

**ARENAS IN GLOBAL HISTORY: DATING THE GREAT DIVERGENCE**  
**POSITION PAPER**

# Dating the Great Divergence

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## Abstract

New data on Dutch and British GDP/capita show that at no time prior to 1750, perhaps not before 1800, did the leading countries of northwestern Europe enjoy sustained strong growth in GDP/capita. Such growth in income per head as did occur was highly episodic, concentrated in a few decades and then followed by long periods of stagnation of income per head. Moreover, at no time before 1800 did the leading economies of northwestern Europe reach levels of income per capita much different from peak levels achieved hundreds of years earlier in the most developed regions of Italy and China. When the Industrial Revolution began in Britain, it was not preceded by patterns of pre-modern income growth that were in any way remarkable, neither by sustained prior growth in real incomes nor exceptional levels of income per head. The Great Divergence, seen as the onset of sustained increases in income per head despite strong population growth, and achievement of incomes beyond pre-modern peaks, was a late occurrence, arising only from 1800.

**Keywords:** Great divergence; global history; Holland; Great Britain; China; industrial revolution; national accounts

The old has become the new. Reconstructed national accounts for the Netherlands and Great Britain have led economic historians to again embrace the classical view of the rise of the West.

This view – stemming from Marx and Weber – argues that from the sixteenth-century (or earlier), European economies began to grow steadily richer. By contrast, incomes in Asia stagnated or declined.<sup>1</sup> Europe's nineteenth-century industrialization thus resulted from an early divergence in economic trajectories, visible before 1700.

Recent works have argued that from the 1500s, Europe's interstate competition, foreign conquests, universities, corporate organizations, values or simply greater work effort commenced a sustained growth in income per head that had no equal in other societies.<sup>2</sup> To be sure, this process was not synchronous all across Europe. Italy made its contribution in the Renaissance, the Netherlands leapt ahead in the sixteenth century and England surged in the seventeenth and eighteenth centuries. Yet scholars describing a dynamic early modern Europe see this as a single

<sup>1</sup>H.-F. Hung, "Orientalist Knowledge and Social Theories: China and the European Conceptions of East-West Differences from 1600 to 1900," *Sociological Theory* 21 (2003): 254–79.

<sup>2</sup>P. Hoffman, *Why did Europe Conquer the World?* (Princeton, NJ, 2015); G. Clark, *A Farewell to Alms: A Brief Economic History of the World* (Princeton, NJ, 2007); T. Huff, *The Rise of Early Modern Science: Islam, China and the West* (Cambridge, 2003); D. N. McCloskey, *Bourgeois Equality: How Ideas, Not Capital or Institutions, Enriched the World* (Chicago, 2016); J. Mokyr, *The Culture of Growth* (Princeton, NJ, 2016); S. R. Epstein, *Freedom and Growth: The Rise of States and Markets in Europe, 1300–1750* (London, 2000); Angus Maddison, *Contours of the World Economy 1–2030 A.D.: Essays in Macro-Economic History* (Oxford, 2007); J. L. van Zanden, *The Long Road to the Industrial Revolution: The European Economy in Global Perspective 1000–1800* (Boston, 2009); J. de Vries, *The Industrious Revolution: Consumer Behavior and the Household Economy, 1650 to the Present* (New York, 2008); R. C. Allen, *The British Industrial Revolution in Global Perspective* (Cambridge, 2009); J.-L. Rosenthal and R. B. Wong, *Before and Beyond Divergence: The Politics of Economic Change in China and Europe* (Cambridge, MA, 2011); P. Vries, *Escaping Poverty: The Origins of Modern Economic Growth* (Goettingen, 2013).

process, resulting in Europe's leading regions being already far richer than their counterparts elsewhere by the onset of industrialization.<sup>3</sup>

Twenty years ago a small group of scholars, based mainly in California, argued that the classical view was profoundly mistaken.<sup>4</sup> This 'California School', drawing on emerging scholarship on China's economic and social history,<sup>5</sup> argued that economic and technological conditions in Europe c. 1800 were not greatly superior to those achieved even earlier in comparable parts of China. The advanced areas of China, like those of Europe, had achieved relatively high levels of urbanization, produced large volumes of sophisticated manufactures for international and long-distance domestic trade and had developed diverse consumer markets. This was not to deny great differences in political and social structure, in culture and science, most of which had been present for millennia.<sup>6</sup> Rather, the California School claimed that despite these differences, before the impact of industrialization Europe showed no distinctive advance with regard to its ability to sustain growth in *both* income per capita *and* population (the clearest mark of escape from Malthusian conditions), nor did Europe achieve unprecedented levels of income per capita.

Despite the importance of this dispute to understanding world history, arguments on both sides were made with data that was, admittedly, fragmentary. Moreover, the problem of making appropriate comparisons is rife with difficulties – what periods and geographical units should be the basis for estimating progress? Is it fair to compare income levels in Holland, the richest sliver of Europe with a population under 800,000 in 1750, with the much larger and more diverse countries of England (6 million in 1750) or France (25 million), much less China (200 million)?<sup>7</sup> Getting the right data to truly compare growth trajectories has been a challenge.

## I

One can, therefore, only shout 'Hallelujah' that dedicated teams of researchers have recently created national accounts for Britain and Holland from 1500 to 1800 that are unprecedented in their comprehensiveness and detail.<sup>8</sup>

<sup>3</sup>R. Fouquet and S. Broadberry, "Seven Centuries of European Economic Growth and Decline," *Journal of Economic Perspectives* 29 (2015): 227–244.; S. Broadberry and B. Gupta, "The Early Modern Great Divergence: Wages, Prices and Economic Development in Europe and Asia, 1500–1800," *Economic History Review* LIX (2006): 2–31.

<sup>4</sup>K. Pomeranz, *The Great Divergence: China, Europe, and the Making of the Modern World Economy* (Princeton, NJ, 2000); R. B. Wong, *China Transformed: Historical Change and the Limits of European Experience* (Ithaca, NY); A. G. Frank, *Re-Orient: Global Economy in the Asian Age* (Berkeley, CA, 1998); B. Li, *Agricultural Development in Jiangnan, 1620–1850* (New York, 1998); R. Marks, *Tigers, Rice, Silk and Silt* (New York, 2006); J. A. Goldstone, "The Problem of the 'Early Modern' World," *Journal of the Economic and Social History of the Orient* 41 (1998): 249–84; J. A. Goldstone, *Revolution and Rebellion in the Early Modern World: Population Change and State Breakdown in England, France, Turkey and China 1600–1850*. 25<sup>th</sup> Anniversary Edition (New York, 2016); J. A. Goldstone, "The Rise of the West—or not? A Revision to Socio-Economic History," *Sociological Theory* 18 (2000): 157–94; D. O. Flynn and A. Giraldez, *China and the Birth of Globalization in the 16<sup>th</sup> Century* (Farnham, 2010); P. Parthasarathi, *Why Europe Grew Rich and Asia Did Not: Global Economic Divergence, 1600–1850* (Cambridge, 2011); P. Vries, *Via Peking Back to Manchester: Britain, the Industrial Revolution and China* (Leiden, 2003).

<sup>5</sup>Especially G. W. Skinner, *The City in Late Imperial China* (Stanford, CA, 1977); W. Rowe, *Hankow: Commerce and Society in a Chinese City, 1796–1889* (Stanford, CA, 1992); J. Z. Lee and W. Feng, *One Quarter of Humanity: Malthusian Mythology and Chinese Realities* (Cambridge, MA, 2001); P. Perdue, *China Marches West: The Qing Conquest of Central Eurasia* (Cambridge, MA, 2005); T. Brook, *The Confusions of Pleasure: Commerce and Culture in Ming China* (Berkeley, CA, 1998); S. Naquin and E. S. Rawski, *Chinese Society in the Eighteenth Century* (New Haven, CT, 1987).

<sup>6</sup>D. Zhao, *The Confucian-Legalist State* (Oxford, 2015).

<sup>7</sup>Population of Holland from text below; England and France from M. Livi Bacci, *A Concise History of World Population*, 6<sup>th</sup> ed. (Hoboken, NJ, 2017), 69; China from von Glahn, *China*, 330.

<sup>8</sup>S. Broadberry, B. M. S. Campbell, A. Klein, M. Overton and B. van Leeuwen, *British Economic Growth, 1270–1870* (Cambridge, 2015); J. L. van Zanden and B. van Leeuwen, "Reconstruction National Accounts of Holland," 2016, <http://www.cgeh.nl/reconstruction-national-accounts-holland-1500-1800-0>. All uses of "GDP" and "GDP/capita" in this paper are *real* GDP and *real* GDP/capita from these sources.

These data open up new possibilities for evaluating the arguments on when modern growth began. We can scrutinize the national accounts for Britain and Holland to ask when they managed to sustain steady growth in GDP/capita, and when income growth was no longer squeezed out by subsequent population increase. We can compare this data with estimates of GDP/capita in other times and places to determine when real incomes in Holland and Britain moved significantly beyond those previously attained elsewhere. Finally, we can examine the new income data for consistency with other estimates of living standards, such as data on wages, heights or consumption, to assemble a fuller picture of various dimensions of changes in real incomes.

The creators of the new national accounts believe their data strongly supports the classical view. Broadberry states that ‘the Great Divergence between Europe and Asia had its origins in the late medieval period and was already well under way in the early modern period, as in the traditional economic history literature’.<sup>9</sup> De Pleijt and van Zanden similarly state that the ‘Industrial Revolution ... was ... a continuation of trends going back to the late Middle Ages’.<sup>10</sup> Other scholars have affirmed this view: Humphries and Weisdorf claim that ‘modern economic growth began more than two centuries earlier than commonly thought’, while Vries states that ‘Industrialization and modern economic growth in Great Britain ... were not sudden contingencies as the Californians like to suggest; they were to a certain extent a continuation of already existing trajectories’.<sup>11</sup>

Yet I shall argue that when looked at closely, the new data in fact do the opposite – they confirm the *absence* of sustained growth in income per head and of overcoming population pressures in Europe before 1800.

I proceed in three steps. **First, I examine the national accounts of Holland 1510–1807.** These reveal that while Holland had an impressive efflorescence of growth during its Golden Age, it thereafter settled into a long stagnation. Holland’s income per capita peaked in the 1590s, then gently declined and recovered partially only because significant population decline after 1700 offset a smaller decline in economic output. There is no evidence of any meaningful gains in GDP/capita in Holland for almost two centuries after 1600.

Next, I examine the data from Broadberry et al.’s landmark study of British economic growth. I demonstrate that at *no time prior to 1750*, going all the way back to the 1270s, did England experience *both* population growth and significant growth in income/capita during the same half-century. Rather, all of England’s growth in per capita income between the thirteenth and mid-eighteenth centuries came in just two half-centuries, 1350–1400 and 1650–1700, in both of which population declined. During all periods of even modest population growth prior to 1750, growth in GDP/capita was either negative or minimal (less than .2% per year). As with Holland, the gains in per capita income prior to 1750 are episodic and followed by stagnation, rather than marking the onset of sustained economic advance.

Finally, I briefly compare Dutch and British GDP/capita in 1750–1800 with data on GDP/capita from other times and places. These show that the economic achievements of Holland and Britain before 1800 were notable, but not unprecedented.

<sup>9</sup>S. Broadberry, “Accounting for the Great Divergence,” LSE Economic History Working Papers No. 814/13 (London, 2013), 3.

<sup>10</sup>A. M. de Pleijt and J. L. van Zanden, “Accounting for the ‘Little Divergence’: What drove economic growth in pre-industrial Europe 1300–1800,” *European Review of Economic History* 20 (2013): 387–409; also van Zanden, *Long Road*.

<sup>11</sup>J. Humphries and J. Weisdorf, “Unreal Wages? Real Income and Economic Growth in England, 1260–1850,” *The Economic Journal* 129 (2019): 2867; P. Vries, “What we do and do not know about the Great Divergence at the beginning of 2016,” *Historische Mitteilungen der Ranke-Gesellschaft* 28 (2016): 248.

## II

Van Zanden and van Leeuwen have painstakingly reconstructed detailed national accounts for Holland going back to the late Middle Ages.<sup>12</sup> I will here focus on their data for the period of 1510–1807. These years encompass Holland's Golden Age, a period in which many observers, including De Pleijt and van Zanden, but also de Vries and van den Woude, claimed to find the emergence of modern economic growth.<sup>13</sup>

In 2002, I introduced the concept of 'efflorescences' in economic history, to counter the notion that prior to industrialization there was only Malthusian stagnation or modern sustained income growth.<sup>14</sup> I noted that while pre-industrial societies mostly experienced long periods of little or no growth in per capita incomes, history revealed numerous exceptions. On many occasions, pre-modern societies made breakthroughs in productivity through improvements in agricultural practices, in energy and water transport, adopting new production techniques and products or advances in government organization and finance. Increased output and new products enabled a major expansion of trade, bringing further income gains. While such a burst of creativity could augment population increase, the real gains in productivity could be considerably faster, leading to a rise in *both* population *and* income per capita, breaking Malthusian bounds through Schumpeterian or innovation-led growth.

In such periods – often deemed 'golden ages' – even pre-modern societies start to look more modern, as surging productivity, gains in the service sector and investments in libraries and education, and high levels of urbanization, cultural production and consumption create richer, more diverse economies and lifestyles. Whether in Periclean Athens, Antonine Rome, Song China, the Caliphate of Baghdad, the high Middle Ages in Europe (where the advent of horse collars, heavily-ploughed three-field rotations and wind and water mills spurred the Cathedral Age), Renaissance Italy or Golden Age Holland, such episodes set standards for wealth and sophistication that stood for centuries.

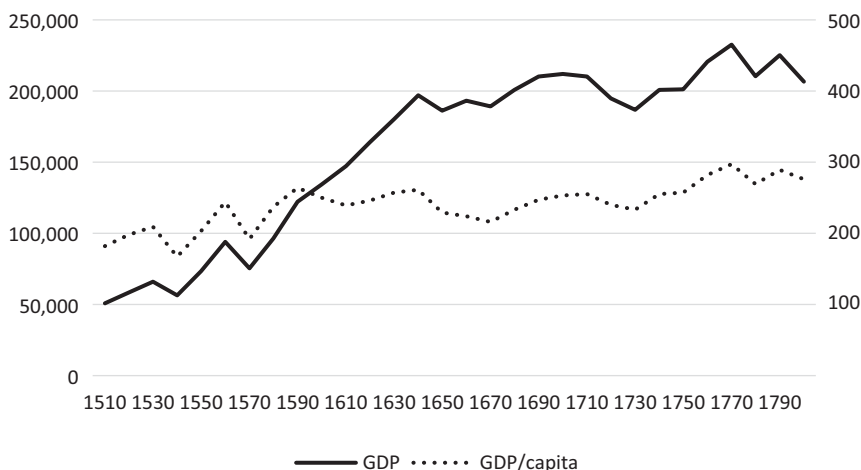
Yet such episodes lasted only a few decades. Once the gains of the initial productivity breakthrough had spread through society and been absorbed, there were no further large Schumpeterian gains. The return or continuation of population growth then squeezed out any further gains in income. To be sure, societies often retained the techniques and capital accumulated during the efflorescence, and preserved a new equilibrium, so that an efflorescence usually had a ratchet effect. Barring massive losses of capital due to wars or plagues or loss of major markets, the new higher levels of GDP/capita could be maintained for several generations. But the rapid growth in income per head seen during the efflorescence peters out and does not return, leaving subsequent stagnation of GDP/capita for generations or even centuries.

Holland's Golden Age was a classic efflorescence. In the fifteenth and sixteenth centuries, the spread of a cluster of innovations in ship design and construction, fishing, commercial farming and livestock production, warehousing, brewing, the use of peat and wind power, hydraulics and land reclamation provided major technological gains. The collapse of Antwerp due to wars in the mid-sixteenth century allowed Holland to dominate Baltic and north Atlantic trade, producing further growth. But by the 1590s, surging population halted any further gains in income per head, and after 1640 Holland settled into a long period of stagnation.

<sup>12</sup>van Zanden and van Leeuwen, "Reconstruction"; J. L. van Zanden and B. van Leeuwen, "Persistent But Not Consistent: The Growth of National Income in Holland, 1347–1807," *Explorations in Economic History* 49 (2012): 119–30.

<sup>13</sup>De Pleijt and van Zanden, "Little Divergence"; J. de Vries and A. van der Woude, *The First Modern Economy. Success, Failure and Perseverance of the Dutch Economy, 1500–1815* (Cambridge, 1997).

<sup>14</sup>J.A. Goldstone, "Efflorescences and Economic Growth in World History: Rethinking the 'Rise of the West' and the Industrial Revolution," *Journal of World History* 13 (2002): 323–389. Earlier, but less precise versions of this concept include "recurring growth" by E. L. Jones, *Growth Recurring: Economic Change in World History* (New York, 1988) and "florescences" by M. Hodgson in *Rethinking World History: Essays on Europe, Islam and World History*, ed. E. Burke III (Cambridge, 1993).



**Figure 1.** GDP (thousands) and GDP/cap in Holland 1510–1800 (decade averages in constant 1800 guilders).

We can now trace these developments in detail in Holland's national accounts data. The major trends are shown in Figure 1. The left scale shows GDP in constant 1800 prices in Dutch guilders; the right scale shows GDP/capita in the same measure.<sup>15</sup>

GDP started to rise strongly from the 1540s to the 1560s, declined in the next decade when the Dutch war for Independence with Spain began, but after the 1570s, there was rapid and unbroken growth up to the 1640s. By the 1640s, GDP had quadrupled from the beginning of the sixteenth century.

The national accounts show how the structural change in the Dutch economy manifested a clear efflorescence pattern. From the 1540s to the 1570s there was a sudden, one time shift in the composition of GDP, as more efficient services and new energy, transport and manufacturing processes took hold. In the 1540s, 48.4% of economic output was in services, 30.3% in crafts and manufacturing and 21.3% in agriculture. By the 1560s, as new techniques spread, services leapt to 64.7% of output, with crafts and manufacturing dropping to 21.7% and agriculture to a mere 13.6%. This new structural pattern then remained largely unchanged over the next two centuries. In the 1750s, services still contributed 59.4% of GDP, crafts and manufacturing 30.1% and agriculture 10.5%.

After 1640, the growth of GDP ceased. For over a century up through the 1750s, Holland's GDP was never more than 2% above the 1640s peak. There was a slight spurt of new GDP growth in the late eighteenth century, with GDP in the 1760s, 1770s and 1790s up by about 10% from the 1640 to 1750 level; but this too faltered and by 1800–1807, GDP was back to within 5% of the then 160-year-old peak. According to this new data, Holland's GDP grew by 300% from 1540 to 1640, but by not more than 5% for the next 150 years.

Tracking GDP/capita reinforces the view of this episode as an 'efflorescence'. From 1540 to 1590, GDP/capita in Holland grew strongly, gaining roughly 56%. This was accompanied by vigorous population growth, a rise of 37% from 337,000 in the 1540s to 462,000 in the 1590s.

After these five decades, however, growth in per capita income disappeared. GDP grew strongly for another half-century, but in those years, population growth accelerated and more than kept pace, so that GDP/capita dipped after the 1590s, inched up to that level again in the 1640s, but

<sup>15</sup>The decadal averages shown in Figure 1, and the period growth rates in Table 1, are calculated by the author from the annual data provided in van Zanden and van Leeuwen, "Reconstruction".



**Table 1.** Growth in Holland, 1510s–1800s, real GDP, population and real GDP/capita (indexed to 1500 levels = 100; growth is shown as annual growth rates)

	GDP	GDP growth since prior date	Pop	Population growth since prior date	GDP/cap	GDP/cap growth since prior date
1510s	100		100		100	
1540s	111.1	.35	121.4	.64%	91.4	–.30%
1590s	241.0	1.56%	166.4	.63%	144.7	.92%
1640s	389.0	.96%	271.4	.98%	143.3	–.02%
1700s	418.5	.12%	301.6	.18%	138.8	–.05%
1800s	407.9	–.03%	269.9	–.11%	151.2	.08%

then fell for the next century. Not until the 1760s did GDP/capita again reach its level of the 1590s, more than 150 years earlier.

Shortly after the 1640s peak in GDP, the population also hit a peak in the 1670s, at 876,000. By the 1750s, the population had declined by almost 100,000 to 783,000, and then fell yet another 34,000 by the years 1800–07. Had Holland's population not declined over the eighteenth century, the decline in GDP from the 1700s to 1800–07 would not have produced the 9% net increase in GDP/capita observed in that period. Even so, in 1800–07, Holland's GDP/capita was still just 4.4% above the level reached in the 1590s, over two centuries earlier.

These trends emerge more clearly in Table 1, which shows the rate of changes in GDP, population and GDP/capita during the three centuries from the 1510s to 1800s. GDP/capita shows tremendous growth in the five decades from the 1540s to the 1590s, but that is all. After the 1590s, growth in income per capita turned negative for over a century. Even the return of growth in the eighteenth century was almost risible, reaching .08% per year only because the decline in Holland's population over the eighteenth century (–.11% per annum) was greater than the decline in GDP (–.03% per annum).

The data compiled by van Zanden and van Leeuwen thus perfectly illustrate a classic pre-modern economic efflorescence: several decades of truly remarkable growth in GDP, GDP/capita and population, followed by a return in the succeeding two centuries to virtually zero growth in GDP, GDP/capita and population. Indeed, for all of these quantities, their level in the first decade of the 1800s is almost indistinguishable from their level in the 1640s, as is the sectoral composition of the economy.

Van Zanden and van Leeuwen note this general pattern, but prefer to stress the persistence of growth in GDP/capita.<sup>16</sup> This is despite the fact that such growth was strong for only five decades in the sixteenth century, then reversed for over a 100 years from 1590 to 1730, returned weakly from 1730 to 1770, then turned negative again from 1770 to 1807.

Moreover, even this persistence of growth in GDP/capita is somewhat illusory, as is clear when examining the underlying trends in *both* GDP *and* population. We then see that Holland's gains in GDP/capita were due to strong economic growth in the sixteenth century, but then were due to slightly *negative* economic and population growth in the eighteenth century, as shown in Table 1. The dynamics of growth were thus *not* consistent across time.

Even if one isolates the years from the low point of 1720 up to 1800, as van Zanden and van Leeuwen do to obtain positive GDP growth for the eighteenth century, as opposed to the slightly negative GDP trend found when comparing 1800–07 to 1700–09, their data show that total factor productivity growth during this period was tiny, just one-eighth that achieved from 1540 to 1620.<sup>17</sup> This hardly suggests that the return to slight gains in GDP/capita in the late eighteenth century represents a true continuation of the economic dynamic found in the sixteenth century.

<sup>16</sup>Van Zanden and van Leeuwen, "Persistent but not consistent" and "The Character of Growth before 'Modern Economic Growth'? The GDP of Holland between 1347 and 1807." CGEH Working Paper Series, no. 4. (Utrecht, March 2011).

<sup>17</sup>Van Zanden and van Leeuwen, "Character of growth," Tables 6 and 7.

Rather, as is evident from the population decline after 1700, Holland entered the eighteenth century in an increasingly depressed state. As Noordegraaf and van Zanden himself noted in an earlier study of regional growth in the Netherlands, by 1800 ‘In the port cities, fishing villages and industrial centres in Holland the economy was running full-speed backwards. . . . The expansion seen in the seventeenth century brought a relatively high standard of living for all social classes, including the lowest; the decline seen in the eighteenth century caused the standard of living to decrease and ultimately put Holland at a disadvantage in comparison to [other] parts of the Republic’.<sup>18</sup>

While these facts make the Dutch Golden Age even more impressive as an episode of GDP and GDP/capita growth, they also distinguish it from being the onset of an era of sustained growth in income per head. The absence of any meaningful increase in per capita income *for two centuries* after the 1590s could hardly be more distinct from the sustained rapid increase in income per head that we associate with modern economies.

To be sure, Holland was not alone, but part of northwest Europe. Broadberry and others have argued that although per capita income growth ceased in the Netherlands after 1600, it was just about to take off in England. England would then carry that growth forward into the industrial era.<sup>19</sup>

Let us, therefore, turn to the new data on GDP/capita for Great Britain.

### III

There is no dispute that after 1800, Great Britain’s economic progress was stunning. By 1850, its railways moved people and freight at previously unimaginable speeds, its steam-powered and ironclad warships subdued the mightiest empires in the world, and its factories allowed this small island to replace the centuries-old leadership of the vast Indian and Chinese empires and become the world’s leading exporter of cotton goods.

What is still a matter of great debate, however, is how far in this direction Britain’s economy had moved prior to 1800. Had Britain’s economy already by 1700 shown a clear break with Malthusian patterns, capable of producing rising real incomes despite population growth? Or was a new growth pattern only evident after the onset of industrialization, in the late eighteenth or even only the early nineteenth century? Fortunately, we can now answer that question in the light of the new national accounts.

Table 2 shows Broadberry et al.’s data for the growth rate of GDP/capita for half-century periods from the 1270s through the 1860s, along with their data on population growth.<sup>20</sup> If we except two periods – the late 1300s and the late 1600s – then the net growth of GDP/capita for all other periods from the 1270s to the 1750s, a period of almost 500 years, was essentially zero; to be precise, just .0003% per year. By contrast, in the two growth periods, we see very rapid gains in income per head of .57% and .79% per year. Essentially, *all* the growth in English GDP/capita between the Middle Ages and the mid-eighteenth century was due to these two brief spurts, three centuries apart. Put another way, according to Broadberry et al., GDP/capita for England/Great Britain increased by 135% from 1270 to 1750. But this was in no way due to sustained growth; without those two brief growth spurts, GDP/capita in 1750 would have been just 12.4% higher than in 1270.

<sup>18</sup>L. Noordegraaf and J. L. van Zanden, “Early Modern Economic Growth and the Standard of Living: Did Labour Benefit from Holland’s Golden Age?” in *A Miracle Mirrored: The Dutch Republic in European Perspective*, eds. K. Davids and J. Lucassen (Cambridge, 1995), 434.

<sup>19</sup>Broadberry, “Accounting,” Fouquet and Broadberry, “Seven centuries”.

<sup>20</sup>The 1340s were used as the late decade for the early fourteenth century because the Black Death created a sharp discontinuity between the 1340s and 1350s. Throughout this paper, decadal levels and growth rates presented as “from Broadberry et al.” were calculated from their annual data (Appendix 5.3, 225–244), unless explicitly attributed to another specific table in Broadberry et al.

**Table 2.** Growth rates for population and real GDP per head in England and Great Britain, from decadal averages, from the 1270s to the 1860s (% per year)

	Population	Real GDP per head
England		
1270s–1300s	.23	–.02
1300s–1340s	–.06	.07
1340s–1400s	<u>–1.32</u>	<u>.57</u>
1400s–1450s	–.14	–.07
1450s–1500s	.29	.11
1500s–1550s	.66	–.16
1550s–1600s	.64	.18
1600s–1650s	.45	–.05
1650s–1700s	<u>–.06</u>	<u>.79</u>
Great Britain		
1700s–1750s	.31	.18
1750s–1800s	.82	.39
1800s–1830s	1.43	.41
1830s–1860s	1.17	1.15

These results are similar to those obtained in a segmented analysis of Broadberry et al.'s data by Crafts and Mills. They also find growth occurred only in spurts, finding an annual increase of real GDP/capita of just .03% prior to 1663, jumping to .74% per year from 1663 to 1707, but then falling back to .27% per year from 1707 to 1822. Only after that date does growth in GDP/capita shift up to the Industrial Revolution level of over 1% per year.<sup>21</sup>

The late fourteenth century was the era of the Black Death, and income gains followed a major population decline. Yet, England's post-plague gains merely raised Britain's fifteenth-century GDP/capita to the level already attained by Spain over a century earlier, while remaining well behind that of Italy.<sup>22</sup> After this brief spurt of catch-up growth to 1400, English GDP/capita then remained unchanged for the next 250 years.

If we were to stop the clock in 1650, it would be obvious that England had not yet embarked on anything like sustained economic growth. Not only had there been no change in GDP/capita in the prior two and a half centuries, there were also no major shifts in the structure of the economy. The share of GDP produced by agriculture in 1381, of 45.5%, remained almost unchanged in 1600, at 41.1%.<sup>23</sup>

After 1650, there are signs of change. Table 2 shows that income per head rose strongly in 1650–1700, and then from 1700 onwards, Britain was able to combine growth in both population and GDP/capita. Humphries and Weisdorf's new real wage data shows precisely the same pattern: the wage level in the 1650s was no higher than the post-Black Death peak in the 1400s, but then rapidly increased.<sup>24</sup> Was this the onset of modern economic growth?

How we answer this question depends greatly on how we view events from 1650 to 1800 – was this entire period one of sustained growth in income per capita, or something else? We shall examine the eighteenth century in more detail below. Let us first focus on the remarkable income growth from 1650 to 1700. What happened in these decades?

The answer is that a one time shift in the economy coincided with a period of slight population decline to produce a surge in income per capita. In this period, England experienced a boom in the export production of textiles, driven by the 'new draperies', a blend of wool and other fibres that was lighter than the 'old draperies' of heavy wool.

<sup>21</sup>N. Crafts and T. Mills, "Six Centuries of British Economic Growth: A Time-Series Perspective," *European Review of Economic History* 21 (2017): 142.

<sup>22</sup>Broadberry et al., *British Economic Growth*, Table 10.02.

<sup>23</sup>*Ibid.*, Table 5.01.

<sup>24</sup>Humphries and Weisdorf, "Unreal Wages," Table A2.



The new draperies were wildly popular internationally, spurring a marked expansion of English textile exports, in place of raw wool. This success propelled a large number of workers into spinning and weaving for merchants.<sup>25</sup> (It also helped that England received large numbers of skilled Protestant workers fleeing stricter Catholic rule on the Continent.)

Nonetheless, this shift did not transform the entire economy, and certainly did not create the onset of *sustained* substantial growth in income per capita. If one accepts the Broadberry et al. estimates for this period, changes in agriculture were minimal. Their Table 5.07 shows that from the 1650s to 1700, real output in agriculture rose only .2% per year. This was the smallest gain since the 1400s, and would have fallen far short of keeping pace with population if the latter had grown at the same rate as in the previous century-and-a-half, when population increase averaged .59% per year. Industrial output rose smartly, by 1.01% per year in this period, as did output in services (.71% per year). Still, agriculture remained the largest sector of the economy, so this drag mattered. If population growth had continued at .6% per year in 1650–1700, even the observed gains in *all* sectors would have yielded an increase in GDP/capita for this period of only .006% per year, wiping out all the gains. An increase in income per capita that is *entirely* dependent on a significant drop in the normal rate of population growth hardly appears to be a new mode of growth.

More importantly, the vigorous growth in industrial output per capita that drove income gains in 1650–1700 then petered out. Where industrial output per capita had risen by 73% from 1650 to 1700, such gains came to an abrupt end when population growth returned after 1700; in the next half-century, industrial output per capita rose only 8.6%, or just over one-tenth as much.

In sum, while growth in GDP/capita from 1650 to 1700 was striking, it did not begin a process of dynamic growth. Rather, the late seventeenth-century spurt in GDP/capita depended on a plunge in the population growth rate, and was followed by a return to much slower income growth when relatively modest population growth resumed.

Broadberry et al.'s data show that from the 1700s to the 1750s, British growth in GDP/capita was just .18% per year. It is striking that Britain could not make stronger gains in GDP/capita in this half-century, even though this was also a period of relatively weak population growth, indeed lower than any half-century of population increase since the fifteenth century. Far from entering a new dynamic growth phase, after 1700, Britain's growth of GDP/capita to the 1750s was *just the same as* the long-term growth rate from the 1270s to the 1700s, which had been .18% per year. An observer looking back from 1750 at income growth in the last half-century would have found, once the 'new draperies' boom of the late seventeenth century petered out, no divergence at all from the centuries-old long-term growth rate since the thirteenth century.

We must therefore look for the onset of modern economic growth somewhat later – no earlier than 1750.

#### IV

Britain in the eighteenth century saw the invention of the steam engine, the Arkwright water frame and Crompton's mule, the use of coking coal and puddling to produce iron, the seed drill, Wedgwood's pottery works, the marine chronometer, the threshing machine, chemical bleaching and more.

<sup>25</sup>C. Muldrew, "'Th'ancient Distaff' and 'Whirling Spindle': Measuring the Contribution of Spinning to Household Earnings and the National Economy in England, 1550–1770," *Economic History Review* 65 (2012): 498–526. Muldrew notes that a huge portion of labor moved into textile production in this period. This supports the findings of L. Shaw-Taylor and E. A. Wrigley, "Occupational Structure and Population Change," in *The Cambridge Economic History of Modern Britain: Volume 1, Industrialisation, 1700–1870*, eds. R. Floud, J. Humphries, and P. Johnson (Cambridge, 2014), 53–88, who find that a major shift of employment into manufacturing occurred prior to 1700.

Yet, there is a long path from invention to adoption, and then to having an impact on the economy. Even if these inventions had significantly raised output as early as the later eighteenth century, one has to ask whether it was sufficient to raise output per head. As the population was rising fast, if agriculture was not keeping the pace, then the early stages of industrial growth might not have offset the struggle to provide sufficient food and its drag on incomes. To know whether Britain had embarked on a path to modern growth before 1800, we have to determine whether growth in GDP/capita had broken from prior trends before that date.

Broadberry et al. seem to provide a clear answer. According to their data, shown in Table 2, after 1750 Britain managed to combine both strong growth in population and large gains in GDP/capita. It looks like a break from pre-industrial patterns of income growth had arrived.

Unfortunately, however, there are anomalies in their data for 1700–1800. Broadberry et al.'s reported gains in GDP/capita in this period depend not only on rising output per head in industry and services, but also on their claim of remarkable growth in agricultural output per capita: .55% per year from the 1700s to 1750s, and even stronger growth of .93% per year from the 1750s to 1800s. This is anomalous because all other analysts of British agriculture in the eighteenth century have found a marked *decline* in the growth of agricultural output per capita from 1700 to 1800.<sup>26</sup>

So far, all arguments in this paper have taken Broadberry et al.'s data as they present them. But I am not the only one to suggest further examination of that data. Recent analyses by Nuvolari and Ricci and by Clark argue for much lower rates of agricultural growth after 1750 than reported by Broadberry et al.

Nuvolari and Ricci tested the output-based estimates of Broadberry et al. by constructing a demand-side approach, following the method used by Malanima to construct GDP estimates for Italy.<sup>27</sup> Their estimates of GDP/capita start at 1250, and they find England's post-plague income gains from the 1270s to the early 1400s are not new advances, but just a recovery to mid-thirteenth-century levels of income per head. They then see a slight further rise in GDP/capita of 16% to 1450, followed by no further gains until the late 1600s. So far, this is not radically different from Broadberry et al. But for the eighteenth century, they wholly reverse Broadberry et al.'s results. Where the latter find strong growth in GDP/capita over this century, Nuvolari and Ricci find gains in GDP/capita from 1700 to 1750, but then a sharp downturn that leaves GDP/capita in 1800 almost 20% lower than in 1750, and unchanged from its level in 1710.

There is a similar divergence in their estimates of agricultural output per capita. Broadberry et al. report a rise in agricultural output/capita from 1700 to 1750 of 12.6%, then a further rise of 5.5% to 1800. While Nuvolari and Ricci find a similar rise of 15% from 1700 to 1750, for the next 50 years they find that agricultural output per capita sharply *declined*, falling by 25% to 1800.

Clark has long argued for slow growth in Britain's economy, and he reasserts that in his latest analysis of British agriculture.<sup>28</sup> While Broadberry et al. have mounted a vigorous response to his views,<sup>29</sup> this centres largely on Clark's estimates of output in the medieval period. In fact, Broadberry et al.'s and Clark's data are in reasonably good agreement regarding growth trends in agricultural output per capita from 1500 to 1750. However, for the period 1750–1800,

<sup>26</sup>R. C. Allen, "English and Welsh Agriculture, 1300–1850: Output, Inputs, and Income," Economics Working Paper, Nuffield College, Oxford University (Oxford, 2005); G. Clark, "Growth or Stagnation? Farming in England, 1200–1800," *Economic History Review* 70 (2017): 1–27; A. Nuvolari and M. Ricci, "Economic Growth in England, 1250–1850: Some New Estimates Using a Demand Side Approach," *Rivista di Storia Economica* 39 (2013): 31–53; D. Meredith and D. Oxley, "Food and Fodder: Feeding England, 1700–1900," *Past and Present* 222 (2014): 163–214.

<sup>27</sup>Nuvolari and Ricci "Growth in England," following P. Malanima, "The Long Decline of a Leading Economy: GDP in Central and Northern Italy, 1300–1913," *European Review of Economic History* 15 (2010): 169–219.

<sup>28</sup>Clark, "Growth or Stagnation"; for earlier work see Clark, "Long March" and "The Macroeconomic Aggregates for England, 1209–2008," in *Research in Economic History*, ed. A. J. Field, 27 (2010): 51–140.

<sup>29</sup>S. Broadberry, B. M. S. Campbell, A. Klein, M. Overton, B. van Leeuwen, B., "Clark's Malthus Delusion: Response to "Farming in England 1200–1800" ," *Economic History Review* (2017): 1–26.

**Table 3.** Estimates for total agricultural output per head of population in England and Wales (Allen, Clark and Broadberry et al. to 1700), England (Nuvolari and Ricci) and for Britain (Broadberry et al. 1700s–1800s), indexed to 1700 = 100

	Allen	Nuvolari/Ricci	Clark	Broadberry et al.
1500/22	131.2	126.4	140.3	117.1
1550s	102.9	119.5	81.3	97.5
1600s	84.3	93.0	95.0	100.9
1650s	90.7	93.2	91.3	88.9
1700s	100	100	100	100
1750s	110.9	114.6	102.6	117.9
1800s	<b>83.5</b>	<b>86.0</b>	<b>65.2</b>	<b>124.4</b>

Clark reinforces Nuvolari and Ricci; where the latter finds a decline in agricultural output/capita of 25%, Clark finds a decline of 35%.

We can also add the estimates of farm output by Allen.<sup>30</sup> Allen has worked on English farm output for decades and has published estimates of agricultural production based on input, output and income approaches. His findings again mirror those of Clark and Nuvolari and Ricci, and run sharply counter to those of Broadberry et al. Allen finds that from 1700 to 1750, agricultural output per capita rose by 10.9%, but in the second half of the century, it dropped by 24.7%.

Table 3 summarizes the estimates of agricultural output per capita for all of these authors from the early sixteenth century to the 1800s.<sup>31</sup> Their agreement for the centuries from 1500 to 1750 is striking. All authors show a slow decline in output per head from the early 1500s to 1750, and their estimates are generally within 10–20% of each other. Yet, equally striking is the anomalous character of the Broadberry et al. data for output per head in the 1800s, where their estimate of output per head is 50–100% greater, and in the opposite direction, showing an increase in output per head from 1750 to 1800, where all others show a marked decline.

Why are the Broadberry et al. estimates of agricultural output per head so disparate? It is not because of large differences in estimating arable output, although Broadberry et al are more optimistic. They claim that the output of wheat (in million bushels, net of seed and animal consumption) just kept pace with population growth from the 1700s to the 1800s, both rising by 66%.<sup>32</sup> Rather, a significant part of the differences, and the gain in output per head, come from their estimates of livestock and livestock products. These are most difficult, as Broadberry et al. tell us that ‘Calculating the output of the livestock sector is more speculative than equivalent calculations for the arable sector,’ and moreover that ‘Paradoxically, the least well-documented period is that nearest the present,’ as eighteenth-century farm accounts are more scarce than medieval manor rolls. They thus rely heavily on small samples of farm accounts, and then generalize to the rest of the country. Yet, this is particularly dubious for livestock, inasmuch as they state that ‘perhaps disappointingly, data on numbers of farm animals are not systematically recorded in the accounts.’<sup>33</sup>

Nonetheless, Broadberry et al. develop national estimates of farm animals. These provide startling numbers for eighteenth-century increases in livestock and livestock products. They find from

<sup>30</sup>R. C. Allen, “Economic Structure and Agricultural Productivity in Europe, 1300–1800,” *European Review of Economic History* 3 (2000): 1–25.; Allen, “English and Welsh Agriculture.”

<sup>31</sup>Note: for Allen and Clark, as their output data is only for England and Wales, I derive per capita output from 1700 onwards using their total output and the population data on England and Wales (not Britain) from E. A. Wrigley, R. S. Davies, J. E. Oeppen, and R. S. Schofield, *English Population History from Family Reconstitution, 1580–1837* (Cambridge, 1997), Table A9.1. For Clark, I use agricultural output with his assumption of a 250-day working year.

<sup>32</sup>Broadberry et al., *British Economic Growth*, Table 3.07.

<sup>33</sup>*Ibid.*, pp. 86, 99.

the 1700s to the 1800s that the output (in millions of pounds of meat) of beef and veal increased by 442%, mutton by 99% and pork by 327%. Total meat output in this half-century rose by 163%, or two and a half times as fast as the population increased (66%). By far, the largest increase in meat output per capita was in the latter half of the century: meat output grew from 53.1 pounds per person per year in the 1700s to 63.3 pounds per person in the 1750s and then to 83.9 pounds per person in the 1800s. Because all livestock and livestock produce estimates are based on imputed animal counts, not only meat, but hides (193%), milk (259%), cheese (391%) and butter (441%) also show extraordinary increases in output and output per capita.<sup>34</sup>

Are these figures plausible? Were England and Wales producing 83.9 pounds of meat per year for every man, woman and child in the country? This seems unlikely. In 2018, in the United States of America, the combined consumption of beef and pork was 110 pounds per person. In China, as of 2018, consumption of beef and pork was 81.4 pounds per person. Is it conceivable that Britain, during the early stages of the Napoleonic war, was eating as much meat per person as China is today, and almost as much as the United States of America?<sup>35</sup>

## V

Given the stark differences in these estimates, it should be possible to determine who is correct by looking at other data on the availability of foodstuffs in the late eighteenth century. Fortunately, we have studies giving trends in wages, consumption and heights.

While one should be suspect of what the real wages of workers tell us about living standards overall, given distributional issues, there is certainly no evidence in the new Humphries and Weisdorf wage index of strong improvements throughout the eighteenth century – even though they rightly argue that their index is far more optimistic than prior real wage series for the eighteenth century. While their annual real wages index closely tracks the Broadberry et al. GDP/capita index from 1250 to 1670, it then diverges significantly, remaining substantially lower than the GDP/cap index for every decade (except an anomalous jump in the 1780s) until after 1800. Although Humphries and Weisdorf do show a net gain in real wages over the eighteenth century, they do follow Allen, Nuvolari/Ricci and Clark in finding stronger growth in the first half of the eighteenth century: their annual real wage series shows an annual growth rate of .28% from 1700–10 to 1750–60, but then an annual growth rate of .18% from 1750–69 to 1790–1800.<sup>36</sup>

Several other scholars have joined Allen and Clark in their pessimistic assessment of agricultural output per person during the eighteenth century. Wrigley estimates that total kilocalories consumed per day per person from home production of grain, meat and dairy products declined from 3,136 in 1700 to 2,772 in 1800, and Warde suggests a decline from 3,300 per person per day to 2,900 over the same period.<sup>37</sup>

The discrepancy between Broadberry et al. and almost all other accounts of agricultural output in 1750–1800 is so great that several scholars have tried to reconcile these differences by a critical review of this work. Kelly and O'Grada suggest that Broadberry et al. simply have overall calorie consumption in 1700 too low, and that contributions from rye and lard are undercounted.<sup>38</sup>

There is also a curious error in Broadberry et al.'s text, suggesting they might accept the mainstream view. In Chapter 7, they write 'During the first half of the eighteenth century a prospering

<sup>34</sup>Meat production from *ibid.*, Tables 3.15 and 7.04; per capita values calculated using population totals from Wrigley et al., *English Population History*, Table A9.1.

<sup>35</sup>Hannah Ritchie, "Which Countries Eat the Most Meat," *BBC News*, February 4 (2019); Caixin, "Charts of the Day: China's Growing Meat Consumption," October 12 (2018).

<sup>36</sup>Humphries and Weisdorf, "Unreal Wages," Table A2.

<sup>37</sup>P. Warde, *Energy Consumption in England and Wales, 1560–2000* (Rome, 2007); E. A. Wrigley, *Energy and the English Industrial Revolution* (Cambridge, 2010).

<sup>38</sup>M. Kelly and C. O'Grada, "Numerare Est Errare: Agricultural Output and Food Supply in England Before and During the Industrial Revolution," *Journal of Economic History* 73 (2013): 1132–63.

agricultural sector began to export grain, so that by 1750 roughly 8% of the grain crop was exported. Thereafter, as population grew faster than domestic output (Table 5.07), the trend was reversed and Britain became a net importer of grain. . . . By 1800 grain imports were already making a critical difference'.<sup>39</sup> Yet, their Table 5.07 shows that from 1750 to 1800, they have agricultural output growing considerably *faster* (.93% per annum) than population (.77% per annum). Perhaps, the discrepancy is simply a computing mistake?

That would also explain why Broadberry et al. show domestic food consumption in kilocalories *declining* from 1750 to 1800: their Table 7.06 shows a drop from 2,253 kilocalories per head extracted from agricultural output in the 1750s to 2,022 extracted in the 1800s.

Another effort to reconcile these diverse estimates has been provided by Meredith and Oxley, who cross-examined a variety of estimates of calorie consumption and heights in Britain over the eighteenth century.<sup>40</sup> After all adjustments, their 'final estimate' of consumption fails to find any growth over the eighteenth century: they estimate kilocalories per day consumed from domestic agriculture per 'equivalent consuming unit' to have declined slightly from 3,350 in 1700 to 3,205 in 1800. They also find a moderate increase in domestic calories consumed from 1700 to 1750, but then a sharp decline from 1750 to 1800. In fact, they note that all estimates of consumption that they examine 'agree on a decline by 1800'.<sup>41</sup>

This would sharply refute the estimates of Broadberry et al. of an agricultural sector whose output was growing considerably faster than population, providing 24.4% more output per person in 1800 than in 1700. Indeed, Meredith and Oxley's assessment of conditions by 1800 is sobering:

The golden age of English agriculture crashed to its end under unprecedented levels of population growth, in spite of attaining hitherto undreamed-of productivity. Never again would English agriculture produce sufficient to feed its own people, and in the early 1790s England made the transition from net grain exporter to net importer. Now the store cupboard emptied more quickly than it filled [and] domestic calories fell.<sup>42</sup>

Given the contention over agricultural output and calorie consumption, scholars have turned to another measurement, which does not depend on examining agricultural quantities or prices at all – the heights of large samples of the population. Adult heights are quite sensitive to nutritional status during the growing years. A higher intake of calories should lead to noticeable increases in heights.

Yet, we do not see any improvements in height in any of the samples studied of the English population born before 1800. Meredith and Oxley summarize the existing height data from diverse military and prison populations for which we have measures of adult height. They see a rise to the 1770s but then a marked decline to 1800, which is consistent with their summary of consumption. Two separate reanalyses of Floud et al.'s height data by Komlos and by Cinnirella, adjusting for recruitment practices by the Marine Society and truncation points in army recruitment, confirmed that for lower class British youth, heights declined considerably over the latter half of the eighteenth century.<sup>43</sup>

In sum, neither the height data nor alternative estimates of agricultural output from other scholars, nor the efforts by yet other scholars to reconcile the diverse estimates, gives any support

<sup>39</sup>Broadberry et al., *British Economic Growth*, 261.

<sup>40</sup>Meredith and Oxley, "Food and Fodder".

<sup>41</sup>*Ibid.*, 171.

<sup>42</sup>*Ibid.*, 212.

<sup>43</sup>R. Floud, R. W. Fogel, B. Harris, S.-C. Hong, *The Changing Body: Health, Nutrition, and Human Development in the Western World since 1700* (Cambridge, 2011); J. Komlos, "On English Pygmies and Giants: The Physical Stature of English Youth in the Late 18<sup>th</sup> and Early 19<sup>th</sup> Centuries," *Research in Economic History* 25 (2008): 149–68; F. Cinnirella, "Optimists or Pessimists? A Reconsideration of Nutritional Status in Britain, 1740–1865," *European Review of Economic History* 12 (2008): 325–54.

**Table 4.** Sensitivity of Broadberry et al.'s estimates of GDP/capita growth rates in the eighteenth century to adjustments in agricultural output (annual growth rates based on decadal averages)

	Agricultural output	GDP	GDP/capita
(a) Broadberry et. al.			
1270s–1700s (England)	.10	.22	.18
1650s–1700s (England)	.20	.78	.79
1700s–1750s (Britain)	.55	.49	.18
1750s–1800s (Britain)	.93	1.21	.39
1700s–1800s (Britain)	.74	.85	.29
(b) Consensus of other scholars: 25% decline in average output/capita 1750–1800			
1270s–1700s (England)	.10	.22	.18
1650s–1700s (England)	.20	.78	.79
1700s–1750s (Britain)	.55	.49	.18
1750s–1800s (Britain)	.24	1.02	.20
1700s–1800s (Britain)	.40	.75	.19

to the notion of a substantial increase in output per person in British domestic agriculture from 1750 to 1800. Rather, they all point to a decline in agricultural output per person for the late eighteenth century.

## VI

This matters greatly for Broadberry et al.'s claim to have located the onset of modern economic growth in Great Britain before 1700. For if we take away their very rapid expansion of agricultural output in the latter part of this century, their evidence for a strong continuous rise in income per capita starting in 1650 disappears as well.

Table 4 shows what happens to Broadberry et al.'s overall growth estimates if one modifies their extraordinary growth of agriculture in the latter 1700s. Part (a) shows a summary of annual growth rates for agriculture, GDP and GDP/capita from Broadberry et al.'s data in Appendix 5.3.

Contrary to all other evidence, Broadberry et al. report an accelerating rate of growth in agricultural output over the eighteenth century, with annual growth vaulting from .55% per year in the first half to .93% in the second half. This helps GDP/capita growth jump from the typical pre-modern rate of .18% per year from the 1700s to 1750s to the impressive rate of .39% from the 1750s to the 1800s.

However, if we adjust agricultural performance, the picture for the eighteenth century becomes far less impressive. In part (b), the rapid growth in agricultural output after 1750 has been replaced with more realistic assumptions based on the review of research on the agricultural output given above. We noted that Clark, Nuvolari and Ricci and Allen estimated a decline in British agricultural output per head between 1750 and 1800 of 35%, 24.7% and 25%, respectively. Meredith and Oxley, in their final adjusted series, estimate that calorie consumption from domestic sources declined from 4,058 in 1750 to 3,205 in 1800 – a decline of 21%. Given this range of estimates, and putting aside the lowest and highest, it seems reasonable to see what happens if we replace Broadberry et al.'s unrealistic advances in agricultural output per head with something closer to a consensus view: that agricultural output per head declined by 25% in the latter eighteenth century. This would imply a growth rate of the agricultural output of .24% per year, about half that in the first half of the century.

As Table 4 shows, this change has significant consequences for the argument for sustained growth in income beginning in 1650. Overall GDP growth declines just slightly from the 1750s to 1800s, from 1.21 to 1.01% per year, but given strong population growth, this is enough to reduce the growth rate of GDP/capita to a far less impressive .20% for the late eighteenth



century, and to .19% for the century as a whole – essentially the same as the long-term growth rate from 1270 to 1700.

Broadberry et al., in their unchanged data, already show the growth rate of GDP/capita dropping from .79% per year during the growth spurt of 1650–1700, when the population was slightly falling, back to the long-term average rate of .18% per year when population growth returned after 1700. If we insist that their estimates of agricultural output per head be changed to conform to the scholarly consensus of a decline from 1750 to 1800 – as is confirmed by the height and calorie consumption data as well as competing output estimates – then for the entire eighteenth-century Britain returned to the long-term, miniscule growth rate. Indeed, for the entire four centuries from 1400 to 1800, aside from the one episode of 1650–1700, *in no half-century period did GDP/capita growth ever exceed .2% per year.*

Crafts and Harley were quite right – growth *was* very slow during the early Industrial Revolution.<sup>44</sup> This is not to say that Britain did not experience dramatic changes in the eighteenth century. Growth rates in industry and services, at nearly 1.5% per year from the 1750s to 1800s, greatly exceeded anything seen in England's prior history; and the boom in these sectors likely promoted exceptional population growth as well.<sup>45</sup> It was a time of amazing invention, urbanization and trade expansion, during which industrial growth reached unprecedented levels and Britain began its role as a workshop of the world. Yet, the Broadberry et al. data firmly show that these great changes began *before* Britain had achieved anything like a clear departure from pre-industrial patterns of per capita income growth. Thus, it was the Industrial Revolution that produced a novel pattern of sustained growth in income per head despite rising population; there was no such pattern prior to the nineteenth century.

## VII

One may wonder why I have bothered to make the above points. After all, Broadberry et al. note the same patterns in their data. They say 'Between 1270 and 1700 much [GDP/capita growth] was concentrated into the two great growth surges of the second half of the fourteenth and second half of the seventeenth centuries.' They also grant that from 1650 to 1700 'GDP per head was able to move ahead so strongly . . . in part because the population had stopped growing and even shrank a little . . . . This episode therefore fails to meet one of Kuznets's . . . criteria for modern economic growth, namely that rising population and GDP per head should take place concurrently.' They even note the petering out of income growth after 1700: 'Significantly, the rate of GDP per head growth slackened in the eighteenth century as the rate of GDP growth slowed (Table 5.04) and the population began again to increase. . . . As the pace of population growth quickened from mid-century GDP per head growth slowed further (Table 5.05).'<sup>46</sup> Their Table 5.05 shows the growth rate of GDP/capita falling from .84% per year from the 1650s to the 1690s to just .27% per year from the 1690s to the 1760s, then nearly disappearing altogether, falling to .10% from the 1760s to the 1780s. In other words, even their own, unrevised, data show that after the income gains of 1650–1700, population increases were gradually squeezing out any growth in GDP/capita from 1700 to 1780.

Broadberry et al. thus seem to accept that according to their data, GDP/capita growth prior to the 1780s was highly episodic, limited to periods of no population growth and was petering out after the most recent spurt in the late 1600s. As noted earlier, Crafts and Mills's econometric analysis of their data identifies the same pattern: they find a stationary state of zero growth from 1400 to 1660. After that date, they do not find a steady growth acceleration; rather they find further

<sup>44</sup>N. Crafts and C. K. Harley, "Output Growth and the British Industrial Revolution: A Restatement of the Crafts-Harley View," *Economic History Review* 45 (1992):703–30.

<sup>45</sup>J. A. Goldstone, "The Demographic Revolution in England: A Reexamination," *Population Studies* 49 (1986): 5–33.

<sup>46</sup>Broadberry et al., *British Economic Growth*, 203, 211.

segmentation: .84% per year growth from 1663 to 1707, dropping to .27% all the way from 1707 to 1822, then a sudden quadrupling of the income growth rate to 1.03% per year to 1870.<sup>47</sup> Again, it seems clear that the late seventeenth-century growth spurt was exceptional and followed by a sharp slowdown in growth, with rapid GDP/capita growth only erupting suddenly in the nineteenth century.

And yet, Broadberry et al.'s interpretation of the historical significance of their findings is nearly the opposite! They maintain that their data shows that 'the growth of real GDP ... proceeded more or less continuously ... Plainly the economy had been advancing along an upward growth path long before the industrial revolution got under way.'<sup>48</sup>

Why adopt a description that is so at odds with the very data that they have produced? Broadberry et al., and others who share their view, want to interpret their findings as supporting the traditional account that European economic growth, and hence the Great Divergence, began at a relatively early date. They, therefore, impose an interpretation on their data that identifies trends which they seem to believe make Europe exceptional. They seek to do that in four ways: First, for both Holland and Britain, they treat the whole period from the 1300s to the 1800s as one of slow, but persistent income growth. They do this by stressing that even if growth really was highly restricted and episodic, with all gains made in short periods of a few decades, what matters is that the gains made during such periods of growth were retained and not lost in later periods. That is, an absence of 'growth reversals' is claimed to be the unique factor that makes Holland and Britain 'divergent' from other parts of Europe and the world. Second, they argue that over these centuries the Dutch and then British economies underwent exceptional structural shifts, with manufacturing and services becoming more significant parts of the economy. Third, they argue that northwest Europe formed the 'leading edge' of Europe's economy, with first Holland and then Britain taking the role of advancing GDP/capita, building on the earlier gains of Renaissance Italy. Altogether, these claims allow them to maintain that parts of Europe did in fact have uniquely dynamic economies that were on a trajectory of sustained growth in income per capita even before the onset of industrialization in the late eighteenth century.<sup>49</sup>

Yet this is simply untrue. There is absolutely no evidence in the data for either the Netherlands or Britain of truly *sustained growth* in GDP/capita before the 1780s. Holland did succeed in combining strong population growth and GDP/capita growth for *five decades* from the 1540s to the 1590s. Thereafter, growth in GDP/capita disappeared for the following two centuries. Britain *never* achieved strong growth in both population and GDP/capita before the 1780s; its only surges of GDP/capita growth occurred when the population fell, lasted only a few decades, and were both followed by a petering out of income growth.

It is of course true that there was a structural change during the periods of income growth; that is how 'efflorescences' occur. A cluster of productivity-raising advances in agriculture, manufacturing or trade creates a boom and rising incomes; new markets are exploited and trade expands. But such structural shifts offer no guarantee of future income growth. As we have seen, Dutch achievements in shipbuilding, hydraulics, brewing, fishing, finance and trade before 1640 were incredible; but after a few decades, they also stimulated a surge in population that future GDP growth could not outpace, putting an end to GDP/capita growth. The innovations in trade and textiles and the shift of labour into manufacturing that spurred British income growth from 1650 to 1700 were also notable; but when population growth returned after 1700, growth in GDP/capita faded away. Structural change of the episodic kind seen in northwestern Europe before the 1780s could be substantial without producing further income growth.

Broadberry et al. make much of the fact that these episodic gains were retained; even if GDP/growth ceased for centuries, or as soon as population growth returned, what mattered is

<sup>47</sup>Craft and Mills, "Six Centuries," 142.

<sup>48</sup>Broadberry et al., *British Economic Growth*, 203.

<sup>49</sup>These arguments are presented in the works cited in footnotes 9–14.

that GDP/capita levels did not fall back to earlier levels. That is true, but why is that significant? Such long-term stasis of GDP/capita was neither a special virtue of northwest European countries, nor was it the basis for modern growth; instead, it was the normal situation for most advanced organic economies for a century or two after an efflorescence.

Central/northern Italy's GDP/capita in 1570 was just 20% lower than its peak level in 1450. That is about the same decline as Holland experienced after its Golden Age, when by the 1670s GDP/capita had fallen 18.5% from its 1590s peak.<sup>50</sup> Moreover, even in 1750, central/northern Italy's GDP/capita was unchanged from its level in 1500; that performance equaled England's stability of GDP/capita from 1400 to 1650 – except that Italy's GDP/capita was sustained at a level of 40% higher than England. Yet, no further real income growth followed.<sup>51</sup>

Far more impressive was Song China, which in 1020 with a population of 50 million achieved GDP/capita levels within 10% of what Britain achieved in 1650 with 5 million population. While China's GDP/capita rose and fell with the dynastic cycle over the following centuries, in the early Qing, 700 years after the Song, GDP/capita for China again reached Song levels, despite a further tripling of the population to 150 million.<sup>52</sup> Yet GDP/capita grew no further. Much earlier in western history, Josiah Ober claims that classical Greece, c. 350 BCE, reached levels of urbanization and income per head comparable to those of seventeenth-century England, while Paulo Malanima and Elio Lo Cascio argue that Italy under Caesar Augustus reached similar levels of income per head that lasted over 150 years.<sup>53</sup> Merely attaining income gains and holding them for centuries despite later population growth clearly bestowed no special advantages for further progress.

Of course, had it been the case that growth spurts in Holland and Britain really did build on prior growth, creating progressive gains that continuously raised the income frontier, surpassing anything comparable anywhere else in the world, then one could make a claim for an exceptional European growth dynamic as the prelude to industrialization.

Yet this is factually untrue; far from being a locomotive of progressive gains, the spurts of growth in Renaissance Italy, Golden Age Holland and Stuart Britain were more like a merry-go-round; each leader simply caught up to and took the place of the last.

## VIII

There are enormous risks and likely errors in converting output and population data in very diverse regions and economies into comparable figures for output per capita. These risks would be severe enough if the comparison was in kilocalories of food per person, or silver exchange equivalents; it becomes even more hazardous when contemplating comparisons in modern units such as constant international dollars. Some have even pronounced such comparisons to be meaningless.<sup>54</sup> But as Broadberry et al. have undertaken to create such comparisons, and used them to argue regarding the date of the Great Divergence, let me pay them the compliment of using their own data to make my case.

Table 5 shows the latest data assembled by Broadberry and his collaborators on GDP/capita for various European countries and China, in terms of the peak level of GDP/capita achieved.<sup>55</sup> The

<sup>50</sup>Decade averages calculated from the annual data provided in van Zanden and van Leeuwen, "Reconstruction".

<sup>51</sup>S. Broadberry, H. Guan and D. D. Li, "China, Europe and the Great Divergence: A Study in Historical National Accounting 980-1850," *Journal of Economic History* 17 (2018): 47.

<sup>52</sup>China GDP/cap data from Broadberry, Guan and Li, "China, Europe," 46; Chinese population levels from von Glahn, *China*, 225, 330.

<sup>53</sup>J. Ober, *The Rise and Fall of Classical Greece* (Princeton, NJ, 2015), 84–87; E. Lo Cascio and P. Malanima, "GDP in Pre-Modern Agrarian Economies (1-1820 AD): A Revision of the Estimates," *Rivista di Storia Economica* 25 (2009): 400.

<sup>54</sup>K. Deng and P. O'Brien, "Establishing Statistical Foundations of a Chronology for the Great Divergence: A Survey and Critique of the Primary Sources for the Construction of Relative Wage-Levels for Ming–Qing China," *Economic History Review* 69 (2016): 1057–82.

<sup>55</sup>Broadberry, Guan and Li, "Great Divergence" Tables 7 and 8, pp. 988–99.

**Table 5.** Peak GDP/capita in various societies in history, in constant 1,990 international dollars, from Broadberry, Guan and Li, 'Great Divergence'

Country (Year)	Peak GDP/capita	Ratio: Renaissance Italy
Augustan Italy	1,400	.84
China (1020/1700)	997/1,089	.60/.66
China – richest region (1020/1700)	1,775/1,905	1.07/1.15
Spain (1348)	907	.54
N. Italy (1450)	1,657	1.00
The Netherlands (1750)	1,877	1.13
Great Britain (1750)	1,710	1.03
Great Britain (1800 – Broadberry et al.)	2,080	1.25
Great Britain (1800 – Allen, N&R)	1,837	1.10

last column then gives the ratio of those peak levels to that achieved in central/northern Renaissance Italy, c. 1450.

I should add a word about choosing spatial units to make comparisons more truly comparable. As noted above, while it is useful to take advantage of our excellent data on economic trends in Holland to observe long-term dynamics in a very advanced region, it would be wrong to take Holland as typical of even the northern Netherlands as a whole, much less northwest Europe. Holland was a tiny trading republic with under a million inhabitants before 1800, centred on the city of Amsterdam. Pfister has shown that incomes in coastal trading cities are not representative of incomes in the hinterland. His analysis of real wages in German towns from 1650 to 1800 showed that Hamburg's unskilled workers' wages were generally even higher than those in London and Amsterdam, even though wages in inland Germany were similar to wages in Italy and Spain, at less than half the level of the coastal trading cities.<sup>56</sup> I thus exclude GDP/capita in Holland from comparison with other entire countries of several or tens of millions, rather using the Netherlands for such comparisons.

For China, we have the opposite issue; if Holland is too small a unit, then China as a whole, with a population ranging from 50 million in 1020 to 150 million in 1700, is too large. Even the Yangzi delta had 30 million inhabitants in 1700, making it far larger than the Netherlands, Britain or central/northern Italy, all with populations of under 7 million at that date. To make a comparable unit, we would have to select a relatively prosperous area with perhaps the richest 25% of regions in the delta, such as the silk-producing region that stretched from Hangzhou to Suzhou, filled with towns and cities of 20,000–50,000 'whose inhabitants engaged in hundreds of artisanal crafts to sate the swelling hunger for luxury goods and new consumer staples.'<sup>57</sup> Broadberry, Guan and Li suggest that it is reasonable to assume that the very richest area of China had an income per head 1.75 times that of China's population as a whole.<sup>58</sup>

Table 5 shows that with the exception of medieval Spain and China as a whole, which are low, and Great Britain in 1800, which by Broadberry et al.'s unadjusted data is exceptionally high, the figures are all within 15% or less of each other – that is, arguably the same within reasonable measurement error. Far from building on earlier waves of progress, Great Britain and the Netherlands in 1750 were at about the same level of income, and both were within 15% of the peak attained c. 1450 in Renaissance Italy – essentially zero progress in income per capita over three centuries. Depending on whether one takes the unrevised or agricultural output adjusted GDP/capita figures for Britain, even in 1800, its income per head was only 10–25% greater than that of Italy 350 years earlier. Compared to the richest areas of China, as late as 1750, Britain had

<sup>56</sup>U. Pfister, 'The Timing and Pattern of Real Wage Divergence in Pre-Industrial Europe: Evidence from Germany, c. 1500–1850,' *Economic History Review* 70 (2017): 701–729, Figure 8.

<sup>57</sup>Von Glahn, *China*, 300, 346.

<sup>58</sup>Broadberry, Guan and Li, 'Great Divergence,' 990.

not reached the level achieved in China in 1020, and even then only had a GDP/capita about 20% higher than Augustan Italy, seventeen centuries before.

If we look at the world's leading economies from 100 to 1800 C. E., the pattern of output per head is one of remarkable uniformity: none of the European countries at any time achieves any meaningful advantage in GDP/cap over any other's peak achievement, nor over that of China. At least as regards peak GDP/cap, as late as 1800, there is no divergence of any kind, anywhere.

Broadberry et al. argue that after 1700 China's GDP/capita rapidly declined, creating a marked divergence in incomes from Britain.<sup>59</sup> That may be true; but 'Great Divergence' should not mean just a gap in real income per head; Italy, after all, enjoyed a huge such gap in the 1400s over Britain, and Holland in 1600 an even bigger one, to no long-term advantage. Rather, the idea of the 'Great' divergence is that some regions entered a growth trajectory never seen before, with per capita income steadily rising, income gains no longer limited by population growth and GDP/capita reaching levels never previously attained.

Yet, no part of Europe shows such a divergence before 1800. Even according to Broadberry et al.'s unrevised data, from 1700 to 1780, Britain's growth in GDP/capita was in steady decline, shrinking to barely .1% per year from the 1760s to the 1780s. Population growth was already squeezing out gains in GDP/capita, and if not for the gains from industrialization after the 1780s, worse was to come. Meredith and Oxley's vision of the future looking forward from the 1770s does not portend divergence: 'England and Wales were set on a dangerous, Malthusian road. Without a port, an empire, and a newly emerging trading world beyond, that road would have led to a dead end.'<sup>60</sup> If not for the coming gains from industrialization, England after 1770 might well have followed the same path followed by China after 1700, with population growth pushing ahead of food production and income per head not merely ceasing to grow, but starting to decline.

## IX

This is not to deny that crucial things were happening in Europe from 1600 to 1800, such as the flurry of inventions, the advance of parliaments, religious pluralism, scientific advances and other factors that contributed to subsequent economic achievements. It is only to say that the backdrop for these crucial things was not a pattern of uniquely sustained income growth. It was, in each country, centuries of complete stagnation of GDP/capita, interrupted by a few decades of exceptional growth, followed by a return to very low growth rates in income per head, with GDP/capita never much exceeding the levels reached in central/northern Italy in 1450. It thus appears that for pre-industrial societies, there was a 'Peak Pre-Industrial Income' of roughly \$1,800 per year in 1990 International Dollars, which many societies across the world and across thousands of years of history approached, but never significantly exceeded.

As Leigh Shaw-Taylor and E.A. Wrigley remark in their review of changes in pre-modern England's economy,

Rather than viewing the changes in the English economy which took place before the mid-eighteenth century as part of a lengthy but unitary process which culminated as the industrial revolution, therefore, they should perhaps be regarded differently. Such changes may have been a necessary but were not a sufficient condition for the later transformation which took place. . . . the nature of the major changes taking place in the seventeenth and early eighteenth centuries had much in common with those which had occurred earlier in the Netherlands, and . . . were more likely to herald future stagnation than an increased momentum of growth.<sup>61</sup>

<sup>59</sup>Broadberry, Guan and Li, "Great Divergence".

<sup>60</sup>Meredith and Oxley, "Food and Fodder," 191.

<sup>61</sup>Shaw-Taylor and Wrigley, "Occupational Structure," 84, 86.

This paper has said nothing about the ultimate causes of the Great Divergence. That debate remains open. Still, in order to explain something, it is important to know exactly what is to be explained. Identifying exactly *when* a departure from typical patterns of pre-modern growth in GDP/capita occurred is surely foundational for explaining that departure. The new data make it indisputable that the onset of a distinctive and new pattern of economic growth – strong growth rates in GDP/capita that are sustained for more than just a few decades despite increases in population – was a relatively late phenomenon, only evident in the GDP/capita data from the very late 1700s, or perhaps only after 1800.

We can therefore see why the Great Divergence, when it took place in the nineteenth century, caught the population of the world quite unawares, and why even expert observers of the British economy in the late eighteenth century, such as Adam Smith and Thomas Malthus, could not see signs of its approach. A completely new growth pattern only arrived suddenly after 1800. The Great Divergence was indeed sudden and late.

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