"East Asia, Europe, and the Industrial Revolution"

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This paper has emerged from one very familiar and one less familiar project. The familiar one, which provides the focus for the early part of the paper, involves thinking about how the literature on European economic history could be usefully brought to bear on the much less advanced field of Chinese economic history. This involves generating estimates for China of some things that are more or less known for Europe, such as levels of consumption, real earnings in different kinds of work, and so on. The results greatly undermine any notion -- which still lingers in various ways -- that late Imperial China had a subsistence economy, or that despite massive commercialization, there was no growth in per capita output. We'll also see that it significantly modifies another of the old war-horses of the China literature: "over-population," suggesting that that term can only be applied in a very restrictive, anachronistic sense -- and that, since in that sense, it could be applied to 18th century Western Europe, too, it will hardly do as an explanation for the longer-term course of Chinese economic development.

In fact, my data on living standards, resource shortages, and so on suggest a rough comparability between the more advanced portions of 18th century China and the more advanced portions of 18th century Europe. And that brings up a second, more unusual, project: to think about how, if we describe China and Europe in comparable terms, the Chinese experience may cast light on

Europe. (Or, perhaps more accurately, how the experience of the Lower Yangzi and of Lingnan--- China's two most advanced regions -- may cast some light on England and the rest of Northwest Europe.) In particular, it seems to me that seeing what 18th century China and Europe shared can help cast light on the nature of the Industrial Revolution, which opened such an enormous gulf between them in the 19th century. The result of the two projects combined is to take two 18th century stories that are conventionally treated as already locked into completely different paths -- towards dramatic growth in Europe and stagnation in China -- and suggest that they may have been much less different than that, and their divergence a discontinuous, partly exogenous development.

The European developments responsible for this early 19th century divergence -- the Industrial Revolution -- look very different to us than they did 30 years ago. At that point, one would have found a near consensus, across a broad ideological spectrum (from, say, Ashton to Landes to Hobsbawm) that a)the Industrial Revolution constituted a fundamental and fairly sudden break with the economic world of the 18th century; b) that it was first an English phenomenon, followed by the spread of new best practices to the Continent, and c) that the essence of the phenomenon could be found in a few specific industries (first cotton, then coal, then iron, steel, and land transport) which, one after the other, experienced major technological

breakthroughs and spectacular growth, rather than in the continued expansion amidst much smaller productivity gains in many, many other activities. And Britain's foreign trade would also have occupied a prominent place in the story -- especially the textile story -- with at least some scholars linking this to discussions of colonies, slavery, and so on.

But the literature of the past 25 years has gone in other directions. It has increasingly treated European industrialization as just part of a long process of slowly-growing markets, division of labor, lots of small innovations in many kinds of production, and millions of people accumulating small profits, rather than as a major discontinuity concentrated in a few sectors in one country. And once one focuses on these more subtle and more general transformations, one finds that they go back well before Europe had large-scale extra-continental trade. Thus, the current consensus emphasizes a gradual European story rather than either the old British story with sudden breakthroughs in cotton and coal or a global story, in which, say, the Americas might loom large. (Of course the more it's a European phenomenon, involving lots of places that didn't have colonies, the more leaving out the globe seems reasonable). And at the same time that the social history literature is questioning more and more of the alleged links between proto-

industry and industrialization proper[1] -- links that helped create the sense that industrialization was not as discontinuous a phenomenon as we once thought -- more and more of the economic history literature seems to suggest that the whole problem isn't terribly significant: seeing the continuity of growth over the early modern/modern long haul is more significant than identifying technologically and temporally discrete phases of the process and exploring their connections.

I'm arguing, in a long book manuscript from which this paper is abridged, that this new picture is misleading-- not because Europe's slow process of market-driven growth didn't matter, but because it doesn't differentiate Europe from East Asia (or perhaps other places). Smithian dynamics worked just as well in China as in Western Europe, but they didn't lead to any dramatic change in basic possibilities -- eventually, highly developed areas came up against serious resource constraints, in part because commercialization and handicraft industry also tended to accelerate population growth. Europe's escape required a combination of technological innovations, plus coal, New World resources, and various favorable global conjunctures -- or more properly, Britain's escape, since proto-industrialization in places like Flanders and even Holland led to results more like the Yangzi Delta or the Kanto plain than like England. (Not to

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[1]For a recent summary, see the essays in Ogilvie and Cerman 1996.

mention Denmark, where very labor-intensive solutions to similar ecological pressures yielded agrarian prosperity, but ruled out any significant expansion of even handicraft industry until after 1850.[2]) Thus the Industrial Revolution was discontinuous, and shouldn't be seen as something that "had to" emerge from 18th century proto-industrialization anywhere. It is just as easy to see Europe as "China manque" as vice versa, or England as Flanders manque; and since this is a relatively untried way iof looking at things, the returns to such an exercise may now be higher than to the old one of asking why various places weren't England.

In a very powerful account of the Industrial Revolution as a gradual and European phenomenon, Jan DeVries has subsumed the Industrial Revolution in a larger process he calls the "industrious revolution." In this process, which began well before the mechanization of production, households in at least Northwestern Europe chose to work more hours and to allocate more of their labor time to the production of goods for the market, while saving time for that labor by purchasing some things that they used to produce for themselves. The industrious revolution, then, is both a process of increasing labor (a result of a changing set of preferences which favored various kinds of goods over leisure) and of Smithian specialization, with the expected

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[2]Kjaergaard 1994: 151-4, 158, 160.

gains from increased efficiency.[3]

But these processes describe development in the more commercialized parts of 18th century China as well as they describe those in 18th century Europe. (I'd argue the same for Japan as well, but enough for one day.) While this suggests the power of this concept, it also suggests some limits: in particular, that there are problems with suggesting that these processes somehow subsume an industrial revolution, which, of course, didn't happen in China. In the latter part of the paper, I'll try to suggest some reasons -- primarily ecological ones -- why the industrious revolution played itself out so differently in these different places: reasons, I would suggest, that have less to do with economic or demographic processes in these core regions themselves than with the fortuitous location of coal deposits, and with the very different set of politically-structured relationships between Northwestern Europe (especially England) and some of its trading partners on the one hand and those between China's Yangzi Delta and Pearl River Delta cores and their peripheries in the Chinese interior and Southeast Asia, on the other hand. (Of course it also had sometheing to do with the process of invention itself,but -- to make a long story short -- the important differneces there seem to me to be external to the economy *per se*.)

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[3]DeVries 1994: 249-270.

Thus, this paper has four basic parts: 1) a discussion of consumption levels, 2) an analysis of Chinese labor markets and household labor allocation 3)a discussion of possible ecological "limits to growth" in the 18th century at both ends of Eurasia and 4) a brief and speculative discussion of why China's industrious revolution appears to have stalled out (though, as we'll see, that appearance is somewhat deceptive) at roughly the same time that population, production and consumption per capita in Europe all began to grow even more rapidly, and at least some ecological indices that had been declining steadily stabilized.

Popular Consumption and the Industrious Revolution

DeVries proposes his industrious revolution, among other things, to resolve a paradox. The grain-buying power of Europeans' per hour or per day wages fell dramatically between about 1430 and 1550, and did not return to 1350 levels until 1840 or later (it varies from country to country, but the general pattern is clear).[4] Yet over the same period (especially after about 1650), inventories taken at death show a pretty steady rise in what ordinary people own -- clothes, pot and pans, jewelry, furniture, decorations, and what have you. Well, how can these things both be true? At least in part because people spend more and more hours per year working for the market, generating income that pays for these things above and beyond the large number of

[4]Braudel 1981: 134-5; Abel, 1980: 121, 136, 161,199; Clark 1991: 446.

hours they need to work for subsistence. In the process people decrease their leisure time, and also the amount of time that they spend making things for their own households -- a process of specialization, in which you stop, say, making your own candles, and put more hours into weaving cloth that you sell in order to buy candles. (The process has a logical conclusion of sorts in the 90's two wage earner family that even contracts out child-rearing and most of food preparation.) So there's an increase in amount of labor, in orientation of labor towards market, and in specialization of labor.

This process has various pre-conditions. It requires a certain population density -- you can't specialize in one craft until there are enough people around who need that to keep you occupied. You need freedom of occupation -- there can't be, say, a feudal lord who can forbid his peasants from making cloth. You also need certain attitudes, which may or may not be new. You can't for instance, think of feeding people as something so intimate that it shouldn't be done by strangers through an arm's length transaction. Moreover, people have to want various things that they can't readily make for themselves more than they want more leisure -- you need a certain degree of consumerism, even amidst difficulty making ends meet. As DeVries sees it, these things emerged in Europe sometime between, say, 1500 and 1750.

The same thing is happening in China. The rice-buying power

of day laborers' wages probably falls from about 1100 on,[5] but there's also powerful evidence of an increase in consumption of "non-essentials" even by pretty ordinary people, especially between about 1500 and 1750. In fact, many of them are the same non-essentials as in Europe: tobacco, sugar, more and better clothes, eating utensils, and so on.

A)Nutrition and Health

But before we get to non-essentials, let's start with basic foodstuffs. Most estimates of basic caloric intake in 18th century China compare pretty well with Europe. Using data on the diets of landless agricultural laborers contained in 17th century agricultural treatises, Ming-te Pan calculates that they represent a daily diet of 4,700 calories during the working months.[6] Overall figures are of course lower, but estimates of per capita grain consumption in the 18th century average about 2.2 shi of rice equivalent per person (including both sexes and all ages).[7] This converts to 1,837 calories per person from rice alone. If the age structure of the population was about the same

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[5]Zhao Gang 1983: 57. There are some problems with the way Zhao makes his argument -- most importantly that he sometimes reports only cash wages, ignoring what was often a large in-kind supplement -- but the general trend is probably nonetheless correct.

[6]Pan unpublished 10-11.

[7]See Marks 1991: 77-78 for a justification of this figure.

as in the 1930s,[8] this would work out to 2,386 calories per adult equivalent of grain alone, and perhaps as much as 3,181 calories per adult male equivalent. This would compare fairly well to the various estimates for workers in late 18th and 19th century England (the richest part of Europe) cited by Clark, Huberman and Lindert (which range from 1,500 to 2,400 calories per person from all foods), and would be just very slightly short of the highest figure they cite: 3,262 calories per day per adult male equivalent for agricultural workers in the much more prosperous England of 1863.[9]

At least comparable nutritional levels are also suggested by the fact that 18th century rural Chinese life expectancies -- between 35 and 40 in most available studies -- are quite comparable to those for 18th century England, and higher than those found in most studies of continental European populations.[10] Moreover, since recent studies suggest that

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[8]See Perkins 1969: 301.

[9]Clark Huberman and Lindert 1995: 223-6. Pan 1994: 327 and accompanying notes, makes a good case for estimating adult male consumption at double that for adult females. If this is true, which is the conversion used to get the adult male equivalent consumption figure above. It is, however, a much larger male-female differential than that used by Clark, Huberman and Lindert (1995: 226 n. 25), which complicates comparisons considerably.

[10]compare Lavely and Wong 1991 (especially Table II and Figure III) and Lee and Campbell 1997: with Wrigley and Schofield :230, 708-13 (and see Razzell 1993: 757-763 for a suggestion that these figures are too high; Razzell's suggested adjustment for infant mortality alone would bring a life expectancy at birth of 37.0 down to somewhere between 31,6 and

Chinese birth rates were below European ones throughout the 1550-1850 period,[11] while the overall rate of population growth was faster (1550-1750) and then similar (1750 -1850),[12] we have a further indication that Chinese death rates were probably lower.

Moreover, Chinese appear to have reached these nutritional standards without spending any more of their incomes on basic foodstuffs than did their European counterparts. Fang Xing's study of Yangzi Delta farm laborers suggests that they spent 55% of their earnings on basic grain supplies in the 17th century, and almost the same amount (54%) in the early 19th century.[13] This is almost exactly the same as the figure for rural poor people in the 1790s cited by Phelps Brown and Hopkins;[14] and since agricultural laborers were the poorest working people in China, the comparison seems apt. Moreover, Fang does not calculate peasant incomes directly. Instead he relies on accounts of the minimum expenditures needed for clothing, firewood, and so on (again, mostly in agricultural manuals). Thus he excludes various other kinds of expenditures: e.g.

34.0). For continental examples see Knodel 1988: 68-9 and Blayo 1975 (showing a much lower life expectancy in France).

[11]Li Zhongqing 1994:3.

[12]Li Bozhong 1994a: 32-4; compare McEvedy and Jones 1978: 28-29.

[13]Fang 1996: 93, 95.

[14]Phelps Brown and Hopkins 1981: 14.

occasional, but very large expenditures for life-cycle rituals; jewelry, which even poor women seem to have had some of;[15] clothes for special occasions,[16] entertainment, and so on. Overall, then,it is much more likely that Fang has under-estimated what even farm laborers could spend on things beyond basic calories than that he has over-estimated it: and yet his estimates seem comparable to those for English poor people.

B)Beyond the basics

Conceivably, of course, Chinese could have buried this extra income under the house: but what evidence we have suggests otherwise. Unfortunately, we don't have death inventories of possessions in China, but we do have lots of other things. Literary evidence includes lots of material from domestic travelers describing (and usually decrying) increases in popular consumption; fiction that was meant to be realistic describing the range of goods for sale in even some pretty small and remote towns (accounts that are generally backed up by the lists of "products sold" in local histories) and descriptions of the food, clothing, and home furnishings of families at various levels in the social hierarchy.[17] We also have the accounts of various

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[15]Pan 1994: 85

[16]See the complaint about peasants' "gaudy" clothing at religious festivals by the official Chen Hongmou in Huang chao jingshi wenbian 36:

[17]Particularly striking accounts may be found in the novels Jin ping mei and Xingshi yinyuan zhuan -- striking in part

European visitors, most of whom (before 1800) compare levels of consumption favorably with those back home. I'm particularly struck by the comments of two English emissaries who traveled from Beijing to Canton in 1793, about how much more elite Chinese smoked than the English[18]-- a comment lent additional support by a source claiming that even toddlers smoked in Zhejiang[19] -- and by Gaspar Da Cruz's account of the construction and furnishing of the homes of China's more successful farmers. The latter, though a bit earlier than I'd ideally like, is interesting because Da Cruz (a Portuguese ship captain arrested for smuggling at Canton, who was eventually exiled to the Southwest and left the country overland into Burma) saw areas pretty far off the beaten track, and specifically noted that he was describing the homes of what he called "successful husbandmen" rather than the officials and great merchants who made up China's real upper class;[20] and also because, given China's severe timber shortages (about which more later) and the surprisingly sparing use of stone in domestic

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because they deal with a medium sized city and a small town, respectively, in North China rather than with any of the country's great metropolises. For some reflections on consumption in China by a leading historian of early modern European consumption, see Burke 1993: 148-161. I deal with this at much greater length in Pomeranz, forthcoming, Chapter 3.

[18]Staunton 1801: II,48; Macartney (1793) in Cranmer-Byng 1963: 225.

[19]Cited in Dermigny 1964 III:1253.

[20]DaCruz in Boxer 1953: 106; see also 99.

construction, one would expect housing to be among the areas in which Chinese consumption would most lag European.

But these sources are no substitute for quantification, and I've tried to do that where I could. Usually this had to be done by working backwards from estimates of the amount of land under various crops, multiplying by contemporary yield estimates, and subtracting exports where they are relevant. This introduces various uncertainties, but I've also taken various steps to insure that these estimates are conservative. By starting with the quantity of land reported on the tax rolls, we build in a big conservative bias, since under-reporting was chronic throughout China. I've used the highest estimates I could plausibly defend of the amount of land that was under basic grain crops, and where estimating cash-crop production for an area was particularly tricky, I've simply omitted it from national totals, even though contemporaries may have remarked often that it produced the good in question. In the case of sugar, for instance, I've counted only output in Guangdong and Taiwan plus known imports, though we know that mainland Fujian was also a major producer, and production scattered through the rest of China was estimated by a contemporary to be about 1/9 of the total of Guangdong, Taiwan and that uncounted mainland Fujian output.[21] And within Guangdong itself I have used a figure for cash-cropping area more than 20%

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[21]Cited in Daniels 1996:97,105.

below that generated in Bob Marks' study of that province, and assigned only 1/10 of this cash-cropping area to sugarcane: a figure that Marks suggests is almost certainly too low.[22] I've made similar efforts in calculating other things. But even so, we come out with some very surprising figures. It may be no shock to see that per capita tea and silk consumption were higher in China than in Europe, but consider the following data for sugar and for ordinary cloth:

[22]for further discussion, see appendix A.

Table I Tea and sugar consumption in China and Europe

A) China circa 1750: 3.8-5.0 pounds of sugar per capita for country as a whole, heavily concentrated in the Lower Yangzi, southeast coast and Lingnan, where consumption may have been as high as 10 pounds per capita.
Tea: .7 pounds per capita ca. 1840; no earlier figures available

B) Sugar in Europe

Date	Europe	Europe ex-Britain	Britain
1680	1 lb.	.85 lbs	4 lbs
1750	2.2 lb	1.90 lbs	10 lbs
1800	2.6 lb	1.98 lbs	18 lbs

Tea in Europe

	England	Non-Russian Europe (includes England)
1780	1.0 pound	.12 pounds
1840	1.4 pound	.25 pounds

Sources: Production figures from Carla Rahn Philipps, "Trade in the Iberian Empires, 1450-1750," in Tracy, Rise, pp. 58-61 (Portuguese and Spanish colonies) and Neils Steensgaard, ""Trade of England and the Dutch Before 1750," in Tracy, Rise, p. 140 (for French, Dutch, and English colonies. Braudel, The Structures of Daily Life, pp. 251-252; Gardella, Harvesting Mountains pp. 6, 38. Wu Chengming, Zhongguo zibenzhuyi de meng ya, p. 99. European population figures from McEvedy and Jones, p.28. British consumption figures from Mintz, pp. 67, 73 (using 1700 figure for 1680). For Chinese calculations, see Appendix A.

Table II Selected comparisons of cloth output and consumption

Yangzi Delta, omitting salt-producing prefectures (population approximately 31,000,000) ca. 1750:
Cotton cloth: 14.5 pounds per capita output (amount consumed locally unknown)
Silk cloth: 2.0 pounds per capita (amount consumed locally unknown)

China ca. 1750:
Cotton cloth: 6.2-8.3 pounds per capita (probably nearer low end)

Selected European estimates:
United Kingdom ca. 1800: 12.9 pounds per capita output of cotton, linen, and wool cloth combined (8.7 pounds per capita consumed within UK)

France ca. 1789: 8.4 pounds per capita output of cotton, linen and wool combined

Germany ca. 1830: 5.0 pounds per capita output of cotton, linen and wool cloth combined.

For sources and discussion of data problems, see Appendix F.

In each of these cases, Chinese per capita consumption seems comparable to or higher than that in Europe at the same or a later date. This may be no great surprise for tea and silk, but the numbers for sugar (which are double European levels) and for total cloth are quite surprising. And if we take cloth output for The Yangzi Delta (with 31,000,000 people, a perfectly respectably-sized unit), there's reason to think (despite numerous data problems) that it comes out very close to that for England.

Finally, let me hazard one more set of comparative consumption figures: between inventories of furniture in Chinese homes and death inventories from the early modern Netherlands. Admittedly, this comparison is shaky. First of all, a table is obviously not just a table in the same way that a pound of sugar is a pound of sugar; there can be huge differences in quality. Secondly, the Chinese data come from the early 20th century, not the 17th or 18th. But by most accounts the 19th century saw no improvement (and quite likely a decline) in Chinese living standards, and the price of wood soared relative to other commodities as it became scarce (wooded acreage per capita in 1937 was somewhere between 6% and 8% of what it had been in 1700.[23]), so that one would

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[23]Based on figures for forested area from Ling Daxie 1983:34-5, and a population of 100-120 million in 1700 and 450-500 million in 1937. Deforestation and trends in harvestable wood supply per capita per year are discussed in much greater

think furniture would become a smaller part of a family's market basket. For the same reason, furniture should be an area in which Sino-European comparisons should be especially bad for China. And finally, bear in mind that even the figures for the less prosperous European communities come from a less prosperous part of Holland, not Portugal or Poland, while the Chinese figures represent a truly national sample of 30,000 households, divided into 2 broad areas:[24]

Table III Home furnishings

Good	Average Number Per Rural Household			
	China Wheat	China Rice	Friesland Inland	Friesland Coastal
Tables	4.1	4.6	1.3	2.6
Benches	4.0	12.0	2.5	4.3
Chairs	2.1	4.0	6.7	13.5
Mirrors	.4	.3	1.0	1.2
Beds	3.4	4.1	3.3	5.2
Chests	2.2	2.7	1.0	1.2

Even given its many problems, this comparison should make us pause before we contrast a supposedly spartan rural China with European homes stuffed to the gills with new consumer goods.

Of course, similar numbers can have very different meanings. But here, too, I see broad similarities over the 16th - 18th centuries -- the urbanization of elites, decline of retinues as main mark of status, handbooks on consumption (early modern "dress for success" books), and a long series of sumptuary laws, all of which prove ineffective (and are abandoned in China after

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detail in Pomeranz, forthcoming, chapter 5.

[24] DeVries, 1975: Table 6-16; Buck Land Utilization, p. 456.

about 1550). There are, of course, differences, too -- in particular, I would argue the Qing don't undermine extended kinship the way growing European states do, so there may be less need to redefine oneself by displaying goods -- but again, the general patterns look more alike than different. (A more authoritative observer -- Peter Burke, a leading cultural historian of early modern European consumption, has also suggested, based on the Chinese and Japanese sources available in translation, that the similarities in this area are more striking than the differences.[25])

Production, Women's Earnings and Household Labor Allocation

Next, though, we need to look at production. It could be, after all, that despite this apparently high standard of living, Chinese institutions were such that commercialization, division of labor and so on were not likely to push standards of living up any further. Looking at land and labor markets for 18th century China and Western Europe, I don't find any convincing evidence that either one is clearly closer to neo-classical ideals than the other: land was generally less encumbered in China, and guild restrictions on artisanal activities far less important.[26] And while European capital markets were clearly better developed for

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[25]Burke 1993: 158.

[26]I compare these at much greater length in Chapter 2 of Pomeranz, forthcoming.

the amassing of really large sums of capital, the relevance of this to most productive activity prior to the railroad era is pretty limited. Chinese interest rates were higher, probably in large part because penalties for default were less severe; but this combination of higher rates and lower risk may well have been preferred by the millions of rural households who made most of the investments in new equipment for both agriculture and proto-industry. (Mechanized industry represented such a breakthrough that it would have been profitable even at interest rates much higher than those in either Europe or China.)

The best-known argument that the way in which the rural economy in China grew was fundamentally different from that in Europe is Philip Huang's argument about "involution." (Zhao Gang and Jack Goldstone have their own variations on this concept, but several major points are similar.)[27] Essentially, Huang claims that because land was so scarce relative to population, Chinese engaged in self-exploitation, working incredible hours to squeeze very marginal returns out of the land and stay one step ahead of population growth. But given (among other things) the vastly higher yields of rice as opposed to wheat, it is far from clear, as we will see, that land hunger was any worse in 18th century China than in most of Europe. Huang's more promising argument is that because Chinese women, in particular, were strongly

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[27]Zhao 1986; Goldstone, 1996.

discouraged from working outside the home, the marginal cost of their time was artificially low; and since they had to be fed anyway, and couldn't be sent out to do wage labor, their families pushed them into more and more hours of very low-return work that was for the market but based at home (mostly textile production) while never taking any steps to decrease their domestic burdens (steps that would have involved cash expenditures on finished goods for the family, and which would have cumulatively created a market for industrial growth). Thus here the intensification of labor was not accompanied by any meaningful re-allocation of time in response to the market, and did not create any market for those specializing in non-farm goods: consequently, it led to "involution," not development. [28]

It is not worth rehearsing here the numerous critiques of Huang's position, most of which I concur with.[29] For today's purposes, I would add just two things. First, the sorts of consumption figures I have suggested above are hard to square with the idea that Chinese were not getting any further above subsistence than before. Second, it turns out that Huang's estimates of the returns to spinning and weaving -- the basis of his argument that women's work earned a sub-subsistence wage -- are based on data from a very atypical year: one in which cotton

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[28]Huang 1990: 91, 110.

[29]See Wong 1991 for a good example.

cloth prices reached one of their two lowest points in the entire 1450-1850 period, while raw cotton prices were relatively high.[30] When I recalculated earnings for weaving and spinning using the same estimates of physical productivity as Huang, but what seem to me to have been more typical mid-18th century prices, the results look very different indeed: the basis for these estimates is discussed in more detail in Appendix E.

The potential earnings of spinners still come out quite low, but as Huang himself notes, this was work mostly done by young girls, rather than adult women -- at least in the Lower Yangzi -- and even the most pessimistic scenario yields enough earnings from 210 days of a year work to feed such a person all year round (20th century data, the earliest we have, suggests a work schedule of 300 days a year[31]). More optimistic scenarios yield enough earnings for an adult woman to feed herself, and perhaps even a couple of small children. For a hypothetical woman who first spun cotton into yarn and then wove it herself, the same 210 days of labor would yield about 12 taels of income per year. At mid-century rice prices, this would 7.2 shi of rice: almost 3 times the typical consumption of an adult female. To create another standard of comparison, I assumed that a male agricultural laborer of the period could have counted on 12

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[30]Zhang 1988:207-8; compare Huang 1990: 84-86.

[31]Xu Xinwu 1988:469

months a year of work at the monthly rates for this period quoted by Zhao Gang in his article on Chinese wages, and that in addition to the cash wages Zhao reports, such workers would have received all their meals every day of the year. (This is surely a generous assumption, though we know that wages included some food, which Zhao does not mention in his figures.) Even with these assumptions, I come up with a range for male farm-workers' wages of 10.4 to 13.4 taels per year (including food): this would place the earnings of rural women precisely in the middle of the range of male earnings.

In short, whatever other effects the culturally-specific features of Chinese patriarchy may have had, it appears that, at least in this period, women 's earnings more closely approximated men's than was the case in Europe.[32] Thus, there was every reason for Chinese families to consider the opportunity costs of both men's and women's time in making their purchases, and there is every reason to think that they did: anecdotal evidence suggests that more and more families turned to buying rather than making their own candles, specialty foods, and so on. So to a rising standard of living and increased "consumerism" we add, at least provisionally, an equally calculating approach to the deployment of the family's cash and labor time in order to acquire this growing bundle of goods and services. In short, I would argue,

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[32]For English data see Horrell and Humphries 1995: 102-3.

the picture looks very much like that of the more advanced parts of Western Europe, on both the production and the consumption sides.

But of course the resemblance doesn't last: China's industrious revolution does not lead to an industrial revolution. In the 150 years after 1750, there's an explosion of population growth, per capita consumption, and a much greater intensification of work in Europe, while in China, population growth slows significantly after 1800 (or perhaps 1820), further intensification of work is hard to document, and per capita non-grain consumption declines -- 1900 figures for cloth, sugar, and tea are all way below even my most conservative estimates for 1750. [33] Moreover, this decline in Chinese consumption occurs without much comment -- which would be inconceivable if the same sort of thing had happened in Europe, and might seem to suggest that either my figures were wrong in the first place or that people had not actually developed much attachment to these new goods. So what's going on?

Ecological Constraints? Energy, Fiber, and Trade

Much of the difference is, I think, ultimately, ecological -- but not because, as some people have suggested, the most

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[33]See, for instance, the estimate of roughly 2.2 pounds of sugar consumption per capita for the 1930's cited by Daniels 1996:85. Chang (1955:303) cites a 1930's estimate for tea consumption of 1.3 pounds, which would be much higher than my estimate for 1840; but the 1840 estimate, because it counts only tea that entered long-distance trade and paid internal customs, is surely an under-estimate.

developed parts of China were "over-populated." If over-population means the inability to reproduce what was, for the time an acceptable living standard without doing immediately threatening ecological damage, then 18th century China was no stronger or weaker a candidate for this designation than Europe. As we've seen, life expectancy and grain consumption were similar (if not, indeed, higher in China) and other kinds of consumption were probably comparable as well. And as we'll soon see, it is not clear which end of Eurasia had the more serious ecological problems. Rather, Malthusian pressures seem to have been about equally relevant to both ends of Eurasia down to about 1800, and I want to briefly review them in terms of Malthus' four necessities that compete for land: food, fuel, fiber, and building materials.

In neither place do we see signs of an immediate shortfall in food production, though I would argue that at least for England, by the late 18th century there was not much capacity left to expand agricultural production further without either exhausting the soil or implementing new techniques that were still unknown at the time (e.g tapping mineral sources of fertilizer). Much of mainland Europe still had lots of slack capacity, thanks to institutions that encouraged too much fallowing, delayed the draining of swamps, etc., but not Britain; and in fact, agricultural yields there changed very little between 1750 and

1850.[34] Interestingly, the little bits of data I can pull together suggest that even in dry-farming North China (generally a much more vulnerable ecosystem than the South) the nutrient balances of food-crop farming were more favorable than in England circa 1800. (This was probably not true, though, for the portion of North China's land that grew cotton -- about which more later.) And in the rice-growing parts of China, there was still quite a bit of room to expand yields with known techniques and without facing soil exhaustion.

For both fuel and building materials, the key question is deforestation. Here we might assume that China would be a lot worse off than Europe, given its denser population and its horrible deforestation in the late 19th and 20th centuries: but interestingly, this seems not to have been the case circa 1750 or even 1800. Britain already had severe wood shortages in the 17th century, as did Northern Italy; by the end of the 18th century, Britain was down to perhaps 5% forest cover, and the rest of "insular and peninsular Europe" is in the 10-15% range. (Central and Eastern Europe were far better off, of course).[35] Even France, which was relatively well-forested by Western European standards was about 16% forest in 1789 -- particularly striking when one compares that figure to about 33% 2 centuries earlier,

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[34]Thompson 1989: 189, 193; Clark, 1991: 456-9; B. Thomas 1985: 145-6.

[35]Williams 1990: 180-181.

and notes that population growth in between had not been nearly as rapid as what was to follow.[36] As we'll see in a minute, this meant that even if not a stick of wood was ever wasted, France by 1789 would have needed about 90% of the annual growth of its trees just to meet the minimum heating and cooking needs of its inhabitants, leaving precious little even for building, much less for expanding fuel-hungry industries like iron forges (which often functioned only a few weeks a year for lack of fuel[37]) or even the production of dyes.

For China proper we know that deforestation was disastrous by 1900, and we have one estimate for 1700 (by Ling Daxie, whose numbers seem generally plausible, but who unfortunately doesn't explain how he derived them) which comes out to a perfectly acceptable 37% forest cover. The issue then, is how and when we got from A to B, how the pattern varied across the country, and how much fuel and building material people could have used at any particular time and place without making unsustainable demands on their trees. We can't know for sure, but we can tell a few things. First, even in the extremely densely populated Yangzi Valley, complaints about the ecological effects of people clearing the highlands are very rare before about 1820: what we get before that are plenty of complaints, but they're almost all

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[36]Cooper 1985: 139 n. 2.

[37]Braudel 1982 I:367.

about the alleged rowdiness of the people involved, not their effects on trees or hillsides. And while George Staunton, traveling along the North China Grand Canal in 1793 (through what became one of China's most deforested areas a century later) noted that trees were a bit thin, he also noted that certain practices were only common "when fuel was scarce." [38] He also noted that trees lined the banks of the Canal itself for its entire length. While those trees aren't so numerous themselves, the fact that they didn't get cut down is significant -- security was minimal, and in the 20th century, even with far greater security efforts, the government was completely unable to stop the cutting of these trees by fuel-hungry peasants.[39]

More quantitatively, I've been able to do a rough reconstruction of land use for SW Shandong circa 1800 -- an area that's particularly interesting because it's quite densely populated but not rich enough to import timber, and because by the 20th century it was an ecological disaster area. (In the 1930s it had about 4% forest cover, and an annual sustainable fuel supply (using both wood and crop residues) below that of the contemporary Sahel, and less than 1/3 of what the Asian Development Bank considers an absolute minimum for subsistence.) It is therefore of some interest that, despite making every

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[38]Staunton 1801 II:141.

[39]Staunton 1801 II: 142; Pomeranz: 1993: 123-7; more details in Pomeranz 1988: Appendix F.

effort I could to make the 1800 situation look bad, it comes out looking almost exactly the same as that for France: 13% forest cover and a sustainable fuel supply per year about 20% above probable minimum needs. [40] Obviously this meant great hardship for many people, since distribution was not even and since much wood could not be used for fuel, but these things were likely just as true of France; and this is an area chosen in part because it seemed so likely to be one of China's ecological disaster areas.

But what of still more densely populated rice-growing China? Unfortunately, calculations are impossible for the Lower Yangzi, since this area had huge but unmeasured timber imports in the 18th century. Calculations are, however, possible for Lingnan, China's second most developed macro-region (focused on Canton). Lingnan is in some ways a good match for France: it's about 70% of France's land area, and had 17.5 million people in 1753, rising to 30 million in 1853. The figures in the following tables tell the story. Lingnan's forest cover even in 1853 was considerably higher than France in 1789; and though a far denser population was making claims on those trees, available wood per capita was double French levels in 1793, and still above France's 1789 levels in 1853. And thanks to a milder climate, more efficient cooking methods, and the burning of crop residues, the

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[40]Pomeranz 1993: 124-5; Pomeranz 1995: 7-11; also see Appendix B.

difference in wood available for non-fuel uses (assuming fuel needs were met first) was enormous: 6 times France's 1789 per capita levels in 1793 and still more than double France's 1789 levels in 1853. So despite its denser population, various Chinese efficiencies seem again to suggest that it may have faced less "Malthusian" stress than Europe circa 1800. The overall figures look something like this:

A few examples of ecological comparisons for parts of China and Europe, ca. 1800

A) Soil fertility and nitrogen flux comparisons: North China and England ca. 1800.

Total wheat yields over 6 years:
England 2,092 kg/acre North China 1,836 kg/acre
(Note: If one adds the 3 soybean crops on the North China plot, versus 2 clover crops for the British crop, the North China land is probably a better total food producer.)

Nitrogen depletion by wheat crops:
England 44.77 kg/acre North China 42.49 kg/acre

Nitrogen added to soil by manuring:
England: 4,000-5,600 kg/cropped acre X .6% - 4.9% Nitrogen content (assuming most manure from cows)
North China: 5,600-8,900 kg/cropped acre X 2.0 -7.5% Nitrogen content (assuming mostly pigs)
(Note: percentage nitrogen content are for fresh manure, and decline sharply with time. Since North China farmers tended to add little bits of manure every few days, while English farmers more often did a massive application of fertilizer once or twice a year (using an animal-pulled cart to save labor), the Chinese fertilizer probably had an additional advantage not measured here.)

Nitrogen-fixing crops:
England: 2 crops of clover at an average of 60 kg N/acre
North China: 3 crops of soybeans at an average of 48 kg N/acre per crop.
(Note: very wide observed variation around mean for individual cases of both clover and soybeans -- relatively little is known about what determines these variations.)

B) Wood/fuel supply comparisons: Lingnan, France, and SW Shandong

Table 4-1

Date	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

Comparison: France ca. 1550: 33% forested. France ca. 1789 16% forested (little further decline after that). SW Shandong ca. 1800: at least 13% forested.

Table 4-2

Date	Total Lingnan fuel supply per capita (if wood had no other uses)
1753	1.75 tce
1773	1.45 tce
1793	1.19 tce
1813	.99 tce
1833	.83 tce
1853	.70 tce

Comparison: France ca. 1789: .64 tce; SW Shandong ca. 1800: .62 tce.

Table 4-3

Date	Forest land (hectares)	Forest needed for fuel	Remaining	"Surplus" wood forest 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

Comparison: France ca. 1550: 3.6 tons; France ca. 1789 .29 tons.

For sources and methods of calculation, see Appendix C

But the other thing these tables suggest is that even with very efficient fuel-gathering and use, the growth of population and proto-industry were rapidly eroding any slack supplies of resources that one could imagine mobilizing. Timber prices in China (and in Europe and Japan) were high and rising in the 18th century,[41] and even if popular subsistence wasn't yet threatened, one can nonetheless see, with the benefit of hindsight, a serious bottleneck which would seem to bar a simultaneous further jump in both population and per capita energy use.

Now, the wood crisis, at least for England and Belgium, was greatly alleviated by the late 18th and 19th century coal boom, but we need to remember a few things about that. One is that this switch to mineral energy has limited relevance for most of Europe until quite far into the 19th century. Secondly, the rise of coal didn't end the wood shortage, but just kept it from being even worse -- the demand for paper, construction, and so on made European timber supplies even more scarce in 19th, until North American imports alleviated the pressure. (Forested acreage roughly leveled off in Europe by the mid-19th century, but even

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[41]Goldstone 1991: 186; Labrousse 1933 (1984): 343, 346-7, finding a larger price increase for fuel wood than for any other commodity in France between 1726 and 1789, with the rise continuing into the early 19th century.

that impressive achievement meant a steadily shrinking per capita wood supply.)

Most importantly for today's purposes, we need to remember that the rise of coal production, as Anthony Wrigley has pointed out, represents a genuine discontinuity of staggering dimensions. He conservatively calculates that the annual energy yield from British coal circa 1820 was the equivalent of what could have been sustainably harvested from 15,000,000 acres of forest.[42] Using more standard figures for energy yields per acre of forest, the same level of coal output becomes the equivalent of 21,000,00 "ghost acres": more than the total pasture and crop-land of 19th century Britain.

It's worth emphasizing that this breakthrough required a combination of technical innovation and geographic good fortune. Not only was the coal close to the ground, it was close to good transport and relatively close to London, which provided both a wealthy and fuel-short market, and a large number of skilled artisans who made the crucial improvements in precision boring for pumps, steam engines, and so on. By contrast, China's best coal deposits lay in Shaanxi, over 1,000 landlocked miles from The Yangzi Delta. Moreover, these mines posed a very different technical problem from that which the British faced: rather than constantly needing water pumped out (for which a coal-fired

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[42]Wrigley, 1988: 54-55.

steam-engine, which would later also solve the transport problem, was a great solution), they were so dry that they were always suffering explosions. Imagine Europe's coal in an equivalent place -- say, under the Carpathian mountains -- and it becomes a lot harder to imagine a smooth transition from proto-industrialization to industrialization and an escape from the limits of an organic economy; it becomes a lot easier to imagine a slow but steady mounting of ecological pressures eventually catching up with the gains that could be realized by increased division of labor without major energy breakthroughs. In short, it becomes possible to imagine Western Europe as a Lower Yangzi that didn't happen, rather than our more usual exercise of imagining China as a failed Europe.

And then finally, there's fiber, where the situation in the late 18th century looks almost as bad as fuel -- especially in Europe -- and which clearly had to be solved if far more people were going to not only wear more clothes, but export cloth to large portions of the globe in return for primary products. Raising wool simply takes up too much land, which was in demand for more intensive uses, to allow much further expansion in Europe. Flax is both very hard on the soil and very labor-intensive, a combination that made it a garden crop in much of Western Europe: i.e something grown on a small scale in peri-urban areas with lots of nightsoil and lots of labor. Parliament repeatedly enacted heavy subsidies for flax production

throughout the 17th and 18th centuries, and yet UK production rose very little, and continental production not much more (except in Russia, where the soil could be given a long rest after a couple of flax crops).[43] Matching the fiber supply that came from New World cotton by 1830 with domestic sources would have required a 30-fold increase in English flax production -- hardly a likely prospect given the failure of earlier incentive programs.

Cotton, which was the principal Asian fiber source, is not quite as labor intensive as flax, but like flax it is very hard on the soil. Most of the massive amounts of soybean cake that the Lower Yangzi imported from the Manchurian frontier in the 18th century went to sustain its cotton production; the same is true of the massive increase in fishing by the Japanese in the late 18th and 19th centuries. The European solution, of course, will be to turn to cotton, too -- not by importing fertilizer and growing it at home, but by importing the cotton itself, mostly from the New World.

This gets us, by a circuitous route, to something I've thus far neglected, but that is central to my argument: the importance of long-distance trade. As densely populated cores faced shortages of various land-intensive products, they sought

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[43]Warden 1967:32-40; Grantham, 1989a: 13-14; Blum 1961: 333-4. Note that Warden, writing in 1864 (1967:724) despaired of increasing British flax imports from the Continent.

more of them by trading with less densely populated areas that could produce surpluses of timber, cattle, grain or whatever, and which did not produce very much of what the more developed areas had in abundance -- manufactures, mostly textiles. Thus England and the Netherlands turn to the Baltic trade and later the New World; and the Lower Yangzi imports rice and timber from the Chinese interior, soybeans (mostly for fertilizer) from Manchuria, and raw cotton from North China. And The Yangzi Delta's trade for these primary products dwarfed anything elsewhere in the 18th century world.[44]) Lingnan, China's second most developed region, was beginning to follow the same pattern, with rice and timber imports from the interior, raw cotton from further North and (to some extent) from India, and growing volumes of rice and timber-based naval stores from Southeast Asia, too.

But this kind of trade also has limits, because it tends to run into one of two problems: the first more characteristic of East Asia in this period, the second of Europe. If families in

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[44]Food imports from the Middle Yangzi alone fed approximately 6,000,000 people per year in the Lower Yangzi, and the soybeans that the Lower Yangzi imported could have fed another 3-4,000,000 had most of them not been used as fertilizer. Even Shandong, a not particularly commercialized province with perhaps 23,000,000 people in 1800 (Huang 1985: 322) imported enough food to feed 700,000-1,000,000 people, and exported a like amount. By contrast, the Baltic grain trade fed about 600,000 people a year at its peak, and all of Europe's long distance grain trade put together fed at most 2,500,000 people at its pre-1800 peak. For numbers on these different flows see DeVries 1976: 17, 56; Braudel 1981: 127; Adachi, 1978: ;Wu 1985: 277; Xu 1995: 86; Marks 1991: 76-9; Wang 1989: 423-430; Lu 1992: 493.

the peripheral areas are more or less free to allocate their own labor, then it's quite likely that a) the export boom and commercialization will touch off population growth (both natural increase and immigration), and b)as the best land fills up (or most accessible forests get cut down, or whatever) people will switch at least some of their labor to handicrafts: i.e. there will be proto-industrialization, reducing raw materials surpluses for export and reducing demand for imported manufactures. In an era in which technology was not generally embodied in very expensive capital goods, and in which high transport costs on bulky items provided some natural protection for infant industries, this sort of import substitution was a much more natural process than in the 20th century.

In short, as population grows in the primary products exporting area (and the export boom itself could easily increase population growth by raising incomes, creating demand for wage labor that allows more early marriages, promoting immigration, etc.) there are reasons for such a region to follow its proto-industrial trading partner into handicraft production, as long as its laborers are relatively free to allocate their own time (in other words to have their own "industrious revolution"). The dynamic has been nicely sketched in a model by Joel Mokyr[45]:

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[45]Mokyr 1976: 132-164.

Essentially, the argument is that as the marginal productivity of labor in agriculture falls (in part due to land being finite), it eventually crosses the flat line for marginal productivity in handicraft industry: and beyond that point, additional labor will go into proto-industry, with the products sold to buy food if necessary. At least in theory, the model works either for an individual household or for a region as a whole. But if applied to a region, this model, to which I'll return later, assumes that the price of the food (or other primary product) being imported by the area that's increasingly specializing in handicrafts is not affected by this area's increased demand for that good, nor the price of the handicrafts it exports affected by the fact that it is increasing its exports of those: in other words, he assumes that the relevant products trade on a market large enough so that the "small country assumption" holds. If that assumption doesn't hold, then the marginal productivity of handicraft labor falls rather than being flat, the cash returns to marginal labor inputs in agriculture fall more slowly than the physical returns, and we get a very different picture.

While Mokyr's model was designed to describe a "core" region (the Netherlands and Belgium) there's nothing to prevent this process from re-occurring in what had been a primary-products-exporting hinterland. And this is precisely what happened in much of the Chinese interior in the late 18th and

early 19th century. The Middle and Upper Yangzi grew very rapidly,[46] eating into their rice and timber surpluses, and some of their population growth became a proto-industrial work force, making coarse cloth and cutting into the Lower Yangzi's export markets. In North China, population growth was so rapid that it probably required the re-conversion of some cash crop land to subsistence production (though this is not completely clear -see Appendix F); and at any rate, much more of the region's huge raw cotton crop was spun and woven locally, rather than sent south for processing.

In theory, of course, increases in the price of the primary products exported by a periphery could postpone the point at which marginal returns to this activity sink low enough to spark a move into proto-industry: and it is somewhat puzzling that rice prices didn't rise even faster in late 18th and early 19th century China.[47] But for whatever reason, the diminishing physical returns to labor in primary product production eventually did lead to the expected switch of labor into proto-industry in large portions of the Chinese interior, creating serious problems in coastal core areas. While at least to some

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[46]Skinner 1977a: 213; he then notes elsewhere the likelihood that this growth reduced the long-distance trade in rice between the 18th and 20th centuries.

[47]I consider this issue at some length in Pomeranz forthcoming (Chapter 5), looking at a wide variety of factors -- from transport difficulties to preferred gender roles -- none of which seems fully satisfactory.

extent, The Yangzi Delta compensated by finding new and more remote markets (in Manchuria, Southeast Asia, and to some extent in the West) and by concentrating more heavily on fancier fabrics (moving up the value-added ladder like an established industrial area should) it clearly faced serious economic pressures that inhibited its further specialization in proto-industry. Though spotty price data make all calculations shaky, my best estimate is that the rice-buying power of our hypothetical Yangzi Delta weaver/spinner fell by 22-42% between 1750 and 1800 (with the upper end of the range more likely) and by 32-52% between 1750 and 1840. (See Appendix E.) Meanwhile, population growth in the Lower Yangzi was close to zero over this century, while China as a whole close to doubled. (The earnings decline in Lingnan was less step, because transportation improvements kept the price of imported raw cotton down -- but even here, the spinner/weaver's earnings in rice probably fell by at least 20%-30%, while population growth fell far short of the national average.)

It seems clear that, as China's peripheries filled up, its most advanced areas became unable to grow much in size, intensify their specialization in non-farm activities (which would have been necessary to population growth, given very scarce land in these cores) or increase their per-capita consumption any further. There is even some (though slight) evidence for de-industrialization in the Yangzi Delta in response to these price shifts.

In addition to the possibility that price rises for raw materials could have maintained the older core-periphery division of labor for longer, another possible alternative to the scenario I've sketched involves migration.[48] People could have migrated from the peripheries to The Yangzi Delta as those peripheries filled up -- indeed they should have, given the higher standard of living there. Presumably, this should not only have relieved some of the ecological stress in peripheries and made it possible for them to sustain high levels of primary product exports for longer; it should have lowered Yangzi Delta wages, enabling its manufactured exports to hold onto a larger share of peripheral markets.

Here, however, I think specifically Chinese institutions and cultural values probably did matter. Spinning and weaving were overwhelmingly female activities, and single women did not undertake long-distance (or usually even short-distance) migration alone. When women moved, it was as part of households headed by men; men who, for the most part, had both their human capital and their personal identity invested in farming skills. Moreover, most industry remained rural, and there were few places to live in the countryside for somebody who had neither kin to move in with nor access to land; this was not a landscape with

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[48]I thank Jean-Laurent Rosenthal for bringing this to my attention

great landlords looking to settle and hire "cottagers." With land in core areas expensive to buy, and a substantial deposit often required even to rent, it is not surprising that few poor couples from the interior moved towards the coast as long as they had access to any sort of plot. Substantial and sustained migrations of poor people towards areas of plentiful capital (as opposed to those of plentiful land) would begin only with the rise of urban factory industry (often accompanied by dormitories, especially for single female workers) in the 20th century. (It was then interrupted again by the PRC's virtual ban on migration in the 1950s-1980s.)

On the other hand, Chinese institutions (including government loans of seed, animals, etc.) had done an excellent job of facilitating migrations of poor people towards areas with better land to labor ratios throughout the 18th and early 19th centuries: much better than in Europe, where institutional arrangements made land-rich Eastern and Central Europe uninviting to any Western European seeking a better life, while high migration costs limited poor people's migration to the pre-1800 New World to those willing to accept indentures on terms that land-owners found competitive with the chance to purchase slaves. As long as there was land to go to, facilitating those flows probably mattered far more to integrating labor markets than any flows towards rich areas such as the Yangzi Delta would have (and we should of course remember that labor markets were far

from integrated across Europe in either the 18th or 19th century): thus the conclusion to draw is not that Chinese labor markets in general were peculiarly poorly integrated. But once those frontiers were largely gone (except in Manchuria) the difficulties of moving towards manufacturing or service jobs in highly developed regions became more significant: and meanwhile the strong cultural preference for a "man plows, woman weaves" household had helped insure that migrations to the frontier had led to proto-industrial as well as agricultural development there.

This filling up of China's peripheries also helps explains how early 20th century consumption figures could be so much lower than those I've generated for the mid-18th century without many 19th century observers remarking on a sharp fall in living standards. There probably wasn't much decline in most areas (the North and Northwest being possible exceptions): what happened instead was that the weight of different areas in national aggregates is shifted. The Yangzi Delta alone was probably somewhere between 18 and 21% of the Chinese population in 1750, but it was less than 9% by 1850 and under 7% by 1950. The three most prosperous of Skinner's 8 Chinese macro-regions were over 40% of the population in 1750 and around 25% in 1843.[49] And if we assume, for instance, that those 3 macro-regions accounted for

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[49]Calculated based on Skinner 1977:213; Skinner 1987: 67-76; and Liang 1980: 395-413.

the overwhelming majority of the country's sugar consumption in the mid-18th century -- which seems quite likely -- the shift in relative population alone would be enough to account for almost all of the difference between my mid-18th century figures and those in the Buck surveys of the 1930s.[50] The story is not as simple for cotton: to explain the fall in cloth consumption there one does have to assume an actual fall in raw cotton output in one major producing region, namely North China. But such a fall is perfectly consistent with other data.[51] Moreover, it also tends to confirm that what choked off further growth in the Yangzi Delta and the other Chinese cores was nothing internal. Instead, the source of stagnation in cores was growth in the hinterlands that decreased their primary products exports, and meant that the "small country assumption" ceased to hold for the parts of China that imported primary products: their demand for primary products was no longer small enough relative to the quantity available for export in their "world" to be absorbed without affecting the price. In the hinterlands, where proto-industrialization was happening, the standard of living may have continued to creep upwards (though this is more likely in the

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[50]The effect of the regional redistribution of population alone would lower an average consumption of 4.3 pounds to about 2.5, and Buck reported average consumption of centrifugal sugar of 2.2 pounds. Sugar processed in other ways, plus what was eaten raw in producing areas (where sucking on cane was common) could easily make up the remaining difference.

[51]See Appendix F.

Middle and Upper Yangzi than in North China[52]) -- but it was still far short of Yangzi Delta standards, and it came to have much more weight in Chinese aggregates. The effect on China-wide numbers is somewhat like what would have happened to European aggregates if Northwest European population had been flat from 1750 to 1850 while population in Eastern and Southern Europe had soared, instead of vice versa.

Contingency and "the European Miracle"

With that in mind, let's turn back to Northwestern Europe now and think some more about how it was able to escape the Yangzi Delta's fate, combining massive further increases in population, specialization in industry, and per capita consumption in the 19th century. Much of that, of course, was a matter of technological change -- particularly coal, which relaxed the land constraint in a fundamental way that no other innovation did until the late 19th century breakthroughs in chemicals and electricity. But another part, I'd suggest -- probably more important than the small changes in many other sectors that have received increasing attention in the scholarship of recent decades -- lay in the ways that its relations with its peripheries differed from those of China's most advanced region with their peripheries.

Western Europe's early modern trade with Eastern Europe did

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[52]Compare Fang 1995 with Huang 1985, Kraus 1968 or Pomeranz 1993.

not face the same threats of rising population and import substitution in the periphery that eventually choked off the Yangzi Delta's growth. Thanks to Eastern European serfdom and other institutions that hobbled agricultural improvement, population rose a lot more slowly than one would expect in a free labor periphery: few people would migrate in from crowded but freer areas, and there wasn't much of the wage labor that allowed people elsewhere to marry without waiting to inherit land, thus raising population. Nor were people free to switch into proto-industrial activity on any great scale. So here you didn't get growth and import substitution squeezing raw materials exports. But on the other hand, these same institutions limited the ability to respond to export demand in the first place; they also meant that the region didn't develop a very big market for goods from the core, because much of the population was very poor and/or outside the cash economy (even if their products weren't). Thus both supply and demand factors militated against trade between Eastern and Western Europe expanding as rapidly as Western needs for land-intensive products; and indeed, the Baltic trade did level off after 1650, at levels a fraction of those in China's long-distance staple trades.[53] But this blockage of further development in Eastern Europe did leave slack export capacity waiting there to be activated when institutions changed

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[53]Pach 1990:186-8, 190.

and/or technological change and price shifts made the logic of becoming the West's granary and buying its manufactures irresistible: this eventually happened, but mostly after the middle of the 19th century.[54]

And in the century or so before 1860, the New World did a great deal to ease pressure on the land in Northwest Europe: something facilitated by both its natural bounty and its unusual history. Smallpox and other disasters had depopulated the region, and much of labor force was replaced by slaves -- who were purchased from abroad at a cost which consumed about 1/4 of the annual export earnings of the late 18th century Caribbean and Brazil.[55] Moreover, many of these slaves were either forbidden or unable to engage in much subsistence production (unlike coerced cash crop workers in the Old World who met most of their own subsistence needs). Thus despite the slaves' poverty, their needs created a significant market for items of daily use: coarse cloth, grains, etc. Consequently, the circum-Caribbean slave region (from Brazil to US south) became the first periphery to look like a modern one -- having large bills to pay for the import of capital goods (in this case human, kidnaped, capital

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[54]B. Thomas 1985:

[55]Calculations based on slave prices from Miller 1986:70; numbers of slaves from Curtin 1969: 216 and Ludwig 1985: 314; Caribbean export figures from Deerr 1949-50: 193-203 (British Caribbean) and 235-242 (French Caribbean); plus British import data from Mitchell 1988: 462-4; Brazilian export figures for 1821-6 from Ludwig 1985: 107, and for 1796 and 1806 from Morineau 1985: 177-8.

goods) and a pretty large market for mass consumer goods (e.g. cheap cloth for slaves). This meant that, unlike Old World peripheries, the New World kept expanding as a source of land-intensive exports, and allowed Europe to become specialized in manufacturing as never before. (Manufactured goods were the bulk of the goods used to buy slaves in Africa, and were also sold to North America, which generated much of the needed foreign exchange for its purchases by selling grain and timber to Caribbean plantations.[56])

In the long run, exports from free North America would be even more significant, but that's a later phenomenon -- and it's worth remembering that, as McCusker and Menard show, North America was also settled by a process which for quite a while tied immigration to the capacity to export.[57] What I'd like to emphasize today is that the quantities of New World commodities helping to relieve land shortages in industrializing Britain were vast, even before the great mid-19th century rush of grain. Replacing Britain's 1801 consumption of Caribbean sugar with locally-grown calories would have required an additional 850,000 to 1.2 million acres of top-yielding English wheat land; by 1831 (still before the great fall in sugar prices and quintupling of per-capita consumption that followed it) the figure is about 1.2

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[56]Klein 1991: 291; Shepherd and Walton 1972: 43-4; Richardson, 1987: 765-6.

[57]McCusker and Menard 1985: 18, 23, 28-30.

to 1.6 million. Replacing Britain's American cotton imports of 1815 with wool would have required setting aside 9,000,000 acres. To match 1830 imports would have required over 23,000,000 acres: more than either Britain's total pasture and crop land[58] or Wrigley's roughly contemporaneous figure for the impact of coal. (See Appendix D for derivation of all figures on "ghost acreage.")

In a sense, then, contrary to conventional wisdom, Western Europe got an extended window in which to find its way out of certain resource constraints partly because markets didn't work in its peripheries as well as they did in East Asia, thanks to bound labor, colonial monopolies, etc. But more important -- at least for present purposes -- than thinking about the role of a particular labor regime or legislation is to consider the importance of the New World over the longer haul.

Land-saving New World imports would only grow in significance after the initial stages of the Industrial Revolution: for decades they kept pace quite nicely with the progress of mineral-based energy. True, Britain's coal output would increase 14 times from 1815-1900,[59] but its sugar imports increased roughly 11-fold over the same period,[60] and its cotton

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[58]About 18,000,000 acres; see Mitchell 1988: 186.

[59]Mitchell, p. 247.

[60]Calculated based on Mitchell, pp. 709-711,

imports a stunning 20 times.[61] Meanwhile it also began to live off American grain, beef, and other primary products; lumber imports soared; and the New World, at last, also became a significant outlet -- in fact a huge one -- for surplus population from various parts of Europe. As these migrants brought with them European tastes, as technological progress created numerous mechanical capital goods (rather than the enslaved humanones of an earlier era) in high demand across the Atlantic, and as independent New World governments emerged with their own reasons for paying the overhead costs of pushing back the frontier, the various peculiar institutions once important to creating a flow of land-intensive New World exports were no longer important, and a vastly larger flow could occur through more market-driven mechanisms; but it was not insignificant that the early colonial enterprise had taken shape through very different mechanisms.

"Ghost Acres," Substitutability, and Discontinuity

At this point, many readers are likely to raise at least one of three objections -- all of which, in one form or another, hinge on the notion that no one resource is "vital": there is more than one way to skin a cat, and as scarcity induces price shifts, people can find ways to substitute for any particular resource. Thus, I may seem to be 1)placing too much emphasis on

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[61]Compare Farnie 1979: 7; Mitchell 1988: 178-9 (check pgs) and Bruchey 1967: Table 2-A.

coal; 2) forgetting that, however useful land-intensive New World products may have been, the majority of such resources still came from within Europe, so that I am over-emphasizing the exotic. But there are, I think, answers to both of these. Lastly, 3) I may appear to be issuing a "Club of Rome" report for 1790: suggesting that without the New World and coal, Europe was headed for a Malthusian crisis, when in fact it probably would have adjusted through some combination of lower fertility, lower consumption, and the adoption of various land and energy saving techniques. I agree that this would have been a far more likely outcome than actual catastrophe, though there were signs of serious soil exhaustion and other problems in various regions.[62] I would, however, argue that the ecologically viable techniques available in the absence of New World resources and such modern inputs as chemical fertilizer (itself dependent on cheap fossil fuels) were sufficiently labor-intesnive that their widespread adoption would have made 19th century European economic history very different -- more like that of the richer parts of East Asia, or some unusual European cases like Denmark, than like England. Let us consider each of these objections in turn.

Coal was, of course, central to earlier views of the industrial revolution. Its prominence in these accounts was

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[62]See Kjaergaard 1994 (Denmark); Ambrosoli 1997 (parts of England); Brookfield and Blaikie (parts of France and Germany). I take up the issue at more length in Pomeranz, forthcoming, chapter 5.

matched only by cotton, iron, steel and railways, and the last 3 of these 4 other main sectors were themselves dependent on coal. In more recent literature, coal has more often been treated as just one of many expanding sectors. People have noted, for instance, that more early factories were powered by water than by coal, and that most of England's coal was used for the unglamourous and not particularly innovative tasks of home heating and cooking. E.A. Wrigley has re-asserted the centrality of coal by calculating that it would have taken 15,000,000 acres of woodland (21,000,00 had he used a less conservative conversion) to match England's annual energy yield from coal by 1815,[63] but this figure cannot be taken as a literal counter factual statement. In the absence of the coal boom, England would not have consumed that much additional wood (nor does Wrigley say it would have) since it didn't have it; nor can we say for sure that some specific number of forges would have closed, glass gone unmade or homes unheated. The adjustments would instead have involved some complex combination of people being colder, buying more clothes, producing less iron, and so on, and we cannot say for certain that particular lines of industrial advance -- much less industrialization more generally -- would have ground to a halt without coal.

Nonetheless, at least a partial return to the earlier emphasis

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[63]Wrigley 1988: ; for more on he conversion issue, see Chapter 6, pp.

on coal seems to me warranted, both for Wrigley's reasons and for others. Water may for a time have powered more mills than coal, but it was geographically restricted, non-portable, and often only intermittently available. Moreover, it was no substitute for coal combustion in all sorts of chemical and physical processes (from brewing to metallurgy to dye-making), nor in the land transport revolution that gave such a boost to the division of labor. In the critical iron sector (and thus also steel, railways, and so on) it is hard to see how any adequate alternative to fossil fuels could have been found at any price.

True, Hammersley has made a strong case that -- contrary to some earlier claims -- England's iron industry in the 1660-1760 period did not contract, and probably did not suffer from a critical shortage of affordable fuel: he estimates that forest covering 2% of the land of England and Wales would have sufficed to supply England's iron industry in this period.[64] However, we should remember that Britain was down to 5-10% tree cover by the end of the 18th century;[65] thus even under ideal conditions, the maximum possible output of charcoal pig iron in Britain would have been roughly 87,500-175,000 tons. But in fact as early as 1820, British output had reached 400,000 tons.[66] And quite aside

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[64]Hammersley 1973: 602-7; see also Flinn 1978: 139-164.

[65]Williams 1990: 180-181.

[66]Harris 1988: 25, 56. Flinn 1978: 145 also points out that without coal charcoal shortages could have hobbled the growth of

from the need to conserve some wood for other purposes, it was simply not feasible to mobilize all wood for charcoal iron-making. Forges also needed to be close to both iron and water power (to drive the bellows), and charcoal for iron production could not be transported more than 10-12 miles (preferably under 5): the furnaces needed large chunks of charcoal, but it tended to break into small bits (or even dust) when moved very far.[67] So while Hammersley and others do suggest that 1760 levels of iron production need not have caused or been constrained by an "energy crisis" -- and a fortiori that we cannot invoke deforestation as the cause of the breakthrough to coal-based iron -- the same figures show that without coal the iron industry could not have grown much further. Geography does not explain innovation, but it was necessary for those innovations to have a transformative effect.

In most other British industries, development of coal-based processes came earlier than in iron-making,[68] and so is further separated in time from the enormous expansion of coal output in the 19th century due in large part to the availability of steam engines to pump the mines. Thus the case that the coal/steam

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English iron production after 1750; his emphasis is on showing that the earlier rate of output was sustainable, and that there was no worsening charcola crisis that caused the development of coal-based iron-making.

[67]Harris 1988: 26; Flinn 1957:150.

[68]Harris 1988:26.

engine boom was essential is necessarily weaker in these cases. Still it is worth noting that even if coal was initially used mostly for home heating, whatever was burned for industrial uses would have been far more expensive had coal been unavailable. In fact, real English charcoal prices seem to have stabilized in the 1700-1750 period after soaring for much of the previous 150 years, though all wood and charcoal prices must be treated with considerable caution.[69] And even before steam engines allowed deeper mining, cheap coal was gradually becoming more widely available thanks to incremental improvements in transport. Real charcoal prices then rose again after 1750, probably due to increased iron output.[70] Vastly more expensive fuel would certainly have put a crimp in the quantitative expansion of many industries, and it is not hard to see it limiting innovation as well: even the steam engine itself was at first sufficiently bulky, fuel-hungry and dangerous that experimenting with it might not have seemed worth it if fuel had been much more expensive and if the coal mines themselves had not offered an ideal place to use steam engines.

Moreover, though it would be excessively Whiggish to see in

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[69] Hammersley 1973: 608-610 points out that high transport costs made wood prices vary enormously by locality, and often one seller or buyer dominated a particular market, making prices a poor guide to scarcity. Moreover, charcoal prices included a significant labor cost, and so were only loosely related to wood prices.

[70] Flinn 1978: 143-5, 147-8; Hammersley 1973: 608-610.

the early 19th century coal boom all the ways in which cheap fossil fuels have eventually relaxed pressures from a finite land supply, (including the declining significance of land in farming itself thanks to energy-intensive fertilizers) it was clearly a crucial step on that path; water power, no matter how much the wheels were improved, simply did not have the same potential to provide energy inputs that would significantly outpace a rapidly growing population for decades to come, and lay the basis for relief of the land constraint through chemistry. Thus it seems sensible, after all, to look at the mining and the uses of coal as the most promising site for a European technological advantage that was purely home-grown, crucial to its 19th century economic divergence from the rest of the world, and (unlike, say, cotton spinning) not dependent for its full flowering on the simultaneous expansion of Europe's resource base to encompass large portions of other continents.

Similarly, one might object to the emphasis on New World imports on grounds which parallel a common response to older 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 sub-categories, 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 it seems more likely to me that New World <u>resources</u> were crucial than that New World profits were crucial: there were clearly alternate investments that could yield money, but 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 <u>always</u> substitutes for any particular thing, and markets <u>always</u> accurately measure the long-term 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% identical to those of pygmy chimps,[71] but few of us would want to 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%.

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 famous "chaos theory" example of a butterfly beating its wings in Africa and changing the weather in Greenland). Arguing for such occurences may cut against equilibrium-seeking models based on a world that conforms to linear differential equations, in which small differences should not create large and lasting divergences, and thus makes for an awkward marriage between economics and history.[72] They can also lead to intellectual anarchy. Explanations can become so cluttered that we can't 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

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[71]Diamond 1992: 23.

[72]For a similar point put in rather different terms (and with different implications developed) see McCloskey 1991.

size might suggest.

Arguing for such factors by making comparisons requires that the cases being considered are otherwise quite similar. History is never as neat as the chimpanzee/human case, in which 98.4 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 that: 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; and 4)the examples of core regions in China and 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 akin to imagining that with a slightly longer ecological window, India, China, or Japan would have produced an industrial revolution. (No place need have done so: another reason, I would argue, why asking "why wasn't England the Yangzi Delta?' may be a useful corrective to ideas derived from asking the opposite question.) 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 which actual people in somewhat similar circumstances made, and which had some real successes, but which would have taken Northwest Europe down a path that did not lead to anything like the British breakthrough. Indeed, 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 reasonable, rather than reckless invocation of the principle that not so large initial difference can lead to vastly larger future ones.

If 1750-1850 was a period in which the absence of coal and overseas resources could have led to a very different path, what might that path have looked like? In essence, I would argue, more like that of the advanced economic regions in East Asia. In making this suggestion, this paper parallels some recent work on

global development by Sugihara Kaoru[73] -- but also differs from him. Sugihara emphasizes, as I do, that the high population growth in East Asia between 1500 and 1800 should not be seen as a pathological thing which blocked "development," but, on the contrary, a market-driven "East Asian miracle" of supporting more people without depressing living standards, creating skills, and so on, comparable in importance (for, among other things, gross global product) to the "European miracle" of industrialization. And, like this work, Sugihara emphasizes both the high standard of living in 18th century Japan and (to a lesser extent) China, and the sophistication of institutions that produced many of the beneficial effects of markets without any precise analogue to the property rights legislation of the early modern West. He also argues -- a point beyond the scope of this paper, though not of this conference -- 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 product, not a simple diffusion of Western achievements. (In fact, he argue, the attempt to simply transplant Western ways has had rather poor results in many areas where the Western powers had more power to impose their ways than they ever had in East Asia.)

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[73]Sugihara 1996, 1997.

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 but for certain important and sharp discontinuities, based on both fossil fuels and access to New World resources, which together obviated the need to manage land intensively, Europe, too, could have wound up on an "East Asian, labor-intensive path. Indeed, there are many signs of such tendencies in 18th century Europe: in the decline of meat-eating through much of Europe from the late Middle Ages until the 19th century (Braudel 1981: 196); in certain aspects of English agriculture (Ambrosoli, 1996), proto-industry (Levine, 1978), and in almost everything about Denmark (Kjaergaard, 1984). This East-West difference was not essential, but highly contingent; take away the "resource shocks" of coal and the New World and it is not hard to imagine a much more labor-intensive world, in which far more people worked on the land, increasing yields while preserving fertility through more marling, more careful manuring, more gathering of crop residues and so on. Progress along such a path might well have maintained or even improved living standards somewhat, but it would not have brought Europe any closer to the energy-intensive,

capital-intensive world we are used to. Indeed, to the extent to which additional laborers on the land really were productive -- so that removing them from farm work would push up agricultural prices-- and to the extent that such labor-intensive "solutions" to land constraints gradually decrease the rewards accruing to anyone who solved the problem in a different way, they could well make breakthroughs like the one that we generally call the Industrial Revolution and the 19th century version of the Agricultural Revolution (see Thompson 1968) progressively less likely with time.

For another way of conceptualizing this possibility, let's return to Mokyr's "growing up model," and consider how it sets up the relationship between proto-industry, industry and labor supply. After rejecting many of the claims made for the contribution of proto-industrialization to the emergence of mechanized industry, Mokyr suggests that the most important reason why having extensive handicraft industries may have made it relatively easy to industrialize is that these industries served as a reservoir of what he calls "pseudo-surplus labor": workers who were ideally suited to become the first generation of factory operatives.

The availability of this particular labor pool is important for at least three reasons. First, despite numerous attempts to demonstrate the existence of "surplus labor" in agriculture according to Arthur Lewis' classic definition -- i.e. workers who

could be removed from that sector without appreciably affecting agricultural production[74]-- such labor has proved difficult to find, even in the 20th century "third world";[75] and clearly none of our cores could afford to have their agricultural output fall very much in the late 18th or early 19th century. Secondly, factories employing former proto-industrial workers have a distinct advantage. If we imagine a world in which factory workers were drawn out of agriculture, then even if demand for them did not push up the price of labor (in other words, if there was surplus labor in agriculture), there would certainly be no reason for that wage to fall; and as the diffusion of mass production techniques caused the price of the product made by the factory to fall, the firm would encounter declining profits, and might have difficulty expanding further. (Mokyr assumes, as is common in early industrialization, that the factory's wage bill is the largest part of its costs.) But if the labor pool for nascent industry includes proto-industrial workers who made the same product as the factory, then the same technological diffusion that places downward pressure on the factory's prices places severe downward pressure on their earnings; thus it lowers the wages the factory must pay recruits from this sector, and

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[74]Lewis 1954

[75]Schultz 1964: 61-70.

enables it to maintain higher profits for longer.[76] And, of course, proto-industrial workers often moved to the factory with some relevant skills, and/or had knowledge that made them ideally suited to figure out how to mechanize further parts of the production process.

Thus, it was a major asset for Europe that in the decades preceding industrialization proper they had been able to greatly increase proto-industrial capacity and "store" a growing part of their growing population in that sector: and that that pattern could continue in some places and some industries for several decades even after mechanized production was well-established in other activities and parts of the continent. But it is hard to imagine how that process would have continued in the industrializing parts of Europe without, say, the availability of New World cotton and later grain: in other words, had the "small country" assumption ceased to hold for them in their trade with their hinterlands in the same way that it ceased to hold for the Yangzi Delta and Lingnan.

Well, what do we make of all this? My point is not to revive old arguments about primitive accumulation overseas in financial terms --- it's pretty clear that the slow, unspectacular accumulation of profits from Europe's own farms and shops dwarfed those profits. Instead, I want to suggest that the

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[76]Mokyr 1976: 132-164.

processes that have best been captured in the recent literature on early modern growth and "how the West grew rich" are a central part of the story, but they're actually the parts that Europe shared with at least a couple of other parts of the early modern world. Moreover, those processes alone could as easily have led to a Lower Yangzi result (or for that matter a Dutch or Flemish result) as an English one: not because of limits to capital accumulation, but due to basic ecological realities, and to limits on the ability of labor and capital to substitute for land in the era before mineral energy, synthetic fertilizer, and the like. To explain the differences, it seems to me that we need to look at how those constraints were relaxed in one particular case. Part of the story -- which I have largely neglected here -- is technological innovation, and, because we cannot take that for granted, it makes little sense to argue that, if they had only had their own New Worlds, China or Japan would have their own industrial revolutions. But nonetheless, the new technologies of the 1750-1850 period do not seem sufficient, by themselves, to relax the land constraint enough to create self-sustaining growth; moreover,without the land-saving (but not very labor-using) windfalls from coal and the New World, one can imagine the focus of inventive efforts themselves being very different. Thus, I would argue that for understanding the "European miracle" (once we place it back in the 19th century, rather than earlier) it is worth looking again at some of the

foci of an earlier generation of scholarship -- coal, empire, English exceptionalism, and the discontinuity of the industrial revolution -- as they appear in a Chinese mirror.

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