Prologue: Historical national income accounting

Gross Domestic Product (GDP) is the single most widely employed measure of the value of a country's market-based economic activity, as GDP per head is of relative and absolute levels of prosperity, and annual rates of change in GDP per head are of the pace of economic growth. GDP has its flaws (it omits non-market activity and leisure, and captures changes and differences in quality, especially of services, imperfectly) but has the merit of being widely understood and respected (Leunig, 2011: 358). There is no alternative single measure that does the same job more effectively. That is why today many governments make their own estimates of GDP per head based upon official statistics of economic output and population and why the United Nations, World Bank and other organisations publish annual estimates of GDP and GDP per head for most of the world's economies, including many for which only the most rudimentary economic and demographic data are available. It is these estimates that inform contemporary debates about the pace of economic growth, widening gap between rich and poor countries, and progression of countries from underdevelopment to development. Obtaining a proper historical perspective on these issues is more problematic, for governments took little interest in the gathering of official statistics before the nineteenth century and the first attempts to measure GDP followed some time later. It has therefore devolved upon historians to rectify this deficiency, drawing upon a range of mostly unofficial data sources.

No attempt to provide historical GDP figures has been more ambitious than that of the late Angus Maddison, who generated national income estimates for most of the world's economies over the last two millennia, persevering with this ambitious project even when appropriate historical data were largely lacking (Maddison, 2001,

2003, 2007, 2010; Bolt and van Zanden, 2014). Other more cautious economic historians have concentrated upon reconstructing the historical national accounts of individual well-documented countries for which good quantitative data series are available prior to the advent of official statistics in the mid-nineteenth century. Deane and Cole (1967) led the way with their reconstruction of British economic growth from 1688 to 1959, although the project to reconstruct robust series of key economic variables had begun a hundred years earlier with the tabulations of prices and wages from 1259 to 1793 made by J. E. Thorold Rogers (1866–1902). Systematic work on England's uniquely copious public and private archives has since yielded data series on government revenues and expenditures, dutiable overseas trade, money supply, interest rates, rents, agricultural production and productivity, the outputs of key industries, the size and structure of the population, the occupational structure, and the share of the population living in towns, all mostly commencing long before Deane and Cole's start date of 1688 (see Part I, 'Measuring economic growth', for details). More recently, subsets of these data have been combined to shed light on core components of the economy – agriculture, urbanisation, population – and the first attempts have been made to estimate the total value-added output of the entire economy (Wrigley, 1985, 2006b; Wrigley and Schofield, 1989; Mayhew, 1995a; Snooks, 1995; Overton and Campbell, 1996; Campbell, 2000; Clark, 2010a). Meanwhile, the pioneering GDP estimates of Deane and Cole have been revised by Crafts and Harley (1992) and GDP estimates extending back to at least the sixteenth century have been reconstructed for Holland, Italy, Spain and Sweden (van Zanden and van Leeuwen, 2012; Malanima, 2011; Álvarez-Nogal and Prados de la Escosura, 2013; Schön and Krantz, 2012).

Within the methodological framework provided by national income accounting, the estimation of GDP can be approached in three different ways, via income, expenditure and output, all of which ought to yield broadly similar results. From the income side, GDP is estimated as the sum of wages paid to workers, profits accruing to the owners of capital and rents received by landowners:

GDP = (daily wage-rates × days worked) + (return on capital × capital stock) + (rent × land area)

Although nominal and real daily wage rates have been available on an annual basis for England back to the mid-thirteenth century since the pioneering work of Phelps Brown and Hopkins (1956), to convert these into reliable estimates of annual labour income requires information on the total number of days worked. That in turn hinges on the share of the population working and the average number of days worked by each person in a year, neither of which is easy to establish. Since labour income accounts for some two-thirds to three-quarters of national income, this is an important limitation to any strategy of estimating GDP from the income side alone. As Chapter 6 demonstrates, there is a real risk that GDP per head thus estimated will merely replicate trends in real wage rates.

An alternative approach is to estimate GDP from the expenditure side by summing the various categories of expenditure, using the famous Keynesian identity:

GDP = consumption + investment + government spending + net exports

Historical data on consumption and investment, which together make up the lion's share of expenditure, are, however, limited and without them the expenditure approach cannot be used as more than a rough cross-check on the other approaches to the estimation of GDP. This is frustrating, for systematic accounts of government expenditure and revenue reach back to the late-medieval period, as do data on exports and imports generated by government taxation of international trade. Instead, these data are more usefully incorporated into an output-based estimate of GDP.

In terms of output, GDP is estimated as the sum of outputs produced in the three main sectors of the economy: agriculture, industry and services:

GDP = agricultural value added + industrial value added + services value added.

It is important here to work in terms of value added in each sector, to eliminate double-counting. So, in the case of woollen cloth sold by a merchant operating in the service sector, the final selling price of the cloth includes the values added in (i) the agricultural sector (the tending of sheep to produce raw wool), (ii) the industrial sector (the spinning and weaving of the raw wool into woollen cloth) and (iii) distribution (the margin between the price the merchant paid for the cloth and the price at which he sold it). It would be fair to say that in historical national accounting, available information on agricultural and industrial outputs is better than that on the service sector, partly because the last has received the least historical attention. This is a real limitation in the recent past but is less of a problem in the remoter past when services remained the smallest sector and economic activity was dominated first by agriculture, then by industry.

One approach to output-based reconstruction of GDP is to divide the economy between agricultural and other activities. Output of the agricultural sector is then estimated via a demand function, drawing upon data on population, real wage rates and the relative price of food, and employing elasticities derived from the experience of other economies at comparable levels of development but in later periods. Allowance is also made for external trade in food. For the industrial and service sectors, the urban (non-agricultural) population is used as a proxy for trends in output, but with some allowance made for rural industry. This is a short-cut approach, heavily reliant for its results upon evidence of wages, prices and the urban and non-urban populations, and has been developed and applied with particular effect by Álvarez-Nogal and Prados de la Escosura (2013).

Alternatively, available historical evidence can be deployed to estimate the output of each sector directly. The sum of these results, weighted by each sector's output share, then yields total output. This is the approach adopted in Part I of this book. Thus, in the case of agriculture (Chapter 3), it has entailed, first, estimating the amounts of land under different agricultural land uses (Chapter 2) and, then, deriving valid national trends from spatially weighted farm-specific

output information on cropped areas and crop yields and livestock numbers and livestock yields (Chapter 3). The latter task is further complicated by the need to correct for data biases towards particular regions, periods and classes of producer. The physical outputs of crops and livestock products are then converted into value-added outputs at constant prices using corresponding price information. Availability of comprehensive price series at annual resolution is therefore a sine qua non of this method (Appendices 5.1 and 5.2).

Inevitably, direct evidence of output is rarely available for all economic activities. In these situations historical national accountants typically employ proxy measures to model the activity in question. For several key industries the scales of their raw-material inputs provide the relevant proxies (Chapter 4, Section 4.2). In the case of woollen textiles, for example, there are no contemporary estimates of the volume of cloth output. Instead, estimates of the volume of wool produced by the agricultural sector can be obtained from available information on the number of sheep, the proportion of sheep producing wool and average fleece weights. There are also reliable data on exports of raw wool, which declined substantially as England was transformed during the fourteenth century from an exporter of raw wool to an exporter of woollen textiles. Subtracting raw wool exports from total domestic production thus yields a time-series of the major raw-material input used by the woollen textiles industry. Knowledge of the industry's cost structure can then be used to convert this measure of gross output into a value-added series. A similar approach is used for the leather industry, where the major input was raw hides. Relevant agricultural outputs likewise provide a basis for estimating value added in food processing. Output of the construction industry, on the other hand, is assumed to have varied with the size of the population but qualified by data on major prestige building projects and the growth of towns.

In the case of services, the major use of proxy measures is in distribution and domestic service (Chapter 4, Section 4.3). Thus, the combined outputs of the agricultural and industrial sectors serve as the

relevant proxy for distribution, weighted to take account of the growing proportion marketed, as measured by an index of the number of markets during the medieval period and the share of the population living in towns during the early modern period. Domestic service, on the other hand, is taken to have grown in line with the population, following Deane and Cole (1962), who assumed that there was no labour productivity growth in this sector, so that output grew in line with the labour-force, which in turn is assumed to have grown in line with the population.

Summing the value-added outputs of agriculture, industry and services to yield the GDP of the entire national economy (England 1270–1700, Great Britain 1700–1870) presents a further methodological challenge, since their respective shares of value-added output were neither equal nor fixed over time. Much of Chapter 5 is devoted to this issue, whose resolution hinges upon establishing an appropriate set of sectoral weights that capture the changing structure of the economy. The real value-added output series of agriculture, industry and services provide the starting point. These are then converted to nominal or current-price output series (thereby taking account of the effects of relative prices upon each sector's contribution to total value added) and linked to a nominal input–output table for 1841 reconstructed by Sara Horrell and others (1994), with nominal price output shares for the benchmark years 1381, 1522, 1600, 1700, 1759 and 1801 providing additional anchor points. GDP is then the sum of these price-weighted and benchmarked sectoral output series. Again, the availability of detailed price information for each output component of each sector is fundamental to the entire exercise.

The last variable requiring estimation is, of course, population, since it is the denominator of the GDP per head equation. It also serves as the proxy for domestic service output and as a partial proxy for output of the construction industry. As a rule, the more people there were the more output there was. Thanks to the work of Wrigley and Schofield (1989), estimates of English population 1541–1870 are uncontroversial; corresponding estimates for the period 1270–1541

are, however, less certain and are the subject of Chapter 1. Debate has tended to focus more on the size than the trend of the late-medieval population but an upper limit to credible estimates is set by the estimated kilocalorie output of the agricultural sector net of exports, since 2,000 kilocalories per head per day was the minimum required to enable a population to work and reproduce itself (Livi-Bacci, 1991). These population estimates, in their turn, when linked to benchmark information on sectoral shares of the labour-force (taking account of the differential occupational participation rates of men and women), provide the basis for estimating sectoral labour productivity (Chapter 9). Disaggregated by socio-economic class they also allow estimation of the proportions of households and individuals living above and below the poverty line in 1290, 1381, 1522, 1688, 1759 and 1801 (Chapter 8).

One of the aims of extending national income analysis back to well before the industrial revolution is to investigate whether, as Malthus claimed, increases in economic output merely allowed larger populations to be supported with no material gain in living standards. This, after all, is the implication of the inverse relationship between trends in the real wage rates of building and agricultural labourers and trends in population that prevailed until the very end of the nineteenth century. There has been a tendency to assume that trends in wage-rates equate to trends in earnings and living standards, without taking account of changes in the lengths of the working day and year. Yet households clearly varied how hard they worked according to their need to maintain incomes and the demands of the labour market. Comparison between real wage rates and GDP per head reveal several periods when the two diverged (Angeles, 2008), either because, as in the fifteenth century, high real wage rates enabled labourers to work less hard, or because, as in the sixteenth century and during an era of industrial expansion, it was only by working more industriously that they could maintain their living standards (Chapter 6). Hence the paradox that real wage rates stagnated whereas GDP per head slowly improved. Investigation of this important issue naturally requires

consideration of both the output and income approaches to the estimation of GDP. The same applies to discussion of the social distribution of income in Chapter 8, while issues of expenditure feature in discussion of food and non-food consumption in Chapter 7.

The more countries to which historical national income analysis is applied, the more robust the results, since these should be consistent between economies at similar stages of development. Any differences in levels of GDP per head should also be consistent with other measures of economic development, such as urbanisation ratios. Where common patterns emerge between countries, as in the case of divergences between real wage rates and GDP per head, there is good reason to believe that they are genuine rather than artefacts of the estimation process or evidence used. For that reason this reconstruction of the British historical national accounts has been conducted as part of a joint project comparing Britain with its southern North Sea neighbour, Holland (van Zanden and van Leeuwen, 2012). It has also taken place in parallel with studies of other countries using the historical national accounting framework, including Italy and Spain within Europe, and India, China and Japan within Asia (Malanima, 2011; Bassino and others, 2012; Álvarez-Nogal and Prados de la Escosura, 2013; Broadberry and others, 2014a, 2014b). This has enabled Britain's growth to be evaluated within the context of developments taking place elsewhere in Eurasia, including the most developed economies of the pre-industrial era: China under the Northern Song Dynasty (960–1127), Renaissance Italy and Holland during its sixteenth- and early-seventeenth-century Golden Age.

The historical national accounts reconstructed in Part I of this book indicate that GDP per head doubled in England between 1270 and 1700 and then, in the enlarged context of Great Britain, doubled again between 1700 and 1850. In the process, Britain was transformed from a poor and predominantly primary producing economy on the periphery of Europe, which in the twelfth century even in its most developed regions lagged behind Song China, to the most dynamic economy in Europe from the late seventeenth century during its own commercial

revolution, when trade and industry were growing strongly and agriculture improving in productivity (Chapters 5 and 10). This pre-industrial growth made possible the industrial revolution which placed Britain at the hub of the global economy in the nineteenth century. Until the industrial revolution Britain's slow but cumulative rise is nevertheless part of a wider story, for, from the sixteenth century, the more dynamic parts of Europe were forging ahead of their Asian counterparts in what has become known as the Great Divergence and, at the same time, a Little Divergence was opening within Europe, as its own economic centre of gravity shifted from the Mediterranean to the countries bordering the southern North Sea, led in turn by the southern Low Countries, Brabant, Holland and, eventually, Britain. Throughout this process Britain gradually improved its economic position relative to other countries but had to compete hard against smaller but richer and more successful Holland, whose impressive GDP per head – by the seventeenth century the world's highest – Britain only finally overtook during the industrial revolution. Plainly, this is not a story of Malthusian stagnation, rather, it is one of the progressive escape from Malthusian constraints and transition to a post-Malthusian economy in which, from 1700, prosperity and population rose together. This analysis leaves it at the point, in the 1870s, when, with onset of the demographic transition, population growth declined but GDP per head climbed ever higher.