1944) 6
³ Burford (1972) 85
time. Plutarch may have been more accurate when he credits Solon with having made the crafts more socially accepted by enacting that sons need only support their fathers if they have learned a trade from them (*Sol.xxii*), though this is otherwise unsubstantiated. If Plutarch is correct, then this not only shows the value Athenians placed on being self-supporting, but that they were comfortable with the notion that banausic occupations should be a normal part of citizens’ lives and livelihood. This acceptance of crafts as a means of generating income was an important element in Athens’ economic development. Herodotus tells us how Egypt treated craftsmen with suspicion and might have taught Greece (especially Sparta) to do the same (II.166-7). Where Sparta was the archetype of the oligarchic, regimented, military-based state, Athens was a place of opportunity. The reforms of Draco and Solon addressed land ownership – that was and would remain for some time the major source of subsistence for the vast majority of citizens – but they also created an environment where citizens were expected to be responsible for their own subsistence (with regular hand-outs from the state) and the distribution of wealth was less unbalanced than in many other states.4 By insisting on maintaining the tributes she received from the Delian League and investing them in glorious buildings, the city created a huge demand for craftsmen, far beyond the capacity of the local population to supply and attracting artisans from all over Greece. Of similar importance was the path to freedom that industry offered the more capable and loyal slaves. These factors in turn allowed Athens to develop her industries faster than other Greek states – even faster than Corinth, despite its naval power (Thuc. I.13). The opportunities manufacturing offered soon began to play an important part in Athenian social, economic and political life. Francotte held that the social mobility, employment opportunities and relatively even distribution of wealth enabled by the advent of money, commerce and industry were what enabled Athens to avoid the revolutions that the Peloponnesse suffered regularly between Cinadon’s revolt in Sparta in 399 BCE and that of Diaios and Critolaus in Roman times.5 He saw agriculture as the real capitalism, contributing to social inequality, and industry as the great leveller. As Burford puts it, “The craftsman was not born a craftsman, but a citizen, the son of a slave, a metic or a total foreigner.”6 The story of manufacturing in classical Athens is in no small part the story of an increasing number of citizens, rich and poor, finding other ways to survive or

4 Recent research (e.g; Harris (2002b)) suggests that Solon’s reforms were not so exclusively focussed on land ownership as had once been thought.

5 Francotte (1900-01) II.340-65

6 Burford (1972) 28
get rich than the traditional sources of land, plunder and handouts, as well as of metics and slaves whose options were more limited.

The surviving literature, sparse as it is, provides evidence of a variety of arrangements for the ownership and operations of manufacturing workshops in classical times, notably:

- Enterprises employing ten or more slave-labourers, actively managed by their owners who might have provided both manufacturing skills and sales capability. Perhaps the best known (and largest) example is Lysias’ shield workshop (see Chapter Five). In our typology, these are Type I industries, enjoying barriers to entry, and, in some cases, the potential for competitive advantage through product differentiation.

- Similar enterprises managed by a slave-foreman who enjoyed the profits after paying a pre-agreed return to the owner. Cohen (2002) lists several examples. The factories inherited by Demosthenes (xxvii) are instances; the owner’s fixed returns are more similar to a bond or preference share than to true risk-bearing equity. It is highly probable that some owners transited to such an arrangement after establishing the business themselves; Demosthenes’ father seems to have managed at least one workshop himself and from Aristophanes we may infer that Cleon’s father was active as a tanner at some stage (e.g: *Pax* 270; *Eq*. 44), though he might have inherited a working operation complete with foreman. Cleon “presumably inherited the tannery”\(^7\), but is unlikely ever to have worked in it; the demands of politics almost certainly meant he would have delegated operating responsibility by the time of the Peloponnesian War. These are also Type I industries and again some offer the potential for product differentiation.

- Teams of slaves who operated under a slave-foreman and paid a fixed sum to their owner. These seem to have been confined to Type IIa crafts where skills offer the basis for competitive advantage. It would be too risky for a lessee to hire a team in IIb businesses where the skills were not special enough to guarantee demand and the margin probably too tight to pay the *apophora*.

- Small workshops which might belong to poorer citizens, freedmen or metics; in these the owner did the bulk of the work himself, supported as occasion demanded or opportunity offered by one or two slaves or family members. There is no doubt that

\(^7\) Davies (1971) 319
these “mom and pop” operations formed the vast majority of workshops, but it is less certain that they accounted for the majority of manufacturing output. Again these are Type II crafts. Those with a particular skill in making differentiable products would have made a handsome living, though would not have been able to expand successfully as success depended on individual skills.

In one or other of these guises, or in variations on them, many people from all social groups participated in manufacturing. We now explore their incentives for doing so.

**The Investor Class: Rich Citizens**

Determining what proportion of citizens might be deemed “rich” is obviously a matter of judgment, but our objective here is to differentiate those citizens who were looking for income from investments from those who sought it from their own labour. Ober points out that “Greek writers seem to have had no well-developed concept of a middle class. The sources typically speak of the ‘wealthy’ and the ‘poor’, meaning by the former the leisure class and by the latter those constrained to work for a living.”

Davies argues that the wealth needed to be a liturgiast was three to four talents and that not more than three or four hundred citizens would qualify at any one time. He goes on to suggest that the number with net assets of a talent or more was probably around 1,200 and certainly not more than 2,000. A talent was more than enough to be able to make investments in loans to friends, property, maritime ventures, industrial slaves or mining leases, especially as families with this level of wealth are likely to have been able to feed their household from their own farms; perhaps even selling a seasonal surplus or two. Harris suggests there were about twelve hundred liturgiasts in the fourth century and a slightly larger group paying the eisphora (a form of wealth tax). Some who missed this mark were still comfortably off: “A person who owned property assessed at 2500 drachmae (a little over 40% of a talent) would probably have had land, housing, and 4 or 5 slaves and to increase his income he may have chosen to work part of the time.”

1500 drachmae invested in manufacturing would buy four or five slaves and a cash return of

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8 Ober (1989) 27-8
9 Davies (1981) 6-35
10 Harris (1995) 18-9
11 Rhodes (2004) 130
around four minae.\textsuperscript{12} It is probably reasonable to think in terms of the richest 20% of citizens as being in a position to invest, although some of them might have worked for income as well.

While it is important to remember that the commercial activities of citizens with funds to invest did not generally extend to hands on participation in manufacturing, there is no suggestion in any of the original sources that income from owning industrial slaves was rare or unworthy. On the contrary, it quickly becomes apparent that for a number of distinguished citizens, commercial activity, including investment in manufacturing, was an important source of income. Some owed their wealth and status to manufacturing operations that they or their forebears had started themselves;\textsuperscript{13} others treated it as an attractive investment opportunity. Christesen summarises the different options for an Athenian citizen who had funds to invest.\textsuperscript{14} He could choose real property, lend against land or domestic commerce, acquire slaves to produce goods for sale, make maritime loans, or acquire a mining lease. Another option, which probably involved less risk, was to acquire by tender the rights to collect specified state taxes (Andoc. i.133). Many Athenians would have followed Hesiod’s recommendation not to put their all into “hollow ships” (\textit{Op}./\textit{689}) and diversified their investment across multiple asset classes. On the premise that “expressive rationality should be the base assumption in ancient economic history”, Christesen suggests that returns in different investment and lending options reflected their relative risk: real property yielded about 8%, loans on land or domestic commerce 10-18%, and maritime lending 15-25%.\textsuperscript{15} He argues that this “widespread pattern of economic decision–making where investors…demanded a return commensurate with the anticipated risk….could only have come into being in a economic environment populated by investors employing instrumental rationality with income maximisation as a dominant preference.”\textsuperscript{16}

The option with the lowest risks and returns, land ownership, was an active occupation and not simply a matter of collecting rents. The standard plot size was small; poorer citizens

\begin{itemize}
\item \textsuperscript{12} See Chapter Eight
\item \textsuperscript{13} de Ste Croix ((1981) 124) expresses a belief this occurred “less often than is generally supposed”, but does not attempt to quantify it further. Cleon, Anytos, Lysias, Isocrates and Demosthenes are among known examples.
\item \textsuperscript{14} See also Chapter Two and Homer (1996)
\item \textsuperscript{15} Christesen (2003) 39
\item \textsuperscript{16} Christesen (2003) 53
\end{itemize}
worked their own lands while those who owned several plots would employ gangs of slaves or (probably seasonally) poor citizens without farms of their own. Athenians were constrained by politics and geography from large landholdings in Attica, but these restrictions themselves must have led to attractive returns for those with land to rent out, given demand from, among others,metics and khoris oikountes slaves. Overseas real estate helped and “certainly it is plain that at the height of Athens’ imperial power, wealthy men benefitted immensely from the possession of landholdings overseas”. Acquisition of land in Attica at least was a zero-sum game and behind the rhetoric of democracy, this disparity in landholdings might have underpinned a continuing class division.

Davies describes an extended family that consolidated their domestic power base over several generations through intermarriage, marriage within the deme, judicious adoption of relatives and cunning funeral arrangements. A scion of this family, Theopompos, broke the mould, married out of the family and deme, and set about acquiring his relatives’ shares of the family holdings through employing the best lawyers to exploit the inheritance and adoption laws and making bargains with suborned co-litigants whom he later betrayed. This shady behaviour certainly confirms Foxhall’s view that increasing landholding was difficult, but Davies is probably overstating the case to say there was no market in land – although the legal process took some time, the poletai seem to have had no trouble finding buyers for the estates confiscated from those who profaned the Mysteries or from the Thirty Tyrants. It was a source of income for the wealthy but only one of several and, other than by overseas colonisation, a hard one in which to accumulate much beyond one’s inheritance. The notion that the elite favoured investment in land over commerce is contradicted by Kron’s prosopographic analysis; he concludes that “no clear relationship can be demonstrated between an individual’s social status and pattern of investment, whether in landed or commercial wealth.”

Lending money in general was a major source of income for those with capital and conducted in a fairly sophisticated manner. Francotte thought that a citizen’s favourite use of capital was lending, and it was by no means only against real property. Wealthier citizens typically

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17 Foxhall (2002) 214
19 Walbank (1982) 95-7
20 Kron (1996) xiii
21 Francotte (1900-01) I.213
financed the trade of poorer ones through maritime loans whose terms could be extraordinarily complex and provide differentially for a wide range of contingencies (Dem. xxxv.10-13). Many such loans were syndicated, which enabled more specialised and informed opinion to be brought to bear on risk and investors to diversify into multiple shared risks rather than take on a few large ones themselves. It was also possible to lend money against manufacturing slaves or working capital: Pantainetus’ ore processing facilities and its slaves seem to have been largely or wholly pledged (Dem. xxxvii.4). Mantias and his son funded their mining interests with debt (Dem. xl.52). Aeschines took on a succession of loans for his perfume business (Lys. fr.38). Aristarchus borrowed to fund raw materials for making clothes (Xen. Mem.2.7.11-12) and Athenogenes to buy stock for his perfumery (Hyp. iii.6.9-10).

Although not strictly a manufacturing business, a well documented instance of how the Athenian elite liked to put their capital to productive purposes is the mining industry. Mines played a vital part in the success, perhaps the very existence, of classical Athens. “It is far more true that the battle of Salamis was won in the mines of Laureion than that the battle of Waterloo was won on the playing fields of Eton.”22 Over a six year period there were at least 149 new mine leases sold by the state each year. With around 10,000 slaves in the mines, each costing at least one obol a day, a large number of citizens was taking a capital risk. We have many examples of well-to-do mining entrepreneurs. Diotimos was heavily involved in mining, both as registrant and lessee, and owned workshops around Laureion and Thrasymos which together were enough to enable him to afford a trierarchy, guarantee ships for Chalkis in 340 BCE and donate a large number of shields after the battle of Chaironea, for which he was crowned by the city.23 Pheidippos of Pithos, whose name appears most frequently in the mine leases analysed by Shipton, had a son who followed his mining interests and became a trierarch himself.24 Demosthenes tells how two brothers inherited 45 minae each, which, lent at interest, would have brought in the average wage, but chose to invest in the more lucrative mining industry instead (xliii.22). Nicias, the well-bred, leisured aristocrat, was very active commercially as a large employer of mining slaves (Xen. Vect.4.14). Other mining

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22 Bromehead (1945) 89; despite mining’s huge contribution to public and private wealth, the Athenians of classical times left a lot behind. Strabo (IX.1.23) says the dross still yielded good ore in his time and when the mines were reopened in 1864 this dross yielded 81.5 ounces of silver (White (1917)).
23 Davies (1971) 163-5
24 Shipton (2002)
entrepreneurs to do exceptionally well were Epicrates, whose mining syndicate made 300 talents (Hyp. iv.35), and Diphilus, whose pile of 160 talents was distributed to the people by Lycurgus (Plut. Mor. 843d).

To increase their wealth – or to convert capital into a steady income stream – those with capital might choose to invest directly in a workshop or in a team of manufacturing slaves. “Investment in the crafts, at least to the extent of owning workshops and enjoying the profits, was a feature of city life throughout antiquity; such ownership was not confined to the lowly, the poor or the lacking in initiative.” Strictly speaking, as we discuss at length in Chapter Eight, many owners enjoyed not the profits of their workshops, which usually went to the foreman-slave, but a secure fixed dividend. Direct investment in manufacturing offered an alternative to mining or leasing of land; riskier than land, manufacturing would have offered more predictable returns than mining but without the chance of spectacular upside.

A number of distinguished Athenian families appear to have owed their wealth to success in manufacturing, whether by building a business through hands-on enterprise or investing in a team of slave craftsmen and labourers. Anytus inherited a tannery and, despite Xenophon describing the operations as slave-like, he did well enough to have been accused of bribing a large number sitting in judgement on him and to lose a lot of money under the rule of the Thirty ((Arist.) Ath.Pol. 27.5). He seems to have moved in the best circles, and was rumoured to be one of Alcibiades’ lovers. Cleon’s inherited wealth stemmed from his father’s tannery. Demosthenes inherited two factories (xxvii). Timarchus owned a team of shoemakers (Aeschin. i.97); and Athenogenes a perfumery (Hyp. iii).

These documented instances of citizens’ investments in manufacturing are of three types: direct investment in a manufacturing operation, generally run by a slave on the owner’s behalf (Demosthenes, Timarchus and Athenogenes are examples; Anytus and Pantainetus are probably others though we do not have direct evidence); loans to other citizens who wanted to invest in manufacturing, such as Aristarchus and Athenogenes; and labour-hire businesses (Nicias). Direct investment was usually in Type I industries: the barriers to entry meant these were permanent, dedicated, specialised and “bankable” manufacturing operations which could be relied upon to provide an apophora. Most of the loans we know of were also in

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25 Burford (1972) 119
26 Scholiast on Pl. Ap. 18b, citing Theopompus Comicus fr.38 (PCP VII 735) and Archippus fr.31 (PCP II 549).
these industries for the same reason. It is no matter of chance that Cleon’s family wealth came from tanning and not from shoemaking; returns in the latter depended on individual skill and could not be captured by an owner in such a way as to be passed on through the generations. One could invest in Type II craft slaves as well, but the business might not outlive the slaves on whose reputation demand depended.

There were exceptions to this pattern; not all ergasteria of the rich were necessarily examples of profit-maximising investment strategies. Philocrates owned multiple properties outside the city, a house in the city deme of Melite, and two ergasteria next door to it.²⁷ Osborne suggests this combination—“an agricultural base in the country supplemented by industrial interests in the astu”—was probably common and “that the ergasteria were a worthwhile purchase for such a man may indicate their size”. Were these ergasteria dedicated year-round industrial operations using funds which, as far as the owner was concerned, could have been put into mining or commercial lending if he chose? Or were they sites in which members of a large slave labour force could occupy themselves productively as craftsmen in the seasonal intervals between other domestic and agricultural duties, as suggested in the Olynthus textile example in Chapter Five?

**Other Citizens**

For many other citizens, manufacturing was not so much one of a range of investment options as a means of survival. They were engaged almost exclusively in crafts and these were not only compatible with, but actually facilitated the exercise of their democratic rights and duties. Citizens who did not own land, of whom there were roughly 5,000, had to make a living another way.²⁸ Others would have needed income to supplement a bare sustenance from their small farms—a problem exacerbated by generations of inheritance and (probably) by the concentration of multiple land parcels in the hands of a few.²⁹ Choices included service in the military, hoping to be selected by lot to hear legal cases and carrying out other political duties for which the state paid a basic allowance. The income available depended on Athens’ ability to pay and the skills of demagogues in persuading the Assembly to agree to do so. Military pay consisted of board (sitos) and cash (misthon) with plunder a third, and

²⁷ Osborne (1985) 53
²⁸ Harris (2002a) 70
²⁹ For contrasting views on land distribution, see Foxhall (2002) 211-2; and Hanson (1995)
often the most valuable, component. Pericles introduced pay for hearing trials at the rate of two obols a day which Cleon raised to three (Plut. Per. 9.2-3; (Xen.) Ath. Pol. 27.3; Pl. Grg. 515e; Arist. Pol. 1274a). Attending the assembly was originally worth one obol; by the time of Aristophanes’ Ecclesiazusae it was three (308-9), and in Aristotle’s time as much as nine (Ath. Pol. 62.2). With the Assembly meeting at least forty times a year, this could contribute significantly to a poor citizen’s sustenance but the fact that it was paid at all suggests that, compared with pursuing a craft, civic duties would have been dull and unrewarding.\(^{30}\) There was also a system of public handouts. Cleophon introduced the diobolon, intended to be a daily dole of two obols (enough to support a very modest lifestyle), but it was probably only affordable irregularly and in short bursts. The theoric fund, created in the fourth century after the diobolon had been abandoned, tied dole payments to attending festivals and the theatre, so was not a permanent income source for the poor. The disabled (adunatoi) were beneficiaries of a special fund. These hand-outs made it more likely that poorer citizens would have the leisure to enjoy their democratic rights, but would not fully provide for a family without other sources of income.

In Chapter Two we saw that a careful reading of the sources suggests that while it might have been unworthy of a citizen to work for another, no such stigma attached to self-employment in manual labour. Hesiod praised it “Work is not a disgrace at all, but not working is a disgrace. And if you work, the man who does not work will quickly envy you when you are rich” (Op. 311-313). Manufacturing for income was admired by Xenophon: “By manufacturing one of these commodities, namely groats, Nausikydes keeps not only himself and his family, but large herds of swine and cattle as well, and has so much to spare that he often takes on expensive public duties as well and lives in luxury by baking bread, Demeas of Collytus by making capes, Menon by making cloaks, and most of the Megarians make a good living out of smocks” (Mem. 2.7.6).

This tolerance did not extend to paid employment in an enterprise owned by someone else. Isaeus bewails the lot of the free man compelled to accept paid employment (v.39), and Isocrates equates hired employment (thetia) with slavery (xiv.48), echoing the comment of Achilles in hell that even the abject condition of not having control over one’s own work – the worst imaginable condition for a free man – was better than being a prince among the

\(^{30}\) Scholion to Dem. xxiv.20; Harris (2006c) 103-120
dead (Hom. *Od.* XI.489-91). 31 Others went further, saying it was better to be a slave with a good master than to live a base life as a free man (Men. *Fr.* 564). Drawing on analogies from the antebellum Southern States, Scheidel (2002) has shown that status concern about working for another citizen was not peculiar to the ancients but, along with the same reasoning about leisure facilitating the virtuous life, tends to be strongest in slave-owning societies. There is little evidence of long-term employment arrangements for free men except in the navy, which is consistent with Cohen’s view that free men only undertook paid labour if there was no alternative and then would avoid committing themselves for very long. 32 Paid employment was regularly provided by the state, perhaps often with a view to enabling poorer citizens to earn some money on a temporary basis. With the exception of councillors and specific bureaucratic roles in tax-collection or regulation of the market or port, state employment was usually on public building works and tended to be sporadic and casual. Of those engaged in public works, architects and clerks of works were typically the only salaried citizens. Other long-term administrative posts in the state’s gift were invariably allocated to slaves. The Erechtheion work force was paid well, both skilled and unskilled workmen getting about one drachma a day. State-employed slaves, soldiers, sailors and day-labourers received about half of this, often being paid in food and clothing. 33

There has been much debate among economists about whether slavery depressed wage rates for the free. 34 Finley’s observation that wage-earners do not seem to have objected to competition from slaves is true, and for a very sound reason. 35 Other things being equal, free men would have been preferred employees for short-term needs or for risk-averse enterprise owners. In particular they were not likely to run away. They might have captured some of the benefits of the flexibility they offered by demanding a price premium over slave rental costs, but seem to have chosen not to, perhaps to preserve the greater certainty of employment when they needed it.

Harris suggests that probably all non-landed citizens (about a quarter of all citizens – (Dion. Hal. *Lys.* 34) were engaged in some form of productive activity. 36 Extrapolating from the

31 Garlan (1988) notes that the comparison is not with slavery – which a freeman cannot imagine!
32 Cohen (2002) 102
33 Loomis (1998) 232-239
34 Oertel (1925); Erb (1937, 1938)
35 Finley (1973) 79-80
36 Harris (2002a) 70
ratio of citizens to metics and slaves in the employment records for the building of the Erectheion, Harris estimates that 10,000 citizens in all would have been involved in goods or service industries, meaning that, contrary to the romantic view, up to half of the Athenian citizenry were not simple farmers at all. “Besides the small farmer, freeholder or tenant… the small craftsman who performed his trade alone or with the assistance of one or more slaves, was the normal type of citizen….” Even land holders would have been looking for employment and income during the summer months and pursuing a manufacturing craft would have been an attractive option for many of them. It is likely that a number of potteries only operated during the summer, in which drying conditions were better anyway (Thuc. II.40.2). In fact, “the essential for self-respect was that each citizen was employed in his own small business”, but unsurprisingly “the majority of Athenians were quite ready to give up the effort to make money as soon as they could afford a comfortable rentier existence.” Self-employment in manufacturing offered an option for a citizen needing or wanting more income than his own capital and the state could provide. This intense level of manufacturing activity led Francotte to place Athens well ahead of Corinth as an industrial centre, even though he saw industry as a distant third to agriculture and commerce.

In terms of our typology, most citizens engaged in manufacturing were involved in crafts in which everyone competed on equal terms and capital was not a constraint. In differentiated crafts those who could establish a skill and reputation would find they could get a premium for their labour and would be likely to operate full time in order to maximize their income and keep their customer base. Those who could not, made a living out of working on less differentiated products, perhaps as part of a portfolio of activities including attending the assembly, military service and market gardening. This would have especially suited those with land to be cared for during some of the year, or who chose to spend time on civic duty rather than in a workshop. With no economies of scale in production or capital barriers to entry in these craft businesses, even a poor citizen could compete effectively with larger producers, building a business on his own efforts and those of his slave(s) and financing expansion through retained earnings. The prevalence of such occupations is confirmed by what we know of the forebears of famous figures in the classical Athenian democracy:

37 Bolkestein (1958) 65
38 Jameson (2002) 170
39 Humphreys (1970) 16, 21
40 Francotte (1900-01) I.118
Sophocles’ father was a carpenter or a smith; Cephalos, the statesman and envoy to Chalkis, was the son of a potter; Cleon’s colleague Clephon made lyres (Andoc. i.146) and Isocrates’ father made flutes ((Plut.) Isoc.1). Such businesses were small and employed only one or two slaves but in some cases, where the degree of skill was high and in demand, they might have made an excellent income. Both lyre-making and flute-making are likely to have been such differentiated businesses and appear to have produced significant wealth for their owners. Philon, the architect and designer of the arsenal in the Piraeus, also became a trierarch (Aeschin. ii.150; IG 1622 694).

The only apparent exception to this general rule – that the involvement in industry of citizens without investment capital was in crafts businesses – is that some might have been responsible for originating firms that became Type I. Unfortunately we do not know whether the factories owned by Demosthenes, or the tanneries Cleon and Anytus inherited, had been grown organically from small operations, the founders having been fortunate enough to be early entrants in businesses with barriers to later ones, or whether an entrepreneurial founder had invested to achieve immediate scale, as it seems Pantainetos did, or whether the first owner was a metic who brought plenty of capital to Athens, like Cephalus the shield-maker. In any event, by classical times, most such Type I businesses were already in place and the ordinary citizen who lacked the resources to buy one was largely confined to crafts.

The link between earning income from crafts and democratic participation is a crucial one. Pericles stressed the compatibility of the industrial pursuits of the average citizen with civic duties (Thuc. II.40.2). Aristotle defined an Athenian citizen as “one who shares in the administration of justice and in the holding of office” (Pol.1275a), and writers of the period make clear that the Athenian assembly was far from the preserve of farmers and the idle rich. Xenophon’s Socrates lists crafts first in his description of the Assembly’s members (Mem.3.7.6) and a sausage-seller tells Aristophanes’ Demos that in submitting himself to the Assembly, he is about to put himself in the hands of “lamp-merchants, turners, leather-dressers and cobblers” (Eq. 738-40). It is no coincidence that the jobs mentioned are mainly

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41 Attributed to Aristoxenos in Life of Sophocles I.
42 Scholion to Ar. Eccl. 81. An earlier Cephalos, possibly related, is satirised as a potter later in the same play (248-53).
43 The profession of architect, though a service occupation, involves a highly skilled individual operator, and is similar in that respect to Type IIa manufacturing.
Type II. Many of these people would have been small farmers during the winter and served in the military in summer, but in town they were identified by their craft occupations. These casual craftsmen would tend to choose undifferentiated crafts that did not require continuous activity in order to maintain one’s skills, customer base and reputation. Manufacturers pursuing more differentiated crafts would have tended not to be away from Athens so much and were possibly over-represented in public activity in the city and this might be why several of the references are to Type IIa.

We noted in Chapter Five how developments in technology in many industries provided the barriers to entry that led to the consolidation of industry structures. In this sense, the history of technological development is also the story of the decline of the individual craftsman. Athenian democracy flourished at a time when there was still scope for the sole operator to make an adequate living on a less than full time basis in many fields which subsequently came to be dominated by large concerns demanding full-time employment and the indignity of working for someone else. The ability to combine income earning and political participation became more and more difficult as industries evolved and a participatory democracy on Athenian lines simply could not exist today. There is a strange irony about Finley’s world-view: his Marxist leanings led him to deny the relevance of economics to Athenian society. In fact the Marxist paradigm of industrial structures determining social ones provides a compelling explanation of the underpinnings of Athenian democracy.

**Women**

In Chapter Two we saw that the legal restrictions on women did not disqualify them from playing a major role in managing the *oikos*, the economic unit that owned assets and generated income for an Athenian family. The role of women extended far beyond what is today described as “housework” and meant women were very significant contributors to the entrepreneurial and industrial efforts of Athenians, even though for certain types of transaction they needed the assistance of a man. The comic poet Pherecrates suggested that before slavery women did all the work.⁴⁴ Xenophon observes that “the wife has primary responsibility for managing the household (*Oec*.7.35-43).” Ischomachos’ wife can run their entire household by herself (*Oec*.7.3) and Aristotle takes issue with Plato’s claim that men and women can do the same work on the grounds that women have households to run

⁴⁴ Long (1978) 381
A high level of female influence was an inevitable demographic consequence of the social custom of late marriage for men and early marriage for women; there were many widows and they held the purse strings. Female management of household finances, including productive investments and exchange of goods and coin with other parties, is common in many less technologically developed societies. In fact a case can be made that it is only since the Industrial Revolution, when the rewards for success in industry became large, visible and envied, that women were largely alienated from the management of production.

A woman’s role in industry often reflected that of the household’s kurios. Rich citizens’ wives and widows would have played a major role in investment decisions and many decisions on investing resources (capital and/or slave power) in industrial activity would have been made by women or at least with their interested involvement. They would also have helped keep the female members of the oikos and underutilised males busy in industries where the irregular participant is not disadvantaged, such as textiles. Ischomachos’ wife is a splendid example: she manages their slaves “like a queen bee”, plans the household’s consumption and manages the stores, and is charged with increasing the value of slave-assets through training (Xen. Oec. 7.32). The extent of female ownership of workshops is unclear as is shown by the debate over a vase painting which depicts a woman working in a pottery.\textsuperscript{45} Scholars agree that this is at least evidence that there were women potters, but while the raised dais suggests proprietorship, there is disagreement about whether women were qualified to own large operating workshops of the type depicted.\textsuperscript{46} Cohen, on the other hand, notes correctly that the amount they were allowed to own was quite large, and certainly enough to cover most day-to-day business activities.\textsuperscript{47}

For women of the households of poorer citizens, metics and freed slaves, the oikos was the ergasterion and, very often, the lady of the house was the foreman. “The division between business and workplace as a sphere of production and household as a sphere of consumption was entirely absent from classical Athens.”\textsuperscript{48} They would have helped – perhaps managed – the family’s involvement in an undifferentiated activity (IIb), but would have had less of a

\textsuperscript{45} The Caputi Hydria: Daremberg (1896), 1127, fig.304
\textsuperscript{46} Beazley (1944) 13; Richter (1923) 71; Venit (1988) 270 suggests the dais was a compositional necessity in any case.
\textsuperscript{47} Cohen (2002) 106
\textsuperscript{48} Harris (2009) 3
contribution to make where their husband was selling a premium skill (IIa), although we know of a female cobbler (IG II 2 1578.5) and a metalworker and Artemis did the gilding for her helmet-maker husband Dionysus (SIG. 1177). These are thought to have been exceptions. Female slaves were occasionally employed in workshops but more usually in the home and sometimes as prostitutes with the owner as pimp. Ergazesthai meant both “to work at a paying activity” and, in the modern euphemism, “to be a working girl”.

Other women played roles that were quite independent of any male relatives, generally in undifferentiated crafts, often to do with food or textiles. Not only were these seen as typically feminine occupations; they also allowed intermittent involvement and could be taken up or dropped as other demands such as child-bearing allowed. In Aristophanes we find many women operating places of refreshment – kapelides (Plut.426, 1120) or pandokeutriai (Ran.549ff) – and female vendors of bread and vegetables (Vesp.). Others sold garlands (Thesm.446-58). The most common items manufactured by women for sale were textiles; selling ribbons seems to have been a major sector (Dem. lvii.31), while some made dresses for market (Ar. Ran.1349-51). Thirty-one out of 42 identified professions of females in the manumission lists were taleisourgoi – a far higher concentration in a single trade than among men. There were some things women did not do: Pherecrates (Fr.70) says no one has seen a woman fishmonger or butcher and they are not attested as selling books or armour.

The literature seldom makes explicit the social status of the women whose occupations are described. Many would have been metics or slaves or freedwomen, though the bread and vegetable sellers in the Wasps seem to be citizens’ wives, as were Lysistrata’s army of tradeswomen. While the need to earn was the reality of life for many women, it was not seen as honourable. “The sale of a woman’s produce (or of her labour) was the refuge of a woman in need of money.” Euxitheos knew that his mother’s past as a wet-nurse was an obstacle to his being granted citizenship (Dem. Ivii.31-5), despite the fact that wet-nursing was the most

49 This might have been a potter (Green (1961) 73-75).
50 Green (1961)
51 Schaps (1979) 19
52 Brock (1994) 340-341;
53 Schaps (1979) 18
common occupation on the gravestones of citizens’ wives and daughters. It is probably true that a wife not earning income was something of a status symbol, and that “only economic necessity made a woman ever do work for external consumption”, but there is little doubt that economic necessity bound a large proportion of the female population, including the wives and daughters of citizens.

**Metics**

Metics were outsiders, some Greek, some barbarian, who had either come freely to Attica to take advantage of the opportunities it offered for trade and industry, or had been brought in as slaves and then given their freedom, choosing to stay where they knew they could make a living rather than returning to the clan or tribe which had as likely as not sold them into slavery in the first place. Though registered in demes they were not considered members of them and had no political rights or the capacity to hold public office (Arist. *Pol.* 1275a). They could not marry a citizen and could only bring private lawsuits before the *polemarch*, although they had the same right of hearing as citizens in public trials. They received no allowances or social benefits but were liable for military service and fought in the army, especially in local campaigns, and as rowers (*Xen. Vect.* 2.1-2). Borrowing was restricted because they could not own land to offer as security on loans. Despite these drawbacks, they specifically sought to live in Athens where their rights were at least protected more than in many other places and they were free to make a living, sometimes a very good one. Burford calls Athens “the labour exchange of the Greek world.” The fact that the highest proportion of metics settled in urban demes is indirect evidence of the importance of their contribution to industry. Many were entrepreneurs, trained in metalwork, pottery or other trades. The *metoikon*, an annual tax, which was not based on income or assets but simply an annual charge for the right to live and do business in Athens, shows they felt these business opportunities were worth paying for. Nicias used the commercial attractions of Athens to motivate metic rowers before the battle at Syracuse (Thuc. VII.63).

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54 Brock (1994) 337
55 Brock (1994) 346; Schaps (1971) 19
56 Burford (1972) 35
57 Burford (1972) 59
58 Isager (1975) 70-73
Manumitted slaves were assigned metic status but frequently continued to have obligations towards their original masters – obligations enshrined in the *dike apostasiou*.\(^{59}\) They were often obliged to continue to live with and work for him and even provide him with slave-children. Purchasers of a workshop of slaves preferred the foreman to have been freed first, so as to avoid taking on responsibility for any debts he might have. Epicrates got caught like this (Hyp. iii.4-9). In general freed slaves are thought to have performed lower status work than foreign metics.

Some metics or freed slaves had the wherewithal to establish or acquire industrial businesses. Cephalus’ set up a shield factory and Pasion bought one. More commonly they used their wealth to finance trading enterprise. Among a group of lenders who financed Athenian foreign commerce by maritime loans, there were 12 metics and aliens but only seven citizens.\(^ {60}\) Many ships were probably self-financed (and not represented in the literature because self-financing would give rise to fewer disputes), but again many of the owners would be metics. Isocrates (vii.32; xv.159-60) and Demosthenes (xxvii.61; xxxiv.51) emphasised that lending to such entrepreneurs was of prime importance for the development of the city. Pseudo-Xenophon suggested that Athens treated metics well because they were useful for trades and in the fleet (*Ath.Pol*.1.12), and Xenophon proposed that metics who offered capital and services to the city be rewarded with property rights (a small parcel of land and a house) and be exempt from military service so as to encourage more metics to settle in Athens (*Vect*.2.1-6). Any hostility towards metics was more likely to have been xenophobic than economic.

The majority, who were without investment capital, and some of those with it, would have set up and run craft operations. It is safe to assume that virtually all metics would have been directly involved in the production of goods and services as there were few other ways for them to make a living.\(^ {61}\) Several considerations lead one to speculate that the proportion of metics in the more demanding and lucrative IIa crafts rather than the simpler IIb ones was higher than the comparable ratio for citizen craftsmen; their predominantly urban demes, the greater likelihood that they would be working full time in the absence of civic or agricultural duties and their willingness to pay the *metoikon* all point to such an inference.

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59 Harpocrates’ *Lexicon* s.v. ‘apostasiou’; cited in Westermann (1945) 95
60 Isager (1975) 72
61 Harris (2002a) 70
Aliens

Labour on public works, in Athens and elsewhere, seems to have been largely undertaken by itinerant craftsmen and labourers, reflecting the difficulty of staffing large and infrequent projects from a small local population. Some foreigners, however, came to Athens to conduct commerce on their own account. To participate in market activity in Athens, they had to pay a xenika tax, but still had limited legal rights. Unless they became metics, they could only bring a lawsuit if a treaty had been signed with their home town. They had explicit rights to appear before the dikai emporikai, and before that tribunal was established in 350 BCE there were probably similar arrangements in place. The notion that there were citizens at Athens whom other cities had appointed to look after the legal interests of their aliens has little support; any proxenoi arrangements were probably ad hoc, but might nevertheless have been quite common. An alien who had stayed for a certain period of time in Attica had to register as a metic and enrol in a deme under the auspices of a prostates or guardian. If he stayed beyond a certain time without registering, he could be sold into slavery. Xenoi made up the majority of traders frequenting the Peiraeus, ranging from major investors with the ability to finance an entire ship and its cargo to modest dealers who shared voyages and arranged finance for their own moiety of the cargo while the master contractor insured the ship itself. From the point of view of Athenian manufacturing, aliens were competitors or suppliers in importing and trading, but any alien who wanted to set up as a manufacturer in Athens would almost certainly have become a metic.

Slaves

While slavery “may have been a social institution, that does not imply that no important economic consequences flowed from it.” Cartledge, following Finley, cites three preconditions for slavery: an unequal economic system, a market for slaves and the lack of

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62 Isager (1975) 69
63 Gauthier (1972)
64 Cartledge (1998) 27-8
65 Weidemann (1997) 31
other labour. The first prevailed in Athens as a result of unequal landholdings and the second as a result of wars. The third seems to have stemmed from a combination of the demands of agriculture or military service on smallholders, the availability of irregular income from the state and the mentality among citizens which associated paid employment with humiliation.

No slaves are mentioned as craftsmen in Homer or Hesiod, crafts being a way for serfs to achieve independence from working for a master. From the earliest times slaves almost certainly did much of the work inside the oikos that later became the production of goods for sale and by the classical period, when even households of modest means are likely to have owned at least one slave, it is safe to assume that any oikos making goods for market would have employed its slaves in production, perhaps working alongside the master when he was around and continuing on their own or with other family members when he was at court or attending a play or otherwise engaged.

French believes that domestic slaves made up the largest proportion of the slave population, followed by mining slaves (estimated at 10,000) and then industrial slaves. This is plausible but probably draws a sharper distinction between domestic and industrial slaves than the Athenians did. Demosthenes describes the manufacturing slaves he inherited as having been left to him “in the house” (xxvii.24). In terms of desirability, the worst lifestyle would fall to a chattel slave in a mine where the labour was hard and the working conditions appalling. They were leased out at the low rate of one obol a day (Xen. Vect.4.14) and were probably confined to mining for all their short and miserable working life. To work at a craft, often beside your master, would have been much better. Best of all was being trusted to run your master’s business.

As we saw in Chapter Two, their lack of any legal rights does not seem to have prevented slaves from carrying out considerable business activity. As the only option for a permanent labour force, slaves played a vital role in industry; owners of large industrial businesses without the time, inclination or capacity to carry out day-to-day management became very dependent on slaves. Sometimes their trust was abused. Demosthenes shows how Moschion took advantage of his master Comon (xlviii.14-15) and Cittos and his accomplices were

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66 Cartledge (2002) 162
67 See Appendix B
68 French (1964) 156
accused of appropriating the enormous sum of six talents from their masters (Isoc. xvii.11-12). Leaving a slave to get on with running the business after paying a fixed *apophora* was supposed to circumvent such problems; the slave took the risk on the business. Demosthenes’ factories were run by freed slaves (xxvii.19) and the slave Midas managed Athenogenes’ perfumery works (Hyp.iii). Similar arrangements applied to slaves in craft businesses: Timarchus’ team of shoemakers had a slave as leader or *hegemon ergasteriou* (Aeschin. i.97). Sometimes masters seem to have left slaves to carry on their own businesses as sole operators, provided they paid the *apophora* as seems to be the case with Menander’s charcoal-burner (*Epitreps* 380) and Timarchus’ woolworker. Cohen lists numerous other examples of slaves operating in similarly autonomous arrangements, supporting the view that this was a common way of doing business.\(^{69}\) Slaves would save the profits they made and eventually use them to buy their freedom. This was an attractive system for the capitalist; he received a steady income at little risk and with little personal effort, followed by a capital sum and continuing obligations on the part of the manumitted slave who often continued to work in the same enterprise. It also led to a proliferation of small business enterprises as some freed slaves left their masters and went into business on their own account and the cycle started again. Slaves could also do very well even when the master kept the operating risks himself: Nicias paid his mine overseer the massive sum of one talent and, we presume, kept the profits from the latter’s efforts in leasing out his slaves. From the names we have of slaves who enjoyed such arrangements, it appears that these privileges and opportunities were only available to Greek-born slaves rather than barbarians who were more likely to have been confined to work in fields, mines and brothels.

While slaves who enjoyed these positions of responsibility and the income and chance of freedom they brought are well-documented, they would have formed only a tiny fraction of the slaves engaged in manufacturing. By far the majority would have been engaged in basic labouring tasks, either on the shop-floor of large industrial operations or assisting their masters in crafts such as shoe-making or pottery. Some might spend most of their time on agricultural or domestic duties and occasionally be set to work on crafts to supplement the *oikos*’ income. Female slaves would have been responsible for much of the textile production in classical Athens, most of it being for home consumption.

\(^{69}\) Cohen (2002) 103
Overall, whatever their reputed capacity for innovation, slaves had advantages as employees. Good workers were valuable, and well looked after. They were exempt from political and military duties and had no option but to report for work each day. They had to concentrate on their work as there was nothing else that would provide security for themselves and their families. Some could be motivated by expectations, others at least by fear. As Bresson puts it, “on achétait donc un esclave comme aujourd’hui on achète une machine”, referring to a similar sentiment in Aristotle (Pol.1255b). On the other hand, they represented a capital outlay (or opportunity cost) and their maintenance was a fixed expense, independent of their productivity. Death, disease and debility were costly risks for slave owners.

One possible conclusion from the rapid growth in slave numbers, especially in the fourth century, is that it indicates a rise in manufacturing. Although there might have been some growth in silver mining, it could not account for a very large part of the increase in the slave labour force. Agriculture would not have needed more labour, (except perhaps for adding value to produce, which was not a big business), so unless we assume that the average number of domestic slaves per household more than doubled (which is possible but unlikely), we might infer that the additional slaves were wanted to operate new or expanded manufacturing enterprises.

Towards a Quantification of Participation in Manufacturing

Such attention as has been paid by ancient historians to the subject of manufacturing in classical times has tended to be qualitative or anecdotal. The limited data have not encouraged any quantification of the extent and form of participation among Athenian residents and the attempt to do so that follows must be recognised as very approximate and with little pretension to historical precision. It is presented for two reasons: first, quantification can sometimes be revealing in terms of ratios and proportions, as these are likely to be subject to less error than the raw data themselves; second the methodology

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70 This is addressed in Chapter Nine
71 Bresson (2007) 197
72 See Appendix B
outlined may provide a basis for better informed and more skilled historians to achieve a more accurate quantification than this one.

The estimates that follow are based upon population numbers and demographics that might be considered representative of Athens in the classical period. These are detailed in Appendix B. First we estimate the proportion of males engaged in industry (Table 6.1), then the proportion of females (Table 6.2). When we combine them, we find that over a quarter of the entire adult population was probably engaged in manufacturing as a source of income, which implies it deserves more attention than is usually paid to it by modern historians. Finally Table 6.3 attempts to allocate participants to the four Types of manufacturing based on the analysis in the earlier sections of this chapter.

The number of rich citizens involved with manufacturing we can only make a guess at based on anecdotes, but it is small. Since many of the more intimate forms of personal service were carried out by slaves, the proportion of working citizens earning a living through manufacturing is likely to have been higher than the 30% manumission lists indicate for slaves (see below). For citizens without land who chose manufacturing, it would have constituted a major source of income and a full-time occupation and we estimate 50% of them were involved in it. The same considerations apply to metics. For citizens with land, it was a casual and seasonal supplement to other sources and perhaps 30% would have been involved. In calculating the proportion of slaves engaged in manufacturing, we factor our population estimates by the proportion of those occupations represented in the manumission lists that are manufacturing businesses (approximately 30%). Among 110 slaves in the manumission lists, Harris has identified 98 occupations including 26 in craft or industry, 35 in retail, 13 in agriculture and 12 domestic. Glotz identifies 69 slaves who continued in the same line of business after they had obtained their freedom. Of these, 24 (35%) were involved in manufacturing, including nine leather workers, a tanner and a dresser. A large number of slaves were not included in this sample because their duties were exclusively or

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73 Lewis (1959) 368-80
74 Harris (2002a, App.1.88-97) also identifies a number of service occupations including doctors, barbers, hairdressers, wet-nurses, inn-keepers, clothes-cleaners, bankers, money-changers, bath-house keepers, prostitutes, musicians, and various kinds of teachers. Some of these occupations would have required serious learning and apprenticeship and a dedicated pursuit; others would be occasional opportunities to earn a few obols.
75 Glotz (1926) 230
almost exclusively domestic. If we assume that exclusively domestic slaves accounted for the same proportion of the total as in the manumission lists (12%), then we again have a figure close to 30% for the proportion of slaves in involved in making goods. With around 20% of male slaves being in the mines, this allows for each citizen involved in manufacturing to be supported by at least one male slave and the remainder to be employed by metics or in larger groups.

These figures are summarised in Table 6.1.

**Table 6.1: Industry Participation by Social Group: Adult Males**

<table>
<thead>
<tr>
<th>Social Group</th>
<th>Adult Male Population</th>
<th>Role/ Reason for Participation in Industry</th>
<th>Estimated % in Industry</th>
<th>No. in Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rich Citizens</td>
<td>5,000</td>
<td>Investment option</td>
<td>5</td>
<td>250</td>
</tr>
<tr>
<td>Other Citizens: Landless</td>
<td>5,000</td>
<td>Prime source of income</td>
<td>50</td>
<td>2,500</td>
</tr>
<tr>
<td>Other Citizens: Landed</td>
<td>15,000</td>
<td>Supplement other income from agriculture or state duties (seasonal)</td>
<td>30</td>
<td>4,500</td>
</tr>
<tr>
<td>Metics</td>
<td>15,000</td>
<td>Income</td>
<td>50</td>
<td>7,500</td>
</tr>
<tr>
<td>Slaves</td>
<td>50,000</td>
<td>Assisting master – either in a small workshop or a large team. Occasional casual work (large households). One of the better life-styles for a slave, offering some the opportunity of freedom</td>
<td>30</td>
<td>15,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>90,000</strong></td>
<td></td>
<td></td>
<td><strong>29,750</strong> (33.1%)</td>
</tr>
</tbody>
</table>

If we convert this to full-time equivalent employment by excluding rich citizens (for many of whom any hands-on income earning activity was negligible), and reducing the figure for landed working citizens by 50%, the numbers still suggest that manufacturing kept almost 30% of the adult male inhabitants of classical Athens occupied.
The proportion of females among the citizen group involved in manufacturing was likely to have been higher than males as the wives of many poorer citizens would have been engaged in manufacturing while their husbands performed other tasks – perhaps in the fields or in the navy or on other state duties – or in selling textiles and food products on their own account. On the other hand, a higher proportion of the wives of slaves are likely to have spent their time in domestic service or prostitution, rather than in making products for market. While males with metic status probably had fewer female dependants than citizens and slaves, more of these females are likely to have been involved in earning money alongside their husbands or while the latter were engaged in trading or financing activities. Hence:

Table 6.2: Industry Participation by Social Group: Adult Females

<table>
<thead>
<tr>
<th>Social Group (Wives, Widows or Daughters of:)</th>
<th>Adult Female Population</th>
<th>Role/Reason for Participation in Industry</th>
<th>Estimated % in Industry</th>
<th>No. in Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rich Citizens</td>
<td>5,000</td>
<td>Inheritance/managing the affairs of the oikos</td>
<td>10</td>
<td>500</td>
</tr>
<tr>
<td>Other Citizens:</td>
<td>20,000</td>
<td>Assisting husband; taking charge while husband was engaged in military or state duties. Widows or single women making a living selling fabrics or food.</td>
<td>50</td>
<td>10,000</td>
</tr>
<tr>
<td>Metics</td>
<td>12,000</td>
<td>Assisting husband/ bringing in extra income for metics involved in trading.</td>
<td>70</td>
<td>8,400</td>
</tr>
<tr>
<td>Slaves</td>
<td>50,000</td>
<td>More limited involvement because more would have been involved in domestic duties and/or prostitution.</td>
<td>10</td>
<td>5,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td>87,000</td>
<td></td>
<td>26</td>
<td>23,900 (27.5%)</td>
</tr>
</tbody>
</table>
This calculation refers only to making goods for sale; up to 100% of the wives of poorer citizens and non-mining slaves would have been involved in making food and clothes for home consumption.

Combining the calculations for males and females, almost a third of the adult population of Athens was engaged in manufacturing goods for sale – or just under 30% after adjusting for part-timers.

Drawing on the analysis of the different industry Types from earlier in this chapter, a tentative allocation of social groups among these Types is shown in Table 6.3.

**Table 6.3: Industry Participation by Social Group and Industry Type**

<table>
<thead>
<tr>
<th>Social Group</th>
<th>No in Manufacturing</th>
<th>Type Ia - Differentiated Industry</th>
<th>Type Ib - Undifferentiated Industry</th>
<th>Type Ia - Differentiated Craft</th>
<th>Type Ib - Undifferentiated Craft</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rich citizens - M</td>
<td>250</td>
<td>150</td>
<td>80</td>
<td>20</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Rich Citizens - F</td>
<td>500</td>
<td>300</td>
<td>150</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Citizens – Landless - M</td>
<td>2,500</td>
<td></td>
<td>1,000</td>
<td>1,500</td>
<td></td>
<td>B</td>
</tr>
<tr>
<td>Other Citizens – Landed - M</td>
<td>4,500</td>
<td></td>
<td>500</td>
<td>4,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Citizens – F</td>
<td>10,000</td>
<td></td>
<td>500</td>
<td>9,500</td>
<td></td>
<td>C</td>
</tr>
<tr>
<td>Metics - M</td>
<td>7,500</td>
<td>100</td>
<td>100</td>
<td>3,500</td>
<td>3,800</td>
<td>D</td>
</tr>
<tr>
<td>Metics - F</td>
<td>8,400</td>
<td></td>
<td></td>
<td>900</td>
<td>7,500</td>
<td></td>
</tr>
<tr>
<td>Slaves - M</td>
<td>15,000</td>
<td>2,500</td>
<td>2,000</td>
<td>5,000</td>
<td>5,500</td>
<td>E</td>
</tr>
<tr>
<td>Slaves - F</td>
<td>5,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>53,650 (30.3% of pop.)</td>
<td>3,050</td>
<td>2,330</td>
<td>11,470</td>
<td>36,800</td>
<td></td>
</tr>
</tbody>
</table>
NOTES:

A: Rich citizens and their widows would tend to invest almost exclusively in businesses with barriers to entry, though some acquired skilled slaves as income generators in such occupations as shoemaking. Allocation between Type Ia and Ib is an estimate based on impressions from literature. Opportunistic deployment of domestic slaves in pottery or textiles at times they were not busy is not included here.

B: Citizens would not work for others (Type I). Allocation of landless citizens between Type IIa and IIb is an estimate but consistent with Harris’ analysis of manumission lists. The proportion of citizens with land engaged in Type IIa would be lower, as these crafts were hard to succeed in on a part-time or seasonal basis.

C: Instances of women working in Type IIa crafts seem rare. A large number would either be helping their husbands manage a slave or two in a business demanding less craft skill, or making simple products to sell on their own account.

D: Some freed slaves owned Type I factories. Of the rest, the fact that many came to Athens for the commercial opportunities suggests that they would have been expecting to earn a good income – hence a relatively high ratio of Type IIa activity to Type IIb.

E: This allows for an average of one and a half slaves supporting each citizen in Type IIa activity, 1000 being available for lease and 1000 helping the better-off metics and freed slaves. For Type IIb there is one male slave for each male citizen. The vast majority of citizen women in Type IIb activity would neither have needed nor been able to afford slaves. The numbers allocated to Type I activities are residual but consistent with the limited indications of Type I businesses in the primary sources. Female slaves worked predominantly in the house; those who didn’t would have lent a hand in simple tasks in potteries and making garments or food products (IIb), though the numbers here represent only the small part of these activities that was aimed at the market rather than home consumption.

Rough though these estimates are, they are consistent with the analysis of the original sources earlier in this chapter. Above all they confirm the picture we find in Aristophanes and the philosophers of the dominant mode of commercial activity for all Athenian residents but the very rich being simple, unskilled and fragmented (Type IIb).
Industrial Athens

We are now in a position to start to paint a picture of industrial Athens, combining our analyses of types of manufacturing and the demographics of participation with recent epigraphic and archaeological findings. In the early classical period, the Agora resumed its importance in manufacturing. It had been the major production centre from the start of the millennium but activity had declined and the area contained mainly private dwellings and retailing outlets for most of the seventh and sixth centuries. There were still some potteries, shoemaking and metal working operations in the North West corner, but now most manufacturing was located in the area between the Areopagus and the Hill of the Nymphs. Even that was starting to be squeezed out by the intrusion of large public buildings in the decades after the Persian Wars and many other districts were starting to blossom into significant centres of production. The Cerameicus’ role as the city’s main necropolis was constrained by the presence of multiple ergasteria and almost all houses in the Inner Cerameicus were active in manufacturing. As space constraints became more pressing, production moved further out to the area between the Long Walls and the city wall which became a major production centre. Colonos Hippios Street and Demosion Sema also overtook the central districts as manufacturing areas. Even with this significant concentration of manufacturing in particular quarters, it would be wrong to infer that production was limited to these locations. Across the city between 20,000 and 30,000 houses were involved in manufacturing goods for sale, with workshops in or alongside the living quarters as was typical in other cities of the time such as New Halos and Abdera. The vast majority of these were modest establishments occupied by poorer citizens, metics or freed slaves where the master’s efforts were supported by one or two people, often their wife and a slave. These ancient forerunners of today’s industrialised

76 Except where otherwise noted, locations follow Monaco (2000) 19-46; 69-103.
77 Jones (1975) 70-1, 93. Note the co-location of Type IIa and IIb activity that continued into classical times.
78 Reinders ((1988) 1256ff) has identified a large part of a house occupied by a workshop for manufacturing figurines, and two rooms in the House of the Coroplast dedicated to weaving and pottery.
79 Laziridis (1952) 272
80 Hasebroek (1928) and Oertel (1925) both suggest that the average factory had 20 to 30 slaves, but this is to define a factory as a dedicated establishment in which the owner employs a largeish team to carry out specific production activities on a permanent basis. Tens of thousands of Athenians were involved in manufacturing products for sale whose workplaces did not meet this stringent definition.
suburbs were what made Athens attractive for many people.\textsuperscript{81} Smellier occupations like tanning and fulling would probably be a little further out from the agora. Industries involved in processing foods or ores would be away from the city centre for logistical reasons. Many craft establishments would be found clustered together – potters near the Cerameicus, metal workers near the Peiraeus and food processors and ribbon and garland makers on the main roads into the city. The street of the herm-sculptors (Plut. \textit{De.Gen.} 580a-d) included a small craft centre for the working of marble, bronze and bone, probably attended by multiple independent craftsmen.\textsuperscript{82} This clustering is partly explained by Hotelling’s Law, which attributes the observed tendency of ice-cream vendors to gather at one end of the beach to a desire to steal each other’s customers (or at least so customers know where to come).\textsuperscript{83} Other practical reasons included easy access to raw materials (possibly sharing supply), exchanging new ideas and convenience for leasing or lending slaves not required at a particular time. This reflects a similar logic to the industrial clusters of recent times like Detroit for automobiles and Northern California for digital technology.\textsuperscript{84} The encouragement of such clusters is the basis of many contemporary national and regional industry policies and today there are hundreds of cluster initiatives all over the world.\textsuperscript{85} Athens achieved them instinctively.

In all of these residential-industrial areas, a wide variety of goods was being produced and craftsmen of all kinds were to be found in every street that was not the preserve of the very rich.\textsuperscript{86} One house could fulfil many destinies: we hear of one that had provided home and business premises to a doctor, a smith, a fuller, a carpenter and a pimp (Aeschin. i.124). Production generally took place in a room in the house, probably with a window onto the street for sales purposes (in other houses, the few windows faced the courtyard). In some smaller houses, the workshop served as a bedroom for the slaves or even for the owner and his family. The houses of the poorer citizens would have been scattered among metics’ dwellings and indistinguishable from them, although the kurios would have had more non-manufacturing tasks to occupy him in the way of trial duties or military service or collecting a

\textsuperscript{81} Osborne (1987) 115
\textsuperscript{82} Osborne (1987) 114
\textsuperscript{83} Hotelling (1929)
\textsuperscript{84} Krugman (1991) 35-68
\textsuperscript{85} Porter, Letter to \textit{The Economist}, 17/11/2007
\textsuperscript{86} Burford (1972) 82
dole for attending the assembly. In these homes, the household was less dependent on income from product sales and in general would have devoted fewer resources to it; as a result, a higher proportion of the work of production would be done by women and the few domestic slaves. Many of the poorer citizens’ houses would have been involved in undifferentiated craft occupations including the simpler stages of the textile industry, carding, weaving and spinning for home use, or throwing a wide variety of vases for dining and *symposia* as well as amphorae and other jars for storage and transport. Others contributed to the massive construction programs of the time, including carpenters, lead-cutters, lathe-workers, brickmakers, stone-cutters, sawyers, shipwrights, and muleteers for hauling heavy materials. A smaller number were engaged in more specialised trades such as making jewellery and trinkets, vase-painting and armour manufacture. The residences of citizens and metics making a subsistence income through the exercise of a simple trade (Type IIb) would nestle between those of highly skilled craftsmen (Type IIa) and be hard to distinguish from them, unless by the quality of the furnishings inside. As well as being a centre for armour manufacture, the Peiraeus was home to many simple pottery workshops.

Some households put considerable effort into accumulating capital through manufacturing, borrowing money and buying or leasing slaves to generate wealth. For others it was an amusement and a source of extra spending money. For most it would have been somewhere in between. Outside the city, some split their time between agriculture and manufacture, coming to town to sell their wares and returning to their homes to continue a largely agricultural lifestyle.

For many products, some households would make their own, some would buy from others and some would make for sale – Francotte’s “modalites mixtes”. Much was sold directly from the workshop. Some items were collected by customers who had ordered them; the rest went to passing traffic. Some manufacturers took their goods to market themselves. Others sold in bulk to traders who would resell in the Agora or on roadsides. Much of the shopping would be done by slaves, though for personal items such as cosmetics or jewellery, the lady of the house would typically venture out herself, escorted by a slave carrying a *skiadeion* to give shade.

87 Occupations cited in this passage are drawn from Harris (2002a) App.1.88-97; (2006a) 145.
88 The attraction of this lifestyle is the central theme of Aristophanes’ *Peace.*
In addition to these thousands of small production establishments, and located in the more salubrious parts of the city, were a few dozen larger houses belonging to wealthier citizens with workshops employing a dozen or more slaves. In some cases these were dedicated, year-round industrial establishments which may have passed through the hands of several owners and been the subject of loans or legal suits. In others, they were facilities which would remain unused at times of the year when the slave labour force was needed in the fields and applied in craft businesses when it was not.

The role of women in this activity was substantial. In citizens’ households the wife managed much of the production, acquiring raw materials, deciding what to make next, ensuring that goods were taken to market or bespoke customers and keeping the slave workforce productive. In metics’ homes where industry was the main source of income, the master of the house was more active, and roles for the rest of the household assigned by him, though, because of the identity of home and workplace, female influence was still considerable. Where the metic was primarily a trader, his wife (if he had one) led the production effort, perhaps supported by one or two slaves. In some cases metic families probably combined skills or shared work according to personal preference and collaborated in sourcing materials and taking finished goods to market.

Children were to be found in most of the workshops, helping, learning and playing according to their age and position. The children of slaves and metics quickly learned to contribute to the production effort, both because they could increase production and because they needed to acquire skills to deploy as adults. The need for children of citizens to become adept at a manual trade depended on the wealth of their family; in any case they had other schooling as well as a craft to learn. They also learned from observing their mother managing the output. Apprentices would observe and learn every stage in the process, even if they were to work in a highly specialised part of it.

Meanwhile, not far away, in the more salubrious public spaces and more lavish private houses, philosophers and their leisured disciples discussed the virtues of the contemplative life, perhaps many of them with one eye on the security of the *apophora* they depended on, or wondering what productive use they should ask their wife to put the slaves to once the harvest was over.
This picture would not seem alien to Finley. He would have expected multiple, small, unsophisticated establishments, for some of which production was only an incidental part of life. He asserts a major role for women, slaves and metics and that little of the hands-on production effort actually came from male citizens. What he would have found harder to accept is that it all made economic sense and that the activity of manufacturing goods for sale was an important and, for many people of all classes, defining part of the life of Athens. Nor would he have agreed with our comments on the economic logic of clustering – or at least would not have thought the fact of clustering reflected economic rationality – and he attributed the small scale of most enterprises to other factors than the economic ones identified here.
7. INDUSTRY FORMATION: THE EFFECT OF SUPPLY AND DEMAND

The previous four chapters have demonstrated that the application of modern business concepts of industry structure to what we know about manufacturing in classical times can cast a new light on ancient Athenian society. Together they constitute the major analytical module in support of our thesis that there is value in applying contemporary economic analysis to the ancient world. The next three chapters extend the argument by applying economic frameworks to three other important questions that relate to manufacturing in classical Athens. These questions are:

How did industries come to be formed (this chapter)?

7. How did Athenians of classical times value the returns to be derived from investing in industry (Chapter Eight)?

8. Why did classical Athens not apply more advanced technology to manufacturing (Chapter Nine)?

This chapter explores how industries emerged from the oikos – specifically how manufacturing made the transition from being primarily for domestic consumption or hospitality gifts to being primarily for sale to third parties. It shows that differences between sectors in the timing and degree of this development can be explained as resulting from rational decisions made in accordance with the laws of supply and demand.

Elementary supply and demand theory has been applied to Athens’ evolution towards a slave economy by Morris, and informs some of the research of Hopkins, Bresson, Reger and others.\(^1\) I am not aware of any previous attempts to apply it to industry formation.

From literature and the research of experts in the relevant technologies enough is known about how goods were produced to assess how costs would have behaved with variations in volume or utilisation (the Supply Curve). We then consider the choices confronting purchasers (the Demand Curve). The chief example used here is metalworking but the same

methodology can be applied to the evolution of any other manufacturing activity. Empirical evidence is found in the way the sequence of development in the manufacture of four different products can be traced to differences in the nature of their underlying supply and demand factors. The chapter concludes by identifying how the factors driving industry formation relate to those previously identified as determining structure.

**Supply and Demand**

The occupations named by Harris and Glotz that we drew on in *Chapter Six* are predominantly crafts (sole operator) and, allowing for a few Type I industries whose slaves were probably less likely to attract manumission, represent a reasonably comprehensive list of the manufactured products purchased by households in fourth century Athens.\(^2\) We also know from Homer that these products were not made for sale to third parties in earlier times. The question at hand is how and why these products came to be produced for sale to third parties. The analysis that follows shows that industry formation, defined here as the increasing prevalence of product manufactured for sale rather for than home consumption or gift-giving, can be understood as the result of the interaction of the classical microeconomic forces of supply and demand. Today microeconomics reaches high levels of complexity and abstraction and uses sophisticated mathematical devices to calculate dynamic properties and elasticities. Our purposes require only a few of the theory’s basic principles, as follows:

- Prices in a competitive market are set by the intersection of the relevant product supply and demand curves. This is generally shown by a graph with volume on the horizontal axis and price or cost per unit on the vertical one:
  - The supply curve arrays producers in ascending order of production costs per unit of output, with the horizontal width of that part of the curve that represents each producer being proportionate to that producer’s production volume. It is upward sloping, because higher unit costs accompany higher total industry volume as less efficient capacity is brought into play.
  - The demand curve arrays purchasers according to how many units they would buy at any given price. It starts with a high price which would attract very few

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2 Harris (2002a) App.1.88-97; Glotz (1926) 230
purchasers and little volume. As price falls the number of units that would be bought increases. The curve is therefore downward sloping (Fig. 7.1):

**Figure 7.1: SUPPLY & DEMAND**

- An increase in demand (the demand curve shifts to the right) will cause unit prices to rise, enabling more product to be supplied profitably. In the graph below, demand increases (D0 to D1) as more products are bought at any given price point. This leads to an increase in price from P0 to P1 and in volume from V0 to V1 (Fig. 7.2):

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3 This figure and the three that follow it can be found in any elementary primer of microeconomics, e.g: McTaggart (2006). This corresponds to Figure 4.2 on page 50 of that work. Note that in this graph and other graphs in this chapter, the relationship between price or cost and volume is shown as a straight line. In general this is roughly the case if plotted on logarithmic paper; otherwise the relationships shown would typically form parabolas. For example the expected relationship between costs and volume is a downward sloping parabola becoming flat at the volume at which the allocation of fixed production costs results (impossibly) in a zero cost increment per unit produced.
An increase in supply (the supply curve shifts to the right) involves more product being made available for sale at a given price. This will in turn increase the volume purchased. This is shown below as the curve moving from $S_0$ to $S_1$, price falling from $P_0$ to $P_1$ and volume increasing from $V_0$ to $V_1$ (Fig. 7.3).

A reduction in industry costs will shift the supply curve downward, which has exactly the same effect on activity as the increase in supply shown above, resulting in lower
prices and increased purchases. Such a reduction can be achieved in a number of ways, notably by concentration of production and economies of scale and utilisation.

- A virtuous circle can emerge whereby an increase in demand increases volume, which in turn reduces supply costs, thereby further increasing demand and so on, until demand is fully satisfied and/or costs cannot be reduced any more (Fig. 7.4):

**Figure 7.4: DEMAND-SUPPLY INTERACTION**

Regrettably there are few or no data from ancient times on which we can test microeconomic theory’s predictions for price or cost elasticity. This is not altogether surprising, since it is extremely hard to test these predictions even in a contemporary experimental setting. Of more interest here are the dynamics of supply and demand, and whether the sequence of industry formation can be seen to respond as the theory predicts to known changes in supply and demand factors or whether it might have been determined by other causes.

**The Evolving Role of Craftsmen in Homer**

This section examines the works of Homer for evidence as to the emergence of specialist craftsmen, the ancient forerunners of manufacturers of goods for sale. The question of what period Homer was describing has too many answers to be useful; while some of the customs

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4 Elasticity is the responsiveness of volume to a change in price. It specifies the slope of the supply and demand curves.
and practices in his poems may have truly been prevalent at the time of the Trojan War, much
may be more representative of later times, possibly as late as the early seventh century.
Finley argues that they have more affinity with the early centuries of the first millennium than
with the twelfth century when the events Homer purports to describe took place, Morris calls
Homer “a priceless source for our understanding of the eighth century BC”, though he
advises caution in the light of the radical social changes that took place in that century, and
Snodgrass has shown that the poems were changing up to the middle of the sixth century.  
What is certain is that Homer was talking about a world before classical Athens and that it is
legitimate to regard changes between the society he describes and the classical period as
chronologically sequenced. Our concern is with that sequence, even if we cannot specify the
time lapse between the Before and After takes. In Homer’s poems we find that most
manufacturing was done in the home for domestic consumption, though certain crafts were
represented by itinerant practitioners, usually operating at the customer’s premises. In
classical Athens, many products were purchased from specialised producers with their own
workshops. The task is to understand how that change came about.

As we noted in Chapter One, for Homer skill in crafts was grounds for high praise. He
comments on the excellence of the manufacture of Sarpedon’s shield (II.XII.294-7) and of the
entry to Odysseus’ storeroom (Od.XXI.43-5). He praises Tychius as “skutotomon och’
aristos” (II.VII.221) and Phereclos son of Tekton “hos chersin epistato daidala panta
teuchein” (II.V.60-1) and how one of the characteristics Athene had to take on as a beautiful
mortal was being “aglaa erga idute” (Od.XIII 289, XVI.158). He also uses technology
extensively as metaphor. A falling corpse is like trees felled by builders (tektones andres –
II.XVI.482-4), the tug of war over Patroclus’ corpse is like the tanning process (II.XVIII.389-
93), and dancing is like a potter’s wheel (II.XVIII.600-2). More directly, Odysseus made his
raft like a skilled carpenter (Od.V.249-50). These references to technology suggest Homer’s
audience was familiar with watching products being made to a far greater extent than we are
today: how many modern writers would expect readers to appreciate an action better by
comparing it to a General Motors assembly line? Homer reflects a world in which crafts took
place largely at home, in full view and with the participation of owners, slaves and
neighbouring peasants.

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5 Finley (1954); Morris (1986) 129; Snodgrass (1998)
In the times Homer describes, the free population was economically and socially polarised into rich households on the one hand, with a lot of land, slaves and tenant-farmers, and poor tenants or smallholders with few or no slaves on the other. Both might have achieved self-sufficiency, but for contrary reasons. The rich had, or liked to think they had, the resources to make anything they wanted at home. Autarkeia or self-sufficiency was the ideal to which the rich man’s oikos aspired and, to achieve this, manufacture had to take place within the oikos itself, as did all forms of domestic labour. The work was shared around: Homer’s poems give no suggestion that manual work was ignoble or only for slaves, even in the wealthiest households. Princess Nausicaa does the family laundry (Od.VI.57-9), Odysseus prides himself on his skill in constructing his own bed (Od.XXIII.183-201) and the noble Eumaeus, now a swineherd, is still dios and orchamos andron (Od.XV.301; 351). But this did not involve the indignity of working for pay; the work was by and for the family unit, not like the despised hired labourer or paid dependant – the thetes. Meanwhile the poor had to content themselves with whatever they could make at home. Hesiod advocated autarkeia for even small peasant households (WD.293-319); although their more limited production capability was inevitably matched by more limited consumption, this was still better than labouring for another person. There may have been exchanges of goods at the margin, leading to some degree of specialisation within a community, but it would have carried counterparty risks and was probably not extensive.

The itinerant practice of manufacturing is confirmed by the rare occasions on which Homer introduces a craftsman into his story. Nestor summons a goldsmith with his bronze tools (hammer, anvil, and tongs) to help prepare an offering to Athene (Od.III.425-7, 432-5). Eumaeus asks why one would invite anyone from a long way away unless he had some special skill the household lacked (Od.XVII.382-5). The idea of inviting skilled craftsmen from a distance shows that by Homer’s day, possibly as early as the time he was describing, some craftsmen had taken their skills and implements away from the rich agricultural household and became independent migrant traders. Diffusion of craft skills seems to have been through these migrating craftsmen who, in the case of metals for example, might be looking for ores, servicing ore owners or teaching their trade. Crafts were often hereditary

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6 “Godly; leader of men.”
7 It is possible that this goldsmith was part of Nestor’s household, but he still needed to be summoned for a specific task.
8 Forbes (1964-72) VIII.85
and independent craftsmen were free. Just as in Athens a few centuries later, practising a craft for income was a good option for the free poor – far better than the servile condition of paid peasants or the itinerant labourers who found irregular slave-like work in the home or, more usually, in the fields. These *thetes* were typically paid in commodities, mainly food and clothing. It was seen as better than begging but not by much.

Finley suggests that the special skills of craftsmen gave them a special status in the social hierarchy: “Because they supplied certain essential needs in a way that neither the lords nor the non-specialists among their followers could match, these men, a handful in number, floated in mid-air through the social hierarchy.” Bucher distinguished between the first stage of industry development – *Produktionsteilung* – in which labour started to be engaged in production activity outside the home, and the next stage – *Berufsspaltung* – in which craftsmen narrowed their range of specialisation, as, for example, metalworkers beginning to specialise in either copper or iron but not both. In Homer, specialisation by materials is at a very broad level: travelling specialists or *demiourgoi* include workers in wood and stone (*tekton*), metal (*chalkeus*), leather (*skutotomos*) and clay (*kerameus*) as well as service providers such as doctors and poets. Homer was quite clear that top class craftsmanship required specialists: while all women in Ithaca are expected to be proficient in every skill, the excellent Phaeacian women focus on particular tasks – and the men on sailing! – (*Od.* VII.103-11), but his “specialists” needed a wide range of skills even to work on one material; a *tekton* was carpenter, mason, sculptor and builder, a *chalkeus* worked a variety of metal composites into a wide range of goods and a *skutotomos* tanned, designed, cut and stitched a broad set of leather products from saddles to shoes. Even though specialisation in Homer was not very developed, Burford observes that the silence of the sources “is no proof of these subjects’ lack of importance, and the quality of preclassical products often match the greatest works of classical times.”

From Homer then we learn that craftsmanship was prized, specialisation was starting to emerge, and the rich, while largely self-sufficient, were customers for the services of travelling specialist makers of certain goods. Some of these craftsmen went on to establish fixed workshops. It is likely that the prize of ore offered by Achilles is to be smelted at the

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9 Finley (1954) 55
10 Bucher (1893); cf. Weber (1947)
11 Burford (1972) 97-8
winner’s home rather than taken to a local smelter (*II.XXIII.826*), but at some point, probably a little before Homer’s time but after the time he describes, these travelling craftsmen started establishing workshops. The next section analyses the forces that might have led first to the appearance of itinerant craftsmen and then to fixed independent production establishments.

**A Decision for the Oikos**

The central institution in Homer, as it was for classical Athenians, was the household or *oikos*. The *oikos* of a rich landowner included all his dependants, slave and free, together with all his physical possessions. The family’s own productive output was supplemented but not replaced by the labour of slaves. Penelope had fifty slaves and she still made textiles herself. In some cases slaves held high and trusted status in households and were given special responsibilities in supplying the home with desired products. The key measures of wealth were land, slaves, herds and flocks and treasures such as were found in Odysseus’ storeroom: foodstuffs, jewellery, and decorative utensils like urns and tripods (*Od.II.337-42*). With these assets and an adequate complement of slaves (typically acquired through war or exchange of gifts), an estate could be genuinely self-sufficient. Trading and exchange were at the margin and not a reliable way to source the household’s necessities. By classical times, such *autarkeia* was a thing of the past; Hippias the Sophist was looked on as very odd for making all his own clothes and paraphernalia (*Pl. Hp.Mi.368b*). Even the richest Athenians are not said to have had much of what they used made for them by their own slaves. A factor that from the earliest times would have created exceptions to this model of self-sufficiency was oversupply. Inevitably, in some products, home output would occasionally exceed consumption; perhaps after an exceptional harvest or if, for whatever reason, household labour activities were misaligned with household demand for a period. For example the capacity to make arms and weaponry might not be fully required in times of peace. This would lead the household to seek opportunities for exchanging its products for different ones, from a neighbour initially, later perhaps from further afield. Though this process might be unplanned at first, in time some rich households might choose to specialise,

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12 Initially clients probably still supplied the raw material.

13 This does not seem to have changed until Roman times when the richest Romans had so many slaves some might have managed to regain this costly form of self-sufficiency.
deliberately overproducing certain items or crops in order to exchange them for others they were less proficient at producing. By the end of the Bronze Age some parts of the Mediterranean had established themselves as specialist producers of wine or olive oil, and others specialised in manufacture. Undoubtedly the same thing would have happened at the household level among landed estates.

The impact of specialisation is to reduce unit costs by increasing utilisation. This is because production being concentrated in fewer production units entails lower fixed costs per unit produced. Specialised slaves are a fixed cost and increasing the output of such slaves delivers more output at lower cost, as shown in Figure 7.5:

The more an individual’s specialisation means he cannot contribute effectively in other areas when not required to work in his own, the greater the benefit achieved through fully utilising him. A non-specialist worker can be redeployed, so his costs do not need to be attributed to any activity that does not require full time attention (Figure 7.6):
The same considerations apply to resources other than labour. If the minimum unit of production requires access to raw materials which for the same degree of effort can be accessed in quantities much greater than one household would need, then there will be savings to be made from aiming the production at a larger market than the household itself. If a large investment is required in inventory or equipment, the same dynamic applies. The cost-reduction benefit of increasing the utilisation of specialised labour and assets is one predictor of the sequence and extent of industry formation: the more specialised the resources required to make a product, the faster that product will come to be traded.

While the emergence of mobile craftsmen is usually attributed to the effect on demand of quality considerations, the same analysis suggests that supply economics might have been of at least as much importance: mobile craftsmen would have been able to achieve higher volumes and therefore lower costs than those operating from a single estate, even if the latter served several adjacent estates as well (Figure 7.7):
Once in motion, the effect of the increasing availability of third-party alternatives to in-house production would have been self-reinforcing. A rich householder may have been in a position to include, say, skilled metal tradesmen among his slaves, to source ores from miners (or have his own slaves find them) and to acquire and maintain the tools required. He may have come from a long line of ancestors who did so. This was not a light undertaking and required considerable specialised human resource. On a large estate, especially in time of war when arms and armour were needed, this resource might be kept busy. At other times the equipment, the working capital (raw ores) and possibly some specialised elements of the labour force would be unutilised. Many householders might be so rich that this waste did not matter. At some point, for some of them, it probably did. A loss of wealth following conflict, a desire to spend more heavily on other items, or the simple need to redeploy the labour force to fill important gaps in other areas might all have triggered some deliberation about whether the in-house option was best. The beneficiary of this thinking was the travelling craftsman. Because he keeps busy all year round, he can charge a price very much lower than the in-house cost. His income is derived from several customers, each of whom can pay much less than the cost of maintaining a specialist slave, even if the craftsman’s living standard is much higher. The costs of his equipment and inventory acquisition are similarly shared between several customers. He can afford a large store of raw materials.
(probably cheaper to buy, or easier to find in bulk), because his larger customer base will get through them more quickly. As a result, a householder offered a travelling alternative will probably come to the view sooner or later that he will stop employing his own metalworking specialists and rely on visiting craftsmen, though he might continue to source his own ores.

There would have been developments in demand to continue and accelerate the process. Specialisation would increase with living standards, exposure to a wider range of product through trade and colonisation and the resulting increase in quality expectations. Over and above the practical economics of outsourcing many products rather than trying to make them at home, the enhanced quality that specialisation offered would have been increasingly sought after.\textsuperscript{14} People who could afford to purchase goods would increasingly choose to do so, their domestic resources being unable to match the quality and innovations of the specialists. This is undoubtedly the reason why specialisation appears to have advanced first in large cities; just as today, tradesmen in a small community would typically be more multi-skilled and less expert than those in a city. Athens, as a large city with strong links to ideas and techniques from abroad, would specialise much faster than most of Greece. This search for quality would also shift the demand curve for the products of specialists to the right (Fig.7.2). Combined with the utilisation benefits of specialised production and mobility, which would have the collective effect of shifting the supply curve to the right (Fig.7.3), the process would gather its own momentum in the virtuous circle of Figure 7.4.

Demand would also have grown as a result of new customers. The term ‘\textit{demiourgos}’ or ‘worker for the people’ (Hom. \textit{Od.} XVII.383) implies a much wider customer base than the landed gentry. An excess of heirs and increasing fragmentation of landholdings would have created a class of households which had enough wealth to exchange for goods they wanted but not enough to maintain a permanent capability to make those goods themselves; meanwhile war would have brought modest wealth to some soldier-peasants. As the costs of purchased products declined and they became more affordable to these new groups, increased demand would have resulted in increased volumes, reducing costs still further. Scholars have debated how, when and why this middle-class came into being, but it is unlikely that a substantial market for outsourced manufactured goods would have developed if it had not.

\textsuperscript{14} The importance of specialisation in creating market demand is evident in Homer’s many references to the Phoenicians (e.g: \textit{Il}.VI.289-91; XXIII.740-5; \textit{Od}.XIV.287, XV.415-84).
A force underpinning these increases in demand would have been the emergence of currency for exchange; an itinerant operator would not find it useful to be paid in cows or for all his many clients to give him clothes and food. This is only a short step from the way the gift economy actually operated anyway; gifts included “fees, rewards, prizes and sometimes bribes”, and, as Finley recognised “it may be stated as a flat rule of both primitive and archaic society that no one ever gave anything….without proper recompense.”

On this basis, the precise point at which coinage became widespread is not of great significance. Ferguson describes the pragmatic approach to devising means of exchange from a much earlier civilisation:

“In ancient Mesopotamia, beginning around five thousand years ago, people used clay tokens to record transactions….Rings, blocks or sheets made of silver certainly served as ready money (as did grain), but the clay tablets were just as important and probably more so. A great many have survived, reminders that when human beings first began to produce written records of their activities, they did so not to write history, poetry or philosophy, but to do business.”

As exchange became more common in ancient Greece with the onset of large scale colonisation, standardised tokens would have played a larger part for simple reasons of convenience but the change would only be a matter of quantity, not a sign of a different type of economy. From an economic point of view, what matters is that simplification of the means of exchange would have increased demand by drawing more of the population into the number of potential buyers of a product.

While the travelling craftsman was more cost-efficient than the in-house option on all but the very largest estates, the model was still capable of significant improvement. Visiting the client might bring good entertainment, but time spent travelling could not be spent producing and periods when one client’s work had to be left for a while in the course of the production process could not be spent on work for other clients. How much more efficient to stay in one place and work continuously! For this to happen, the craftsman needed people to come to

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15 Finley (1954)  68
16 Ferguson (2008) 28
17 Seaford (2004) suggests that the introduction of coinage reinforced the distinction between the wealthy (self-sufficient) and those who had to work for a living.
him. In the first instance it would not have been the richer house owners. It might have been difficult for them to cede the principle of autarkeia in various goods by using travellers; it would have been much harder to go to someone else’s workshop, or even to send a slave there. The rich may, over time, have come to use fixed workshops, but would probably not have initiated it. Only when they saw prices very much lower than those offered by the travellers would they have patronised such establishments. It was more likely the middle class with its new purchasing capacity that prompted the switch to fixed workshops. If all your business came from a handful of customers, you could afford to visit them. As more of those with limited household wealth decided they wanted certain products, but not in sufficient quantity to make them in-house or to expect a travelling craftsman to come to them, the conditions were established for a fixed site. All jobs, however small, could be carried out there without interruptions to production, maximising utilisation and minimising costs. This result of increased demand was visible by the time of Hesiod, who speaks of small-town workshops as places to lounge in (Op.493). Their anvils, a familiar sight on vases, were noted by Herodotus (I.68). Increased utilisation would reduce prices; craftsmen with fixed sites would be able to charge less per unit to achieve a certain level of income and competition would have ensured they did. Once this was in place, the lower prices that resulted would have encouraged the wealthy to send their slaves to a fixed workshop rather than wait for a visit. As density of demand increases, the savings from not travelling grow much faster than the savings from covering a wider territory (Fig.7.8):
The Economics of Industry Formation

The economic narrative can be summarised as follows:

1. Overproduction, perhaps involuntary at first, led to exchange and then specialisation which increased utilisation and reduced costs, increasing the amount exchanged.
2. Specialisation would have been especially marked in the case of products:
3. Where a high level of craftsmanship is valued, making the labour force less flexible and the cost of underutilisation high.
4. Where other dedicated resources, such as raw materials, equipment or inventory come in quantities that exceed the needs of one household.
5. Mobile craftsmen could increase their utilisation and reduce unit costs below those of specialist craftsmen operating from a single estate if the latter were not fully occupied.
6. This, together with increasing sophistication of demand for complex products, made outsourcing of production a sensible decision for many estates.
7. A further increase in demand arose from the emergence of more people with the wealth to acquire product, facilitated by simplification of the means of exchange.
8. This increased demand enabled the establishment of fixed workshops which reduced costs still further and attracted more custom from formerly self-sufficient rich estates.

9. Increasing industry consolidation and continuing growth in demand led to a virtuous circle of industry growth (Fig. 7.4).

In terms of supply and demand, three factors affect supply. The most influential of these is likely to have been utilisation of skilled labour (S1). The more an owner chose to employ specialist expertise in particular areas, the less flexible his labour force became. If the skill was in making a product which took the skilled person less than a year to supply for the whole household, and the expert could not be readily redeployed to other tasks, there would start to emerge a serious opportunity cost. He could make surplus products the owner could exchange with guests and neighbours, enabling others to have a labour force more attuned to their needs. Specialists would establish a customer base of their own, enabling them to operate independently. This would seem to account for the development of the metal and leather working industries and ultimately for the emergence of specialist tanners, which by this account is likely to have followed the growth in demand for independent leatherworkers, rather than causing it as is sometimes thought.

A second supply factor is utilisation of investments (S2). An in-house perfumer would have a great deal of inventory that he might never get through. An in-house metal worker would have equipment that might lie unused most of the time and a large investment in ores.

The third supply factor is the impact of scale and utilisation on costs (S3). Each increase in throughput from serving new customers – either by travelling or by adopting a fixed location – tends to reduce costs, especially when resources are specialised. Provided these cost reductions are reflected in prices, as tends to result from new entrants seizing a perceived opportunity, they will attract additional demand, thereby reducing costs further.

Two demand factors were important. First, for some complex products – luxury items like cosmetics and perfumes and rare textiles, or ones where quality of workmanship was especially valued – decisions by the rich that they could best satisfy their wants by purchasing from specialists (D1), even if cost was not a consideration, would have been enough to establish the viability of independent businesses. Many such businesses probably remained itinerant around their wealthy client base. Second, in certain trades like metal and
leatherwork, the emergence of **less rich customers** (D2) would have led to an increase in work for independent craftsmen and to more of them deciding to set up in a permanent site as a wider customer base made it increasingly economic to do so.

From this analysis, we can predict that industries will tend to develop and evolve faster when any of the following circumstances apply:

1. Production involves either or both of:
   a. specialised labour activity or resources that are not readily applied to other purposes within the household (S1, S2)
   b. products of a nature or quality that cannot easily be supplied to meet the needs of a single household as a result of investment (S2) or quality requirements (D1).
2. There are significant cost savings to be made through increased utilisation (S3).
3. The products are ones that are wanted by people of modest means for whom it is impractical to make them at home (D2).
4. Utilisation can be increased by establishing fixed workshops away from customers’ premises (S3, D2).

**Supply and Demand in Action**

Our narrative posited that both the rich and the new “less poor” were in a position to implement economically rational decisions as to whether to make products at home or to buy them from a third party. By no means all industries emerged from the *oikos* at the same rate and to the same degree and we may conceive of the pattern and sequence in which goods and services became traded as being the cumulative result of decisions by many households as to how best to spend their resources. This section explores how supply and demand economics affected the formation of four of these industries, general metalworking, textiles, leatherwork and cosmetics and perfumes. These examples confirm that the relative rate of emergence of these different manufacturing industries reflects the relative cogency of the economic case for each. The shape these industries had taken by classical times was described in *Chapter Five*:

1. General metalworking was largely an activity of sole craftsmen, supplying customised product. Sometimes this could be seen as highly skilled (as in the case of bronze armour) and some practitioners probably made a good living.
2. Leatherwork: by classical times, tanneries were well established in specific locations and seem to have been highly profitable. Some appear to have integrated forward into shoes and other leather goods, though these seem to have been produced mainly by sole operators working with purchased tanned hides.

3. Cosmetics and Perfumes were sold largely by individual vendors using proprietary recipes. Evidence for large establishments in classical Athens is limited but it would have been logical for specialist importers and wholesalers to supply multiple resellers or to employ their own slaves.

4. Textiles continued to be produced principally at home for home consumption. Much exchange was of fine textiles made from specially imported fabric. Practitioners were generally sole operators; large establishments were rare and probably an opportunistic use of underemployed females in the oikos. Processes such as fulling and dyeing were probably carried out by third parties, but evidence is limited prior to Roman times.

Metalworking is the archetypical example of the pattern of industry formation described in the previous section. The specialist skills required, together with the need to source and store ores, would have made the in-house option increasingly expensive relative to the third party alternative, and the emergence of a middle class who could not have afforded either a specialised slave or the ore acquisition and storage process would have reinforced the trend and encouraged the establishment of fixed workshops. By classical times the metalwork business had multiple guises: differentiated industry (knives), differentiated craft (bronze armour) and undifferentiated craft (general smiths).

In deciding whether to buy leather products in or make them at home, the rich householder would have been confronted with much the same choice as in regard to metalwork. Should he keep his (typically underutilised) specialist leather slave(s) or buy product made elsewhere and reduce or reskill his labour force? Though in this instance, there was less to worry about in terms of equipment and inventory, over time the superior economics of the busier independent craftsman would tell. For shoes, the demand factor was probably stronger, especially for the emerging middle class. It would be hard to make excellent shoes if you only make one or two pairs a year. Better to spend your time doing what you are good at so you can afford better made shoes than your own products. Shoemaking became a differentiated craft, with sufficiently recognised skills for at least one business to be
established with shoemaking slaves. Tanning would have accompanied shoemaking at first and then, not least for reasons of amenity, would have established itself in separate locations providing processed leather to several shoemakers – the basis of its subsequent profitability.

In the case of cosmetics and perfumes, the same supply and demand factors were at work. A rich man willing to spend enough money on acquiring the right slaves and equipping them with a large and expensive inventory far beyond his household’s needs, could have ensured his oikos was self-sufficient, but he might have had a difficult time persuading the ladies of the house that they were not occasionally missing out on the latest scent or eye-liner. Buying in from independent experts in the craft would have solved this problem as well as being much cheaper in terms of labour and investment, and explains why by classical times cosmetics and perfumes were largely bought in from specialist suppliers. The difficulty of ensuring your own employees can keep up with the latest trends and professional know-how without being part of their wider professional community is one that exercises companies employing professional lawyers today and would certainly have influenced decisions on how to source cosmetics and perfumes. The industry evolved primarily into a differentiated craft, though citizens choosing to invest in a substantial holding of inventory could create a small industrial operation employing several skilled slaves.

The textile industry, by contrast, shows few of the relevant characteristics. Only if the workmanship required was of very high quality, or if the cloth to be worked was very rare, would there be an economic case for seeking external supply. This reflects exactly the nature of the industry we find in classical times.

Table 7.1 summarises how supply and demand factors apply to these four cases and explain the observed outcomes:
Table 7.1: Factors Determining Industry Formation

<table>
<thead>
<tr>
<th>Factor Determining Industry Formation</th>
<th>Application To:</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Metalwork</td>
<td>Leatherwork</td>
<td>Cosmetics and Perfumes</td>
<td>Textiles</td>
<td></td>
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<tr>
<td></td>
<td>Fine</td>
<td>Standard</td>
<td>Fine</td>
<td>Standard</td>
<td></td>
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<tr>
<td>Supply (S)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1: Special skills?</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>(Y) N</td>
<td></td>
</tr>
<tr>
<td>S2: Significant dedicated assets or inventory?</td>
<td>Y</td>
<td>Y (tanning)</td>
<td>N (shoemaking)</td>
<td>Y</td>
<td>Y N</td>
</tr>
<tr>
<td>S3: Major cost impact from higher utilisation of skills or investment?</td>
<td>Y</td>
<td>(Y)</td>
<td>Y</td>
<td>Y N</td>
<td></td>
</tr>
<tr>
<td>Demand (D)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1: More sophistication</td>
<td>Y</td>
<td>Y (shoemaking)</td>
<td>Y</td>
<td>Y N</td>
<td></td>
</tr>
<tr>
<td>D2: New middle class</td>
<td>Y</td>
<td>Y</td>
<td>?</td>
<td>N N</td>
<td></td>
</tr>
</tbody>
</table>

EXPLANATION FOR OBSERVED OUTCOME

- Exchange initially driven by savings in skilled slaves. New middle class leads to fixed workshops.
- Outsourcing driven by skills and emergence of new middle class customers. Amenity leads to fixed sites for tanning.
- Outsourcing based on sourcing and mixing skills and inventory holding, reinforced by growth in demand factors.
- Exchange chiefly in luxury items, not available locally.
- No economic benefit in outsourcing, given the capability of the oikos.
We may note here that there is an important overlap between the factors that we have identified as conducive to outsourced production and those in Chapter Five relating to barriers to entry and competitive advantage. However, the way in which they operate with regard to industry formation is different from their impact on industry structure. Attractive (above subsistence level) returns depend on the ability of some players to differentiate their skills from those of competitors. We suggested this was more likely to be achievable in making bronze armour than in general metalwork although both probably emerged from the oikos at the same time. For a sector to be composed of one or a few large firms, rather than a multitude of small operators (Type I versus Type II), it must be possible for early movers to secure a position that new entrants cannot challenge. This applies in shield-making but not in bronze armour because reputation belongs to a group rather than an individual and is accompanied by the ability to make product for stock and a minimum size of production unit. The first two features applied to knife-making which became an industry but not to shoe-making which remained a craft. The need to invest in a large inventory that made the importing and wholesaling of cosmetics and perfume attractive to investors is also the main reason that industry emerged from the oikos in the first place, but there was no major barrier to entry to independent dispensers with narrower product lines who could continue to succeed at their craft. The inability of manufacturers of standard textile products to improve on the costs of the in-house option or to differentiate their product from it underlay the lack of potential for advantage or barriers to entry that kept the sector fragmented for centuries. In brief, the factors that underpin competitive advantage and barriers to entry are elements of the same supply and demand forces that drive industry formation, but which factors matter depends on whether they are being assessed against the in-house option or against new entrants and current competitors.

That ancient industry formation appears to have followed a pattern predictable from elementary microeconomics is not to suggest that every Greek made a rational calculation on a regular basis and started to buy product in as soon as it became profitable to do so. Some newly rich households might be risk averse and favour saving resources rather than spending them on third-party product. There would be many reasons for the rich to retain a favourite slave even if his or her output was poor value compared to external alternatives; one reason might simply be the owner’s pride in having a lot of slaves. Some outsourcing decisions might have been triggered by the deaths of slaves whom it was awkward to replace. Nevertheless, the overall sequence of the emergence of products manufactured for sale must
have reflected the cumulative effect of these individual decisions. Whether or not the ancients addressed these problems consciously, and whatever hesitations and delays occurred along the way in particular cases, the outcome of this decision process was clearly consistent with practical economics and tended towards optimising resource efficiency in supplying household needs. As demand grew and volume increased, costs declined, bringing more customers into the market in a self-reinforcing process. As with any such radical change in lifestyle, the process was naturally a slow one and probably many sectors only took off some time after they could have made an effective business case for their customers to buy from them. The reasons the ancients might have resisted making these optimising decisions for a long time after the economic solution became obvious, would themselves constitute an interesting subject for study.
8. THE DEMOSTHENES PARADOX: THE APPLICATION OF RISK-RETURN INVESTMENT ANALYSIS

“This represents a remarkable conception of “capital” and it becomes all the more remarkable when one pursues in detail the actual claim on the guardians, which ignores amortization and depreciation and assumes unchanging figures for annual production, rate of profit and income.”

Finley’s dismissive view of Demosthenes’ ability to articulate a meaningful appraisal of the economic value of factories he inherited from his father sets the context for our next application of contemporary economics to transactions in classical Athens. This chapter shows that Finley was correct in noting Demosthenes’ failure to allow for asset depreciation but his concern about unchanging rates of return was based on a misunderstanding of the nature of such investments. More to our purposes, the analysis demonstrates that the application of a contemporary risk-return framework to the investment reveals that Athenians thought about their investments in much the same way as we do today, with certain exceptions that are informative about social attitudes and values.

The Paradox

In this speech, Demosthenes is suing one of his guardians, Aphobos, for not looking after his inheritance. He complains that his father left an estate of nearly 14 talents (§4) and, after allowing for interest being paid to another guardian and dowries for his mother and sister (whom the guardians were supposed to marry as a way of ensuring their allegiance to the family (§5)), Aphobos’ stewardship has left him with only 14 slaves and 30 minae (§6).

This inheritance featured the following three items which Demosthenes describes as energa – usually translated as ‘productive capital’ (§9):

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1 Finley (1973) 166 on Dem. xxvii.
2 In this chapter, all numbers in this format indicate a paragraph in Dem. xxvii.
1: A knife (sword?) factory with “thirty-two or thirty-three knife makers, worth five or six minae each, none worth less than three minae, from which (he) derived net income of thirty minae a year.”

2: A luxury furniture (beds, couches?) factory, which had “furniture makers twenty in number, pledged for forty minae, who brought (him) in twelve minae net (a year).” Demosthenes senior had taken this as security for 40 minae he had lent to Moerides.

3: A talent “lent at a drachma (a month), whose yield each year came to more than seven minae.”

The assumption of constant returns that Finley ridicules is easily explained. The sum was almost certainly an apophora or sum agreed with the slave foreman for the latter’s right to run the workshop and retain any profit after the payment to Demosthenes. If the arrangements had been different and Demosthenes was taking an equity risk on factory profits, then in the interests of plausibility one would have expected him to propose an average income figure or to say the sum was “sometimes as much as X” or “never less than Y”, which is the way he usually deals with variable numbers. In the absence of marked and measurable inflation in the economy as a whole, a rate fixed for the duration of the arrangement is perfectly sensible and seems to be identical to those in the examples from Aeschines and Xenophon analysed below. We can conclude that figures cited reflect the whole of Demosthenes’ annual entitlement to investment returns (rather than a partial dividend), and that these do not change during the life of the contract.

Let us calculate the yield (annual income divided by assets) on each investment:³

- Demosthenes is vague about the number (32 or 33) and value (five or six, not less than three minae each) of the knife making slaves. He might have been inclined to exaggerate a little here but 32 at four minae is the most commonly accepted inference for his capital investment in slaves. Thus an investment of 128 minae gives a return of 30, or about 24%. If they were really worth five minae on average, then the return is just under 20%; if he was exaggerating and the true average value was closer to three minae, then the return was about 31%.

³ With all values unchanged in all periods, yield and return on investment are identical.
• The furniture enterprise seems to have been doing just as well: if we assume that the value of the security is the market value of the slaves, then 40 minae worth of slaves brings in 12 minae a year – a neat 30% return.
• The yield on the loan is 12%. This is also the rate Demosthenes assumes the guardians’ ill-gotten gains would be reinvested at (§23), indicating it is a typical rate for loans with a modest degree of risk.

In other words, Demosthenes seems to be saying that there were opportunities to make a return of 30% on capital investment in industry, but his father had still chosen to leave a large amount of his “productive capital” on loan at 12%. And presumably, as Demosthenes must have expected jurors to see this as normal behaviour, other Athenians were known to pass up similar opportunities. Surely this lends strong support to an “Embedded” reading of the Athenian economy? Athenians must have lacked the commercial drive that today would see such opportunities snapped up as soon as they appeared.

Today’s usual model for assessing and comparing investments is the risk-return paradigm, which posits that, in a rational market, the higher the risk on an investment, the higher its return. In Chapter Two, we noted Christesen’s argument that this was the dominant investment paradigm in classical Athens. Although the terminology would have been strange to the Greeks, the concept was not. Demosthenes praised Apollodorus’ wisdom in choosing a shield workshop rather than a bank that was earning much more; the shield enterprise was ktem’ akindunon (a riskless business) while the bank produced risky revenues from other people’s money (xxxvi.11). In case of his own factories, Demosthenes seems to be expecting such high returns from his investment in industry that either industrial investment was seen as very high risk, or the Athenians were not rational in their appraisal of it. The analysis that follows suggests that, properly accounted for, yields on the factory investments are actually lower than those on the loan and that this in turn draws attention to particular social attitudes to elements of wealth.

**Factory Yields**

The simplest explanation for the apparently high level of returns is that Demosthenes was exaggerating his inherited income (as he had motive to do in this case). This is consistent

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4 Christesen (2003)
with his complaint that the factories had made no money during his childhood, but it is unlikely that he would take the risk of projecting a state of affairs that the court would see as untypical or fabricated. Another possible explanation is that Demosthenes senior’s factories enjoyed such a significant competitive advantage against other competitors and new entrants, that while others in the industry might only make a modest return approximating their cost of capital, the returns of the Demosthenes businesses were much higher. This is not satisfactory either: two other texts refer to similar, unvarying returns on the deployment of slaves for productive purposes.

Timarchus’ shoemaking slaves included “nine or ten craftsmen of the art of shoemaking, each of whom brought him a payment of two obols a day and the supervisor of the workshop brought him three” (Aeschin. i.97). The craftsmen had a capital value of four minae per head and the supervisor, six minae. To determine the income they generated, we need to estimate how many days slaves would work in a year. Few free craftsmen appear to have worked full time.\(^5\) Citizens employed on public works seem to have had a working year of no more than 200 days, with much of the rest being devoted to at least 60 public holidays, attending festivals and performing various other civic duties including attending legal proceedings. Slaves did not enjoy these privileges and obligations and Xenophon’s calculations below assume 360 days a year for mine slaves. Evidence from construction projects at the temple of Eleusis and at Delos shows labourers being paid for 360 days a year.\(^6\) 250 days would give an income to Timarchus of around 80 drachmae per year from each slave and 360 would produce over 120, giving returns on capital of between 20 and 30%.

Xenophon was thrilled to discover a new way of resourcing the state:

“A truly remarkable thing about the city is that it watches many people getting rich, but does not imitate them. We who are interested in these things heard long ago that Nicias the son of Niceratos owned a thousand slaves in the silver mines. He hired them out to Sosias the Thracian at one obol net per day and on condition that he kept

\(^{5}\) Glotz (1926) 283

\(^{6}\) Francotte (1900-01) II.13-17; Bourget (1929) Inscription 2940; IG \(^2\) 1672.105

\(^{7}\) For comparison, Demosthenes’ knife makers brought in about 100 drachmae each per year and the furniture makers just 60.
the number the same. Hipponicos had six hundred slaves and hiring them out brought him in one mina net per year; Philemonides had three hundred who earned him half a mina….” (Vect. 4.14-5).

Given continuing demand and abundant capital, the state ought to get into this business:

“If you start with 1,200 slaves, then from the income they bring in, in five or six years you will have at least 6,000, and then if they each bring in one obol net per day, revenues will be 600 talents a year. If you set aside 20 slaves for the city’s own purposes, then they will become 40. When the total gets to 10,000, revenues will be 100 talents a year” (Vect. 4.23-4).

In addition to observing that this reflects the sound management doctrine of reinvesting in growth businesses before milking them, we can calculate the returns he was basing his prescription on. In order for 1200 units to grow to 6000 in five or six years through compound reinvestment requires a yield in excess of 30% a year. Based on these examples, Glotz concludes that “below 25% the income from industry is on the low side; above 30% it is rather high.”

In a normal competitive market, outstanding investment opportunities do not last very long. If people perceive that they can increase their wealth by investing in a particular asset at the going price, they will acquire such assets and enter the industry; competition for these exceptional assets will result in all such opportunities being taken up as they emerge, increasing their capital value and reducing the returns available to new investors. If, after allowing for risk, a knife factory’s yield was significantly higher than the yield on a loan, then if the business depended on skills that could not be easily duplicated, the volume of money being put into loans would reduce, and the price of the relevant slaves would be bid up which would reduce the original owner’s true returns. If the skills were easily teachable, then other slaves would be trained and new product would come onto the market, gaining share and reducing prices and again trimming returns. There is no indication of such

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8 30% would achieve it in a little over six years and 35% in about five and a half.
9 Glotz (1926) 283
10 For economic purposes, the slaves should be valued at their market rate rather than historic cost, reflecting their opportunity cost in the market for slaves, which is the investment the owner is making through a decision to retain them.
instability in any of the texts we are concerned with, and it is therefore legitimate to assume that the numbers given by Demosthenes reflect a state of equilibrium, that the yields implied are typical and sustainable, and that he might well be right in claiming that non-payment of the *apophora* during his childhood was due to his guardians’ incompetence or dishonesty.

How far do these returns seem excessive? Let us rank them alongside Christesen’s estimates for other investment alternatives (Fig.8.1).

Figure 8.1: RISK AND RETURN (% pa)

In a rational investment market, we would expect returns on investment in industry to be in excess of the risk-free loan rate (for which we will take as surrogate the return on land which seems to have been around 8%) by an amount that reflects the market valuation of the higher risk, including any premium necessary to compensate for possible aversion to taking up the opportunity (for example, if it meant changing one’s way of life in an unappealing way). These premiums, reflecting intangible attitudes to risk and lifestyle, cannot be known to us with any degree of certainty, but it would be surprising if they were as large as those implied in these numbers. For a typical business with an established customer profile and proven manufacturing capability, today’s financial markets seldom add more than 5% to the risk-free cost of capital.\(^{11}\) The premium for maritime loans in Athens could be much higher (Aeschines paid 36% on such a loan, compared with 18% for a personal debt rollover (Lys. Fr.38)) but the comparison is indirect as maritime loans were not time-based and in any event, the Demosthenes factories can hardly be thought to involve risks comparable to the

\(^{11}\)The rate on government bills is typically used by investment analysts as a measure of the interest available on risk-free investments (i.e.: it only takes account of the time value of money).
storms, piracy and fraud that sea-going traders faced on each voyage. If the true returns to industrial enterprise can be shown to be consistently above, say, 20%, we must conclude that social attitudes towards industry were such as to prevent a large number of citizens, metics and freed slaves from pursuing or investing in obvious commercial opportunities. This would reflect a very “embedded”, economically suboptimising society. In order to establish whether this is the case, we need to look closely at the economics of the arrangement from Demosthenes’ point of view.12

**Enterprise Structures in Athens**

When rich Athenians owned manufacturing enterprises, they would typically identify and appoint a foreman to run the business. Demosthenes’ guardians initially managed the workshops themselves and later appointed a freed slave named Milyas (§19). It is reasonable to expect that some owners would have played a role in promoting the sales of their factories’ products, perhaps even making some sales of major items, but Aristophanes’ depictions of Hyperbolus hawking his lamps and Cleon his leather are clearly overdrawn.

With the *apophora*, owners were more like bondholders than equity investors. The risk and the profit of the business belonged to the foreman and, provided the factory remained solvent, the owner’s income was unaffected by the business’s performance.13 Within this overall ownership-management framework, the question of who pays for what is not one that has received much attention from historians. Xenophon clearly assumed that no costs at all attach to the owner and, given the low rate of lease costs in the case he cites, he might be largely right. In other cases the owner might have carried some of the business’s costs or assets.

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12 In analysing returns in this way, it is important to stress that no claim is being made that Athenians made such calculations explicitly or discussed such matters as ‘risk-adjusted return on capital’ or ‘opportunity cost’. Christesen suggests that “it is much more likely that, if the risk-return balance was an important consideration, that balance emerged as a result of experience rather than abstract calculation” (2003, 47). The question is whether they behaved in an economically rational way, not whether they could describe it in economic language.

13 This is confirmed by Demosthenes’ arguments that when half the knife-making slaves were sold he should have continued to receive half the income (§18-19), and that the income from the (vanished) furniture-making slaves should have continued at the previous rate (§29) despite the fact both businesses were obviously failing.
Much depends on the word *ateles* used by both Demosthenes and Xenophon and given the conventional translation above as “net”. The lexicon gives three other meanings:

- **Unending:**
  - Unaccomplished (Homer, Xenophon, Sophocles).
  - Incomplete, unfinished (Thucydides, Aristotle).
  - Imperfect (Aristotle, Lucian).
  - Unending (Plato).
  - Indeterminate (Aristotle).
- **Ineffectual** (Pindar, Plato, Aristotle).
- **Uninitiated/unmarried** (Plato).

In the fourth meaning (to do with money), it can mean “free from tax or tribute” (Herodotus, Aristophanes) or “not costly” (Sophocles, Pausania). The attributed meaning of “net/nett” is only referenced to the passages from Demosthenes and Xenophon that we are looking at, so we cannot use the lexicon to conclude that no other costs accrued to the investors in these instances. We need to explore whether the returns put forward by Demosthenes reflect all the costs and assets he carried on behalf of the business.

**Slaves – Current Costs**

One substantial expense was the maintenance cost of slaves. “Slaves had been bought and raised at their master’s expense. Furthermore, slaves had to be fed, clothed and taken care of.” Surprisingly, no scholars seem to have formed a view on who paid these costs under an *apophora* arrangement so we must start by estimating what these costs would have amounted to. We have a number of estimates of what a man would consume in a day ranging from half a choinix of barley (Thuc. VII.87.2; Plut. *Nic.*29.1; Diod. Sic. XIII.19.4), to two choinikes (Thuc. IV.16.1; Hdt. VI.57.3). Aristophanes makes a joke of a dole of 3 choinikes a day (*Eccl.* 424), and we hear in Athenaeus of records set by trumpeters – a woman who ate four choinikes at a sitting (x.415b), and a man who ate six (x.414f). Foxhall and Forbes argue that one choinix a day was a standard “distributed” quantity, but really only necessary for active adult males. They prefer an average of 237 choinikes of wheat per person per

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15 Kyrtatas (2002) 142
16 Foxhall (1982) 41-90
year and suggest that grain provided 70-75% of daily calorific consumption. Slaves might have had a lower entitlement, but if they were working in a factory, a prudent owner might not have chosen to undernourish them.

By the time at which Demosthenes is speaking, wheat cost around five drachmae per medimnos. A choinix a day would cost 45 drachmae a year. Presumably part of the slave calorie intake consisted of more expensive commodities than grain and there was an additional need for clothing, lodging and fuel. Many slaves might have had wives and children who would also need feeding and were not able to bring in enough income to cover their own living costs. Glotz estimates the cost of supporting a slave and his family as 280 drachmae a year at the end of the fifth century, based on 7.5 medimnoi per person of wheat at three drachmae per medimnos, and 37.5 drachmae for other foods, making 60 drachmae per person per year and 180 in all for food. He adds 50 for clothing and 50 for other costs. Ober estimates the cost of subsistence food at 80-90 drachmae per adult. Assuming a slave’s family consisting of parents and two children consumed three full rations between them, this makes about 250 drachmae for food, 40% higher than Glotz. Glotz estimates the total cost of maintaining a slave’s family late in the fourth century had risen to around 450 drachmae per year. We may infer that it was probably of the order of 350-400 at the time of which Demosthenes was speaking.

There is considerable uncertainty in these calculations. We do not even know what proportion of the slaves in these factories had families, nor whether, for those who did, some of the wives and children were counted among the employed slaves. It is compatible with what we know of the period that the wives of slaves brought in other income to the owner or foreman from prostitution. What we can be confident of, though, is that whatever these costs were, they must have already been taken into account before Demosthenes’ assertion of his ateles income, since even the most conservative interpretation would more than wipe it out. At 400 drachmae per slave, costs of maintaining the slaves in the knife factory would have amounted to six or seven times the apophora and in the furniture factory almost four times.

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17 Glotz (1926); Pritchett (1956) estimates wheat costs at 6 drachmae per medimnos, which seems a little high. Glotz (1926) 286. His “family” consisted of a man, wife and two children, equivalent to three adults in total. Pay for a public slave was around 180 drachmae per year, which suggests the state provided clothes or some food. Ober (1989) 131
Even if we make the improbable assumption that the numbers of slaves cited included all members of slave families and reduce the costs accordingly, the figures still do not work out. Slave maintenance must have been at the expense of the foreman, not the investor.

**Slaves – Capital Costs**

The texts cited show that the Athenians evidently recognised that slaves had to be paid for in capital as well as maintenance and, as Finley noted, one thing that typically affects capital assets is that they depreciate over time as their productive capabilities deteriorate and need to be replaced. One machine in a factory might last twenty years, another ten. The business owner will need to replace his asset as it starts to fail and eventually ceases to function altogether. To provide for this, he makes a charge against profits each year representing how much further the asset has moved towards the end of its useful life during the period in question. This is not a cash cost, so in theory this creates a pool of cash, not allocated to owners as profit, which will ultimately fund the replacement of the asset at its original cost.

There is no indication that the Athenians accounted for depreciation in any formal way. They did, however, face the problem that the slaves they owned depreciated fairly fast. They aged, fell sick, died, and ran away. Some probably required continuous maintenance in an unproductive old age or after an accident. Maintaining a slave team would require regular reinvestment. Someone leasing a gang of slaves will expect any that cease to be productive to be replaced by the owner or he will stop paying for them. This is why Sosias insisted that Nicias kept up the complement of the gang he was leasing (Vect.4.23). It is clearly an error in Xenophon’s calculations that, though he emphasises the condition that Nicias “kept the number the same”, he never allows for the possibility of any attrition among the slave cohort. The passage of five or six years among slaves, especially if they were to be employed in mines, would have seen a lot of death, injury and escape. Conditions in the mines at Laureion might have been better than those of Nubian miners under the Ptolemies, who “labour without rest… until through harsh treatment they die in the midst of their tortures (Diod. Sic. III.13)”, but in Attica’s mines we still “find human vitality sapped by nightshifts, heavy labour for women and children, such complete exhaustion as is quite unknown in the Old World.”

It would be surprising if any mine slaves lived to retire into a comfortable old age, and even if they did, they had to be replaced. Xenophon clearly understood that

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21 Bolkestein (1958) 35
replacement of slaves was a cost that fell on the owner but failed to allow for it. To calculate Demosthenes’ true returns, we must estimate that cost.

The planter Edward Littleton estimated that to maintain a complement of 100 slaves in eighteenth century Barbados it was necessary to acquire between eight and ten per year.\textsuperscript{22} An 8-10% attrition rate reflects conditions of very high mortality and very low reproduction, perhaps like the mines. Industrial and domestic slaves in Athens probably lived longer and reproduced more. We might estimate the typical working life of a slave as about 25 years.\textsuperscript{23} Male life expectancy was not more than 44, possibly as little as 40.\textsuperscript{24} Assuming they were not fully productive earlier than about the age of fifteen, allowing for physical limitations and some apprenticeship, and that the last five years of their life were unproductive, we might suggest a good, faithful and healthy slave could work in his master’s workshop for about 20 years. This would prompt a depreciation charge against profits of 5% a year, enough to fund the replacement of one slave in a gang of 20 each year. In practice an owner of a gang of 20 slaves would need to replace his slaves at a higher rate than this. Disease, disability, crippling accidents, manumission and the temptations of escape would all account for some slaves before their time. This cost would be partially offset by slaves who fathered sons who would enter the same occupation, but we have no evidence that this was a frequent occurrence. In this instance a prudent owner might provide, say, a total of six percent, possibly more.\textsuperscript{25}

Again it is important to stress that we are making no suggestion that the Athenians did these calculations explicitly. Clearly Xenophon did not do them at all. It is enough for our purposes to suggest that those seriously contemplating entry into such a business would be aware that part of the earnings would need to be ploughed back in to renewing the labour force. To put it another way, is it conceivable that intelligent Athenians would continually

\textsuperscript{22} Ferguson (2004) 80
\textsuperscript{23} Isager (1975) 31
\textsuperscript{24} Bisel (1985); Morris (2004)
\textsuperscript{25} Interestingly the furniture slaves might have been more robust than this calculation implies. The guardians have claimed a cephalaiion expenditure on these slaves of almost 1,000 drachmae over ten years (§24). Again there is no agreed definition of exactly what this word means, but it cannot have meant upkeep which would have been several times as much. If it means slave-replacement, it is still puzzling. One mina a year on slaves with a capital value of 40 minae implies a working life of 40 years which is clearly absurd. It is more likely that the guardians bought cheaper slaves or let the numbers run down.
find themselves having to reinvest a significant part of an *apophora* in order to maintain it without ever taking that experience into account in their investment decisions?

**Other Costs**

Other than slave replacement and upkeep, the main cost of operations would have been raw materials. We know from Demosthenes’ list of his other assets (discussed below) that he possessed a large quantity of materials that would have been used in making furniture and knives, and it is reasonable to assume that he supplied these materials to the workshop. It also seems evident from the quantities involved that he would have been paid for it by the foreman. Demosthenes claims that one workshop typically used two minae worth of ivory every month and the other more ivory and some iron. Even without allowing for “wood, gall and copper” (§10) we are looking at raw material costs that amount to well over half the *apophora*. Beyond slaves and raw materials, other costs would have been almost negligible. They might have consisted of some consumables such as oil and nails, and small inexpensive tools.\(^{26}\) The complexity of arranging for the owner to pay these minor expenses – and the obvious difficulties in trying to audit the expenditures claimed – suggest that these costs too were likely to have been carried by the foreman.

Further evidence that the person running the workshop was expected to pay all operating expenses as well as the *apophora* is to be found in the guardians’ claim they had spent money on the short-team lease of three slaves (§21). In fact Demosthenes voices the suspicion that the guardians had let Milyas pay all such costs, including raw materials, and then kept the *apophora* for themselves rather than passing it through to him (§43). We conclude that *ateles* is best interpreted to mean that there were no regular financial obligations on Demosthenes as owner other than slave replacement.

**Other Assets**

We must also examine whether Demosthenes has understated the denominator in the returns by omitting or misclassifying some productive assets. To do this we consider each of the major asset categories:

\(^{26}\) Larger and more expensive pieces of equipment (if any) might have been supplied by the owner
• Land occupied by the ergasteria should be treated as a component of capital investment. The factories were attached to Demosthenes’ house (§24-5), which must have been large enough to accommodate the slave labour force and workshops and was valued at 30 minae. More than fifty slaves would take up a large amount of space relative to the needs of a small family and their domestic slaves (if these were separate). There was also the need to store a very substantial quantity of raw materials. The wood and ivory for the furniture factory in particular would be bulky. Perhaps an estimate of 40% living space and 30% for each workshop is reasonable, giving 9 minae of asset value to be attributed to each workshop.

• Equipment is unlikely to have been significant. In knife making, a rebuildable furnace, some simple handling tools and some whetstones would probably be enough. The furnace would be made of basic materials and the labour involved in building and rebuilding it would be fully accommodated by costs already attributed to the slaves. The furniture makers probably used little but hammers, nails, saws and chisels.

• Debtors would also be a small item. There is consistent evidence from Aristophanes, Plato and Xenophon that most sales were cash-on-delivery. Any need to finance sales proceeds committed but not yet paid might be balanced by suppliers with raw material bills outstanding.

• There was a large amount of raw materials inventory. In his list of arga (non-energa) assets, Demosthenes refers to “ivory, iron and wood” worth 80 minae and “gall and copper” worth 70 (§10). The wood and part of the ivory must have related to the furniture factory and would have accounted for most of the 80 minae. More ivory, iron, plus the gall and copper would have been for knife making. We might allocate 80 minae of raw materials to the knives and 70 to the furniture.

• Finished goods inventory is likely to have been small. Most luxury items of furniture would probably have been delivered and paid for when finished. Knives would have been made for stock, but intelligent production management would have kept finished inventory to a few weeks of demand at most.

• Cash requirements are likely to have been small for the same reason and, as a practical matter, would have had to be dealt with by the foreman.
Revisions to the Numbers

Demosthenes’ valuations of his slaves are troubling. As Davies points out, if we take the 40 minae valuation of the furniture making team as being the true or market value, then after adding the deposited talent and subtracting the sum from the total for the three energa assets of four talents and 50 minae, we have a valuation for the knife makers of 190 minae; this could be composed of eight at five minae and 25 at six, but if any really were worth three as Demosthenes admits, the sum does not work.\(^\text{27}\) And why would Demosthenes choose phraseology that leads the listener to infer a much lower number? Harris argues for a much higher investment valuation for the furniture makers than the nominal 40 which is based on the amount Demosthenes senior lent to Moriades.\(^\text{28}\) He approaches the sum from the other direction and assumes that the average value of the knife makers was five minae each, which, added to one talent and subtracting from four talents and 50 minae, gives a residual sum of about 65 minae for the furniture makers, rather than the 40 in the text. Furthermore, he argues, this is just what we would expect; Demosthenes is clearly referring to the figure for which the slaves were pledged, and however primitive one might consider the Athenian credit system, their value as security would surely have been lower than their true value in terms of earning potential. Support for Harris’s view is found at §27-8, which refer to an additional 500 drachmae that Aphobos lent to (and recouped from) Moriades against these same slaves.

Harris’s argument is well supported by his analysis of the text and the figures, although there remains a question as to why, if the average value of a knife making slave was five minae, Demosthenes describes it as “five or six and none less than three” which a sceptical listener would interpret as implying a lower average. A more comfortable reading, and one that does no violence to Harris’s arguments, might suggest that the total value of the knife makers might have been around 155 minae, and the furniture makers about 75.

To this adjustment we add the costs and assets Demosthenes was responsible for: the depreciation cost which we have estimated at 6% must be deducted from the nominal returns and we must include in the analysis the assets we have identified as properly belonging to the factories – real estate, raw materials and other assets.

\(^{27}\) Davies (1971) 127

\(^{28}\) Harris (2006a)
Together these adjustments make a large difference to the initial calculation of returns on investment:

**Table 8.1: Knife Factory – Revised (minae)**

<table>
<thead>
<tr>
<th></th>
<th>Original</th>
<th>Revised</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Depreciation on slaves</td>
<td>-</td>
<td>(9)</td>
</tr>
<tr>
<td>NET INCOME</td>
<td>30</td>
<td>21</td>
</tr>
<tr>
<td>Assets: Slaves</td>
<td>128</td>
<td>155</td>
</tr>
<tr>
<td>Land and buildings</td>
<td>-</td>
<td>9</td>
</tr>
<tr>
<td>Raw material inventory</td>
<td>-</td>
<td>80</td>
</tr>
<tr>
<td>Other assets</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL ASSETS</td>
<td>128</td>
<td>245</td>
</tr>
<tr>
<td>YIELD %</td>
<td>24</td>
<td>9</td>
</tr>
</tbody>
</table>

**Table 8.2: Furniture Factory – Revised (minae)**

<table>
<thead>
<tr>
<th></th>
<th>Original</th>
<th>Revised</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Depreciation on slaves</td>
<td>-</td>
<td>(4)</td>
</tr>
<tr>
<td>NET INCOME</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>Assets: Slaves</td>
<td>40</td>
<td>75</td>
</tr>
<tr>
<td>Land and buildings</td>
<td>-</td>
<td>9</td>
</tr>
<tr>
<td>Raw material inventory</td>
<td>-</td>
<td>70</td>
</tr>
<tr>
<td>Other assets</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL ASSETS</td>
<td>40</td>
<td>155</td>
</tr>
<tr>
<td>YIELD %</td>
<td>30</td>
<td>5</td>
</tr>
</tbody>
</table>

We have arrived at quite a different puzzle from the one we started out with. *Prima facie,* Demosthenes’ words suggested that owning factories was a great opportunity to make money and, in an economically rational society, people would have done much more of it. In fact,
by adjusting the asset base using numbers provided by Demosthenes himself and recognising that, as any Athenian would be aware, slaves are not immortal, we find that a properly calculated rate of return suggests that he would have been better off putting more money on loan at 12%.

Implications for the Study of Athenian Society

To explore this further, we should consider carefully what these adjustments represent. Despite Finley’s strictures, a failure to take depreciation into account is scarcely evidence of an uncommercial approach to business. Depreciation was only recognised as an expense by the UK tax system in 1878, long after the Industrial Revolution and still longer after the “nation of shopkeepers” had come to dominate world trade. Further, all the above analysis has assumed that the slaves spent all their time in the factory. It is apparent from the words of many of Aristophanes’ slaves that there was no firm distinction between domestic and industrial slavery. When Plato observes that “one who supervises many slaves in his own service is rightly concerned with the income coming to him from them” (Leg.846e), the word he uses is oiketai, conventionally taken to refer to slaves engaged on household tasks. When listing his arga assets (§10), Demosthenes nowhere mentions domestic slaves, but he does describe the workshop slaves as being left “in the house” (§24). Complaining of the present state of his finances, he says he has just “14 slaves and 30 mina” (§7). Is it fanciful to suggest that 14 might have been the proportion of the original 52 or 53 factory slaves whose activities centred on the Demosthenes home and family rather than their workshops?

Raw material inventory seems large and there seems to have been enough for many years’ production. It is informative that the materials are not included in the energies assets. Clearly Demosthenes (and his audience) did not see these as investments in the business any more than he saw his own house as a factor of production. They are both simply elements in calculating wealth and the categorisation reinforces the indivisibility of home and ergasterion in the Athenian mind. The fact that these assets were earning nothing (except perhaps capital appreciation, for which we have no evidence) does not seem to have been a concern. Here we do have evidence of behaviour that is not economically rational; a profit-maximising approach would have caused inventory to be minimised and taken into account in the

29 Macve (1985)
investment analysis. Far from minimising it, Demosthenes seems proud of the amount. And if he had factored it into the analysis a rational profit-seeker might have chosen to close the business, liquidate the stock and lend the proceeds at 12%.

Economically irrational though it might seem this behaviour is understandable. Francotte observes that “aux époques primitives, l’accumulation des métaux précieux est l’une des formes de richesse.” What is more, this attitude is also relatively common today. Stock is a major outlay for small businesses and often a major element of value when the business comes to be sold. Once an owner has made the initial investment, his financial concerns centre on getting enough cash flow for his income needs while still being able to replenish his stock. The stock is considered as a form of saving. Antique dealers, jewellers and second hand booksellers are familiar examples. It seems Demosthenes senior was another. He had 80 minae worth of silver also classified as arga (§10).

In other words, both of the factors that make factory ownership seem financially unattractive, bring quite different advantages when seen from an owner’s perspective and are rational within an easily recognisable paradigm. Even though the second at least can be labelled non-profit maximising, the inference cannot be drawn that they reflect a society to whom economic behaviour was alien. It can also be shown that with some reasonable allowance for the non-economic value Demosthenes might have placed on these items, returns converge around the levels we are expecting. For instance if 20% of the cost of slaves reflects personal use and the raw material inventory is considered purely as a store of wealth, then the yield of the knife factory is about 15% and that of the furniture factory 12%, just the sort of returns the modern paradigm would lead us to expect. Again it is not being suggested that Demosthenes or his contemporaries did these calculations: only that had they not implicitly understood matters in this way, their investment choices might have been different.

A review of Demosthenes’ other inherited arga assets throws more light on the Athenian investment paradigm. The full list after the two sets of raw material is (§9-10):

- House: 3000 dr.
- Furniture, jewellery etc: 10,000 dr.
- Silver: 80 minae

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30Francotte (1900-01) I. 88
The maritime loan seems out of place here. Clearly it was “commercial” – as we have observed above, such loans tended to pay very high returns and involved taking considerable insurance risk. Yet it is not included in the *energa* assets. This suggests that *energa* had an active meaning – capital which the owner has put to work directly rather than as a passive loan or savings – but it raises questions about the talent lent at 12% and classified as *energa.* We must also wonder why the deposits with Pasion and Pylades were included here and not in the *energa* assets along with that talent. Was it because they were non-interest bearing? Harris argues that banks never paid interest on loans, though Bogaert believes they did and specifically refers to these loans. Isager and Hansen conclude from the fact that the deposits with Pasion and Pylades are mentioned after the maritime loan that “it is practically certain that the bank deposits were also interest bearing.” If they did not bear interest, why does Demosthenes say explicitly that the miscellaneous talent was non-interest bearing without saying anything about these? And what about the loan to Demonides? *Energa* cannot mean that anything outside it is not income producing, or it would have included the maritime loan. The three sums in question would have provided an income of 4 or 5 minae a year if lent on the same terms as the *energa* talent.

While all these arguments are logical, we tend to side with Harris. Demosthenes’ presentation suggests that if the loans bore interest, it was not very much. When he totals his *energa* assets of four talents and 50 drachmae, he ascribes to them an income of 50 minae (only a slight exaggeration; 30 from knives, 12 from furniture and 7 from the deposited talent make 49). But when he sums his other assets (8 talents, 46 minae) he makes no reference to income. If there was any income generated from this asset group, it must have been incidental. It is probably safer to see the list as not income producing at all, the maritime loan being considered a large bet whose outcome was uncertain and not a source of regular cash.

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31 Harris (1993) 102-7; Bogaert (1968) 347-8  
32 Isager (1975) 95
These data also allow us to take a view on just how well off Demosthenes senior was from his investments. The 49 minae of stated income must be offset by slave replacement needs. After these costs, he would have been deriving a little under 40 minae a year from his industrial activities and his loan. Nice to have and it would keep him in some style, especially if the costs of buying and maintaining a good domestic slave force were already covered in these calculations. If this was the full extent of his wealth, he could certainly have undertaken the occasional liturgy at 1,000 drachmae or so, but would have struggled to afford many trierarchies. It is notable that the orator never refers to such public benevolence on his father’s part. Davies suggests that this might be because some of the senior Demosthenes’ wealth was *aphanes*, and that it was in order to maintain this invisibility that the guardians agreed to the maximum rate of tax being levied on a sum slightly higher than the claimed value of the estate (§7).\footnote{Davies (1971) 125-7} They wanted to avoid a tax audit. This is plausible but it is unlikely that the hidden amount would have represented a very substantial degree of wealth. Demosthenes senior was acknowledged as one of the *kaloi kai agathoi* (leading citizens) by Theopompos (Fr.297), but his wife, daughter of the Gylon who betrayed Athens and fled into exile, only came with a dowry of 5,000 drachmae and, soon after the marriage, a substantial financial liability resulting from her father’s disgrace. As Davies argues, this unwanted debt would have been a good reason to conceal his wealth, but the underlying premise of the case makes it unlikely that the deceased estate was very much greater than the sums his son is claiming.

This son, by contrast, was a great deal better off. Davies lists two full trierarchies and three joint ones, multiple liturgies, several public gifts, including one of a talent and another of rather more, some major arms purchases on behalf of the city, two chorus productions and a ransom of prisoners from Philip. Davies also observes that his last trierarchy was in 353 and his last liturgy in 341, his beneficence thereafter being confined to irregular, special purpose activities on behalf of his fellow citizens. This does indeed look like someone who preferred to keep his wealth *aphanes*, quite likely, as Davies suggests, because much of it consisted of slightly dubious payments for settling public cases in particular ways.

It was not from industrial investments then that the orator earned Dinarchus’ appellation of “the richest man in Athens” (I.111). On the other hand there is no suggestion in the whole of this family history that industry was an unacceptable form of wealth generation or an
inappropriate inheritance for a truly distinguished Athenian. Even though the investment in
the furniture factory was originally made by Moriades, both father and son seem quite as
happy to be deriving income from it as from more conventional loan interest, even with the
concomitant need to tie up a large amount of funds in working capital. As far as we know,
the knife factory was a deliberate investment choice by Demosthenes senior.

**Conclusion**

As we have admitted from the outset, this analysis is necessarily imprecise and does not
claim to define accurately the economics of investing in the wide range of industrial activity
operating in classical Athens. It does, however, demonstrate that what Finley construed as an
important piece of evidence that classical Athenians were not economically rational and
motivated beings, can equally well be interpreted as showing that they thought about the
returns needed from enterprise in very much the same way as many small business owners do
today, and that their implicit approach to determining the equilibrium rate of return from
industrial investments, whether articulated or not, is not all that different from ours. The ways
in which it does differ can be explained in quite rational terms and, importantly for this thesis,
are brought to the surface by applying modern economic analysis.
9. WHY ATHENS HAD NO INDUSTRIAL REVOLUTION

Our final module of analysis in support of the proposition that applying economic concepts to the study of classical Athens can offer new insights draws on previous chapters to examine Athens’ failure to apply technology to industrial production. In Chapter Three we reviewed several of the most common explanations for the modest scale of manufacturing enterprises and suggested that limited application of technology was a vital factor, mediated by its effect on barriers to entry and the potential for competitive advantage. Chapters Four and Five tested this hypothesis in several sectors and Chapter Six showed that a large proportion of the population in all stations of life looked to specific Types of manufacturing as a source of income. Chapter Seven showed that, whether or not early Greeks thought in those terms, industry formation followed a strong economic logic and in Chapter Eight we found that investors considered the returns they expected from a given commitment of funds in much the same way as we do, but with interesting variations. Here we use the results of those analyses to argue that two common explanations for Athens’ limited application of technology – the absence of financial motivation and the institution of slavery – are wrong, and that other theories do little to distinguish Athens from highly commercial societies prior to the Industrial Revolution.

Before exploring alternative hypotheses as to why the application of novel industrial technology in classical Athens was relatively feeble, we summarise the evidence that the failure cannot be attributed to a lack of scientific knowledge.

A Failure of Application

Sachs identifies four factors that can create economic growth: savings, trade, technology and a resources boom.1 Trade and the resources of Laureion both contributed significantly to Athens becoming one of the richest cities in the Mediterranean. Savings for reinvestment seem to have played a smaller role, though Xenophon understood the benefits (Vect. 4.23-4). The factor that seems to have played almost no part at all is technology.

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1 Sachs (2005) 52-4
This was not because technical advance was seen as unimportant; the level of expertise in making certain products such as wooden vessels, pottery, sheet metal work, casting, weaving, embroidery and carpentry was very high and the ancient Greeks consistently sang the praises of innovation and innovators. Theodoros the silversmith is credited with inventing the carpenter’s square, the plummet, the lathe, the level, keys and bronze casting. Anacharsis the Scythian is credited (wrongly) with inventing the potter’s wheel, as well as the bellows and improved anchors; Glaucos of Chios came up with the soldering iron. Lemnos was known for its development of weaponry. Innovation could pay off handsomely: the huge wealth of 6th century Samos which enabled the construction of massive buildings like the temple of Hera was thought to have been founded on the innovations of Rhiokos and Theodoros (probably brothers, but possibly father and son) who discovered how to cast large bronze figures, cut jewels, and solve tricky architectural problems.

While inventors were celebrated in literature, the technical details of their work pass without comment. Hopper notes that technology only appears in literature as metaphor, and that what we know of tools and techniques comes from archaeology and paintings. As we noted in Chapter One, this is neither surprising nor a bad thing; ancient literature would have been very boring if it was mainly about engineering. As a result “the actual diffusion of new techniques…. happened at a social level below the attention of the writers.” In any case, the development of technology is not a matter of verbalisation: “Many of the more historically important ideas were not at first put into words. They were technical inventions that were at first handed down by imitation, and only slowly developed a verbal theory. When they did, the theory was generally nonsense but the practice sound.” Mankind was weighing things for thousands of years before Archimedes. Nevertheless, we are entitled to wonder why the reality was not much more advanced than the literature suggests; unlike the Romans, the Greeks of classical times never even harnessed animal or water power for milling – a relatively small step towards the mechanisation of mindless processes.

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2 Hopper (1979) 136
3 Examples are drawn from Farrington (1944). The Corinthians held that their countryman Hyperbios invented the potter’s wheel and Critias claimed the same distinction for Athens (Fr.1.12-14). These and the Anacharsis claim ignore two thousand years of prior history in the Middle East.
4 Hordern (2000) 288
5 Haldane (1968) 60
The craftsmen themselves do not seem to have been keen to investigate opportunities for mechanisation, nor, as far as we know, did they engage with scientists to help them improve production technology as industrial companies do today. Technology was not seen as something to be developed with effort; new inventions are simply accidents. As a result, “Mechanical invention…always remained slight; when it did occur it had only limited application, for the devices employed in catapults and other siege-engines were never transferred to the workshops, and steam power remained merely a motivator of toys.”⁶ Finley observes that the essential technology applied in agriculture, metallurgy, pottery and textiles had not changed since Neolithic times. He lists Greek inventions as the gear, the screw, the rotary mill, the water mill, the direct-screw press, glassblowing, concrete, hollow bronze-casting, the dioptra for surveying, the torsion catapult, the water clock, the water organ and sundry mechanical toys. The Greeks improved existing processes such as the olive press, ore refining technology and mine construction, but newly available technology such as water power was never applied to industrial production.⁷ Kealey is even more scathing about later antiquity, suggesting that the only two significant inventions of Roman and Hellenistic times were corn harvesting machines and water mills for grinding, the latter borrowed from barbarian tribes. The Dark Ages were more innovative!⁸ In mitigation, Bresson points out that classical Greek techniques for processing oils and grains were not superseded for 2000 years.⁹

Finley says that this “question cannot be dismissed simply by pointing to alternative values” and highlights the distance between science as taught by leading thinkers and production-related technologies.¹⁰ Aristotle’s pupil deliberately avoided industrial examples in illustrating the *Mechanics*. Vitruvius considered technology only as a means to achieving new outcomes rather than improving productivity. It seems the lack of interest in practical advance was accompanied by a shift in the preoccupation of philosophers towards abstract speculation rather than tangible experiment. The Ionian scientists of the 6th and 5th centuries had been practical men whose science was experimental and whose aims embraced technological innovation. Pythagoras’s work was often abstract, but he still sought

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⁶ Burford (1972) 22  
⁷ Finley (1965a) 29, 35-36  
⁸ Kealey (1996) 23  
⁹ Bresson (2007) Ch. 7  
¹⁰ Finley (1965a) 32

229
foundations in empirical proof and he developed his musical scale from listening to anvils. The shift “from doing to knowing” was typified by the change in the identity of the First Principle from “Fire” (Heraclitus) to “Number” (Pythagoras) and reflected in the attitude of Plato and Aristotle to the superiority of the abstract and ideal to the practical and messy.\(^\text{11}\) Industry was relegated to an inferior position in the world of science, the objective of which was knowledge, not the production of goods. Parmenides was the first to claim that reason was more to be believed than the senses, even when it contradicted them (for example by declaring that “nothing changes”). Plato followed Parmenides to a logical conclusion when he asserted that the user of a product has a better understanding of it than the manufacturer since its essence consists in its use (\textit{Resp.} 601d). Unsurprisingly, Plato chose to teach the young prince of Syracuse geometry rather than, say, metallurgy or pottery. This abstract approach to scientific enquiry lent itself to ridicule: in \textit{The Birds} (1004ff), Aristophanes has the astronomer and geometer Meton conducting absurdly cerebral town planning experiments with an architect’s rod, and in \textit{The Clouds} (1485-92) Socrates has his “thinking shop” burnt down for similar activities; these depictions reinforce the conclusion that the practical application of the fruits of man’s genius was not an objective of scientific enquiry during the 4\(^{\text{th}}\) and 5\(^{\text{th}}\) centuries, as “the banausic associations of the oven, the soldering iron, the bellows and the potter’s wheel reduce their influence on Greek thought in comparison with the more gentlemanly pursuit of theory of numbers and geometry.”\(^\text{12}\) This picture is overstated: Aristotle certainly believed in experiment and some sophists considered \textit{techne} to be part of wisdom; the eccentric Hippias was admired for making his own clothes: “a spinner, weaver, tanner, tailor, cobbler, and smith, all in his own person, he is typical of the older generation of wise men whose title to wisdom is not compromised by the ability to use their own hands.”\(^\text{13}\)

After its apparent suspension in classical Athens, the development of applied science in the classical world resumed its course in Alexandria and Rome. Both came up with remarkable achievements in fields ranging from astronomy and archaeology to hydraulics and medicine. In neither case though, over many centuries, do we see serious attempts to improve manufacturing productivity. A classic instance frequently cited of failure to use technology is the Alexandrian invention of the steam engine, whose only application seems to have been to effect a “miraculous” appearance of the statue of a goddess from behind steam-operated

\(^{11}\) Farrington (1944) 141

\(^{12}\) Farrington (1944) 49

\(^{13}\) Farrington (1944) 88
doors. More remarkable still is the Antikythera Mechanism from the middle of the first century BCE, an astronomical device of such extraordinary sophistication that it prompted Arthur C Clarke to observe that if the Greeks had been able to build on their knowledge, the Industrial Revolution would have occurred a millennium earlier.

As we discuss in the conclusion to this chapter, the failure to apply much of the technology that was scientifically within their grasp was not peculiar to classical Athens – or even to Finley’s “Ancient Economy” – but was a feature of every society prior to eighteenth century Europe. This has not, however, prevented historians from asserting that specific features of society in classical times were responsible for limited technical advance. We now address two of the prime suspects, a lack of commercial motivation and the institution of slavery.

**Lack of Commercial Motivation**

In Kealey’s view, technological innovation stems from attempts to solve practical problems rather than from the inspiration of new scientific discovery. He rejects the ‘Baconian paradigm’ (science > technology > industrial application), noting that it is more common for the impetus to come from industry innovators who have decided to address a certain problem than from scientific experiment. They will draw on new and old science and, today at least, sponsor novel research, in order to develop technical means of achieving commercial outcomes. Left to its own devices, science will provide interesting results (which a civilised society should support for much the same reasons as it might support opera) but will not prompt industrial innovation. In fact far from being the driver of innovation, science is often informed and improved by technology-inspired discovery. Thus Carnot’s practical *Reflexions sur la Puissance de Feu* (1824) led to major changes in the theory of thermodynamics, and superconductivity was first harnessed in the laboratories of IBM.

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14 Against this, Bresson (2007 Ch. 3) points out that before the great productivity increase that came from the use of charcoal to generate steam from the sixteenth century in England, steam engines were unstable and not very efficient, there being too much friction in the cogs.

15 Marchant (2009) 128-9

16 The distinction seems to be becoming blurred as today many industrial start-up companies emerge directly from science laboratories. On the other hand this also reflects the fact that much research is now focussed of its own accord on commercial challenges and opportunities.
Many examples from the period of the Industrial Revolution can be found to support Kealey’s view that innovation is usually a response to a commercial problem or opportunity. The steam engine was put to use in response to a pressing need to pump water out of mines, Bessemer mechanized the process of making gold leaf because labour costs were high, and the United States developed blast furnaces and wrought iron so as to make use of its huge deposits of anthracite coal. This problem-solving approach was quite different from that of the French, whose scientists led the world in the early eighteenth century but one hundred years later, “in practical Mechanics the French must be at least 100 years behind the English. It is indeed astonishing that in a country so contiguous to one where the mechanical arts are brought to their highest perfection their contrivances in everything should still be so rude.”

It is not the quality of French science that is at issue here but its orientation. “By pouring money into academic science, the French followed the wrong model. But laissez-faire Britain, freed from centralised planning, could follow the market which correctly directed investments into technology, not science.”

Burford’s account of the development of crafts in Greece seems to contradict Kealey’s hypothesis: “Man used his ingenuity, he responded intelligently to the challenge, he was open to the suggestion of new forms, materials and ideas, but he is never described as first feeling the lack, and then going out to look for the fulfilment of it, or experimenting to see what would happen.” Was the paradigm inapplicable to ancient Greece or were there simply no things they noticed they lacked? As Galbraith observed, “inventions that are not made, like babies that are not born, are rarely missed.” Kealey would hold that, for whatever reason, problems and opportunities did not present themselves to entrepreneurs that made them seek a technical solution. Others support this line: Bresson argues that innovation was applied when it became profitable to do so. He contends that in general inventions did not reduce costs – or at least not by enough to offset other sources of cost advantage –, nor did they enable new products or create new markets, so it is a mistake to conclude that the ancients missed out on commercial opportunities offered by technology. Further, he argues, any gains from making industry more productive would be captured by rich owners and so did not

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17 Robinson (1828) 79
18 Kealey (1996) 217
19 Burford (1972) 188
20 Galbraith (1962) 9 iiii
21 Bresson (2007) 200ff

232
increase the purchasing power of potential customers; as a result markets would not grow in response to new investment. (He errs on this point. Under *apophora* arrangements, the gains would have accrued to working foremen). Another recent account of the Industrial Revolution emphasises the coincidence of high labour costs and low energy prices providing the economic imperative to mechanise.\(^{22}\) This may have been relevant, but these conditions largely applied in classical Athens too.

There are two questions at issue here: whether the application of new technology offered no important commercial opportunities and whether Athenians were somehow constrained from pursuing such opportunities as did exist. Our previous analyses have shown that neither theory explains the limited amount of technological development in classical times.

The existence of commercial opportunities is simply demonstrated by reference to a typical industrial business such as the shield factory analysed in *Chapter Five*. Turning the lathe to form a shield took around eight man-days per unit, which could have been largely eliminated with the application of water or animal power. Across the whole Lysias enterprise this could have saved approximately 50 slaves with a capital sum of perhaps three talents and annual maintenance costs of almost the same amount. We have observed that tanning is largely a materials handling business and similar savings would have been available there. The water mill was introduced at the end of the Hellenistic period because it improved mill economics. It would have had the same effect in earlier periods. As we saw in the case of Wedgwood, the first enterprise to apply such cost-saving innovations would have enjoyed significantly higher profits in markets where prices reflected the costs of traditional production methods. Further, by creating economies of scale, mechanisation would have turned many Type II crafts into Type I industries, so that early movers who found a way to mechanise leather-stitching or to introduce automated shaping for commodity pottery would have been able to win business from sole operators with a higher cost structure, as happened in these industries many centuries later. The opportunity for investors was real enough.

It is not easy to understand why these opportunities to reduce costs would have gone begging. The story of industry formation in *Chapter Seven* shows that historic outcomes eventually reflected resource optimisation. In classical times it is scarcely conceivable that a man with, say, Pasion’s commercial instincts, owning a very labour-intensive factory and with plenty of

\(^{22}\) Allen (2009)
access to finance, would have failed to seize an identified opportunity to reduce costs. There is direct evidence that the ancients consciously recognised and pursued technology based savings in some fields. We have seen how the commercial advantages of improved beneficentiation of ore were identified and then implemented with some skill by miners and, in a later period, Pliny points out that the value of a water mill depends on the quantity of crops available locally and the scarcity of labour (HN.18.300).

A more sophisticated version of the lack of motivation hypothesis suggests that ownership structures meant that the benefits of investment in new technology would not have accrued to those who were in a position to implement them. This argument has two parts: one states that those who would benefit did not understand enough of the process to recognise the potential of new technology and the other that those who did understand the process did not have access to investment capital. Finley captures both ideas in his assertion that “there were enough individuals who possessed the resources” (to invest in new technology), “but not among the men whose interest lay in production.” However, not all relevant innovations would have required more capital than a successful foreman could finance out of his own retained earnings and in cases where they did, even if a slave or freed foreman was not able to borrow from the typical sources open to citizens, he could have persuaded the owner to invest a little more in equipment in exchange for a higher apophora (sharing the benefits of productivity gains), just as he would if he wanted to increase the complement of slaves. While the fixed return principle governing owners’ income from workshops explains why capitalists might be indifferent about increasing productivity, the foremen running those workshops who took the risk on profit volatility would have had a real incentive to increase it and could surely have found ways to do so, through some form of borrowing or benefit sharing. And of course some wealthy and educated owners such as the fathers of Demosthenes and Cleon had run their own workshops, so knowledge of the process, incentive to improve returns and access to capital were often perfectly aligned. While it is clear that the limited application of technology to manufacturing in classical Athens cannot be attributed to a lack of commercial incentives, it is by no means so clear why they were not pursued.

23 Finley (1965a) 37
Slavery

The institution of slavery is sometimes held to have created conditions that made technical innovation uneconomic or unlikely. Again, simple economic considerations show the inadequacy of such explanations.

The most naive form of this argument – that slaves were a costless input to production, so there was no benefit in replacing them with machines – is easily rebutted. In the previous section we saw that mechanising the lathe would have reduced shield making capital and labour costs by around 40%. It is certainly nonsense to suggest as Meikle has (1995a) that slavery meant there was no market in labour and that this prevented the development of credit markets for investment. The fact that slaves had a capital cost meant that there was a very clear market in labour, in fact a more transparent and negotiable one than we have today, as our labour market carries a whole diversity of types of wage-work bargains, making market benchmarking especially difficult. In Athens you bought a slave at a predictable price and maintained him at a predictable cost; other things being equal, if you had an opportunity to replace the slave’s output with a capital item that would cost you less all up, then you would logically do so. Nor does the ready availability of slaves provide a valid reason not to automate; Burford pointedly observes that “the abundance of human labour available in the eighteenth and nineteenth centuries did not prevent the mechanisation of labour.”

Some commentators suggest that a slave labour force is poor at innovation, reflecting a view that goes back to Adam Smith who opined, “slaves are very seldom inventive, and all the most important improvements….have been the discoveries of free men.” Early American writers on slavery asserted (without adducing evidence) that slavery was unprofitable or that “the soul of commerce is the spirit of enterprise and this is ever found wanting in communities where slavery exists.” Cairns claimed that it was “quite impossible that (a slave) should take part with efficiency in the difficult and delicate operations which most manufacturing and mechanical processes involve.” His understanding of automated processes, which would have benefited from a viewing of Chaplin’s Modern Times, is contradicted by more recent historians: in Massachusetts, “the textile industry showed that

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Burford (1972) 119
Smith ((1776) 1999) II .270
Olmsted (1862) Cairns, (1863)
unskilled workers could rapidly learn to use powered tools to make product parts, which were assembled at the end of the production line.”

These arguments anticipated the blatant racial prejudice of UB Phillips’ notorious 1918 study of negro slavery. More recent research, based upon detailed analysis of company and plantation accounts, leads to quite different conclusions: for instance, slave-based agriculture was 35% more efficient than family farms. Fogel and Engerman conclude that “the purchase of a slave was generally a highly profitable investment which yielded rates of return that compared favourably with the most outstanding investment opportunities in manufacturing.” This suggests a slave labour force is certainly not incompatible with investment in automation, though to the extent slaves are more productive than other labour as these findings suggest, the hurdle rate for replacing them with machinery would be that much higher. The analysis further undermines any suggestion that ignorance on the part of slave foremen as to what technology could do contributed to the lack of technological progress in the ancient world. Certainly slaves would have been less exposed to formal scientific education than freemen, but we have already seen that such education had little to do with technical advance, and Fogel and Engerman’s research indicates that slaves would have understood workplace productivity at least as well as their free counterparts.

Finley’s negative view of the impact of a slave workforce on industrial development is based on more sophisticated reasoning than the pejorative theories of Phillips, Olmsted and Cairns. He thought an argument “that slave labour is inefficient… and ultimately unprofitable…would have astonished Greek and Roman slave-owners.” The impact he saw was indirect: he posited a causal connection between “the disdain of at least the Greek elites for applying technology to economic improvement and progress and their preference for relying on manpower.” The connection is almost certainly there, though it may not have been as consciously political as Finley implies. Aristotle makes the same point more pragmatically: having a slave to do the poiesis allows you, citizen, to get on with your praxis (Pol.1253b-1254a). Finley goes on to posit a reluctance on the part of owners to change the production system too radically in the direction of using less slave labour, as it risked

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27 Rosenberg (2007) 11
28 Fogel (1974) 193, 195
29 Finley (1973) 83
30 Cartledge (2002) 158
upsetting the stability of ancient society. This fear of social unrest is conceivable, but it is hard to imagine a silent conspiracy of capitalists agreeing that none of them would countenance labour-saving innovations. We have seen in Chapter Six how manufacturing constituted an important source of income, both for the rich and for those needing to earn their daily bread, and it is difficult to make a case that either group would have consciously decided not to make it more profitable if they saw the chance. Even if social concerns were real, they would only have affected behaviour if the relevant decision-makers calculated that the introduction of mechanisation in one process would spread rapidly to affect so many workshops as to have a major impact on the total demand for slave-labour, which is contrary to the incremental dissemination of most inventions in history and inconsistent with the expectations and intent of most process-innovators. Of course a simpler path to alleviating the risk of a large number of underutilised slaves was open to Athens at that time – to stop importing them!

In fact Finley was right to suggest that technical innovation would have undermined the ancient lifestyle but the reasons have less to do with slavery than with the impact on industry structure and the nature of opportunities for citizens to earn an income. To understand this, we must consider the impact of mechanisation in terms of our industrial typology. The initial effect would have been primarily on industries that employed large numbers of slaves and where the savings would have been substantial. In Chapter Six we estimated that the number of slave jobs this might affect as not more than 5% of the slave population. Some of these would have been retained to run the machines, while others might have been redeployed within the owner’s oikos. It would have made little sense to mechanise the work of slaves employed in individual craft enterprises and would in any event have probably led to them being redeployed to other domestic or agricultural duties. Overall, then, the impact on slave occupations would be modest.

The impact on citizens would be much more severe. We have seen in Chapters Four and Five how technology led to the subsequent consolidation of many industries that in classical times were fragmented crafts suitable for the sole operator and a slave or two. Had this happened in classical Athens, many of the income-earning opportunities available to citizens and others of modest means would have disappeared. Pottery would have been dominated by proto-Wedgwoods, mechanised cutting and stitching would have eliminated all but a few bespoke cobblers, and independent food vendors, if they continued to exist, would have
sourced their wares from a handful of agricultural processing conglomerates rather than from their own kitchens. The effect on Athens’ social structures would have been overwhelming. One might speculate how the change would have been managed: would the reluctance of citizens to accept full-time employment have given way to force majeur? Would a larger and more regular system of dole-payments have been introduced, perhaps funded by a new and comprehensive tax-system? Would it have led to a massive increase in emigration and colonisation or a search for new wars to fight and new plunder to redistribute? What we can say with confidence is that it would have resulted in an Athens that was very different to the one so admired by its citizens and by later generations. This would have been a real reason for Athenians to fear technological change, but it is stretching credulity to suggest that it was anticipated and determined the behaviour of Athenian manufacturers. Even Darwin lamented, “Nothing is easier than to admit in words the truth of the universal struggle for life, or more difficult – at least I have found it so – than constantly to bear this conclusion in mind.”

The Athenians are unlikely to have found it easier.

**Conclusion**

We have argued on the basis of simple economics and commonsense that two of the most common explanations for Athens’ failure to apply its scientific knowledge to production technology are invalid. In this section we assess other, more recent theories of industrial progress for their specific relevance to classical Athens.

First we must note that Athens was by no means unique in this failure. Clark points to the large number of important technologies that had been discovered or introduced to Europe since 1000CE without creating major economic change, including windmills (England, 1185), buttons (Germany 1230s), the spinning wheel (France, by 1268), mechanical clocks (England, 1283), firearms (Spain, 1331) and movable type printing (Germany, 1453). Just as in ancient Greece, none of these innovations were applied primarily to improving productivity. Kealey points out that “almost everything which really matters and which the world possessed at the commencement of the modern age, was already known to man at the dawn of history: language, fire, the same domestic animals which we have today, wheat, barley, the vine and the olive, the plough and the wheel, the oar, the sail, leather, linen and

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31 Darwin (2007) 47
32 Clark (2007) 197, 134
cloth, bricks and pots, gold and silver, copper tin and lead – and iron was added to the list before one thousand BC – banking, statecraft, mathematics, astronomy and religion….”

Given this universal lack of significant progress before eighteenth century England, we can express the question at hand as: “Why did the Industrial Revolution not occur before or elsewhere?”

A view that has received considerable attention in recent years is the deterministic geographic or ecological explanation that posits that people living in tropical climates tend not to have learned to innovate since the means of subsistence were readily available without much personal effort. Certainly it requires more human intervention to acquire food in a temperate country such as England than it does in, for example, much of sub-Saharan Africa and this is often taken to explain a higher degree of energetic activity in general in temperate lands than in tropical ones. On the other hand, much of Northern Europe had similar ecological challenges to England without achieving leadership in industrial development, and subsistence in the Mediterranean basin was by no means a simple and effortless proposition.33

A more sophisticated version of this ecological thesis has been popularised by Diamond (1997). His account attributes development to environmental accident and evolution: the better a location’s endowment of domesticable plants and animals, the faster it adopts a sedentary lifestyle which is the forerunner to civilization. That this is not a comprehensive explanation for all development is demonstrated by the very different living conditions in two countries that share the same island and, by implication, its ecology: Haiti and the Dominican Republic. Diamonds appear to have been as much a blessing for Botswana as a curse for Sierra Leone. More to the point, ecological conditions did not differ much between England and other parts of Northern Europe that lagged in industrial development, and the same or similar domesticable plants and animals existed throughout Europe including the Mediterranean basin.34 The theory might explain “Why Europe?” but not “Why Britain?” or “Why then?” It certainly does not seem to explain “Why not classical Athens?”

An alternative hypothesis is put forward by Jacques (2009) who holds that the Industrial Revolution occurred in Britain rather than China because of Britain’s access to coal and colonies, the latter overcoming the shortage of land suitable for agriculture that had

33 Hordern (2000)
34 Sachs (2000) 33-38
previously impeded development in both places. Once the agricultural ceiling on growth was lifted, England was better able to take advantage of a technical base that by then was much stronger than that of classical Greece: it had paper, gunpowder, optics and coal, as well as a social structure with more consumers which favoured mass production.\(^{35}\) It also benefited hugely from developing the use of coke and bituminous coal for iron smelting. Scientific and resource endowment by themselves can scarcely explain why Britain led the Industrial Revolution and not, say, Germany, but the extent of colonisation may constitute an important differentiator. On the other hand if empire is a significant explanatory factor in industrial development, one must question why Macedonia, Rome, and the Mughal civilization all had far larger empires than Athens and a technical base that was at least similar but made little more progress in developing technology.

Britain mounted a massive industrial effort to create and defend her empire. To secure her colonies against France in the eighteenth century, William Pitt the elder initiated a huge increase in the size of her fleet to 105 ships of the line, half as many again as the enemy had.\(^{36}\) To do this required the large scale application of the latest technology in shipbuilding, metallurgy and gun-founding. This exercise is seen to have contributed to the broadening of the domestic skill base and perhaps to the increased application of technology in other spheres. On the other hand, a similar increase in the equally innovative fleet available to Athens at the start of the Second Persian War seems to have had no such effect.

Toynbee was one of the first historians to take an institutional view of the causes of the Industrial Revolution, attributing it to the reduction in restrictive practices that accompanied the decline of craft guilds in England.\(^{37}\) Similarly North and Olsen argue that a shift in England’s institutional arrangements and social practices towards economic liberalism was instrumental in encouraging economic growth.\(^ {38}\) Macauley boasted that “no other society has yet succeeded in uniting revolution with prescription, progress with stability, the energy of youth with immemorial antiquity…. Every man has felt entire confidence that the state would protect him in the possession of what had been earned by his diligence and hoarded by his self denial. Under the benignant influence of peace and liberty, science has flourished

\(^{35}\) Bresson (2007) Ch.8
\(^{36}\) Ferguson (2004) 32-3
\(^{37}\) Toynbee (1884)
\(^{38}\) North (1990); Olson (1982)
and been applied to practical purposes on a scale never before known.” Ferguson suggests an important feature of the British Empire was imposing social institutions that promoted commerce: “the rule of law, credible monetary regimes, transparent fiscal systems and incorrupt bureaucracies.” Against this, as Clark points out, Britain’s institutions favoured growth for at least the 500 years leading up to the Industrial Revolution and conformed more with recent World Bank orthodoxy in the past than they do today. These explanations based on the institutional context appear at best to suggest necessary conditions – at least to those who believe in the power of unfettered markets – but not sufficient ones. We have seen there is no sound basis for suggesting that Athens imposed specific institutional constraints on free enterprise.

A number of theorists adopt a more Thucydidean approach to history and focus on the people and personalities involved. Weightman (2008) in particular points to a central role for entrepreneurs and to the practical turn of mind of the British. British success on this basis might be attributed to what Daniel Defoe had meant as a criticism: “better to improve than to invent, better to advance upon the Designs and Plans which other people have laid down than to form Schemes and Designs of their own,” but the Athenians were also quick to copy manufacturing innovations that they admired. Indeed that is how shield-making became established. More convincing is Clarke’s demographic explanation for an increase in entrepreneurialism at the time of the industrial revolution. He shows that as a result of the Malthusian Trap and Ricardo’s diminishing returns to labour on a fixed supply of land there was no real increase in living standards between 1000 BCE and 1800 CE. The Industrial Revolution stemmed from a change in culture inspired by a particular demography: “There must have been informal, self-reinforcing social norms in all preindustrial societies that discouraged innovation,” but “people’s basic preferences were changing as the world approached the industrial revolution.” England’s industrial leadership was due to its having been a stable agrarian society with limited population growth for many centuries, during

39 Macauley (1967) 1.20, 220
41 Clark (2007) 145-7
42 Berlin (1967)
43 Defoe (1728) 299
44 Clarke (2007) Ch.3; Ricardo (1895)
45 Clark (2007) 165
which time the best and the brightest (the aristocracy) had outbred the other strata of society. This meant a need to earn a living for people who had the genes for leadership and success. Some contemporary research posits an alternative demographic causality: that when population reaches a critical mass, density multiplies human interactions and thereby increases productivity.\textsuperscript{46} Both lines of argument are plausible but neither seems to differentiate eighteenth century Britain from the character and dynamism of the Athens we know of.

We come back at last to arguments based on the profit motive. Following Marx, Schmookler (1966) sees this as the driver of innovation. We have shown earlier in this chapter that arguments that Athenians were not interested in opportunities to improve profits are wrong. The case that profit had much to do with the Industrial Revolution is no more accurate. Successful English magnates tended not to become very rich as a result of their entrepreneurial success, often because of unfettered competition leading to industry overcapacity, as was the case in textiles and railways. In fact most of the gains seem to have gone to unskilled labour, which might explain why “the evidence from Industrial Revolution England suggests that, at least in early societies, the profit motive is a relatively weak stimulus to innovation.”\textsuperscript{47}

According to Finley, the embedded nature of the ancient economy was implicated in the lack of technical progress in the ancient world in at least three ways: scientific education emphasised the unpractical; the best and brightest were not interested in industry; and those who were, lacked the resources. We have shown that in fact existing scientific knowledge offered great opportunities and although this does not preclude technical ignorance on the part of slave-labourers being a contributory factor to limited development, the nature of the innovations that drove the Industrial Revolution suggests it was not a very important one. Similarly the arms’ length nature of the engagement of leading citizens with industry meant that more talent might have been brought to bear on technical innovation in Athens than actually was, but this was probably true in England at the time of the Industrial Revolution as well. The only members of the old aristocracy who went into industry in the eighteenth and nineteenth centuries (and for most of the twentieth) were those who had to. Finally the

\textsuperscript{46} See for example Apolte (1992).
\textsuperscript{47} Clark (2007) 256
structure of industrial investment in Athens shows that access to investment resources was not a constraint.

With no single explanation being wholly convincing, we must acknowledge that the failure of classical Athens to take advantage of technology to reduce manufacturing inputs might be attributable to some combination of geographic, demographic and social factors. The mechanisms are complex, however, and the lack of significant technological advances in manufacturing productivity in every society everywhere prior to eighteenth century Britain cannot sensibly be attributed to a social context that is said to have prevailed specifically in classical Athens or even, as Finley claimed, in the ancient world more broadly.
10. CONCLUSIONS

The preceding chapters have applied a range of elementary economic frameworks and analyses to different aspects of manufacturing in classical Athens in order to demonstrate that this approach can add useful insights to our understanding of that society. This concluding chapter summarises the results of those analyses, indicates how they might be developed further and points out their implications for the Embeddedness Paradigm. It concludes with a discussion of the logical status of the economic “laws” applied here and suggests how they might contribute to a new approach to historical studies more broadly.

Summary of Findings

In Chapter Two we argued against Finley’s belief that in some societies exchange activities are wholly determined by social conventions and values while in others economic rationality prevails. We showed this was misconceived and failed to describe the reality of any society, ancient or modern. We also disaggregated some of the central propositions that constitute the Embeddedness Paradigm and found that even if one accepts those that are reasonably supported by the evidence, Finley’s conclusion about the irrelevance of economic concepts to ancient commercial transactions did not necessarily follow. Subsequent chapters demonstrated that the application of a modern economic perspective to manufacturing activity not only aligns with most of the facts as we know them, but can also provide fresh insights into the social history of classical Athens. In Chapter Three we introduced the framework of competitive analysis and in Chapter Four used it to show the small size of potteries in Athens was consistent with economically rational decision-making by participants. Chapter Five showed that where firm size exceeds the minimum complement of workers required for efficient production, the reasons could be found in the nature of demand for the products in question; cases where they cannot suggest an interesting new angle on the way in which large households were managed. The chapter concluded by identifying four Types of manufacturing business, defined in terms of competitive advantage and barriers to entry, each offering different forms of economic opportunity to participants. Chapter Six showed how different segments of the population participated in different Types of manufacturing, and how this perspective provides an important overlay to the social
history of the city. Chapter Seven demonstrated that the shift in the prime purpose of production from satisfying household demand to sale to third parties reflected supply and demand conditions, and how this framework can be used to predict the sequence and extent of different products emerging from the oikos to be manufactured commercially. Analysis of an investment portfolio in Chapter Eight showed that it was largely compatible with a risk-return paradigm and that deviations from that paradigm offer important insights into social values. Finally Chapter Nine argued on the basis of simple economic logic that Athens’ failure to apply technology to production processes to a greater extent than it did cannot be attributed purely to the institution of slavery or to a lack of commercial motivation.

These analyses also identified several areas in which commercial decisions fit less easily with a strict interpretation of economic rationality, each of which is revealing. Demosthenes seems to have placed a higher value on the benefits of slave ownership than a simple financial calculation would suggest. Finds of a large textile operation at Olynthus, and the suggestion by experts that some ancient potteries might have contained more slaves than we have shown to be economically optimal, suggest that in at least some areas the Athenians made choices different from the ones that pure profit-maximisation would prompt. These choices cannot be described as irrational; they are logical ways of achieving certain objectives and not without parallels in our society. They do, however, suggest that some objectives were more important to some people at some times than immediate financial gain. Keeping a large complement of slaves who are not always required on their normal tasks and redeploying them in a way that keeps them busy and brings in a little income is a fine example. Seeing working capital as a store of value is another. It is the economic rationality of the oikos, not the bourse, but it is none the less rational for that. As Xenophon (Oec.VII.4) and Marshall both recognised, economic rationality can and does reflect a conception of what is useful that embraces more than short-term profit-maximisation.¹ This thesis has shown that economic analysis is a powerful device for revealing what Athenians considered useful.

Perhaps the most important insight generated by the analysis is the apparent relationship between the availability of certain opportunities for earning an income and the social structures it facilitated. Limited technology resulted in abundant opportunities for the lone craftsman and it was possible to earn at least part of one’s income from manufacturing in a way that was compatible, both in dignity and time-requirements, with being an active

¹ Marshall (1959) 1
participant in a democracy of nominal equals. Considering the Athenian polity in the context of how citizens were able to make ends meet provides a novel perspective on how the democracy was able to function that would not be possible without the relevant economic frameworks.

Finley “denied that ancient commerce and its evolution could be studied according to such ideas as competition or the laws of supply and demand.” We have shown that using elementary economic principles as an explanatory device is both heuristically effective and a source of important historical insight. We have found that these basic economic concepts can explain industry formation and structure in a way that aligns with the known facts, both about enterprise size and profit-characteristics and about the demographics of participation. The analysis makes sense of the confused jumble of enterprise forms we find in classical Athens, and the approach seems most valuable in precisely those areas such as slave deployment and asset valuation where it points up true differences between the choices of certain Athenians and our own. Without the tools, these insights are simply not available. The analyses have covered multiple aspects of commercial manufacturing and a wide range of examples, but we must acknowledge their limitations. The data are scanty, and we have been obliged to make several assumptions. The assumptions made in the main module on Industry Structure are, in the author’s professional judgment, the most probable interpretations of industry dynamics based upon what is known about technology and product demand. Another set of assumptions that proved structures and behaviour in the cases examined were uncommercial would be harder to reconcile with the few known facts. Nevertheless it is possible that new evidence will be found to contradict the hypotheses put forward here about how certain industries worked, or that new material will come to light showing that a manufacturing sector does not fit the paradigm proposed. Similarly we may find evidence of industry formation that does not seem to reflect supply and demand conditions or an investor with quite a different preference set from both Demosthenes and us. We must acknowledge too that we have focused on transactions and outcomes, not the intent behind those transactions. In all the analyses, care has been taken to emphasise that there is no suggestion that classical Athenians did – or even could – describe their activities in the terms used here. It is conceivable, though rather unlikely, that these transactions and outcomes have the appearance of commercial rationality while in fact being motivated

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2 Andreau (1995) 36
entirely by other considerations. A more reasonable conclusion is that when making commercial decisions humans tend to operate in consistent and predictable ways across cultures and eras, and that these ways are captured under the general rubric of microeconomics. Some of the terms used might seem anachronistic but it seems the concepts underlying those terms are timeless; the charge of anachronism can only be properly levelled against the transient.

In addition to these limitations, the analysis is far from complete. Even without new primary sources, it should be possible to refine it by, for example, more fully testing the proposition that among sole operators, those involved in differentiated (Type IIa) crafts earned better incomes than those in Type IIb, or that only differentiated crafts lent themselves to investment. It may also be possible to quantify how far the inherent profitability of certain businesses was reflected in the price of dedicated slaves. The information gathered here on labour input for various goods can be related to what is known about the cost of labour, selling prices and consumption volumes more thoroughly, and it might be possible to build a complete financial profile of the manufacture and sale of specific products. The demographic analysis in Chapter Six takes a representative population for two centuries and adduces evidence drawn from the whole period; more granular analysis might reveal changes in the structure of certain industries and in the demographics of participation over the period. There is scope to write another work of at least the same length that does no more than fill out these gaps.

**Embeddedness Revisited**

This thesis has tried to avoid presenting itself as an attempt to confound the Embeddedness Paradigm. Finley’s work has been an important source regarding many aspects of ancient Greek society and Chapter Two was careful to point out that much of the argumentation offered by Embeddedness proponents is compatible with rational outcomes of transactions. That chapter also foreshadowed that by applying economic paradigms that assumed economic rationality, the analyses would identify areas in which behaviour was economically irrational. We have noted some examples of this above, but it must be acknowledged that these deviations from profit-maximising rationality are rather minor. They do not seem either to reflect a regular pattern of irrational behaviour or to reveal a world whose attitude to
commerce was significantly less profit-oriented than our own. To the contrary, the following propositions have been at least partially tested and not found to be false:

1. The nature of manufacturing industry in classical Athens was determined by supply technology and demand factors. This applies both to the sequence in which products started to be manufactured for sale to third parties in ancient Greece and to the structure of industries in classical Athens.

2. When Athenians engaged in commercial activity, they made decisions that were for the most part consistent with today’s understanding of good (rational, profit-maximising) business practice.

3. The small size of typical enterprises was consistent with profit-maximising strategies. (On the other hand, some of the larger enterprises we hear of seem not to have been geared to profit-maximisation).

4. However much the intelligentsia prized the contemplative life and showed contempt for all manifestations of commerce and industry, that did not prevent people at all levels of society from participating in industry with commitment, enthusiasm and some success.

5. The participation of different segments of the population in manufacturing reflected rational choices based on the differing economic characteristics of the product-markets and their ability to meet different economic needs.

These propositions also sit more easily with our readings of the philosophers (why fear the moral impact of an exchange culture based on philia?) and the orators, mostly serious men for whom their own and their clients’ business affairs were the stuff of life. They chime with the hordes of characters Aristophanes presents as being filled with commercial intent. To the extent the Embeddedness Paradigm relies on showing that what actually happened in the economic sphere was quite different from what would occur in a capitalist commercial world, we must conclude that the empirical case for it has not been established. While Finley’s observations of behavioural patterns were astute, the implications he drew from them were false. Some of the factors he emphasised, notably status restrictions on who could conduct certain transactions, exchanges based on friendship, elitist contempt for industry, the absence of important commercial infrastructure and limited evidence of an ability to conceptualise economics must have affected many transactions and form an important part of the picture we have of classical Athens. Finley deduced that economic behaviour would therefore have been recognisably different from a rational profit-maximising model. This thesis has tested for
rationality directly and demonstrated that Finley’s world coexisted with the immutable laws of economics. Whether or not these laws were understood or articulated by the actors, human behaviour converged towards conformity with them.

The Role of Microeconomics in Interpreting History

To the extent we have succeeded in showing that these economic laws accurately predict transactional outcomes, an interesting question arises as to their logical status. They are not inductive, because they can be proved true by virtue of the definition of their terms. The Law of Supply and Demand can be presented as \( p = f(S, D) \), competitive advantage means that \( \pi - \text{Cost of capital} = \sum (A_{\text{price}} + A_{\text{cost}} + A_{\text{assets}}) \)\(^3\) and the Capital Asset Pricing Model of risk-related investment returns is expressed as \( E(R_i) = R_f + \beta_i (E(R_m - R_f)) \)\(^4\). Nevertheless the work of Finley and many others suggests that the universality of their application is not self-evidently true. Moreover, they do not always apply with full force at once; hence the opportunities for arbitrage in investment markets and the ability of companies in irredeemably weak competitive positions to make excellent profits for short periods, especially with aggressive leadership. Over time, however, the rules tend to apply and outcomes to reflect them. Tautologies are not usually subject to such qualification.

If the rules can explain commercial dynamics in societies as different as classical Athens and the contemporary developed world, they would seem to be more than contingent truths depending on specific observations. Perhaps they are of the same order as the propositions of logic and mathematics that Ayer labelled \textit{a priori} truths that “are independent of experience in that they do not owe their validity to empirical verification”,\(^5\) or Kant’s concept of the synthetic \textit{a priori} as typified by “everything which happens has its cause.”\(^6\) Of special importance is that the rules are readily falsifiable in that their predictions are quite clear and can be tested against any relevant evidence, although it is likely that “we shall always find that the situations in which (a logical or mathematical principle) might appear to be confuted are accounted for in such a way as to leave the principle unassailed” – in our terms,

\(^3\) \( \pi \) is profitability; \( A_x \) is the financial value of an advantage against the marginal competitor in element X.

\(^4\) \( E(R_i) \) is the return on the value of enterprise \( i; R_m \) is the market rate of return; \( R_f \) is the risk-free rate of return; and \( \beta_i \) is a measure of the volatility of the value of enterprise \( i \) relative to that of other enterprises.

\(^5\) Ayer (1971) 100

\(^6\) Kant (1968) 50
falsification would shed more light on the nature of the world in which they did not apply than on the validity of the rules themselves.\(^7\) The most appealing characterisation of the axioms for our purposes is as heuristic devices that can be applied productively to understanding specific forms of causality in the past, just as they can be used to guide success in the present. It is a critical element of our findings that when applied to classical Athens the rules are not shown to be incorrect or irrelevant in the way that Finley would have expected, believing as he did that the applicability of economic theory presupposes a particular mindset. This thesis has shown that his insights serve principally to prove that economic principles operate in even the most unlikely social milieus.

In applying these heuristics to industry in classical Athens, though our findings do not support Finley’s conclusions, they are – by definition – compatible with the society and values he describes. They bear out Weber’s view that there were real markets in slaves and land and the distinction made here between industry and craft echoes his analysis of the twofold role of slaves in manufacturing.\(^8\) Polanyi’s concern that markets would destroy the livelihood of smallholders is also proved correct as regards the likely effect of technical advance on industry economics. Our findings are also, perhaps surprisingly, compatible with Bucher. The Athenian economy was in a primitive state compared with the world Bucher knew, but we have shown that this was not attributable to the institutional framework (the *oikos*) so much as to the state of technology and its impact on the economics of production: technology limitations meant that a major source of competitive advantage (low unit costs resulting from large scale and high utilisation) was not prevalent anywhere before the Industrial Revolution; large-scale mechanisation changed this and provided the basis for more industries to become concentrated as some competitors become advantaged. Each society at a point in time will provide different opportunities to small and unsophisticated competitors according to the state of technical development. Manufacturing in classical Athens (and in other less technically-advanced societies) can be characterised by the extent to which one could earn a good income while still attending to civic duties, or a rich household could open and close a large workshop on a seasonal basis without being disadvantaged against dedicated incumbents. The evolution of competitive advantage means that opportunities to do the same in any manufacturing business today are vanishingly few. This

\(^7\) Ayer (1971) 102-3; see also Popper (1952).

\(^8\) Weber (1891)
makes for a curious inversion of the Embeddedness Paradigm; rather than society
determining the nature of the economy, it was the undeveloped nature of the microeconomy
that enabled the Athenian lifestyle and values.

In terms of historiography, we seem to have come full circle. The original modernist-
primitivist debate was partly based around an argument as to whether there were certain
economic laws that led to the emergence of particular types of commercial activity at
different periods of history. Menger sought the “exact laws” that could inform historical
analysis. Bucher, Weber, Polyani and Finley in their different ways also sought economic
rules that explained social development. The rules they were looking for were grand laws of
social behaviour and the macroeconomic setting that could explain or describe discontinuities
in economic history. The rules we have applied deal with individual decision makers and the
microeconomics of individual decisions and we have found them to display a remarkable
continuity in their relevance to economic history. They do not attempt to explain why
societies were as they were, merely to examine what they did through a particular lens. A
recent leader in The Economist observed, “economics is less a slavish creed than a prism
through which to understand the world.” This thesis has aimed to show that this prism is an
especially revealing one that deserves to be more widely used by historians and students of
all periods and societies. Countless questions of immense interest present themselves for
similar analysis, such as:

- The relation between different forms of government and income-opportunities for
citizens.
- Detailed case studies from different periods of industry emergence and development
  in the context of supply and demand factors.
- The extent to which industry structures changed in Alexandria and Rome; the social
  impact of those changes.
- The structure and conduct of manufacturing in highly commercial societies such as
eleventh century Venice, Renaissance Florence and Reformation Holland.
- How manufacturing industry was structured in radically different advanced cultures,
such as Moghul, Han, Incan, Persian, Ottoman, etc. Cross-civilisation analysis of the
  structure and conduct of specific industries.

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9 Menger (1985) 38
10 The Economist, 18/07/2009
• How the Industrial Revolution affected competitive advantage and industry structure in different countries and the impact on comparative economic development and on social and political structures.
• How empire-led colonisation affected competitive advantage and industry structure in particular industries and how this in turn affected colonisation policies.

More generally, we challenge those who claim economic analysis has no place in the study of certain societies and eras to identify any non-centrally directed societies in history where the simple microeconomic principles enunciated here can be shown to be inapplicable or uninformative.
1. PRIMARY SOURCES

Abbreviations used in the text follow the Oxford Classical Dictionary Third Edition (Oxford University Press, 1996) and are shown here in italics.

Figures in parentheses indicate the chapter in which the reference is cited.

GREEK AUTHORS

Aeschines (Aeschin.):
   i. 97 (3, 5, 6, 8); 124 (6); ii. 29 (2); 150 (6)

Aeschylus (Aesch.):
   Prometheus Bound (PV): 109-112, 236, 448-50, 715, (I)

Andocides (Andoc.):
   i. 133 (I, 2, 6); 146 (6); ii. 11 (I)

(Anon):
   Life of Sophocles 1. (6)

Aristophanes (Ar.):
   Acharnians (Ach.): 299, 478, 521-8, 719-27, 760, 964-5, 1124, 1181 (5)
   Clouds (Nub.): 648 (5)
   Birds (Av.): 488-91 (5); 640 (6);
   Ecclesiazousae (Eccl.): 248-53, 308-9 (6), 413, 415, 841 (5); scholiast to 81 (6), 814 (7)
   Frogs (Ran.): 112, 443, 549ff, 840, 857-8, 1126, 1349-51 (5); 549ff, 1349-51 (6)
   Knights (Eq.): 44 (5, 6), 48, 59, 104, 136, 203, 315, 379, 449 (5), 644-5 (2), 738-40 (5, 6), 963-4 (5); Lysistrata (Lys.): 416-9, 458, 735 (5)
   Peace (Pax): 752-3 (I); 1198-1202 (2); 1200-39 (5); 270 (6)
   Ploutos (Plut.): 162, 166, 513-4, 983, 426, 1120 (5); 426, 1120 (6)
Thesmophoriazusae (*Thesm.*): 387, (5), 446-58 (6)
Wasps (*Vesp.*): 19, 438 (5)(6)

*Aristotle* (*Arist.*):
Politics (Pol.): 1252a-b, 1255b (6); 1258b, 1259a, b, 1260a (5), 1264b (6), 1265b, 1266a, 1267b, 1270 (2), 1274a, 1275a (6), 1296a, 1318b, 1319a, 1327a, b, 1329a (2)
Rhetoric (*Rh.*): 1381b (4)

*Pseudo-Aristotle* (*Arist.*):
Constitution of the Athenians (*Ath. Pol.*): 27.5 (5); 19.3, 27.5, 62.2 (6)

*Athenaeus* (*Ath.*):
Deipnosophistae: xii.511d (I); x.414f, 415b (8)

*Demosthenes* (*Dem.*):
xviii. 257-65 (I), xxiv. 6-23 and Scholion (2), xxvii. (I, 3, 5, 6, 8), xxxii. 4 (2), xxxiv. 39 (2) 51, xxxv. 10-13 (6), xxxvi. 4 (5), 11 (2, 5, 8), 14 (2), xxxvii. 4 (3, 5, 6), 17 (5), 31 (3, 5), xxxviii. 25-7 (I), xl. 52 (5, 6), xli (2), xlii (2, 6), xlv. 86 (*App. B*), xlvi. 77 (2), xlviii. 14-5 (6), lvi. 8, 10 (2) 48-50 (2), lvi. 31-5 (6), lvii. 1 (5)

*Dinarchus* (*Din.*):
I.111 (8)

*Diodorus Siculus* (*Diod. Sic.*)
IV. 76.5 (4); V.13 (5); III. 13, XIII. 19.4 (8)

*Diogenes Laertius* (*Diog. Laer.*):
5. 11-16 (*App. B*)

*Dionysius of Halicarnassus* (*Dion. Hal.*):
On Lysias 34 (6)

*Geoponica* (Byzantium C10 CE; author unknown):
II. 49, VI. 3. 1-5 (4)
Harpocration:
    Lexicon (6)

Herodotus (Hdt.):
    I. 68 (7); I. 141, 143, 169 (5), II. 166-7 (I, 6), II. 182, III. 47, 125, IV. 14, V. 28, 88 (5), VI. 57.3 (8), VII. 90 (5)

Hesiod (Hes.):
    Works and Days (Op.): 25 (4), 45-7, 176-8 (1), 293-391, 492 (6, 7), 678 (6)
    Theogony (Theog.): 139-41 (1)

Pseudo-Hesiod ((Hes.)):
    Epigrammata Homerica XIV (4)

Homer (Hom.):

Hyperides (Hyp.):
    iii. 1-5 (2, 7), 35 (5); 6-10 (3, 5, 6)
    iv. 35 (6)

Isaeus (Isae):
    v. 39 (6)

Isocrates (Isoc.):
    iv.42 (2), vii. 32, xiv. 48, xv. 159-60, xvii. 11-12 (6), xvii.9 (2)

Lycurgus (Lycurg.):
    Against Leocrates (Leoc.): 108 (2); 22.3 (5); 23 (3,6); 58 (6)
Lysias (Lys.):
  xii.4 (3, 5), 18-19 (I) xix, xxii. 7, xxxii. 5 (2); 19, xxiii.58 (5), v. 5 (App. B)

Menander (Men.):
  Aspis (I); Epitrepontes 380 (I, 6)

Plato (Pl.):
  Apologia (Ap.): scholiast to 18b (5, 6)
  Gorgias (Grg.): 490d (5); 514e (4); 515e (6).
  Hippias Minor (Hp. Mi.): 368b (7)
  Lachesis (La.): 187b (4)
  Laws (Leg.): 740b-c, 742c, 846d, 849b, d-e (2)
  Protagoras (Prt): 347c (2)
  Republic (Resp.): 371-3 (I, 2); 429d, 454c (5), 496d-e (I, 2), 504d (3),
          524d-531d (I), 545a-547b (I, 2); 601c (5)
  Symposium (Symp.): 197b (I); 221e (5)

Plutarch (Plut.):
  Life of Agesilaus (Ages.): 26.4-5 (I)
  Life of Alcibiades (Alc.): 7.5 (5)
  Life of Nicias (Nic.): 28.5 (5); 29.1 (8)
  Life of Pericles (Per.): 2 (I); 9.2-3 (6)
  Life of Solon (Sol.): 21 (5); 22 (6)
  Life of Theseus (Thes.): 25. 2-3 (6)
  Moralia (Mor.): 843d (5, 6)
  On Socrates’ Divine Sign (De. Gen.): 580a-d (6)

Pseudo-Plutarch: ((Plut)):
  Life of Isocrates (Isoc): 1 (I, 6)
  Life of Lysias (Lys.): 1 (5)

Pollux:
  Histories: 1.1.49, 10.32.5 (5)

Sophocles (Soph.):
  Antigone (Ant.): 365-6 (I).
Strabo:
Geography: VII. 30 (4), IX. 1.23 (6), XI. 2.17 (5).

Suidas:
Lexicon: 3.214 (4)

Theophrastus (Theophr.):
On Odours (5)
Characters (Char.): 10.10 (Ap. A)

Thucydides (Thuc.):
I. 2.2 (2); I. 6.3 (5), 13 (5, 6), II. 40.2, 63 (6), IV.16.1 (App. B), V. 96.3, VIII. 25 (5); VII. 27-8 (App. B), 87.2 (8)

Xenophon (Xen.):
Apologia 29 (5)
Constitution of the Lacedaimonians (Lac.): 7 (1, 2)
Cyropaedia (Cyr.): 8.2.5 (2); 5.3.39, 8.2.5 (5)
Memorabilia (Mem.): 2.7.6 (5), 2.7.11 (3, 5), 3.10.9 (5); 2.7.6, 2.7.11-2, 3.7.6 (6).
Oeconomicus (Oec): 2.5-6, 4.2-3 (2), 6.4 (2, 9), 7.3, 7.32, 7.35-43 (6)
Poroi (Vect.): 2.1-6 (6); 4.6 (2); 4.14-15 (3, 5, 6, 8); 4.23-4 (8)
Symposium (Symp.): 4.35 (2); 2.4 (5)

Pseudo-Xenophon ((Xen.)):
Constitution of the Athenians (Ath. Pol.):
1. 11-2 (2, 6); 27.3 (6)

ROMAN AUTHORS

Cicero (Cic.):
De Officiis (Off.): 1.150.1 (2)

Juvenal (Juv.):
Satires: III. 168 (4)

Pliny (Pln.):
Natural History (HN): VII. 191ff. (I, 4); XII. 18 (5); XVIII. 300 (9)
Virgil (Verg.):
Aeneid (Aen.): VIII. 424-5 (I)

FRAGMENTS

Adesp. (unknown author): fragment 516 in T Koch, Comicorum Atticorum Fragmenta
(Leipzig, 1880-88) III 503 (5)

W de Gruyter. II. 549 (5,6)

Critias: fragment 1. 12-14 in Fragmenta Historicorum Graecorum. C. and T. Müller
(Paris, 1853-1883) A.F. Didot (9)

Bibliotheca Scriptorum Graecorum et Romanorum Teubneriana 184 (6)

Pherecrates: fragment 70, cited in Long (1978) (5)

d'edition des Belles Lettres. (2, 3, 5, 6, 8)

Sophocles: fragment 438 in Sophocles: The plays and fragments: with critical notes by
RC Jebb. (Cambridge 1887-1900) Cambridge University Press 438 (4)

Theopompos: fragment 297 in Hellenica Oxyrhynchia: cum Theopompi at Cratippi

Theopompos Comicus: fragment 38 in Poetae Comici Graeci. R Kassel, C. Austin
(Berlin, 1983). W de Gruyter VII. 735 (5, 6)

INSCRIPTIONS

Corpus Inscriptionum Latinarum: (Berolini, 1869-92). George Reimer.
VI.9185, 1214 (5)

Feuilles de Delphes: Bourguet E, (1929) de Bocard,
Vol.III, Fasicule 5: Inscription 2940 (2)
Inscriptiones Graecae (IG): (Berolini, 1873-1904). George Reimer. I^2 324 (I), II^2 1622.694 (6), 1672.105 (5, 8); 11688 (5).

Sylloge Inscriptionum Graecarum (SIG): (Dittenberger, 1883) Hirzelius. 1177 (6)

2. SECONDARY SOURCES

REFERENCE WORKS

New Pauly. (Boston 2003), E.J. Brill.

COLLECTIONS

These books each contain more than one article listed under Books and Articles below, where they are referred to using abbreviations shown here:


BOOKS AND ARTICLES


——— (2002). *Markets, Fairs and Monetary Loans; Cultural History and Economic History in Roman Italy and Hellenistic Greece* in MLL.


——— (2002). *The Strategies of Mr. Theopompos* in *MLL*.
Deutsches Archäeologisches Institut (1891). *Antike Denkmäler (Band 1)*. Berlin.


267


(2006c). **When Did the Athenian Assembly Meet?** in *DR.*


(1931). **Griechische Wirtschafts- und Gesellschaftsgeschichte bis zu Perserheit**. Tubingen, Mohr.


Hume, D. ((1758)). **Of the Populousness of Ancient Nations** in *Essays*. Published for J Jones, 1822. Cambridge.


Leeuw, S. van der (1996). *Some Notes from the Potter’s Point of View*, in *CP*.


269


——— (1957c). *Time as an Instituted Process*, in *TMEE*.


271


Robinson, M. (1828). *Letters of Moncure Robinson to his Father, John Robinson of Va., Clerk of Henrico Court (July 22, 1825)*. William And Mary Quarterly 8(2).


**ELECTRONIC ARTICLES**


## APPENDIX A: Pottery Item Size Data

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| Smallest | 3.0 | 6.6 |
| Total | 1.0000 | 3.0 | 6.6 |
| Average | 3.0 | 6.6 |
| With Shrinkage | 3.1 | 6.8 | 330 | 0.31 | 2 | 462 |
| Tall, thin | 1995.088 Unguentarium | 13.3 | 2.7 |
| 1995.089 Unguentarium | 17.6 | 6.3 |
| 1995.090 Unguentarium | 14.4 | 4.0 |
| 1995.091 Unguentarium | 19.0 | 4.0 |
| 1956.0021 Jug | 19.0 | 8.8 |
| 1987.0097 Juglet | 11.2 | 7.4 |
| 2222.0021 Lekythos | 13.5 | 4.8 |
| 1990.0020 Lekythos | 16.0 | 5.7 |
| 1929.0080 Lekythos | 16.9 | 6.7 |
| 1931.0003 Lekythos | 20.5 | 8.9 |
| Largest | 20.5 | 8.9 |
| Smallest | 11.2 | 2.7 |
| Total | 10.0000 | 161.4 | 59.3 |
| Average | 16.1 | 5.9 |
| With Shrinkage | 16.7 | 6.1 | 440 | 0.26 | 2 | 616 |
APPENDIX B: The Population of Classical Athens

The total numbers of inhabitants of Athens at any given point in the fifth and fourth centuries is a matter of much dispute. Precision on these numbers is not important to our thesis and we are, for the most part, guided by Isager and Hansen (1975, 51). Based on a passage in Athenaeus, citing Ctesiades, an historian from the first century BC, they propose totals of 20,000 citizens, 10,000 metics and an unknown number of slaves, probably quite a lot fewer than the 400,000 in the same source. The numbers used in Chapter Six are based on notional or “representative” figures derived as follows:

CITIZENS:

Isager and Hansen’s numbers are for the fourth century. There are indications in Herodotus that there were more than 20,000 adult male citizens at the time of the Persian Wars. There seems to have been some decline by the end of the fifth century, partly due to the Peloponnesian Wars, that was not recovered in the fourth.

CITIZEN WOMEN:

We have very little data on the number of women. It is likely that there were more female members of citizens’ families than males, given differences in life expectancy, but in the absence of reliable estimates of this ratio, equal numbers are assumed. No attempt is made to estimate the number of children, but, from these figures, citizens and their families would number at least 80,000, perhaps slightly more at the start of the classical period.

METICS AND FREED SLAVES:

The census of Demetrius at the end of the fourth century gave 10,000 as the number of metics. Austin and Vidal-Naquet ((1977) 100-1) suggest that it was much higher than this in the fifth century, so we estimate 20,000 at that time, slightly more than Harris’ calculation of 19,000 ((2002a) 70). The slightly lower number in Hansen (1991) seems not to include manumitted slaves. While slave numbers grew substantially, the number of metics seems to have declined over the 200 years of our period by 30 to 40%, an even faster decline than among the citizen body. Slaves could be imported in response to demand and attrition; citizens and metics lost to wars or emigration could not. Though there is little evidence on
this point, it seems likely that the wives of metics and freed slaves were not quite as numerous as males, not least because at least some entrepreneurial immigrants are likely to have come to Athens without dependants.

SLAVES:

Isager and Hansen consider Athenaeus’ 400,000 slaves was a wild guess; a more reasonable one might be a little under 100,000 at the start of the fifth century, and close to 200,000 at the end of the fourth. Jameson (2002) believes that 50,000 “is more likely to be a minimum than a maximum.” In the Peloponnesian War, Thucydides tells of 20,000 slaves running away, most of them craftsmen (VII.27-8). From textual analysis, French (1964, 139) follows Plato’s estimate that rich Athenians might have had as many as 50 slaves, with the average citizen having a dozen or more. It is likely that even the poorer citizens would have had slaves. Lysias says “everyone” has a slave (v.5) and Demosthenes clearly expects that all dicaists have one (xlv.86). Aristotle describes the Athenian nuclear family as “a man, his wife and their slave” (Pol. 1252a-b). He himself, not known to have been especially rich, seems to have had at least five male slaves and seven female ones (Diog. Laer. 5.11-16). The same source tells us that Theophrastos had nine, Stration seven and Lycon thirteen. It is evident that all these figures include men and women, and quite possibly children. These ratios of slaves to citizens suggest slaves and their families probably accounted for well over half the population. There can scarcely have been fewer than 100,000 of them. Gomme (1933), Finley (1952), and de Ste. Croix (1981) agree with an estimate of between 80,000 and 120,000 in the fifth century and all commentators agree that the total rose by the end of the fourth, probably to over 200,000, possibly much more. Isager and Hansen (1975, 32-3) go on to show that by the fourth century slave reproduction was well below the replacement rate and the vast majority of slaves were made up of ‘barbarians’ who were being imported at the rate of at least 6,000 a year.

ALIENS:

Data are very scarce on numbers of foreigners; they were largely transient or, if long-term residents, often illegally so. The contribution to manufacturing in Athens of aliens who did not take the step of becoming metics was almost certainly trivial, so accuracy on their number is not important for our purposes.
SUMMARY

For the analysis in Chapter Six, it is the relative size of each group that matters more than their absolute numbers and it therefore uses numbers that may be considered representative during the classical period rather than aiming for accuracy at a specified point in time; the table below summarises the above estimates of the population by group at the beginning and end of the classical period, and shows the figure that is used in Chapter Six.

Table B:1: ESTIMATED ADULT POPULATION OF ATHENS

<table>
<thead>
<tr>
<th>SOCIAL GROUP</th>
<th>Adults 500 BCE</th>
<th>Adults 300 BCE</th>
<th>Representative Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult male citizens</td>
<td>25,000</td>
<td>20,000</td>
<td>25,000</td>
</tr>
<tr>
<td>Citizen women</td>
<td>25,000</td>
<td>20,000</td>
<td>25,000</td>
</tr>
<tr>
<td>Metics and Freed Slaves - male</td>
<td>20,000</td>
<td>12,000</td>
<td>15,000</td>
</tr>
<tr>
<td>Metics and Freed Slaves - female</td>
<td>12,000</td>
<td>10,000</td>
<td>12,000</td>
</tr>
<tr>
<td>Slaves (male and female)</td>
<td>80,000</td>
<td>200,000</td>
<td>100,000</td>
</tr>
<tr>
<td>Aliens (chiefly male)</td>
<td>5,000</td>
<td>5,000</td>
<td>5,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td>167,000</td>
<td>267,000</td>
<td>182,000</td>
</tr>
</tbody>
</table>
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