THE GREAT DIVERGENCE

China, Europe, and the Making of the Modern World Economy

KENNETH POMERANZ

THE GREAT DIVERGENCE

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CONTENTS

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Irvine, California
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INTRODUCTION

COMPARISONS, CONNECTIONS, AND NARRATIVES OF EUROPEAN ECONOMIC DEVELOPMENT

MUCH OF modern social science originated in efforts by late nineteenth- and twentieth-century Europeans to understand what made the economic development path of western Europe[1] unique; yet those efforts have yielded no consensus. Most of the literature has focused on Europe, seeking to explain its early development of large-scale mechanized industry. *Comparisons* with other parts of the world have been used to show that "Europe"—or in some formulations, western Europe, Protestant Europe, or even just England—had within its borders some unique homegrown ingredient of industrial success or was uniquely free of some impediment.

Other explanations have highlighted relations between Europe and other parts of the world—particularly various forms of colonial extraction—but they have found less favor with the majority of Western scholars.[2] It has not helped matters that these arguments have emphasized what Marx called the "primitive accumulation" of capital through the forcible dispossession of Amerindians and enslaved Africans (and many members of Europe's own lower classes). While that phrase accurately highlights the brutality of these processes, it also implies that this accumulation was "primitive" in the sense of being the *beginning* step in large-scale capital accumulation. This position has become untenable as scholarship has shown the slow but definite growth of an investible surplus above subsistence through the retained earnings of Europe's own farms, workshops, and countinghouses.

This book will also emphasize the exploitation of non-Europeans—and access to overseas resources more generally—but not as the sole motor of European development. Instead it acknowledges the vital role of internally driven European growth but emphasizes how similar those processes were to

[1] It should be noted here that "western Europe," for most authors, is a social, economic, and political construct, not an actual geographic entity: Ireland, southern Italy, and most of Iberia, for instance, did not have much of the economic development usually held to be characteristically European or western European. I will generally use the term in a geographical sense, while pointing out that the areas often taken to stand for "Europe" in these comparisons (e.g., the southern Netherlands, or northern England), might be better compared, in both size and economic characteristics, with such units as China's Jiangsu province, rather than with entire subcontinents such as China or India.

[2] Note, for instance, the generally negative current mainstream verdicts on the arguments of Eric Williams (1944), Andre Gunder Frank (1969), Samir Amin (1974), etc. A good general critique of the overseas extraction thesis is DeVries 1976: 139–46, 213–14.

processes at work elsewhere, especially in east Asia, until almost 1800. Some differences that mattered did exist, but I will argue that they could only create the great transformation of the nineteenth century in a context also shaped by Europe's privileged access to overseas resources. For instance, western Europe may well have had more effective institutions for mobilizing large sums of capital willing to wait a relatively long time for returns—but until the nineteenth century, the corporate form found few uses other than for armed long-distance trade and colonization, and long-term syndicated debt was primarily used within Europe to finance wars. More important, western Europe had by the eighteenth century moved ahead of the rest of the world in the use of various labor-saving technologies. However, because it continued to lag behind in various land-saving technologies, rapid population growth and resource demands might, in the absence of overseas resources, have forced it back onto a path of much more labor-intensive growth. In that case it would have diverged far less from China and Japan. The book thus calls upon the fruits of overseas coercion to help explain the *difference* between European development and what we see in certain other parts of Eurasia (primarily China and Japan)—not the whole of that development or the differences between Europe and *all* other parts of the Old World. A few other factors that do not fit firmly into either category, such as the location of coal supplies, also play a role. Thus the book combines comparative analysis, some purely local contingency, and an integrative or global approach.

Moreover, the comparative and integrative approaches modify each other. If the same factors that differentiate western Europe from, say, India or eastern Europe (e.g., certain kinds of labor markets) are shared with China, then comparisons cannot simply be the search for a European difference; nor can patterns shared at both ends of Eurasia be explained as unique products of European culture or history. (Nor, of course, can they be explained as outgrowths of universal tendencies, since they distinguish some societies from others.) The resemblances between western Europe and other areas that force us to turn from a purely comparative approach—one that assumes essentially separate worlds as units of comparison—to one that also looks at global conjunctures[3] have another significance as well. They imply that we cannot understand pre-1800 global conjunctures in terms of a Europe-centered world system; we have, instead, a polycentric world with no dominant center. Global conjunctures often worked to western Europe's advantage, but not necessarily because Europeans created or imposed them. For instance, the remonetization of China with silver from the fifteenth century on—a process that predated the European arrival in the Americas and the export of its silver—played a crucial part in making Spain's far-flung New World empire financially sustainable; and hor-

[3] For a discussion of comparisons between entities that are assumed to be systemically interrelated rather than truly separate (which he calls the "encompassing comparison"), see Tilly 1984.

rific, unanticipated epidemics were crucial to creating that empire in the first place. Only after nineteenth-century industrialization was well advanced does it make sense to see a single, hegemonic European "core."

Most of the existing literature, however, has remained set in an either/or framework—with either a Europe-centered world system carrying out essential primitive accumulation overseas[4] *or* endogenous European growth called upon to explain almost everything. Given those choices, most scholars have leaned toward the latter. Indeed, recent scholarship in European economic history has generally reinforced this exclusively internal focus in at least three ways.

First, recent research has found well-developed markets and other "capitalist" institutions further and further back in time, even during the "feudal" period often thought to be the antithesis of capitalism.[5] (A similar sort of revision has occurred in analyses of medieval science and technology, where what was once disparaged as the "Dark Ages" has now come to be seen as quite creative.) This has tended to reinforce the notion that western Europe was launched on a uniquely promising path well before it began overseas expansion. In some recent treatments, industrialization itself disappears as a turning point, subsumed into centuries of undifferentiated "growth."

To put matters slightly differently, older literatures—from the late nineteenth-century classics of social theory to the modernization theory of the 1950s and 1960s—stressed a fundamental opposition between the modern West and its past, and between the modern West and the non-West. As more recent literature has tended to narrow the first gap, it suggests that the second gap—European exceptionalism—goes back even further than we thought. But it is a central contention of this book that one can just as easily find grounds to narrow the gap between the eighteenth-century West and at least some other parts of Eurasia.

Second, the more market dynamics appear even amid supposedly hostile medieval culture and institutions, the more tempting it has been to make market-driven growth the *entire* story of European development, ignoring the messy details and mixed effects of numerous government policies and local customs.[6] And if legislative fiat at home added only small detours or

[4] E.g., Blaut 1993: 186–206.

[5] For a good recent example, see Britnell 1993.

[6] For a good example of the tendency to minimize the importance of both legislative changes and popular custom, see the large literature reinterpreting the decline of English open fields. These fields were once thought to represent a collective ethic hostile to nascent capitalism and to have been destroyed by legislation as more individualist, less paternalist ideas became dominant in Parliament. It is now common to argue that open fields in fact represented a rational strategy for individuals in a world of fluctuating harvests and no insurance and disappeared largely because gradually declining interest rates made another form of harvest insurance—namely grain storage—cheaper and more effective than keeping one's land in many scattered plots likely to have slightly different soils and micro-climates (e.g., McCloskey 1975a, 1975b, 1989). A further

occasional slight shortcuts to European development paths, why should coercion overseas—in places far from the main action of the story—be worth much attention? Meanwhile, an increasingly exclusive focus on private initiatives has not only provided an enviably clear story line, but a story line compatible with currently predominant neoliberal ideas.

Third, since this ongoing process of commercialization touched much of preindustrial western Europe, much recent literature treats whatever is left of the Industrial Revolution as a *European* phenomenon, rather than, as used to be common, as a British phenomenon spreading later to the rest of Europe.[7] Such a move is challenged, not only by a mass of older scholarship, but also by more recent work suggesting that England had already diverged from the continent in crucial respects centuries before the Industrial Revolution.[8] But the shift from a British to a European focus has been facilitated by the aforementioned tendencies to deemphasize politics and to minimize the conflict between "traditional" practices and rationally self-interested individuals, making it easier to minimize variation within western Europe.

Positing a "European miracle" rather than a British one has important consequences. For one thing, it again makes extra-European connections seem less important. Most of western Europe was far less involved in extracontinental trade than Britain was: so if it was "Europe" rather than "Britain" whose commercial growth led smoothly to industrial growth, then domestic markets, resources, and so forth must have been adequate for that transition. Moreover, if growth was largely achieved through the gradual perfection of competitive markets, then it seems implausible that colonies beset by mercantilist restrictions and unfree labor, to name just two problems, could possibly have been dynamic enough to significantly effect their mother countries. Thus Patrick O'Brien, a leading exponent of a "European" view, concedes that *British* industrialization, in which cotton played such a crucial role, is hard to envision without colonies and slavery, but then continues:[9]

> Only a simplistic growth model with cotton as a leading sector and with British innovation as the engine of Western European growth could support an argument that the Lancashire cotton industry was vital for the industrialization of the core. That process proceeded on too broad a front to be checked by the defeat of an advanced column whose supply lines stretched across the oceans to Asia and the Americas.

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consequence of this view, discussed (and disputed) on pp. 76–80 below, is the claim that the absence of any comparably successful government assault on traditional open fields in France was not as important an impediment to French development as earlier historians had generally held.

[7] For two classic, though very different, statements of the British-centered view, see Landes (1969) and Hobsbawm (1975). One of the most explicit and trenchant critiques of this view is O'Brien and Keydar 1978.

[8] See, e.g., Snookes 1994a, Wrigley 1990: 101–2.

[9] O'Brien 1982: 12.

He then concludes that "for the economic growth of the core, the periphery was peripheral."[10]

Such arguments make Europe's overseas expansion a minor matter in a story dominated by emerging economic superiority. Empire might be explained *by* that superiority or might be independent of it, but had little to do with creating it. The resulting narratives are largely self-contained in two crucial senses: they rarely require going either beyond Europe or beyond the model of free, competing buyers and sellers at the heart of mainstream economics. For those scholars who also explain the increased speed of technological change largely in terms of a patent system granting more secure property in creativity, this closure becomes almost complete.

The emphasis on "European" industrialization has also tended to shape the units used in our comparisons, often in unhelpful ways. In some cases, we get comparative units based simply on contemporary nation-states, so that Britain is compared to India or China. But India and China are each more comparable in size, population, and internal diversity to Europe as a whole than to individual European countries; and a region within either subcontinent that by itself might be comparable to Britain or the Netherlands is lost in averages including Asian equivalents of the Balkans, southern Italy, Poland, and so on. Unless state policy is the center of the story being told, the nation is not a unit that travels very well.

A second durable approach has been to first search for things that made "Europe" as a whole distinct (though the particulars chosen often really describe only part of the continent) and then, once the rest of the world has been dropped from the picture, to look within Europe for something that made Britain distinct. These continental or "civilizational" units have so powerfully shaped our thinking that it is hard to shake them; they will appear here, too. But for many purposes, it seems more useful to try a different approach, anticipated in important ways by my colleague R. Bin Wong.[11]

Let us grant the following: few essential characteristics unite, say, Holland and the Ukraine, or Gansu and the Yangzi Delta; a region like the Yangzi Delta (population 31,000,000–37,000,000 circa 1750, depending on the precise definition) is certainly big enough to be compared to eighteenth-century European countries; and various core regions scattered around the Old World—the Yangzi Delta, the Kantō plain, Britain and the Netherlands, Gujarat—shared

[10] Ibid. In his work with Keydar on Britain and France, O'Brien makes the much more convincing but rather different point that European industrialization was not *simply* the diffusion of British innovations to the rest of the continent. France, for instance, concentrated on different industries, which often involved finishing British semi-finished goods. But the very complementarity between Britain and France that shows the possibility of different routes to industrialization also suggests that we cannot simply remove British industrialization from the story and say that had that not happened, the continent would have industrialized anyway. And the British story, as we shall see, is unimaginable without two crucial discontinuities—one created by coal and one by colonies.

[11] Wong 1997.

some crucial features with each other, which they did not share with the rest of the continent or subcontinent around them (e.g., relatively free markets, extensive handicraft industries, highly commercialized agriculture). In that case, why not compare these areas directly, before introducing largely arbitrary continental units that had little relevance to either daily life or the grand patterns of trade, technological diffusion, and so on?[12] Moreover, if these scattered cores really had much in common—and if we are willing to allow some role for contingencies and conjunctures—it makes sense to make our comparisons between them truly reciprocal: that is, to look for absences, accidents, and obstacles that diverted England from a path that might have made it more like the Yangzi Delta or Gujarat, along with the more usual exercise of looking for blockages that kept non-European areas from reproducing implicitly normalized European paths.

Here, too, I am following a procedure outlined in Wong's recent *China Transformed*. As Wong points out, much of classic nineteenth-century social theory has been rightly faulted for its Eurocentrism. But the alternative favored by some current "postmodern" scholars—abandoning cross-cultural comparison altogether and focusing almost exclusively on exposing the contingency, particularity, and perhaps unknowability of historical moments—makes it impossible even to approach many of the most important questions in history (and in contemporary life). It seems much preferable instead to confront biased comparisons by trying to produce better ones. This can be done in part by viewing both sides of the comparison as "deviations" when seen through the expectations of the other, rather than leaving one as always the norm. It will be my procedure in much of this book, though my concrete application of this reciprocal comparative method has some significant differences from Wong's, and I carry the approach onto rather different terrain.[13]

This relatively untried approach at least generates some new questions that put various parts of the world in a different light. For instance—and here again I largely agree with Wong—I will argue that a series of balanced comparisons show several surprising similarities in agricultural, commercial, and protoindustrial (i.e., handicraft manufacturing for the market rather than home use) development among various parts of Eurasia as late as 1750. Thus the explosion of further growth in western Europe alone during the nineteenth century again becomes a rupture to be explained. By contrast, some recent literature, by limiting itself to intertemporal European comparisons and finding similarities there (which are real enough), tends to obscure this rupture. Thus, such

[12] On the limited utility of "civilizations" as a unit, see Fletcher (1995: 3–7); Hodgson (1993: 17). On continents, see Wigen and Lewis (1997).

[13] For example, I place greater stress than Wong does on global conjunctures and reciprocal influences and bring more places besides Europe and China into the discussion; I also say little about some of his topics, such as state formation, and much more about some he does not treat extensively, such as environmental change.

literature also often barely passes over important contributions to industrialization—especially conjunctural ones—which may appear as taken-for-granted "background" in a comparison limited to different periods in Europe.

A strategy of two-way comparisons also justifies linking what may at first seem two separate issues. The point at which western Europe became the richest economy need not be the same as the point at which it broke out of a Malthusian world into one of sustained per capita growth. Indeed, most of what I have called the "Europe-centered" approaches argue that western Europe had become uniquely rich long before its industrial breakthrough. And if our only question were whether China (or India, or Japan) could have made its own breakthrough to such a world—i.e., if we normalize the European experience and make it the pattern one would expect in the absence of "blockages" or "failures"—it would no longer be very important to ask when Europe actually escaped a Malthusian world: it would matter far more that it had been for a long time on a path bound to lead to that breakthrough eventually. Meanwhile, the dates by which it had definitively surpassed other places would tell us little about other possibilities for Europe and only about when those other places had taken their detours into stagnation.

But if we make reciprocal comparisons and entertain the possibility that Europe could have been a China—that no place was bound to achieve dramatic and sustained per capita growth—the link between the two becomes closer. If we further argue—as I will in subsequent chapters—that some other parts of the eighteenth-century world were roughly as close as Europe was to maximizing the economic possibilities available to them without a dramatic easing of their resource constraints (like that made possible for Europe by fossil fuels and the New World), then the link between the two issues becomes closer still.

The two questions are still separable: differences in climate, soil, etc., might have given different areas different preindustrial possibilities. But it seems unlikely that Europe enjoyed a substantial edge in those possibilities over all other densely settled regions, particularly since the evidence presented later in this book suggests that it did not in fact become much better-off than east Asia until industrialization was well under way. Or it might turn out that although Europe did not pull ahead of east Asia until the eve of industrialization, certain institutions were in place by a much earlier date that did make industrialization bound to happen after all; that even without the Americas and favorably located fossil fuels, technological inventiveness was already sufficient to sustain growth in the face of any particular local resource shortages, and without resorting to the extremely labor intensive solutions which sustained aggregate, but not per capita, growth elsewhere. But the strong assumptions that such an assertion of inevitability would require begin to look shaky once we actually hold Europe up against the standard of some other preindustrial economies—especially since the last few centuries of European economic history before industrialization do not show consistent and robust per capita growth. Thus,

two-way comparisons both raise new questions and reconfigure the relationships among old ones.

Thus, this book will emphasize reciprocal comparisons between *parts* of Europe and parts of China, India, and so on that seem to me to have been similarly positioned within their continental worlds. We will return to continental units and to still larger units, such as the Atlantic world, when our questions—such as those about the relationships of cores to their hinterlands—require it. And in some cases we will need to take the entire world as our unit, requiring a somewhat different kind of comparison—what Charles Tilly calls the "encompassing comparison," in which rather than comparing two separate things (as classical social theory did) we look at two parts of a larger whole and see how the position and function of each part in the system shape their nature.[14] At this level, which I emphasize more than Wong does, comparison and the analysis of connections become indistinguishable. The importance of keeping the analysis reciprocal, however, remains. Our perception of an interacting system from which one part benefited more than others does not in itself justify calling that part the "center" and assuming that it is the unshaped shaper of everything else. We will see, instead, vectors of influence moving in various directions.

Variations on the Europe-Centered Story: Demography, Ecology, and Accumulation

The arguments positing that western Europe's economy was uniquely capable of generating an industrial transformation generally fall into two clusters. The first, typified by the work of E. L. Jones, argues that beneath a surface of "pre-industrial" similarity, sixteenth- through eighteenth-century Europe had already moved far ahead of the rest of its world in the accumulation of both physical and human capital.[15] A central tenet of this view is that various customary checks on fertility (late marriage, a celibate clergy, etc.) allowed Europe to escape from the otherwise universal condition of a "pre-modern fertility regime" and thus from a similarly universal condition in which population growth absorbed almost all of any increase in production. Consequently, Europe was uniquely able to adjust its fertility to hard times and to increase its per capita (not just total) capital stock over the long haul.

Thus, in this view, differences in the demographic and economic behavior of ordinary farmers, artisans, and traders created a Europe that could support more non-farmers; equip its people with better tools (including more livestock); make them better nourished, healthier, and more productive; and create a larger market for goods above and beyond the bare necessities. The central

[14] Tilly 1984.

[15] Jones 1981, 1988.

arguments underlying this position were laid out over thirty years ago by John Hajnal:[16] they have been elaborated since then, but not radically altered. However, as we shall see in chapter 1, recent work on birthrates, life expectancy, and other demographic variables in China, Japan, and (more speculatively) Southeast Asia has made what Hajnal thought were unique European achievements look more and more ordinary.

The significance of these findings has not yet been fully appreciated, but they have been partially acknowledged in the one important recent addition to the demographically driven story line: the recognition that there were economic booms and rising living standards in preindustrial settings outside Europe. However, these are always treated as temporary flowerings that either proved vulnerable to political shifts or played themselves out as productivity-enhancing innovations proved unable to stay ahead of the population increases that prosperity encouraged.[17]

Such stories are an important advance over much earlier literature, which argued either implicitly or explicitly that the whole world was poor and accumulation minimal until the early modern European breakthrough; among other things, it has forced scholars to look at "the fall of Asia"[18] as well as the "rise of Europe." However, these versions of the story are often anachronistic in at least two crucial ways.

First, they tend to read too much of the nineteenth- and twentieth-century ecological disasters that have afflicted much of Asia (and the underlying problem of dense population) back into earlier periods and present eighteenth-century Asian societies as having exhausted all the possibilities available to them. Some versions attribute this condition to all of an artificial unit called "Asia" circa 1800; but, as we shall see, India, Southeast Asia, and even parts of China still had a good deal of room to accommodate more people without either a major technological breakthrough or a decline in the standard of living. Probably only a few parts of China and Japan faced such a situation.

Second, such stories often "internalize" the extraordinary ecological bounty that Europeans gained from the New World. Some do so by assimilating overseas expansion to the pattern of "normal" frontier expansion within Europe (e.g., the clearing and settlement of the Hungarian plain or the Ukraine, or of German forests). This ignores the exceptional scale of the New World windfall, the exceptionally coercive aspects of colonization and the organization of production there, and the role of global dynamics in ensuring the success of European expansion in the Americas.[19] The clearing of new agricultural lands in Hungary and the Ukraine had parallels in Sichuan, Bengal, and many other Old World locales; what happened in the New World was very different from anything in either Europe or Asia. Moreover, because nineteenth-century

[16] Hajnal 1965, 1982.
[17] Jones 1988; Elvin 1973; Powelson 1994.
[18] Abu-Lughod 1989; Frank 1998.
[19] See, e.g., Jones 1981: 70–74.

Europe found enormous ecological relief beyond its borders—both acquiring resources and exporting settlers[20]—such accounts rarely consider whether some densely populated core regions in sixteenth- through eighteenth-century Europe faced ecological pressures and options not radically different from those of core regions in Asia.

Thus, the literature that incorporates the "fall of Asia" tends to do so with the aid of an oversimplified contrast between an ecologically played-out China, Japan, and/or India, and a Europe with plenty of room left to grow—a Europe that, in one formulation, had the "advantages of backwardness"[21] because it had not yet developed enough to make full use of its internal resources.

In an attempt to move beyond such impressionistic claims, chapter 5 offers a systematic comparison of ecological constraints in selected key areas of China and Europe. This inquiry shows that although some parts of eighteenth-century Europe had some ecological advantages over their east Asian counterparts, the overall pattern is quite mixed. Indeed, key Chinese regions seem to have been better-off than their European counterparts in some surprising ways, such as available fuel supply per capita. Moreover, Britain, where industrialization in fact began, had few of the underutilized resources that remained in various other parts of Europe. Indeed, it seems to have been no better-off than its rough counterpart in China—the Lower Yangzi Delta—in timber supply, soil depletion, and other crucial ecological measures. Thus, if we accept the idea that population growth and its ecological effects made China "fall," then we would have to say that Europe's internal processes had brought it very close to the same precipice—rather than to the verge of "take-off"—when it was rescued by a combination of overseas resources and England's breakthrough (partly conditioned by geographic good luck) in the use of subterranean stores of energy. If, on the other hand, Europe was not yet in crisis, then in all likelihood China was not either.

In making this argument this book parallels some of the arguments in work on global development by Sugihara Kaoru—work I discovered too late in my writing to deal with in great detail.[22] Sugihara emphasizes, as I do, that the high population growth in east Asia between 1500 and 1800 should not be seen as a pathology that blocked "development." On the contrary, he argues, this was an "East Asian miracle" of supporting people, creating skills, and so on, which is fully comparable as an economic achievement to the "European miracle" of industrialization. Sugihara also emphasizes, as I do, the high standard of living in eighteenth-century Japan and (to a lesser extent in his view) China, as well as the sophistication of institutions that produced many of the beneficial effects of markets without the same state guarantees for property and contract

[20] Crosby 1986: 2–5, 294–308.
[21] Frank 1998: 283, playing on Gerschenkron.
[22] Sugihara 1996.

that many Westerners believe is the precondition of markets.[23] He also argues—a point consistent with my argument though beyond the scope of this book—that in the long run it has been a combination of western European and east Asian types of growth, allowing Western technology to be used in societies with vastly more people, which has made the largest contribution to world GDP, not a simple diffusion of Western achievements.

Sugihara does, however, suggest that a basic difference between these two "miracles" is that as far back as 1500, western Europe was on a capital-intensive path and east Asia on a labor-intensive path. By contrast, I argue—in keeping with the finding of surprising similarities as late as 1750 and with my determination to take the question "Why wasn't England the Yangzi Delta?" as seriously as "Why wasn't the Yangzi Delta England?"—that Europe, too, could have wound up on an "east Asian," labor-intensive path. That it did not was the result of important and sharp discontinuities, based on both fossil fuels and access to New World resources, which, taken together, obviated the need to manage land intensively. Indeed, there are many signs that substantial regions in Europe were headed down a more labor-intensive path until dramatic late eighteenth- and nineteenth-century developments reversed that path. We will find such evidence in aspects of agriculture and proto-industry throughout Europe (including England) and in almost everything about Denmark.[24] The East-West difference that developed around labor-intensity was not essential but highly contingent; the distribution of population growth (as opposed to its aggregate size) turns out to be one crucial variable, which in turn has much to do with market *distortions* in sixteenth- through eighteenth-century Europe and with migration to the New World in the nineteenth century.

In both China and Japan population growth after 1750 was heavily concentrated in less-developed regions, which then had smaller surpluses of grain, timber, raw cotton, and other land-intensive products to "vent" through trade with resource-hungry cores; and since part of the increased population of these peripheral areas went into proto-industry, they also had less need to trade with core regions. In Europe, on the other hand, it was largely areas that were already relatively advanced and densely populated that had large population increases between 1750 and 1850. Most of eastern Europe, for instance, only began to experience rapid population growth after 1800, and southern Europe (especially southeastern Europe) began to catch up even later. Chapters 5 and 6 will have much more to say about the political-economic and ecological bases of these differences and their significance for industrialization. Meanwhile, it is worth emphasizing that they are not differences that reflect a greater

[23] It is worth noting, however, that in recent years many Western economic historians have also become interested in describing institutional arrangements that made contracts easily enforceable, and thus permitted efficient markets, even in the absence of much state involvement in guaranteeing property rights. For a helpful summary, see Greif 1998: 597–633.

[24] See for instance Ambrosoli 1997; Levine 1977; Kjaergaard 1994.

overall strain on resources in east (much less south) Asia as compared to Europe. Let us move, then, from arguments about quantities of resources available—either those already accumulated or those left untapped—to arguments claiming that European institutions *allocated* resources in ways more conducive to long-term self-sustaining growth.

Other Europe-Centered Stories: Markets, Firms, and Institutions

A second group of arguments—evident in somewhat different ways in the work of Fernand Braudel, Immanuel Wallerstein, and K. N. Chaudhuri, and in a very different way in that of Douglass North—pays less attention to *levels* of wealth. Instead, these arguments emphasize the emergence of institutions in early modern Europe (or some part of it) said to be more conducive to economic development than those existing elsewhere. The focus of these arguments is generally on the emergence of efficient markets and property-rights regimes that rewarded those who found more productive ways to employ land, labor, and capital. A common, though not universal, companion to these arguments is the claim that economic development was stifled elsewhere (especially in China and India) by a state that was either too strong and hostile to private property or too weak to protect rationalizing entrepreneurs when the latter clashed with local customs, clergy, or strongmen.[25]

Potentially consistent with these arguments—though quite distinct from them—is the work of Robert Brenner, who explains divergent development paths within Europe as the result of class struggles that altered property-rights regimes. In Brenner's interpretation, western European peasants won the first round of a struggle with their lords in the century or so after the Plague, establishing their freedom from forced labor; eastern European peasants lost, and the ruling class lived for centuries thereafter by squeezing peasants harder, without ever modernizing agriculture or introducing labor-saving innovations. Within western Europe, Brenner continues, a second round of struggle ensued, with lords who now owned only the land seeking the freedom to manage it so as to maximize profits, often by removing unproductive or "excess" tenants. French elites lost this battle, according to Brenner, and France was stuck thereafter with an agricultural system based on millions of smallholders neither able nor very interested in innovations that would make some of them unnecessary. But in England the lords won, invested in innovations that made it possible to cut labor costs, and expelled huge numbers of unneeded workers from the land. At least some of these dispossessed farmers eventually became En-

[25] Wittfogel 1957; Jones 1981: 66–67, 118, 125; Jones 1988: 130–46; Mokyr 1990: 233–34, 256–60; Powelson 1994.

gland's industrial workforce, buying food from the agrarian surplus created by their expulsion and marketed by their former lords.

In Brenner's argument, class struggle, rather than either Malthusian pressures or the "natural" emergence of more perfect markets, supplies the motor of the story; the destination, however, is similar. How much a society winds up resembling neoclassical models determines how productive it will be thereafter; in particular, England, the country where land and labor wound up most sharply separated (and most completely commodified) is presumed to have *therefore* developed the most dynamic economy. In this, Brenner winds up rather oddly aligned with Douglass North, who—while rejecting class struggle as the explanation of property-rights regimes—also argues that economies became increasingly capable of development as they evolved increasingly competitive markets for commodified land, labor, capital, and intellectual property.

Both North's and Brenner's arguments focus on the institutional settings in which the great majority of people operated: markets for day labor, tenancy contracts, and for products that ordinary people both produced and consumed. In this they resemble the arguments discussed above, which argue that preindustrial Europeans were already uniquely prosperous and productive, and tend to merge with those arguments.

However, the other major set of institutionalist arguments—those of Braudel and his school—focuses more on the profits accumulated by a few very wealthy people; the institutions that facilitated this kind of accumulation often involved special privileges that interfered with neoclassical markets. Consequently, these scholars have paid more attention to profits based on the use of coercion and collusion. And because many of the great merchants they focus on were involved in long-distance trade, these scholars have paid more attention to international politics and Europe's relations with other areas. Wallerstein, in particular, treats the growth of trade between "feudal" eastern Europe and "capitalist" western Europe as the real beginning of a world economy, and he emphasizes that continued accumulation of profits in the free-labor "core" of that economy has required the continued existence of poor, generally unfree "peripheries."

But nonetheless, the motor of Wallerstein's story is western Europe's unique combination of relatively free labor, large and productive urban populations, and merchants and governments that facilitated long-distance trade and the reinvestment of profits. The international division of labor that emerged from this trade increased the difference in wealth between western Europe and everyone else, since peripheries increasingly specialized in those goods for which cheap, often coerced, labor was more important than the tools and institutions needed for high productivity—but it was based on preexisting socioeconomic differences that enabled western Europe to impose on others in the first place.

Problems with the Europe-Centered Stories

This work borrows from these arguments—mostly those of the various "institutionalists"—but ultimately argues for different propositions. First, no matter how far back we may push for the origins of capitalism, *industrial* capitalism, in which the large-scale use of inanimate energy sources allowed an escape from the common constraints of the preindustrial world, emerges only in the 1800s. There is little to suggest that western Europe's economy had decisive advantages before then, either in its capital stock or economic institutions, that made industrialization highly probable there and unlikely elsewhere. The market-driven growth of core areas in western Europe during the preceding centuries was real enough and was undoubtedly one crucial precursor of industrialization—but it was probably no *more* conducive to industrial transformation than the very similar processes of commercialization and "proto-industrial" growth occurring in various core areas in Asia.[26] The patterns of scientific and technical development that were taking shape in early modern Europe were more unusual, but we shall see that they still did not, by themselves, guarantee that western Europe would wind up on a fundamentally different economic path from, for instance, east Asia.

Second, European industrialization was still quite limited outside of Britain until at least 1860. Thus, positing a "*European* miracle" based on features common to western Europe is risky, all the more so since much of what was widely shared across western Europe was at least equally present elsewhere in Eurasia.

Part 1 of this book calls into doubt various contentions that Europe had an internally generated economic edge before 1800. It substitutes a picture of broad similarities among the most densely populated and commercialized parts of the Old World. Chapter 1 draws on evidence from numerous places to show that Europe had not accumulated a crucial advantage in physical capital prior to 1800 and was not freer of Malthusian pressures (and thus more able to invest) than many other large economies. People in various other areas seem to have lived as long and as well as Europeans and to have been at least equally willing and able to limit fertility in the interest of household-level accumulation. The second half of the chapter then examines the possibility that Europe had a crucial technological edge even before the Industrial Revolution. Here we do find some differences that mattered—but which would have had smaller, later, and probably qualitatively different effects without both the fortunate geographic accidents essential to the energy revolution and Europe's

[26] Sugihara and Hayami (1989) see the "industrial" and "industrious" revolutions diverging already in the seventeenth century, Arrighi in the eighteenth century. Although there are indeed signs of such a divergence that far back, I will argue that it was not sealed until the turn of the nineteenth century, when the New World plus coal made it clear that such a land-using, resource-intensive path would remain sustainable for a prolonged period.

privileged access to overseas resources. Technological inventiveness was necessary for the Industrial Revolution, but it was not sufficient, or uniquely European. It is unclear whether whatever differences existed in the *degree* of technological inventiveness were crucial to exiting a Malthusian world (technological breakthroughs could have been spread over a slightly longer period), but it is clear that the differences in global context that helped ease European resource constraints—and so made innovation along particular (land-using, energy-using, and labor-saving) paths a fruitful, even self-reinforcing, process—were significant.

Chapter 2 turns to markets and related institutions. It focuses primarily on a comparison between western Europe and China. It shows that western European land, labor, and product markets, even as late as 1789, were on the whole probably *further* from perfect competition—that is, less likely to be composed of multiple buyers and sellers with opportunities to choose freely among many trading partners—than those in most of China and thus less suited to the growth process envisioned by Adam Smith. I begin by comparing laws and customs governing the ownership and use of land and the extent to which agricultural producers could choose to whom to sell their output. The next section concerns labor: the extent of compulsory labor, restrictions on (or encouragement of) migration, restrictions on changing occupations, and so on.

The last and most complex section of chapter 2 treats the relationships between households as units of consumption and as institutions that allocated labor—particularly that of women and children. Some scholars have argued that Chinese families were more prone than western European ones to keep women and children working beyond the point at which their marginal output sank below the value of a subsistence wage, thus producing an "involuted economy"; I will show that there is little reason to believe this.[27] Rather, labor deployment in Chinese families seems to closely resemble the reorientation of labor, leisure, and consumption toward the market that Jan DeVries has called Europe's "industrious revolution."[28] In sum, core regions in China and Japan circa 1750 seem to resemble the most advanced parts of western Europe, combining sophisticated agriculture, commerce, and nonmechanized industry in similar, arguably even more fully realized, ways. Thus we must look outside these cores to explain their subsequent divergence.

Building a More Inclusive Story

Part 2 (chapters 3 and 4) begins by moving away from survival-oriented activities to examine new kinds of consumer demand, the cultural and institutional changes that accompanied them, and the possibility that differences in demand

[27] P. Huang 1990: 11–17; for a related argument see also Goldstone 1996.
[28] DeVries 1994b.

had important effects on production (chapter 3). Here we find differences that may well have differentiated China, Japan, and western Europe from other places, but not very much from each other. The differences in both quantities of goods available and "consumerist" attitudes among these societies seem small and of uncertain direction. (For instance, mid-eighteenth-century Chinese almost certainly consumed more sugar than Europeans, and people in the Lower Yangzi core may have produced as much cloth per capita in 1750 as Britons did in 1800.) And institutions in all these societies (though not necessarily elsewhere) seem to have been such that increased production routinely created demand, while it is much less clear that increased demand could create supply. Finally, those differences in consumer behavior that did favor Europe seem to have been heavily influenced by extra-European elements—for example, the extraction of New World silver and the demand for it in Asia, which sucked other "exotic" goods into Europe, and the system of production shaped by New World plantations and slavery.

Chapter 4 then follows the merchants and manufacturers who brought the new "luxuries" of chapter 3—whether imported, imitated (e.g., Wedgewood "china"), or purely homegrown—to market. In doing so, it moves away from the "typical" household and the sorts of markets for land, labor, and consumer goods in which they participated. Instead it looks at actors who operated on a larger scale, examining markets in the last factor of production—capital—and arguments about a distinctive European capitalism. It thus moves away from institutional arguments focused entirely on the growth of allegedly more perfect markets within western Europe to those that pay more attention to external connections, find advantages for certain crucial actors in imperfect competition, and so also pay more heed to extraeconomic coercion.

Chapter 4 begins by rejecting various arguments that either the general structure of society or the specific rules surrounding commercial property gave European merchants a crucial advantage in amassing capital, preserving it from the state, or deploying it rationally. Although some financial assets may have been better defined and more secure in Europe (or at least in England, Holland, and the Italian city-states), such differences are too small to bear the explanatory weight assigned to them by scholars as diverse as Fernand Braudel, K. N. Chaudhuri, and Douglass North—and even harder to link to the early Industrial Revolution, which was not very capital intensive. Certainly some of the larger Chinese firms, for instance, regularly assembled sums of capital adequate to implementing the major technical innovations of the pre-railroad era.

Western European interest rates were probably lower than Indian, Japanese, or Chinese ones; but it turns out to be very hard to show that this made an important difference to relative rates of agricultural, commercial, or proto-industrial expansion, and even harder to show much impact on the early rise of mechanized industry. And it is significant that where eighteenth-century

Europeans' supposedly superior commercial organizations had to compete with merchants from other Old World regions without using force, their record was mediocre. Only in overseas colonization and *armed* trading did Europe's financial institutions—nurtured by a system of competing, debt-financed states—give it a crucial edge.

Even more important, as Braudel himself emphasizes, is the point that capital was not a particularly scarce factor of production in the eighteenth century.[29] Constraints connected to energy, and ultimately to quantities of land (particularly the shrinking forests of core areas throughout Eurasia), were a far more important looming impediment to further growth. The essence of development was that both labor and capital became more plentiful relative to land, but producing any of Malthus's four necessities of life—food, fiber (clothing), fuel, and building materials—still required land.

To some extent, capital and labor could create more land (reclamation) or make land yield more food and fiber through irrigation, fertilization, or extra-careful weeding, but this was quite limited compared to what late nineteenth-century chemical industries would make possible. And when it came to producing fuel and building materials before the massive use of fossil fuels, the ability of labor and capital to substitute for land was very limited indeed. Thus, even if Europe had an edge in assembling investment capital, this would not by itself have solved the ecological bottlenecks faced by all the most "developed" proto-industrial regions. Certainly there are enough examples of capital-rich but late industrializing areas even within Europe to make any link between greater capital accumulation and a transition to industrialism dubious. Northern Italy and Holland are obvious examples, despite their highly sophisticated commercial economies, and so, in a different way, is Spain, where a huge flood of silver into a less-developed economy may well have retarded growth.[30]

Braudel did not systematically explore how his own insight about the relative abundance of capital before 1800 might affect explanations of European distinctiveness; instead he turned back to unverified claims that European fortunes were more secure.[31] However, the Braudelian family of arguments does direct our attention toward long-distance trade and toward phenomena—the state, colonial ventures, and nonmarket extraction—which I think played a greater role in the European breakthrough than is visible in most recent studies. In particular, I will argue that while neither the new forms of property created in early modern Europe (e.g., corporations and various securitized claims on future income streams) nor the domestic policies of Europe's competing and revenue-hungry states made pre-1800 Europe itself a significantly better environment for productive activity, the projection of interstate rivalries overseas

[29] Braudel 1977: 60; DeVries 1976: 210–14.
[30] Flynn 1984; Hamilton 1934.
[31] Braudel 1977: 60–75.

did matter. Similarly, joint-stock companies and licensed monopolies turned out to have unique advantages for the pursuit of armed long-distance trade and the creation of export-oriented colonies—activities that required what were for the time exceptional amounts of capital willing to wait a relatively long time for returns. When we combine this notion of European capitalism, in which links to the state and the right to use force and preempt certain markets loom large, with the idea that advanced market economies everywhere faced growing ecological problems, a new picture emerges of what Europe's most significant differences were.

Part 3 (chapters 5 and 6) then sketches a new framework for thinking about the relationships between internal and external factors in Europe's development path. Chapter 5 begins by arguing for serious ecological obstacles to *further* growth in all of the most densely populated, market-driven, and commercially sophisticated areas of Eurasia. These were not so acute as to cause major food crises, but they made themselves felt in shortages of fuel and building materials, to some extent in shortages of fiber, and in threats to the continued fertility of some areas' soils. After examining these constraints, the last part of chapter 5 examines the attempts made by all these core areas to address these shortages through long-distance trade with less densely populated Old World areas; it argues that such trade could not provide a fully adequate solution. The high cost of transport before the age of steam was one reason, but others are rooted in the political economies of many of the "peripheral" regions, the relatively low levels of demand there, and the resulting difficulties of sustaining an exchange of core manufactured goods for raw materials without either a colonial system to enforce it or the much larger interregional differences in manufacturing productivity (often based on relatively immobile factors such as capital equipment embodying new technology) that emerged from the late nineteenth century onward.

Chapter 6 then considers the dramatic easing of Europe's land constraint during industrialization. It looks briefly at the shift from wood to coal—an important story, but one well covered elsewhere—and then turns to the ecological relief provided by Europe's relations with the New World. This relief was predicated not merely on the natural bounty of the New World, but also on ways in which the slave trade and other features of European colonial systems created a new *kind* of periphery, which enabled Europe to exchange an ever-growing volume of manufactured exports for an ever-growing volume of land-intensive products.

A crucial part of this complementarity, up through the early industrial era, was the result of slavery. Slaves were purchased from abroad by New World plantations, and their subsistence production was often limited. Thus, slave regions imported much more than, say, eastern Europe and southeast Asia, where the producers of export crops were born locally, met most of their own basic needs, and had little cash with which to buy anything else.

The plantation zone also differed in critical ways from free labor peripheries such as the Chinese interior. Exporters of rice, timber, and raw cotton in east Asia had more purchasing power than did peasants in regions of coerced cash-cropping and had greater flexibility and incentives to respond to external demand. But the same system of more or less free labor that produced these dynamic peripheries also allowed people to shift away from activities with diminishing returns. With time, these areas tended to undergo significant population growth (partly due to rising incomes) and proto-industrialization of their own; this decreased both their need to import manufactures and the surplus of primary products that they could export.

By contrast, the circum-Caribbean plantation zone showed much less tendency to diversify its production or to cease needing imported slaves and provisions. And since Europe acquired most of the slaves it shipped to the New World in return for manufactures (especially cloth), while much of the grain and timber sent to the Caribbean came from British North America, enabling those colonies to buy European manufactures, all of the New World's import needs—even those for grain and humans—helped Europe use labor and capital to solve its land shortage. Finally, we will also see in chapter 6 that dynamics set in motion during the colonial period created the framework for a flow of resources to Europe from both slave and free areas that accelerated throughout the nineteenth century, despite independence and emancipation.

In the process, chapter 6 also shows how differing long-term core-periphery relations could shift the significance of a feature common to various core regions in Eurasia. That feature is "proto-industrialization": the massive expansion of nonmechanized industries, mostly composed of rural laborers producing for (often distant) markets through the mediation of merchants. Historians of Europe, who created the concept, have been divided about the relationship between proto-industrialization and industrialization proper. Some have argued that proto-industrialization contributed to the accumulation of profits and/or the development of market-oriented activity, specialization, and tastes for products hard to make at home. And Joel Mokyr has shown—in an argument I would claim is as applicable to parts of Asia circa 1750 as for his own European cases—that the development of a large pool of "pseudo-surplus labor" in proto-industrial occupations could make a crucial contribution to industrialization, without many of the complications that arise if we look for industrial workers to emerge from "surplus labor" in agriculture.[32]

But Mokyr's model of proto-industrialization assumes that proto-industrial areas will be able to keep expanding their handicraft exports and agricultural imports without affecting relative prices in whatever "world" they are a part of. Considering the limits of this assumption brings into focus another side of proto-industrialization.

[32] Mokyr 1976: 132–64; compare Lewis 1954: 139–91.

Proto-industrial growth has generally been associated with significant population increases (though the exact nature of the connection is hotly disputed); and in many cases, rapid population growth in proto-industrial areas has been associated with a vicious cycle of very low piece rates, increasing output from workers struggling to buy enough food and often without much access to land, and still lower piece rates. Any shift in relative prices—whether created by an increased proto-industrial population glutting the export market while needing to import more food, or by diminishing external supplies and markets—will intensify this pattern of immiseration. And more generally speaking, population growth—whatever its relationship to proto-industrialization—could place serious pressure on the land needed for raising fuel, fiber, and other necessities of industrial development. Unless these goods can be acquired by trade, the only way to keep increasing output is by working the land more intensely, which with the technologies then available meant higher farm-product prices, lower per capita productivity, and a drag on industrial growth.

Signs of both serious ecological bottlenecks and spiraling poverty among too-numerous proto-industrial workers and underemployed farm laborers are as evident in many regions of mid-eighteenth-century Europe as in comparable parts of China or Japan—indeed, perhaps more so. But then, I will argue, Europe and east Asia changed places.

China's Lower Yangzi, for instance, had increasing trouble selling enough cloth and importing enough food and timber to sustain either proto-industrial growth or the relatively high living standard of its workers. This was not because of any internal "flaw" in the region but because the areas it had traded with were undergoing their own population and proto-industrial booms and so were becoming less complementary to it. To some extent, the Yangzi Delta compensated as a leading area should—moving up the value-added ladder by specializing in higher-quality cloth—but this was not enough. In short, markets worked well within China's eight or nine macro-regions (each larger than most European states), encouraging people in much of the interior to devote more time to making cloth and the like as they filled up the land, felled the trees nearest the rivers, and so on. But these smoothly functioning regional markets and interdependencies conflicted with the growth of empire-wide markets, especially after about 1780; this made it harder for one or two leading regions to keep growing and to avoid having to adopt even more labor-intensive strategies for conserving land and land-intensive products. Thus, freedom and growth in the peripheries without dramatic technological change led the country as a whole toward an economic cul de sac.

By contrast, northwestern Europe became able, in the century after 1750, to specialize in manufactures (both proto-industrial and industrial) to an unprecedented degree and to make its spectacular population growth during this period an asset. A big part of this transformation was, of course, a series of impressive technological advances in manufacturing (which made huge amounts of rela-

tively cheap goods available to exchange for land-intensive products) and in transportation, which greatly facilitated specialization. But these relatively well-known developments are not the whole story. Western Europe could also increase its population, specialization in manufacturing, and per capita consumption levels—when even eighteenth-century levels had seemed to many people near the limits of ecological possibility—because the limits imposed by its finite supply of land suddenly became both more flexible and less important. This was partly because its own institutional blockages had left significant unexploited agricultural resources that could be tapped after the French Revolution and post-Napoleonic reforms in Germany; partly because far more extreme institutional blockages (above all serfdom) in eastern Europe (the counterpart to, say, China's Upper Yangzi or southwest) had left lots of slack there; and partly because new land management techniques were brought home from the empire in the early nineteenth century. In all these ways, one might argue, Europe was catching up with China and Japan in both best and average practices in agro-forestry, rather than blazing new trails. Even so, Europe's transformation also required the peculiar paths by which depopulation, the slave trade, Asian demand for silver, and colonial legislation and mercantilist capitalism shaped the New World into an almost inexhaustible source of land-intensive products and outlet for western Europe's relatively abundant capital and labor. Thus, a combination of inventiveness, markets, coercion, and fortunate global conjunctures produced a breakthrough in the Atlantic world, while the much earlier spread of what were quite likely better-functioning markets in east Asia had instead led to an ecological impasse.

Thus, chapter 6 locates the significance of the Atlantic trade not in terms of financial profits and capital accumulation, nor in terms of demand for manufactures—which Europe could have probably generated enough of at home[33]—but in terms of how much they relieved the strain on Europe's supply of what was truly scarce: land and energy. And because it helped ease these fundamental, physical constraints, Europe's overseas extraction deserves to be compared with England's turn to coal as crucial factors leading *out* of a world of Malthusian constraints, rather than with developments in textiles, brewing, or other industries, which, whatever their contributions to the accumulation of *financial* capital or development of wage labor, tended to intensify, rather than ease, land and energy squeezes in the core areas of western Europe. And, indeed, a preliminary attempt to measure the importance of this ecological windfall suggests that until well into the nineteenth century, the fruits of overseas exploitation were probably roughly as important to at least Britain's economic transformation as its epochal turn to fossil fuels.

[33] On capital accumulation within Europe versus "exotic sources" see DeVries 1976: 139–46, 213–14. On demand, see ibid., 176–92; Mokyr 1985b: 21–23; and Mokyr 1985a, which questions the significance of demand factors in the Industrial Revolution more generally.

Comparisons, Connections, and the Structure of the Argument

Thus part 1, which is essentially comparative, argues that although a combination of relatively high levels of accumulation, demographic patterns, and the existence of certain kinds of markets may separate out a few places—western Europe, China, Japan, and perhaps others—as the most likely settings for a dramatic shift in economic possibilities, they cannot explain why that shift in fact occurred first in western Europe, or why it happened anywhere. Nor can technological differences explain very much before the nineteenth century (when Europe closed the gap in land management and took a wide lead in many other areas)—and even then, only when Europe's complex and often violent relations with other parts of the globe are added to the story.

In part 2, intercontinental comparisons continue, but in a context in which intercontinental connections also begin to be important. It argues that as we move toward kinds of economic activity less directly tied to physical necessity—and involving a smaller share of the population—some possibly important western European differences in culture and institutions do appear, even vis à vis other "core" regions. However, these differences are ones of degree rather than of kind, quite limited in strength and scope. They certainly do not justify any claim that western Europe, and western Europe alone, had either a "capitalist mode of production" or a "consumer society," and they cannot themselves explain the dramatic divergences that *would* emerge in the nineteenth century. Moreover, it is striking that where significant differences are discernible, they are consistently related to *deviations* from simple Smithian market dynamics—especially to state-licensed monopolies and privileges, and to the fruits of armed trade and colonization.

Part 3 begins with comparison again, showing that whatever advantages Europe had—whether from a more developed "capitalism" and "consumerism," the slack left by institutional barriers to more intensive land use, or even technological innovations—were nowhere near to pointing a way out of a fundamental set of ecological constraints shared by various "core" areas of the Old World. Moreover, purely consensual trade with less densely populated parts of the Old World—a strategy being pursued by all the core areas of Eurasia, often on a far larger scale than pre-1800 western Europe could manage—had limited potential for relieving these resource bottlenecks. But the New World had greater possibilities, in large part due to the effects of global cojunctures. First, epidemics seriously weakened resistance to European appropriation of these lands. Second, the transatlantic relations that followed conquest and depopulation—mercantilism and especially the African slave trade—made the flow of needed resources to Europe self-catalyzing in ways that consensual trade between Old World regions was not: it anticipated, even

before industrialization, the self-perpetuating division of labor between primary products exporters and manufacturing regions in the modern world. Thus the world's first "modern" core and its first "modern" periphery were created in tandem—and this global conjuncture was important in allowing western Europe to build something that was truly unique upon the base of an advanced market economy whose main features were not unique. We end, then, with connections and interactions explaining what comparison alone cannot.

A Note on Geographic Coverage

Having sketched the book's main ideas, a brief warning is in order about its geographic coverage. While joining the burgeoning field of "world history," this book treats the world's regions very unevenly. China (principally east and southeast China) and western Europe are treated at some length; Japan, south Asia, and the Chinese interior much less so; eastern Europe, southeast Asia, and the Americas still less; Africa even less, except through the slave trade; and the Middle East, central Asia, and Oceania are barely mentioned. Moreover, China, Japan, south Asia, and western Europe are treated in terms of both comparisons and connections. In other words, they are treated both as places that were plausible enough sites for fundamental economic transformations that their experiences illuminate the places where such a transformation did occur, and in terms of the reciprocal influences between themselves and other regions.

Eastern Europe, southeast Asia, the Americas, and Africa, on the other hand, are treated largely through their interactions with other regions. This does not imply that they were only acted *upon*—on the contrary, the argument sketched insists that what was possible in the areas we think of as "cores" was conditioned by the development paths and internal dynamics of "their" peripheries. Nor should it imply that the regions I treat comparatively were the only ones where important changes could happen. Industrial growth is just one part, albeit a vital one, of what we call "modernity": others may have other geographic origins. Nor, for that matter, can we afford to understand only those areas that were the seedbeds of what we now take to be the dominant characteristics of our age; to do so would greatly increase the risk of taking those features to be inevitable. In short, adding a few Chinese and Japanese foils to a European story does not make it "world history."

But there are reasons besides my finite energies for focusing as I do here. Some have to do with the stories I want to question and some with the story I want to tell.

First of all, it is China, more than any other place, that has served as the "other" for the modern West's stories about itself, from Smith and Malthus to Marx and Weber. Thus, two crucial aims of this book are to see how different

Chinese development looks once we free it from its role as the presumed opposite of Europe and to see how different European history looks once we see the *similarities* between its economy and one with which it has most often been contrasted.

Second, the processes emphasized in my own argument direct us to densely populated parts of the world and their trading partners. On the one hand, ongoing specialization is fueled by high population density; one cannot generally support oneself doing certain tasks that each person needs done only occasionally unless there are many people within one's market area.[34] Population density is not the sole determinant of Smith's "extent of the market," nor is it impossible for even sparsely populated areas to have elaborate arrays of specialists who subdivide certain tasks that the culture deems important. But for elaborate specialization to be developed in many areas of economic activity—food production, clothing production, building, transport, and exchange itself—there is ultimately no substitute for having many people within an affordable physical and cultural distance. (This is also true for specializing in the investigation of the natural world and the quest for new ways to manipulate it—the Smithian component of the much less predictable, but obviously crucial, process of generating technological change.)

Meanwhile, the ecological pressures that are also central to my argument are even more closely linked to demography.[35] Of course, areas that are sparsely populated in an absolute sense may also come under heavy ecological pressure if they are simply not capable of supporting very many people, or if people use their environment in certain ways. Thus in part 3 I make a distinction between densely populated areas and what I call "fully populated" ones—areas that have little room left for extensive growth without significant land-saving technological change, institutional improvements, or increased access to land-intensive commodities through external trade, even though they may have fewer people per acre than some other area. (Thus eighteenth-century Britain, for instance, could be more "fully populated" than Bengal, even at a lower population density, given its far lower per-acre yields and higher standard of living.) But this criterion, too, leads to a focus on western Europe, China,

[34] It should be noted in this connection that "specialization" is not the same as "division of labor," much less "complexity." One could imagine, for instance, a society with extremely complex rules of exchange determining who baked the bread each week, but in which no one person was a full-time baker. Such a society could certainly be as complex as any, and its people each master of a very complicated set of skills, but precisely for that reason, it would not have the same economic dynamics as one in which people are continually driven to focus on just a few tasks for which they in particular can find a market.

[35] I call these dynamics quasi-Malthusian because I do not argue that population densities were necessarily about to lead to a decline in the standard of living in any of the core areas I discuss, but only that worsening land/labor ratios were a serious obstacle to large amounts of further growth given the technologies of the preindustrial revolution, and that while early industrial technologies alleviated this constraint, they were not by themselves sufficient.

Japan, and, to a lesser extent, India. Further arguments might be made about dense populations, the pooling of information, and the likelihood of certain kinds of technological and institutional changes, though these are less straightforward.

A final, though less intellectually defensible, point is that my own training has equipped me better to write about China, Europe, and Japan than about other places and to access the relatively large piles of existing research on them. What James Blaut refers to as "uniformitarianism"—the idea that at a certain point (in his analysis, 1492), many interconnected parts of Afro-Eurasia had roughly similar potential for "dynamism" in general, and thus for "modernity"[36]—is a useful point of departure, but has limits we must discover empirically. It would be a remarkable coincidence if it turned out to be applicable everywhere, and there is much evidence that it is not. My own guess, as made above, is that population density will turn out to be extremely important, and thus that it is more likely that, say, north India will turn out to belong with China, Japan, and western Europe than, say, central Asia or even the Ottoman Empire.[37] (It is worth remembering in this connection that anyone attempting to write a book like this ten years ago would have had a much harder time finding literature to support the case I make for China than I have; twenty-five years ago it would have been hard even for Japan.) But with the literature available now—both based on my own limits and the limits of our knowledge—the geographic emphases in this book seem adequate to at least put new questions on our agendas. The places I look at relatively closely are not the world, nor does the rest of the world only matter as it interacts with them, or when it serves as a negative example, illuminating, for instance, how eastern Europe shows what China and western Europe share by being much more different from both China and western Europe than China and western Europe are from each other. But this is, I think, a reasonable distribution for rethinking where our current industrialized era came from.

[36] Blaut 1993: 42, 124, 152.

[37] On Ottoman population, which seems to have been both relatively sparse in most of the empire and declining for most of the eighteenth century, see McGowan 1994: 646–57.

FIVE

SHARED CONSTRAINTS: ECOLOGICAL STRAIN IN WESTERN EUROPE AND EAST ASIA

HAVING SEVERED industrialization from any "natural" working out of early modern economic processes in *any* area, we can now suggest ways in which a developing pattern of relations between certain areas gave western Europe important advantages on the eve of industrialization. These were not advantages that *had* to lead to an industrial breakthrough, but advantages that greatly increased that possibility and made such a breakthrough much easier to sustain. These advantages helped address a major problem shared by Old World cores: that before synthetic fertilizer, synthetic fibers, and the cheap mineral energy that makes synthetics economical, there were limits on the ability of labor and capital to substitute for land. These limits made it difficult to continue to expand populations, raise per capita consumption, and increase an area's degree of specialization in industry simultaneously, much less to do so at the accelerating rates of the nineteenth century. Trade helped, as we will see, but it could not solve these problems. Labor-intensive land management could support more people and perhaps sustain modest improvements in living standards, but probably no more than that; and it would tend to lower, not raise, the percentage of the population able to work outside agriculture.

Europe's advantages in escaping these constraints were largely ecological. Some stemmed from slack resources in Europe itself—and were ironic benefits of barriers to the earlier development of these resources—but these were largely offset by east Asian advantages in the efficient use of land and fuel. Others, already discussed in chapter 1, were related to the fortunate location of coal deposits and skill at exploiting them. Others were based on the bounty of the New World and the particular conjunctures that shaped its relationship to Europe: this part of the story will be the focus of chapter 6. These favorable resource shocks, in turn, bought time for the emergence of other innovations; together they transformed Europe's world of economic possibilities. That does not, of course, mean that having this extra breathing room explains technological creativity—but the two factors worked hand in hand, each increasing the rewards of the other.

Thus, in this chapter, I first recap briefly how western Europe's prospects compared to those of other regions, emphasizing what it shared with other densely populated areas. Then I sketch a set of common eighteenth-century ecological challenges and find that, despite being less densely populated in absolute terms than either China or Japan, western Europe faced comparably serious ecological problems. Both in western Europe and east Asia, there was relatively little room left by the late eighteenth century for further extensive growth to occur without significant institutional change, new land-saving technologies, and/or vastly expanded imports of land-intensive commodities. While Japan still had some peripheral domains in which, if institutional changes could be made, growth could be realized by applying existing best practices to land that was not yet used intensively, and Europe much larger areas (especially in eastern Europe) of this kind, China had relatively few. All three areas also had cores (the Yangzi Delta and Pearl River Delta, Britain and the Netherlands, the Kinai and Kantō) where only major technological change, vastly increased trade with peripheries, or both could sustain further growth in population and consumption.

Theoretically, Europe had more room left than did east Asia to sustain further population growth by increasing the labor intensity of its land use; but the nature of European farming made it unlikely that it would ever fully exploit these possibilities. Moreover, such a path was unlikely to lead to large further increases in per capita consumption, much less industrialization. When we look at one European country that did more or less develop in this direction—Denmark—we will see that increased labor intensity allowed it to stabilize its fragile ecology and *maintain* its standard of living: but population and per capita consumption stagnated, and no foundation for a major breakthrough was laid.

Finally, I examine the extent to which all these core regions attempted to alleviate their problems through trade with various less fully populated Old World areas. In each case, such trade was only a partial solution, not only because of technical limits (e.g., high transport costs) that might have been surmounted eventually, but because of social and economic limitations that were inherent in the nature of consensual trade between more and less "advanced" parts of the Old World.

It seems reasonable to assume that only those areas that combined relatively dense populations, productive agriculture, extensive and sophisticated commerce, and extensive handicraft industries were even possible sites for an industrial transformation. But these criteria would still leave China, Japan, and perhaps India—especially north India—in the same category as western Europe.

Upon further consideration, India comes to seem a less likely site than the other regions. Though it had a large, dense population in absolute terms, it was still far from its peak preindustrial carrying capacity. Population growth ap-

pears to have been much slower in Mughal India than in China, Japan, or western Europe over the same period; estimates for 1600 to 1800 vary from .1 percent to at most .3 percent per year, with more rapid growth beginning only after 1830.[1] Moreover, the caste system, where operative, gave fairly tightly knit groups of specialists exclusive control of certain resources and (at least theoretically) made those people and their descendants dependent on those resources in perpetuity; this may have worked against the rapid depletion of resources more common in China, Japan, and Europe, where restraints on overuse were harder to enforce and people could more easily escape reliance on a depleted resource through occupational or geographic mobility.[2] While caste seems to have often been honored in the breach even where Europeans claimed it was important, it may well have acted as some sort of a brake on economic growth, on population growth (which is more likely where wage labor and occupational mobility allow people to marry without inheriting an existing economic niche), and on resource exhaustion.

For whatever reason, India's political economy and ecology look different from those areas that were already very near their preindustrial population peaks and well above any previous cyclical peaks. Certainly, late eighteenth-century India still had very large amounts of forest: even densely populated Bengal was still about one-third uncultivated woods and swamps in the mid-1700s.[3] The most common mode of peasant self-defense—individual and collective flight—was one that had long since become impractical in most of China, Japan, and western Europe. Granted, recent research has undermined the idea that precolonial Indian rulers carefully maintained an ecological equilibrium before British timber and cash-crop demand, fee simple property rights, and nineteenth-century population growth upset the balance. But the same evidence that has undermined the romantic image of the precolonial ecological regime—including accounts of the authorities burning forests in order to deny sanctuary to tax evaders, rebels, and robbers[4]—reminds us that India still had a degree of ecological slack and a style of peasant resistance that had become much rarer at the ends of Eurasia.

With empty land still relatively plentiful, Indian elites often relied on bound labor, though there was also a large "free" rural proletariat that worked for others because they could not acquire land.[5] Thus, as we have seen, even though vast amounts of both Indian farm and artisanal goods entered the market, the producers often did not—and that meant they also bought fewer

[1] Moosvi 1987: 402, 405; Subrahmanyam 1990: 358–60; Habib 1982a: 166–67; Visaria and Visaria 1983: 463–65.

[2] Gadgil and Guha 1993: 91–110.

[3] Van Schendel 1991: 38.

[4] See, e.g., Rangarajan 1994: 149–52.

[5] Raychaudhuri 1982a: 180–81; Habib 1982a: 168; Habib 1982c: 249; Fukuzawa 1982b: 251–52; Raychaudhuri 1982b: 284, 304; Raychaudhuri 1982c: 335; Arasaratnam 1980: 259–60.

goods and faced fewer of the time-allocation issues central to the "industrious revolution."

One consequence of these patterns of land use and class relations was a surprisingly limited internal market for the everyday goods used by commoners. Indeed, for as far back as we can trace, India appears to have exported far more goods than it imported (exclusive of precious metals).[6] Changes in external and elite demand loom far larger in explanations of its economic fluctuations than they do for China, Japan, or western Europe, where it is generally assumed (at least after 1500 or so, or after 1000 in China) that any increase in production would create its own demand through payments to the producers.[7] Where production and elite incomes can be increased by driving bound laborers harder and/or bringing unused land under the plow, elites are not very likely to invest in attempts to develop new production processes.[8] There was also no assured market for innovations that could expand the production of ordinary goods, despite the vast population and relatively good transportation; too many people had very limited money. Moreover, a clever Indian artisan had little assurance he personally would benefit from an innovation. Finally, given the valorization of hierarchical reciprocity embedded in many patron-client relationships, the quest for financial profit itself, though certainly present, may have been less powerful than it was in China, Japan, or western Europe.

Thus, India was not a very likely site for an industrial breakthrough, despite its sophisticated commerce and technologies. It is worth recalling again how varied the Indian scene was, especially in the politically fluid eighteenth century. Social arrangements in some areas seem to have been moving in the same directions as in the "fully populated areas." Tokugawa Japan, in which what were on paper very elaborate and restrictive legally binding roles were increasingly circumvented, seems a plausible analogy for these areas. We should probably not think of India as a place on a completely different economic track from China, Japan, or western Europe, but as one in which the tendencies I have described for those areas were quantitatively weaker and the forces push-

[6] Chaudhuri 1978: 155–56; Latham 1978a: 50.

[7] Compare, for instance, Raychaudhuri (1982b: 306), Bayly (1983: 204–6, 251, 266, 272, 290), and Prakash (1981: 196–97) with standard accounts for China, Japan, and western Europe.

[8] David Washbrook (1988) has made roughly this point in trying to argue that eighteenth-century India was "capitalist," but in a way that would not lead to industrialization: he focuses on the cheapness of labor rather than the fact that it was so often *bound*, which I consider at least equally important, and does not discuss the issue of cheap idle productive capacity. This other part of the scenario has been developed as the "vent for surplus" model of foreign trade, largely for application to countries that still had lots of open land in the late nineteenth and twentieth centuries. (See Myint 1958; Lewis 1954.) Among the points these economists make is that under such circumstances, growth requires very little capital, at least for a while; for our purposes, we might reformulate this insight by saying that in such settings, elite profits can grow through exports with relatively little investment and certainly without much investment in transformative technology.

ing in other directions a good deal stronger. Which tendencies would have prevailed in the absence of colonialism must remain conjectural—and growing long-distance trade could potentially have contributed to either direction.[9]

Elsewhere in the Old World, population was much further still from its eventual preindustrial maximum than it was in India, and the case for a path of development fundamentally different from that of western Europe and east Asia correspondingly stronger. From southeast Asia to eastern Europe, sparse populations meant that elites could not easily give up bound labor, and they often tightened it in response to new markets for their products.

This leaves us with China, Japan, and western Europe. Not coincidentally, these were the areas that "shattered the biological Old Regime"[10] and reached new levels of population density prior to 1800.[11] At least in their core areas, dense populations and substantial accumulations of capital allowed elites—who were relatively free to deploy productive assets as they wished—to do without bound labor and still get workers at rates that left room for profit. And by the same token, these were the areas that had the least empty land, misallocated labor, and other forms of "idle capacity."

Thus, these three regions had the greatest *need* for an industrial breakthrough and the institutions that maximized incentives to transform production processes—but need alone could not create results. Thus, these "fully populated" areas all faced a common potential cul de sac.

None of these areas faced an immediate shortfall in food production, but other kinds of biological stress were evident. In China and Japan, output of both food and fiber crops kept up with population growth, but at the cost (at least by the nineteenth century) of serious deforestation, hillside erosion, and a concomitant increase in flood dangers; and without important new farming tools (such as lots of mined or manufactured fertilizer), even this sort of ecologically costly labor-intensive expansion might have been nearing its limits. The same was generally true in western Europe, but with two important differences.

On the one hand, as we have seen, various ways of intensifying western European agriculture remained underutilized, even in 1800. Consequently, there were somewhat more "slack" resources than there were in East Asia that could be tapped if institutional and price changes made it profitable, and this was slowly happening. George Grantham's work on France, for instance, shows that gradual improvements in market access induced peasants to change their crop mixes, use previously underutilized household labor, and shift their own consumption patterns in ways that allowed them to sell far more grain by 1850 than in 1750, even without much technical change. Similar patterns are

[9] This point is made especially forcefully by Perlin 1994: 83–85; Perlin 1985: 468–73.

[10] The phrase is Fernand Braudel's (1981: 70).

[11] On China, see Ho (1959); on Japan, Saito (1985: 185–88); on Europe, McEvedy and Jones (1978: 26–30).

found in Germany, beginning a bit later: after 1800, when the end of Old Regime restrictions on land use led to an enormous reduction in fallowing, there was a marked switch to new crops and much more market-oriented agriculture.[12] To the extent that it left such improvements to be realized in the future, eighteenth-century European farming left more room to continue growth before encountering Malthusian constraints than was present in east Asia.

But on the other hand, this "slack" could not be quickly and easily mobilized to meet the new population and other pressures of the nineteenth century. Grantham's data shows that the turn to more productive farming occurred very unevenly, even across relatively advanced northern France. French farming, as he argues elsewhere, remained undercapitalized even in the 1860s, though there was no shortage of capital in the economy as a whole; the problem was very slowly changing institutional arrangements, which influenced the choice of techniques in farming.[13] France continued to feed itself, but its population—especially its urban population—grew much more slowly than that of England, Germany, and nineteenth-century Europe as a whole.

Meanwhile England, where both industrialization and population growth were most rapid, probably had very little of this slack left to exploit even in 1750, since the stimulus of marketing opportunities and favorable institutional arrangements had become widespread far earlier than in France. Consequently, English agricultural productivity seems not to have changed much between 1750 and 1850.[14] Improvements in fodder crops allowed more middling-quality land to be used for pasture and meadows so that top-quality land could be devoted more exclusively to cereals, but the result was a stricter division than before between land for grain and land for animals, with the extra manure generated by better-fed livestock kept entirely in the improved pastures. Grain land was no better nourished than before. Thus, per-acre and total yields from arable land remained flat and the threat of decline constant,[15] until Britain began mining, importing, and later synthesizing fertilizer, mostly after 1850. Mauro Ambrosoli's work indicates that though the English studied continental practices, classical agricultural manuals, and their own experiments very intently, much of what they learned about how best to maintain soil fertility while increasing yields was not actually applied in England, because it involved highly labor-intensive methods and English capitalist farmers (unlike continental peasants, Ambrosoli suggests) were intent on labor-cost minimization and profit maximization. The methods they adopted instead, which raised labor productivity, represented a fundamental break with much of the literature on best farming practices and actually interfered with preserving soil fertility in many cases; it was in part because of these strategies that increasing

[12] Nipperdey 1996: 126–27, 130–31.
[13] Grantham 1989b: 147, 151.
[14] E.g., Clark 1991: 454–55.
[15] Ambrosoli 1997: 367, 374, 392–95, 412.

amounts of off-farm phosphates and nitrates were needed in the nineteenth century just to keep yields from declining.[16] In other words, without the new industrial inputs that came to its rescue, England might have had a hard time even maintaining its yields without putting far more labor into the soil. As we shall see, many other places took the labor-intensive path, but it did not lead to industrialization.

Even when these new inputs became available, it was difficult to do much more than maintain output for several decades, while consumption soared. F. M. L. Thompson estimates that English farm output grew perhaps 50 percent per laborer between 1840 and 1914, but since the number of laborers fell, this represented an increase in total output of perhaps 12 percent in seventy-five years; grain production actually fell between 1866 and 1914. And since the contribution to output of machinery plus feed and fertilizer from off the farm—still quite small in 1840—had reached 45 percent by 1938–39, it is clear that most of these productivity gains involved technologies that were simply not available circa 1800. What was available at that point within England itself were very limited gains from further market-induced rationalization in what was already a very market-oriented agriculture,[17] some of which actually decreased total agricultural output (though it released labor for other work) and did nothing to shore up soil fertility.

Moreover, since overall European population roughly doubled between 1750 and 1850,[18] whatever slack capacity was being brought into play on the continent was meeting local needs. Northwest Europe as a whole was deficient in bread grains by 1836[19]—a point at which continental industrialization had barely begun. In Germany, despite a gain of close to 80 percent in cultivated acreage in the fifty years after Napoleon began tearing down the old regime, output just barely kept pace with soaring population (also produced in part by the end of the Old Regime, which had restricted both marriage and the movement of people into the proto-industrial and other wage-labor jobs that often made marriage possible). Indeed, growing rates of emigration during "the hungry 40's" and thereafter indicate that food supply growth here may have lagged a bit behind population.[20] The European mainland did not have growing surpluses to sell to Britain.

Britain's own grain and meat output were becoming inadequate, as indicated first by a sharp rise in the price of wheat relative to other products (40 percent between 1760 and 1790)[21] and then by intense problems during the Napoleonic Wars. For relief, it turned first to imports from Ireland, subsidized at about 10 percent of value by the Irish Parliament from 1784 on.[22] These

[16] Ibid., 412.
[17] F. Thompson 1989: 189, 193; Ambrosoli 1997: 395, 412.
[18] McEvedy and Jones 1978: 28–29; Grantham 1989a: 43.
[19] Thomas 1985a: 149.
[20] Nipperdey 1996: 92–93, 97.
[21] Thomas 1985a: 141.
[22] Ibid.

imports were equal to about 10 percent of Britain's own output from agriculture, forestry, and fishing combined by 1824–26 (surpassing combined imports from Germany and Poland), and still more in the 1830s (when statistics become unavailable),[23] but they could not grow much further; soon, Ireland would fail dramatically to feed itself, and its farm exports would fall sharply (without stopping altogether). As Britain's food deficit kept growing, it came to depend heavily on the New World and to a lesser extent on Russia and Oceania.

Meanwhile, Britain's nineteenth-century food consumption did not grow as fast as its increases in both population and per capita income would predict. As Clark, Huberman, and Lindert note, all available estimates show that British foodstuff supplies per capita stagnated or declined in the nineteenth century, even with the imports we have already discussed and the huge surge in sugar imports that we will discuss in chapter 6.[24]

The reasons a more prosperous population did not consume more calories per head had to do, in various ways, with industrialization itself. Fewer people worked outdoors, which lessens food requirements. Agricultural workers' families in 1863 consumed almost 50 percent more calories per adult male equivalent than families of urban workers and spent more on food than urban workers with the same incomes.[25] Fewer people did heavy, nonmechanized labor—a shift that can reduce caloric needs by one-third to one-half per hour.[26] The vast decline in the cost of cotton cloth—85 percent between 1750 and 1850[27]—and in the cost of home heating[28] also greatly reduced caloric needs.[29] Tea and sugar, which became vastly cheaper and more common in the nineteenth century relative to other foodstuffs,[30] tend to act as appetite suppressants;[31] thus their contribution to reducing British needs for cereals is even larger than is captured by the substantial share of British calories that sugar provided. (We will discuss this further in chapter 6.) It is important to note that all these changes were linked to either the coal breakthrough or to the surge in cheap imported raw materials (cotton, sugar, and tea) from extra-European sources. They thus accentuate the point that Britain did not meet its growing food needs in the way that Grantham suggests for continental Europe; and thus it strengthens our sense that without the dual boons of coal and colonies, Britain would have faced an ecological impasse with no apparent internal solution.

Moreover, Grantham's argument that the growth of urban demand increased supply by stimulating a switch to more productive crop mixes probably applies mostly to food crops. Fiber crops posed more serious problems, in large part because they demand so much from the soil, and so much labor. In most of

[23] Ibid., 145–46. For comparison with continental imports, see p. 141.
[24] Clark, Huberman, and Lindert 1995: 215.
[25] Ibid., 226–28.
[26] Ibid., 225.
[27] Mokyr 1990: 111.
[28] Clark, Huberman, and Lindert 1995: 233.
[29] Ibid., 235.
[30] Ibid., 233.
[31] Ibid., 234.

England, flax and hemp were essentially garden crops, grown on a very limited scale. Even numerous government subsidies failed to induce the increases in output that would have been necessary to make Britain self-sufficient in these crops. And self-sufficiency in these crops would still have been a far cry from self-sufficiency in fibers, since in the late eighteenth century Britain began to import ever-growing quantities of cotton.[32] In France, fiber crops were rarely grown in regular crop rotations because they took so much out of the soil. Hemp cultivation did expand a bit between 1750 and 1850, but only near cities, where plentiful supplies of human and animal manure were available. The extent of land close to cities was of course limited; and since peri-urban areas offered many employment opportunities, these farms rarely had the plentiful underutilized labor that would have been needed for a large expansion of labor-intensive fiber crops.[33] (At the other extreme, flax-growing did expand in Russia, where it was easy to rest the soil between crops—but neither the labor problem nor transport problems were so easily solved.) Thus, although European agriculture may have been able to meet increased demand for food without further deforestation, soil depletion, or technological breakthrough, it had far less flexibility with regard to fiber. When cloth production skyrocketed in nineteenth-century Europe, that continent found itself importing vastly more of its fiber than either China or Japan had to, or probably could have.

And if fiber supply was less price elastic than food supply, supplies of building materials and fuel—the last two of Malthus's four necessities—were considerably less so than either. Silviculture can raise wood yields per acre above those of natural stands. However, such efforts were still fairly rudimentary everywhere, with Japan probably a bit more advanced than either China or Europe as of 1800.[34] Though the European experience in the tropics and the East India Company's takeover of Indian forest reserves were yielding valuable knowledge about both the importance and the methods of afforestation techniques, this knowledge was not applied in Europe until after the 1840s.[35] Certainly nothing in the late eighteenth or early nineteenth century suggested that any of the core regions of the Old World could increase production of wood very much: instead all of them faced rising demand for wood, shrinking local acreage on which to grow it, and little change in yields per acre. Here, then, was a severe ecological threat to accelerating growth for both western Europe and east Asia. It is worth examining further.

[32] On imports, see Bruchey 1967: table 2-A; on subsidies for flax and their limited effects, see Warden 1967: 362–64.

[33] Grantham 1989a: 49–71; on limited prospects for increasing continental flax output, see Warden 1967: 724.

[34] Totman 1995: 104; Totman 1989: 116–70; Li Bozhong 1994b: 88; Osako 1983: 132, 135, 142; Menzies 1996: 651–54.

[35] Grove 1995: 187, 199, 261, 264–66, 299–300, 332–36, 365, 382, 387–406, 409, 427, 435, 440, 463–64, 471–72.

Fuel shortages were a major problem in the most developed parts of Europe, China, and Japan as forest land gave way to arable. Timber shortages in Europe were, unsurprisingly, the worst in areas of intensive cultivation—from Sicily to Denmark—but they were reported almost everywhere on the continent; by the Napoleonic era, the timber shortage was perceived as an acute Europe-wide crisis.[36] This perception was surely inaccurate for, say, Scandinavia and Russia, but its existence demonstrates how habitual it had become to worry about timber supplies.

If we accept Braudel's estimates, overall European fuel supplies were still sufficient to supply roughly .5 tons of coal equivalent (tce) per person per year.[37] This would have left Europe on average comfortably above contemporary estimates of the minimum (.33 tce per capita) amounts required by farm families in Asia.[38] But given northern European winters, Europe's more energy-intensive methods of cooking, and its inefficient hearths, Braudel's figure may not represent greater comfort than the contemporary "minimum" for rural Asia. Kjaergaard's figure for total fuel use in late eighteenth-century Denmark[39]—which converts to .55 tce per person per year—roughly matches Braudel's guesses for France and for Europe as a whole. That level of fuel consumption made the years 1740–1840 the worst in Danish history for indoor temperatures—and for tuberculosis.[40]

Averages understate the problems, since timber could not be moved long distances over land and local fuel shortages were common. Even in relatively well-forested France, there were areas where "timber [could] no longer be found" and "the poor [did] without fires" in the eighteenth century. And the situation was getting worse with population growth.

The rise in fuel prices in eighteenth-century Europe generally seems to have greatly outpaced other price increases.[41] In France, Labrousse estimates that the price of fuel wood rose 91 percent between 1726 to 1741 and 1785 to 1789—the largest increase for any commodity in his huge study. This rise was particularly rapid after 1768 and continued into the early nineteenth century, when it attained a "remarkable force."[42] In Britain, firewood prices had already risen 700 percent between 1500 and 1630 and three times as fast as the general price level between 1540 and 1630;[43] for much of the country the seventeenth century was a period of energy crisis.[44] After 1750, the country was perpetually short of wood, charcoal, naval stores, and bar iron (made with charcoal). The price of bar iron doubled between 1763 and 1795 and imports from Swe-

[36] Kjaergaard 1994: 18–19, 89–91.

[37] Braudel 1981: 367.

[38] For such an estimate, see, e.g., Asian Development Bank 1982: 114, 360. These minima would probably be somewhat higher in Europe, given the cooking methods used there, and would of course be higher still in the colder parts of northern Europe. (By contrast, most of contemporary Asia's poor, except in North China, live in relatively warm climates.)

[39] Kjaergaard 1994: 123.

[40] Ibid., 97.

[41] Goldstone 1991: 186.

[42] Labrousse (1984): 343, 346–47.

[43] Nef 1932: I: 174, 263.

[44] Nef 1964: 262–64.

den and Russia soared despite tariff protection and the beginnings of substantial growth in coal-based production.[45] Over half the total shipping tonnage entering British ports in the 1750s was timber; and fir imports grew a further 700 percent from 1752 to 1792.[46]

Even where adequate fuel for cooking could be scrounged up, it was not necessarily adequate for industrial uses; iron forges in various parts of eighteenth-century Europe regularly operated for just a few weeks a year due to fuel shortages.[47] Indeed, crude estimating techniques suggest that by 1789, just maintaining the fuel consumption figure estimated by Braudel would have required over 90 percent of the sustainable yield of France's woodlands.[48] Thus even if no wood were wasted and all of it could be easily transported to where it was needed, there could have been precious little wood available for an expansion of kilns, breweries, or forges, or to make more paper, boats, or houses. Increasing use of coal—to which we will return later—provided significant relief in much of Britain, in Belgium, around Lyon, and (through imports) in Denmark,[49] but not before 1850 in the rest of western Europe.[50]

The Netherlands is an interesting intermediate case, having run for quite a while on what we might call a semi-fossil fuel: peat. Heavy investments in digging peat and in canals to transport it provided the Netherlands in the sixteenth through the eighteenth centuries with unusually plentiful and cheap energy supplies. In the long run, however, peat would not be adequate for truly sustained and large-scale industrial growth.[51]

This is not to say that the troubles of Dutch industry were caused by fuel-supply problems. DeVries and Van der Woude show that energy supply cannot be seen as the limiting factor in the Dutch economy, since much peat still remained unexploited while industries declined (nineteenth-century peat output rose considerably). Moreover, imported coal could reach Holland at a price not that far above its cost in London. Lack of fossil fuels was not the limiting factor in Dutch growth. Instead, they argue, peat production stagnated because demand did; Dutch industry slumped for various reasons, but not because it lacked fuel.[52]

These arguments are quite logical. And peat is, of course, mined rather than grown annually. But the stagnation of Dutch population, industrial production, and per capita energy use for one hundred fifty years makes the Netherlands a special case. So does its unusual niche as an exporter of commercial, financial, and insurance services to much of western Europe, and the fact that it had long relied on imports of both grain and timber while it met its own needs for fiber

[45] But note that Sweden and Russia's competitive advantage in iron involved low labor costs and high-quality ore, not just plentiful fuel (Flinn 1958: 151).

[46] Thomas 1985a: 140; Thomas 1985b: 729.

[47] Braudel 1981: 367.

[48] See appendix D.

[49] Kjaergaard 1994: 120.

[50] Nef 1932: I: 169.

[51] De Zeeuw 1978: 23–25.

[52] DeVries and Van der Woude 1997: 709–10, 719–20.

and fuel. We do not need to show that a shortage of some sort of raw material was pressing hard on every advanced economy regardless of other circumstances; and certainly other, institutional causes of stagnation might intervene before fuel became a constraint, as was apparently the case in the Netherlands. But if any large economy was to sustain both further growth in population and in output per capita, it would need fossil fuels and/or some other dramatic easing of the land constraint. By the 1780s, even the Netherlands, with its stagnant population and plentiful peat, was importing coal equal to about one-third of its peat production.[53] Had the Dutch population doubled between the early eighteenth and early nineteenth centuries, as Britain's did, then even the rapid growth in peat production that occurred in the nineteenth century would only have sustained a per capita energy supply of 2,000,000 kcal per year; the British economy was already using over 8,000,000 kcal of coal-based energy per person in 1815, *before* most of the boom in steam engines.[54] And if even large supplies of peat were inadequate to fuel the new economy, the annual growth of trees was much less so.

Meanwhile, better quality timber for things like ship's masts was in even shorter supply. Such shortages led Britain to try to reserve for the navy all suitable trees in its New England colonies and to shift much construction of merchant ships to its heavily forested colonies from Quebec to Madras. On the eve of the American Revolution, one-third of Britain's merchant fleet had been built in the American colonies alone.[55]

Nor were British—much less French—timber shortages unusually severe for Europe. Perhaps 16 percent of France was still forested in 1789, versus over 33 percent in the mid-sixteenth century.[56] Michael Williams has estimated that most of the rest of "insular and peninsular Europe"—Italy, Spain, the Low Countries and Britain—was down to 5–10 percent forested by 1850.[57] Denmark's forests—20–25 percent of its land area in 1500—were only 4 percent of its land area by 1800,[58] despite massive fuel conservation measures. This, as we shall see, is about the same percentage of forest land to which China's Lingnan macro-region, an area second only to the Lower Yangzi in commercial development and population density, would gradually decline by the *1930s*.[59] Much of Scandinavia, some parts of eastern Europe, and huge

[53] Ibid., 709n. 18.

[54] Dutch figures based on ibid. (subtracting the contribution of imported coal) and observation on p. 719 that nineteenth-century peat production equaled that of the seventeenth and eighteenth centuries combined. British coal production figures from Mitchell (1988: 247); energy content for coal based on Smil (1985: 36), and assuming a 50–50 mix of soft and hard coal.

[55] Lower (1973: 36) on Quebec; Cronon (1983: 109–10) on New England; Gadgil and Guha 1993: 119; Albion 1965: 161; Thomas 1985a: 140.

[56] See Cooper 1985: 139n. 2.

[57] M. Williams 1990: 181.

[58] Kjaergaard 1994: 15.

[59] See Ling (1983: 35), for estimates of forested area.

parts of Russia were still heavily forested, but as we shall see, their capacity to relieve shortages in more "advanced" parts of Europe was limited. The area that became Germany and Austria still had more forest than France, perhaps as much as 25 percent overall.[60] Regional shortages were nonetheless severe in parts of Germany, even before the great nineteenth-century surge in population and cultivated land; and annual consumption appears to have exceeded forest growth for Germany as a whole even in the late eighteenth century, resulting in *both* timber imports and unsustainable amounts of tree-felling within Germany.[61]

Meanwhile, growing food demand also threatened another kind of European energy supply: the fertility of the soil. Sheep and cattle herds appear to have been diminishing (as suggested by the long-run decline in meat consumption discussed earlier) as former pasture land was turned into arable.[62] Dwindling forests also made it more expensive to keep pigs, and these herds seem to have declined as well.[63] In Denmark, where forests were becoming especially scarce, cattle were banned from the forests in the eighteenth century;[64] this allowed more tree seedlings to survive but greatly increased the cost of keeping cattle and so decreased the supply of manure.

Consequently, the amount and quality of manure applied per acre of farm seems to have fallen in much of Europe during the late seventeenth and eighteenth centuries, even in some areas where cropping was becoming more intensive;[65] at least in France, the pace of decay seems to have accelerated after 1750.[66] In Denmark, the price of manure rose by 500 percent between 1700 and 1759, while crop prices rose very little. And while clover at first seemed such a panacea that it was planted on 40–70 percent of the land in some late eighteenth-century Danish rotations, this produced its own problems: "clover fatigue" in the soil, rapidly spreading clover disease in the plants themselves, and declining yields that necessitated further changes.[67]

In England, where a very market-oriented agriculture and a high rate of literacy produced an enormous literature on agricultural improvement, animal herds were, on the contrary, probably increasing; but the outlook for soil fertility was still far less rosy than is suggested by some accounts of the "Agricultural Revolution." A 1787 report from Norfolk made it clear that the famous "Norfolk rotation" had not solved problems of soil degradation, at least on light soils; the clover came in patchy and the land showed signs of fatigue.[68] Imported clover varieties and other fodder crops had their greatest effect in making it possible for some second-rate land to be turned into good pasture, allowing the best soils to be reserved for cereals. But the manure generated on

[60] M. Williams 1990: 181.
[61] Ibid.: Heske 1938: 5, 25–26.
[62] Slicher Van Bath 1977: 90.
[63] Ibid., 89.
[64] Kjaergaard 1994: 107.
[65] Slicher Van Bath 1977: 95.
[66] Blaikie and Brookfield 1987: 131–32.
[67] Kjaergaard 1994: 60, 85–86.
[68] Ambrosoli 1997: 374.

these new pastures had to be kept there if they were to be sustainable, so the system brought no relief to either grain land or the grain supply; it increased total farm output (grain plus animal products) but not crop output.[69]

Overall, then, despite gradually improving land management knowledge, some of the most intensely farmed soils of Europe (including in England) faced serious depletion by the early nineteenth century. (However, England does not seem to have faced the serious erosion problems which, as we shall see shortly, plagued parts of the continent, perhaps due to convertible husbandry and the early exit from agriculture of many producers without adequate resources for reinvestment.[70]) Without the boom in nineteenth-century fertilizer imports (especially guano), mined phosphates, and, later, synthetic fertilizers, the situation could have been disastrous.[71]

Finally, where deforestation was followed by overgrazing, the soil itself could disappear: sand drifts and huge dust storms (sometimes carrying soil over thirty miles) were common in suddenly treeless parts of eighteenth-century Hungary, Prussia, Sweden, Denmark, England, Holland, and coastal France.[72] Other former forests became waterlogged (since other vegetation neither absorbs water as well as trees nor provides as good a surface for re-evaporation) and highly acidic; enormous amounts of labor-intensive marling and ditch-digging were needed to offset this.[73] Archaeological studies of parts of France and Germany suggest that the eighteenth century was one of the two worst in European history for soil erosion and that the problem reached its worst level ever in this period.[74] Moreover, serious erosion usually indicates the presence of further soil problems,[75] which are confirmed by reports of stagnant or declining yields in many parts of continental western Europe after 1750.

Much of the lowland erosion in Europe was reversed in the nineteenth century. (Many upland areas, however, never recovered.[76]) This took a combination of better plowing and manuring techniques (with improved plows much like those long common in China), reforestation efforts (aided by new ecological knowledge, increased availability of non-wood fuels, and later in the century, North American timber), and the abolition of the remaining common fields (which became badly overused as they shrank and population grew). Migration to the cities (and to the Americas) by marginal farmers in the nineteenth century probably also helped. And the increased availability of farm products from overseas and off-farm fertilizer (first mined, then synthesized) was also essential to allowing more Europeans to eat better in the 1800s, while

[69] Ibid., 392–94.
[70] Blaikie and Brookfield 1987: 140.
[71] Hobsbawm 1975: 106; F. Thompson 1968: 62–77.
[72] Kjaergaard 1994: 20–21.
[73] Ibid., 21, 40–41, 50–56.
[74] Blaikie and Brookfield 1987: 129–31, 138, 140.
[75] Ibid., 137.
[76] Ibid., 136.

checking the decline of soil quality. Without these multiple sources of relief, in which the New World bulked large, the nineteenth century could have seen a downward ecological spiral—as seems to have occurred in some parts of China—or avoided that fate only at the cost of much slower growth in population, lower living standards, and a need to keep a far larger share of the population on the land, engaging in very labor-intensive land-saving techniques rather than providing cheap labor for industry.

There is even some reason to speculate—though we can do no more—that western European deforestation had begun to have deleterious effects on climate. The normal European pattern is for precipitation to be spread relatively evenly throughout the year, but the late eighteenth century witnessed "the European monsoon," in which brief periods of violent, concentrated (and often highly erosive) precipitation alternated with relatively long seasons of drought.[77] While we do not know why this occurred, deforested areas are much more prone to such weather patterns. Indeed, as we have seen, Europeans were just beginning to learn this from the changing weather in several colonial possessions where forests had been overcut to create plantations and/or provide naval timber.[78] One of the few temperate zone regions with such a climate today is severely deforested North China, to which we shall turn shortly. Moreover, even where deforestation may not go so far as to affect the climate, it can have the same effects on the soil that would occur if the climate did become more extreme. Peak temperatures at surface level can rise significantly when land goes from forest to cultivated field (by 10–11 degrees in some experiments in New England), while minimum temperatures become lower. Moreover, because land with fewer trees does not hold snow as well, it loses a protective blanket and tends to freeze to a greater depth than before. Average wind speeds increase, with potentially serious consequences for erosion, and runoff becomes more rapid, accentuating both floods and droughts and lowering the water table, even without any change in the atmospheric weather.[79] To the extent that parts of Europe that already had little agricultural output to spare stood on the brink of such changes—or of needing to devote far more labor to avoiding them—they faced an ecological crisis with the potential to seriously retard industrialization.

Deforestation and Soil Depletion in China: Some Comparisons with Europe

Quantitative data on rural China is scarce, but we do know that regional resource depletion was often serious. In the Yangzi Delta, timber shortages caused the price of large buildings and ships to soar. The cost of wood for a

[77] Ibid., 133; see also Lamb 1982: 235–36. [78] Grove 1995.
[79] For a useful summary of these relationships, see Cronon 1983: 122–23.

seagoing ship may have risen 700 percent between 1550 and 1820 (while rice rose perhaps 100 percent); much of the building of junks for overseas trade relocated from the Yangzi Delta, Fujian, and Guangdong to Southeast Asia.[80] As much as possible, people in various parts of China avoided burning precious timber for fuel, turning to crop residues, grasses, and dung.[81] By about 1750, at least three macro-regions—Lingnan, the Southeast Coast, and above all the Lower Yangzi—depended on outside supplies of various ecologically sensitive goods. All three of these regions imported significant amounts of food (13–18 percent of total supply for the Lower Yangzi); all three imported timber; and at least the Lower Yangzi, a major producer of soil-depleting cotton, also imported large amounts of beancake fertilizer from Manchuria.[82] (Lingnan imported most of its cotton and also began to import much more beancake in the nineteenth century, when its population, unlike that of the Yangzi Delta, continued to grow.)

Indeed, given China's high population densities, it is tempting to assume that Chinese ecological problems were considerably worse than those in Europe; but that is not actually clear. Though China may have had less chance than Europe to expand construction and fuel-intensive industries, it probably did not face a much greater threat to its ability to reproduce its existing standard of living than a hypothetical Europe without the Americas would have faced; indeed, it may have been slightly better-off.

Wet-rice farming—in which water, rather than the soil, carries most of the nutrients, and one year's algae can replace the nitrogen depletion caused by twenty-four successive paddy crops[83]—made intensive cropping in south China quite sustainable; and the number of pigs (a major fertilizer source) seems to have kept increasing.[84] Per-acre food yields in Lingnan's irrigated rice farming kept growing with the help of ever-more beancake fertilizer and may have doubled between 1750 and 1900. In the Lower Yangzi, where beancake was already heavily used in the eighteenth century, yield increases slowed after 1800, but some apparently continued even into the 1930s, without much use of new technologies. (Synthetic fertilizers and pesticides only began appearing after 1900 and were not widely available until the late 1960s.)[85]

Dry-farming areas were more fragile ecologically, but still compared surprisingly well to those in western Europe. The crude estimate I have generated

[80] Li Bozhong 1994b: 86–89, 94; Viraphol 1977: 180.

[81] Marks 1997: 320. Li Bozhong (1998: 48, 200n. 23) notes a shortage of manure in Jiangnan and a switch to off-farm sources of fertilizer. He emphasizes, however, the advantages of the new fertilizers rather than the use of dung for other purposes.

[82] Y. C. Wang 1986: 90–95; Y. C. Wang 1989: 427; Adachi 1978; Marks 1991: 76–79.

[83] For a classic description of the ecology of paddy rice, see Geertz 1963: 29–37. For the capacity of dried algae placed on the field to restore nitrogen losses, see Smil 1985: 140.

[84] Perkins 1969: 71–72.

[85] Marks, personal communication, on Lingnan; Perkins (1969: 21) on Lower Yangzi.

for a predominantly wheat and sorghum-growing dry-farming area in North China circa 1800 suggests that perhaps 40–60 percent more manure was applied per cropped acre than in western Europe. We know little about the quality of this manure, but there are reasons to think it was better than that in use in western Europe and was applied in ways that preserved its nutrients better.[86] More important, a typical North China farm would receive three crops of nitrogen-fixing soybeans over an average six-year rotation as opposed to two nitrogen-fixing clover crops every six years in a hypothetically average mixed husbandry rotation. (Actual rotations were very varied, in China and in Europe.) Appendix B estimates nitrogen depletion rates on a sample North China wheat farm and an English wheat farm. Though this exercise is far from exact, it suggests that soil nutrients were being better preserved in North China—except perhaps on its cotton lands—than in the heartland of "advanced" European farming.[87] Moreover, the loess soil that covers much of North China has an important advantage. Because such soil has remarkably good capillary action, it draws up water and minerals from unusually far below the surface; this makes it, in the words of one geographer, effectively "self- fertilizing" as long as it remains moist.[88] Since what evidence we have strongly suggests that crop yields per acre continued to rise in much of nineteenth-century China, even without imported or artificial fertilizers, there is little reason to think that soil problems were critical outside a few particular areas. By contrast, many English and other farmers would have been unable to sustain their circa 1800 yields much longer without imports of guano and other mined fertilizers.[89]

Fiber shortages were potentially more serious at both ends of Eurasia. In China, as we have seen, per capita cotton production may have fallen significantly between the mid-eighteenth and late nineteenth centuries, but not total production. The costs to the soil of even that achievement may have been serious, however, at least in areas that did not get large inputs of soybean cake fertilizer from Manchuria. The big difference for Europe, of course, was that beginning in the late eighteenth century it would massively increase its imports of fiber—above all American cotton, but also Indian and Egyptian cotton, and later wool from Australia and New Zealand.

China's problems with forest cover and fuel supply were more serious, but probably not as bad as we often think, and—surprisingly—not clearly worse than those of western Europe. Ling Daxie has estimated the overall share of forested land circa 1700 at 26 percent of the empire.[90] If we subtract four remote and sparsely populated areas that had little to do with the rest of the

[86] See explanation of calculation in appendix B.

[87] See appendix B.

[88] Chi 1963: 14–15.

[89] Rossiter 1975: 149–53, 172; Ambrosoli 1997: 395; Hobsbawm 1975: 106; F. Thompson 1968: 65–70. See also appendix B.

[90] Ling 1983: 34.

empire—Tibet, Xinjiang, Qinghai, and Outer Mongolia—the figure for the rest of China would be 37.2 percent. Moreover, Ling's estimates for much of the North China plain are likely too low.[91]

However, Ling's figures are for 1700, when the great Qing population boom was just beginning; how much worse was the situation in 1800? Certainly, a vast amount of what had been forest became farms in the eighteenth century, particularly once the dissemination of maize, sweet potatoes, and other imported crops allowed people to farm previously uncultivable lands; and in the long run, the clearing of hillsides was ecologically disastrous. Meanwhile, the ever-increasing reclamation of land from lake and riverbeds led to slower-moving rivers, rising siltation rates in riverbeds, and growing flood problems. Yet these problems took many years to become critical; in 1800 they were quite likely no worse than in other densely populated regions. The pattern by which highland settlement led to erosion and increased flooding, for instance, was also quite evident in Japan's highly developed Kinai and Kantō regions and seems to have reached a stage of near-permanent flood danger at least fifty years before the Yangzi Valley did.[92]

Let us begin in the Lower Yangzi, the macro-region most comparable to rich but ecologically strained areas such as England and the Netherlands in Europe, or to the Kantō and Kinai regions of Japan. Complaints about excessive lowland reclamation were common by the mid-eighteenth century in both the Lower and Middle Yangzi, but this was generally at the expense of water, not forests, and its effects (mostly on drainage) were not yet critical.[93] There are few complaints about ecological problems caused by highland clearance before the 1780s.[94] (Complaints about social problems were another matter—many of those who cleared highlands were migrants from other regions, and clashes between "native" and "immigrants" were frequent.) Much of the Yangzi Delta, having been reclaimed from sea and swamp rather than by clearing forest, had always had fewer trees than most of south China; Jiangsu province, including much of the Delta, is the only southern province that was apparently less than 50 percent forested (46 percent) even in 2700 BCE.[95] Ling Daxie estimates that by 1700, Jiangsu—which consisted largely of part of the Yangzi Delta plus a southern extension of the north China plain—was roughly 5 percent forest: this made it comparable to the worst parts of North China and to eighteenth-century England.[96]

But forests were not far away. Large areas of the Zhejiang hills, which lay just beyond the southern half of the Yangzi Delta, were still forested as late as

[91] See below, pp. 234–35, and appendix C.

[92] Compare Totman 1992: 22, with Schoppa 1989: 147–67; Perdue 1987: 227, 230; Will 1980; Osborne 1994: 30–31.

[93] Compare Schoppa 1989: 120–39 with 147–63; see also Perdue 1987: 196, 202, 219–33.

[94] Osborne 1994: 30. [95] Ling 1983: 33. [96] Ibid., 34.

1802, and new clearing continued to occur through the 1840s; in fact, the rate of clearance accelerated after 1820.[97] And the very first case of flooding attributed to hill clearance does not appear in the records until 1788.[98] Parts of Fujian on the southeast coast—like Jiangnan a very crowded area, and also a major center for boat-building—appear to have had serious problems of hillside deforestation, increased erosion, and flooding as early as the sixteenth century, but the situation seems to have stabilized later, rather than getting steadily worse.[99]

Serious problems were building in the ecology of the Lower Yangzi, but it was probably not until well into the nineteenth century that they became more severe than problems in core regions in Europe and Japan. And by that time, as we shall see, the most developed parts of Europe had obtained significant ecological relief from underground *and* overseas; to a lesser extent, so had Japan, which increasingly relied on food and fertilizer from far-flung fishing expeditions.[100] And even with this relief, Japan's population stagnated from roughly 1720 to 1860. Some scholars also argue that Japan's per capita income stagnated beginning in the mid-eighteenth century, albeit at an exceptionally high level.[101]

A more quantitative measurement of deforestation and fuel-supply pressures is possible for Lingnan, probably China's second most commercialized and densely populated macro-region. And though this area was certainly ecologically troubled by the late eighteenth century, it had larger remaining wood supplies than much of "insular and peninsular Europe" did. Quite likely, it was even in better shape than France, which is often singled out within Europe as a contrast to developed but deforested Britain.[102] (Lingnan had 17,500,000 people circa 1753 and reached 30,500,000 by 1853;[103] France had 26,000,000 people in 1789 and a land area about 40 percent greater than that of Lingnan.)

Ling Daxie gives a circa 1700 figure of 54.5 percent forest cover for the coastal province of Guangdong and 39 percent for Guangxi, the adjacent province that was becoming Guangdong's rice bowl.[104] As elsewhere in China, the population boom that was just beginning in 1700 took a great toll on the forests; and unlike in the Lower Yangzi, Lingnan's population growth continued unabated right through the nineteenth and twentieth centuries. By 1937, Guangdong's forest area can be reliably placed at about 10 percent and

[97] Osborne 1994: 36.

[98] Ibid., 30–31.

[99] Vermeer 1990: 141–47, 156, 161.

[100] Totman 1992: 23.

[101] Hanley and Yamamura (1977: 16–28) survey this view and criticize it; L. Roberts (1991: 88–95) suggests the need for a more complex breakdown and argues that the old view may indeed apply to some periods and regions.

[102] See, e.g., M. Williams 1990: 181–82.

[103] Marks 1997: 280.

[104] Ling 1983: 34. Robert Marks, author of the first comprehensive survey of the ecological history of Lingnan, finds these figures generally plausible.

TABLE 5.1
Forest Area in Lingnan, 1753–1853

	Forested area (hectares)			*Percent forested*		
	Guangdong	*Guangxi*	*Lingnan*	*Guangdong*	*Guangxi*	*Lingnan*
1753	9,000,000	6,500,000	15,500,000	45	35	40
1773	8,200,000	6,020,000	14,220,000	41	32	37
1793	7,440,000	5,660,000	13,100,000	37	30	34
1813	6,560,000	5,240,000	11,800,000	33	28	30
1833	5,760,000	4,940,000	10,700,000	29	26	28
1853	4,880,000	4,700,000	9,580,000	24	25	24

Guangxi's at a mere 5 percent.[105] But we lack figures for the dates in between, and we need to make some estimates.

One simple way is to make use of trends in population. Using figures compiled by Robert Marks, we can compute an average relationship between population growth and the disappearance of forest: each additional person in Guangdong meant a reduction of roughly .4 hectares of forest, and each new person in Guangxi a reduction of .6 acres.[106] (This difference makes sense since Guangdong reclaimed coast as well as clearing forests, had lots of very intensively farmed paddy, and, unlike Guangxi, also imported rice.) We can then use those averages to compute how much forest would have been lost by certain dates, given Marks's population estimates at twenty-year intervals. While the method is crude, it probably biases our results in the direction of making the situation look very bad at an *earlier* date than was really the case.[107] The results are given in table 5.1.

The steady downward trend is obvious, yet Lingnan still had almost 25 percent forest cover in 1853, when it had roughly 77 people per square kilometer; by comparison, France had already declined to 16 percent forest cover in 1789, when its population density was still under 50 per square kilometer.[108]

Precisely because Lingnan was much more densely populated than France, its higher percentage of forest land might still mask a greater scarcity of wood. To investigate this, I have created two simple though artificial measures. One,

[105] Ling 1983: 35.

[106] Based on Marks 1997: 280.

[107] In fact, we would expect each additional person to cause a smaller reduction in the forest in the earlier part of our period and a larger one later. Better land is likely to be settled first, so earlier additions to the population probably required fewer acres than did later ones (though rising land productivity could offset this). Further, in earlier years the additional fuel needs of new population could be met without exceeding the year's annual wood growth; but as population became very dense, cutting for fuel could exceed sustainable yields, setting off a downward spiral in at least some areas.

[108] French population statistics from McEvedy and Jones 1978: 59.

sustainable fuel supply per capita, is an estimate of how much heat (in tce) could be harvested each year without cutting more than the normal growth of woodlands. The second, industrial wood supply per capita, is an estimate of how much wood would be available for other uses (from paper-making to construction to firing forges) assuming that basic home fuel supply needs were met but not exceeded and that no wood was wasted.

It might seem obvious that France would come out better than Lingnan on these measures, with so many fewer people relying on each hectare of forest. But at least four factors suggest otherwise.

First, fuel needs per capita in south China were probably significantly lower than those in France: less heating was needed in a warmer climate; Chinese cooking methods were much faster and more fuel efficient than European ones; and Chinese stove design was much more efficient, both for cooking and home heating, than the stoves and (especially) open hearths common in Europe. I have made some adjustments for these differences in my calculations for Guangdong (see appendix C) but in a way that almost certainly underestimates their impact.[109]

Second, the general pattern of tree cultivation and fuel-wood gathering in China—characterized by small clumps of trees in or near each family's courtyard and more linked reliance on harvesting consolidated blocks of forest—meant that transport costs were minimal. Thus, it was worthwhile to gather twigs and other small bits of combustible material that would be left on the forest floor and wasted in Europe. I have no way of knowing the size of this difference and will omit it from the calculations, but it fits a general pattern in which Chinese farm families used a little extra labor (often that of women and children) to make the most of resources and offset the ecological costs of a denser population.[110] (The relative lack of large blocks of forest also fits another pattern in which Chinese elites—far less taken with hunting and riding than most Eurasian ruling classes—did less to reserve large blocks of land for low-intensity uses than did the dominant groups of most other settled societies.[111] The result was greater efficiency, but fewer of the slack resources that would later become "advantages of backwardness" for Europe.)

Third, the annual growth of each tree was almost certainly greater in subtropical Lingnan than in France. This difference could be estimated and added

[109] On stove design, stir-frying, and other matters affecting the fuel efficiency of cooking, see Anderson 1988: 149–51, 154. See also appendix C, pp. 308–9.

[110] On this pattern of tree cultivation and its difference from that in Europe, see Menzies 1996: 663, 667.

[111] Such a generalization refers much more to the ethnic Chinese gentry, merchants, and landlords than to the Manchu conquerors who set up the Qing dynasty; but the latter were never numerous, except in Beijing and Manchuria. Moreover, while many Manchus became less "martial" in their cultural interests and abandoned hunting and riding, very few Han Chinese adopted either hunting or horseback riding.

to the calculations, but I have not done so; this is one more way of making sure that these comparisons are, if anything, biased against China rather than Europe.

Fourth, and perhaps most important, Chinese farm families got much of their fuel supply not from wood, but by burning crop residues. Thus, while each hectare of forest turned to farmland in France was a total loss to the fuel supply, in China, land put under the plow still produced fuel, too. Burning crop residues was not environmentally costless, but it was not necessarily a big problem, either. It entailed a loss of organic matter that would otherwise be returned to the soil (as worms, bacteria, and fungi broke up the plant matter into nutrients accessible to plants), though our estimates of nitrogen fluxes suggest that this would not have been a crucial problem. Another incalculable but perhaps more serious problem is that the removal of crop residues tends to increase the loss of soil to wind erosion. This would more likely have been a serious problem in North China, which we will consider later, than in Lingnan, since the North had generally lighter soils and a much longer interval between harvest and the next appearance of plants with roots stong enough to help hold the soil. For current purposes, I will ignore these costs, at least in Lingnan, and proceed to estimate the value of this practice in meeting the area's fuel needs.

Less than half the weight of pre–Green Revolution rice plants (and other small grain plants) was edible; we will certainly not be overestimating the amount of crop residue if we assume it was equal to the output of edible rice, which is reasonably well known. Some of these residues, however, were also used to feed farm animals, especially pigs. Although we have no census of farm animals for any part of China before the 1920s, there are reasons to think that the ratio of pigs (the primary source of meat) to people did not change much; this enables us to project backward from twentieth-century to eighteenth-century figures. I have assumed that other farm animals, who would have been used primarily for work, were roughly as numerous per human as they were in twentieth-century north China; this is almost certainly an overestimate, since Lingnan peasants farmed much smaller plots than northerners. (For more details on sources, assumptions, and calculations, see appendix B.)

Applying this method to Lingnan's food output in 1753 (as reconstructed by Robert Marks) leads to the conclusion that crop residues available for burning would have generated at least .08 tce per capita, or roughly one quarter of the Asian Development Bank's estimate of minimum needs today; a much more likely figure is .16 tce per person. (It is unlikely that eighteenth-century peasants used much more fuel than is considered necessary today, and it would be paradoxical to assume that they did and therefore faced a terrible fuel crisis.) And just in case this estimate still contains some upward bias, I have completely ignored any crop residues from land planted with crops other than grains, sweet potatoes, and beans—and other crops were very widespread.

TABLE 5.2
Total "Fuel" Supply per Capita
If Wood Had No Other Uses (in tce)

1753	1.75	1813	.99
1773	1.45	1833	.83
1793	1.19	1853	.70

TABLE 5.3
Supply of Wood Above and Beyond Domestic Fuel Needs

	Forest Land (hectares)	*Forest Needed for Fuel*	*Remaining Forest*	*"Non-fuel" Wood per Capita (tons)*
1753	15,500,000	1,650,000	13,850,000	2.85
1773	14,220,000	1,675,000	12,545,000	2.25
1793	13,100,000	2,260,000	10,840,000	1.73
1813	11,800,000	2,469,000	9,331,000	1.32
1833	10,700,000	2,956,000	7,744,000	1.00
1853	9,580,000	3,339,000	6,241,000	.74

Marks has estimated that all the food consumed by the population of Lingnan in 1753 could conceivably have been grown on as little as 30 percent of its cultivated acreage. Thus, even in the unlikely case that Marks's yield estimates need to be halved, the amount of land devoted to other crops throughout Lingnan must have been over 40 percent of total acreage; ignoring residues from those lands almost certainly overcorrects for any optimism in the estimate of heat obtained from residues.

We can now move on to the fuel supply in 1753 and thereafter. Adding the population gained in Lingnan at twenty-year intervals, plus an appropriate number of animals, assuming (falsely) that the additional land brought under cultivation did no more than meet the food needs of that population and using the figures calculated above for the disappearance of forests, generates tables 5.2 and 5.3. Table 5.2 shows how Lingnan's potential fuel supply per capita changed. Table 5.3 shows how much wood was available for other uses if only the sustainable yield of the woodlands was taken each year and if the amount needed to meet the gap between available residues and minimum home heating and cooking was subtracted in advance of other uses.

Imprecise though they are, these figures illustrate two very important points. On the one hand, we see how quickly population growth could eat away at wood supplies even in an economy that used resources efficiently. When we remember that the "non-fuel" wood in Table 5–3 was used for many buildings, carts, boats, and other essentials, it is clear that the energy supplies needed for

growth in any industry (even textiles, which use fuel for bleach and dye production) were dwindling fast. Thus, it would appear that insofar as the growth of market handicrafts helped power population growth, those same forces could eventually close the ecological window within which the "industrious revolution" could lead to an industrial revolution: unless, that is, there was a massive turn to fossil fuels and/or imported primary products. An ecological bottleneck was at hand, which in retrospect (though only in retrospect) appears as a severe constraint on further population growth, per capita income growth, or movement out of agriculture.

On the other hand, these figures do not suggest an imminent Malthusian crisis, even as late as 1853. Lingnan's situation seems more benign than that faced much earlier by France (again, hardly the most deforested part of western Europe). Around 1550 France probably had a total potential fuel supply per inhabitant of 2.3 tce per inhabitant or 3.6 tons of harvestable wood per capita above basic fuel needs; by 1789, almost all of this surplus had disappeared. Fuel supply would be about .64 tce per capita if all harvestable wood were burned, leaving about .29 tons of wood per person for other uses if fuel consumption were kept at Braudel's estimate of .5 tce per person. Far from having uniquely severe ecological problems, even some of China's more densely populated parts seem better-off than economically comparable parts of Europe.

Finally, though, we need to consider North China. This dry-farming region lacked the advantages of paddy rice, and the burden of supporting China's capital (always one of the world's largest cities) has been considerable. By 1900, much of North China *was* an ecological disaster area, and there has been a widespread tendency to assume that this had been true for a long time. Ling Daxie's figures for 1700 suggest that two north China provinces—Shandong and Henan—were already very severely deforested (1.3 and 6.3 percent forest, respectively). The third province entirely in the North China macro-region, Zhili, was in much better shape (22.7 percent), as was Shanxi, which is partly in North China (18.8 percent). Nonetheless, this would still be a very worrisome situation.

Overall, the North and Northwest China macro-regions probably had China's most serious ecological problems. Since Northwest China was sparsely populated, we will ignore its worsening problems here—important as they were locally—and focus on its much more populous neighbor. Indeed, North China, as we saw in chapter 3, is the one Chinese macro-region in which the production of non-food crops probably fell in absolute as well as per capita terms between 1750 and 1900, as more and more of its land was needed for food. But even in North China, the overall picture circa 1800 was not uniformly grim: prospects for raising living standards were limited, but stable living standards and some continued population growth were still ecologically plausible.

Traveling along the Grand Canal in 1696, the French missionary Du Halde mentioned vast forests in southern Shandong, one of the most densely popu-

lated parts of North China's most deforested province.[112] And throughout the eighteenth century, the area near Yanzhou—near the forests Du Halde saw—continued to send firewood up the canal to the imperial brickworks at Linqing. Though the amounts involved were small, this also tends to suggest that Shandong was not as devoid of woodlands as Ling's figures suggest.[113] Even as late as 1793, George Staunton, a member of a British mission to Beijing, presents a mixed picture. While noting that trees were "scattered thinly" on most of the North China plain,[114] he also noted large groves in some places, usually near cemeteries.[115] In general, he believed that the rural North Chinese he saw, though often poor, did not lack basic necessities. He also noted that the roots of North Chinese sorghum, usually burned to use the ash for fertilizer, were burned at home "*when* fuel is scarce."[116] Finally, he notes that the Grand Canal itself in North China was lined for miles and miles by willows and other trees planted to strengthen its banks.[117] Though not numerically significant in themselves, these trees suggest that the fuel shortage was not yet critical: in the twentieth century, when people had become truly desperate, it proved impossible to defend such trees from illicit cutting.[118]

Any quantitative estimates must be very rough, but some reasonable guesses are possible by working backward from twentieth century data. As a sample area, I chose twenty-seven counties in southwestern Shandong, with a probable 1800 population of about 5,000,000. This particular portion of North China had one of China's most desperate fuel shortages by the 1930s—with a fuel supply of perhaps .09 tce per person per year, worse than the worst parts of contemporary Bangladesh or the Sahel.[119] So it is striking that even this area seems to have been fairly livable circa 1800—much as Staunton's testimony suggests.

Crude but very conservative estimating techniques give this region a fuel supply at that date of .62 tce per year: about 20 percent above Braudel's estimates for French energy use at the same time, and almost double contemporary estimates of a minimum viable supply. Probably over 40 percent of that fuel supply would have come from crop residues, but it seems likely that the area was still at least 13 percent woodland in 1800.[120] This would not have left

[112] Pomeranz 1993: 134.

[113] Xu Tan 1986: 138.

[114] Staunton 1799: I: 279, II: 46.

[115] Ibid., I: 266; also II: 46, 169.

[116] Ibid., II: 138, 141.

[117] Ibid., II: 142.

[118] On twentieth-century fuel shortage and illicit tree cutting, see Pomeranz 1993: 124–25, 143–45.

[119] See Pomeranz 1993: 125; Pomeranz 1988: appendix F.

[120] See appendix C. The woodland figure is significantly higher than Ling's figure for the province as a whole (1983), but I can see only two ways that it could be too high. One would be if I have seriously overestimated crop yields per acre, but that would require the unlikely conclusion that growth in yields during the ecologically calamitous and technologically unimpressive nineteenth century grew much faster than even the rapidly growing population. The other would be if I have significantly underestimated the amount of land under non-food crops in this area, which seems to have been (as it would be in the twentieth century) heavily concentrated in wheat

much wood for other uses—rural housing, for instance, made heavy use of sundried brick—much less for industrial growth; and the burning of crop residues might have taken a long-term toll in increased erosion and loss of soil nutrients (particularly in combination with further deforestation in later decades, and a falling water table, which we will discuss later). As of 1800, however, the overall situation seems no worse than in large parts of western Europe.

So despite its dense population, Chinese pressure on the land was probably not much worse than that in Europe (or Japan) in 1800. And at least with respect to trees and soil, the rate of decay in China was probably slower than that seen in eighteenth-century western Europe.

In other areas Europe may have had a greater ecological cushion. For instance, the greater use of multi-cropping in east Asia made that area more vulnerable when the Northern Hemisphere experienced cooler temperatures (i.e., an unexpected shortfall of solar energy) in the first half of the nineteenth century.[121] Less speculatively, Europe still had large amounts of grasslands and pasture that were sufficiently well watered to be converted to arable. Almost two-thirds of the farmland added in non-Russian Europe between 1700 and 1850 came from these pasture lands, and both demographic and institutional histories suggest that most of that conversion came after 1800. But in China (or, more accurately, Chinese central Asia), most remaining grasslands were semi-arid, and almost all additional farmland had to come from clearing forests or reclaiming land under water.[122] Thus, a relative abundance of water (as a matter of original endowments) may have given Europe extra room for dealing with the pressure on its land.

Land and water problems were related in other ways, too. Although the careful gathering of twigs, crop residues, etc., in China solved fuel shortages just as well as clearing less land and leaving more trees, it was not as good in other ways. Deforestation eventually led to soil erosion and flood dangers; the former, as already noted, may have been no worse in eighteenth-century China than it was Europe, but the latter probably were. Deforestation also leads to desiccation (since deforested areas get less rainfall and have higher rates of evaporation from ground and low plants exposed to the sun). North China in particular has a pattern of highly seasonal rainfall and aridity more like some Mediterranean and tropical locations than like northern Europe,[123] a pattern

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and sorghum, with relatively small amounts of tobacco and cotton. This is more possible—I have argued in chapter 3 that North China as a whole probably grew more cotton in the late eighteenth century than one hundred years later—but if my woodland figures are wrong for this reason it would mean that there were even more crop residues available for fuel than we thought and that China circa 1800 was even more prosperous than I have suggested.

[121] Marks 1997: 224.

[122] For European figures, see Richards 1990: 164.

[123] See, for instance, maps I-17 and I-23 in Hsieh (1973), showing average annual precipitation of roughly 500 millimeters for most of North China, with 250 mm. of that coming in July and

that was probably exacerbated as its forests disappeared. Moreover, as loess soil becomes increasingly dry it can no longer provide plants with extra nutrients from below through its unusually strong capillary action. Most important of all, because loess soil is very light, it is particularly vulnerable to erosion as deforestation removes badly needed windbreaks. (Much of the soil lost in the American Great Plains during the 1930s dust bowl was also loess.)

Thus, Europe's way of coping with its fuel shortages (even before the coal boom) may have been better for other kinds of conservation than China's method. It should be emphasized that this was not because Europeans were consciously trying to prevent desiccation by maintaining tree cover. Though such efforts were beginning in a few of Europe's tropical possessions (where the effects of deforestation on climate were much more obvious), these ideas (in part learned from Chinese and Indian sources) had no impact in Europe itself until later: tree conservation, to the limited extent it was practiced in eighteenth-century Europe, was aimed solely at securing adequate timber for construction (especially of ships) and fuel.[124]

Lack of water may have been developing into a serious problem by 1800 in parts of late eighteenth-century North China, though our current knowledge does not allow a definitive conclusion. The last two centuries have seen a large, dangerous decline in the water table; indeed, today many North Chinese cities face both water shortages and serious subsidence problems.[125] But in the late eighteenth century, these problems were probably not yet critical. True, North China peasants were finding it necessary to drill deeper and more expensive irrigation wells, especially if they wanted to plant cotton. (In the long run, of course, this made matters worse.)[126] However, a survey of the area immediately south of Beijing in 1771 still showed 117 springs and 5 large lakes, almost unchanged from what had been found in 1420.[127] The disappearance of surface water near Jinan (Shandong's capital) and in southwest Shandong also seems to have been primarily a late nineteenth- and (especially) twentieth-century phenomenon. An 1839 prefectural gazetteer listed 7 lakes, 150 springs, 11 wells, 14 ponds, and 18 bays in Licheng county; it specifically mentioned that 2 of the 72 springs for which the county had been famous were gone, and listed 7 other springs and 2 lakes that had been recorded in the past (sometimes the distant past) but had since disappeared. (The previous gazetteer for the area was done in 1785.)[128] This suggests some decline in the water

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August alone, and 150 at most in October through April. For a northern European comparison, see Wallen 1970: 63, 114, 162–92, 227–39.

[124] Grove 1995: 56–59, 155, 199, and passim.

[125] Smil 1994: 38–49; *China News Digest*, May 21, 1998.

[126] Pan 1994: 57–59.

[127] Zuo and Zhang 1990: 476. This area was, however, unusual since much of it had been kept as an imperial preserve.

[128] *Jinan fuzhi* 1839: *juan* 6. The specific references to water that has disappeared are on 6:24a–b, 6:32a, 6:33b, 6:35a, 6:36a–b, 6:40b, and 6:42b.

table, but not a sharp one. By the 1920s, however, a county gazetteer for Licheng, which is far more detailed in almost every way, mentioned only 5 lakes, 40 springs, 5 ponds, and 4 creeks; it specifically said that fewer than half of the 72 famous springs (70 still active in 1839) still existed and listed numerous other bodies of water that had disappeared or shrunk considerably.[129] It thus seems likely that any eighteenth-century problems with wells and a declining water table were an early and relatively mild sign of a problem that would accelerate greatly sometime after 1850.

Nonetheless, with the advantage of hindsight, we can see some important differences in the nexus between ecological and economic problems in China and Europe. Europe had little chance of expanding its supplies of clothing fiber and wood from within its own borders, given its relatively non-intensive agriculture and (compared to east Asia) limited labor supply (which would have interfered with increasing flax production, more careful fuel gathering, and use of crop residues), and perhaps not even of expanding its food supply at a rate that could match nineteenth-century population growth. However, it turned out to be possible to address these shortages through long-distance trade (first cotton, guano, sugar, wooden ships, and naval stores and later grain, meat, and logs). China and Japan met more of these needs domestically through labor-intensive methods and (as we shall see later) internal trade; and they did so without placing themselves in an immediate ecological bind. But in the long run, at least China did so at the price of reducing its margin of safety in water supply and (perhaps) vulnerability to cold weather, problems that could not be solved by either trade or any technology readily available even today.

The relatively thin margin of ecological safety in China's peripheries also made them vulnerable to any decline in the efficiency or commitment of the state, which helped manage these problems—and a sharp decline occurred in the mid-nineteenth century. The rich Yangzi Delta, which had long been expected to manage most of its own water control and other ecological tasks, was much less affected by this decline, though it was greatly affected by the nineteenth-century civil wars and soaring opium imports that also accompanied the state's new problems and new orientation.[130]

Finally, once the people who were involved in and supported by this more intensive agriculture and fuel-gathering were there, there was no easy way to backtrack and exchange the problems that this route created for those of Europe's path, which proved to be solvable through colonies, technology, and chemistry.[131] Even under contemporary conditions, moving China's popula-

[129] *Xuxiu Licheng xianzhi*: *juan* 10–12; the reference to the 72 springs is on 10:44a.

[130] See Pomeranz 1993: chaps. 3–5.

[131] Sugihara (1997) reads this same phenomenon more optimistically, arguing that while the adoption and adaptation of Western technologies to the large population bases left by the later east Asian "miracle" has thus far produced only one country (Japan) whose standard of living rivals the richest Western nations, it has brought benefits to millions not paralleled in the rest of the non-

tion into export-oriented industry and importing more primary products (as Europe did) has proved very difficult to do on a sufficient scale. This is true not only because the numbers of people involved are so large, but because many of these "surplus" workers, unlike "surplus" workers in proto-industry, *cannot* in fact be moved to factories without worsening the shortfall of agricultural output.

In short, none of the changes that combined to arrest western Europe's ecological decline during the nineteenth century was operative in China. There was no slack from highly inefficient land-use patterns such as commonage, three-field systems, or pastures reserved for horse-loving nobles. There were no gains from the spread of heavier iron plows (deep plowing retards erosion), which had been common for centuries, nor from the importation and further development of ideas and techniques for afforestation. Marginal farmers had neither industrial cities nor the Americas as an alternative, and, as we saw in chapter 2, customs reduced even the much more limited relief that peripheries might have realized from migrants seeking higher earnings in the proto-industrial Yangzi Delta. There was neither a coal boom to substitute for firewood nor vast quantities of land-intensive goods from the New World. And though Chinese population growth was probably slower than that in Europe between 1800 and 1850 (and about the same from 1750 to 1850), it was concentrated in regions such as north China and the Middle and Upper Yangzi, which had been important exporters of primary products to the Yangzi Delta. So if one adds together the ways in which China circa 1800 may have already become more ecologically vulnerable than Europe (partly by remaining self-sufficient in fibers), as well as the absence of institutional slack, of relatively easy-to-realize improvements in land management, and of any equivalent to the Americas as both population outlet and source of primary products, a sudden divergence becomes much less surprising. We can see how an ecological situation that was not much worse than that in Europe circa 1800, especially in core regions, and even seemed to be worsening more slowly, could rapidly become much worse in some Chinese regions, all at the same time that Europe's situation was stabilizing. And so, conversely, it seems possible to imagine that without all (or at least most) of its multiple sources of relief—some generated by new technology, some through catching up, and some through the New World windfall—Europe, too, could have wound up with much less economic transformation and much more environmental travail.

In this context, it is revealing to look again at Denmark, a western European case that looks in some ways more like parts of China and Japan than like England. Despite a vigorous expansion of both its navy and its merchant marine in the sixteenth through the eighteenth centuries (at considerable cost

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European world and has been responsible for more total growth in twentieth-century world GDP than the West's own growth.

to its forests) and the chartering of companies for overseas trading and colonization on the Anglo-Dutch model, Denmark did not ultimately gain much from overseas expansion, and its land, fuel, and soil fertility problems became acute in the eighteenth century. However, it did far better than most of Europe at stabilizing its ecology through domestic measures: massive campaigns of marling, reclamation of sand dunes, ditch-digging, systematic forest management, convertible husbandry with the planting of huge amounts of clover, and so on. These were very labor-intensive measures—Kjaergaard *very* conservatively estimates a 50 percent rise in per capita working hours for rural laborers[132]—and in many cases required massive mobilizations of forced villein labor (which was still common in eighteenth-century Denmark).[133]

Though these efforts placed agricultural prosperity on a new and ecologically sounder footing, Denmark saw no increase in the share of its population living in cities between 1500 and 1800 and witnessed only limited growth of proto-industry;[134] certain fuel-intensive products, including glass, were virtually all imported, despite the transport problems involved.[135] These patterns persisted well into the nineteenth century, even though Denmark had reasonable amounts of capital, good transport, participated in European science, and had plenty of nearby and culturally similar models for industrialization. Moreover, labor remained overwhelmingly concentrated in agriculture even though these very labor-intensive approaches to farming, fuel conservation, and land management produced a substantial long-term decline in the physical productivity of labor: Kjaergaard estimates an increase in agricultural output of at most 100 percent between 1500 and 1800 (a rising share of which had to be sold to pay for imports like fuel), while labor inputs increased over 200 percent.[136] (When returns to labor in Denmark did begin to rise, in the late nineteenth century, this was at first less because physical productivity improved than because its neighbors became increasingly industrial, raising the prices Danes could get for their farm goods.)

Thus, the path of ecological near self-sufficiency through rural labor intensification, once adopted, was not easily abandoned, at least until twentieth-century chemistry and machinery made possible a far more radical transformation of farming. In that sense, Denmark's path resembled that taken by various parts of eighteenth- and early nineteenth-century east Asia more than that of England or even Flanders. (It is, as well, the "peasant" path that Ambrosoli sees England diverging from, in a gamble that could have been ecologically catastrophic had guano and other off-farm fertilizers not become available.)

[132] Kjaergaard 1994: 151. In fact, since he finds a probable increase of 50 percent in the length of the work week and more weeks of work per year, the likely increase is larger than 50 percent. See also the discussion of marling on pp. 55–56, where he calculates that 110 labor days per *tonde* (.55 hectare) was likely, but then does further calculations based on 50 days per *tonde*.

[133] Kjaergaard 1994: 37–38.

[134] Ibid., 151–54.

[135] Ibid., 123.

[136] Ibid., 158.

And even with this huge application of labor to land management, the result was only *near* ecological balance: coal imports rose steadily after 1740, and especially after 1820.[137]

But it is only in hindsight that Europe's problems appear more solvable than those of China, and solvable only with a combination of technological change, institutional catching-up, and New World resources. In the late eighteenth century, east Asia could not be judged "overpopulated" compared to Europe, since its larger number of people were living just as well and in some ways straining their ecology less than Europeans were.

Even the further growth of Chinese population—by at least 150,000,000 and perhaps even 225,000,000—between 1800 and the 1930s was accomplished without any clear decline in nutritional levels. Even in the early twentieth century itself, when social misery was particularly acute and Malthusian ideas seemed particularly appropriate, there may have been a small upward creep in the average height of young adults, an often-used (though controversial) proxy for general nutrition.[138] Average consumption of nonessentials probably did decline, but much of this was, as we saw in chapter 3, an effect of population growth being concentrated in less-developed regions, so that the relatively high-living people of Jiangnan and a few other places came to have less weight in national averages for consumption. With the possible exceptions of North and Northwest China, there is little to suggest a decline in the living standards of any particular place, except during the mid-nineteenth-century disasters. Thus, there is little to suggest either "overpopulation" or imminent "ecological crisis" in 1800 (much less 1750), if by this we mean a threat to existing expectations. At most we could argue that there was an ecological "bottleneck" constraining any sharp further improvement in living standards, as well as some hints of more serious problems in the future for North and Northwest China.

Overall, then, both ends of Eurasia were in serious trouble. Any difference in the degree to which they were in trouble (based on domestic resources alone) would probably turn out to be fairly small. And most of Europe's advantages consisted of slack left by institutional barriers to intensive land use, not the gradual accumulation made possible by superior economic arrangements. What seems more significant than any differences, as long as we restrict ourselves to these areas' internal resources, is how quickly population growth and proto-industrialization seemed to be closing the ecological window in which a much more radical change in economic life and per capita resource use would be possible anywhere. Massive windfalls of fuel, fiber, and perhaps even food would have to be found somewhere for an industrial revolution to occur and be sustained, or even for proto-industrial growth to continue much longer.

[137] Ibid., 127–28.

[138] Lee and Wang forthcoming: 6, 10.

But to understand the full significance of these rather sudden windfalls, we must first look at one last area of general similarity. I have argued above that thanks to extremely efficient (and often labor-intensive) ways of using resources, Chinese and Japanese cores did better at finding *local* palliatives for shortages of land-intensive resources; but these solutions were far from complete (especially for timber) and they depended on importing other non-local resources (e.g., Manchurian beancake to relieve cotton-growing soil). In short, both European and Asian core areas needed to obtain land-intensive resources through long-distance trade with less densely populated areas. To the extent that this long-distance trade was consensual trade with other parts of the Old World, cores at both ends of Eurasia faced comparable opportunities and limits; but, a good case can be made that Chinese cores used this kind of trade more successfully than their western European counterparts did.

Trading for Resources with Old World Peripheries: Common Patterns and Limits of Smithian Solutions to Quasi-Malthusian Problems

Import Substitution in Free Labor Peripheries

Core areas in China, Japan, and Europe all imported land-intensive commodities (especially forms of energy) from more sparsely populated zones. For western Europe, this meant first the Baltic and eastern European grain, timber, and cattle trades, and later a plethora of New World products. For Lingnan, there were some imports from Southeast Asia and even India, but Jiangnan relied primarily on rice and timber from upstream on the Yangzi and its tributaries, and, beginning around 1680, on timber and soybeans from Manchuria. In Japan, a large sixteenth- and early seventeenth-century foreign trade was seriously restricted by the state after 1640, leaving little except some traffic in silver and silk by 1700.[139] However, a pattern of internal exchange developed between core regions (what Susan Hanley and Kozo Yamamura call "Region I") and the rest of the country (Hanley and Yamamura's "Region II"). Region I, which appears to have reached the maximum population it could support by 1720, exported nails, tiles, tools, leather shoes, and above all textiles. Region II imported manufactured goods and exported rice, timber, horses, and other land-intensive products. The outer areas, especially in the far north, were also major sources of fish, which became increasingly important both as food and as fertilizer in core regions from the mid-eighteenth century onward, and which was sought further and further afield.[140]

[139] Sugihara 1996: 38.

[140] Hanley and Yamamura 1977: 19–28, 132–36, 163–71; Howell 1992: 271–75.

Land-intensive imports had to be paid for, and all our core regions sought to do this by selling manufactures, particularly textiles. But that pattern of exchange faced at least two possible limitations.

One was that raw materials exporters often began a process of import substitution, in which they themselves began to make the manufactured goods they had previously imported. And as diminishing returns set in in the production of the area's main exports—as, for instance, exporting more lumber began to involve hauling logs further and further to the riverbank—people turned to other work. In the twentieth century, many Third World governments have adopted import substitution as a conscious strategy for industrialization, often with rather poor long-term results.[141] Consequently, economists tend to view import substitution as an effort to push against the "natural" tendencies of the market, using tariffs, subsidies, and the like to artificially improve the competitive position of nascent industries. But two-hundred plus years ago, the technological gaps between cores and peripheries were often fairly small, and whatever gaps there were were not guarded by internationally recognized patents; very few production processes required large initial investments of fixed capital; and relatively high transport costs (especially for high bulk-to-value items of daily use) provided a certain amount of "natural" protection. A few kinds of production (e.g., silk-rearing and weaving) were so complex that it was very hard to compete with established producers,[142] but many others were simple. Thus, import substitution was not a "forced" process in the pre-1800 world: it seems to have occurred fairly naturally in those peripheries where people were free to switch into new kinds of production and to decide which goods to produce for themselves and which to purchase with the cash earned from their other labors (i.e., to participate in DeVries's "industrious revolution"). The process was blocked only when some special raw material was missing, where particularly complex skills were involved, or where government or lordly monopolies interfered.

Indeed, import substitution eventually spread through most of that part of China with which the Lower Yangzi and Lingnan traded. The development of proto-industry cut into the Middle Yangzi's rice surplus (both because population grew and because some land switched into cotton to supply local spinners and weavers), which had previously gone to the Lower Yangzi, and it also made that area less dependent on cloth from Jiangnan.[143] North China had begun to make more of its own cotton textiles in the seventeenth century and, as this process continued in the eighteenth century, it exported less raw cotton to Jiangnan.[144]

North China's decline as a raw cotton exporter was probably more severe than that of the Middle and Upper Yangzi as rice and timber sources, because

[141] Of course, many more open economies have also fared poorly.

[142] Borah 1943: 85–101; Schurz 1939: 44–45, 364–66.

[143] Li Bozhong 1998: 108.

[144] Lu 1992: 482–83.

it appears to have had fewer built-in brakes on its population growth and ultimately far more severe ecological problems. Like the Middle and Upper Yangzi, North China's population growth exceeded the empire's average between 1750 and 1850. But in the Middle Yangzi, population growth seems to have been self-regulating, much as it was in the Lower Yangzi. It slowed considerably in the last few decades before the mid-nineteenth-century civil wars, as land and water shortages mounted; it then probably took fifty years to recover from those wars.[145] And although pressure on the region's land and water was serious, the slowdown in population growth seems to have come soon enough to avert major ecological or economic crises. The surface area of Dongting Lake—the second largest in China—is one useful proxy for population-driven ecological stress in the Middle Yangzi, since much land was reclaimed from the lake, greatly increasing flood dangers. This area seems to have declined by almost 800 square miles (13 percent of the lake's previous size) between 1825 and 1850, but then held roughly steady for the rest of the century.[146]

In North China, on the other hand, population growth continued with barely a pause, right through to the still faster population growth that began in the 1950s: and it did so in spite of a series of genuine ecological catastrophes with lasting effects. And both before and after 1850, the most rapid population growth within North China appears to have been in Henan, generally the poorest province in the macro-region.[147] It is not clear why this should have happened. But recent studies of fertility control elsewhere in China may provide some clues.

James Lee and Wang Feng's pathbreaking new work on the Chinese demographic system emphasizes the role of extended kin groups, acting through lineage organizations or through the household heads of joint co-resident families. Such groups were essential for enforcing restraints on procreation within marriage, arranging the adoptions that compensated for such restraint, and providing reasonable guarantees of old-age security and ritual continuity in cases where a given conjugal unit failed to produce a male biological heir.[148] More generally, it has been argued that social arrangements in which bonds between married brothers remain strong provide a form of insurance that reduces the need to hedge risk by having more children to call upon.[149] Lineage

[145] Perdue 1987: 219–33; Skinner 1987: 67–77.

[146] Perdue 1987: 204.

[147] Liang 1981: 396–97, 400–404 (pre-1850); Lin and Chen (1981: 39) for 1774 and for later dates, disregarding 1842 figures, which are suspiciously high for all the provinces they list, and the 1711 Henan figure, which is impossibly low (but would make that province's subsequent growth rate still more impressive).

[148] See Lee and Wang forthcoming, especially chaps. 7 and 8; on adoption in particular, see also Waltner (1990) and Dennerline (1986).

[149] Cain 1982: 173.

organizations were especially strong in south China (though the households that composed them were no more complex on average than in the north[150]); joint households were particularly common in Liaoning, the other major source of Lee and Wang's rural data.

But lineages were generally weak in North and Northwest China, joint households seem (based on admittedly spotty data) to have been much less common than in Liaoning, and essentially independent nuclear families were much more common. When brothers divided the family property in the north (whether a parent was still alive or not) they were far less likely to leave or create any property that belonged to a supra-family unit than was the case in the south.[151] Even the room that had housed the family's ancestral tablets and altar was likely to be turned into housing and/or divided; each brother maintained his own separate altar thereafter, even if the brothers' homes still fronted on a common courtyard.[152] Under such circumstances, it is hard to imagine that the extended family, either as material force or as ideal, could shape fertility decisions made within the nuclear family as strongly as it apparently did in Jiangnan and in Liaoning. It may be, then, that a different kinship system made the household-level mechanisms that were central to demographic restraint in some other parts of China relatively weak in the North and Northwest, leaving them closer to the population dynamics that Malthus, Hajnal, and others have mistakenly attributed to all of China.

Whatever the causes of North China's population boom, its population density probably exceeded that of the Middle Yangzi by 50 percent in the 1840s—despite having less water, a shorter growing season, and other disadvantages.[153] By 1953, North China's population density exceeded that of the Middle Yangzi by 70 percent. Under the circumstances, North China—unlike the Middle and Upper Yangzi—almost certainly decreased its per capita production of non-food crops somewhere between 1750 and 1900; it may even have suffered a fall in absolute production levels. And if raw cotton output fell while more of it was spun locally, the fall in exports to Jiangnan would have been very large. (For more on these scenarios, see appendix F.)

Whether these processes of development in the peripheries reached a relatively benign equilibrium, as they seem to have done in the Middle and Upper Yangzi, or failed to do so, as in North and Northwest China, they limited the ability of more advanced regions to keep growing and to specialize further in manufacturing. Before we return to those consequences, however, it is worth looking further at causes of the process.

Thus far, I have described this as a "natural" process, to be expected if peripheries had more or less free labor and no special restrictions (e.g.,

[150] See, for instance, Buck 1964: 367.

[151] Wakefield 1992: 224–29, 254.

[152] Wakefield 1994: 201, 227–28.

[153] Skinner 1977a: 213, 226, adjusting for Skinner 1987.

colonial monopoly systems). But the reality is more complex. We are still far from understanding what caused population growth in any of these peripheries, though external demand for their products and increasing opportunities to earn a living surely played some role.

Nor is the link between rising population and falling raw materials exports a simple one. In dry-farming North China, where increased labor inputs alone could not raise yields dramatically, population growth and environmental strain are probably a pretty good explanation for why so much of the area's additional labor power went into handicrafts and raw cotton exports fell.[154] Population growth alone would also explain much of the decline in exports from timber-producing regions; food and forest compete for land, and knowledge of how to raise per-acre wood yields was still rudimentary.[155]

But in the Middle Yangzi, where additional labor could easily raise rice yields, it is not as certain why, as the labor force grew, the extra workers did not concentrate on growing even more rice than they did and trading for cloth, rather than producing cloth themselves. Indeed, Perkins's scattered data suggest that per acre rice yields in some of the most export-oriented counties in the Middle Yangzi province of Hunan did rise sharply as the province filled up: they were about 60 percent of Lower Yangzi levels in the eighteenth century and caught up during the nineteenth century.[156] Cultivated acreage also rose significantly—presumably mostly in less-advanced areas.[157] Since Hunan's population grew about 40 percent between 1775 and 1850 (it probably grew faster on a per annum basis between 1750 and 1775, but the data are very poor)[158] the province probably could have maintained its per capita food output and so increased the absolute size of its exportable surplus. Since those exports fell instead, we must conclude that the yield increases of the leading export counties were not matched in many other places where they could have been, at least in part because people chose to use their labor differently. Many Qing officials believed as much; several blamed failures in their campaigns to encourage double-cropping on the unwillingness of peasants to put in the necessary labor, even where the local environment was suitable.[159] And the people who put more of their labor into non-grain production—whether they were lowland women weaving cloth or highland men and women growing tea—still consumed rice, decreasing the exportable surplus. These reallocations of labor were not inevitable.

Despite diminishing physical returns to the labor engaged in producing any particular export, primary-product prices could certainly rise enough to make continued specialization more rewarding than diversification. While premodern transport costs could encourage regional self-sufficiency, riverine and

[154] For a further discussion, see appendix F.
[155] Menzies 1996: 619–22, 644–65, 659–63.
[156] Perkins 1969: 21, 315, 318–19, 321.
[157] Ibid., 234.
[158] Perdue 1987: 56–57.
[159] Ibid., 129, 132.

coastal shipping rates were often modest. Since China's peripheries did continue to ship large (though declining) amounts of high bulk-to-value goods to Jiangnan and Lingnan, one would think that shippers, needing return cargoes, would have offered attractive shipping rates for Jiangnan's exports (though adding weight was a greater problem when going back upstream than it was going down to Jiangnan). So we need further explanations of Middle Yangzi proto-industrialization, either through forces that *discouraged* further export growth or forces that *encouraged* intraregional diversification.

One logical possibility—though one for which we have little data—would involve local transport costs. Within a macro-region, people first filled up the most fertile and accessible regions, closest to the rivers that served as major transportation arteries; later growth would be disproportionately located away from these arteries, from which shipping bulky goods was expensive. And since China had fewer large domesticated animals per person than Europe or India did, it is possible that—although (as argued in chapter 1) it was at no disadvantage in *overall* transport capacity—transport costs may have risen unusually steeply as one moved away from riverbanks. But at most this would help explain why exports did not keep rising in step with population, cultivated area, and total output in the peripheries. It does not explain why the people already settled near good transport would have exported less in the nineteenth century, unless we can show that they began trading their primary products for goods produced in later-growing areas.

This would have made sense for some groups among those who settled outside the main river valleys—the rapidly growing number of people who cleared and cultivated hillsides in late eighteenth- and early nineteenth-century China. This hillside settlement has long been linked to the Chinese adoption of foreign food crops (potatoes, sweet potatoes, etc.) that would grow on highland and inferior soils.[160] This places hillside clearance in a Malthusian context, with population growth forcing people onto inferior land and the new crops providentially allowing them to survive there, or with new food lands allowing population to grow further. Such poor highlanders scratching out a living with inferior foods would be irrelevant to the export surpluses of the more fortunate farmers in the valleys.

But highland farming had another face, which is relevant to our story. Much of what was grown on hillsides and former wasteland—tea, peanuts, and various oilseed crops—were in greater demand because of increased prosperity, not just rising population. In fact, in a recent article Fang Xing rests his case for an improved standard of living in the Lower Yangzi between the seventeenth and nineteenth centuries precisely on evidence that more non-grain foods were consumed.[161] Although we do not yet have comparable studies of

[160] For the classic statement, see Ho 1955: 192, 196–97.
[161] Fang 1996: 97.

diets in the rest of China, it seems likely that the lowland rice growers of the Middle and Upper Yangzi, whose terms of trade and land productivity were both improving,[162] would have spent some of their increased incomes on condiments of various sorts. If they did, they would have become customers of their upland neighbors and probably sent them at least some rice in return. The literature has reasonably emphasized how Chinese producers of non-grain cash crops often grew food, too—so that, say, tea and sweet potatoes might advance in tandem—which made them less dependent on purchased food than the very specialized producers of "drug foods" in the Caribbean.[163] The spread of secondary grains in the late eighteenth and nineteenth centuries even turned a few former food-deficit counties in Hunan into net exporters.[164] But it still seems likely that some of the rice that used to go downriver now instead went up into the hills.

So far, I have restricted this discussion to economic factors, adding details specific to the way that market forces played themselves out in China, rather than invoking any other causal forces. Still more economic factors could be added to explain still more of Jiangnan's increasing shortage of crucial imports. Water transport between North China and the Yangzi Valley deteriorated after 1800, further inhibiting raw cotton shipments; the rise of opium as a cash-cropping alternative to cotton in the Upper Yangzi, Northwest, and Southwest could not have helped either, though this came after 1850.[165] But other influences, related to culture and to state policy, need to be considered as well.

One such possible factor is the system of state and charity granaries, which, at least in the eighteenth century, were fairly effective at dampening both seasonal price fluctuations and price increases in bad harvest years. As Pierre-Etienne Will and R. Bin Wong point out, this lessened the risk of going into non-grain production and buying food from the market.[166] The granary system was at its height in the eighteenth century; it fell on hard times thereafter. But many local granaries continued to work well even later, while the government could no longer make large interregional grain transfers to meet episodic crises. Thus, the nineteenth-century granary system may have continued to buffer the risks for some peasants in grain surplus areas who chose to diversify, while no longer doing as much to buffer the risks of interregional specialization.

A more deep-seated factor may have been Chinese gender norms. It was much more "proper" for women to work indoors (above all, spinning and

[162] Perdue 1987: 113–35; Perkins 1969: 21.

[163] Mazumdar 1984: 269–70; Gardella 1994: 32.

[164] Perdue 1987: 134.

[165] On the decline of the north-south Grand Canal, see Hoshi 1971: 223–27; Pomeranz 1993: 154–64. On opium replacing cotton in some regions, see Chao 1977: 23.

[166] Will and Wong 1991: 496–97.

weaving) than in the fields. Had this preference (and one for wives with bound feet) not existed, hinterland families might have sought larger plots or farmed even more intensively—thus having a larger surplus to sell—and made less cloth.

We have already discussed (in chapter 2) some of the problems in assessing how much these norms constrained economic choices, and we have seen that even in Jiangnan, women did not completely leave the fields until after 1850. We also saw that, at least at mid-eighteenth-century prices, one need not invoke cultural preferences to explain that rural women in this period did weaving rather than farming. (Relative prices presumably favored weaving even more in the Middle Yangzi, where rice was cheaper.) But the most parsimonious explanation does not always give the best account of actual motives, and the idealized "man plows, woman weaves" division of family labor—one that became more common during the Ming and especially Qing, with state encouragement—probably did encourage import substitution in the interior.[167]

Since the "man plows, woman weaves" division of labor was an ideal that was sometimes overridden by practicality, one might even see it as a coveted lifestyle (much like restricting women to homemaking in some Western countries during certain periods when men earned enough to allow this) that more Middle Yangzi families would have adopted as the area became more prosperous in the later eighteenth century. And since cultural preferences do not automatically enact themselves—Hunanese men had to learn how to grow cotton and Hunanese women how to spin and weave it—Qing efforts to encourage the farmer/weaver household by disseminating knowledge presumably made some difference.

Furthermore, these gender norms probably also mattered in the mid-nineteenth century—once internal frontiers had largely filled up (except in Manchuria)—in discouraging people from migrating back toward Jiangnan. As long as land was still available in the interior and most people's skills (and self-images) were tied to farming, there probably would not have been much migration toward the coast anyway. But despite its nineteenth-century troubles, Jiangnan still had the highest per capita income in China, and as land became scarce elsewhere, one could imagine people without enough land migrating toward the handicraft and service jobs of the Yangzi Delta—and thus restarting its population growth, lowering its wages, making its cloth exports cheaper, and so on. That is, one could imagine such migrations if women had been able to migrate alone (toward textile-making jobs) without stigma, and had weaving not been seen as ideally done by women who were part of a household in which the husband had secure access (through ownership or long-term rental) to farmland. But since these preferences did exist—even tenancies in Jiangnan usually required a significant deposit—no migration of poor

[167] Mann 1992: 75–96; Li Bozhong 1996: 99–107.

rural households to the core was likely. It took the rise of urban factory-based industry (some of which included dormitories for single women workers) and a proletariat in the European sense after 1900 to create such a movement; and then it was halted again when the People's Republic banned migration to the cities after the mid-1950s.

The Qing favored population growth and handicraft development in less-developed regions not only as parts of a cultural ideal but also as a way of maximizing the number of ordinary households prosperous enough to pay their taxes reliably. And the Qing did not simply trust market dynamics to create these developments. We have already seen how the state encouraged migration to less-populated areas, providing information, infrastructural investment, and sometimes loans. And land-tax policies—both the de jure assessment of heavy tribute quotas on Jiangnan and a few other rich areas that were not levied elsewhere and the de facto policy of allowing much newly settled or resettled areas to stay off the tax rolls—certainly favored "peripheral" development, while probably restraining that of the empire's foremost core.

The state also made considerable if sporadic efforts to promote the spread of best practices in both agriculture and handicrafts: introducing new crop varieties and hiring Jiangnan weavers to come teach people in other areas, for instance.[168] (Having officials who never served in their home territory and rotated frequently facilitated these efforts.) And in both North and Northwest China, the Qing made major efforts to make subsistence secure in ecologically marginal areas. The biggest such project, the Yellow River conservancy (which served other purposes as well), probably consumed over 10 percent of total government spending in the early nineteenth century: more than some governments spent on all expenditures beyond war, debt repayment, and official salaries.[169]

We cannot measure precisely the impact of Qing policies; and they probably did not fundamentally alter the dynamics of development. But surely they had some effect: one that worked with markets to spread an agricultural, handicraft, and commercial economy across the empire. That effect, however, was probably not constant over time, and it would be well worth examining when and why it changed.

As R. Bin Wong has pointed out, late Ming and Qing officials had before them two models of economic expansion across the empire. One stressed interregional trade and specialization; the other, the multiplication of largely independent, self-sufficient cells. Both kinds of expansion usually involved some

[168] Mann 1992: 86; Wong 1997.

[169] For a lengthy account of this system as a subsidy to ecologically fragile North China—which, however, emphasizes that the subsidy was withdrawn near the end of the nineteenth century (so that it cannot account for continued rapid population growth in the twentieth century), see Pomeranz 1993.

state effort in their early stages, but the latter required considerably less ongoing attention from higher levels of the state.[170] (Or at least it was thought to: if one considers the long-run ecological effects of regional or local autarchy, this may not remain true. The picture is also complicated by the many different levels at which we can talk about degrees of interdependence or self-sufficiency, from the empire through Skinnerian macro-regions and down to local marketing communities.) The post-1750 period in which, I have argued, the reality on the ground shifted strongly in the direction of "separate cells" was also one in which (especially after 1800) the state seems to have been more reluctant to handle large projects and was less effective when it did so. To what extent the prevalence of different ideas changed to reflect a changing sense of what was possible, or vice versa, and exactly how shifting official visions, specific policies, and broad trends in the economy were related all remain to be fleshed out by further research.

Japan, meanwhile, shows somewhat similar patterns of development with very dissimilar central government commitments. Growth in Japan's major cores was very limited after about 1720—in fact, population in both the Kantō and the Kinai *fell* in the late eighteenth and early nineteenth centuries—while population and handicrafts took off in various peripheral areas after about 1780.[171] The Tokugawa did not encourage the peripheries at the expense of the cores. But after about 1760 they at least gave the leaders of some peripheral domains tacit permission to undertake new measures that enabled these domains to diversify their economies and support growing populations less precariously than in the past.

For instance Tosa, a relatively poor lumber-exporting domain, was badly deforested during the seventeenth-century construction boom, stripping entire mountains to provide lumber for Osaka (and to pay for the very high expenses that the lords of Tosa incurred for service to the shogunate and attendance in Edo). Subsequent attempts to farm the cleared land failed to keep up with population growth and were dogged by massive floods descending from bare hillsides. The eighteenth century was harder than the seventeenth century in Tosa; the popular diet appears to have gotten sparser and the 1750s were years of famine.[172]

But population growth resumed and hardship eased a bit in Tosa late in the century; this was largely due to the abolition of domainal monopolies, which led to an enormous boom in small-scale production of exports such as high-quality paper. This relaxation of monopolies, in turn, was possible because the lords of Tosa greatly reduced their expensive establishment at Edo and their

[170] Wong 1997: 139; see also 224–29.

[171] On the stagnation of core area populations, see Saito (1985: 211) compared to Iwahashi (1981: 440). On the continued growth of population in peripheries—despite serious famine in the mid-eighteenth century—see L. Roberts 1991: 87–91.

[172] L. Roberts 1991: 88–100, 115–21.

service to the shogunate—changes that the central government had to agree to before the burdens of this particular periphery could be lightened and its economy freed from harmful fiscal pressures.[173]

As it became fiscally possible to abolish harmful monopolies and labor obligations and thus support a larger population in the peripheries, that population growth itself also worked to reinforce tendencies toward liberalization. Population growth in outer domains was accompanied by greater double-cropping of paddy rice, and the increased use of that very labor-intensive and hard-to-supervise cropping system seems to have encouraged a trend toward smaller farms and greater tenant autonomy. The same changes in the land system had appeared two centuries earlier in the Kinai region, when it was experiencing both population growth and increased planting of double-cropped paddy rice.[174]

So although the Tokugawa did not, like the Qing, promote a more even spread of population and proto-industry across the landscape, they did eventually eliminate policies that had encouraged the concentration of people and handicrafts in cores. Meanwhile, at least some European states were doing the opposite, fighting (not always successfully) against markets to maintain the privileged position of specialized core regions. For whatever reasons, proto-industry in Japan, as in China, came to show a much less marked regional division of labor than proto-industrial England, and a more marked familial division of labor.[175]

Development in Old World hinterlands did not cause immediate shortages in the more advanced regions that bought primary products from them. Even the densely populated Lower Yangzi continued to find markets where it could exchange its industrial exports for raw materials—partly by going further afield and partly by specializing in certain niches, such as higher-quality fabrics, in which other regions could not yet compete. But these processes had limits.

By 1800, China's timber merchants had penetrated every corner of the empire, and some lumber floated over one thousand miles to its final destination. In low-wage Shaanxi, some trees were hauled sixty-five miles just to get to the river—further than Europeans hauled logs overland except in the very peculiar case of supplying Madrid.[176] But the quantities of free labor required for such tasks ultimately made such timber too expensive even for Jiangnan. As an eighteenth-century source put it, "Whether a tree is worth 100 *taels* or 1,000

[173] Ibid., 271–99.

[174] Smith (1959) quoted in Palat 1995: 62.

[175] Saito 1983: 40–43.

[176] Wu and Xu 1985 435–46; Li Bozhong 1994b: 93; Braudel 1981: 365–67. On Madrid, see Ringrose 1970: 27. Madrid could afford unusually expensive resources (and thus grow to a size that its immediate hinterland could not supply) because of its position as tax collector and way-station for New World silver, not from any goods it produced to exchange for primary products or even any rents and taxes owed it from its immediate surroundings.

taels, it will still cost 1,000 *taels* to harvest."[177] Moreover, high transport costs could have the paradoxical effect of increasing the depletion of forests without benefiting importing regions: a pattern exactly opposite to the efficiencies achieved when fuel was gathered from trees near the family courtyard. In the 1920s, for instance, high transport costs from the forests of northwest China meant that only the most valuable parts of the tree were worth shipping: the effect was not to slow logging, but to increase the size of stumps and quantity of "waste wood" that loggers left on the ground, slowing the forest's regeneration.[178] Late eighteenth-century lumbering probably became similarly wasteful as it moved into more remote areas. Thus, despite the remarkable efficiency of China's long-distance product markets, they could not provide raw materials for growing coastal regions indefinitely.

The trade between Japan's Region I and Region II was running into similar problems in the eighteenth century, though perhaps not as rapidly. Import substitution in Region II was gathering steam, and peasants in these domains were becoming more involved in the cash economy, though both processes were still slowed down somewhat by daimyo monopolies.[179] Thus, by the nineteenth century, many of Region I's still unchallenged export niches were in the sale of luxury goods for Region II's rather small elite. Meanwhile, population growth in the hinterland (which continued long after it had stopped in Region I) was reducing its surpluses of land-intensive products. Lumber output, for instance, stagnated in the eighteenth century.[180] Overall, as Conrad Totman puts it, "Tokugawa society encountered unprecedented difficulty in expanding its ecological base."[181] And this occurred despite zero population growth in core regions, liberalization of the timber and rice trades,[182] and a geography that gave most of the country some access to water transport.

Less Free and Flexible Peripheries

Western Europeans trading with eastern Europe faced a different set of constraints. Unlike the Chinese interior, eastern Europe was full of estates managed with varying degrees of forced labor. While peasants in Prussia could sometimes sue in defense of their rights, the Junkers controlled the courts, and success would not come easily;[183] peasants in Mecklenburg, Poland, and Russia had even less recourse to justice. And while this still left the possibility of

[177] Quoted in Li Bozhong 1994b: 93.

[178] Menzies 1996: 634.

[179] Hanley and Yamamura 1977: 19–23, 131–46. The greater effectiveness of daimyo control in Region II seems to have been partly a matter of different administrators—Region I was largely ruled by the Tokugawa themselves, who tended to handle their domains more loosely than did many of the "outside" daimyo—and partly due to the lesser development of towns, trade, and opportunities for off-farm employment in Region II.

[180] Totman 1995: 104.

[181] Ibid., 102.

[182] Ibid., 105–7.

[183] Hagen 1985: 114; Hagen 1986a: 71–72.

running away, those who did so risked losing whatever few rights they did have,[184] as well as serious reprisals. Russian serfs who fled were often returned. Though estate owners could not stop flight, they seem to have coordinated their responses far more than the "owners" of labor obligations in India and Southeast Asia, with considerable deterrent effect. Polish peasants fled fairly successfully for a time, but this became increasingly difficult in the eighteenth century.[185] Though recent scholarship has made it clear that even eastern European lordship was "negotiated" rather than simply imposed, it nonetheless created very different dynamics than those in freer areas. These differences meant that population growth and import substitution were slower than in the Chinese interior. But as we shall soon see, they limited exports in other ways.

Landlords who relied heavily on compulsory labor were much slower to experience diminishing returns to export production than were owner-cultivators or employers of wage labor. At least in theory, an extra hour of a serf's time cost his lord nothing, so that even hard-to-reach timber need not have sold at sky-high prices. And cultivation with bound labor could expand under circumstances that would be perverse in a world of free labor (even low-wage free labor): output, for instance, sometimes expanded in response to falling prices in order to maintain the lord's income.[186]

In fact, labor was not simply extracted from a passive peasantry. As William Hagen has shown, at least in Prussia, the huge additions in compulsory labor extracted during the sixteenth-century grain boom were partially offset by decreases in the in-kind and cash payments required of peasants; thus this labor did have a significant cost to the estate holder. Moreover, peasants accepted these increases (grudgingly) in part because they stayed within bounds that still allowed the peasant enough time (and use of his horses) to cultivate his own plot; this suggests that earlier images of a peasantry crushed by these increased labor impositions may well be exaggerated. Indeed, peasants seem to have increased the cultivation of relatively labor-intensive garden crops on their own land. This was in part, no doubt, a necessary measure brought on by the shrinkage of those plots as population grew and lords used various advantages to gobble up additional farmland for themselves, but it also probably reflected the decrease of in-kind (grain) and cash payments, which meant that the peasant could get by with a smaller grain harvest.[187] If people worked more hours growing export crops for their lords and took a more labor-intensive approach to their own shrinking plots, it seems likely that total labor input was being increased—probably more than it would have had export demand

[184] Hagen 1985: 114; Hagen 1996: 308; Hagen forthcoming: 38–39.

[185] Blum 1961: 309–10, 552–54; Hagen 1996: 307; compare Reid 1988a: 129–30; Fukuzawa 1982b: 251; Habib 1982c: 248; Ludden 1985: 42–50, 80–84.

[186] Kochanowicz 1989: 100–102.

[187] Hagen 1985: 104, 107, 111; Hagen 1986b: 154; Hagen forthcoming: 38–39, 43.

pushed up peasant earnings per hour and allowed them to choose more leisure and/or more consumption. In this area, then, "negotiated lordship" may well have had an impact not too different from what we would expect from older models of a unilaterally imposed "serfdom." And in Mecklenburg, most of Poland, Lithuania, Russia, and many other places something close to the old image of serfdom may yet apply.

Meanwhile, the rather weak development of towns and of proto-industry in eastern Europe also prolonged export orientation and decreased the potential for the sort of import substitution that we saw in east Asian peripheries. Explanations for the stagnation and destruction of towns in late medieval and early modern eastern Europe vary. Some stress competition from other commercial and industrial centers, some the impact of numerous wars, some a backward agriculture that limited town size in the first place, some the conscious efforts of nobles to break the power of the bourgeoisie at any cost (and deny to peasants the possible refuge of cities), and some the grain boom itself, bringing with it a new division of labor between eastern and western Europe.[188]

Whatever the reasons, textile production went into at least relative decline in eastern Europe as early as the fifteenth century, and it declined in absolute terms while grain exports were rising.[189] There were some exceptions, where textile production grew rapidly: eighteenth-century Silesia and parts of Bohemia and Alpine Austria. But such growth usually occurred in the interstices of lordly power—i.e., in mountain districts where good land was scarce but where there was little compulsory labor.[190] On most of the great plains of eastern Europe, estates were more powerful, and rural industry lagged far behind that of western Europe.[191] In the Hungarian parts of the Habsburg Empire—which were not Baltic and not major *grain* exporters to the West until later but did export cattle, wine, and other land-intensive goods beginning in the "long sixteenth century"—over 80 percent of the labor force was in agriculture until the 1860s or 1870s.[192]

Moreover, neither the export boom nor proto-industrial development in this region had quite the same demographic impact as did prosperity in freer areas,

[188] See the historiographic summaries in Hagen 1988 and Hagen forthcoming.

[189] Pach 1990: 183, 186–88, 190; Kisch in Kriedte, Medick, and Schlumbohm (1981): 178–99.

[190] Kriedte, Medick, and Schlumbohm 1981: 14, 19. Good (1984: 22) makes the same point for Austria-Hungary, associating proto-industry with low soil fertility and an absence of estate agriculture.

[191] Gunst 1989: 64, 69. Bohemia did have both great estates and highly developed proto-industry, but the estates were unusual in at least two ways. First, the peasantry had unusually strong rights by eastern European standards. Second, because a strong mining sector had existed *before* most of the estates were formed—and had given rise to a relatively large town population and an unusually monetized economy—most of the surplus of the estates was targeted at local markets (and was mostly in the form of rye and hops for brewing, rather than food grains, anyway) rather than export to the West.

[192] Good 1984: 23.

where, via wage labor, they often led to earlier marriages and more children. Prussian lords responding to a renewed rise in grain prices after 1763 did eventually use more wage laborers, as attempts to further increase compulsory labor ran into increasing resistance and inefficiency: in doing so, they settled additional people on their land as independent cottagers, allowing more rapid formation of new families.[193] But so far as we know this was not a common pattern elsewhere east of the Elbe—indeed, compulsory labor generally increased in the eighteenth century, sometimes to six days a week—and even in Prussia it belongs primarily to the last half-century before emancipation.[194] Furthermore, even in this case, the preemancipation turn to wage labor was not a steady trend. On the contrary, as wage laborers grew more numerous, they also became more like the older labor force of encumbered peasants. In 1763, these day-laborers paid 9.5 *taler* (a silver coin, roughly equal to a week's cash wages for a rural day laborer) for their houses, gardens, and grazing rights; were paid in kind for threshing and in cash for various other tasks; and rendered only six days of unpaid labor per year. By 1808, their cash rent had been cut to 5 *taler*, but they each owed sixty-five days per year of unpaid labor (plus threshing, plowing, and other heavy work): about 40 percent of the obligation of a "full peasant" given a much more substantial piece of land.[195]

Proto-industrial development also was less likely to lead to easier marriage and more rapid demographic growth in eastern Europe than in western Europe. In one area studied intensively by Jürgen Schlumbohm, even the growth of a large linen industry in the eighteenth and nineteenth centuries provided relatively few opportunities to the landless. Instead, most of the labor for this industry came from "full-holding" farmers, who already had enough land to support a family, and their dependent cottagers. The large-holding patrons continued to control the right of these cottagers to form families, and they did not want too many of them. Population grew, but not at the booming pace that Schlumbohm, in his earlier writings, associated with proto-industrialization.[196] Looking at eastern Europe in general circa 1800, Werner Rosener estimates that 10–15 percent of the rural population were household servants on large estates who were generally unable to form families.[197] In Austria-Hungary it was not until 1781 that peasants could marry without lordly interference.[198]

This kind of regime also kept immigration to the east low, even when land was relatively uncrowded. There were colonization schemes—especially in Prussia, where perhaps as many as 300,000 colonists were brought in to drain and occupy wetlands, but also in parts of Galicia, Lithuania, and Russia. To secure these new tenants, rulers usually had to assure them of their personal freedom and grant them hereditary rights to their farms and various exemp-

[193] Hagen 1986a: 73–90. [194] Rosener 1994: 113. [195] Hagen 1986a: 88.
[196] Hagen 1997. [197] Rosener 1994: 154. [198] Good 1984: 34.

tions from the usual dues.[199] But these were exceptional arrangements and involved what had been waste land; the best land drew no migrants, since it was farmed under conditions few Westerners would have agreed to. Moreover, though the wave of (mostly German) emigration to eastern Europe, which dated back to the twelfth century, continued into the eighteenth century, it came to have less and less influence on local conditions. Earlier emigrants had brought both new farming techniques and ideas about the rights of cultivators, which influenced their Slavic neighbors in Prussia, Bohemia, and parts of Poland, but the eighteenth-century migrants to points further east (mostly Bukovina and Russia) had little impact: they were too few relative to the surrounding population and too isolated.[200] Thus, just when demographic trends in western Europe would lead us to expect more people (and with them ideas) to move east, the flow instead dwindled.

Thus the institutional forces slowing any trends toward population growth, proto-industrialization, and a turn away from exports were far stronger in eastern Europe than in Japan's peripheries, and far, far stronger than in the Chinese interior. The chance for western Europe to perpetually trade manufactures for primary products here was correspondingly enhanced. We get some sense of the trans-European differences in purchasing power, resources, and opportunity costs when we consider that Baltic timber reaching English dockyards cost about twenty times what it cost on the stump, without any further processing; the very limited and imprecise data I have for wood prices in Jiangnan and remote Chinese hinterlands suggests a ratio of more like ten to one.[201]

But this kind of trading partner posed different problems for western Europe. First, institutional rigidities limited eastern Europe's ability to increase output. Second, it was not much of a market for manufactures, which limited western Europe's ability to pay for its primary products. Consequently, bound labor helped stabilize a pattern of east-west exchange in Europe but also kept it on a fairly small scale, one that was increasingly inadequate to western Europe's appetite for land-intensive goods. Let us look first at the obstacles to increasing output and then at the problems resulting from eastern Europe's relatively limited demand for western European goods.

Forced labor tended to be unproductive, and neither lords nor peasants invested much in improvements. It is significant, that when the Junkers began to invest more heavily in capital for their farms, they also began to use more wage labor.[202] It is also worth remembering that the seigneurial systems of eastern Europe (like the much milder ones in much of western Europe) were not only

[199] Rosener 1994: 130–32.

[200] Gunst 1989: 63–64.

[201] Albion 1965: 103 versus Li Bozhong 1994b: 93. It should be emphasized, though, that some of the price reports Li quotes are vague, using terms such as "several *taels*" or "several tens of *taels*."

[202] Hagen 1986a: 86–92.

relationships between a lord and individual peasant households, but also between a lord and a village community. As such, they helped reproduce various kinds of common property—woodlands, common pasture, and open fields—on which, as we have seen, it was extremely difficult to make changes. By maintaining this "slack," eastern European institutions may have set aside an exportable grain surplus for the future; but in the shorter run these institutions made it very hard to mobilize this land for grain-growing, regardless of price incentives.[203]

In Germany, as we saw in chapter 2, the end of commonage made massive output increases possible, but only after Napoleon. In the Habsburg lands, where emancipation was slower, so was the decline of fallowing: from 33 percent of land circa 1750 it declined only as far as 25 percent by 1850.[204] The replacement of fallowing with new crop rotations was just beginning in mid-nineteenth-century Poland and Hungary. In fact, even the two-field system was not completely gone from these regions until the mid-nineteenth century, while in Russia, Romania, Bulgaria, and Serbia it persisted, well beyond the introduction of railroads linking farm areas to ports and the opening of the Bosporus to Russian ships in 1829. In parts of Russia, the two-field system lasted until after the emancipation of the serfs in the 1860s.[205] In general, the further East one got, the slower new techniques were to spread. Thus there were supply-side reasons for grain exports from preemancipation eastern Europe to stagnate at a level far below what was ecologically possible. As we shall now see, there were demand-side problems as well.

Eastern (and far northern) Europe did not buy very many western European manufactures. Most eastern European peasants bought almost no imports, being largely outside the cash economy; townspeople were few, and a relative handful of rich lords did not by themselves create a very large market. In Prussia, at least the "full-holding" peasants seem to have sold enough grain of their own to enable them to buy significant amounts of linen and other manufactured goods; but even in Prussia, such families were greatly outnumbered by poorer "half-holders," cottagers, and servants. In Poland, commoners who could buy much in the way of manufactured goods seem to have been rare indeed.[206] In most of Scandinavia, the farmers and foresters were free, but there just were not enough of them to buy very much; thus opportunities to buy from them were likewise limited.[207] While western Europeans did manage to sell both their own and extra-European luxury goods (Asian spices and silks, and later New World sugar) to the upper class, about one-third of their imports from eastern Europe had to be paid for with silver.[208] And even demand for

[203] Rosener 1994: 172–84.

[204] Good 1984: 70.

[205] Gunst 1989: 76–77.

[206] Hagen forthcoming.

[207] Blum (1961: 132–34) on limits of the money economy in Russia; Jeannin (1969: 94) on Scandinavia; Kindleberger (1990: 58–59) on Norway.

[208] Glamann 1977: 262–63.

silver could easily be glutted in an economy where monetization was limited (as in Russia), or where monetization was occurring, but in a small economy (as in Norway).

Similar demand-side problems dogged western Europe's trade with southeast Asia, though the distances involved would have limited any pre-steamship trade in bulky products anyway.[209] (And here, too, there was much land that later supplied exports going unexploited in the eighteenth century, as we saw in chapter 4.) The trade of China and Japan with southeast Asia presents a more complex picture, with various monetary media flowing in different directions (indicating that arbitrage, rather than the settlement of trade balances, was the principal motivating force)[210] and many Chinese goods being purchased for resale to points further west. Nonetheless, everyone selling to southeast Asia per se seems to have found only a fairly small market, so that a large cargo of any given commodity could easily glut the market in a particular port.[211] Meanwhile the primary products that left south and southeast Asia for China and Japan (Vietnamese and Thai sugar, Indonesian pepper, and so on) had much broader markets and faced no comparable "glut" problem. Indeed, a good deal more of some of these commodities probably could have been sold were it not for restrictions placed on the participants by authorities at both ends of these routes.[212]

Once again, India presents a complex and intermediate picture, on both the import and export sides. In its trade with China, India exported farm products primarily—cotton, indigo, and later opium—and reexported some of the silver it received from further west. From China it received gold and a variety of luxury fabrics (some but not all of which were then reexported). The gold in question certainly had monetary and quasi-monetary uses (jewelry, for instance, was often melted down when needed) but more as a store of value than as a medium of either state payments or (least of all) daily transactions; indeed, much of it probably circulated sufficiently slowly that demand for it could be seen as largely a hoarding rather than a transactions demand. In its trade with China, then, India looks almost like a larger southeast Asia or eastern Europe—which would fit with our earlier observations about how many Indians were still largely outside the cash economy and with an apparently very uneven distribution of income.

But India's eighteenth-century trade with other areas looks very different. Here the exports were much more varied, and by far the largest one—cloth—was a manufactured good. Though the British were beginning to show an interest in India's forests, this was still largely in the form of having ships built at Madras and Bombay. Timber exports still lay in the future, as did the cotton,

[209] Barrett 1990: 250–51.
[210] Von Glahn 1996: 132.
[211] Van Leur 1955: 67, 135–36, 162, 197–200.
[212] Cushman 1975: 105–6, 124, 200–211; Viraphol 1977: 107–21, 181–209.

indigo, and eventually wheat exports of the nineteenth century.[213] It is true, as Charles Kindleberger notes, that India bought few European-made goods in volume other than coins made of New World metals in the eighteenth century; but this often reflected either local competition or transport difficulties rather than an inert economy.[214] Moreover, the coins imported from Europe (and the cowries imported from Oceania) were widely used for ordinary transactions by ordinary people, not just as a store of value for the rich.[215] Various Indian states also imported large amounts of European-made arms and war horses from central Asia and Arabia;[216] these are not consumer goods, but they are further evidence that stereotypes of India as an economy of "hoarders" rather than "spenders" are seriously overdrawn. Thus, India does not seem to have posed the same "small-market problem" for its European trading partners that eastern Europe and Southeast Asia did, but the particular commodities traded did little to meet western Europe's need to trade manufactures for land-intensive products: that pattern of exchange would come later.

Finally, the parts of Africa that traded extensively with early modern Europe present a picture somewhat like that of southeast Asia, though in some ways even less promising as a source of primary products. Here, too, we find a relatively sparse population (though not in some parts of Senegambia) and a social structure in which bound labor played a major role. (Though, like southeast Asia's bound labor, bound Africans were generally freer than eastern European serfs.) Meanwhile, local industries were perfectly capable of meeting the vast majority of local needs, with imports largely confined to luxuries. John Thornton has argued persuasively that the iron that Europeans sold to Africa in the sixteenth and seventeenth centuries cannot have accounted for more than 10–15 percent of iron use, even in the importing coastal regions, while cloth imports cannot have been above 2 percent of those regions' cloth use: what imports there were were probably used mostly as exotica for elite display. Meanwhile, Africa also sold significant amounts of cloth to Europe.[217]

Moreover, since Africa (here unlike southeast Asia) also had large amounts of gold, there was relatively little besides luxury manufactures that Europeans could use to acquire goods here. And Africa's principal primary-product exports—pepper, gold, and ivory—did little to substitute for European land, anyway; it was not until much later that Europeans had the military power (and disease resistance) with which to force Africans to grow what Europe needed.[218]

[213] See Wadia (1955) on ships; Rangarajan (1994) on forests; McAlpin and Richards (1983) on cotton acreage and deforestation; Latham and Neal (1983: 271–73) on wheat.

[214] Kindleberger 1990: 68–69; for a list of European goods sold to India, see Chaudhuri 1978: 475–76.

[215] Perlin 1987: 248–314.

[216] Chaudhuri 1990: 278–83.

[217] Thornton 1992: 45–54.

[218] Ibid., 112–25; Crosby 1986: 136–42.

Eventually, of course, one African export did reach a huge scale: slaves. But the growth of the slave trade does not indicate that Europeans could unilaterally shape their trade with Africa, even though from a contemporary standpoint this traffic suggests a relationship of complete dominance. The external slave trade took advantage of the fact that the relevant societies not only allowed a kind of property in people, but did not have private property in land. Thus, ownership of people became a way of storing accumulated wealth,[219] and Europeans who bought slaves were allowing their owners to convert this stored wealth into inanimate (and thus more secure, if less productive) prestige goods: goods that Europe had to continually scramble to find enough of as the slave trade expanded.[220]

To summarize, then, we should avoid projecting back into earlier eras the twentieth-century pattern in which the terms of trade usually favor industrial exporters over raw materials exporters, making "agrarian" almost synonymous with "poor."[221] This pattern only became set once primary-product production itself began to require more manufactured inputs and once even poor people began to purchase many non-farm goods and/or farm goods produced with the aid of industrial inputs. Consequently, "underconsumption" emerges here as a very different phenomenon from the one often presented by scholars (mostly, though not exclusively, Marxists) working on the late nineteenth and twentieth centuries. In most such accounts, inadequate demand is seen as a problem of core areas, created when the huge leaps in productivity made possible by mechanization far exceeded the purchasing power of poorly paid workers; thus, some have argued, the need for additional markets motivated a new, peculiarly capitalist wave of *late* nineteenth-century imperialism. Here, however, underconsumption emerges as a problem created by social structure and demographic conditions in some preindustrial peripheries themselves (which is why *they* exported more than they imported) and is seen to have hampered the efforts of preindustrial cores (which were short of certain supplies, not of consumers) to obtain the land-intensive goods they needed.

For western Europe in particular, eastern Europe represented a peripheral trading partner that was *ecologically* capable of exporting vast quantities of grain, wood, and other land-intensive products. And thanks to institutional rigidities, that capacity was not being diverted to internal growth at the same

[219] Thornton 1992: 85–90.

[220] On the difficulties in procuring enough Indian cloth for this trade (which helped spur the English cotton boom), see Hobsbawm 1975: 57–58; Chaudhuri 1978: 273–75.

[221] One finds this assumption most fully elaborated in dependency and world systems analyses, which emphasize how infrequently countries that have become part of the world economy's periphery have been able to close the gap with the core. However, the same assumptions also underlay a variety of development projects and perspectives that emphasized the need to move resources out of agriculture and build an industrial base as quickly as possible, even when the latter theories, unlike the former, often praised in principle the effects of participation in global markets.

rate as in east Asian peripheries. But the same rigidities meant that eastern Europe's trade with western Europe peaked rather quickly and at levels that, as we have already seen, were minor compared with the long-distance flows of grain, timber, and fertilizer in China.[222] The relatively restrained cutting of abundant Baltic timber, despite strong demand, rising prices, and generally good water transport, is also striking. We lack the data to do a quantitative comparison with China's lumber trade, but Baltic lumbering seems to have been much more restrained than timber-cutting in, for instance, eighteenth-century New England and Canada, which had few other exports and imported most of their manufactures. It certainly pales next to nineteenth-century lumbering.[223]

World-systems theorists generally see these exchanges between "feudal" eastern and "capitalist" western Europe[224] as a transformative moment, from which a global division of labor unfolded. What we have seen here, however, is that those exchanges were not unusual in kind or in scale and that there were crucial built-in limits on their growth: limits that were also limits on western Europe's ability to expand its stock of food, fuel, fiber, and building supplies through these exchanges. Merely finding "less-advanced" trading partners did not solve any core's problems, at least not for long.

In the late nineteenth century, it may have become an advantage for western Europe that eastern Europe had not undergone massive population growth (either by natural increase or by immigration[225]) and import substitution at an earlier date, the way the Chinese interior and Japan's "Region II" had. This had the effect of leaving more of eastern Europe's land-intensive products available for export in an era in which the massive capitalization of production and productivity increases of the Industrial Revolution had made both the Habsburg lands and Russia places where one could sell everything from cloth to rolling stock. Thus here, too, Europe (if considered as a whole) may eventually have reaped certain "advantages of backwardness" that resulted from institu-

[222] See pp. 34–35, 226 above.

[223] Lower (1973: 22, 31–32) and McCusker and Menard (1985) on the late eighteenth-century Baltic, New England, and Canada; on nineteenth century, see Lower 1973: 59–134; Tucker and Richards 1983: xii–xvii.

[224] Wallerstein 1974: 71–89.

[225] In the case of immigration, we have another way in which the existence of multiple states maintaining multiple social systems mattered to Europe—but again by impeding short-term efficiency, not by pressing the race for it forward. Certain czars might occasionally lure Germans to their country by making special promises, but given the legal status of most Russian land and cultivators, even the Black Earth belt would not lure people from overcrowded Westphalia or East Anglia the way that Sichuan or the Jiangxi highlands lured Fujianese, or Manchuria the Shandongese. Instead, these people stayed where they were until the New World attracted them—at the cost of a *temporary* loss of freedom if they went in the seventeenth or eighteenth century, but for the much smaller and rapidly falling cost of a place in steerage if they went in the nineteenth or early twentieth century.

tional barriers to more intensive use of the land at an earlier date. But those advantages could not yet be reaped in the technological and institutional climate of the eighteenth or early nineteenth century. At that point, when emancipation and the parceling out of the commons were just starting to spread across central and eastern Europe, ordinary people in much of eastern Europe still bought very few manufactures, and expensive capital goods were still rare. Consequently, trade between eastern and western Europe circa 1800 remained where it had been since the mid-seventeenth century, which was far short of meeting the west's needs. Thus, in 1800, the ecological pressures described earlier in this chapter remained unresolved for western Europe, as they did for China and Japan. Those pressures could have either stopped growth altogether or forced it down a more labor-intensive, "east Asian" (or perhaps "Danish") path that involved no dramatic breakthrough. Eventually, the ecological "advantages of backwardness" discussed here made a major difference, but they took time to become available.

In the interim, the coal breakthrough provided one important form of ecological relief—but even that was not enough, given the variety of land-intensive products required. If western Europe was to undergo a large further increase in its industrial production and primary-product consumption beyond the levels of the mid-eighteenth century—even a total increase, much less a per capita one—it would need a new kind of trading partner. And that, as we shall see, was uniquely possible in the New World.

SIX

ABOLISHING THE LAND CONSTRAINT: THE AMERICAS AS A NEW KIND OF PERIPHERY

ONE CORE, western Europe, was able to escape the proto-industrial cul de sac and transfer handicraft workers into modern industries as the technology became available. It could do this, in large part, because the exploitation of the New World made it unnecessary to mobilize the huge numbers of additional workers who would have been needed to use Europe's own land in much more intensive and ecologically sustainable ways—if even that could have provided enough primary products to keep ahead of nineteenth-century population growth. The New World yielded both "real resources" and precious metals, which require separate treatment. Let us begin with real resources; they, in turn, begin with plantation products from the Caribbean, northeastern Brazil, and later the southern United States.

The New World's farm exports were largely slave grown. The plantations were almost all either on islands or near the coast. Consequently, exports from the circum-Caribbean plantation zone did not plateau the way that exports from the Chinese interior to Jiangnan and Lingnan did when free laborers ran into diminishing returns and switched more of their efforts to handicrafts; nor were they beset by the soaring transport costs that Old World foresters faced once they moved away from the riverbanks. And because the proprietors of New World plantations (unlike those of eastern European estates or southeast Asian pepper fields) purchased most of their labor force from abroad and often curtailed their subsistence production, western Europe's trade with this area also escaped the "small-market problem" that had dogged its trade for eastern European raw materials. Exports had to be high enough to cover the costs of buying slaves and much of the cost of feeding and clothing them.

There were many reasons why African slaves became the principal workforce in so many New World colonies. First and foremost are the astonishing death rates among New World peoples after contact, mostly from disease. Few of Europe's poor, as we have seen, could pay their own passage before 1800, and they were only worth transporting if one could force them to produce exports. With outright enslavement of Europeans unacceptable, this meant indentures that would end with freedom and a grant of land. As survival rates for Europeans (and Africans) in the New World began to improve, this

became too expensive for most plantation owners; they preferred to pay more money up front and get a slave who never had to be freed.[1] The surviving New World peoples were sometimes enslaved (especially in Brazil), but Africans were preferred for several reasons. New World peoples were seen as fragile because so many died upon contact with Europeans; and at least some Europeans opposed their enslavement on humanitarian grounds (but not that of Africans).[2] Amerindians also would have found it much easier to flee and to make common cause with unconquered native peoples nearby (though Africans sometimes did this, too). And since the conquest of native peoples slowed down considerably after the first half century (once smallpox had done its worst damage and various indigenous peoples had acquired guns and horses), acquiring indigenous slaves was not always easy.[3] By contrast, the large internal slave trade in Africa made it relatively easy for Europeans to acquire slaves there, as long as they had goods that the slaveholders wanted. Meanwhile, the Spanish and the Portuguese crowns preferred the transatlantic slave trade to New World slave-raiding, because the former was much easier to monitor and tax than local slave-raiding.[4] This was yet another way in which interstate competition and military fiscalism indirectly helped accelerate the repopulation of the New World from overseas and helped place the settlers in a context in which they (unlike, say, settlers on the Chinese frontier) would find it hard to switch away from a focus on export production. The slaves had no choice at all, and even their owners may have had little choice, since they (unlike a hypothetical group raiding locally for slaves) had to pay for their purchased workforce.

Slave imports to the British West Indies equaled roughly one-fourth of sugar export revenues between 1760 and 1810; imports from Britain itself covered about one-half, and food and wood from British North America (above and beyond the amounts swapped directly for sugar) covered the remaining quarter.[5] French Caribbean sugar exports were about 15 percent below those of Britain just before the French and Haitian Revolutions, and its slave imports were almost identical to those for the British Caribbean throughout the eighteenth century: so here slave imports should have covered roughly 30 percent of sugar revenue.[6] And in Brazil, the world's largest slave importer, the prices paid for imported slaves in 1821–26 (the first set of several consecutive years for which I found figures) equaled the country's total export

[1] Galenson 1989: 52, 76; Morgan 1975: 215–16, 296–99.

[2] Thornton 1992: 135–36.

[3] Ibid., 138–41.

[4] Ibid., 136–37.

[5] Calculations based on slave prices from Miller 1986: 70; British import data based on Mitchell 1988: 462–64 and Deerr 1949–50: 1: See also appendix D.

[6] For export volumes, see Deerr on the British Caribbean (1949–50: I: 193–203) and the French Caribbean (I: 235–42); for slave imports, see Curtin 1969: 216.

revenues for those years.[7] Since the 1820s saw an unusually high volume of high-priced slave imports, this is no doubt atypical: the late eighteenth-century average was probably closer to one-fourth the value of all exports, much as in the British and French West Indies.[8] Thus, the slave trade helped make Euro-American trade fundamentally different and more expandable than the more direct exchanges of raw materials for manufactured goods and silver between Old World cores and peripheries.

Furthermore, though nearly all bound cash-crop producers in the Old World also grew what was needed for their subsistence, many New World slaves had little or no opportunity for subsistence farming. And since for a long time plantation owners purchased very few women slaves (and manumitted more of them than they did men), many slaves also lacked families, who helped supply the subsistence needs of compulsory cash-crop workers in many Old World settings.[9] Thus, despite their poverty, the everyday needs of slaves created a significant market for imports; in this, slaves were unlike most of the unfree populations in Old World peripheries. These goods (above all cheap cotton cloth for slaves to wear) were a large part of the manufactured imports that took up almost 50 percent of sugar export proceeds in the British Caribbean. Some of these goods were always made in Europe; others came at first from India via Europe but were later replaced by British imitations.

Grain and wood from British North America (above and beyond an unknown amount obtained in direct barter for sugar) took up the remaining one-quarter of Caribbean sugar revenue. And since this trade enabled the mainland to pay for its own imports of British manufactures,[10] it represented an indirect route through which Britain turned still more of its relatively abundant capital and labor into land-saving imports. Slave plantations in Brazil and British North America acquired more of their supplies locally than those in the Caribbean, and Brazilian plantations in particular also economized by providing exceptionally skimpy food and clothing to their slaves;[11] thus they purchased less from abroad, but these needs were still non-trivial.[12] Moreover, the Brazilian strategies that limited supply purchases—from skimpy diets to unbalanced sex ratios—increased the need to replenish the supply of slaves themselves with fresh purchases from Africa.

[7] Figures for 1821–26 from Miller (1986: 70) and Ludwig (1985: 107, 314), using a rough price of 250,000 *reis* per slave (toward the low end of Miller's range); calculation methods the same as for West Indies.

[8] For slave purchases and prices, see Miller 1986: 70; Ludwig 1985: 107, 314; Curtin 1969: 216. Brazilian export figures for 1796 and 1806 from Morineau 1985: 177–78.

[9] See, e.g., Schwartz (1985: 354–58, 385) on sex ratios and marriage rates in Brazil.

[10] See Shepherd and Walton 1972: 43–44; Richardson 1987: 765–66.

[11] See, e.g., Schwartz (1985: 136–38, 296, 436, 441–42) on Brazil.

[12] See, e.g., Subrahmanyam (1993: 182–85 on the cheapest cloth being shipped to Brazil for slave clothing.

Thus, slavery helped make Euro-American trade unlike any between Old World cores and peripheries. A free-labor periphery like southwest China would not have served Europe as well, even if it had been just as ecologically bountiful; nor would a periphery like eastern Europe (or later Java) in which participants in a still-functioning subsistence-oriented economy were forced into part-time export production. Silver exports from Potosi, which fell as the native population recovered and a more self-sufficient regional economy reemerged,[13] remind us that European demand alone did not ensure a continued flow of a commodity to Europe without either massive force or the *reproduction* of local needs for European goods. We will return to silver shortly. What needs emphasizing here is that it was not only ecology that made so much sugar, tobacco, and later cotton flow from the circum-Caribbean region: the region was also sociologically and politically set up to "need" almost everything else. Indeed, one of Britain's advantages was that unlike France, Holland, or Denmark, it did not need to ship *food* from Europe to its sugar colonies but could rely on continental North America to do so, which in turn bought English manufactures (employing labor and capital rather than land).

Thus, a combination of depopulation and repopulation with slaves made the circum-Caribbean region a perversely large market for imports and a source of land-intensive exports. In fact, it became the first periphery to assume a now familiar "Third World" profile: that of a large importer of both capital goods (in this case, walking, talking, kidnaped ones) and manufactured goods for daily use, with exports that kept falling in price as production became more efficient, capital intensive, and widespread. By contrast, the prices of most forms of energy produced in Europe, including food, rose throughout the eighteenth century, relative to both wages and other goods.[14] Thus the plantation areas of the New World were a new kind of periphery: one that would import enough to keep its trade with the core fairly balanced. Moreover, its imports and exports stimulated each other: more sugar exports consistently led to more slave imports, more food and clothing imports, and (often) more plantation debt, which led to selling more sugar next year, at whatever price.[15]

Meanwhile, concentration on one or two exports in most plantation areas greatly facilitated a crucial improvement in trade itself. Transatlantic shipping costs fell roughly 50 percent during the eighteenth century, even without substantial technological change. Part of the decline was due to political change:

[13] Lang 1975: 61, 65–66. See also Stern (1988) for a more general discussion of the reemergence of economies with a significant degree of internal coherence and autonomy in the Spanish-ruled New World.

[14] See, for instance, the chart in Goldstone 1991: 186; also Thomas 1985a: 140–41.

[15] Richardson (1987: 745–46) shows a direct relationship between the exports of sugar from the British West Indies in any given year and the area's demand for slaves in the following year, which in turn produced more sugar.

the British Navy repressed most piracy, which reduced insurance rates and allowed more freight to travel on unarmed ships with smaller crews.[16] However, the other major component (briefly discussed in chapter 4) was a sharp decline in the time spent acquiring cargo. This meant a faster turnover of working capital, more intensive use of ships, and large savings in sailors' wages (who had to be paid for every day away from home, even if they were waiting in port while a cargo was purchased). This reduction in port time was achieved by having a local agent collect the desired goods in a warehouse before the ship arrived, rather than having the ship visit many plantations and spend time haggling. Such delegation of responsibility was much easier when each area only sold one or two exports, rather than the numerous possibilities in, say, an Indian Ocean port.[17]

Thus, while seeking more primary products from many Old World peripheries meant exhausting the most accessible sources, facing higher transport costs, and working against the logic of import substitution, an opposite dynamic was at work in much of the New World. With political and sociological factors working against import substitution, export monocultures brought down transatlantic transport and transaction costs. This in turn allowed Americans to incur higher local transport costs—i.e., expand further inland—and still sell enough in Europe to pay for manufactures and repay start-up costs. This dynamic operated whether the labor in question was slave, indentured, or free but in need of start-up money, and it played a crucial role in populating North America.[18] It also helped the transatlantic exchange of manufactured goods (and kidnaped "capital goods") keep expanding, unlike the Baltic trade or the trade from the Chinese interior.

In other words, a demographic catastrophe, colonial legislation, and slavery combined to create a periphery that was an ever-expanding source of raw materials in an era before most production required expensive capital goods and when most people still had some connection to subsistence production. Indeed, this situation proved temporary even in much of the New World; as population levels recovered in Peru and Mexico, more self-sufficient economies reemerged and exports fell.[19] Without the peculiar conditions created in the circum-Caribbean region, the mere existence of trade between a rich, free labor core and a poorer, bound labor periphery would not have had such epochal effects; western Europe's trade with eastern Europe, for instance, was in no way more important or dynamic than that between the Lower Yangzi and its various free labor peripheries. The form of labor control on the periphery was indeed crucial, as world-systems theorists insist, but we oversimplify

[16] Shepherd and Walton 1972: 81–84.

[17] Ibid., 52–53, 87. On the enormous diversity of cargo carried on any given merchant ship in the Indian Ocean, see Van Leur 1955: 132, 253; Chaudhuri 1978: 204–8.

[18] Shepherd and Walton 1972; especially McCusker and Menard 1985: 18, 23, 28–30.

[19] Lang 1975: 61, 65–66.

greatly if we lump together all kinds of "coerced cash-crop producers." New World slavery and colonialism were different in very important ways.

Earlier arguments about the importance of slavery in European (especially British) industrial growth have often focused on export markets as a stimulus for burgeoning industries; they have thus been vulnerable to the "internalist" argument that domestic markets were growing, too, and off a much larger base. Such debates may be inherently inconclusive—if Caribbean demand accounted for 12 percent of the growth of British industrial output between 1748 and 1776,[20] is the proverbial glass half full or half empty? By contrast, the argument here emphasizes that some markets mattered more than others. For the New World and the slave trade offered what an expanding home market could not have: ways in which manufactured goods created without much use of British land could be turned into ever-increasing amounts of land-intensive food and fiber (and later timber) at reasonable (and even falling) prices.

Another New World, Another Windfall: Precious Metals

Meanwhile, Mexico, Peru, and later Brazil sent Europe vast amounts of precious metals. Some of this was the direct result of colonial extraction, such as the Spanish and Portuguese kings' cut of all mining in their domains. Legally, this share was at least 27.5 percent—and perhaps as much as 40 percent—of all shipments prior to 1640.[21] Since these rates quickly led to widespread smuggling, the crown's actual share of output was never that high, and the legal rates were gradually lowered to try to reduce contraband; even so, the crown probably received one-tenth to one-fifth of registered output.[22]

A substantial further portion of the flow was only slightly less directly based on coercion. Forced labor quotas lowered the costs of mining, whether indigenous people actually did the labor themselves or bought their way out of it, subsidizing the wages of others.[23] While the direct beneficiaries of these quotas were mining entrepreneurs resident in the New World, they clearly increased the output possible at any given price; and since many people—from big and medium-sized mine operators to "sharecropping" miners themselves—had gold and silver to sell,[24] they could not keep from passing along these savings to European buyers. Meanwhile, colonial legislation greatly reduced competition among those bringing European and Asian goods to exchange for precious metals—and at least attempted to restrict production of local alternatives to these imports. Thus both the scale of this trade and the prices at which it

[20] Richardson 1987: 768.
[21] Hamilton 1934; Flynn and Giraldez 1996: 321–29.
[22] Morineau 1985: 102, 121, 289.
[23] Stern 1988: 849–52; Tandeter 1993: 15–85.
[24] Stern 1988: 852–54.

occurred were distorted, making some unknown further portion of gold and silver exports a "gift" to Europe.

Some of this "gift" stayed in western Europe. Those metals probably did little for Europe's economic development, since they financed numerous wars, including Spain's nearly successful assaults on the emerging core economies of northwest Europe.[25] Nonetheless, the metals may have helped grease the wheels of European trade, and they certainly played a role in the growth of more effective militaries. Meanwhile, much New World treasure went further east, bringing other commodities to Europe. It can be roughly divided into three separate streams.

One substantial stream of New World gold and silver exports went to various ecologically rich small market zones in the Old World—from Southeast Asia to parts of the Near East to eastern Europe—making it possible for Europe to expand its imports of real resources from these peripheries. In these cases, silver or (less often) gold were used like modern currency reserves: they were a residual store of value transferred to cover an otherwise unbalanced trade with areas that had limited demand for the goods Europe sold. But one could also see these metals, which were usually coined before transshipment from Europe, as the one European manufactured good for which these zones had fairly large markets and (lacking the proper raw materials) limited local production.[26] In economies that were monetizing rapidly (e.g., much of Scandinavia), this manufactured good was at least partially an item of popular use; in the least marketized peripheries, such as eastern Europe, it was essentially a luxury good. Either way, it made it possible to obtain more primary products from these areas than would have been possible otherwise.

But, since precious metals do not wear out or get used up (unlike cloth, or grain), it was hard to create an *expanding* (or perhaps even enduring) market for them if only a tiny part of the society used them. True, wealthy people could add to their silver or jewelry hoards; but at some point they had enough for all conceivable obligations, and silver as a form of conspicuous consumption must have begun to lose value relative to silk, porcelain, paintings, and so on. Thus, New World silver helped western Europe obtain more raw materials than they could have had the fifteenth-century "bullion famine" continued,[27] but could not by itself indefinitely expand western Europe's trade with less-monetized Old World economies.

The second stream also helped Europe obtain land-intensive goods, but less directly. This flow was exchanged for various Asian (mostly Indian) manufac-

[25] Flynn 1984: 43.

[26] Perlin (1994: 113–18, 147–74) emphasizes the point that coins in this period are often more usefully thought of as a manufactured good than as "money" that stands opposed to "goods." Perlin (1991: 239–373, esp. 248–49, 268–80) examines the production of coins as goods often designed for remote target markets.

[27] Day 1978: 3–54.

tured products, which then covered much of the cost of procuring slaves for the Americas. Indian cloth alone made up roughly one-third of all the cargo by value exchanged by English traders for African slaves in the eighteenth century and may have made up over half of the goods that French traders (whose industries were slower to produce good imitations of Indian fabrics) used to acquire slaves.[28] Much Portuguese imperial trade went directly from Asia to Africa to Brazil, stopping in the mother country only to deliver New World goods.[29] In other words, this portion of the metals flow facilitated the process we have already described, in which New World slave areas became an important complement to labor and capital rich, land-poor Europe.

In India, as we have seen, there is a strong case for seeing much of the flow of gold and silver coins as meeting a broadly based transactions demand, rather than as a store of wealth that covered a "trade deficit." But despite impressive evidence of ongoing monetization in India, it does not necessarily follow that in the absence of New World metals, India would simply have imported more of other Euro-American goods. Much of the population still only entered the market to obtain a few necessities, meet occasional ceremonial expenses (e.g., for weddings), and raise cash to pay taxes and other dues; and to the extent that they did purchase other goods, it is not clear that European manufactures would have been competitive. And the greater prestige of Chinese fabrics and ceramics, Southeast Asian delicacies, and specifically Islamic goods from the Middle East meant that European luxury goods would not have found a large market either. So even if we treat precious metals flowing to India as just another product, they were probably special in another sense: they were about the only European good that one could imagine India buying on such a huge scale. (The one possible alternative that comes to mind is arms; it is unclear what effect a large further increase in this already substantial trade might have had in the period spanning Mogul decline and British ascendancy.)

Finally, the third stream of metals was for decades the largest of all; but this flow of silver probably did the least to ease pressures on Europe's land. It went to densely populated, heavily commercialized parts of Asia, where it was used as a medium for transactions involving every class in society; and in return, various consumer goods flowed to Europe and to the Americas themselves. This description, as we have seen, may fit some of the Indian trade, but it refers above all to the enormous flow of silver to China, where millions of ordinary people used silver to pay their taxes and for many ordinary purchases.

Here silver was clearly a good, not residual wealth used to settle unbalanced accounts. Indeed, while silver flowed into China between 1500 and 1640, gold and copper left China, often ending up in Europe.[30] And though silk, the most

[28] H. Klein 1990: 291.

[29] Subrahmanyam 1993: 183–85.

[30] Flynn and Giraldez 1997: xxvii; Von Glahn 1996: 129–33, 224–29.

important "real good" among China's exports, was a fabric rather than a metal, it, too, was used as money in some places. Thus, New World silver in this trade was just one of many goods being arbitraged: items that were more plentiful in China than elsewhere (gold, porcelain, silk) were exchanged for silver, which was comparatively scarce in China[31] but in very high demand as it became the monetary and fiscal base of the world's largest economy.[32] By about 1640, this trade had brought silver to gold ratios in China and Europe into rough equilibrium; thus, having lost its raison d'être, this trade went into a sharp decline, recovering only in the eighteenth century.[33] In its first incarnation, the trade did little to supply land-intensive commodities to Europe. It had, however, been enormously profitable and yielded goods that (unlike more and more silver) could be used to make exchanges elsewhere.

In China, as in India, it may be difficult to imagine another good that would have been imported on such a massive scale had silver not been available. Thus in this case, too, New World mines were important to Europe's capacity to obtain goods in the rest of the Old World. But the Chinese case differs from the Indian one, from the importer's side, in that it is far harder to see much of the silver it imported as nonessential; thus, in the absence of that flow, we must imagine either other imports of monetary media or a large reallocation of China's own productive resources, perhaps in turn expanding demand for other imports. From the European side, meanwhile, the difference between this flow of metals and that which went to India is that this one did relatively little, even indirectly, to ease pressure on the land.

These distinctions among various uses of New World treasure are post hoc and highly imperfect, and the association of different uses with different final destinations for the metals must be seen as tendencies, not absolute rules. Even in eastern Europe—perhaps the periphery in which the general population was the least involved in the cash economy—not all imported metals represent abstract "wealth" hoarded by the elite in a stagnant economy. At the other end of the scale, there was surely some hoarding of silver even in China. What we need to recognize is that some of this behavior went on everywhere; there are no grounds for the sharp distinction some scholars have seen between western "spenders" and Asian "hoarders."[34] Moreover, the line between hoarding and transactions demand was itself vague in a world in which ordinary people did not have savings accounts, and in which jewelry and other items of display were often a crucial part of securing the marriages that reproduced productive units.

[31] For data on gold/silver ratios in different places, see Von Glahn 1996: 127.

[32] Flynn and Giraldez 1997: xix.

[33] Von Glahn 1996: 128, 232.

[34] For a recent restatement of this alleged difference and its enduring importance, see Kindleberger 1990.

But despite the approximate and fluid nature of these categories, they do show us something: New World metals were not simply "money" that Europeans turned into "real" resources by distributing them around the Old World, with European needs always driving the story. The internal dynamics of other regions could create "needs" no less real than those of Europe, such as China's need for a more usable currency, or the desire of eastern European elites to turn their grain surpluses into something easily stored and shipped and thus usable for provisioning their troops on campaign.[35] It was the *intersection* of European and other regional dynamics that determined the extent and nature of these metals' flows: the world economy remained polycentric, and forces emanating from elsewhere could shape it just as much as those emanating from Europe.

Indeed, as we saw in chapter 4, had China in particular not had such a dynamic economy that changing its metallic base could absorb the staggering quantities of silver mined in the New World over three centuries, those mines might have become unprofitable within a few decades. The massive inflation of silver-denominated prices in Europe from 1500 to 1640 indicates a shrinking value for the metal there even with Asia draining off much of the supply,[36] and the less-monetized parts of the Old World would not have indefinitely kept absorbing precious metals without also devaluing them. This is one more way in which early modern silver and gold were not quite like contemporary "money": today those who have hard currency to spend will never have trouble obtaining more resources, since contemporary peripheries have staggeringly large needs for capital.

Nonetheless, the transshipment of New World metals did allow western Europe to expand its imports of real resources far beyond what it could have obtained otherwise. Some New World silver may have had to have been converted to cloth, porcelain, or spices to keep expanding the flow of resources from some of the less-monetized Old World peripheries; but thanks to Chinese demand, this option was available, too. And as we have already noted, the combination of New World metals themselves, transshipped Asian goods that had often been obtained with silver, and exotica from the New World itself (such as sugar and tobacco) paid for more of western Europe's imports from the rest of the Old World than did manufactures created wholly within Europe.

Thus the distinction that some authors make between bullion extracted through coercion and a far more important flow of real resources obtained through consensual trade seems artificial.[37] Not only were the land and labor that produced New World resource exports very much the fruits of extramarket coercion, but it took the unique arrangements of Caribbean plantations

[35] Blum 1961: 201–4.

[36] Hamilton 1934; Flynn and Giraldez 1996: 323–29.

[37] See, e.g., Jones 1981: 83–84.

and of mercantilist policies throughout the New World to escape all the forces that caused core-periphery exchange within the Old World to plateau. Without these features, and without silver that helped pay for colonial administration and provided for Asian goods to be transshipped to Africa and the Americas, it is hard to see how the "ecological windfall" could have found its way to Europe in such quantities; nor is it clear how Europe could have obtained as much ecological relief from the rest of the Old World as it did.

Some Measurements of Ecological Relief: Britain in the Age of the Industrial Revolution

The quantities involved were vast,[38] but to discuss them usefully they must be broken down a bit. For argument's sake, let us eliminate goods that could have been obtained from Old World peripheries without major institutional changes (e.g., furs, which Russia presumably could have exported in larger amounts) and gains from Old World adoptions of New World plants such as the potato (without which neither Ireland nor Prussia could have exported grain to England). The New World's huge fisheries, for which North American landfalls were convenient but not essential, are also best left out. These belong to the New World windfall in some loose sense, but if we cast our net too widely, we are simply counting traffic across the Atlantic rather than showing that these exchanges (much less any particular mechanism behind them) were essential. So for the eighteenth and early nineteenth centuries, the discussion will focus almost exclusively on sugar and cotton, with some reflections on the larger torrent of primary products that came from the Americas in the mid- and late nineteenth centuries.

Mintz estimates that sugar made up roughly 2 percent of Britain's caloric intake by 1800, and a stunning 14 percent by 1900.[39] In fact, the real figures would appear to be even higher. Using the same estimates of per capita sugar consumption as Mintz does, and the same conversion into calories, the per-person, per-day consumption of sugar for the United Kingdom (including Ireland) comes to over 90 calories in 1800. If the average Briton consumed 2,500 calories per day in 1800 (a generous estimate),[40] then 90 calories is almost 4 percent of total intake even at that early date; the average 1901 sugar intake

[38] For methods of calculation throughout this section, see appendix D.

[39] Mintz 1985: 133.

[40] Clark, Huberman, and Lindert (1995: 223) assemble various surveys of per capita consumption in workers' households and come up with estimates as low as 1,500 calories *per adult male equivalent* (for a sample of the rural poor in 1787–96) and as high as 2,400 (for urban workers in 1863 and 1889–90), plus one estimate of 3,200 for rural workers in the 1860s; but even the latter figure would translate into less than 2,500 calories per person.

would have yielded over 18 percent of total calories if people really averaged 2,500 calories per day, and over 22 percent if they averaged a more likely 2,000. And although today sugar is often derided as a source of "junk" calories, it can be valuable in poorer diets, preventing scarce protein from being burned for energy.[41]

The 4 percent figure for 1800 may seem modest, but it is worth recalling that an acre of tropical sugar land yields as many calories as more than 4 acres of potatoes (which most eighteenth-century Europeans scorned[42]), or 9–12 acres of wheat.[43] The calories from the sugar consumed in the United Kingdom circa 1800 (using figures from Mintz[44]) would have required at least 1,300,000 acres of average-yielding English farms and conceivably over 1,900,000; in 1831, 1,900,000 to 2,600,000 acres would have been needed. And since the land that remained uncultivated in Europe (and especially in Britain) by this time was hardly the continent's best, we could plausibly make these numbers still larger.

Dried meat, plus ships, wood-based naval stores, and small amounts of timber and grain spared some land in the late eighteenth century and a good deal in the early nineteenth century. North American timber exports to Britain, for instance, were trivial before 1800 (though exports to southern Europe were not); but by 1825, they were large enough to replace the output of over 1,000,000 acres of European forest and soared thereafter.[45] Some savings also came indirectly, as New World silver and reexports paid for much of Britain's Baltic timber imports (which replaced the output of about 650,000 acres per year in the 1780s and 1790s). Given that the total arable land of Britain was roughly 17,000,000 acres,[46] the 3,000,000–4,000,000 New World "ghost acres" found so far are a non-trivial addition to Britain's land base, even without cotton—and before the much, much larger boom in American imports in the mid-nineteenth century.

By 1815, Britain imported over 100,000,000 pounds of New World cotton; by 1830, 263,000,000 pounds.[47] If one replaced this fiber with an equivalent weight of hemp or flax, the extra acreage needed would be comparatively

[41] Daniels 1996: 277.

[42] Braudel 1981: 170; Salaman 1949: 479–84.

[43] Mintz 1985: 191.

[44] Mintz refers here to "Britain," but since his figures match those both Deerr and Mitchell provide for the U.K., he probably meant the U.K. as well; for his purposes, it would make little difference. And since, as we have seen, England from 1770 on drew heavily on food supplies from Wales, Scotland, and Ireland—supplies that would have been reduced had those places not had some other way to meet minimum caloric needs—the U.K. figures are what we need to use for estimating the Caribbean contribution to feeding industrializing England.

[45] For methods of calculation, see appendix D; export figures from Lower 1973: 259.

[46] Mitchell 1988: 186. The figure is actually for a later date (1867), but it is the earliest one available and seems to have been fairly stable at that point.

[47] Mann 1860: 112.

modest: 200,000 acres in 1815, 500,000 in 1830. But hemp and flax—especially hemp—were both considered inferior fibers for most purposes, were much more difficult to work with, and processes for spinning them mechanically emerged later than that for cotton.[48] More important, both hemp and flax were extremely labor-intensive and manure-intensive crops: so much so that most people only grew them as garden crops. Even three centuries of government schemes and subsidies had failed to promote larger-scale production in either England or North America.[49]

This leaves wool, long Europe's main clothing fiber. But raising enough sheep to replace the yarn made with Britain's New World cotton imports by would have required staggering quantities of land: almost 9,000,000 acres in 1815, using ratios from model farms, and over 23,000,000 acres in 1830. This final figure surpasses Britain's total crop and pasture land combined. It also surpasses Anthony Wrigley's estimate that matching the annual energy output of Britain's coal industry circa 1815 would have required that the country magically receive 15,000,000 additional acres of forest.[50] If we add cotton, sugar, and timber circa 1830, we have somewhere between 25,000,000 and 30,000,000 ghost acres, exceeding even the contribution of coal by a healthy margin.

Extracontinental imports also reduced per capita food needs by changing habits, as discussed in chapter 5; this might increase our land-savings calculation significantly, but it is probably uncountable. Cheaper home heating was, of course, largely attributed to the surge in coal output. But having far more people work indoors—rather than following the "Jiangnan" or even the "Danish" route to ecological survival—was crucially dependent on *both* cheap coal-based energy and overseas supplies of cotton, grain, and other land-intensive imports; and indoor laborers appear to have consumed about one-third fewer calories per capita than outdoor ones.[51] The unprecedented amounts of cheap cloth that helped preserve warmth and further reduced caloric needs was unimaginable without American cotton. And insofar as caloric needs were also reduced by the appetite-suppressing qualities of tea and sugar, this was another hidden savings achieved in part through coercion abroad. Most sugar came from New World plantations, while tea was paid for first with New World silver and then with Indian opium. These factors together would

[48] Mokyr 1990: 103.

[49] See Warden (1967: 32–40) on England and its colonies.

[50] Wrigley 1988: 54–55. Wrigley actually makes "the death of George III (1820)" his cut-off date, but according to the coal production statistics in Mitchell (1988: 247) it would be 1815 when production actually reached the requisite 15,000,000 tons. More important, Wrigley's estimate that an acre of woodland produced two tons of dry wood a year is, as he notes, probably generous, and biases his estimate of coal's impact downward. Were he to use the contemporary global mean as Smil does (1983: 36) and as I have elsewhere, his estimate of the impact of coal would rise to slightly over 21,000,000 "ghost acres."

[51] Clark, Huberman, and Lindert 1995: 223 vs. 226.

add significantly to the "ghost acreage" even in the early nineteenth century and enormously in the middle and later years of the century.

Of course, the southern United States is not the only place where cotton will grow; but without that area, the early growth of Manchester would have faced very serious impediments. Some sense of how much more difficult it would have been to sustain a boom in cotton textiles without this area's particular ecological and institutional heritage can be gained by looking at the so-called cotton famine that occurred later, during the American Civil War.

Though American cotton exports were cut off only between 1862 and the middle of 1865 (during 1861 the North did not yet have an effective blockade), Britain had begun by 1850 to make considerable efforts to increase cotton supply. These efforts were almost certainly far greater than Britain would have made to find cotton supplies in an imaginary world in which U.S. exports were not available in the first place. British power was far greater at this point than it had been at the beginning of the century, and the shipping and other relevant technologies available to it were far superior. Perhaps more important, the existence of numerous mills, huge numbers of workers, and existing customers expecting products created far greater incentives to avoid a diminution of cotton supply than the imagined possibility of building such an industry could ever have created for overcoming an initial lack of cotton. Yet in spite of these efforts, "the supply of raw material . . . prov[ed] obstinately inelastic."[52]

The major focus of British efforts was India. The Indian government was pursuing a "cotton-oriented policy of annexation and railway construction" during the 1850s but with little to show for it for the first decade. A big jump did occur in 1861—much of it at the expense of domestic consumption and shipments to China rather than by expanding output—but Indian shipments were still less than half of U.S. shipments to Britain in 1861. Moreover, exports rose only 8.6 percent further after this, even though this was when the Union blockade became effective and cotton prices soared.[53]

The other relative success—with far less outside effort—came in Egypt. This was possible because the Egyptian government itself had been committed to expanding cotton output since the days of Mohammed Ali: once the mills he had ordered built proved uncompetitive, the cotton crop was available for export. Exports began in 1821, passed 27,000,000 pounds in 1824, and almost 50,000,000 pounds by the 1850s;[54] but this was less than half of what U.S. exports had been as far back as 1815. At its peak, Egyptian exports approached 200,000,000 pounds (still well short of those of the United States in 1830) before falling back very sharply.[55] These short-lived achievements came after forty years of intense pressure from above—indeed until the Civil War, Egyp-

[52] Farnie 1979: 136.

[53] Ibid., 137, 142, 145–46, 151.

[54] Issawi 1966: 362, 416–17, measurement conversion from 518.

[55] Ibid., 417.

tian cotton cultivation did not spread much beyond the estates of Mohammad Ali and his relatives—engineered by a regime that had been inspired by the example of Lancashire's success. Despite this long preparatory period, they did not represent a sustainable level of production, much less one capable of further expansion. Nor did they provide the cotton at a price Lancashire could have lived with for very long.

During the U.S. Civil War, about 40 percent of the Nile Delta was growing cotton in any given season; given the rotations being used, it appears that cotton was grown in every delta field at some point between 1863 and 1865.[56] Given the limited amount of well-watered land in Egypt, this probably represented an absolute maximum of possible cultivation without the kind of irrigation made possible by twentieth-century mega-projects. Even on this land, costs of cultivation quickly rose to levels that were profitable only at the absolute peak of prices in 1864;[57] and at those prices (in fact, even at the lower ones of 1862), raw cotton was actually more expensive than coarse yarn.[58]

Britain's less-focused efforts to stimulate exports from other promising-sounding sources—Brazil, west Africa, Queensland, and Burma—produced almost nothing,[59] even though prices soared. British cotton consumption fell 55 percent between 1861 and 1862, while prices (already up in 1861 because of the war) doubled. In relative terms, cotton had cost about one-third the price of wool in 1860, but cost more by 1864.[60] Prices would no doubt have gone higher still were it not that when the Civil War began, there was both a fairly large supply of stockpiled raw cotton and a huge glut of finished cotton goods in warehouses (thus depressing demand for more spinning and weaving).[61] Employment in Lancashire mills fell by roughly half in 1862, and the remaining operatives were working two and a third days a week by November (versus six days in 1860–61);[62] large numbers of firms (especially smaller ones, who more closely resembled the early mills in terms of cash reserves, equipment, and other resources) went bankrupt.

True, even this inadequate supply of raw cotton was well above what the United States had supplied in the early nineteenth century; but, as we have seen, it also resulted from efforts that would have been inconceivable at that time. And without twentieth-century farming tools, a substitute for the later and greater bonanza of food crops from the "neo-Europes" is considerably less likely still; there simply was no place in the Old World with anything like the same combination of ecologies that were better for European food plants than Europe itself, relatively sparse population and favorable institutional structures.[63]

[56] Owen 1966: 424.
[57] Ibid.
[58] Farnie 1979: 145.
[59] Ibid., 150.
[60] Ibid., 147, 162.
[61] Ibid., 138–39, 144–45.
[62] Ibid., 145–46.
[63] See, generally, Crosby 1986.

Comparisons and Calculations: What Do the Numbers Mean?

One might object to these calculations in ways that parallel a common response (discussed in chapter 4) to arguments about overseas extraction and European capital accumulation: how can we call something decisive if other factor(s)—capital accumulation within Europe, domestic supplies of food, or whatever—were larger? The question is important, both for this particular case and for conceptualizing historical processes more generally.

If we are largely concerned with growth accounting for a single case, smaller factors are minor factors. But even here, problems of categorization arise. "New World farm goods imported to Britain" as an inclusive category may look small next to a parallel category of "domestic (British) farm production," and "imports from the rest of Europe," but if we break these categories down further ("food imports from Germany," "timber imports from Scandinavia," etc.) we find that some New World subcategories, such as "fiber imports from the United States," would be among the largest items on this longer list of elements. And how narrow we make our categories depends on complex judgments (and some further counterfactuals) about the substitutability of different products, the importance of particular sectors for the larger economy, and so on. (This is one reason why New World resources seem more crucial than New World profits: there were clearly alternate investments that could yield money, but it is less clear that there were alternate ways to get huge amounts of land-intensive goods.) Thus, unless we want to make a categorical statement that there are *always* substitutes for any particular thing, and markets *always* accurately measure the relative importance of activities, goods, etc., such judgments cannot be avoided. (To see some limits to these assumptions, imagine that martians suddenly deprived the earth of all its fossil fuels. We could estimate the impact by looking at the fairly small percentage of world GDP that currently goes to fossil-fuel producers, but the actual impact would certainly be greater.)

More generally, there are clearly some situations where a fairly small increment in something makes all the difference. Human genes are 98.4 percent identical to those of pygmy chimps,[64] but few of us would disqualify an explanation of why humans have spread across almost the entire planet (while chimpanzees survive in just a few pockets) because it focused too much on the behaviors made possible by the remaining 1.6 percent.

The basic idea that relatively small differences can create large historical divergences is both proverbial ("For want of a nail . . . ") and modern (as in the

[64] Diamond 1992: 23.

famous "chaos theory" example of a butterfly beating its wings in Africa and changing the weather in Greenland). It cuts against equilibrium-seeking models, in which small differences should not create large *and lasting* divergences. It thus makes for an awkward marriage between history and economics—at least schools of economics that posit a single equilibrium as the destination toward which a given system tends. Accepting the importance of small factors can also lead to intellectual anarchy. Explanations can become so cluttered that we can not grasp them; or they can become a grab bag, with everybody championing as "crucial" the factor that suits their personal agenda. But for history to matter, there must sometimes be factors with lasting effects larger than their size might suggest.

Arguing for such factors based on comparisons rests in part on how clear it is that the cases being considered are otherwise similar. History is never as neat as the chimpanzee/human case, in which 98.4 percent of the genes are absolutely identical. Instead, we have statements of rough similarity, or of advantages that seem closely tied to some off-setting disadvantage, or where it is hard to think of any mechanism that would have greatly magnified the importance of a particular difference during the period in which the larger divergence emerged.

Thus, how important coal and the New World will seem depends partly on how convinced readers are of the similarities I have suggested in other areas, as well as on the arguments about those particular phenomena. As for those phenomena themselves, I would suggest four reasons to give them special weight:

1. the calculations above show they were not small relative to some reasonable standards (e.g., Britain's domestic land base)

2. they appear at the right time to explain a crucial divergence (once we have pushed the date of that divergence back to the century surrounding 1800)

3. they affected development through relieving a constraint—the finite amount of land—which was otherwise very difficult to relieve within the knowledge base and institutions of the time

4. the examples of core regions in China, Japan, and certain parts of Europe itself (such as Denmark) provide plausible examples of how societies lacking these advantages might have looked.

They do not require us to imagine that without this relief, Europe would have suffered a Malthusian catastrophe: a situation akin to the "butterfly wings yield hurricane" scenario or to imagining that with a slightly longer ecological window, India, China, or Japan would have produced an industrial revolution. A European ecological crisis *could* have happened, but our counterfactual allows us to imagine a variety of more likely outcomes, which have in common a set of labor-intensive adjustments to land pressures that actual people in some-

what similar circumstances made successfully but would not have led to anything like the British breakthrough. Indeed, as we shall see in our last section, these labor-intensive paths may have also made it harder to imitate industrialization even once the technology was there for the copying. Thus, highlighting the factors I have chosen seems to me a reasonable, rather than reckless, invocation of the principle that not so large initial difference can lead to vastly larger future ones.

Beyond and Besides the Numbers

Having introduced the idea of dynamic effects not easily captured by equilibrium models or quantitative measure more generally, let us look briefly at some of these ways of relating the New World to Europe's divergence from the rest of the Old World. We have touched only briefly (in chapter 3) on the dynamic cultural effects of New World exports such as tobacco and coffee—in particular, their influence on consumption habits and incentives to produce for the market. Though not significant in the sorts of ecological calculations we have made, these "unnecessary" goods—and others obtained in Asia with the use of New World silver—no doubt did much to speed the "industrious revolution" so crucial to Europe's economic dynamism.

For one thing tobacco, sugar, cocoa, coffee, and tea were all somewhat addictive, easy to prepare and consume quickly, and provided short bursts of energy. This made them perfect for punctuating long work days, especially away from home: these characteristics became more important as home and workplace were separated, especially in the factory age. (In Britain in particular, the New World silver that financed the partial substitution of Chinese tea for gin and beer may also have done much to create a population better suited to rapid, sometimes dangerous work.) Moreover, these new "everyday luxuries" were all (except for tobacco) commodities that did not grow in Europe and thus could never be made within the household; consequently, they could only be obtained through producing for the market. The same was true for those desiring cotton or silk fabrics, or the popular blends thereof; and the same was true for the silver belt buckles and other small adornments that became important status symbols even among poor people.

Not only did these materials have to be purchased but in many cases their cost was an incentive to specialization. A family that might have made its own clothes out of hemp or flax would be less likely to risk ruining a fancier piece of fabric; and one would have to be quite wealthy to be willing to write off all the fabric that would be wasted in the process of training a youngster to work with silk, unless this was going to be how they made their living. Consequently, the exotic commodities that became parts of many ordinary people's lives in this period may have contributed in important though unquantifiable

ways to the reallocation of labor time from production for home use to production for the market, which in turn was crucial to Europe's "internally generated" gains from increased division of labor. We have also left to one side the possible significance of the plantations themselves as laboratories for factory organization, as suggested by Sidney Mintz.[65]

Moreover, we must remember that New World treasure did more than just allow Europeans to *buy* additional goods in other parts of the New World. It also helped create European military commanders and paymasters who became influential partners of local elites and often later their colonial masters.[66] Consumption taxes on plantation-grown sugar and tobacco, as well as other colonial goods, also played a significant role in building these military capabilities. Half the increase in British government revenues (in constant prices) between 1670 and 1800 (or 1810, if one prefers to take in more of the Napoleonic Wars) came from customs revenue; and at least in 1788–92, two-thirds of customs revenue came from the duties on tea, sugar, Indian cloth, raw silk, tobacco, and "foreign spirits" (mostly rum made with Caribbean sugar—this category did not include wine).[67] Together, customs on these particular commodities made up 22 percent of the yield from all major taxes in Britain during these years.[68] And, of course, the various East India Companies, which lived off these trades, carried out many of the early European conquests in Asia themselves.

It is also worth noting that while growing military power allowed late eighteenth- and early nineteenth-century Europeans to take advantage of political instabilities in various parts of Asia, Europe was having internal upheavals of its own.[69] Jack Goldstone has drawn plausible connections between European political instability in both the mid-seventeenth and late eighteenth centuries and population-induced resource shortages and price shifts.[70] In that light, the resources from abroad loom larger, having kept these problems from being still worse. The same could be said of the state revenues gained from New World commodities, since these taxes were far less unpopular than those on domestic products and assets. This looks still more significant when we remember that Britain had a relatively smooth passage through the Age of Revolution, which for much of the continent involved major economic setbacks, and that it emerged from the period with a vastly enlarged empire.

Thus, it seems likely that the exploitation of the New World, and of the Africans taken there to work, mattered in many ways above and beyond those

[65] Mintz 1985: 46–61.

[66] Bayly 1989: 74; Washbrook 1988.

[67] Calculated from data in O'Brien 1988: 15.

[68] Calculated from ibid., 11.

[69] Bayly (1989) provides an excellent account of the importance of political crises rooted in commercialization that shook Muslim empires from north Africa to Java in opening the way for a new wave of European imperialism and notes general similarities between these crises and the "general wreck of nations" that Europeans found closer to home.

[70] Goldstone 1991 passim.

reflected in our ghost acreage figures. Taking all the indices together, it seems likely that this exploitation did more to differentiate western Europe from other Old World cores than any of the supposed advantages over these other regions generated by the operation of markets, family systems, or other institutions within Europe. Only three strong candidates would seem to exist for a factor of comparable importance in differentiating western Europe from at least east Asian cores. One, paradoxically, would be Europe's ecological "advantages of backwardness," which left unexploited resources that then provided ecological breathing room in the nineteenth century. We have seen, however, that these advantages did not extend to Britain (or to the Low Countries) or to some crucial commodities (notably fiber crops and wood), and they were offset by ecological disadvantages. The second possibility would be the fortunate location of Britain's coal deposits and its relationship to the development of the whole coal/steam complex. The third would be the wave of industrial innovations themselves—something still not fully understood and, as we have seen, of vastly greater significance because it was combined with both plentiful coal and the easing of other resource constraints made possible by the New World.

In this book's last two sections, I follow up the idea of fateful divergences in two ways. First, I carry the argument about the importance of the New World for European development further into the nineteenth century, briefly sketching how these dynamics both changed and continued as industrialization spread beyond Britain. Finally, I look back at China, Japan, and India, all places which, to varying degrees, had to adopt increasingly labor-intensive approaches to ecological stresses and to varying degrees found that these adjustments made capital-intensive, energy-intensive industrialization more difficult later. Since I have argued repeatedly that without the windfalls discussed here, Europe, too, could have been forced down a much more labor-intensive development path, these last examples are meant not just to round out a global story, but to complete the argument that the early nineteenth century represents a crucial moment of divergence with lasting effects—the moment when, thanks to all the factors we have discussed, England avoided becoming the Yangzi Delta, and the two came to look so different that it became hard to see how recently they had been quite similar.

Into an Industrial World

Land-saving New World imports would only grow in significance after 1830: for decades they kept pace with the stunning progress of fossil fuels. Britain's coal output would increase fourteen times from 1815 to 1900,[71] but its sugar

[71] Mitchell 1988: 247.

imports increased roughly eleven-fold over the same period,[72] and its cotton imports increased a stunning twenty-fold.[73] Meanwhile, Britain also began to live off American grain, beef, and other primary products; lumber imports soared; and the New World, at last, also became an enormous outlet for Europe's surplus population.

In the early nineteenth century, of course, Britain ceased selling slaves to North America and the Caribbean, and it had never sold many to Argentina. But by mid-century, new technology had made possible still larger declines in transatlantic shipping costs than in the eighteenth century, and other changes (particularly the railroad) were revolutionizing inland transport. This greatly accelerated the process discussed above, in which falling transport costs allowed European emigrants to cover their costs of passage, start-up, and manufactures by sending primary products back to Europe from ever larger parts of the Americas. (The growth of an independent U.S. government, much less concerned with getting back what it spent to secure and develop the frontier than were earlier for-profit colonial companies, also accelerated the process.)

By that time there were also mechanical (as opposed to human) capital goods that New World producers wanted from Europe and at least some patent protection for the designs. Meanwhile, cheap transport, mechanized production, and tastes brought by European emigrants meant that Europe could also now sell large amounts of consumer goods in the New World. With large inflows of capital and labor in the straightforward forms of immigrants and investment, as well as in the indirect form of manufactured goods, the land-rich, market-oriented United States were a perfect complement to an increasingly densely populated and industrial Europe.

Yet even with all these changes, at least Britain was still indirectly dependent on coercion to finance a good part of its nineteenth-century surge in imported New World resources. In fact, even at the height of its reputation as "workshop of the world," Britain rarely sold enough in the Americas to balance its transatlantic imports.[74] The situation got worse as import substitution proceeded on the European continent and North America and eventually created industries that competed in export markets as well. Consequently, European colonialism and overseas coercion—now concentrated in the Old World—continued to matter for many decades, if not as much as before 1850.

Indeed, in the last four decades before World War I, Britain balanced what had become very substantial trade deficits with the Americas and continental Europe—even after figuring in such "invisibles" as shipping, insurance, and

[72] Calculated based on Mitchell 1988: 709–11.

[73] Compare Farnie 1979: 7; see Mitchell (1988: 709–12) on sugar consumption and (1988: 196–201) showing no significant domestic production until the 1920s; and Bruchey 1967: table 2-A.

[74] See Latham (1978b: 69) and Hobsbawm (1975): 138, 144–45) on the trade balances; see Platt (1972: 4–5) on limits of British markets in Latin America.

interest payments—largely through huge surpluses with Asia. By far the biggest surplus was in Britain's trade with India, where legislation artificially enlarged its markets for everything from cloth to locomotives; and India in turn still financed much of that deficit through exports of opium to China and of various farm goods such as tea and indigo produced under highly coercive circumstances for export to continental Europe.[75] Meanwhile, Britain's ability to sustain large deficits with its Atlantic and continental European trading partners while still exporting large amounts of capital mattered to more than just British consumers: it also aided the next wave of industrializers, particularly the United States, who could protect their own markets, sell in an unprotected market, and receive large capital inflows.

It is true, as Eric Jones has argued, that not just any group of people stumbling on the New World (and depopulating it, as any people bearing Old World diseases would have done) could have used these continents as Europe did; but the European entrepreneurship Jones points to[76] was not the *unique* part of the equation, or one in which western Europe had surpassed developments in other densely settled parts of the globe. Western Europeans' innovations in organizing for exploration and durable conquest and in creating institutions that combined entrepreneurship with intense coercion—plus favorable global conjunctures shaped by everything from Amerindians' vulnerability to smallpox to the massive supplies of New World silver and the equally massive project of Chinese remonetization—gave them much of their edge. This, in turn, gave western Europeans a privileged position from which to endure the last century of the "biological old regime," with its multiple ecological challenges, and even continue expanding industries (from textiles to brewing to iron) that made great demands on the products of the land.

Last Comparisons: Labor Intensity, Resources, and Industrial "Growing Up"

Thus when coal, steam, and mechanization opened up vast new technical possibilities, western Europeans (especially in England) were in a unique position to capitalize on them. Vast untapped New World resources (and underground resources) still lay before them, essentially abolishing the land constraint. Moreover, what they had already gained in the New World meant they entered the nineteenth century with a higher standard of living than they would otherwise have had, enlarged military capabilities (which could force open markets in some cases and impose monopolies in others), and far more extensive handicraft industries than they could otherwise have maintained. And it was from

[75] See Latham 1978b 69–70, 80, 89; Farnie 1979: 325; Hobsbawm 1975: 149.
[76] Jones 1981: 84.

these proto-industrial workers, not directly from the peasantry, that most early factory workers came.

The importance of a factory workforce drawn heavily from people already working in proto-industry is brought out very clearly in Joel Mokyr's "growing up" model of European industrialization. First, despite numerous attempts to find "surplus labor" in agriculture—i.e., workers who could be removed from that sector without appreciably affecting production[77]—such cases seem rare, even in today's Third World;[78] and none of our cores could afford to have their agricultural output fall very much circa 1800. Second, factories employing former proto-industrial workers have a distinct advantage. If factory workers were drawn out of agriculture, then even if demand for them did not raise wages (in other words, if there *was* surplus labor in agriculture), there would be no reason for that wage to fall; and as the diffusion of mass-production techniques caused the price of the product made by a factory to fall, the firm would encounter declining profits and might have difficulty expanding. (Mokyr assumes that the fixed capital needed is fairly cheap, as is common in early industrialization; and since the raw materials cost roughly the same regardless of the production process, the factory's wage bill is the most important variable cost.) But if the nascent industry can draw on proto-industrial workers who made the same product as the factory did, then the same technological diffusion that places downward pressure on the factory's prices also depresses workers' alternate earnings possibilities. Thus the factory can reduce wages and still attract recruits from this sector; this allows it to maintain higher profits for longer.[79]

Thus, in this scenario, industry can result from the "growing up" of proto-industry; it does not require a *simultaneous* social and technological transformation that enables agriculture to maintain or increase output from about the same amount of land while releasing a huge number of workers. Moreover, proto-industrial workers often moved to the factory with some relevant skills and/or knowledge useful for making further innovations. All this suggests that the continued growth of proto-industry in the decades preceding and overlapping the growth of mechanized industry left Europe in a far better position than if it had been compelled to keep more people in agriculture and forestry.

To put things slightly differently: Europe's expansion of both proto-industry and many early mechanized industries required more agricultural output. Quite aside from whether Britain (or even Europe more generally) could have found enough land at home to resolve these problems, putting large additional amounts of labor into supplying these farm goods directly would have created

[77] Lewis 1954: 139–91; for later literature, see Myint 1958: 317–37.
[78] Schultz 1964: 61–70.
[79] Mokyr 1976: 132–64.

further problems later on. But instead, Europe acquired many of these supplies by having others grow them, while putting its own labor into additional soldiers, sailors, traders, and producers of manufactured goods. As factories at home needed more labor, they could draw on proto-industrial workers, with the advantages discussed above.

Over time, soldiers and sailors became more effective per capita thanks to technological change (e.g., better guns and ships) and were increasingly supplemented or replaced by "natives" hired with the proceeds of colonial taxation. Thus the overseas sector went through a sort of "growing up" of its own, which meant that this way of obtaining primary products did not absorb increasing amounts of European labor. The massive expansion of agriculture at home, which would have been needed otherwise, would have been not only ecologically difficult, but hard to reconcile with the expansion of the industrial workforce. When Britain's agricultural workforce finally began to decline in absolute numbers after 1850, it was tied both to technologies that had been unavailable earlier in the century and to massive increases in agricultural imports; production held steady as labor inputs declined, but did not rise much.[80] The contrast to the atypical (for Europe) case of Denmark, discussed in chapter 5, is striking. There, a near-stabilization of the ecology through labor-intensive methods seems to have been inconsistent with industrialization for many decades, even though the marginal returns to much of this work—and the real wages of both urban and rural laborers—were low and falling further.[81]

For a long time China and Japan, like Europe as a whole, also found ways to keep expanding their proto-industrial sectors, even without a New World to supply the needed fiber and other land-intensive inputs. These processes also involved some expansion of trade (and of fishing) to relieve local pressure on the land in cores; but compared to the European solution, they involved a greater intensification and expansion of their own agricultural sectors, particularly for fiber production. And by the end of the eighteenth century, that process seems to have been proceeding at diminishing rates and at considerable ecological cost. Japan's population stopped growing by 1750, and while China's continued growing for another century, the percentage of the population in proto-industry likely stagnated or even declined. In all probability, few areas in China that had extensive proto-industry actually underwent significant deindustrialization. What happened instead was that the heavily agricultural areas of China came to make up a much larger percentage of the population by 1850 than they had in 1750.

[80] Thompson (1989: 189) shows that output of food per farm worker rose about 50 percent between 1840 and the early 1900s, but the number of farm workers fell by 25 percent, making a net gain in output of 12.5 percent. Moreover, even those gains required a massive increase in the use of off-farm chemicals and other products for agriculture (see 193–99).

[81] See Kjaergaard 1994: 160 on wage trends.

The most advanced prefectures of the Yangzi Delta, which had roughly 16–21 percent of China's population in 1750, were barely 9 percent of the empire by 1850, and about 6 percent by 1950. As we shall see shortly, the percentage of these prefectures' population that worked in proto-industry may have fallen slightly, but whether or not that happened, the empire's most proto-industrial region simply ceased to have the same weight in aggregate figures. In Lingnan, the second most proto-industrial macro-region, population growth between 1750 and 1850 was about 75 percent, but China as a whole grew about 100 percent; moreover, a disproportionate share of Lingnan's growth was in Guangxi, a province largely limited to agriculture and forestry.

Thus, even though some of the heavily agricultural macro-regions were becoming more proto-industrial, their very large share in post-1750 population growth meant that China as a whole was at least as agrarian in 1850 as in 1750 and not much less so in 1950. Moreover, proto-industrial workers scattered across the farmsteads of the interior and often seen as part of an ideal agrarian household were not as easily available to move into hypothetical factories as true proletarians with no ties to the land might have been. Thus, during the two centuries or so after 1750, China became less well positioned for industrializing along the relatively easy path of "growing up" and has instead had to deal with all the problems of drawing most of its factory workers directly out of agriculture.

The United States, however, is an important reminder that not all early industrializers had large proto-industrial sectors. In fact, Kenneth Sokoloff and David Dollar, comparing the United States and England in the nineteenth century, have emphasized that the much greater seasonality of agricultural work in England slowed the development of factory-based industry. With large numbers of workers available only part of the year, but at wages far lower than what they would have required to leave the land completely, handicraft industry proved a tenacious competitor for factories, and investment in centralized plants, equipment, and supervision was less advantageous than it would have been had the agricultural and industrial workforces been more completely separate. In the United States, by contrast, very favorable land-to-labor ratios meant that farmers could supplement their grain-growing with other activities—animal husbandry, wood-cutting, fruit-raising and land-clearing, for instance—which yielded less per acre but paid well per hour; thus the rural labor force was occupied full-time without much resort to handicraft industries. Thus when factories were built, they could grow still more rapidly than in England (especially grain-growing, handicraft-producing south England).[82]

This argument is persuasive for the two cases of England and the United States. But the American case was radically different from anything in our Eurasian cores. The very favorable land-to-labor ratios meant that American

[82] Sokoloff and Dollar 1997: 1–20.

farms could easily feed a separate industrial workforce as that group emerged (whether from immigration or from rapid natural increase and rural-urban migration). It also meant that these farmers were sufficiently prosperous, even without industrial by-employments, to buy factory goods, even if those goods were made with fairly expensive labor. Long distances and tariffs, meanwhile, helped ensure that European manufactures made with what was often cheaper labor did not capture all of the United States market.

Under those special circumstances, American factories that had to find their laborers among ex-farmers (whether from Massachusetts, Ireland, or Germany) might still, contrary to the "growing up" model, expand more rapidly than English factories. But very few places in the eighteenth-century Old World could have accommodated a huge increase in population that neither raised local farm output nor brought in primary products by producing industrial *exports*; and where rural populations in Old World cores were not available for proto-industry, this was more likely due to very labor-intensive year-round multi-cropping (e.g., in parts of Lingnan) or enormous amounts of work to preserve a fragile ecology (e.g., marling, ditch-digging, and so on in Denmark) than to the sorts of lucrative but land-intensive by-employments that one finds on nineteenth-century U.S. farms.

Thus, Old World cores could not create a factory labor force in the way the United States did. For them, the choice was between pulling people out of full-time proto-industry or out of at least part-time farming. Given that, being able to draw on proto-industrial workers would still seem the most advantageous way to create Old World industrial workforces. This left England far better-off than places like the Yangzi Delta, which lacked peripheral trading partners that would complement it in the way that England's did.

This argument can also be expressed in terms of another feature of Mokyr's "growing up" model of European industrialization. The model assumes that people turn to proto-industrial activities in the first place when the marginal productivity of their labor in agriculture falls below that of proto-industry. (The former starts off higher than the latter, but falls much more rapidly, largely because the supply of land is limited.) Thus, the extra labor beyond a certain point will all go into proto-industry, as long as the area in question can continue exporting proto-industrial products in exchange for food (and, we might add, fiber and timber) without affecting the relative prices of food and handicrafts in the "world" market where it makes these exchanges.

This condition, usually called the "small-country assumption," makes perfect sense for the Netherlands and Belgium, the cases for which Mokyr developed this model—and at one point it also made sense for the Lower Yangzi and Lingnan, and the Kantō and Kinai regions. Although, as we have seen, the Yangzi Delta prefectures imported huge amounts of primary products—36,000,000 people importing 15–22 percent of their food, plus timber, beancake fertilizer, and so on—the hinterlands and marketing networks they drew

on were so vast that the small country assumption still makes sense as a way of looking at the region's trade in the mid-eighteenth century. But as some of these hinterlands, such as the Middle and Upper Yangzi and North China, grew more populous, experienced diminishing returns in agriculture and developed more of their own proto-industry, the terms of trade did shift, to the marked disadvantage of proto-industrial producers.

Though silver-denominated cotton cloth prices fluctuated from year to year, there seems to have been no trend in nominal cloth prices from 1750 to 1850.[83] Raw cotton prices in Canton, for which we have relatively good data, also show no clear trend, though short-term fluctuations were often violent.[84] But silver-denominated rice prices in the Lower Yangzi rose by 40 percent over that same century.[85] That increase alone would have cut the spinning and weaving income of the hypothetical women in chapter 2 by about 30 percent, from 7.2 *shi* of rice in 1750 to 5.0 *shi* in 1850.

Moreover, fragmentary data collected by Kishimoto Mio suggest that in the Lower Yangzi itself, raw cotton prices did rise substantially between 1750 and 1800. Such a finding is consistent with trendless prices near Canton, since transport costs between these two areas fell sharply in the late eighteenth and early nineteenth centuries. It would also be consistent with seventeenth-century patterns, in which the price of raw cotton in the Yangzi Delta seems to have roughly tracked that of rice.[86] If Kishimoto's data are roughly representative for Jiangnan, then the fall in spinners' and weavers' earnings would be roughly 50 percent just between 1750 and 1794 (when her data stop), though they would be falling from a higher starting point. And if we guess that the trend in raw cotton prices followed that of rice over the long haul, the rice-buying power of our hypothetical weaver/spinner would fall 25 percent between 1750 and 1800, and 37 percent by 1840.[87] Measured in salt or probably firewood, they fell further still.

Even these depreciated earnings could still meet the subsistence needs of the woman herself and would be close enough to male agricultural wages (which were also falling in real terms) that China's "gender gap" remained less severe than that in Europe. But they do show a substantial decline in earnings from home-based textile production, even before any competition from machine-made cloth. A woman weaving very high-grade cotton cloth would have escaped these pressures, since its prices nearly doubled over this same century,[88] but these were atypical women who had unusual skills and probably produced fewer pieces each year.

[83] Zhang Zhongmin 1988: 208.

[84] See Dermigny 1964: IV: table 19.

[85] Y. C. Wang 1992: 42, 45.

[86] Kishimoto 1997: 139, 141; Greenberg 1951: 92; Dermigny 1964: IV: table 19. For more details, see appendix E.

[87] See appendix E for more details.

[88] Zhang Zhongmin 1988: 194.

In Mokyr's model, such a fall in returns to proto-industrial labor in the Lower Yangzi should have led to at least some labor shifting back into agriculture at what would previously have been unacceptably low returns, and thus to a combination of further agricultural intensification and some measure of de-industrialization.[89] Though any such shift would have been modest, we have one possible indication of it. Raw cotton from the Lower Yangzi seems to to have become cheaper and more plentiful in Guangzhou (Canton) in the early nineteenth century, much to the dismay of foreign merchants bringing Indian cotton to sell. Though the fall in price may have been largely a matter of improved transportation,[90] the growth in quantity suggests that perhaps less Yangzi Delta cotton was being spun and woven locally; it seems unlikely that Lower Yangzi raw cotton output rose much in this period, and imports from North China were almost certainly falling.

And yet, most Yangzi Delta women continued to spin and weave, even at lower returns; in fact, as we saw earlier, it is precisely in the nineteenth century that references to women of that region working with men in the fields finally disappear completely.[91] If some families were unwilling to move their wives and daughters back into the fields where they would be more visible—and perhaps even tried to increase cloth output to maintain income—the situation might have come to resemble the quasi-involutionary situation described by Goldstone, in which women "stuck" in very low-wage home-based spinning and weaving made it much less profitable to contemplate factory-based textile production. Any such pattern emerging in this period would be the result of a

[89] When graphed, the relationship looks roughly like this:

Image Not Available

[90] Greenberg 1951: 91–92.

[91] See Li Bozhong 1996, and above pp. 103–4.

temporary conjuncture, rather than a fundamental feature of long-term Chinese development based on timeless norms (as Huang suggests) and it would be too late appearing to be the basic explanation of the nondevelopment of factories, as Goldstone proposes.[92] Nonetheless it might have helped slow the replacement of domestic textile production by factory production, even once the technology became available, as Goldstone suggests later in his essay. Either way, these women remained part of households in which the men (and to some extent children) were driven to increasingly labor-intensive strategies of farming, fuel-gathering, and land-management—not a promising precursor to industrialization.

Japan's response to similar pressures remained within the same basic framework as China's, but with some differences that may have had long-term implications. First of all, Japan's population broke through its historic ceiling, never to return, earlier than that in either China or Europe. Population reached new heights in the late seventeenth century, when both Europe and China experienced downturns, and by about 1720 it had reached a plateau that would last until about 1860.[93] This long period of zero population growth may represent a more rapid and thorough demographic adjustment to ecological constraints than the slowing, but still positive population growth of early nineteenth century China, but it could also be argued that the adjustment was sharper because the situation was even worse: after all, overall population density in Japan even circa 1860 was still much higher than it was in China.[94] And while the enormous increase in Japanese ocean fishing offered a kind of relief much less used in China (it provided both food and fertilizer), and the early development of systematic silviculture was also an important adjustment,[95] Japan, too, faced serious barriers to further expansion of proto-industry in its core regions.

Agricultural prices rose sharply relative to those of industrial goods during the 1730s, then showed no trend until the late 1820s, when they began another steep climb; the average prevailing level for the 1735–1825 period was about 20 percent above the mid-1720s peak and almost 50 percent above the 1730 trough.[96] I know of no signs of deindustrialization in either the Kantō or the Kinai in response to changing relative prices, but these regions did decline

[92] As I argued in chapter 2 and elsewhere, it is not clear that this particular nondevelopment needs much explanation—it faced many barriers both in China and elsewhere, and the more "natural" path appears to have been an exhaustion of the possibilities of proto-industrialization. What needs explaining is why parts of Europe did not follow this path, too—so that Europe can be seen as China manque (or England as Flanders manque) rather than the whole world being England manque.

[93] Saito 1985: 185.

[94] McEvedy and Jones 1978: 166–71, 179–81; note especially the low percentage of Japanese land that is arable.

[95] Totman 1989: 81–170; Howell 1992: 271–75.

[96] Saito and Shinbo 1989: 91.

in population: 16 percent for the Kantō between 1751 and 1821 and perhaps 5 percent for the Kinai, while the prefectures with impressive population growth were mostly in areas that were still relatively sparsely populated in 1870 and also still well below the national average on Saito's index of rural industrialization. (By contrast, the Kinai region had both a population density and a rural industrialization index that doubled the national averages.)[97] We have already seen that the major growth of both industry and population was in poor domains such as Tosa, where old monopolies were being relaxed; but many such monopolies persisted, as did barriers to migration. These barriers to growth in the peripheries may have spread pressure for family limitation into more peripheries than in China (though any comparison is speculative with current data), ultimately preserving some of the same sort of slack capacity that much of continental Europe had but China lacked. To put it another way, the share of Japan's most advanced regions in national aggregates declined, as it did in China, but much more gently, since peripheral growth was more modest. Labor intensity increased, but this was due almost entirely to increased hours per worker, not to population growth. And though cities and towns lost ground relative to the countryside,[98] the country's still relatively high urbanization rate also suggests that more of what Mokyr calls "pseudo-surplus" labor was stored in handicrafts (as opposed to agriculture) than was the case in China.

As we would expect, the Indian story is different again, but it still fits within the same general framework. Moreover, India's differences from China point in the opposite direction from Japan's differences and suggest more serious long-term obstacles to industrialization. India, as we have seen, began its population boom later than China or western Europe did, and much later than Japan: probably after 1830, and almost certainly after 1800.[99] The nineteenth century saw an enormous increase in cultivated land in India and few signs of serious overall shortages of food, fuel, fiber, or building materials. (Distribution was, of course, quite another matter: India exported large amounts of grain in the late nineteenth century, for instance, while it had serious hunger at home.) But despite a continuation of late precolonial commercialization, the share of India's population in non-farming occupations probably fell during early British rule. The subcontinent underwent what Bayly calls "peasantization," as both formerly migratory peoples and former handicraft workers were increasingly drawn—and pushed—into sedentary farming. The process appears to have begun before colonialism, in part because the competing successor states to the Mughal empire hoped that settling migratory peoples on the land would increase state control, public security, and state revenues; it

[97] See Saito (1985: 211) and compare with Iwahashi (1981: 440).

[98] Sugihara 1997: 153.

[99] Moosvi 1987: 402, 405; Subrahmanyam 1990: 358–60; Habib 1982a: 166–67; Visaria and Visaria 1983: 463–65.

accelerated under the British and touched increasing numbers of former urbanites as well.[100]

An intense debate has been waged about whether India deindustrialized in the nineteenth century; with inadequate data, it is unlikely to be settled.[101] However, it does seem fairly well established that the number of full-time weavers and spinners (especially those based in towns) decreased significantly beginning in the late eighteenth century. This seems to have been due at first to measures taken (especially in Bengal) by the East India Company and some other merchants who increasingly bound weavers to a single potential buyer; as this depressed earnings, many artisans fled their occupation.[102] Later, earnings came under intense further pressure from competition with Lancashire.[103] And the percentage of the Indian population living in cities declined significantly over the long term—from 13–15 percent in the late seventeenth century to 9.3 percent in 1881—though it is currently impossible to date the decline much more precisely.[104] Deindustrialization is also suggested by Habib's finding that the value of sugar, cotton, and indigo grown in India quite likely fell in absolute terms (not to mention per capita terms) between 1595 and the 1870s.[105]

While total yarn and cloth output in India may have held their own, thanks to an increase in part-time rural spinning and weaving, this would not have had the same significance for future industrialization as would the growth of a full-time proto-industrial workforce. These were not people who could later be moved into factories with no cost to agricultural output;[106] nor were they workers whose cost to a potential factory owner would fall together with the unit price of his product, since much of their income came from farming.

Thus, it could be argued, though India began the nineteenth century with a less-monetized economy than that found in China, Japan, or western Europe, it was moving in similar directions and had more ecological room for increasing population and per capita consumption than they did. But by the early twentieth century it had lost that advantage and had both the disadvantages of a densely populated zone and those of a zone with limited proto-industrial development and a limited internal market. This combination of problems had occurred not so much through the sort of (largely) market-driven regional development that seems to have led to China's cul de sac, but through the preferences of colonial (and, to some extent, indigenous) authorities for settled

[100] Bayly 1983: 219–26, 290–92; Bayly 1989: 188–89.

[101] See, e.g., Bagchi 1976; Vicziany 1979: 105–43; Bagchi 1979: 147–61; Perlin 1983: 89–95; Harnetty 1991: 455–510.

[102] Hossain 1979: 326–35; Mitra 1978: 23, 25, 29, 32, 37–38, 48–49, 56, 79–80, 84, 87–92, 132, 144, 164, 172–73.

[103] Harnetty 1991: 463–66, 505–7; Mitra 1978: 188, 194–95.

[104] Habib 1982a: 168–69.

[105] Ibid.

[106] On the absence of true "surplus labor" in Indian agriculture, even in the twentieth century, see Schultz 1964: 61–70.

populations, "customary" law, agricultural and forest exports, and a captive market for the mother country's industrial goods. The result was an *increasing* emphasis on primary-product exports even amid great population growth—primary products often produced with labor that was no less coerced (and maybe more so) than in the least free areas of eighteenth-century India.[107]

Thus, despite considerable growth in agriculture and commerce, India may have become less well positioned for industrial-led transformative growth. Compared to what at least might have happened had eighteenth-century social trends continued a bit longer while population grew and competition from mechanized goods stayed away a little bit longer, colonial India's form of "peasantization" might reasonably be labeled a "development of underdevelopment." The British probably did not frustrate an industrial breakthrough that was otherwise highly likely, as some nationalist scholars claim, but nineteenth-century changes may have made such a breakthrough even more difficult than it would have been otherwise and more difficult than the transition faced by either western European economies or east Asian ones. To put it another way, Japanese and especially Chinese cores may have faced bottlenecks due to the convergence of their peripheries toward "core" profiles, but Indian cores suffered the worse fate of converging toward a more peripheral profile.

The wonder then is that at roughly the same time that the "small-country assumption" became less applicable to east Asian cores—largely because the growth of population and proto-industry in their peripheries was making the quantity of primary products available on their "world" markets smaller relative to their needs—that same assumption remained applicable to Britain even though its population soared and its per capita demand grew (first slowly, then very rapidly after about 1840). Moreover, it remained applicable over the next century, not only to Britain, but to an ever-larger "industrial Europe." Without that wonder the combination of a much larger population, higher per capita consumption, and far *less* labor-intensive land management—all central to the "European miracle"—was not possible. Without that wonder, the achievements of Europe's preindustrial market economy—impressive though they were—could have led in the same direction as the also impressive market economies of other regions. Even that other wonder—the string of technological innovations that makes up the original history of the "Industrial Revolution"—might well have slowed to a crawl without this one.

The wonder can be partly explained by western Europe's own "advantages of backwardness," as discussed in chapter 5: domestic resources left unexploited because of institutional blockages that were only relieved in the nineteenth century and that, at that point, kept the import needs of some industrializing areas from being even larger. But as we have seen, this argument has little applicability to Britain, and little to fiber and wood. Technological

[107] See, for instance, Bayly (1989) on tea plantations.

catching up—e.g., in per-acre yields—also helped, but that alone can hardly explain Europe's surge ahead of the rest of the globe. Europe's wood problem was of course substantially eased by coal, but for quite a while this applied only in Britain and a few other places. Furthermore, overall timber demand kept rising even where coal was used heavily, since wood had many other uses: timber imports continued to rise throughout the late eighteenth century and at an unprecedented rate in the nineteenth century. (Though coal, as we saw, also had other dimensions, through its links to steam power, railroads, and so on.)

Thus, for a more complete explanation of what occurred in Europe's core, we must also look at its peripheries and understand why they became growing rather than shrinking suppliers of primary products to the "world" market. Part of the answer lies in institutional arrangements in eastern Europe and Russia that long inhibited population growth and proto-industrialization of the sort that occurred relatively rapidly in the Chinese interior and Japan's Region II—more "advantages of backwardness," but ones that could not be reaped on a large scale until after 1860. Much of the rest of the answer—and the bridge that got Europe through the first century of the proto-industrial to industrial transition—lay, as this chapter has argued, in the New World: not just in its natural bounty, but in the unique institutions and conjunctures that brought far more of its bounty to Europe far earlier than purely Smithian trade could have.

The institutional factors include some—like the slave trade and the mine labor systems—whose departure from market principles are obvious and which we often consign too quickly to a "premodern" world, forgetting their role in making our world possible. Others, like the corporation, are familiar, "modern," and clearly European in origin. Consequently, we tend to forget that they were created by and for extracontinental encounters and that for a long time they may have been most significant as a method of underwriting the huge fixed costs of violence: a method that then forced these enterprises to increase *volumes* of "exotic" imports (rather than focusing exclusively on profit margins, as the Venetians and Portuguese had tended to do) and thus to expand the European presence abroad. Still others, like the specialized slave plantation, are well known, but their role in creating a new kind of periphery for Europe is here placed in a new light. And beyond these institutions lie various global conjunctures that favored the expansion of the European presence in the New World: from wind patterns and disease gradients to European state competition and Chinese silver demand.

Together, these largely extra-European and nonmarket factors were essential in making transatlantic trade a uniquely self-expanding route by which Europe (especially Britain) could use its labor and capital to relieve its hard-pressed land and thus turn even a demographic and proto-industrial expansion that (unlike in east Asia) far outpaced advances in agriculture into an asset for further development. Without those factors, this demographic and proto-

industrial expansion could have been the basis for a later catastrophe; or it could have been stopped by rising primary-product prices in the nineteenth century; or it could have been severely constrained by a need for much more labor-intensive approaches to exploiting and conserving a limited land base.

Thus, forces outside the market and conjunctures beyond Europe deserve a central place in explaining why western Europe's otherwise largely unexceptional core achieved unique breakthroughs and wound up as the privileged center of the nineteenth century's new world economy, able to provide a soaring population with an unprecedented standard of living. Our long journey through interregional comparisons has brought us to at least some resolution of the methodological question with which we began: it has shown that rather than pretend we are seeking the differences among truly independent entities on the eve of industrialization, we must acknowledge the importance of preexisting connections in creating those differences.