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Abstract: Japanese GDP per capita grew at an annual rate of 0.08 per cent between 730 and 1874, but the growth was episodic, with the increase in per capita income concentrated in two periods, 1450-1600 and after 1721, interspersed with periods of stable per capita income. There is a similarity here with the growth pattern of Britain. The first countries to achieve modern economic growth at opposite ends of Eurasia thus shared the experience of an early end to growth reversals. However, Japan started at a lower level than Britain and grew more slowly until the Meiji Restoration.

JEL classification: N10, N30, N35, O10, O57

Key words: Japan, Great Divergence, GDP per capita, growth reversals, Britain

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1. INTRODUCTION

The Great Divergence debate, which began with Pomeranz (2000), has revolved primarily around differences in living standards between Europe and China. However, this focus on China is dependent on a strongly revisionist interpretation of Chinese economic history, with Pomeranz arguing that China did not fall behind the West before 1800. Before this debate, the natural focus for a Europe-Asia comparison of living standards was Britain and Japan, as the first nations to achieve modern economic growth in Europe and Asia, respectively. Whilst it is interesting to note that Hanley (1983; 1986) preceded Pomeranz by nearly two decades in claiming that Japanese living standards were as high as in the West until the nineteenth century, her claims were quickly criticised and never had the same impact as Pomeranz's equally strong claims for China, or the similar claims for India made by Parthasarathi (1998; 2011).

One obvious piece of quantitative evidence which casts serious doubt on the revisionist claims is the comparison of real wages between Europe and Asia. Broadberry and Gupta (2006), Bassino and Ma (2005) and Allen *et al.* (2011) all present evidence to suggest that real wages were substantially lower in Asia than in Europe during the early modern period, even taking account of regional variations within both continents. Although the distributions overlapped, the richest parts of Asia were at best on a par with the peripheral parts of Europe. Bassino *et al.* (2010) extend the evidence on the real wage experience of Japan in international perspective back from 1600 to 1260. However, real wage evidence applies to only a part of the economy, typically the urban industrial sector. A comprehensive assessment of overall levels of economic development and an evaluation of the timing of the Great Divergence requires a historical national accounting approach, covering all economic activities.

Recently, there has been much progress in reconstructing the historical national accounts of a number of European countries during the early modern and medieval periods (Broadberry *et al.,* 2015a; van Zanden and van Leeuwen, 2012; Malanima, 2011; Álvarez-Nogal and Prados de la Escosura, 2013; Schön and Krantz, 2012). Broadberry *et al.* (2015b) have demonstrated that these methods can also be applied to Asia, and hence shed light on the origins of the Great Divergence of productivity and living standards between Europe and Asia. This paper extends the approach to the case of Japan, the first Asian country to achieve the transition to modern economic growth.

The results presented here suggest that Japanese GDP per capita grew at an annual rate of 0.08 per cent between 730 and 1874. As in the North Sea area of Europe, this growth was persistent, with periods of strong positive growth interspersed only with periods of stable per capita income. Without substantial growth reversals, or periods of negative per capita income growth, the Japanese economy was able to cumulate the gains of the growth spurts that occurred during 1450-1600 and after 1721.[1] These earlier growth spurts thus helped to lay the foundations of the transition to modern economic growth after the Meiji Restoration of 1868. Per capita income in Japan was over three quarters of the British level around 1280, but fell behind substantially following the Black Death of the mid-fourteenth century, which led to a roughly fifty percent increase of per capita incomes in Britain. By the mid-fifteenth century, Japanese per capita incomes were around half the British level. Between 1450 and 1600, per capita incomes grew substantially in Japan while stagnating in Britain, so that the gap narrowed. With accelerating British growth from the mid-seventeenth century, however, the gap widened, so that by the mid-nineteenth century, per capita incomes in Japan were only

[1] Broadberry and Wallis (2016) make a distinction between medium-run trends, which are assessed here, and short-run fluctuations, which can only be assessed with annual data.

around 30 per cent of the British level. In 1874, Japan's GDP per capita was $1,013 in 1990 international dollars, substantially above Maddison's (2001) definition of bare bones subsistence at $400 in 1990 prices.[2] This level is derived from the World Bank's poverty line of a dollar a day in 1990, and continues to be experienced by the world's poorest economies today. Japan's GDP per capita was little more than $500 in 730, but by the time of the Tokugawa period, Japan had already clearly emerged from bare bones subsistence, and was laying the foundations of the modern economic growth achieved after the Meiji Restoration of 1868.

How should we view the Great Divergence in the light of these patterns of growth? Just as Britain caught up with and overtook other European countries by spurts of growth interspersed with periods of stable per capita incomes, so Japan caught up with and overtook other Asian economies, including China, by a similar process of episodic growth and the avoidance of major growth reversals or "shrinking". But since Japan started at a lower level than Britain and grew more slowly until the Meiji Restoration, the Great Divergence occurred as the most dynamic part of Asia fell behind the most dynamic part of Europe.

In order to derive the trend in Japanese GDP, we adapt the recent work on reconstructing the historical national accounts of a number of European countries to the circumstances and data availability of Japan. The starting point is the estimation of population in section 2. This is followed in section 3 by the estimation of agricultural output, drawing on both supply side and demand side evidence. Supply side evidence is drawn either directly from

[2] This is higher than Maddison's (2010) figure of $756, because of Fukao *et al.*'s (2015) re-estimation of Japanese GDP for the period 1874-1890 and further work on the period of reconstruction after World War II, documented in Bassino *et al.* (2016).

data on agricultural output or indirectly from the cultivated land area multiplied by the productivity of land. This can be cross-checked against the demand for food based on real wage trends. Section 4 then uses information on urbanisation and population density to estimate output in the secondary and tertiary sectors. The sectoral estimates are combined in section 5 to compute GDP and divided by population to obtain GDP per capita in Japan. This is then compared in section 6 with GDP per capita in Britain, and the Anglo-Japanese comparison is placed in a wider Europe-Asia context to shed new light on the Great Divergence. Section 7 concludes.

2. POPULATION

Historical demographic data allow the estimation of total population for Japan back to around 730. The data in Table 1 are taken from a number of sources that have been cross-checked and made consistent, covering the ancient, medieval and Tokugawa periods (Saito and Takashima, 2015; 2017). Due to the limited availability of primary sources for premodern Japan, it is not possible to provide annual series, so data are provided for a number of benchmark years. For the ancient period (710-1192), data are presented for 730, 950 and 1150, while for the medieval period (1192-1600), the benchmark years are 1280 and 1450. For the Tokugawa period (1600-1868), data are provided for 1600, 1721, 1804 and 1846. These estimates are linked up to a benchmark for 1874, early in the Meiji period (1868-1912).

Here we provide a brief description of the sources and methods for the estimation of the population benchmarks, with further details provided in the Appendix. For the ancient period, the estimates of Farris (2009) are derived ultimately from information on the number and average size of villages (for the year 730) or the cultivated area together with the amount of land needed to provide sufficient food to support a person (for the years 950 and 1150). For the medieval period, the estimates are also taken from the work of Farris (2006). For 1280, a link to the cultivated area in the ancient period is established using a sample of land registers and combined with information on the amount of land per person needed to support life (Farris, 2006: 22-26). For 1450, the population is estimated by establishing the number of soldiers, applying a ratio of soldiers to the rural population and making an allowance for the urban population (Farris, 2006: 95-98). This figure is then cross-checked against Osamu Saito's extrapolation back from the first national census estimate of 1721 (Farris, 2006: 98-100; Saito and Takashima, 2017). For the Tokugawa period, the population data for 1600 are taken from Saito and Takashima (2015), again projected back from the census figure for 1721. The estimates for 1804 and 1846 are based on further national surveys, reworked by Kito (1996). For the early Meiji period, the 1874 level is taken from Fukao *et al.* (2015).

For the ancient and medieval periods, there is inevitably some uncertainty surrounding the size of the Japanese population. For the main series shown in Table 1, Farris (2006) provides an error range of around ±5% for most years before 1600, but with a higher range of ±12% for 950. In the Appendix, we also consider Kito's (2000) alternative estimates for the ancient period, which show substantial population growth rather than stagnation between 730 and 1280. Encompassing Kito's estimates would increase the error range for 730 and 950 from ±5 to 12% to around ±17 to 18%. We will return to the issue of error margins later in the paper when considering the robustness of our results.

Over the entire period 730-1874, Japanese population grew at a relatively modest annual rate of 0.15 per cent using our main series, or 0.18 per cent using the alternative series for the ancient period. However, much of the population growth was concentrated in the period 1280-1721, with periods of much slower growth before 1280 and again after 1721. It should be noted that in contrast to most European countries, there was no major population decline in the mid-fourteenth century, as Japan completely avoided the Black Death that ravaged Europe after 1348. There was an absolute fall in the population level between 1721 and 1804, before a recovery during the nineteenth century. This population decline was driven by trends in eastern Japan, which fell behind the proto-industrialising western parts of the country and was hit by famines as a result of cold weather and economic stagnation (Hayami and Kito, 2004: 221-222). Population continued to increase in western Japan, where proto-industry and agriculture continued to prosper.

3. AGRICULTURAL PRODUCTION

Agricultural output can be estimated directly from the supply side, using data on crops harvested or the amount of land used for crop production multiplied by crop yields. This can then be cross-checked against estimates of the demand for food derived indirectly from data on population, wages and prices. Starting with the supply-side estimates, the precise method of estimation varies by period. For the ancient and medieval periods, agricultural output is derived from data on the amount of arable land in use, multiplied by estimates of the productivity of land. For the period 1600-1874, by contrast, the most reliable data are for total production and land use, with land productivity derived from these two series.

3.1 Agricultural output from the supply side

Starting with the supply-side estimates, the precise method of estimation varies by period. Here we provide an overview, but full details of the methods and sources are set out in the Appendix. For the ancient period, under the *Ritsuryō* legal code, which treated people and land as public property, all persons were recorded in a family register and land was distributed to farmers on the basis of the size and the composition of the household in terms of age, sex and social status.

Farmers cultivated their allotted fields (*kubunden*) and paid land tax to the government in the form of rice, together with various poll taxes. To maintain the system, the allotment of land was revised, in principle, every six years. Sufficient data have survived from this period to allow the estimation of agricultural output from the amount of arable land in use, multiplied by the productivity of land for the benchmark years 730 during the Nara period, and 950 and 1150 during the early and late Heian periods, respectively.

For the medieval period, the absence of a unified government, in contrast to the *Ritsuryō* system of the ancient period, means that there is more limited availability of systematic data on the cultivated area and land productivity. Here, we have made use of the work of Farris (2006: 263), who derived total arable land by multiplying the population by estimates of arable land per capita obtained from primary sources. These estimates are then multiplied by grain yields from the same sources to yield agricultural output. However, it should be noted that the 1280 figure for arable land per capita is derived from the 1450 figure by assuming that arable output per capita was the same in both years, so that arable land per capita declined as land productivity increased. It will therefore be particularly important for this period to cross-check the supply-side results with the demand-side estimates obtained in the next section. We have reworked Farris's figures to make them more consistent with the estimates for other years, by allowing for fallowed and abandoned land and incorporating additional information on land productivity.

For the Tokugawa period from 1600 the most reliable data are for total production and land use, with land productivity derived from these two series. Here, we extend the approach of Nakamura (1968), who established the reliability of output benchmarks in the Shōhō period (1645-1648) and in the early years of the Meiji period (1877-79) and used the number of engineering projects to improve land as a variable to interpolate agricultural output in a number of intervening periods. Whereas Nakamura (1968) worked at the level of Japan as a whole, we recalculate the output changes at the level of 14 regions, using the same 1645 benchmark, but a slightly different 1874 benchmark from Naimushō Kangyōryō (1875) *Meiji 7-nen fuken bussan-hyō* [Tables of Prefectural Products, Meiji 7].

The agricultural production data are set out in Table 2. The arable land area is given in the first column, while the second column shows agricultural land productivity in Tokugawa units. The third column gives agricultural production in 1,000 *koku*, while the fourth column gives the series for agricultural production per head, obtained by dividing agricultural production by the population series from Table 1. The fifth column presents the agricultural production per head data in index number form, based on 1874=100. Agricultural production grew at an annual rate of 0.20 per cent between 730 and 1874, with around two-thirds of the growth coming from an extension of the arable area, and the other one-third from rising land productivity. Most of the output growth was needed merely to keep up with the increasing population, but over the period as a whole agricultural production per head increased by 0.08 per cent per annum. Most of the per capita growth occurred in three phases, 730-950, 1450-1600 and after 1721, which does not suggest any simple Malthusian link to population change. The fact that the huge surge in population between 1280 and 1721 was achieved without any significant decline in agricultural output per capita reinforces that conclusion.

3.2 Real wages and the demand for food

An alternative way of estimating agricultural output is to infer it from a demand function for food, using known trends in wages and prices. This approach can be traced back at least as far as the work of Crafts (1985), who calculated the path of agricultural output in Britain during the Industrial Revolution with income and price elasticities derived from the experience of later developing countries. The approach was developed further by Allen (2000) using consumer theory. Allen (2000: 13-14) starts with the identity:

$$Q^A = rcN \quad (1)$$

where Q^A is real agricultural output, r is the ratio of production to consumption, c is consumption per head and N is population. Real agricultural consumption per head is assumed to be a function of its own price in real terms (P^A/P), the price of non-agricultural goods and services in real terms (P^{NA}/P), and real income per head (y). Assuming a log-linear specification, we have:

$$\ln c = \alpha_0 + \alpha_1 \ln(P^A / P) + \alpha_2 \ln(P^{NA} / P) + \beta \ln y \quad (2)$$

where α_1 and α_2 are the own-price and cross-price elasticities of demand, β is the income elasticity of demand and α_0 is a constant. Consumer theory requires that the own-price, cross-price and income elasticities should sum to zero, which sets tight constraints on the plausible values, particularly given the accumulated evidence on elasticities in developing countries (Deaton and Muellbauer, 1980: 15-16, 60-82).

For early modern Europe, Allen (2000: 14) works with an own-price elasticity of -0.6 and a cross-price elasticity of 0.1, which constrains the income elasticity to be 0.5. Allen also assumes that agricultural consumption is equal to agricultural production. For the case of Japan, where more limited information is available, we implement a restricted version using the rice wage (the daily wage divided by the price of rice) for unskilled labourers and an assumed income elasticity of 0.5.[3] The rice wage is taken from Bassino *et al.* (2010) and Bassino and

[3] One way to justify this would be if the cross-price elasticity is zero and real income is the wage divided by the overall price level. The own-price elasticity must then equal the negative of the real wage elasticity. But then the overall price level used to deflate the wage cancels out with the overall price level used to deflate the grain price, leaving a single term in the grain wage.

Ma (2005), and plotted on an annual basis in Figure 1, together with the per capita agricultural demand derived using the demand approach.

For the period 1260-1600, rice wages in Kyoto were constructed using information on rice prices in copper coins reported in Momose (1959), Rekihaku (2009), and Kyoto Daigaku Kinsei Bukkashi Kenkyūkai (1962) while series of nominal wages in copper coins (or directly paid in rice) were generated on the basis of wage rates for benchmark years collected by Endo (1956) and Tanaka (2007) and on individual contracts reported by Rekihaku (2009). Although wages are also available for highly skilled carpenters, attention has been restricted here to the unskilled helpers of craftsmen and transporters. Skilled wages were paid to a much smaller share of the population, so that unskilled wages are likely to provide a better indicator of average incomes. Throughout the entire period, the nominal wage rates for unskilled workers remained fairly stable at around 10 copper coins, so that most of the rice wage variation resulted from changes in rice prices. For the post-1743 period, rice wages are also available for Kyoto, based on a collection of retail prices of rice sold and labour compensation paid by the Kyoto branch of the trading house Mitsui (Mitsui Bunko 1981).

For the period 1600-1743, unskilled wage rates in copper coins are obtained from a data series for Osaka, which is available for the whole period 1600-1780 (Miyamoto, 1963). The stability of the rate over long periods indicates that an in-kind component of rice was not included. The Osaka wages were substantially lower than in Kyoto, but were adjusted upwards to the Kyoto level by assuming that the in-kind component in Osaka was 0.8 *shō* (1.8 litres per *shō*, and 1.5 kg in the case of husked rice). This adjustment factor is obtained by comparing the Osaka wage series for the period 1743-1870 with the series for Kyoto covering the period 1743-1762 and 1791-1870. Pre-1720 rice price series were generated by projecting backwards the Kyoto Mitsui series, assuming the same yearly variation as for wholesale prices in Osaka for 1700-1742 and 1763-1790, Hiroshima 1620-1700 (Iwahashi 1981) and Osaka 1600-1650 (Kimura 1987).

The unskilled rice wage remained relatively stable between 1260/69 and 1450/59, before roughly doubling to 1550/59 and then slipping back, but remaining on a higher plateau than before 1450/59. An index of agricultural demand per head has been derived in Figure 1 from the unskilled rice wage on the assumption of an income elasticity of demand of 0.5. The plausibility of food supply data can be gauged by converting the rice equivalent output estimates into kilocalories available. Although a *koku* was intended to be sufficient rice to feed one person for a year, the traditional volume measure of 180.391 litres implies a daily amount of 0.5 litres, which provides just 1,448 kilocalories. Since around 2,000 kilocalories per day are needed to work and reproduce[4], the estimated agricultural output per head of around 1.4 *koku* between the 1260s and the 1450s suggests that medieval Japan was producing just enough food, with little margin for loss of kilocalories through either wastage or food processing.[5] The higher figures for later years would be consistent with a rise in food processing activities (sake and noodles, but also soy bean paste and soy sauce), reflecting a rise in living standards. Adjusting for losses in storage and processing would result in kilocalorie figures broadly comparable to estimates for Britain, in a range between 2,000 and 2,400 from the thirteenth to

[4] Average caloric requirements per head depend on body height, which was relatively low in medieval and early modern Japan, but also on claim related to basal metabolism, disease exposure and physical activities, which were quite demanding in Japanese agriculture and industry.

[5] However, it should be borne in mind that non-rice output has been converted to rice equivalent output at market prices, and that the price of a kilocalorie from wheat, barley, millet, buckwheat and other non-rice staples was significantly lower than the price of a kilocalorie from rice. Gross availability of kilocalories would therefore have been significantly higher than 2,000, leaving more scope for losses through wastage and food processing.

the nineteenth century (Broadberry *et al.,* 2015a), but with a much lower intake of animal proteins in Japan.

3.3 Agricultural output: supply and demand

A comparison between agricultural output per capita estimated from both the supply and demand sides is given in Figure 2. The supply-side estimates cover a long span of time, but at a relatively low frequency, while the demand-side estimates are available at a higher frequency, but for a shorter period of time. Both supply and demand estimates suggest a similar increase in agricultural output per capita between the late-thirteenth and mid-nineteenth centuries. Both estimates also show an increase between 1450 and 1600, followed by a decline during the seventeenth century and a return to growth in the eighteenth century.

As with the population series, our agricultural output estimates are inevitably dependent upon the accuracy of the underlying data. To deal with this uncertainty, we adopt the subjective error margins approach used by Perkins (1969) in his study of China from the Ming dynasty to the 1950. This approach has also been used in a number of other historical national accounting studies (Feinstein , 1972; Feinstein and Thomas, 2001; van Zanden and van Leeuwen, 2012). Although the error margins for some of the individual components of agricultural supply and demand discussed in the Appendix are higher, the degree of agreement between the two series suggests an error margin of around ±10% for agricultural output as a composite series derived from rice wages on the demand side and agricultural land multiplied by land productivity on the supply side.

4. SECONDARY AND TERTIARY OUTPUT

4.1 Urbanisation and non-agricultural production

A number of authors have used the share of the population living in towns as a measure of the growth of the non-agricultural sector. This approach began with Wrigley (1985), and has recently been combined with the demand approach to agriculture to provide indirect estimates of GDP in a number of European countries during the early modern period (Malanima, 2011; 2011; Álvarez-Nogal and Prados de la Escosura, 2013; Schön and Krantz, 2012). With the path of agricultural output (Q^A) derived using equations (1) and (2), overall output (Q) is derived as:

$$Q = \frac{Q^A}{1-\left(Q^{NA}/Q\right)} \qquad (3)$$

where the share of non-agricultural output in total output (Q^{NA}/Q) is proxied by the urbanisation rate. The approach can be made less crude by making an allowance for higher productivity in the non-agricultural sector, so that (Q^{NA}/Q) increases more than proportionally with the urbanisation rate.

However, as Saito and Takashima (2016) point out, there is a major problem with applying this method to Japan, because the urbanisation rate declined during the Tokugawa period, which is widely seen as the key period of proto-industrial growth. Data on the Japanese urban population are shown in Table 3. The definition of urbanisation chosen here is the number of people living in settlements of at least 10,000, in line with the work of de Vries (1984) on Europe. The data on the size of individual towns were derived from historical sources compiled by local governments in Japan. The urban population share remained relatively stable at around 2 or 3 per cent until the mid-fifteenth century, when it increased substantially, particularly at the beginning of the Tokugawa shogunate. However, the urbanisation rate then remained on a plateau during the seventeenth and eighteenth centuries before declining during the nineteenth century. The sharp increase in the level of urbanisation at the beginning of the Tokugawa period was the result of the introduction of the *Bakuhan* system, which was based on a principle of separation between peasants in the countryside and warriors in towns, with merchants and artisans also being required to reside in towns (Iwahashi, 2004: 88-89). However, the separation between peasants and the commercial classes was less strictly enforced than that between peasants and the warriors, allowing the growth of proto-industry in the countryside (Shimbo and Hasegawa, 2004).

4.2 Allowing for proto-industry

Under the circumstances outlined above, a crude estimation of non-agricultural production using the urbanisation rate would miss the expansion of cottage industry in the rural industrious revolution highlighted by Hayami (1967). The solution proposed by Saito and Takashima (2016) is to allow secondary and tertiary output to vary with population density as well as the urbanisation rate, with the weights for these two factors derived from pooled regional data for the years 1874, 1890 and 1909. Using data from Fukao *et al*. (2015), they run separate regressions for the secondary and tertiary sectors, with the same right hand side variables allowed to have different effects on the secondary and tertiary sector shares. The secondary sector share variable (*Sshare*) is defined as the proportion of secondary sector output in the sum of primary and secondary sector output, and the regression is run with the dependent variable in logit form to deal with the skewness of the distribution:

$$ln\left(\frac{Sshare}{1-Sshare}\right) = \alpha_0 + \alpha_1 lnD + \alpha_2 ln\left(\frac{U}{1-U}\right) + \alpha_3 M + \alpha_4 YR1 + \alpha_5 YR2 + \varepsilon \qquad (4)$$

Here, *D* is population density, *U* is the urbanisation rate (also entered in logit form), *M* is a dummy variable for modernised prefectures (confined to Tokyo and Osaka in 1874 and 1890, but with the addition of Aichi and Fukuoka in 1909), *YR1* and *YR2* are year dummies for 1890 and 1909 respectively, and ε is a stochastic error term. The tertiary sector share variable (*Tshare*) is defined as the proportion of tertiary sector output in the sum of primary and tertiary sector output, and the regression is again run with the dependent variable in logit form to deal with the skewness of the distribution:

$$ln\left(\frac{Tshare}{1-Tshare}\right) = \alpha_0 + \alpha_1 lnD + \alpha_2 ln\left(\frac{U}{1-U}\right) + \alpha_3 M + \alpha_4 YR1 + \alpha_5 YR2 + \varepsilon \quad (5)$$

The right hand side variables are the same as in equation (4), but the coefficients are allowed to take different values in the two sectors.

Saito and Takashima (2016) employ four different models for their regression analysis: a simple pooling regression model, a pooling regression model with prefectural population weights, a fixed effects model and a random effects model. The model selection test results indicate that the random effects model is preferred, so these results are presented here in Table 4. The key explanatory variables are the population density and the urbanisation rate. The population density is measured in terms of the number of persons per *chō* in each prefecture, while the urbanisation rate is the number of people living in settlements of more than 10,000 persons in a prefecture divided by the total population of that prefecture. These variables are respectively log and logit transformed. A dummy for modernised prefectures is added, as well as year dummies for 1890 and 1909.

The random effects regression results for equations (4) and (5) in Table 4 yield a number of interesting findings. First, both population density and urbanisation were significant determinants of both secondary and tertiary sector activity. Second, however, the population density effect was comparatively more important for the secondary sector, while the urbanisation effect was comparatively more important for the tertiary sector.[6]

[6] The coefficient on the population density term was almost 4 times as large as the coefficient on the urbanisation term in the secondary sector equation, but was less than twice as large in the tertiary sector equation.

The coefficients from Table 4 can be used together with national level data on population density and the urbanisation rate to estimate secondary and tertiary sector output from the data on primary sector output in Table 5. Primary sector output is first derived from agricultural output in Table 2 by making an allowance for forestry and fisheries. For this, the agricultural output data have been increased by 18.5 per cent, in line with the ratio of forestry and fisheries to agriculture in 1874.

Secondary and tertiary sector real output in 1,000 *koku* are shown in Table 5A, together with primary sector output. Table 5C provides the growth rates of GDP and its sectoral components over a number of sub-periods. Over the period 730-1874, and also in the Tokugawa period, agriculture was the slowest growing sector, and the secondary sector grew a little bit faster than the tertiary sector. As a result, the primary sector's share of output in rice equivalent terms declined from a peak of 86.7 per cent in 950 to 59.5 per cent by 1874. Over the same period, the secondary sector increased its share from 5.3 to 12.3 per cent and the tertiary sector share more than tripled from 8.1 to 28.2 per cent.

The key variables contributing to the derivation of the outputs of the secondary and tertiary sectors are the urbanisation rate and population density, which ultimately rely heavily on the population estimates. The error margins are therefore assumed to be the same as for the population series. When constructing a composite series such as GDP, it is likely that some errors will be offsetting, with an upward bias in one series countered by a downward bias in another series (Bowley, 1911-12; Feinstein and Thomas, 2001). Hence the error margins for GDP in Table 6 are assumed to be no larger than for agricultural, secondary and tertiary outputs. This may also be expected to apply to GDP per capita, which was heavily influenced by the agricultural sector, where data on the cultivated area and the population were jointly collected by the authorities.

5. JAPANESE GDP PER CAPITA

The GDP per capita series is shown in level form in Table 7A, and in annual growth rate form in Table 7B. Japanese GDP per capita grew at an annual rate of 0.08 per cent between 730 and 1874. As in the North Sea area economies of Britain and Holland, this growth was persistent from the medieval period, with periods of strong positive growth that were not followed by substantial growth reversals (Broadberry *et al.*, 2015a; van Zanden and van Leeuwen, 2012). The major periods of positive per capita GDP growth occurred during 1450-1600 and again from the 1720s. This latter period of growth during the late Tokugawa period led on to a further acceleration of the rate of growth as Japan made the transition to modern economic growth during the Meiji period. It is interesting to note that the first economies to make the transition to modern economic growth at the two ends of Eurasia, Britain and Japan, both built on earlier gains reaching back to the medieval period. This suggests that a full understanding of the transition to modern economic growth requires paying more attention to the forces which dampened growth reversals rather than focusing exclusively on the forces responsible for the initiation of growth phases (Broadberry, 2015; Broadberry and Wallis, 2016).

Another interesting parallel with the British case concerns the relatively modest increase in per capita agricultural output, despite the approximate doubling of per capita GDP between 1280 and 1874. This contrast between trends in the per capita availability of food and overall output can be seen clearly in Figure 3. This reminds us that before the mid-nineteenth century, the fruits of economic development came mainly through the greater availability of manufactured goods and services rather than through greater consumption of food.

6. IMPLICATIONS FOR THE GREAT DIVERGENCE

6.1 An Anglo-Japanese comparison

To pin down the timing and extent of the Great Divergence, we need to compare GDP per capita in Japan with Britain, where the transition to modern economic growth first occurred, and place the Anglo-Japanese comparison within its wider Europe-Asia context. Here, we project back from Maddison's (2010) estimates of GDP per capita in the late nineteenth century, expressed in 1990 international dollars, but with some important adjustments. First, Bassino et al. (2016) have revised Japanese GDP per capita in constant prices during the reconstruction phase after World War II, while Fukao *et al*. (2015) have also revised real growth during the early Meiji period period, 1874-1890. Projecting back from 1990 to 1874 with a significantly lower growth rate results in a substantially higher level of GDP per capita in 1874 than suggested by Maddison. Second, whereas Maddison worked with the territory of the United Kingdom, Broadberry *et al.* (2015a) provide a series for Great Britain covering the period 1700-1870 and England for the period 1270-1700. They note that even in the Middle Ages, British levels of GDP per capita were well above $400 in 1990 international prices. The figure of $400, or a little more than a dollar a day, is usually taken as the measure of bare bones subsistence, and is observed for many poor countries in the twentieth century. Broadberry *et al.* (2015a) note that GDP per capita figures of well above $400 have been found for a number of west European countries in the late Middle Ages (van Zanden and van Leeuwen, 2012; Malanima, 2011; Alvarez-Nogal and Prados de la Escosura, 2013). Broadberry *et al.* (2015b) also find early modern India well above bare bones subsistence, while Broadberry *et al.* (2017) present estimates showing Chinese GDP per capita as the highest in the world during the eleventh century. It is therefore of great interest to establish Japan's position in the Great Divergence.

Table 8 shows that GDP per capita in Japan in 1280 was more than three quarters of the British level. However, following the Black Death of the mid-fourteenth century, which wiped out around a third of the British population immediately and more than half by the mid-fifteenth century, British GDP per capita increased sharply. A similar increase in GDP per capita and in the real wage occurred across much of Europe, where the Black Death also sharply reduced the population. However, the Black Death did not reach Japan and there was accordingly no similar increase in GDP per capita there. Hence by 1450, Japanese GDP per capita was only around half the British level. The gap narrowed between 1450 and 1600, with Japan at around 60 per cent of the British level by the beginning of the seventeenth century. However, a surge of economic growth in Britain from the middle of the seventeenth century further widened the gap and Japan's per capita GDP was only around a quarter of the British level by the early Meiji period.

The finding that Japanese GDP per capita in 1280 was already below the British level is extremely interesting, since the two countries had similar levels of urbanisation at this time, and urbanisation is often used as an indicator of prosperity. One way of understanding this would be to see two counterbalancing forces at work. First, it seems likely that Japan had a more sophisticated urban culture than Britain (Farris, 2006: 81, 151-153; Rozman, 1973, 13-58; Astill, 2000: 46-49). Second, however, offsetting this first effect was the fact that Britain had an unusually large share of its agricultural sector devoted to high value added livestock farming (Broadberry *et al*., 2015a: 118). Although this did not produce more kilocalories than the minimum required for the population to work and reproduce, it did allow a varied diet, including meat, dairy produce and ale as well as the more basic grain products such as bread and oatmeal. Given the importance of agriculture at the time, it is this effect which dominated, making per capita GDP higher in Britain than in Japan.

How robust are these results, given the error margins presented in the Appendix and summarised in Table 6? If Japanese GDP per capita in 1280 were to be increased by 5 to 15 per cent, in line with its B grading for the ancient period, it would be $610 rather than $531, which would raise Japan to 89.8 per cent of the GB level, but not eliminate the difference. For all other years, taking account of the subjective error margins from Table 6 would make no substantial difference to the general nature of the comparative results.

6.2 Japan in the Great Divergence

So far, we have compared Japan only with Britain. However, Britain was a relatively poor part of Europe in the eleventh century and a relatively rich part by the nineteenth century, as can be seen in the estimates of GDP per capita for a sample of European and Asian countries presented in Table 9. Before the Black Death struck in 1348, per capita incomes were substantially higher in Italy and Spain than in England and Holland (Broadberry *et al.,* 2015a; van Zanden and van Leeuwen, 2012; Malanima, 2011; Álvarez-Nogal and Prados de la Escosura, 2013). There then followed a substantial reversal of fortunes between the North Sea area and Mediterranean Europe, so that by 1800, per capita incomes were substantially higher in Britain and the Netherlands than in Italy and Spain. This "Little Divergence" occurred alongside the "Great Divergence" between Europe and Asia.

The reversal of fortunes within Europe was accompanied by a "Little Divergence" within Asia. In contrast to Japan's persistent growth path which avoided significant growth reversals, Chinese per capita GDP fluctuated at a relatively high level during the Northern Song and Ming dynasties before trending down sharply during the Qing dynasty (Broadberry *et al.*, 2017). On these estimates, Japan overtook China only during the eighteenth century. Like China, India experienced declining GDP per capita from the Mughal peak under Akbar, circa 1600 (Broadberry *et al.*, 2015b). Again, Japan only pulled decisively ahead of India during the eighteenth century.

The Great Divergence between Europe and Asia occurred at the same time as the reversals of fortune that were occurring within both Europe and Asia. Like Britain and Holland, Japan was following an upward trajectory as other parts of Europe and Asia experienced stagnation or decline of per capita GDP. However, compared to Britain and Holland, Japan started at a lower level of GDP per capita and grew more slowly than the North Sea area economies. The transition to modern economic growth thus occurred first in the North Sea area in the form of the British Industrial Revolution, which then spread fairly quickly to other high income parts of Europe. As Japan was overtaking China and India, however, it was also falling further behind Britain until the Meiji restoration of 1868 and the institutional reforms which ushered in Japan's transition to modern economic growth.

7. CONCLUSIONS

This paper provides estimates of Japanese GDP per capita for the period 730-1874, constructed from the output side, using methods developed for the estimation of GDP per capita in medieval and early modern Europe, but amended to suit Japanese circumstances and data. Our estimates for the agricultural sector are built up from direct estimates of arable land use and land productivity, and checked against trends in agricultural demand derived from the grain wages of unskilled labourers. Activity in the secondary and tertiary sectors is quantified using techniques developed originally in the context of Europe, but again amended to suit Japanese circumstances and data availability. As well as linking the growth of non-agricultural output to the urbanisation ratio, a role is identified for population density during the proto-industrial phase of the Tokugawa period.

The results suggest that Japanese GDP per capita grew at an annual rate of 0.08 per cent between 730 and 1874. The upward trend was persistent, if not consistent, as in Holland and Britain. A comparison with Britain and other European countries and also with other Asian countries can be used to establish the main contours of the Great Divergence. Just as Britain caught up with and overtook other European countries in a process known as the European Little Divergence, so Japan caught up with and overtook China and India in an Asian Little Divergence. However, since Japan started at a lower level than Britain and grew more slowly until the Meiji Restoration, the Great Divergence occurred as the most dynamic parts of Asia fell behind the most dynamic parts of Europe.

TABLE 1: Total population of Japan, 730-1874

A. Level in millions

Year	Population
730	6.1
950	5.0
1150	5.9
1280	6.0
1450	10.1
1600	17.0
1721	31.3
1804	30.7
1846	32.2
1874	34.5

B. Annual growth rates

Years	(% per year)
730-950	-0.09
950-1150	0.08
1150-1280	0.01
1280-1450	0.31
1450-1600	0.35
1600-1721	0.51
1721-1804	-0.02
1804-1846	0.12
1846-1874	0.25
730-1280	0.00
1280-1721	0.38
1721-1874	0.06
730-1874	0.15

Sources and notes: 730–1600: Farris (2006, 2009), Saito and Takashima (2017). 1721–1846: Kito (1996; 2000); Saito and Takashima (2015). 1874: Fukao *et al*. (2015). Estimates for all years exclude Ezochi and Ryūkyū (present-day Hokkaido and Okinawa prefectures). The population for 1874 including Hokkaido and Okinawa was 34.8 million.

TABLE 2: Japanese agricultural production, 725-1874

A. Levels

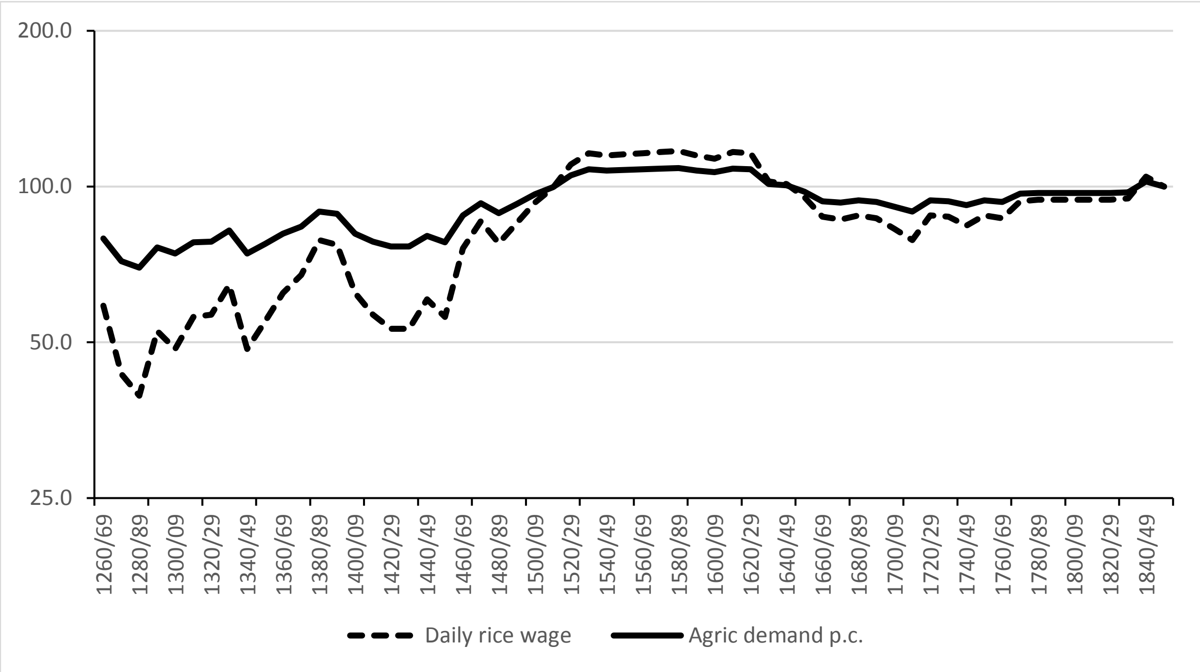
	Arable land (1000 *chō*)	Land productivity (*koku*/*chō*)	Agricultural output (1000 *koku*)	Agricultural output per head (*koku*)	Agricultural output per head (1874=100)
730	640	6.35	6,329	1.04	55.9
950	1,028	5.02	7,990	1.60	86.0
1150	1,109	5.26	9,035	1.53	82.3
1280	1,276	6.49	8,278	1.38	74.2
1450	1,621	8.60	13,938	1.38	74.2
1600	2,497	10.36	25,879	1.52	81.7
1721	3,249	12.67	41,173	1.32	71.0
1804	3,892	12.74	49,604	1.62	87.1
1846	4,265	13.26	56,571	1.76	94.6
1874	4,594	14.12	64,861	1.86	100.0

B. Annual growth rates

	Arable land	Land productivity	Agricultural output	Agricultural output per head
730-950	0.22	-0.11	0.08	0.09
950-1450	0.09	0.11	0.11	-0.03
1450-1600	0.28	0.12	0.41	0.13
1600-1721	0.22	0.17	0.38	0.01
1721-1804	0.22	0.01	0.22	0.25
1804-1874	0.24	0.15	0.38	0.29
730-1874	0.17	0.07	0.20	0.08
1600-1874	0.22	0.11	0.34	0.15

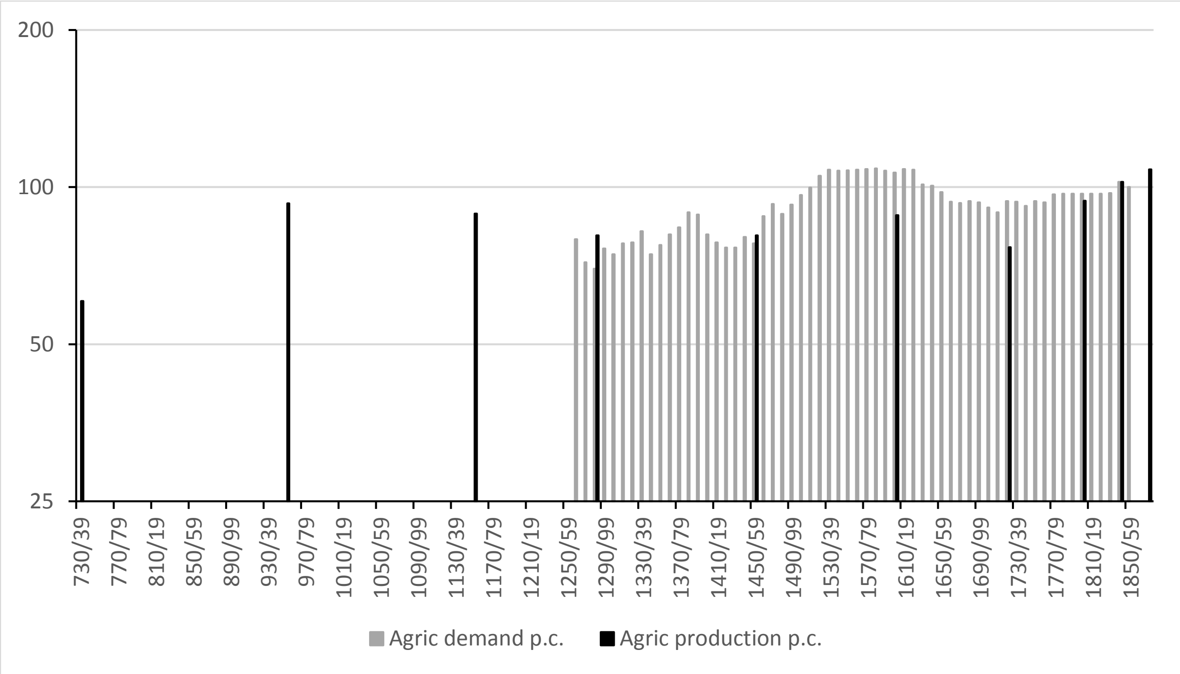
Sources and notes: See discussion in the text.

FIGURE 1: Japanese unskilled rice wage and agricultural demand per capita, 1260/69-1850/59 (1850/59=100, log scale)



Sources and notes: Unskilled rice wage from Bassino *et al*. (2010), Bassino and Ma (2005): 1262-1583: constructed using information reported in Momose (1959), Rekihaku (2009), Kyoto Daigaku Kinsei Bukkashi Kenkyukai (1962), Endo (1956) and Tanaka (2007). 1600-1780: generated using information in Miyamoto, 1963), Iwahashi (1981) and (Kimura 1987). 1793-1862: derived from Mitsui (Mitsui Bunko 1981). See text for details. Agricultural demand per capita: see text.

FIGURE 2: Per capita supply of and demand for agricultural products, 730-1874



Sources and notes: See text.

TABLE 3: Urban population in Japan, 730-1873

	Urban population (1,000)	Total population (millions)	Urban share (%)
730	124	4.5	2.8
950	135	6.4	1.9
1150	120	5.9	1.9
1280	208	6.0	3.5
1450	259	10.1	2.6
1600	1,088	17.0	6.4
1650	2,822	20.7	13.6
1750	4,102	30.9	13.3
1850	3,875	32.3	12.0
1873	3,471	33.9	10.2

Sources and notes: The urban population data for Japan excluding Ezochi and Ryūkyū are taken from Kito (1996), Farris (2009), and Saito and Takashima (2015; 2017). They include persons living in settlements of at least 10,000 persons. The total population data are taken from Table 1, Panel A.

TABLE 4: Determinants of sectoral shares: random effects regression results, 1874, 1890 and 1909

	Secondary sector	Tertiary sector
Population density (log)	0.4604***	0.5380***
	(4.65)	(6.97)
Urbanisation rate (logit)	0.1224*	0.3098***
	(1.92)	(6.26)
Prefectural dummy	0.7745***	0.3065**
	(3.84)	(1.96)
Year 1890 dummy	0.4473***	0.3878***
	(7.38)	(8.29)
Year 1909 dummy	0.7428***	0.4277***
	(10.11)	(7.52)
Constant	-1.5567***	-0.3194
	(-8.48)	(-2.24)
No. of observations	135	135
No. of groups	45	45
Overall R^2	0.7428	0.8366

Sources and notes: Saito and Takashima (2016: 378)

TABLE 5: Japanese GDP by main output categories, 730-1874 (1,000 *koku*)

A. Levels of GDP

	Primary output	Secondary output	Tertiary output	GDP
730	7,502	481	711	8,695
950	9,472	575	883	10,930
1150	10,711	677	998	12,386
1280	9,837	668	1,094	11,599
1450	16,616	1,382	2,221	20,219
1600	30,678	3,652	7,306	41,635
1721	48,808	8,434	20,361	77,603
1804	58,803	10,091	24,402	93,296
1846	67,062	11,698	28,140	106,900
1874	77,103	15,888	36,551	129,541

B. Sectoral shares of GDP (%)

	Primary output	Secondary output	Tertiary output	GDP
730	86.3	5.5	8.2	100.0
950	86.7	5.3	8.1	100.0
1150	86.5	5.5	8.1	100.0
1280	84.8	5.8	9.4	100.0
1450	82.2	6.8	11.0	100.0
1600	73.7	8.8	17.5	100.0
1721	62.9	10.9	26.2	100.0
1804	63.0	10.8	26.2	100.0
1846	62.7	10.9	26.3	100.0
1874	59.5	12.3	28.2	100.0

C. Growth rates of GDP

	Primary output	Secondary output	Tertiary output	GDP
730-950	0.11	0.08	0.10	0.10
950-11500	0.06	0.08	0.06	0.06
1150-1280	-0.07	-0.01	0.07	-0.05
1280-1450	0.31	0.43	0.42	0.33
1450-1600	0.41	0.65	0.80	0.48
1600-1721	0.38	0.69	0.85	0.52
1721-1804	0.22	0.22	0.22	0.22
1804-1846	0.31	0.35	0.34	0.32
1846-1874	0.50	1.10	0.94	0.69
730-1600	0.16	0.23	0.27	0.18
1600-1874	0.34	0.54	0.59	0.42
730-1874	0.20	0.31	0.34	0.24

Sources and notes: Primary output is derived from agricultural output in Table 2, as explained in the text. Secondary and tertiary output before 1874 are derived using data on the urbanisation rate and population density together with the regression coefficient from Table 4, as described in the text.

TABLE 6: Data reliability assessments

	Ancient	Medieval	Tokugawa
Primary output			
Cultivated land	C	C	A
Land productivity	C	C	B
Rice wage	C	C	A
Agricultural output	C	B	A
Secondary & tertiary output			
Secondary output	B	B	B
Tertiary output	B	B	B
Aggregates			
GDP	C	B	A
Population	C	B	A
GDP per capita	B	B	A

Sources: error margins derived from the range of estimates produced from alternative sources and the volatility of the underlying data, as described in the text. The interpretation of the reliability grades is from Feinstein (1972: 21): A = firm figures (± less than 5%); B = good figures (± 5% to 15%); C = rough estimates (± 15% to 25%); D = conjectures (± more than 25%). Feinstein (1972: 22) judged the probability of the true values lying within the error margins for each grade as 90 per cent.

TABLE 7: Japanese GDP per capita, 730-1874

A. Level of GDP per capita

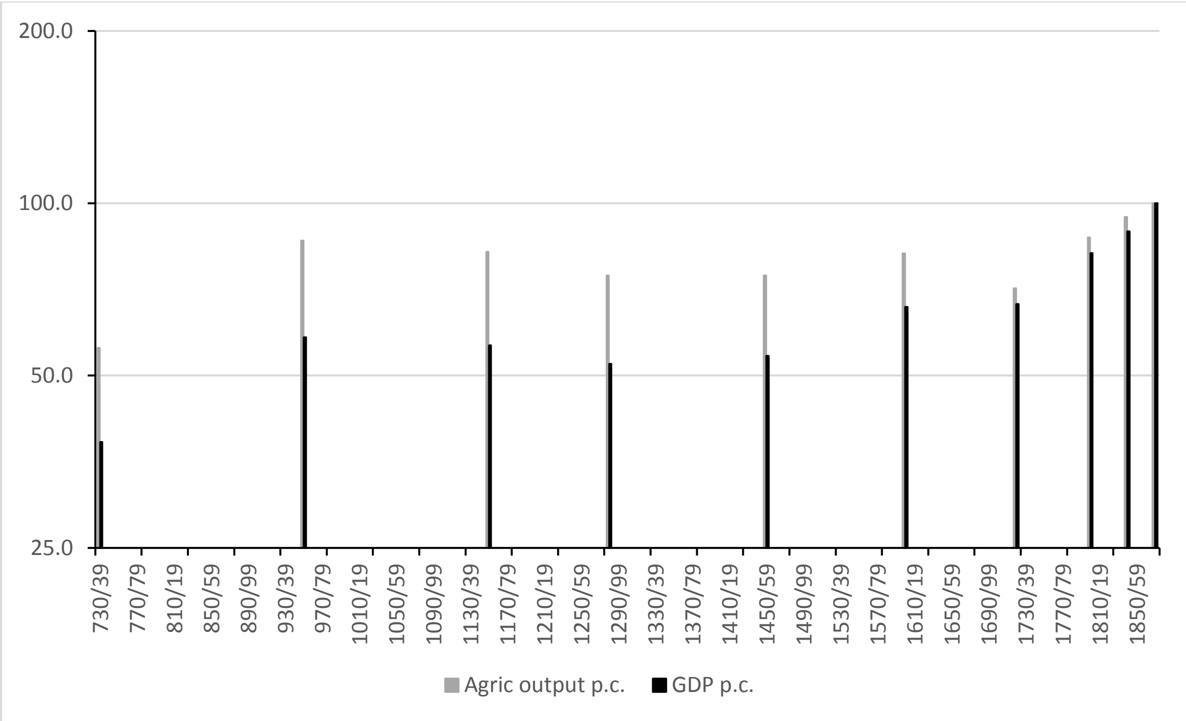
	GDP (*koku*)	Population (1,000)	GDP per capita (*koku*)	GDP per capita (1874=100)
730	8,695	6.1	1.43	38.3
950	10,930	5.0	2.19	58.8
1150	12,386	5.9	2.10	56.5
1280	11,599	6.0	1.95	52.4
1450	20,219	10.1	2.01	54.1
1600	41,635	17.0	2.45	65.9
1721	77,603	31.3	2.48	66.7
1804	93,296	30.7	3.04	81.8
1846	106,900	32.2	3.32	89.3
1874	129,541	34.8	3.72	100.0

B. Annual growth rates of per capita GDP

	Growth rate (%)
725-950	0.19
950-1150	-0.02
1150-1280	-0.06
1280-1450	0.02
1450-1600	0.13
1600-1721	0.01
1721-1804	0.25
1804-1846	0.21
1846-1874	0.41
730-1600	0.06
1600-1874	0.15
730-1874	0.08

Sources and notes: GDP from Table 5, population from Table 1. Hokkaido and Okinawa are included in 1874.

FIGURE 3: Japanese agricultural output and GDP per capita (1874=100)



Sources and notes: Agricultural output per capita from Table 2; GDP per capita from Table 7.

TABLE 8: An Anglo-Japanese comparison of per capita GDP, 730-1874

	Japan p.c. GDP ($1990)	GB p.c. GDP ($1990)	Japan/GB p.c. GDP (GB=100)
730	388		
900	596		
1150	572		
1280	531	679	78.2
1450	548	1,055	51.9
1600	667	1,123	59.4
1721	676	1,605	42.1
1804	828	2,080	39.8
1846	904	2,997	30.1
1874	1,013	4,191	24.2

Sources and notes: Japanese GDP per capita from Table 7, benchmarked at 1874 from Fukao *et al.* (2015) using Maddison (2010). GB GDP per capita from Broadberry *et al.* (2015a), benchmarked at 1850 using Maddison (2010), but adjusted from the territory of the United Kingdom to a Great Britain basis.

TABLE 9: GDP per capita levels in Europe and Asia, 725-1850 (1990 international dollars)

	GB	NL	Italy	Spain	Japan	China	India
730					388		
950					596		
980						853	
1020						1,006	
1050						967	
1086	754					878	
1120						863	
1150					572		
1280	651			897	531		
1300	724		1,466	889			
1348	745	674	1,327	957			
1400	1,045	958	1,570	822		1,032	
1450	1,011	1,102	1,657	827	548	990	
1500	1,068	1,141	1,408	826		852	
1570	1,096	1,372	1,325	919		885	
1600	1,077	1,825	1,224	876	667	865	682
1650	1,055	1,671	1,372	838			638
1700	1,563	1,849	1,344	817		1,103	622
1720	1,605	1,751	1,564	850	676	950	
1750	1,710	1,877	1,446	845		727	573
1800	2,080	1,974	1,327	893	828	614	569
1850	2,997	2,397	1,306	1,144	904	600	556

Sources: GB: Broadberry *et al.* (2015a); Walker (2014); Holland/Netherlands: van Zanden and van Leuwen (2012); Italy: Malanima (2011); Spain: Álvarez-Nogal and Prados de la Escosura (2013); Japan: Table 8; China: Broadberry *et al.* (2017); India: Broadberry *et al.* (2015b).

REFERENCES

Allen, R.C. (2000), "Economic Structure and Agricultural Productivity in Europe, 1300-1800", *European Review of Economic History*, 3, 1-25.

Allen, R.C., Bassino, J.-P., Ma, D., Moll-Murata, C., and van Zanden, J.L. (2011), "Wages, Prices and Living Standards in China, 1738-1925: In Comparison with Europe, Japan, and India", *Economic History Review*, 64 (S1), 8-13.

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

Astill, G. (2000), "General Survey 600-1300", I Palliser, D.M. (ed.), *The Cambridge Urban History of Britain, Volume I, 600-1540*, Cambridge: Cambridge University Press, 27-49.

Bassino, J.P., Fukao, K. and Takashima, M. (2010), "Grain Wages of Carpenters and Skill Premium in Kyoto, c. 1240-1600: A Comparison with Florence, London, Constantinople-Istanbul and Cairo", Paper presented at Economic History Society Conference, University of Durham, http://www.ehs.org.uk/dotAsset/85e81444-8b65-4f60-b950-cc6dd0aaceb2.pdf

Bassino, J.-P., Fukao, K. and Settsu, T. (2017), "Meiji-ki keizai seicho no sai-kento: sangyo kozo, rodo seisansei to chiikikan kakusa [Meiji economic growth reconsidered: industrial structure, labour productivity and regional disparity]", *Keizai Kenkyu [Economic Review]*, 67 (forthcoming).

Bassino, J.-P. and Ma, D. (2005), "Japanese Unskilled Wages in International Perspective, 1741-1913", *Research in Economic History*, 23, 229-248.

Bowley, Arthur L. (1911-12), "The Measurement of the Accuracy of an Average", *Journal of the Royal Statistical Society*, 75, 77-88.

Broadberry, S. (2015), "Accounting for the Great Divergence", Nuffield College, Oxford, https://www.nuffield.ox.ac.uk/People/sites/stephen.broadberry/SitePages/Biography.aspx.

Broadberry, S., Campbell, B., Klein, A., Overton, M. and van Leeuwen, B. (2015a), *British Economic Growth, 1270-1870*, Cambridge: Cambridge University Press.

Broadberry, S., Custodis, J. and Gupta, B. (2015b), "India and the Great Divergence: An Anglo-Indian Comparison of GDP per capita, 1600-1871", *Explorations in Economic History* (forthcoming).

Broadberry, S. Guan, H. and Li, D. (2017), "China, Europe and the Great Divergence: A Study in Historical National Accounting", Nuffield College, Oxford, https://www.nuffield.ox.ac.uk/People/sites/stephen.broadberry/SitePages/Biography.aspx.

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

Broadberry, S. and Wallis, J. (2016), "Growing, Shrinking and Long Run Economic Performance: Historical Perspectives on Economic Development", Nuffield College, Oxford, https://www.nuffield.ox.ac.uk/People/sites/stephen.broadberry/SitePages/Biography.aspx.

Crafts, N.F.R. (1985), *British Economic Growth during the Industrial Revolution,* Oxford: Oxford University Press.

Deaton, A. and Muellbauer, J. (1980), *Economics and Consumer Behaviour*, Cambridge; Cambridge University Press.

Endo, M. (1956), *Shokunin no rekishi [History of Craftsmanship]*, Tokyo: Shibundo.

Farris, W. W. (2006), *Japan's Medieval Population: Famine, Fertility, and Warfare in a Transformative Age,* Honolulu: University of Hawai'i Press.

Farris, W. W. (2009), *Daily Life and Demographics in Ancient Japan*, Ann Arbor, Michigan: Center for Japanese Studies, University of Michigan.

Feinstein, Charles H. (1972), *National income, expenditure and output of the United Kingdom, 1855-1965*, Cambridge: Cambridge University Press.

Feinstein, Charles H. and Mark Thomas (2001), "A Plea for Errors", University of Oxford Discussion Papers in Economic and Social History, No. 41, http://www.nuff.ox.ac.uk/Economics/History/paper41/feinstein2.pdf.

Fukao, K., Bassino, J.-P., Makino, T., Paprzycki, R., Settsu, T., Takashima, M., and Tokui, J. (2015) *Regional Inequality and Industrial Structure in Japan: 1874-2008*, Tokyo: Maruzen Publishing.

Hanley, S.B. (1983), "A High Standard of Living in Nineteenth-Century Japan: Fact or Fantasy?", *Journal of Economic History,* 43, 183-192.

Hanley, S.B. (1986), "Standard of Living in Nineteenth-Century Japan: Reply to Yasuba", *Journal of Economic History,* 46, 225-226.

Hayami, A. (1967), "Keizai shakai no seiritsu to sono tokushitsu [The Emergence of Economic Society and its Characteristics)", in Gakkai, S.K. (ed.), *Atarashii Edo Jidaizo o Motomete*, Tokyo: Toyo Keizai Shinposha.

Hayami, A. and Kito, H. (2004), "Demography and Living Standards", in Hayami, A., Saito, S. and Toby, R.P. (eds.), *Emergence of Economic Society in Japan, 1600-1859*, Oxford: Oxford University Press, 213-246.

Iwahashi, M. (1981), *Kinsei nihon bukkashi no kenkyū [Research on the History of Prices in Early Modern Japan]*, Tokyo: Ohara Shinsei Sha.

Iwahashi, M. (2004), "The Institutional Framework of the Tokugawa Economy", in A. Hayami, Saito, O. and Toby, R.P. (eds.), *Emergence of Economic Society in Japan, 1600-1859*, Oxford: Oxford University Press, 85-104.

Kimura, M. (1987), *La Revolución de los precios en la cuenca del pacífico, 1600-1650 [The Price Revolution in the Pacific Basin, 1600-1650]*, Ciudad de México: Universidad Nacional Autónoma de México, Facultad de Economía (data available in electronic format on the file "Osaka 1600-1650", prepared by David Jacks, 2006, Global Price and Income History website http://gpih.ucdavis.edu/Datafilelist.htm).

Kito, H. (1996), "Meiji izen Nihon no chiiki jinkō [Japan's Population before the Meiji Period], *Jochi Keizai Ronshu [Jochi Economic Review]*, 41(1.2), 65-79.

Kito, H. (2000), *Jinkō kara mita Nihon no rekishi [Japanese History from a Demographic Perspective]*. Tokyo: Kodansha.

Kyoto Daigaku Kinsei Bukkashi Kenkyukai (KKB), ed. (1962), *15-17 Seiki ni okeru bukka hendō no kenkyū [Research on Price Fluctuations in the 15th to 17th Centuries]*, Kyoto: Tokushikai.

Maddison, A. (2001), *The World Economy: A Millennial Perspective*, Paris: Organisation for Economic Co-operation and Development.

Maddison, A. (2010), "Statistics on World Population, GDP and Per Capita GDP, 1-2008 AD", Groningen Growth and Development Centre, http://www.ggdc.net/MADDISON/oriindex.htm.

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

Mitsui Bunko. ed. (1981), *Kinsei kōki ni okeru shuyō bukka no dōtai [Trends of Major Prices in Early Modern Japan]*, Tokyo: Tokyo Daigaku Shuppankai.

Miyamoto M. ed. (1963), *Kinsei Osaka no bukka to rishi [Prices and Interest Rates in Early Modern Osaka]*, Tokyo: Sobunsha.

Momose, K. (1959), "Muromachi jidai ni okeru beikahyō [Rice Price Tables for the Muromachi Period]", *Shigaku Zasshi*, 66(1), 58-71.

Naimusho Kangyoro (Agency for the Promotion of Industry, Ministry of Home Affairs) ed. (1875) *Meiji 7-nen fuken bussan-hyō [Tables of Prefectural Products, Meiji 7]*, Tokyo: Naimusho Kangyoryo.

Nakamura, S. (1968), *Meiji ishin no kiso kozō [The Basic Structure of the Meiji Restoration]*, Tokyo: Miraisha.

Ono, K. (1934), "Chūsei ni okeru Nara monzenmachi ichiba [Temple Town Markets in Medieval Nara]", *Shigaku Zasshi*, 45(4), 484-522.

Parthasarathi, P. (1998), "Rethinking Wages and Competitiveness in the Eighteenth Century: Britain and South India", *Past and Present*, 158, 79-109.

Parthasarathi, P. (2011), *Why Europe grew Rich and Asian did not*, Cambridge: Cambridge University Press.

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

Rekihaku [National Museum of Japanese History], wage and price data available in electronic format in August 2009, http://www.rekihaku.ac.jp/doc/t-db-index.html)

Rozman, G. (1973), *Urban Networks in Ch'ing China and Tokugawa Japan*, Princeton, New Jersey: Princeton University Press.

Saito, O. (2010), "Climate and Famine in Historic Japan: A Very Long-Term Perspective", in S. Kurosu, T. Bengtsson and C. Campbell, eds., *Demographic Responses to Economic and Environmental Crises*, Tokyo: Reitaku University, 272-281.

Saito, O. and M. Takashima (2016). 'Estimating the shares of secondary- and tertiary-sector output in the age of early modern growth: the case of Japan, 1600-1874', *European Review of Economic History*, 20(3), pp.368-386.

Saito, O. and M. Takashima (2017). Jinkō to rōdō [Population and Labor], Fukao, K, M. Nakabayashi, and T. Nakamura (eds.), *Chūsei (Iwanami kōza Nihon keizai no rekisi 1) [Medieval Period (First volume of Iwanami Lecture Series of Japanese Economic History]*, Tokyo: Iwanami Shoten (in Japanese) (forthcoming).

Schön, L. and Krantz, O. (2012), "The Swedish Economy in the Early Modern Period: Constructing Historical National Accounts", *European Review of Economic History*, 16, 529-549.

Shimbo, H. and Hasegawa, A. (2004), "The Dynamics of Market Economy and Production", in Hayami, A., Saito, O. and Toby, R.P. (eds.), *Emergence of Economic Society in Japan, 1600-1859*, Oxford: Oxford University Press, 159-191.

Tanaka, K. (2007), "Kahei ryūtsū kara mita 16 seiki no Kyoto [Sixteenth Century Kyoto from the Perspective of Money Circulation], in K. Suzuki, ed., *Kahei no chiikishi [The Regional History of Currency]*, Tokyo: Iwanami Shoten, 83-124.

de Vries, J. (1984), *European Urbanization, 1500-1800*, London: Methuen.

Walker, J. T. (2014), "National Income in Domesday England", in Allen, M. and Coffman, D. (eds.), *Money, Prices and Wages: Essays in Honour of Professor Nicholas Mayhew*, Basingstoke: Palgrave Macmillan, 24-50.

Wrigley, E.A. (1985), “Urban Growth and Agricultural Change: England and the Continent in the Early Modern Period”, *Journal of Interdisciplinary History*, 15, 683-728.

van Zanden, J.L. and van Leeuwen, B. (2012), “Persistent but not Consistent: The Growth of National Income in Holland, 1347-1807”, *Explorations in Economic History*, 49, 119-130.