Seven Centuries of European Economic Growth and Decline[†]

Roger Fouquet and Stephen Broadberry

John Maynard Keynes (1931) wrote in his essay "Economic Possibilities for Our Grandchildren":

> From the earliest times of which we have record—back, say, to two thousand years before Christ—down to the beginning of the eighteenth century, there was no very great change in the standard of life of the average man living in the civilised centres of the earth. Ups and downs certainly. Visitations of plague, famine, and war. Golden intervals. But no progressive, violent change. Some periods perhaps 50 per cent better than others—at the utmost 100 per cent better—in the four thousand years which ended (say) in A.D. 1700.

Over the decades, his nuanced account of the past has become a great deal more stylized—the lack of "very great" or "violent" change became an absence of any change. Today, received wisdom holds that the western European countries did not experience major phases of economic growth (or decline) prior to the Industrial Revolution. As one example among many that could be cited, Hansen and Prescott (2002, pp. 1214–15) write that "sustained growth has existed for at most the past two centuries, while the millennia prior have been characterized by stagnation with

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no significant permanent growth in living standards." Yet qualitative accounts of European histories seem to indicate that the Renaissance in Italy and the Golden Age in Holland reflected phases of economic development—associated with the expansion of trade and urbanization, as well as developments in art and science—prior to the Industrial Revolution (Goldthwaite 2009; Acemoglu and Robinson 2012; de Vries and van der Woude 1997).

Building in part on Angus Maddison's (1982, 1995, 2003) bold empirical research program to create very long-run data series for many countries, a generation of economic historians has been exploring archives and combining datasets to create more and better evidence. Over the last four years, a number of very long-run time series have been completed for major economies of Europe connecting the late medieval era with the present using annual data. The new time series have been looked at individually by the researchers who produced the data (Broadberry, Campbell, Klein, Overton, and van Leeuwen 2011; Malanima 2011; van Zanden and van Leeuwen 2012; Schön and Krantz 2012; Álvarez-Nogal and Prados de la Escosura 2013; Reis, Martins, and Costa 2013). The main aim of this paper is to present this data together and offer an alternative interpretation of very long-run European economic development.

The first section of this paper rejects the received wisdom that economies in pre–Industrial Revolution Europe were stagnant. The new data shows trends in GDP per capita in the key European economies before the Industrial Revolution, identifying episodes of economic growth in specific countries, often lasting for decades. Ultimately, these periods of growth were not sustained, but they noticeably raised GDP per capita. It also shows that many of these economies experienced periods of substantial economic decline. Thus, rather than being stagnant, pre-nineteenth century European economies experienced a great deal of change.

In the second section, the paper tentatively finds that the likelihood of being in a phase of growth increased and the risk of being in a phase of decline decreased in the nineteenth and twentieth centuries. The discussion in the third section turns to evidence on patterns of divergence and convergence in Europe, showing that divergence occurred when a new economic leader moved ahead, followed by a period of convergence and catch-up by others. The fourth section presents the main data sources and methods used to construct the GDP per capita estimates from the late medieval and early modern eras until the nineteenth century in six European economies: England/Great Britain, Holland, Italy, Spain, Sweden, and Portugal.

Following the publication of successive editions of Maddison's (1982, 1995, 2003) data on long-run economic performance, understanding of long-run economic growth and development advanced, as many economists exploited the new information. Research by Baumol (1986), DeLong (1988), and Pritchett (1997) relating to convergence and divergence is based on Maddison's post-1870 OECD countries dataset, which helped to stimulate endogenous growth theory. Maddison's work was also a key inspiration for new theories of economic growth: for instance, Maddison's later dataset covering the entire world during the second millennium stimulated work by Hansen and Prescott (2002) and Galor (2005).

The production of these new very long-run datasets may spur an equivalent or greater wave of understanding of economic growth and development. For the first time, it is possible to investigate annual changes in economic growth and development over several centuries, potentially identifying multiple major phases of economic growth and decline in one or a series of countries. This more detailed perspective of very long-run European economic growth indicates that the Industrial Revolution was not an isolated event originating in Great Britain. Instead, it was a phase in a much longer process of economic transformation across Europe.

Given current concerns about limited growth in industrialized economies and thoughts about ways to stimulate a new industrial revolution, research based on this data may offer insights about these underlying processes and be of great interest to economists in general. Since economic transformations on the scale of the Industrial Revolution are rare events, an understanding of the processes underlying such transformations will need to look back many centuries. Furthermore, comparisons of past experiences with more recent ones may suggest commonalities in the relationships with and determinants of economic development. This paper focuses on presenting basic facts and patterns to the best of our current abilities, and avoids the temptation to seek more detailed explanations. However, recent work, work in progress, and future papers seem certain to employ this data as the basis for new empirical and theoretical research.

Growth Episodes and Growth Reversals in Europe before 1800

Economic growth before the nineteenth century was not stagnant, but had extended periods of growth and decline. Figure 1 presents GDP per capita for six European countries before the nineteenth century: England (from 1300 until 1700) and Great Britain afterwards, Holland (starting in 1348), Italy (specifically, Central and Northern Italian States from 1310), Spain (since 1300), Sweden (beginning in 1560), and Portugal (from 1500).

Figure 1 depicts four major "growth episodes" in specific European economies. Of the economies shown, Italy was the first to have experienced a per capita growth episode as population declined sharply after the Black Death, leaving survivors with more land and capital per person. Moreover, it was a period in which Italian cities prospered by expanding their pivotal role in trade links between Europe and Asia (Hodgett 2006). Between 1350 and 1420, the level of per capita income rose by 40 percent, which represents a modest but nonnegligible growth rate of 0.8 percent per year over 70 years.

Holland followed with a spectacular sixteenth century. Per capita GDP rose by 70 percent from 1505 to 1595 as Dutch trade expanded rapidly and the economic structure shifted away from agricultural production towards higher-value commodities, which translates into a growth rate of 1.3 percent per annum during this period. A decade later, Sweden started developing through its control of the Baltic trade, and its per capita GDP grew 41 percent in the first half of the seventeenth century.

Figure 1
GDP per Capita in Selected European Economies, 1300–1800
(three-year average; Spain eleven-year average)
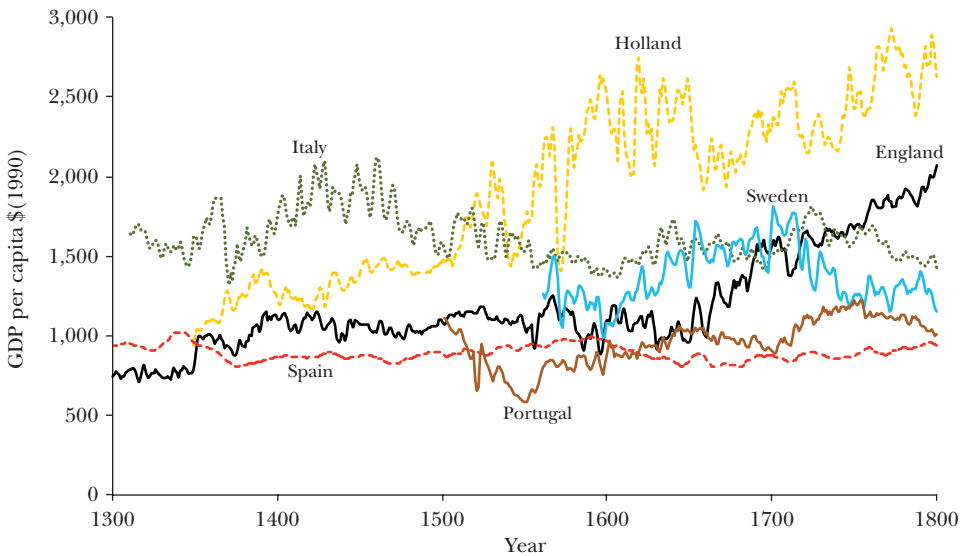
Sources: England/Great Britain (Broadberry et al. 2011); Italy (Malanima 2011); Holland (van Zanden and van Leeuwen 2012); Sweden (Schön and Krantz 2012); Spain (Álvarez-Nogal and Prados de la Escosura 2013); Portugal (Reis, Martins, and Costa 2013; Palma and Reis 2014).
Note: Figure 1 presents GDP per capita for six European countries before the nineteenth century: England (from 1300 until 1700) and Great Britain afterwards, Holland (starting in 1348), Italy (specifically, Central and Northern Italian States from 1310), Spain (since 1300), Sweden (beginning in 1560), and Portugal (from 1500).

In the second half of the seventeenth century, England became the next vibrant economy—its per capita income growing by more than 50 percent during this time. This growth episode followed the end of a Civil War that marked an important step on the road to constitutional monarchy, culminating in the Glorious Revolution of 1688 (North and Weingast 1989; Acemoglu and Robinson 2012). However, population stagnated during the second half of the seventeenth century, so it was only after 1700 that Great Britain achieved modern economic growth with the coexistence of population growth and per capita GDP growth.

To ensure that these phases are not artifacts of selecting peaks and troughs in a volatile series, the total growth in GDP per capita is measured as the average value in the decade following the "growth episode" divided by the average value in the decade preceding this phase—although for reasons explained in greater detail later in this paper, one should be careful about over-interpreting these estimates. Some might argue that, starting from a low base, a rise of 40 or even 70 percent may not be a great absolute increase, and indeed, it is not very impressive when spread over 50 years or more. Nevertheless, these are unquestionably extended periods,

covering a number of decades, in which certain economies grew substantially in both relative and absolute terms, providing major improvements in the average standards of living (although ideally, distributional effects of these increases would also be taken into account). Clearly, these pre–nineteenth century European economies were not stagnant.

Interestingly, at practically every point during the entire sixteenth and seventeenth centuries, at least one economy in Europe was experiencing a growth episode. It would be worth investigating in greater detail the scale of spillovers to trade partners and the degree of emulation in these early periods (Reinert 2011). Certainly, England was highly dependent on Swedish iron imports in the seventeenth century (King 2005) and sought to emulate Holland's economic policies (Thirsk 1978). At the same time, until the eighteenth century, no two economies of the six shown here experienced simultaneous major phases of economic growth. While this certainly does not support the dubious mercantilist belief that foreign trade was a zero-sum game—and in particular, the belief that only exporters gained from international trade—it might help to explain why the belief held traction for so long (Smith 1776).

Figure 1 also identifies the periods that can be categorized as economic "growth reversals." Italy suffered most from periods of major economic decline, from its early period of glory. It experienced three periods of substantial decline of around 20 percent of per capita GDP as population growth returned, its markets remained fragmented between small states, and the focus of European trade shifted from the Mediterranean to the Atlantic. Following the collapse of per capita incomes in Italy in the mid-fifteenth century, it took more than 400 years to regain these levels of GDP per capita. Portugal suffered a dramatic collapse of roughly 40 percent of per capita GDP in the first half of the sixteenth century, associated with poor weather conditions (Reis, Martins, and Costa 2013)—though it recovered partially in the subsequent two decades. The Spanish economy also declined from the end of the sixteenth century—which was associated with the resource curse resulting from silver mining in the colonies (Drelichman 2005; Álvarez-Nogal and Prados de la Escosura 2013). Sweden suffered a collapse in the early eighteenth century, as it lost its great power status, with per capita GDP dropping almost 30 percent in three decades. Finally, after a period of growth in the first half of the eighteenth century, Portugal lost 16 percent of per capita GDP in three years and then spiraled downwards following the Great Earthquake of Lisbon in 1755.

There is little understanding of major economic collapses, especially since they are such rare events. In *Anna Karenina*, Leo Tolstoy proposes that "[a]ll happy families are alike; each unhappy family is unhappy in its own way." Certainly, there has been plenty of effort put toward finding in what way successful economies are alike, but little toward understanding the ways in which unsuccessful economies decline. More analyses of economic declines are needed to complement studies of economic failure such as Easterly and Levine (1997), Rodrik (1999), and Acemoglu and Robinson (2012). These new long-run datasets hold the promise of shedding light on economically depressed phases in history.

The Long Road to Sustained Growth

Each of the six European economies discussed here experienced phases of economic growth and decline at different times. Despite the different national patterns, did a general change in growth rates occur over time? In particular, one might provisionally expect that there were more phases of growth and fewer phases of economic decline in later centuries.

In looking at Figure 1, few obvious differences between centuries emerge. The seventeenth and eighteenth century perhaps show greater growth, but they also have more and better data. Many different criteria have been proposed for identifying phases of growth more formally, such as the frequency of consecutive years of growth (Hausman, Pritchett, and Rodrik 2005; Easterly 2006). However, identifying phases of growth is more difficult when analyzing mostly agrarian economies or periods before reliable statistical records existed, because of the high volatility in the GDP per capita series. The volatility can result either from weather-sensitive agricultural production or the estimation methods, which inevitably display a great degree of uncertainty.

Not surprisingly, therefore, a more formal analysis does not identify any difference over these earlier centuries: for example, in each century before 1800, there was only a 1–2 percent chance of a country being in a period of more than 1.5 percent annual growth in four consecutive years, as shown in Table 1, column 2. For comparison, this likelihood increased to a 5 percent chance in the nineteenth century and a 40 percent likelihood during the twentieth century. So, for the six countries observed, there was a substantial difference in the likelihood of sustained periods of growth between the pre-1800 period and the nineteenth and twentieth centuries. As received wisdom suggests, sustained economic growth seems to be a more recent phenomenon.

Looking at the economic downturns, Figure 1 does not seem to display an obvious change in frequencies before 1800. However, Table 1 provides some evidence. Here, we use a criterion of three consecutive years of less than −1.5 percent growth to identify a downturn. Adding across the six countries, there were 47 downturns before the nineteenth century and only eight after 1800. Between the fifteenth and eighteenth century, there was an average of two economic downturns per country per century (10 + 14 + 9 + 12 episodes divided by six countries divided by four centuries), while the nineteenth and twentieth centuries experienced less than one economic downturn per country per century. In the fifteenth and sixteenth centuries, economic downturns occurred about 8 percent of the time; in the seventeenth and eighteenth centuries, they were experienced 4–5 percent of years; and, in the nineteenth and twentieth centuries, downturns occurred 2–3 percent of the time. Thus, there appears to have been a modest reduction in the likelihood of experiencing downturns over the centuries from the fifteenth century.

Of course, caution should be taken in interpreting these values. While, the nine four-year stretches of pre-1800 economic growth in any of the six economies (see column 1 of Table 1) do coincide with broadly agreed-upon periods of economic improvements; the method used here to identify four-year-phases of growth could

Table 1

Periods of Economic Growth and Decline across Six Economies, 1300–2000

(England/Great Britain, Italy, Holland, Sweden, Spain, and Portugal)

	# of phases of 4-year consecutive 1.5% annual growth rate	*% of years in 4-year consecutive 1.5% annual growth rate*	*# of phases of 3-year consecutive −1.5% annual growth rate*	*% of years in 3-year consecutive −1.5% annual growth rate*
1300s	1	1.1%	2	1.6%
1400s	1	1.0%	10	8.0%
1500s	3	2.3%	14	8.7%
1600s	2	1.3%	9	4.3%
1700s	2	1.3%	12	5.8%
1800s	8	5.3%	4	2.0%
1900s	38	40.0%	4	3.2%

Source: Authors.

Notes: Column 1 represents the number of times countries in the group had four consecutive years of at least 1.5 percent growth in GDP per capita. That is, if this were to happen once in one country and twice in another country within a certain century, it would equal three times in that century. Column 2 shows the same as a percentage of the total number of years (for which data exists) during the specified century. Column 3 represents the number of times a country had three consecutive years of −1.5 percent (or lower) growth rates. Column 4 shows the same as column 3 as a percentage of total number of years.

easily include periods in which the economy did not improve or exclude periods in which the economy did improve.

However, this evidence tentatively indicates that, before the nineteenth century, there was little apparent difference in growth phases and a possible reduction in the frequency of downturns. By comparing the data with the last two centuries, there do appear to be substantial increases in growth phases and reductions in the occurrence of downturns in the nineteenth and especially the twentieth centuries. Explaining the source of these differences could prove to be important for understanding how economies managed to generate sustained economic growth.

Very Long-Run Cycles of Convergence and Divergence

The convergence and divergence of GDP per capita in the very long run is a central question in the literature on economic development. For example, the classic Solow (1956) growth model predicts convergence of less-developed economies with leading economies (for discussion, see Mankiw, Romer, and Weil 1992; see also in this journal the Lucas, 2000, model of convergence driven by the "take-off" date). While some economies have caught up since the end of the nineteenth century, many have remained less developed and fallen behind relative to the leading economies

(Easterlin 1981; Abramovitz 1986; Pritchett 1997). From a very long-run perspective, there has been a great deal of debate about the Great Divergence, when European economies overtook Asian economies like China over the period from the sixteenth to the nineteenth century (Pomeranz 2000; Broadberry and Gupta 2006; Allen, Bassino, Ma, Moll-Murata, and van Zanden 2011; Broadberry 2013). What does the very long-run data presented here have to say about the process of convergence?

With evidence for only a small sample of economies around the world, drawing conclusions about very long-run divergence and convergence at a global scale is inappropriate—in fact, DeLong (1988) showed that often the countries for which historical data exist are the successful economies with high GDP per capita and, therefore, drawing global conclusions based on a historical sub-sample can be very misleading. Thus, it is important to emphasize that the focus in the following discussion is on regional European convergence or divergence. Amongst these six European economies, data availability does not reflect relative success, as there was considerable catching-up and falling behind of particular nations over this 500-year period. Thus, at least tentative conclusions about convergence and divergence for European economies may be drawn from the data available.

A "Little Divergence" between Mediterranean and Northwest European economies has been proposed using some of these new datasets. Broadberry (2013) focuses on explaining the Great Divergence between Europe and Asia and the Little Divergence between northwestern Europe and the rest of Europe from the sixteenth century, arguing that economic structure and institutions determined how particular economies reacted to and were affected by the pivotal shocks (or "critical junctures" in Acemoglu and Robinson 2012) associated with the Black Death in the mid-fourteenth century and the new trade routes between Europe, Asia, and the Americas that opened-up at the end of the fifteenth century. Thus, to some, the shocks were curses; to others, they were blessings in the long run.

However, some additional observations related to convergence and divergence across these countries are also possible. By comparing the position of the leading economy's GDP per capita relative to that of the "following economies," it is possible to discern from Figure 1 the degree of convergence. Using a very limited set of countries (England, Holland, Italy, and Spain), we see that for much of the fourteenth and fifteenth century, the average economy in Europe had a GDP per capita of between 50 and 60 percent of the leading economy, Italy. For a slightly broader set of countries, we see that by 1500, the average economy was 75 percent of the leading economy.[1] By 1600, when Holland had emerged as the new leader, the average economy had fallen to 42 percent of the leader. By 1700, with Holland stagnating and England catching up, this average was 61 percent of the leader. By 1800, with the Industrial Revolution and Great Britain's supremacy, the gap increased and

[1] For this calculation and subsequent calculations in this paragraph, we also include German states (Pfister 2011), France (Álvarez-Nogal and Prados de la Escosura 2013; see also Squicciarini and Voigtländer forthcoming) and what would today be known as Belgium (Buyst 2011), for which new data for each century are available.

the average was 50 percent of the leader. By 1900, for these average European countries, per capita GDP had fallen to 41 percent of the leader (Bolt and van Zanden 2014). In 2000, as other studies have shown (Baumol 1986; Pritchett 1997), the gap had once again dropped amongst these European countries, and the relative average was 84 percent of the leader, the Netherlands.

Thus, amongst the group of economies in Figure 1 and a slightly broader set of countries (and extending the evidence to the present), there appear to be cycles of divergence (in the fourteenth, sixteenth, and eighteenth centuries) and convergence (in the fifteenth, seventeenth, and twentieth centuries) over the very long run. These very long-run cycles of economic divergence and convergence are linked with the emergence of new leaders, the waning of their momentum, and the catching-up by followers. The fourteenth century was probably the beginning of a phase of divergence associated with the rise of Central and Northern Italy. By 1600, Holland was the new leading economy and the (average) relative level of followers had declined, suggesting divergence (Broadberry 2013). In 1800, England was catching up with Holland and taking the lead shortly afterwards; thus, divergence occurred in the eighteenth century and was accentuated during the nineteenth century. Phases of convergence reflected the stagnation (or even decline) of the leader and the process of other economies learning from the leader and perhaps gaining from spillovers.

Finally, building on Quah's (1996, 1997) concept of income mobility, it is worth commenting on the ability of economies to move upwards relative to other followers, though not necessarily to become the leader. Figure 1 shows that there was some mobility and opportunity for economies in Europe to improve their positions and status, which may have been important in determining the outcome of geopolitical tensions amongst European rivals. However, it also shows that there was a tendency for the leader to remain in its position as the wealthiest economy for a century or more, and for the poorest to be stuck for very long periods. Thus, within Europe there was a degree of stratification and the formation of clubs, with some mobility between them (as argued in Durlauf and Johnson 1995).

The Data

How can researchers construct these GDP per capita estimates from the late medieval and early modern eras until the nineteenth century? As discussed earlier, Figure 1 presents six original datasets constructed within the last four years: England/Great Britain, Holland, Northern and Central Italy, Spain, Sweden, and Portugal. Each time series starts and ends in different years and uses a different combination of methods to estimate output. Table 2 summarizes the sources and methods of data construction for agricultural and nonagricultural sectors.

Three main methods have been used to construct historical estimates of GDP and GDP per capita: methods based on direct measures of income, methods based on direct measures of output, and indirect methods. The first method involves estimating national income from data on individual incomes or, more commonly,

Table 2

A Broad Classification of Methods for Estimating GDP per Capita in Selected European Countries

	Period	*Agriculture*	*Industry*	*Service*
England/Great Britain	1270–1870	Output	Output	Output/Proxies
Holland	1348–1510	Demand	Proxies	Proxies
	1510–1807	Output	Output	Output
Italy (Central & Northern Regions)	1310–1861	Demand	Proxies	Proxies
Spain	1254–1850	Demand	Proxies	Proxies
Sweden	1560–1800	Demand	Output	Proxies
Portugal	1500–1850	Demand	Proxies	Proxies

Sources: England/Great Britain (Broadberry et al. 2011); Italy (Malanima 2011); Holland (van Zanden and van Leeuwen 2012); Sweden (Schön and Krantz 2012); Spain (Álvarez-Nogal and Prados de la Escosura 2013); Portugal (Reis, Martins, and Costa 2013; Palma and Reis 2014).

wages—particularly by Clark (2007, 2010). However, when using wages, this approach needs to take account of changes in hours per day worked and days per year worked—or else, it offers only limited evidence on variation in living standards through time. Without taking account of all factors, GDP estimates based on income and output approaches are likely to follow divergent trends over time. Angeles (2008) identifies three key factors determining the divergence: income distribution, per capita labor supply, and relative price changes. He shows that there was considerable divergence in English GDP per capita and real wages between 1700 and 1820 due to increased inequality (Saito 2015), the "Industrious Revolution" (a term used to convey that the Industrial Revolution was a longer-run combination of events than is often considered, as in de Vries 1994), and the increasing relative price of food (Broadberry, Campbell, Klein, Overton, and van Leeuwen 2015).

Given these concerns about using income or wage-based approaches, either the output method or indirect methods (focusing on demand or using proxies), were used to create the six time series presented in Figure 1 and Table 1. Here, some examples will illustrate how GDP estimates were generated using these methods.

The generally preferred approach to estimating national income is the output approach, provided sufficient information is available on the main sources of production (de Vries and van der Woude 1997, p. 721; Maddison 2007, pp. 316–19; Broadberry et al. 2011, p. 2). The rich accounts of English and British economic history since late medieval times offered an opportunity to estimate pre-1870 annual GDP using an output approach that separates the agricultural, industrial, and service sectors.

England/Great Britain

For medieval agriculture, three data sources are available: first, the Medieval Accounts Database of Campbell (2000, 2007) is based mainly on a large sample of

manorial accounts, which were drawn up using a common template by the reeve (a servant of the lord), who managed the demesne (the land owned by the lord) under close supervision of the lord's bailiff or steward and recorded detailed information on land use, crops, animals, and livestock products. Second, the Early Modern Probate Inventories Database covering the mid-sixteenth to the mid-eighteenth centuries, assembled by Overton (1991; 2000) and Overton, Whittle, Dean, and Haan (2004), pulls together similar information extracted from inventories drawn up by the Church Commissioners for the estates of farmers. Third, the Modern Farm Accounts Database of Turner, Beckett, and Afton (2001), covering a period from 1720 until 1913, is based on a large sample of accounts produced by farmers and kept in local record offices. Agricultural outputs were calculated by multiplying the acreage for each crop by the yield per acre. Broadberry et al. (2015) estimate the total acreage. The trends in yields were split into three main time periods, based on the data sources available. For pastoral output, a similar procedure was undertaken, multiplying the number of animals by the share producing and their yields. Prices for individual crops and animal products are used to convert the output into current prices and create weights for the agricultural real output index.

Production estimates or indicators existed for the key English industries up to 1700, based on careful reconstruction from archival records by generations of scholars. Crucial sources included Carus-Wilson and Coleman (1963) for wool and woolen cloth, drawing on detailed records of exports of wool and woolen cloth; King (2005) for iron, based on a reconstruction of all blast furnaces, their capacity, and knowledge of when they were in blast; and Hatcher (1973) for tin, based on receipts of coinage dues. Outputs related to leather and food processing were estimated by Broadberry et al. (2015) on the basis of key inputs obtained from the reconstruction of the agricultural sector. For the construction sector, detailed information on cathedral building is combined with an index of housebuilding based on population and urbanization, while the growth of book production is based on titles listed by the British Library. These series are combined to generate an index of industrial production from 1264 to 1700. Crafts and Harley (1992) offer an index from 1700 until 1870, to which Broadberry et al. (2015) add some new series.

For the service sector, an approach developed by Deane and Cole (1962), was followed with some adjustments. The service sector is broken down into commerce, housing, domestic services, and government. The commerce indicator is based on combining estimates of domestic trade (the volume of agricultural and industrial output adjusted for the growing share that was marketed) and international trade (derived from the detailed records of trade that were kept for taxation purposes), freight transport (based on merchant shipping tonnage, distances traveled on the main trade routes, and volumes shipped), and financial services (using the velocity of money, derived by comparing estimates of the stock of money with existing estimates of nominal, as opposed to real, national income). Housing and domestic services were assumed to grow at the same rate as population. Government activity is measured based on its revenue, which exists in detailed annual exchequer accounts back to the early twelfth century (O'Brien and Hunt 1999).

The three real output series for the agricultural, industrial, and service sectors were combined using a set of sectoral weights that capture the changing structure of the economy. The starting point is an input-output table for 1841 from Horrell, Humphries, and Weale (1994). The nominal value-added shares for 1841 are projected back using the sectoral real output series reflated to convert them into nominal series. The principal sources for the price series used include Clark (2004, 2005, 2006), Beveridge (1939), and Thorold Rogers (1866–1902). Value-added shares for each sector are derived in this way at roughly 50-year intervals and used to create a chained index of GDP, following Feinstein (1972). To estimate GDP per capita, this aggregate GDP series is divided by population, taken from Wrigley and Schofield (1989) and Wrigley, Davies, Oeppen, and Schofield (1997) for the period since 1541, and derived from information on the number of tenants in a regionally representative sample of manors using the method of Hallam (1988) for the pre-1541 period.

Italy

The indirect approach to estimating GDP per capita depends on modeling or using proxies to generate indicators of economic output. Particularly for agricultural production, where demand is deemed to be relatively stable, a model of agricultural demand is used. For example, the lack of evidence on agricultural production in Italy prior to the mid-nineteenth century led Malanima (2011) to use the demand approach. Estimates of agricultural production start with the assumption that they are equal to consumption. While there might be some imports and exports, Malanima (2011) argues that the net value of these imports and exports are negligible for Central and Northern Italy. Thus, estimates of agricultural consumption will provide a close indicator of production.

The exercise for Italy involved estimating per capita agricultural consumption based on a model of demand (including income and price elasticities) and data on consumer income levels and real prices of agricultural production and industrial products (as substitutes). A number of other historical studies, pioneered by Crafts (1980) and more recently developed by Allen (2000), have used estimates of income elasticities of agricultural products ranging from 0.3 to 0.9. Guided by these previous studies, and Italian estimates from 1861 to 1910 (Federico 2003), Malanima (2011) selected an income elasticity of 0.4. The previous historical studies reviewed had used a cross-price elasticity of 0.1—in other words, agricultural and industrial products are seen as weak substitutes for one another. The sum of the income, own-price, and cross-price elasticities are assumed equal to 0 (relying on the "adding-up" property in linear models described in Deaton and Muellbauer 1980, p. 16), which helps to guide the value of the own-price elasticity (-0.5). Thus, based on these elasticities, and on data for wages (acting as a proxy for income) and for the real prices of agricultural and nonagricultural products, Malanima (2011) estimated the per capita agricultural consumption and, hence, an indicator of production. Price and wage data were collected systematically from institutions such as schools, hospitals, and government departments for many European countries reaching back to the medieval period.

For industry and service sectors, indirect production estimates often depend on long-run trends in urbanization rates, and Bairoch's (1988) dataset of European towns greater than 5,000 inhabitants going back 1,000 years is crucial for this approach. Urbanization rates offer an indicator of the share of nonagricultural activities, as town and city dwellers are not likely to be involved in crop cultivation or pastoral activities. Naturally, an indirect approach is generally only used when the direct approaches using output or income are not possible due to a lack of data. However, given the lack of detailed income and output data, indirect methods are starting to be used more in this area of research.

For Central and Northern Italy, the share of nonagricultural output between 1861 and 1936 was regressed on urbanization rates. The coefficient of the relationship was key to estimating output before 1861. However, without taking account of non-urban industry over the centuries, there would have been a risk of overestimating late medieval output. Thus, combining the coefficient and the urbanization rates with an index of the share of non-urban workers (based on Allen 2000), the share of nonagricultural output was estimated back to 1310. With an estimate of per capita agricultural output and of the share of nonagricultural output, it was possible to construct a GDP per capita series from 1310 until 1861. For consistency, this series was linked to a series for Central and Northern Italy (Daniele and Malanima 2007). While Bolt and van Zanden (2014, p. 635) raise some questions about these estimate, this series provides a valuable (and the only) indicator of long-run growth rates related to Italy.

Putting these various estimates together with an estimate of per capita agricultural output and of the share of nonagricultural output (sometimes separated into industrial and service sectors), it is possible to construct a GDP series. This value is then divided by the geographical boundary's population to produce per capita GDP.

General Considerations

As one might expect, there is considerable uncertainty about the margins of error surrounding the estimates of per capita GDP given here. Readers seeking a guide can begin by considering the methodologies used. For instance, van Zanden and van Leeuwen (2012) propose that the data for Holland before 1510 is far less reliable than the data for Holland between 1510 and 1807 because the former was based on modeling agricultural demand and proxies for industry and services, whereas the latter was based on output measures. Thus, data based on output measures, such as those for England/Great Britain, Holland from 1510, and to a lesser extent Sweden, are likely to be more accurate.

Of course, the brief description offered here is a gross simplification of the complexities involved in the truly mammoth task of estimating historical GDP per capita. Generating these estimates includes identifying and pulling together hundreds of data sources and deciding upon historically justifiable assumptions. Great care must be taken in ensuring that prices and baskets of goods are comparable and benchmarked over time (Prados de la Escosura 2000, 2015).

For greater detail, the reader is encouraged to consult the original papers for each country: England/Great Britain (Broadberry et al. 2011, 2015); Italy (Malanima

2011); Holland (van Zanden and van Leeuwen 2012); Sweden (Schön and Krantz 2012); Spain (Alvarez-Nogal and Prados de la Escosura 2013); and Portugal (Reis, Martins, and Costa 2013; Palma and Reis 2014). Data for these countries (and many others) from the nineteenth century to the present are much better known, and information about how they were constructed can be found in a number of sources—probably the most updated discussion of these sources, associated with the Maddison Project, is Bolt and van Zanden (2014).

Conclusion

While the data presented here have notable limitations, they offer the first detailed picture of economic development in Western Europe for the 500 years before the Industrial Revolution. Clearly, the received wisdom that preindustrial economies more than two centuries ago were stagnant is not true. These economies had major and minor phases of economic growth before the nineteenth century, some lasting more than 50 years, which often led to substantial long-run improvements in per capita income—even if these growth rates were not ultimately sustained.

Subsequent research in this area will continue to check and re-estimate the very long-run data on per capita GDP for these economies and others. However, it will also move on to the challenges of explaining the patterns in the data theoretically and econometrically. For example, it will be useful to consider the pre-1800 growth episodes and reversals in European economies, changes in the likelihood of phases of growth and of decline over time, and periods and cycles of divergence and convergence. In addition to GDP per capita, there are more very long-run data available on a number of traditional explanatory variables, such as institutions, human capital, and population changes, as well as shocks like plagues and wars.

Although research using this very long-run data is still in its early stages, it is already offering some insight and challenges for how we think about the processes of economic growth. For example, an economy in which per capita income stagnated for 500 years would have been very different from the preindustrial European economies that experienced multiple peaks and troughs. Each substantial peak and trough in per capita income implied a process of change—of new technologies, institutions, beliefs, and behavior. Each step in history sets the stage for the next step. Thus, the six preindustrial European economies studied here were changing, with agents adjusting to new incentives and constraints and in some ways adopting a substantially new economic system roughly every 50 to 100 years. It seems very possible (even probable) that economies in other regions of the world experienced major peaks and troughs—as China did in the eleventh century (Broadberry, Guan, and Li 2014). However, the dynamism of the rises and falls in European economies from the fourteenth century may offer a clue to the Great Divergence between Europe and China during this time period (Broadberry 2013), which suggests a possible avenue of future research.

Preindustrial Europe also showed patterns of divergence and convergence. Divergence was associated with a new leading economy. Convergence was associated

with phases of economic stagnation or decline amongst leading economies. World economic leaders at one time often seem to struggle to grow beyond a certain range of economic development: for example, this described China in the eleventh century, Italy in the fifteenth century, Holland in the eighteenth century, and even England in the late nineteenth century. In time, a few economies converged on the leader and then, when these catch-up economies developed new technologies and institutions, one of them overtook the leader. It is intriguing to speculate as to whether England, the world leader in per capita GDP in the late nineteenth century, might have stagnated had other economies—like the United States and later Germany—not overtaken it and had England been unable to import new technologies, modes of management, and institutions.

The very long-run historical evidence presented here resolves what had previously appeared to be a major difference between recent developing economy growth patterns and the received wisdom on preindustrial patterns. Received wisdom held that European countries at low levels of economic development before the Industrial Revolution were stagnant. However, empirical studies of developing economies during the last century or so have indicated that GDP per capita has tended to be characterized by spurts of high growth, with periods of stagnation and decline, especially in sub-Saharan Africa (Easterly and Levine 1997; Pritchett 2000; Durlauf, Johnson, and Temple 2006; Easterly 2006; Pinkovskiy and Sala-i-Martin 2014). The findings here suggest that historical patterns of economic growth and decline in preindustrial Europe may have been broadly similar to those of present-day developing economies—another area of ongoing and future research.

Finally, many contending theoretical explanations for past GDP per capita start from the assumption of stagnant economies followed by an economic take-off. Such theories need adjustment to take account of the new evidence. For all of these questions, and many others, the next few years promise exciting advances in our understanding of very long-run economic growth.

References

Abramovitz, Moses. 1986. "Catching Up, Forging Ahead, and Falling Behind." *Journal of Economic History* 46(2): 385–406.

Acemoglu, Daron, and James Robinson. 2012. *Why Nations Fail? The Origins of Power, Prosperity, and Poverty.* Crown Publishers.

Allen, Robert C. 2000. "Economic Structure and Agricultural Productivity in Europe, 1300–1800." *European Review of Economic History* 4(1): 1–26.

Allen, Robert C., Jean-Pascal Bassino, Debin Ma, Christine Moll-Murata, and Jan Luiten van Zanden. 2011. "Wages, Prices, and Living Standards in China, 1738–1925: In Comparison with Europe, Japan, and India." *Economic History Review* 64(s1): 8–38.

Álvarez-Nogal, Carlos, and Leandro Prados de la Escosura. 2013. "The Rise and Fall of Spain (1270–1850)." *Economic History Review* 66(1): 1–37.

Angeles, Luis. 2008. "GDP per Capita or Real Wages? Making Sense of Conflicting Views on Pre-industrial Europe." *Explorations in Economic History* 45(2): 147–63.

Bairoch, Paul. 1988. *Cities and Economic Development: From the Dawn of History to the Present.* University of Chicago Press.

Baumol, William J. 1986. "Productivity Growth, Convergence and Welfare: What the Long-Run Data Show." *American Economic Review* 76(5): 1072–85.

Beveridge, William. 1939. *Prices and Wages in England from the Twelfth to the Nineteenth Century,* Vol. I: *Price Tables: Mercantile Era.* London: Longmans, Green.

Bolt, Jutte, and Jan Luiten van Zanden. 2014. "The Maddison Project: Collaborative Research on Historical National Accounts." *Economic History Review* 67(3): 627–51.

Broadberry, Stephen. 2013. "Accounting for the Great Divergence." Economic History Working Paper 184/13, London School of Economics and Political Science, Department of Economic History.

Broadberry, Stephen, Bruce Campbell, Alexander Klein, Mark Overton, and Bas van Leeuwen. 2011. "British Economic Growth, 1270–1870: An Output-Based Approach." Available at: http://www2.lse.ac.uk/economicHistory/whosWho/profiles/sbroadberry.aspx.

Broadberry, Stephen, Bruce Campbell, Alexander Klein, Mark Overton, and Bas van Leeuwen. 2015. *British Economic Growth, 1270–1870.* Cambridge University Press.

Broadberry, Stephen, Hanhui Guan, and David Daokui Li. 2014. "China, Europe and the Great Divergence: A Study in Historical National Accounting, 980–1850." Economic History Department Paper, London School of Economics.

Broadberry, Stephen, and Bishnupriya Gupta. 2006. "The Early Modern Great Divergence: Wages, Prices and Economic Development in Europe and Asia, 1500–1800." *Economic History Review* 59(1): 2–31.

Buyst, Eric. 2011. "Towards Estimates of Long Term Growth in the Southern Low Countries, ca.1500–1846." Paper for the "Quantifying Long Run Economic Development" conference at the University of Warwick in Venice, March 22–24. http://www2.warwick.ac.uk/fac/soc/economics/events/seminars-workshops-conferences/conferences/venice/venice3/programme/buyst.pdf.

Campbell, Bruce M. S. 2000. *English Seigniorial Agriculture, 1250–1450.* Cambridge University Press.

Campbell, Bruce M. S. 2007. *Three Centuries of English Crop Yields, 1211–1491.* A database. http://www.cropyields.ac.uk.

Carus-Wilson, Eleanora M., and Olive Coleman. 1963. *England's Export Trade, 1275–1547.* Oxford University Press.

Clark, Gregory. 2004. "The Price History of English Agriculture, 1209–1914." In *Research in Economic History,* vol. 22, edited by Susan Wolcott and Christopher Hanes, 41–125. Emerald Group Publishing.

Clark, Gregory. 2005. "The Condition of the Working Class in England, 1209–2004." *Journal of Political Economy* 113(6): 1307–40.

Clark, Gregory. 2006. "England, Prices and Wages since 13th [Century]." Global Price and Income History Group, University of California, Davis. Available at: http://gpih.ucdavis.edu/Datafilelist.htm.

Clark, Gregory. 2007. "The Long March of History: Farm Wages, Population, and Economic Growth, England 1209–1869." *Economic History Review* 60(1): 97–135.

Clark, Gregory. 2010. "The Macroeconomic Aggregates for England, 1209–2008." In *Research in Economic History* vol. 27, edited by Susan Wolcott and Christopher Hanes, 51–140. Emerald Group Publishing.

Crafts, Nicholas F. R. 1980. "Income Elasticities of Demand and the Release of Labour by Agriculture during the British Industrial Revolution." *Journal of European Economic History* 9(1): 153–68.

Crafts, Nicholas F. R., and C. Knick Harley. 1992. "Output Growth and the Industrial Revolution: A Restatement of the Crafts-Harley View." *Economic History Review* 45(4): 703–30.

Daniele, Vittorio, and Paolo Malanima. 2007. "Il prodotto delle regioni e il divario Nord-Sud in Italia (1861–2004)." *Rivista di Politica Economica* 97(2): 267–316.

Deane, Phyllis, and William A. Cole. 1962. *British Economic Growth 1688–1959.* Cambridge University Press.

Deaton, Angus, and John Muellbauer. 1980. *Economics and Consumer Behaviour.* Cambridge University Press.

DeLong, J. Bradford. 1988. "Productivity Growth, Convergence, and Welfare: Comment." *American Economic Review* 78(5): 1138–54.

de Vries, Jan. 1994. "The Industrial Revolution and the Industrous Revolution." *Journal of Economic History* 54(2): 249–70.

de Vries, Jan, and Ad van der Woude. 1997. "The First Modern Economy: Success, Failure and Perseverance of the Dutch Economy, 1500–1815." Cambridge University Press.

Drelichman, Mauricio. 2005. "The Curse of Moctezuma: American Silver and the Dutch Disease." *Explorations in Economic History* 42(3): 349–80.

Durlauf, Steven N., and Paul A. Johnson. 1995. "Multiple Regimes and Cross-Country Growth Behaviour." *Journal of Applied Econometrics* 10(4): 365–84.

Durlauf, Steven N., Paul A. Johnson, and Jonathan R. W. Temple. 2006. "Growth Econometrics." In *Handbook of Economic Growth*, Vol. 1, edited by P. Aghion, and S. N. Durlauf, 555–677. Elsevier.

Easterlin, Richard. 1981. "Why Isn't the Whole World Developed." *Journal of Economic History* 41(1): 1–19.

Easterly, William. 2006. "Reliving the 50s: The Big Push, Poverty Traps, and Takeoffs in Economic Development." *Journal of Economic Growth* 11(4): 289–318.

Easterly, William, and Ross Levine. 1997. "Africa's Growth Tragedy: Policies and Ethnic Divisions." *Quarterly Journal of Economics* 112(4): 1203–50.

Federico, Giovanni. 2003. "Le nuove stime della produzione agricola italiana, 1860–1910: Primi risultati e implicazioni." *Rivista di Storia Economica*, issue 3, pp. 359–82.

Feinstein, Charles H. 1972. *National Income, Expenditure and Output of the United Kingdom, 1855–1965*. Cambridge University Press.

Galor, Oded. 2005. "From Stagnation to Growth: Unified Growth Theory." In *Handbook of Economic Growth*, Vol. 1A, edited by P. Aghion and S. N. Durlauf, 171–293. Amsterdam: North Holland.

Goldthwaite, Richard A. 2009. *The Economy of Renaissance Florence*. Johns Hopkins University Press.

Hallam, Henry E. 1988. "Population Movements in England, 1086–1350." In *The Agrarian History of England and Wales*, Vol. 2: *1042–1350*, edited by H. E. Hallam, pp. 508–93. Cambridge University Press.

Hansen, Gary D., and Edward C. Prescott. 2002. "Malthus to Solow." *American Economic Review* 92(5): 1205–17.

Hatcher, John. 1973. *English Tin Production and Trade before 1550*. Oxford: Clarendon Press.

Hausmann, Ricardo, Lant Pritchett, and Dani Rodrik. 2005. "Growth Accelerations." *Journal of Economic Growth* 10(4): 303–29.

Hodgett, Gerald A. J. 1972 [2006]. *A Social and Economic History of Medieval Europe*. London: Methuen. (2006 edition published by Routledge).

Horrell, Sara, Jane Humphries, and Martin Weale. 1994. "An Input-Output Table for 1841." *Economic History Review* 47(3): 545–66.

Keynes, John Maynard. 1931. "Economic Possibilities for Our Grandchildren." In *Essays in Persuasion*, by John Maynard Keynes. London: Macmillan.

King, Peter. 2005. "The Production and Consumption of Bar Iron in Early Modern England and Wales." *Economic History Review* 58(1): 1–33.

Lucas, Robert E. 2000. "Some Macroeconomics for the 21st Century." *Journal of Economic Perspectives* 14(1): 159–68.

Maddison, Angus. 1982. *Phases of Capitalist Development; Booms, Crises, and Globalizations*. Oxford University Press.

Maddison, Angus. 1995. *Monitoring the World Economy, 1820–1992*. OECD Development Center.

Maddison, Angus. 2003. *The World Economy: Historical Statistics*. OECD.

Maddison, Angus. 2007. *Contours of the World Economy 1–2030 AD: Essays in Macro-Economic History*. Oxford University Press.

Malanima, Paolo. 2011. "The Long Decline of a Leading Economy: GDP in Central and Northern Italy, 1300–1913." *European Review of Economic History* 15(2): 169–219.

Mankiw, N. Greg, David Romer, and David N. Weil. 1992. "A Contribution to the Empirics of Economic Growth." *Quarterly Journal of Economics* 107(2): 407–37.

North, Douglas C., and Barry R. Weingast. 1989. "Constitutions and Commitment: The Evolution of Institutions Governing Public Choice in Seventeenth-Century England." *Journal of Economic History* 49(4): 803–32.

O'Brien, Patrick K., and Philip A. Hunt. 1999. "England, 1485–1815." In *The Rise of the Fiscal State in Europe, c.1200–1850*, edited by R. Bonney, pp. 53–100. Oxford University Press.

Overton, Mark. 1991. "The Determinants of Crop Yields in Early Modern England." In *Land, Labour and Livestock: Historical Studies in European Agricultural Productivity*, edited by B. M. S. Campbell and M. Overton, 284–322. Manchester University Press.

Overton, Mark. 2000. "Prices from Probate Inventories." In *When Death Do Us Part: Understanding and Interpreting the Probate Records of Early Modern England*, edited by T. Arkell, N. Evans, and N. Goose, 120–43. Oxford: Leopard's Head Press.

Overton, Mark, Jane Whittle, Darron Dean, and Andrew Hann. 2004. *Production and Consumption in English Households, 1600–1750*. London: Routledge.

Palma, Nuno, and Jaime Reis. 2014. "Portuguese Demography and Economic Growth, 1500–1850." Paper for the "Accounting for the Great Divergence" conference at the University of Warwick in Venice, May 22–24, 2014. http://www2.warwick.ac.uk/fac/soc/economics/research/centres/cage/events/conferences/greatdivergence14/portuguese_demography_and_economic_growth_1500-1850_-_may_19th_2014.pdf.

Pfister, Ulrich. 2011. "Economic Growth in Germany, 1500–1850." Paper for the "Quantifying Long Run Economic Development" conference at the University of Warwick in Venice, March, 22–24, 2011. https://www.wiwi.uni-muenster.de/wisoge/organisation/personen/pfister/forschung/Growth-Venice-2011.pdf.

Pinkovsky, Maxim, and Xavier Sala-i-Martin. 2014. "Lights, Camera . . . Income! Estimating Poverty Using National Accounts, Survey Means, and Lights." Federal Reserve Bank of New York Staff Report 669.

Pomeranz, Kenneth. 2000. *The Great Divergence: China, Europe, and the Making of the Modern World Economy.* Princeton University Press.

Prados de la Escosura, Leandro. 2000. "International Comparisons of Real Product, 1820–1990: An Alternative Data Set." *Explorations in Economic History* 37(1): 1–41.

Prados de la Escosura, Leandro. 2015. "Mismeasuring Long-Run Growh: The Bias from Splicing National Accounts—The Case of Spain." *Cliometrica.* Published online May 28.

Pritchett, Lant. 1997. "Divergence, Big Time." *Journal of Economic Perspectives* 11(3): 3–17.

Pritchett, Lant. 2000. "Understanding Patterns of Economic Growth: Searching for Hills among Plateaus, Mountains, and Plains." *World Bank Economic Review* 14(2): 221–50.

Quah, Danny T. 1996. "Empirics for Economic Growth and Convergence." *European Economic Review* 40(6): 1353–75.

Quah, Danny T. 1997. "Empirics for Growth and Distribution: Stratification, Polarization, and Convergence Clubs." *Journal of Economic Growth* 2(1): 27–59.

Reinert, Sophus A. 2011. *Translating Empire: Emulation and the Origins of Political Economy.* Harvard University Press.

Reis, Jaime, Conceição A. Martins, and Leonor F. Costa. 2013. "From Major Power to Economic Backwater: Portugal's GDP 1500–1850." Paper presented at "Accounting for the Great Divergence" conference at the University of Warwick, May 28, 2013. http://www2.warwick.ac.uk/fac/soc/economics/research/centres/cage/events/conferences/mayconf/tuesday28may/reis.pdf.

Rodrik, Dani. 1999. "Where Did All the Growth Go? External Shocks, Social Conflict and Growth Collapses." *Journal of Economic Growth* 4(4): 385–412.

Saito, Osamu. 2015. "Growth and Inequality in the Great and Little Divergence Debate: A Japanese Perspective." *Economic History Review* 68(2): 399–419.

Schön, Lennart, and Olle Krantz. 2012. "The Swedish Economy in the Early Modern Period: Constructing Historical National Accounts 1560–2000." *European Review of Economic History* 16(4): 529–49.

Smith, Adam. 1776. *The Wealth of Nations.* London: Methuen & Co.

Solow, Robert M. 1956. "A Contribution to the Theory of Economic Growth." *Quarterly Journal of Economics* 70(1): 65–94.

Squicciarini, Mara P., and Nico Voigtländer. Forthcoming. "Human Capital and Industrialization: Evidence from the Age of Enlightenment." *Quarterly Journal of Economics.*

Thirsk, Joan. 1978. *Economic Policy and Projects: The Development of a Consumer Society in Early Modern England.* Clarendon Press. Oxford.

Thorold, Rogers, J. E. 1866–1902. *A History of Agriculture and Prices in England*, vols. 1–6. Oxford: Clarendon Press.

Turner, Michael E., John V. Beckett, and Bethanie Afton. 2001. *Farm Production in England 1700–1914.* Oxford University Press.

van Zanden, Jan Luiten, and Bas van Leeuwen. 2012. "Persistent But Not Consistent: The Growth of National Income in Holland 1347–1807." *Explorations in Economic History* 49(2): 119–30.

Wrigley, E. Anthony, Ros S. Davies, James E. Oeppen, and Roger S. Schofield. 1997. *English Population History from Family Reconstitution, 1580–1837.* Cambridge University Press.

Wrigley, E. Anthony, and Roger S. Schofield. 1989. *The Population History of England, 1541–1871: A Reconstruction.* Cambridge University Press.