THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

Economic History Working Papers No: 207/2014

Clarifying Data for Reciprocal Comparisons of Nutritional Standards of Living in England and the Yangtze Delta (Jiangnan), c.1644 – c.1840

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DEPARTMENT OF ECONOMIC HISTORY

WORKING PAPERS

NO. 207- AUGUST 2014

Clarifying Data for Reciprocal Comparisons of Nutritional Standards of Living in England and the Yangtze Delta (Jiangnan), c.1644 – c.1840[1]

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Abstract

The Great Divergence Debate, initiated by the 'California School' in 1998 has revitalised a meta question for global history of "when," "how," and "why" the economies of Western Europe, on the one hand and the Ming-Qing Empire of East Asia, the Mughal empire of South Asia and the Ottoman Dominions of West Asia and the Balkans on the other, diverged economically and geopolitically over one long cycle of Eurasian economic development.

This paper is designed to return to 'basics' by interrogating the estimates and proxies utilized by participants in the debate by placing them in a nutritional perspective to see whether and to what extent there was a common trajectory between the Yangtze Delta and England after 1500 for (1) a sustainable intake of food and (2) to support an increasingly urbanised, commercialised and industrialised economy.

Our conclusion is that although the Yangtze Delta's average living standards may have been respectable its economy was not modernising due to the mutually reinforcing factors of a physiocratic state, a labour-intensive farming sector, and low levels of urban development. A similar pattern might be shared by the Mughal and Ottoman empires in the same historical context?

Keywords: Standards of living, Great Divergence, Global History

JEL Codes: N34, N35, N5

[1] We wish to thank Robert Allen, Jan-Luiten van Zanden and Debin Ma for their helpful comments.

Among the most lively of controversies in the newly restored and expanding field of global economic history is the Great Divergence Debate. It is now more than 15 years old and addresses the meta question of "when," "how," and "why" the economies of Western Europe, on the one hand and the Ming-Qing Empire of East Asia, the Mughal empire of South Asia and the Ottoman Dominions of West Asia and the Balkans on the other, diverged economically and geopolitically over one long cycle of Eurasian economic development (1415-1815). Those four centuries began with voyages of exploration by the Portuguese down the coast of Africa, included the rediscovery and settlement of the Americas, witnessed the onset of Britain's precocious Industrial Revolution and closed with that realm's consolidation of naval hegemony over the oceans of the world in 1805-1815. This stimulating and on-going debate has spawned a bibliography of books and articles that can be divided, for heuristic purposes, into three general views (Northrop 2012). The first can be associated with seminal books by the American economic historians: David Landes of Harvard, who published his best-selling polemic *The Wealth and Poverty of Nations* in 1998 and Ken Pomeranz, of Chicago University, whose famous study *The Great Divergence: Europe, China and the Making of the World Economy* appeared in 2000 (Landes 1998; Pomeranz 2000). Utilizing comparative methods recommended decades ago by Marc Bloch they reached opposed conclusions on the chronology and causes behind the rise of the West and the retardation of the East (Ragin 1989).

The second approach, which reinserts geography into history, is elaborated in books written by Jareed Diamond (*Guns, Germs and Steel. The Fate of Human Societies*, 1997), David Christian (*Maps of Time: An Introduction to Big History*, 2004) and Ian Morris (*Why the West Rules for Now*, 2010). These authors tend to explain variations in standards of living with reference to several forms of geographical reductionism and construct narratives that span millennia of time. They favour extremely long chronologies and accord very heavy weight to ecological and other environmental factors behind the observed evolution in levels of economic efficiency and standards of living across Eurasia.

A third approach emphasises connexions operating across space and time to generate long cycles of divergence and convergence in levels of material welfare experienced by populations resident in different locations of a global economy becoming gradually interconnected. These connexions are central to analyses by Fernand Braudel (*Civilization and Capitalism,* 1984), Kirti Chaudhuri (*Asia Before Europe*, 1990), Gunder Frank (*ReOrient: Global Economy in the Asian Age, 1998*) and a library of publications from the world systems school of historical sociology led by Immanuel Wallerstein (*The Modern World System,* 4 vols. 1974, 1979, 1980 and 2011). This school is united in rejecting assumptions that geography is destiny or that Europe has for millennia been economically in advance of the Orient. It now operates with two chronologies: one that dates the onset of connexions that became economically significant for divergence to European expansion overseas that began in 1415 and another that insists that encounters, contact and commerce can be exposed for thousands of years before that symbolic date when the Portuguese began Europe's voyages of discovery. In short the approach recommends that narratives in global history should be constructed on the basis of connexions going back over millennia for time (Frank and Gills 1996).

Historiographically, all three strands to this ongoing debate can be traced back to antiquity and they can be exemplified by quoting words from the scholar with claims to be recognised as the first global historian. As early as 420 BCE Herodotus observed that, "History is marked by alternating movements across the imaginary line that separates east from west Eurasia" (Herodotus). This is an arresting quotation for our generation living through the "convergence" of China and India towards western levels of productivity, technological sophistication and standards of living. He makes an essential epistemological point and mainstream global economic history continues to focus upon long swings in the locus of leaders and followers. That approach serves to undermine both Euro- and Sinocentric narratives (O'Brien 2006). It also degrades linear, path dependant and mono-causal interpretations of economic progress (pace Morris) that refer to and link periods other than clearly demarcated long cycles in Eurasian history when technological and institutional possibilities for economic progress circumvented those more or less powerful, universal (but never unavoidable) constraints of location, ecology and geography (Morris 2010 and 2013). In short, the representation of economic growth over millennia of time is realistically analysed with reference to periods or stages in history. Thus, any analysis of divergence between the empires of the east and the polities of the west will remain preliminary unless and until it is well specified and located within a historical chronology preferably based on acceptable statistical data that exposes discontinuities in rates of growth and levels of economic development (Baumol 1994).

Three recent programmes of research in quantitative economic history have attempted to find, calibrate and compare relevant bodies of economic statistics that might be accepted as fit for that essential epistemological purpose. For reasons elaborated elsewhere the publications of the late Angus Maddison, who laudably endeavoured to offer the best of all possible indices for the location of divergence namely, a series of bench mark estimates of GDP per capita for China and Europe denominated in international dollars embodying conceptually defined and properly calibrated purchasing power parities (Table 1). Alas, his numbers for China are neither conceptually nor statistically viable (Deng and O'Brien forthcoming 2015).

Table 1. Levels of GDP per capita in 1990 International Dollars (Maddison 2001)

YEAR	50	960	1280	1400	1500	1820
China	350	400	575	575	600	600
Europe	450	350	400	450	771	1122

An altogether more micro but promising programme which aims to measure the real incomes of representative groups of wage dependent unskilled, low skilled and skilled labour retains potential to deliver conceptually valid and statistically reliable information about standards of living for a small segment of the Chinese workforce who could be carefully compared to a far larger proportion of the workforce employed in the agricultures and in the construction industries of European towns

(Pomeranz 2000; Allen 2005; and Allen et al 2011). At present the volume and range of statistical evidence that represents daily wage rates paid to the wage dependent workers of China (along with India, Japan and the Ottoman Empire) remains limited in scale and scope and it remains very difficult to interpret (Broadberry and Gupta 2006). The data collected so far on nominal money wage rates and prices for India has delivered some results that are contentious and virtually unacceptable as evidence (Parthasarathi 1998; Broadberry et al 2013 and vide Table 5). Our paper will not presume to deal in any detail with India but on close examination most of the published figures for China refer to:

(a) Remuneration for services provided by labour “recruited” by governmental authorities;

(b) Payments that excluded food and shelter;

(c) Transfers within families and kin groups;

(d) Sums of money denominated in currencies that were not generally utilized by Chinese wage earners and their families to purchase goods and services and payments in cash that were not convertible into such currencies at standardized rates of exchange (Lucassen 2007; Deng and O’Brien forthcoming 2015).

Although many of our distinguished colleagues will disagree, we suggest that the sparse and ambiguous records for nominal daily wage rates currently available for the Ming-Qing Empire, Japan and for the Mughal and Ottoman empires do not, prima facie, seem comparable or even analogous to the rates of pay negotiated for a day’s work on the labour and money markets of Western Europe (Allen 2001; Broadberry and Gupta 2006; Bassino and Ma 2005; Pamuk 2007; Bassino et al 2013; Parthasarathi 2011). Unless and until the evidence for nominal wage rates available for China, India, Japan and the Ottoman dominions, is subjected to the scrutiny and tests undertaken by historians for the comprehension of Europe’s pre-modern labour markets, the comparability and inferences derivable from Eurasian wage data will remain insecure (Scholliers and Schwarz 2004). Even if and when figures that have recently appeared in print for the wage rates of workers employed in the cities of China, Japan, India and the Ottoman Empire are extended and revised to provide a more secure basis for comparisons, the small scales of the samples available and the transposition of evidence for daily wages into proxy indicators for average or modal standards of living for Asian workers and their families will remain problematical basically because majorities of workforces in the Orient were neither proletarians nor evolving anywhere near as rapidly as Europeans into wage dependent labour (Van der Linden and Lucassen 2012). That precocious historical process as exposed by research into European labour markets seems to have been protracted, geographically confined and complex (Scholliers 1989; Leonard and Mironov 1994; Grantham and McKinnon 1994).

For centuries before the Industrial Revolution most of the work forces of the Ming-Qing (and other Oriental) empires remained attached to agriculture lived in villages and worked in household and/or kin-based units of production (Deng 1993 and 1999). Thus, prospects for macro-economic and reciprocal comparisons of the kind outlined by Marc Bloch and recommended as exercises in macro-economic quantification by Kuznets and Maddison will continue to be unavoidably but seriously constrained by the quantity as well as the quality of the statistical evidence available for the measurement of levels and changes in the standards of living afforded to majorities of the populations by the imperial economies of the east. Furthermore, even the sources for nominal wages for Europe are an intractable form of evidence (Phelps-Brown 1977; Pamuk and van Zanden 2010; Lucassen 2005).

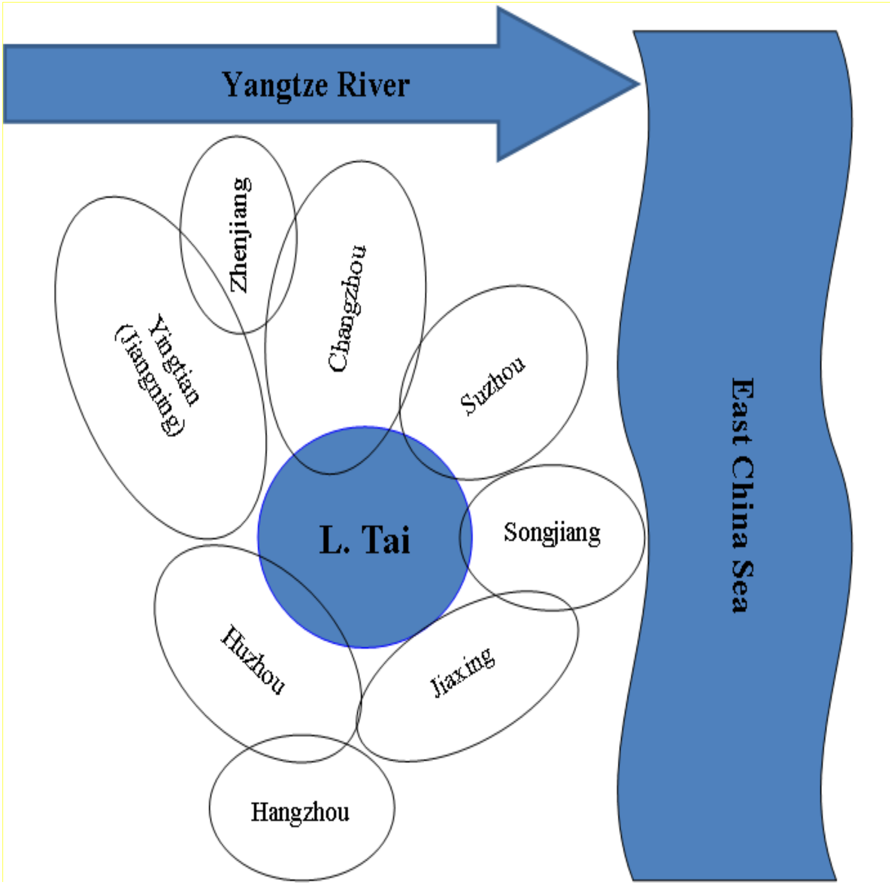
Research in agrarian history **might**, however, uncover statistics that could allow for calculations of net incomes received by Chinese farmers and their families. An accumulation of such evidence would generate estimates of the annual incomes received by majorities engaged in "household units of production" and reveal that endogenous ecological and institutional constraints could well have been more significant than the reserves of coal, access to the Americas and Africa, gains from unequal exchange and other chapters in revisionist narratives of divergence that have concentrated upon Western Europe's fortunate and supposedly contingent advantages over China that came on stream in the late 18th century (Pomeranz 2002 and 2006; Wong 2002; but vide Vries 2013).

Our review of the statistical evidence which simply rejects attempts to measure GDP's for premodern China and most of Europe as unrealistic, will now move on from what seem to be innovative and potentially more heuristic but premature comparisons of real wages and proposes instead to contemplate one case study that seems to us to be the optimal way to provide data for reciprocal comparisons that engages with the Weberian thesis that there were significant endogenous components behind the retardation of the Chinese economy (Pomeranz 2011). Since China and all other pre-modern Eurasian economies in the frame for modern global history were basically organic, the way forward must reside in agrarian history. Alas, it will take years of historical research to find sufficient statistical evidence on the variegated regional and local agricultures of the Occident and Orient for the centuries preceding accelerated rates of structural change which came first on stream in Britain and later in other western societies and which marked the first wave of transitions to modern urban and industrial economies. At present only two preliminary exercises in comparative quantification for three advanced regions of Eurasia are in print. Basically they depend on the scholarship of Li Bozhong and Philip Huang (Li 1998; Huang 1990). The comparisons are with England and Holland (Li and van Zanden 2012). They include soft and very limited data that refers to material outcomes that flowed from a sustained period of population growth among families engaged in cultivating land and manufacturing ramie, silk and above all, cotton fibres into textiles in one economically advanced Asian region, Jiangnan, in the Yangtze Delta. The statistics for these micro-level exercises in comparative in Sino-European economic history have been generated by a controversy among protagonists in an ongoing academic debate that addresses the contested thesis that the economic development that occurred in China after 1600 (even within Jiangnan) could be depicted as Malthusian or involutionary and was above all never likely to support an early transition to a modern industrial economy (Vries 2013; Duchesne 2012; De Vries 2011; Huang and Pomeranz 2003). Alas, nothing comparable seems to be in print for West and South Asia or Japan (except unpublished papers by Broadberry et al 2013; and Bassino 2013).

The term “Jiangnan” was first coined during the Northern Song Period (960–1127 AD) when “Jiangnan Donglu” and “Liangzhe Lu” emerged as administrative units (provinces) of the Yangtze Delta. These provinces were combined to “Jiangzhe” under the Mongol Yuan (1271–1368) and then re-divided into “Nanzhili” (18 prefectures and 110 counties) and “Zhejiang” (11 prefectures and 76 counties) during the Ming. The Qing renamed them “Jiangsu” and “Zhejiang”. Currently, these two provinces have a total land mass of about 206,800 km^2 (Tan 1991, pp. 51–2, 59–66; and Feng 2002, p. 22). As a label for economic geography and history “Jiangnan” has much stricter connotations. It refers to only 51 (out of a total of 186) counties in 8 (out of a total of 29) prefectures across the provinces of Jiangsu and Zhejiang, including Changzhou Prefecture, Songjiang Prefecture, Suzhou Prefecture, Yingtian Prefecture (later Jiangning) and Zhenjiang Prefecture all in Jiangsu Province; and Hangzhou Prefecture, Huzhou Prefecture and Jiaxing Prefecture in Zhejiang Province. This is the delta region that is relevant for the Great Divergence debate.

All these prefectures, surround Lake Tai, form what can be called the “Lake Tai Economic Community” (LTEC) (see Figure 1).

Figure 1. Eight Prefectures of the “Lake Tai Economic Community”



Source: Based on Guo and Jin 2007, p. 152; Feng 2002, pp. 24–7.

Another common feature of those Prefectures is that from the beginning of the Ming Period they carried disproportionately heavy burdens of taxation.

Table 2. Tax Burden on the LTEC under the Ming

	Taxable Farmland (mu)		Tax payment in grain (shi)*	
	1395	1578	1395	1578
LTEC in China's total	5.6%	6.4%	23.3%	21.3%
Suzhou-Songjiang in China's total	1.8%	1.9%	13.7%	11.7%

Source: Fan 2008, p. 389 - measured in rice equivalents.

For the centuries after the Yuan Dynasty Jiangnan has been represented as the most highly taxed and commercialized region of the Chinese Empire. Thus, the data collected by Li and Huang and reconstructed by us to represent proto-typical household accounts for peasant families at work in this developed region could help to focus discussion on two theses at the core of the divergence debate (Li and van Zanden 2012). The first revisited, in a special issue of *Historically Speaking*, states that unlike England the economy of Jiangnan, as it evolved from say the accession of the Qing in 1644 to the Opium War, could not be represented as advancing along a trajectory leading to a precocious industrial revolution (*Historically Speaking,* 2011). The second and more general view concludes that "faced with the pressure of numbers" (to cite Braudel), historians may uncover statistical evidence which supports the Weberian hypothesis that the political, legal and cultural institutions conditioning levels of production for food, fuel and organic raw materials in the Chinese Empire had for some centuries failed to provide standards of material welfare for majorities of an expanding population that were on a par with those afforded to majorities residing in advanced regions and polities of Western Europe (Pomeranz 2000, 2005 and 2011; Bryant 2006; Elvin 2008). One way of testing the second hypothesis, often disparaged as a neo-Weberian and Eurocentric version of Chinese economic history, would be to compare the real incomes of "representative" households resident in Jiangnan (from the accession of the Qing to the Opium war) to those earned by comparable families living in the advancing economies of England or Holland over that same period (Allen 2009; Li and van Zanden 2012). The first hypothesis could then be addressed by placing some scant, imperfect but potentially relevant statistical evidence alongside a rich historical literature analysing institutional and other variables that remain prominent in explanations for divergence (Vries 2013).

Before proceeding we should, however, define the scales of the geographical administrative space that has been utilized in the divergence debate for comparisons with England (Tan 1991, pp. 51–2, 59–66). They included 8 out of 29 prefectures in just two (Jiangsu and Zhejiang) of 18 Qing provinces (Feng 2002, pp. 22, 24–7) and contained approximately 7-12% of the empire's population and 6% of its farmland.

Table 3. Jiangnan and the Prefecture of Songjiang

Period	Unit	Farmland (mu)	Households
1393	Songjiang Prefecture	5,132,290	158,400
	Jiangnan LTEC	47,767,964	1,313,455
	Songjiang % in LTEC	10.7	12.1
	China	850,762,368	10,652,870
	LTEC % of China	5.6	12.3
	Songjiang % of China	0.6	1.4
			Poll taxpayers
1820	Songjiang Prefecture	4,048,871	2,645,871
	Jiangnan LTEC	41,804,711	24,696,318
	Songjiang % in LTEC	9.7	10.7
	China (1812)	791,525,196	358,720,453
	LTEC % in China	5.3	6.9
	Songjiang % in China	0.5	0.7

Source: Liang 1980, pp. 10, 211–2, 233–4, 332, 334, 402, 405; Fan 2008, p. 388.

In an article published in the *Journal of Economic History* Li Bozhong and Jan Luiten van Zanden ventured to construct estimates for the gross domestic product of an atypical prefecture, Songjiang, which in 1820 included around 10% of Jiangnan's farmland and its population (Li and van Zanden 2012; Liang 1980). The significance of their estimates for output income and expenditures (if those categories could be realistically measured and comprehended within an accountancy framework used to represent integrated macro economies engaged in commerce across their boundaries) could only be small relative to the positions and economic influences radiating from say London and Amsterdam within national economies of England and Holland. We suggest that the meaning and inferences for the divergence debate that could be drawn from aggregation of production and income generated by one urbanized prefecture heavily committed to the cultivation of a profitable cash crop (cotton fibres) is neither transparent nor obvious (Fan 2008). Although incontestable criteria for reciprocal comparisons cannot be specified, some seem more apposite that others. Pomeranz set up the divergence debate with reference to Jiangnan – which includes the eight commercially interconnected prefectures (including Songjiang) sketched out in Figure 1 (for an outline economic history of another Prefecture, Giaxing, vide Elvin 2004, Chapter 7).

For the purposes of a statistical exercise, designed to generate numbers in order to: (a) observe changes over time and (b) compare relative standards of living for typical "peasant" families resident in Jiangnan with the families of English unskilled labourers, for a century either side of 1750, the relevant figure to construct for any Chinese region or province is total disposable incomes for modal families expressed in some common unit of account that can be computed and which lends itself to heuristic comparisons across time and space. Given significant degrees of local differences in weights and measures as well as variations in exchange rates between monies of account (silver taels and copper cash) which might otherwise be utilized to measure outcomes of economic activities across the Qing Empire and perhaps across Eurasia, we prefer to work with the most accessible and least ambiguous data available, namely, grain equivalents measured in shi of husked rice (Chen 1975; Kuroda 2005). Quantities of rice, wheat and cotton cloth converted into kilograms of edible rice using relative prices have, often, been utilised for that purpose among historians of late Imperial China (Fan 2008; Wu 2009; Shi 2012).

Secondary literature recently debated by experts and elaborated in Table 4, agrees that a modal household unit for production in Jiangnan circa 1750 consisted of a family of five persons with access to some 7.5 mu of cultivable land. That region's domestic economic units for production could, moreover, deploy sufficient land, labour and other inputs to produce just under two main crops per annum (rice and wheat) supplemented by smallish quantities of animal produce (from fish, pigs and chickens) and a rising volume of coarse unfinished cotton cloth. There seems to have been a clear trend in Jiangnan to switch paddies into the dry farming of more profitable cash crops, especially mulberry trees and cotton (Fan 2008, pp. 298–307). For example in Songjiang Prefecture, 65–80 percent of farmland was under cotton during much the Qing Period (Fan 2008, p. 319). In the neighbouring prefecture of Jiaxing, dry farmland increased by 1.6 million mu while paddies decreased by 1.4 million mu over the late seventeenth century (Fan 2008, p. 107). Higher returns from cash crops then pushed up rents for cultivable land at a much faster rate than food prices (Chen 1996, pp. 105–6).

Our figures, copied and recalibrated from secondary sources, are based largely on best practice farming cited in agronomic manuals published in China at the time, are not ideal and certainly less secure or representative than comparable evidence for England. They have, however, been recently deployed for debates by experts in Chinese economic history and are set out here in a simplified and tabulated form as discussable proxies (nothing more) for material standards of living enjoyed by “representative” households located in the most economically advanced region of the Qing Empire during the 17th, 18th and 19th centuries (Li 1998; Huang 2003; Pomeranz 2003). Hopefully, our calibration of their data captures the material experience of typical Chinese peasant families living between circa 1610 and circa 1820 (Li and van Zanden 2012).

Table 4. Estimates Constructed from Recently Published Data for per Capita Daily Levels of Nutrients Calibrated in Shi of Rice Equivalents Derivable by "Typical" Households / Peasant Families Resident in Jiangnan (including fertile Songjiang) Producing Agricultural Outputs and Cotton Cloth in the Early 17th, Mid-18th and Early 19th Centuries*

	Early 17th Century			Mid 18th Century			Early 19th Century		
Secondary Sources	Li for Songjiang	Li for Jiangnan	Allen	Huang	Pomeranz	Brenner and Isett	Li for Songjiang	Li for Jiangnan	Allen
	1	2	3	4	5	6	7	8	9
1. Period (circa)	c.1610	c.1620	c.1620	c.1750	c.1750	c.1750	c.1800	c.1820	c.1820
2. Labour supply (days in male equivalents)	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0

3. Area cultivated (<u>mu</u>)	25.0	15.0	15.0	7.5	7.5	7.5	10.0	9.0	9.0
4. Area Cropped (in rice plus wheat, <u>mu</u>)	25.0	21.0	21.0	12.8	12.8	12.8	17.0	15.3	15.3
5. Rice Yields (<u>shi</u>)	2.5	1.7	1.7	2.3	2.3	2.3	3.0	2.5/3.0	2.3
6. Wheat Yields (<u>shi</u>)		0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
7. Total Grain Output (<u>shi</u>)	62.5	29.7	29.7	20.6	20.6	20.6	37.0	31.4	25.1
8. Rent (<u>shi</u>)	31.3	12.8	13.0	7.7	8.4	7.6	15.0	13.5	10.4
9. Costs for producing grain (<u>shi</u>)	12.5	5.9	2.0	4.2	4.8	4.5	6.8	5.7	4.2
10.Net returns from grain production (<u>shi</u>)	18.7	11.0	14.7	8.5	7.4	8.5	15.7	5.0	10.5
11. Returns from other crops and animals (<u>shi</u>)	3.0	3.0	3.0	[1.5]	[1.5]	[1.5]	2.0	2.0	2.2/4.4
12. Total returns from farming (<u>shi</u>)	21.0	14.0	17.7	10.0	8.9	10.0	17.2	7.0	12.7/14.9
13. Labour inputs for farming grain (in adult male days)	438.0	304.0	281.0	116.0	125.0	119.0	208.0	205.0	184.0
14. Days allocated to cloth production	62.0	196.0	118.0	210.0	210.0	210.0	283.0	295.0	124/210
15. Bolts of cotton cloth produced	9.0	28.0	17.0	30.0	30.0	35.0	47.0	49.0	30.0
16. Bolts consumed per family	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4
17. Costs of cotton fibres	0.2	0.6	0.6	0.6	0.6	0.6	0.9	0.6	0.6
18. Total net returns from cloth production	0.4	3.6	0.8	2.6	7.3	6.3	5.7	4.0	2.4/6.1
19. Total disposable income (<u>shi</u> of rice)	23.1	17.6	18.5	12.6	16.2	16.3	22.9	18.2	15.1/21.0
20.Total disposable income (kg of rice)	1733.0	1320.0	1388.0	945.0	1216.0	1217.0	1718.0	1365.0	1298/1575
21. Kilocalories per capita per day	3475.0	2647.0	2783.0	1896.0	2438.0	2440.0	3445.0	2737.0	2603/3139

Sources: The figures recalibrated for the construction of Table 4 have been taken from secondary sources that have been mobilized in recent years as evidence for positions taken in the Divergence Debate. For Columns 1, 2, 7 and 8 we relied on figures that refer to Jiangnan and Songjang as cited in Li 1998, pp. 125-7.

For Columns 3 and 9 the figures are from R.C. Allen, "Agricultural productivity and rural incomes in England and the Yangtze Delta, c. 1620 – c. 1820," *Economic History Review* 62 (2009), pp. 525-50. For Column 4 the raw data was taken from P. C. C. Huang, "Development or Involution in Eighteenth-century Britain and China? A Review of Kenneth Pomeranz's *The Great Divergence. China, Europe and the Making of the Modern World Economy*," *Journal of Asian Studies* 61 (2002), pp. 501-38 and his book (2) *The Peasant Family and Rural Development in the Yangtze Delta 1350-1988* (Stanford, 1990). Pomeranz, Brenner and Isett rely on Huang's data for their 1750 estimates for net returns from agricultural production. The dispute over numbers between Pomeranz and Huang is concerned with calculations for net returns from the production of cotton cloth. Vide P. Huang "Further Thoughts on Eighteenth Century Britain and China," *Journal of Asian Studies* 62 (2003), pp. 157-87.

Column 5 is based on data in K. Pomeranz, “Beyond the East-West Binary: Resituating Development Paths in the Eighteenth Century World,” *Journal of Asian Studies* 61 (2002), pp. 539-90; “Facts are Stubborn Things,” *Journal of Asian Studies* 62 (2003), pp. 167-81 and his book *The Great Divergence. China, Europe and the Making of the Modern World Economy* (Princeton, 2000).

Column 6 includes data from R. Brenner and C. Isett, “England’s Divergence from China’s Yangtze Delta: Property Relations, Microeconomics and Patterns of Development,” *Journal of Asian Studies* 61 (2002), pp. 609-62.

Notes and References:

Row 1: Period circa

The periods utilized by the authors are neither particular years nor standardized averages for runs of years. They can be interpreted as referring to the early decades of the 17th century, the mid-18th century and the early decades of the 19th century.

Row 2: Labour supply (days in male equivalents)

All the authors assume that a typical household unit for production and consumption consisted of 2 adults (male and female) and 3 children. The supply of standardized labour time available to and utilized by households is discussed by Pomeranz, 2, pp. 545-9 and Li, pp. 151-3. Li posits that an adult male worked 300 days a year and his female partner 200 days. We have assumed that estimate of 500 male days per annum is an acceptable conjecture.

Row 3: Area Cultivated (mu)

Unfortunately the mu was not an area standardized for the Chinese Empire. Although the official mu was always 240 x 6^2 paces, in reality a cultivated mu varied from 260 x 6^2 paces to 1200 x 6^2 paces. Thus, one cannot convert any cited mu in historical materials into the official standard mu without knowing its area case by case (Shi 2012, p. 55). But all five authors assume standardization for Jiangnan. Li cites average areas cultivated by families in Songjiang for circa 1610 and 1820, p. 140. His figures are accepted by Allen for both dates. For 1750 all three scholars follow Huang, 2, p. 509 and adopt / accept 7.5 mu as a representative average for the cultivated area.

Row 4: Area Cropped in Rice and Wheat

Behind the figures cited is an assumption that as ratios of land to labour declined farm families added a second crop (usually wheat) to their rotations and that by 1750 (if not earlier) most families planted up to 70% of the mu available to them for cultivation with wheat and the cropped area equalled 1.7 times the cultivated area. Vide Li, pp. 23, 138-40, 151-3; P. Huang, pp. 509-11; Pomeranz, p. 542.

Row 5: Rice Yields (Shi per Mu)

There is a consensus among the authors that rice yields for Jiangnan for the period circa 1750 to circa 1820 clustered within a range of 2.25 shi to 2.5 shi. According to Li, yields in the fertile prefecture of Songjiang were higher and rose from 2.5 shi c. 1550-1610 to 3.0 shi c. 1800. For Jiangnan he posits a rise of 47% between circa 1620 and 1820 which is based (pp. 124-50) on crude macro data for the base period which Allen (p. 537) accepts as plausible. Li’s view of the rise in yields is not shared by other agrarian historians. Feng and Fan observe that the grain yield level per unit of farmland dropped during the Qing in the LTEC from its Ming level by about 10 percent and grain imports increased (Feng

2002, p. 40, Fan 2008, p. 297). It was common for the LTEC to import 30 percent of the rice consumed each year from the upper and middle reaches of the Yangtze enough to save 3–5 million mu land for cash crops and feed 4–6 million adults a year (Chen 1996, p. 110; Fan 2008, pp. 65, 300, 302).

Row 6: Wheat Yields converted to Shi of Rice Equivalents

There is a consensus among the authors concerned with yields per mu cropped with wheat and its conversion using relative prices into shi of rice equivalents. The wheat yield is represented as 1 shi of wheat per mu cropped and converted as equivalent to 0.7 shi of rice per mu cultivated**.**

Row 7: Total Grain Output

These figures are derived from the areas cropped in rice multiplied by average yield in shi (Row 3 x Row 5) plus output from the area cropped in wheat (Row 4 – Row 3) multiplied by the yield converted into rice equivalents (Row 6).

Row 8: Rents

The authors agree that rents transferred from farm families to landowners were based upon shares of the total volume of the first crop of rice produced each year. Shares cited vary between 45% and 50%. This cost would **not** apply to owner-occupiers or to all cultivated land. The second crop was rent free and housing provided by the landlord was free. Tenants did not pay land tax. According to Gao Wangling, tenant farmers and their families may have retained up to 70% of the annual gross output produced by their labour (Gao 2005).

Row 9: Costs for Producing Grains

These figures include outlays on fertilizers (particularly beancake), water, hired labour, implements, draught animals, etc. plus shares of the rice and wheat harvests reserved for seed. They are expressed in rice equivalents and were complex to reconstruct. Li's estimates (p. 139) cite production costs per mu for Western Songjiang of 1 shi of rice per mu and 0.25 shi of rice per mu of wheat which convert to 40% of output for circa 1560 and 32% for 1736-1850. But on p. 153 his figures for their cost are cited as 20% and 17%. We assumed that 20% could be a plausible estimate for Jiangnan as a whole for the early 17th century. The problem (confronted in Allen's paper) was to produce a plausible conjecture for costs of production for the early 19th century, Li's figures for volumes of beancake fertilizer purchased from Manchuria have been convincingly questioned by Xue Yong (see text and bibliography). Li's estimates for Songjiang (p. 139) of 1 shi of rice per mu cropped with rice and 0.25 shi of rice per mu cropped with wheat suggest that the costs (outlays) required to produce 26.9 shi of rice equivalents amount to 10.6 shi or 39% of gross output. Prima facie these estimates look too high. They are out of line with all other estimates but may reflect environmental depletion chronicled by Elvin (2004). Allen (p. 538) prefers to follow W. Li's (sic) estimates for costs of producing rice and wheat. He neglects seed, concentrates on fertilizer and uses ratios of fertilizers and seed that are well below those proposed by Li (p. 139). We have added estimates for seeds and fertilizer for wheat to his figure of 0.35 shi of rice as the cost of cropping 1 mu of rice. Huang offers no estimates for these costs and we assumed he would accept the estimates cited by Brenner and Isett. Pomeranz accepted an estimate of 0.36 shi of rice as the cost of fertilizer per shi of rice cultivated but added estimates based on Li (p. 111) for purchased fertilizers applied to cultivate wheat and the shares of rice and wheat output reserved for seed. These figures are nothing more than conjectures.

Row 10: Net Returns from Grain Production are Rows 7 – (Rows 8 + 9)

For a discussion of these numbers: in particular Li's anomalous figure for Jiangnan circa 1820 see text.

Row 11: Returns from other Crops and Animals

The books by Huang and Li contain data on returns from the cultivation of cotton fibres and sericulture. But only Allen's article contains data that allows for the estimation of returns from other crops (beans and rape) and from rearing animals, pigs and chickens. We have utilized his reconstruction of agriculture in the Yangtze Delta, 1820 (Table 2, p. 536) to produce a guess of what the net returns **might** have been for these activities for a typical farm.

Row 12: Total Returns from Farming. We have inserted estimates based on Allen's figures (Row 11) and the area cultivated (Row 3) into the farm accounts of all other authors including Li.

Row 13: Labour Inputs for Farming Grain (Estimated in Adult Male Days).

All authors discuss estimates for adult male days required per annum for the cultivation, harvesting and husking / threshing of rice and wheat. Their estimates are based on agronomic manuals published over the period 1620-1820.

Row 14: Days of Labour Time Allocated to the Production of Cotton Cloth

The figures refer to days allocated to tasks involved in the production of unfinished woven cotton cloth by male, female and child labour available to the family measured in adult male days. Allen's figure of 124 days for circa 1820 is based on the assumption that the production of cotton cloth in Jiangnan was limited to the preparation and processing of raw cotton fibres cultivated and traded within Jiangnan. That assumption is not shared by other authors reviewed in this paper and we have amended his estimate to agree with the 210 days cited by them.

Row 15: Bolts of Cotton Cloth Produced per Annum

These figures are based on estimates derived from technical manuals published at the time which refer to days of labour typically required for fluffing, sizing, spinning, weaving ginned cotton to convert it into bolts of unfinished woven cloth. Finishing processes (dyeing, printing, etc.) were specialised and conducted by artisans working in towns and not domestically on farmsteads. The authors rely on Huang's research for estimates for the labour time required to process ginned cotton fibres into woven cloth. Thus the labour output ratios (Rows 14 / 15) look consistent across authors and through time. Allen's figures are based on his assumption of no net imports of cotton fibres into Jiangnan. In conversation he accepted that the region was (to quote Huang p. 522/3) the leading exporter of cotton and cloth in China and vide p. 518; see M. Huang, pp. 45-6 and 54. Allen would probably accept the 210 days (as suggested by Pomeranz, Brenner and Isett) estimates as an outer-bound for circa 1820.

Row 16: Bolts of Cloth Consumed per Family

This figure originated in research by M. Huang, pp. 46-7 and is repeated by P. Huang, pp. 511 and 523.

Row 17: Costs of Cotton Fibre Inputs

These figures calibrated from data published in P. Huang, pp. 511 and 523 rest on the assumption that approximately 2% of the selling price per bolt of cloth sold converted to rice equivalents. The dispute between Huang and Pomeranz is over the selling price per bolt of cotton and the conversion of the value of output sold into shi of rice equivalents and not about total labour inputs into cloth production (Row 14) or the days of labour time required to transform ginned fibres into woven cloth (Row 15). There seems to be a consensus about labour inputs and labour productivities in cloth production which is based on technical manuals published at the time.

Row 18: Total Net Returns from Cloth Production

Formally these figures have been calculated from data published by the authors as: numbers of bolts of cotton cloth produced and sold minus the costs of the raw material and an estimate of cloth consumed by families of 5 persons measured in rice equivalents. Given that Allen could accept a revision to his figure from 184 to 210 days of labour time allocated to cotton production Rows 14, 15, 16 and 17 display small variations but consistency. The outlying estimates for net returns from manufacturing are Li's 4 shi of rice equivalents for 1820 and Huang's figure of 2.3 shi for 1750. Pomeranz has convincingly exposed the reasons behind that low estimate. They reside in Huang's unrealistic and inconsistent selections of market prices for bolts of cloth sold in the 1750s, arithmetical errors and invalid assumptions about the average price per shi of rice for the same period. Huang has not refuted the detailed critique of his numbers by Pomeranz and we concluded his estimate of net returns from cloth production expressed in shi of rice is too low. But vide sources cited above for Columns 4 and 5.

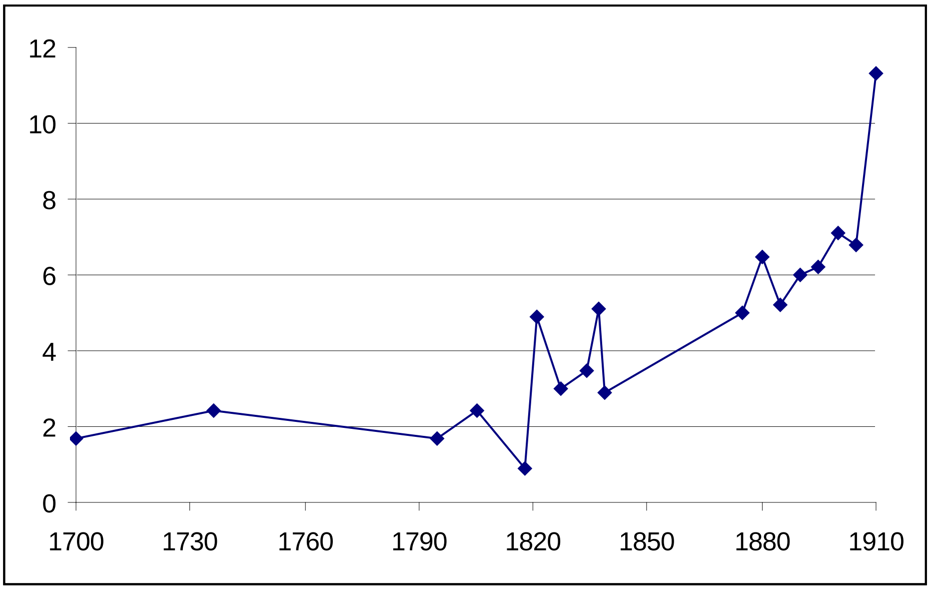
Row 19: is Row 10 plus Row 18 and is equivalent to net disposable income converted into shi of rice.

Row 20: The yield data cited by the authors is for husked rice. The husk constitutes about 22% of the grain and a further 10% is lost in home pounding. 1 shi of pounded rice has been set at 75 kilograms.

Row 21: I kilogram of rice flour (the edible ingredient) is equal to 3600 kilocalories of nutrients. For discussion and references to the conversion coefficients used to convert volumes of harvested grains into edible kilograms and kilocalories, see F.A.O. 2002, and United States Department of Agriculture 2010.

Our figures, recalibrated and referenced for Table 4, offer premature hypotheses for discussion and future research. They reveal that for generations after 1600 households located in this advanced region of the Chinese Empire were afflicted by declining access to land. Finding themselves with increasing supplies of under-employed labour at their disposal they allocated more hours to the manufacture of ramie, silk and above all, coarse cotton cloth (Fan 2008). The man days of labour time required to produce the foodstuffs, fuel, fibres and animal products required to sustain a viable standard of food security and outlays for rent, fertilizer and other inputs can be estimated as numbers of days that varied over time between 120 and 240 per annum. While the labour supply available to a family of five also varied and, for purposes of retrospective calculations depends on assumptions made about the relative productivities of female and child labour. Potential supplies per family could hardly have been less than 500 man days per annum? Volumes of coarse cotton cloth produced by this labour sold on imperial and foreign markets cannot be measured. Swings over time in the net barter terms of trade between cloth and rice may, as Pomeranz implicitly suggests, have been sufficiently unfavourable to support an impression that unless volumes of cloth manufactured by peasant households rose to compensate for adverse shifts in relative prices consumption per capita declined between the early 18th and 20th centuries.

Figure 2. Terms of Trade, Bolts of Cotton Cloth per Shi of White Rice



Sources: Huang 2007, pp. 10, 11–12, 47–9, 52–7, 61–5, 101–7, 109–14, 314, 318–21, 330–3, 336–9 ; Xu 1989, pp. 176. 201; Yu 2000, pp. 805, 921-2, 929.

Our imperfect and tiny sample of data tabulated above suggests that over a period of roughly two pre-modern centuries peasant households of Jiangnan experienced a clear decline in access to cultivable land. They compensated for that adverse trend in three ways. First, by augmenting ratios of cropped to cultivated farmland from 1.4 to 1.7 grain crops per annum. Secondly, and according to Li's contested figures and analysis, they increased both crops of grain per mu cultivated by 21% and yields of rice per mu of land sown with rice by around 47% (Li 1998; Feng 2002). Thirdly, they continued along the path of diversification that had been promoted by inordinately heavy taxation imposed on the Yangtze Delta by the Ming but relaxed under the Qing regime (Fan 2008). Net returns from the production and sale of cotton textiles increased its share of a "modal" family farms net disposable income from say around 20% in the early 17th century to reach 40-45% by the middle of the 18th century. Total output rose over time but (as Pomeranz observed) prospects for profitable diversification diminished after 1750 when the growth of intra-regional trade contracted and the net barter terms for exchange between rice and cotton cloth probably shifted in favour of rice (Figure 2, Table 3, Fan 1998, Wu 2009, and Pomeranz 2000). No economic historian of Qing China or Jiangnan has suggested that the adverse trend was offset by any marked growth of employment in the urban economy, compensating shifts in factoral terms of trade, or any significant expansion of manufactured exports overseas. Although Pomeranz has claimed that a shift to higher quality cloth occurred (Pomeranz 2003).

Thus, and in contrast to England the reallocation of labour in the Yangtze Delta to the manufacture of cotton textiles led to a process labelled by Huang as involution and by economists as immiserizing growth. This appears in our conversions of Bozhong Li's estimates to kilocalories per family member which declined towards the level of 2100 kilocalories proscribed by the F.A.O. for food security (F.A.O. 2002). There is no need, however, to represent such scant and weak evidence as some kind of persistent Malthusian crisis (pace Huang 1990 and 2003). Peasant households who dominated the economy of the Yangtze Delta between the times of turmoil associated with the violent change of the imperial regime 1644-83 and the recovery and accelerated growth of population that followed from the restoration of order clearly survived and adapted (Fan 1998 and 2008; Li 1998).

Nevertheless, there is very little in the statistics thrown up by recent research and debate to suggest anything other than adaptation within the traditional institutional framework and technological frontier by an organic economy to the challenges posed by rising population (Feng 2002). Bozhong Li's altogether more optimistic view of agrarian development in Jiangnan between 1620 and 1850 is either not founded on the scattered array of data contained in his classic study or it derives statistical support from figures for the prefecture (Songjiang) which included less than 10% of the region's cultivate area and tax paying population with a very high proportion of its urbanized residents (Cao 2001, pp. 800-8). The figures that we extracted from Li's book for costs of producing grain in the early 19th century (Table 3, Row 9) puzzled Allen but they are consistent with Li's analysis that soya beancake fertilizers imported in growing volume from Manchuria were behind the disparate evidence for the cited 47% increase in the yield of rice per mu cultivated between the early 17th and early 19th centuries (Allen 2009; Li 1998).

Li's estimates (vide Table 2, Rows 5 and 9) suggest, however, that the maintenance let alone the increase rice yields per mu cultivated in Jiangnan was only obtained at costs for inputs (dominated by fertilizers) that rose from 23% to 47% of gross output over the centuries. Prima facie and after the payment of rent by 1820 majorities of the peasants of Jiangnan seem to have retained for family consumption an amount of grain that was about half the quantity available to their ancestors' families farming larger areas of land at the end of the Ming Dynasty (Huang 2002 and 2003; Chen 1996). If these figures are correct and typical, the record of the agrarian sector of Jiangnan cannot be represented as one of successful adaptation to population growth by way of an agrarian strategy based upon a massive import of soya beancake fertilizer from Manchuria. Serious doubts have been levelled at the thesis of a "fertilisation revolution" between 1620 and 1850 in Jiangnan. For example, Yin and Hui observe that pound for pound the imported soya beancakes cost the same as rice or 2000 wen (or 1 tael of silver in the late Qing) per shi in the Yangtze Delta (Yin and Hui 2012, p. 41; Jiang 2007, p. 39). It was documented that "only rich households can afford soya beancakes as a basic fertiliser. Poor households use compost from pigsties and goat pens." (Jiang 2002, p. 39) Only a small amount of soya beancakes were used to restore fertility - about 0.1 shi per mu according to Yin and Hui, compared with Li's estimate of half a shi per mu (Li 1985, pp. 1–12; Yin and Hui, pp. 37-44). Local supplies of sesame, cotton and rape seedcakes, as well as a range of other fertiliser (such as animal droppings and green manure) suggests that the delta produced most of the fertilizers demanded by local agriculture. Even in the late 19th century most Manchurian cargo – 90% – was designed for the Pearl Delta further south. Thus in 1884 only 5% actually landed in Shanghai for the LTEC. This study also argues that only about 1 million shi of food cargo came out from Manchuria to the rest of the empire a year, 50% of that cargo being soya beancakes and that 30% of the soybean cakes were consumed as animal fodder, leaving about 20% to be used as fertilizer (Xue 2010, pp. 92-118). Moreover, Jiang has observed that local supplies of cottonseed, sesame seed and rapeseed cakes in the Yangtze Delta could make imports of soya beancakes from Manchuria unnecessary (Jiang 2002, pp. 39-42 and pp. 457-58).

Furthermore, Xue's statistically based critique (which has not been challenged or refuted) convincingly undermines the hypothesis that Manchurian agriculture could conceivably have produced an annual export surplus of 10 million shi of soya over the first half of the 19th century. The feasibility of that number is, moreover, not consistent with our own calculation of the volume of oil (53710 metric tons) that could have been extracted from 10 million shi of soyabean cakes and that amount would have been sufficient to have produced 26.2 kg of soy oil per capita per annum for the Manchurian population – an entirely implausible level of consumption (Isett 2007; and Sun 1957, p. 123). Finally, modern agronomic science reveals that soyabean cake needs to be composted and processed with other organic ingredients over a period of 12 months before it could be safely and productively used as a fertilizer (see http://www.360doc.com/content/10/0629/11/1635291_35875612.shtml;http://fl.zgny.com.cn/Tech_153021.shtml;
http://blog.sina.com.cn/s/blog_5706a4c00100tkld.html;http://www.baike.com/wiki/).

Bozhong Li's hypothesis for a fertilizer revolution in Jiangnan, which he claimed raised yields per mu sown with rice by 47% has generated an entirely productive and heuristic debate for the agrarian history of Jiangnan but it lacks the statistical foundations required to establish its validity and relevance for the wider debate concerned with divergence between the economies of the Yangzi Delta and England.

Our view, derived from the scholarship of Mark Elvin, is that through familiar mechanisms of regional specialization and trade, Jiangnan (and presumably China's agrarian system as a whole) seems to have coped about as well as could be expected with declining land-labour ratios and other resource constraints (Fan 1998; Chen 1996), but despite the empire's impressive longer run historical performance, not well enough to have circumvented Elvin's famous "high level equilibrium trap" (Elvin 1973 and 2009). Perhaps the physiocratic Qing state did more than any of its European counterparts (except the English state with its Elizabethan poor law?) to protect particular provinces and their under-classes against harvest failures and to facilitate internal migrations within the empire? (Wong 1999; Will 1990; Patriquin 2007) Nevertheless, the Manchu regime, for explicable reasons, did not extend margins for cultivation by colonizing lands across its borders in Southeast Asia (Pomeranz 2006 and 2011). While marching west added nothing much to total food supplies and the imperial elite restrained Han migration into their fertile and underpopulated homelands in Manchuria (Isett 2007; Perdue 2005; Xue 2007; and Fletcher 1978). No price incentives appeared nor were subsidies offered to shift the structure of agrarian output towards more animal intensive forms of agrarian production (Wong 1997). Perhaps to cite a Eurocentred book the Qing never "saw it like a state" (Scott 1998). Finally, no historian of China has published claims for an upswing in investment by central and local governments or by the gentry of a physiocratic state and empire in the infrastructure for irrigation and flood control surrounding Chinese agriculture. Although data for gross and net agrarian capital formation is unlikely to appear in order to validate our perception there is evidence that a fiscally under-funded Qing government would have found it difficult to meet both the costs of containing environmental degradation and maintaining the infrastructure taken over from the Ming regime at stable levels of productivity (Deng 2012; O'Brien 2012; and Vries 2013).

China's core economic problems, which had emerged once its agriculture crossed from a land-intensive to a labour-intensive system of production dominated by an irrigated agriculture concentrated upon the cultivation of rice persisted, almost certainly intensified when population growth accelerated under the Qing (Elvin 1973 and 1978; Deng 1999). For some time before the Manchu takeover of the imperial state the system had been on a path for development in which hydraulic technology interacted with an unstable environment in ways that demanded ever increasing inputs of resources (including organization, manpower, timber, organic fertilizers, etc.) to respond to and control over river water onto and off the empire's arable land (Elvin 1993). After centuries of increasing returns the agrarian system came under pressure from a rising population. Rates of technological improvement fell behind rapid environmental depletion associated with deforestation, cultivation of marginal land, silting of rivers and drainage channels, salination of soils, and a weakening of defences against the sea (Elvin 2009). Thus, low and static tax revenues, combined with benign fiscal policies and property rights which restrained opportunities for the extraction of rents, discouraged the amalgamation of cultivable land into larger farms, and diminished capacities for higher rates of net investment in the empire's infra-structure for agrarian development to levels that could achieve nothing better than low and unstable levels of food security for majorities of the Ming-Qing Empire's expanding population (Elvin 2004; Brenner and Isett 2002).

Turning to the second hypothesis of whether the regional economy of Jiangnan (as it evolved, say between 1644 and the Opium War) could be plausibly represented as advancing along a trajectory leading to a sustained transition to an urban industrial economy or an industrial revolution, the leading economic historian of China in the West leaves us with the persuasive impression that the agrarian economy of commercialized Jiangnan was not on such a trajectory and Pomeranz would not disagree (Elvin 1996; Pomeranz 2006 and 2011).

Ken Pomeranz posed the question cogently and reciprocally. "Why" he asked, "did England's economy not continue to develop like the Yangtze Delta?" In his view both agricultures located in two commercialized regions of the Occident and Orient ran into diminishing returns over these centuries. England escaped for fortuitous reasons. But "any large difference" in general living standards between the Yangzi Delta and England came quite late. Histories that concentrate upon the culture, political and institutional failures of Imperial China with the problems of resource constraints are Eurocentred and misplaced. Several of his critics have rejoined that England's escape was less and perhaps a lot less than fortuitous than his classic book suggests (De Vries

2011; Vries 2013). Our response set out below has been designed to compare standards of living measured in kilocalories of grain equivalents for the majority of households living in Jiangnan and England over the period 1600-1850.

The imperfect data tabulated in Tables 4 and 5 and summarized in Table 6 and more recent surveys of per capita food consumption have degraded any notion that English agriculture was afflicted by diminishing returns before the 1770s (Meredith and Oxley 2014). They suggest that the English economy provided and continued to provide superior standards of nutrition even for its "labouring poor" (unskilled labourers employed in husbandry and urban construction) before the benefits from natural endowments of coal and gains from foreign trade came fully on stream. Thus, our entry into the debate about the Great Divergence harks back to earlier discussions about the agrarian foundations for England's precocious transition to an urban industrial economy and by extension to more negative views of China's pre-modern agrarian economy as elaborated by scholars of Elvin's generation and more recently by Brenner and Isett (Crafts and Harley 2004; Elvin 1996; Brenner and Isett 2002; Wrigley 2006).

Before the evidence (that refers to incomes from money wages paid to unskilled rural and urban labour working in England as set out in Table 5 below) can begin to be analysed, two major caveats must be kept in mind. First, the annual nominal incomes of English wage dependent farm and building labourers were, to a smaller degree than their Chinese counterparts, supplemented by the earnings of their families, by rights of access to small plots of cultivable land and tied cottages as well as poor relief (Jones 1974). Second, the English evidence for wages remains far more voluminous, more extensive in coverage, more representative, and more accurate than anything published or possibly available in Chinese (or Indian or Ottoman) archives? (Allen 2001; Deng and O'Brien 2015 forthcoming)

Table 5. Estimates of Per Capita Daily Levels of Nutrition Derivable from the Wage Incomes of English Labourers in the Agricultural and Building Industries plus Conjectures for the

Supplementary Earnings of their Families <u>circa</u> 1600 to <u>circa</u> 1850 in Pence, Kilograms of Grains and Kilocalories of Nutrients*

Set 1 (Allen's wage data)	The Nutritional Levels of Farm Labourers and their Families				
Wage income in wheat:	1600-49	1650-99	1700-49	1750-99	1800-49
1.1 Pence per day / farm Labourer	10.2	12	12	13	18.9
1.2 Pence per day worked (275/365)	7.7	9.0	9.0	9.8	14.2
1.3 Price of wheat grain per kilogramme (Clark's database)	1.9	2.0	1.7	2.4	3.6
1.4 Kilograms of wheat grain per day worked	4.1	4.5	5.3	4.1	3.9
1.5 Kilocalories from flour per day worked	10200	11016	12614	10037	9547
1.6 Kilocalories of nutrients per capita*	2040	2203	2523	2007	1909
a) with supplementary family earnings of 20%	2448	2644	3027	2409	2291
b) with supplementary family earnings of 50%	3060	3305	3784	3011	3864
c) with supplementary family earnings of 70%	3468	3746	4276	3402	3236
Wage income in oats:					
1.7 Price of oat grain per kilogram (Clark's data)	1.2	1.2	1.2	1.6	2.6
1.8 Kilograms of oat grain per day worked	6.4	7.5	7.5	6.1	5.5
1.9 Kilocalories from oatmeal per day worked	12640	14813	14815	12048	10863
1.10 Kilocalories from oatmeal per capita	2528	2963	2963	2409	2172
a) with supplementary earnings of 20%	3034	3555	3556	2891	2607
b) with supplementary earnings of 50%	3792	4444	4446	3614	3259
c) with supplementary earnings of 70%	4285	5021	5021	4084	3683

Set 2 (Clark's wage data)	English Farm Labourers and their families Nutrients per Day in Kilocalories				
2.1 Pence per day / farm Labourer	8.4	10.1	10.3	12.8	20.8
2.2 Pence per day worked (275/365)	6.3	7.6	7.7	9.6	15.6
Clark's wage estimates as % of Allen's estimates	82%	84%	86%	98%	109%
Clark implied kilocalories as % of Allen's estimates*	82%	84%	86%	98%	109%

Set 3 (Allen's wage data)	Converted to Nutritional Levels for Builders' Labourers and their Families Residing in Southern English Towns				
3.1 Wage rates per day in pence	8.9	12.1	15.2	17.9	30.8
3.2 Pence per day worked (275/365)	6.7	9.1	11.4	13.4	23.1
3.3 Family consumption levels in kilocalories per capita*					
a) derivable from wheat flour (range of 20/70%)	2130/ 3017	2670/ 3783	3935/ 5559	3373/ 4763	3727/ 5178
b) derivable from oatmeal (range of 20/70%)	2640/ 3728	3591/ 5011	4621/ 6527	4337/ 5718	4171/ 5893

Set 4 (Clark's wage data)	Helpers to Craftsmen in the Building Industry converted to Kilocalories and Expressed as % of Allen's Data for Set 3				
4.1 Vide Set 3	97%	98%	81%	84%	75%

Set 5 (Broadberry and Gupta's wage data in grams of silver)	Builders Labourers and their families Residing in Southern English Towns				
Wage rates in:					
5.1 In grams of silver per day	4.1	5.6	7	8.3	14.6
5.2 In pence at prevailing rates of exchange	8.2	10.7	14.7	17.4	32.1
5.3 In Kilocalories per capita					
a) derivable from wheat flour (range of 20/70%)	2105/ 2981	2644/ 3746	3174/ 4289	3324/ 3411	3712/ 5258
b) derivable from oatmeal (range of 20/70%)	3034/ 4297	3555/ 5021	3733/ 5037	3989/ 5651	4222/ 5982

*Conversion coefficients are discussed and referenced in footnotes to the table

Notes and references:

1.1 Robert Allen's databases:
http://www.nuffield.ox.ac.uk/users/allen/data/lab.web.xls: Series B1 for prices and wages in London and Southern England 1259-1914.

1.2 Days worked per annum are conjectures from Allen's article "Agricultural Productivity and Rural Incomes in England and the Yangtze Delta, c.1620-1820," *Economic History Review*, 62 (2009), pp. 525-50. In other articles Allen worked with 250 days. We have applied 275 adult male working days to all the estimates used in this article.

1.3 G. Clark, "The Price History of English Agriculture 1209-1914," *Research in Economic History*, 22 (2004), pp. 41-124. The price is the annual average for each period. Clark's data in shillings per bushel were converted to pence per kilogram using conversion factors published by F.A.O and United States Department of Agriculture of 60lbs per bushel and 2.2lbs per kilogram. U.S.D.A Pdf. Spectrum of commodities.com/pdf/convfact/Y2KPpdf.

1.4 Wages in kilograms per day worked = 275/365 (farm labourers wage per day employed as cited in Note 1.1).

1.5 Kilocalories from flour per day worked is estimated as follows: the extraction rate given by the F.A.O. for converting wheat grains to wheat flour is cited at 72%, see "Food Energy – Methods of Analysis and Conversion Factors," *F.A.O. Food and Nutrition*, Paper 77 (Rome, 2003); see also N.I.I.R. Project Consultancy Services, *Wheat, Rice, Corn, Oats, Barley, Sorghim Processing Handbook. Cereal Food Technology*, Asia Pacific Business Press (2012).

1.6 Flour is converted into kilocalories per day using conversion factors derived from the sources cited in Note 1.5. These modern sources agree a kilogram of whole grain floor yields nutrients equivalent to 3600 kilocalories. Thus a farm labour's average wage 1600-1850 working 275 days a year could provide a little over 2000 kilocalories of nutrients for himself and his wife and three children.

1.7 Price of oat grain is from Clark cited in Note 1.3.

1.8 See calculations for wheat cited in Notes 1.2 and 1.3.

1.9 The factors used to convert oat grain into rolled oats and oatmeal are outlined in the sources cited in Note 1.5. For oat grain the extraction rates varies with the types of oats cultivated. We settled for a "model" rate of 50% and for the F.A.O. conversion factor of 1 kilogram of oatmeal translates into 3950 kilocalories of nutrients.

1.10 (a, b and c) The amount of additional nutrients units provided by the extra earnings of wives and children and other supplementary sources changed among families and over time. English economic historians have suggested ratios that vary from 20% to 70%. Vide Allen, "Agricultural Productivity" cited in Note 1.2 and Horrell and Humphries, "Old Questions, New Data and Alternative Perspectives," *Journal of Economic History* 56 (1996), pp. 561-604 and J. Humphries, *Childhood and Child Labour in the British Industrial Revolution* (Cambridge, 2011).

2.1 G. Clarke, "The Long March of History: Farm Wages, Population and Economic Growth in England," *Economic History Review* 60 (2007), pp. 97-135, Table 1 "estimated" day wage, Clarke's estimates vary between 82% and 109% of those cited in Note 1.1.

3.1 The wages rates are for builders labourers employed in the towns of Southern England (excluding London) are from the source cited in Note 1.1.

3.2 Allen's preferred assumption of a working year of 275 days is used for this row of figures.

3.3 The calculations for transforming wheat and oat grains into kilocalories of nutrients contained in wheat flour and oatmeal are explained in Notes 1.5, 1.6 and 1.9.

4.1 These figures are calculated as ratios to Set 3.

5.1 Average wage rates in grams of silver per day for these periods are taken from Broadberry and Gupta, "The Early Modern Great Divergence: Wages, Prices and Economic Development in Europe and Asia," *Economic History Review* 59 (2006), pp. 2-31. They obtained wage data from R. Allen, "The Great Divergence in European Wages and Prices from the Middle Ages to the First World War," *Explorations in Economic History* 38 (2001), pp. 411-47.

5.2 The rates of exchange between pennies and grams of silver are from P. Malamina's unpublished paper "When did England Overtake Italy? Medieval and Early Modern Divergence in Prices and Wages". The data can be accessed in the Statistical Appendix on www.paolomalamina.it

5.3 The conversion of wages to kilocalories utilized the methods outlined in Notes 1.4, 1.5, 1.6, 1.8 and 1.9 above.

Table 6. Stylized Comparisons of Standardized per Capita Levels of Kilocalories per Day Accessible to Families of the Labouring Poor in England, the Yangtze Delta and 3 Regions of India, circa 1600 - circa 1850

	Kilocalories Derived from Kilograms of:	1600-49	1650-99	1700-49	1750-99	1800-49
Set 1. Families of English Farm Labourers						

Allen (with 35% supplement)	wheat	2754	2974	3406	2709	2577
	oats	3412	4006	4000	3252	2932
Clark (with 35% supplement)	wheat	2258	2498	2929	2655	3245
	oats	2798	3365	3440	3187	3958
Set 2. Families of English Building Labourers						
Allen (with 35% supplement)	wheat	2396	3003	4426	3795	4198
	oats	2970	4038	5198	4879	4692
Clark (with 35% supplement)	wheat	2324	2943	3585	3187	3148
	oats	2881	3957	4210	4098	3519
Broadberry/Gupta	wheat	2368	2995	3570	3740	4176
(with 35% supplement)	oats	3413	3999	4199	4488	4750
Set 3. Families of Chinese Jiangnan Peasants Estimated by:						
Bozhong Li	rice	2647	-	-	-	2737
Allen	rice	2783	-	-	-	2871
Huang	rice	-	-	-	1896	-
Pomeranz	rice	-	-	-	2438	-
Brenner and Isett	rice	-	-	-	2440	-
Bozhong Li for Songjiang	rice	3475	-	-	-	3445
Set 4. Families of Indian Waged Labourers						
Broadberry/Gupta						
(with 35% supplement)						
North India	rice	2138	2415	1563	-	-
South India	rice	2342	2857	1545	1098	1011
Bengal	rice	-	-	1504	1940	1244

Notes and References:

The data for **Sets 1 and 2** are simplified (averaged) estimates derived from the sources and figures cited in table 4.

The "supplements" are guestimates of amounts added to nominal wage income from the earnings of wives, children and payments in kind from tied cottages with plots of cultivable land plus transfers from poor relief.
Set 3 is calibrated from the data and sources cited for Table 2.

Set 4 relates to the incomes of wage dependant families for 3 regions of India.
These estimates have been calculated from published data see reference to Table 4, Note 5.1 and unpublished data for Bengal made available to us by our colleagues Stephen Broadberry (LSE) and Bisnupriya Gupta (Warwick).

Their database for daily wage rates paid to "unskilled" and "low skilled" workers is derived from secondary sources and refers to a range of years within the periods specified. We calibrated their data cited in kilogrammes of rice into kilocalories per capita using methods described under Table 3, Rows 20 and 21 and Table 4, Notes 1.4, 1.5, 1.6, 1.7, 1.8 and 1.9. The figures for Bengal for 1800-49 are based on an extrapolation derived from an unpublished paper, S. Broadberry et al, “India and the Great Divergence” (LSE, February 2013).

Table 6 summarizes the disappointingly restricted and imperfect range of data painstakingly collected and calibrated for England and Jiangnan along with some preliminary and contentious references to Indian wages that have not been contextualized for purposes of comparison with Parthasarathi's figure for 1750 which translates into 2278 kilocalories (Parthasarathi, 1998). Our aim is to ascertain if valid indices have, or might be, constructed to test revised Weberian perceptions that the long run development of the agrarian economies of East (that possibly included South and West Asia) could continue to be plausibly represented as a history of retardation or relative backwardness compared to the urbanizing economies of Western Europe. Our configuration of this meta question is presumably what the Divergence Debate stimulated by the publication of seminal books by Landes, Frank and Pomeranz has been all about (Vries 2013). Alas, two of the three responses inspired by the Kuznetsian paradigm for modern economic history rooted in social science and quantification has not produced, and probably cannot produce, the statistics required either to lend strong support or to undermine Weberian and other Euro-centred perceptions. This holds because attempts to construct valid estimates particularly for per capita incomes and (so far) for real wages for pre-modern China and India continue to lack access to a foundational base of statistical sources or acceptable proxies for such sources. Quantified comparisons between the evolving economies of a premodern agrarian East and an urbanizing West can only proceed by way of exemplary micro case studies of an entirely regional or local kind representing evidence that addresses the core question of which polities or regions of Eurasia provided majorities of their populations situated in the lower deciles of the income distribution with relatively secure and superior standards of living over the centuries preceding and cumulating into an Industrial Revolution?

We have not investigated the related and supplementary question that has preoccupied other participants in the Divergence Debate, namely the relative levels of productivity per hour or day worked by unskilled labour farming land or engaged in the urban construction industries of England and Jiangnan (Li 1998; Pomeranz 2000, 2002, 2006 and 2011; Allen 2009). We have opted instead to locate our response within debates and theories in economics concerned with underemployed labour. Thus, we have concentrated our attention on data that might, as Pomeranz and Bozhong Li hoped, allow us to draw more secure and plausible inferences about standards of living that these two economies might have afforded for majorities of their resident households over the stages of development before divergence became unmistakable.

Our data derived from secondary sources, transformed into kilocalories and summarized in Tables 4 and 6, might stimulate more economic historians of China to follow the paradigm for research established by Bozhong Li and Philip Huang which are designed to measure the standards of living that the imperial economy provided for majorities of peasant farmers and their families over the centuries preceding the first Industrial Revolution. Meanwhile, the reconfigured micro data for Jiangnan looks secure enough to lend some qualified support to Marxian and Weberian perceptions that suggest that from around 1600 onwards the premodern states, institutions and cultures of China (and India, too?) were already “failing” to cope nearly as well as the economies and states of Western Europe with the “pressure of numbers” and persistent environmental degradation (Elvin 2004; Vries 2010).

As a recent and seminal article demonstrates, even England did not cope all that well between 1770 and 1850 (Meredith and Oxley 2014). Nevertheless, if inferences (derived from micro data for one advanced region of the Qing Empire) are acceptable, the debate on divergence could return to Joseph Bryant’s re-statement of the Weberian view that potential for specialization, trade and technological innovation between and among families, villages and regions of the Chinese Empire (and Mughal Empires?) had diminished over time. Political, agrarian, institutional and cultural preconditions for industrialization were never absent in Asia. They were simply not sustained nor strong enough to deliver earlier transitions to urban, industrial and market economies.

As a negotiable conclusion to a case study of a micro but potentially viable exercise in quantification, the point we wish to recommend is that the divergence debate might now heuristically return to Barrington Moore’s classic concerns with the agrarian foundations of industrialization in the Occident and the Orient (Happenbronwers and van Zanden 2000; Van Bavel 2001; More 1967; and Byers 1996).

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