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Economic trends in Qing China: A response to Rawski's bold claims

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Abstract

Thomas Rawski challenges recent quantitative studies that find declining Chinese GDP per capita during 1700–1850 and suggests that the error margins around the component series for per capita grain supply should be widened, which would make it possible to accommodate stagnation, growth or decline. We show that there are good reasons to reject Rawski's wider error margins. We also reject Rawski's claim that there has previously been a consensus view of eighteenth-century Qing prosperity and demonstrate that trends in the other variables examined by Rawski tend to support declining per capita grain supply.

KEYWORDS

China, economic trends, error margins, Qing dynasty

JEL CLASSIFICATION

E01, N15, O53

INTRODUCTION

Rawski's (2025) paper criticises recent quantitative studies of economic trends in Qing China, particularly the work of Broadberry et al. (2018, 2021) and Xu et al. (2017) on GDP per capita, both of which incorporate the work of Shi (2015, 2017) on agricultural output. Rawski argues that the picture of declining Chinese GDP per capita during the eighteenth century in this new quantitative literature is inconsistent with the existing literature, which he sees as celebrating a period of prosperity during the Qing dynasty's heyday. He cites Rowe (1998), Myers and Wang (2002) and von Glahn (2016) in support of this view of eighteenth-century Qing prosperity. However, he neglects to note that there is also a substantial literature which sees the 18th century as a period of rapid population growth in China, with diminishing returns leading to declining living standards. This can be traced back to classical economists such as Smith (1776) and Malthus (1798) and lives on in the work of economic historians such as Chao (1986), Huang (1985, 1990) and Shi (2017), and also in history textbooks such as Fairbank (1992). We might also point to the literature which sees China as world-leading in science and technology during the first half of the second millennium but falling behind during the Ming and Qing, as advanced technologies such as coke smelting of iron and textile machinery fell into disuse in China while Europe developed 'useful knowledge' through a combination of experimentation and scientific theory (Hartwell, 1966, 1967; Lin, 1995; Mokyr, 1990, 2009; Needham, 1954). There is thus no consensus among the existing largely qualitative literature in support of eighteenth-century Qing prosperity to be contradicted by the recent quantitative work. Rather, it is continuing a venerable tradition.

Rawski begins by making a survey of the quantitative evidence on a number of variables in Qing China that he believes should be correlated in specific ways with a decline in per capita grain supply. He is thus looking for signs of rising mortality, declining physical stature, falling meat consumption, declining real wages and rising relative grain prices. In this part of his paper, he accepts that there is at least some prima facie support for what he characterises as the 'revisionist' view of Qing decline, concluding that:

> This mixed outcome cannot justify rejecting the hypothesis of declining per capita food supply and GDP, especially because long-standing emphasis on eighteenth-century prosperity may have led scholars to overlook or dismiss evidence consistent with BGL's vision of post-1700 economic decay.
>
> (Rawski, 2025, p. 282)

We would add that in any economy, particularly one the size of China, it is inevitable that there will be a range of outcomes in different regions, in different industries and in different social classes, and even in different samples from within particular regions, industries and classes. Nevertheless, this does not preclude a judgement about the predominant trends in the data, which must be consistent with the macro data. Reviewing Rawski's evidence from this perspective, we show that the quantitative data are very consistent with our position of trend decline in China during the Qing dynasty.

In the second part of his paper, Rawski uses an argument about error margins in an attempt to overturn this prima facie quantitative evidence in support of Qing decline at the aggregate level. Here, he suggests that the error margins used by Broadberry, Guan and Li are too narrow and argues that they should be widened substantially so that it becomes possible to conclude that the trend of GDP per capita between 1700 and 1850 could have been rising, falling or stagnating. Rawski (2025, p. 288) uses the wide error margins to conclude that 'BGL and other proponents of Qing-era economic decline cannot substantiate a downward trend in real per capita GDP between 1700/1710 and 1840/1850'. But equally, with the same error margins, neither can any claim of an upward trend or stagnation of GDP per capita be substantiated, since it is not possible to rule out a downward trend. Rawski (2025, p. 274) thus fails to achieve his stated aim to 'narrow the range of plausible long-term outcomes for China's economy during the 150 years preceding the Taiping uprising'. Fortunately, we are able to show that there are good reasons to reject Rawski's wider error margins, so that we can indeed substantiate a downward trend in real per capita GDP.

Turning to Rawski's third section on 'next steps', there is much here that we can agree with since we have already contributed to the expansion of work on regional economies, a subject that has been high on the agenda of recent research since at least the start of the Great Divergence debate (Broadberry & Guan, 2022). We also endorse the view that qualitative and quantitative methods should be combined, but since the qualitative literature is divided over the performance of the Qing economy, we disagree on which strand of the qualitative literature to accept as reliable.

PROBABLE CONSEQUENCES OF FALLING POST-1700 PER CAPITA FOOD SUPPLY

In addition to the authors who directly estimate food supply (Gu & Kung, 2021; Guo, 2012; Shi, 2015, 2017; Wu, 1988) and GDP per capita (Broadberry et al. 2018; 2021; Xu et al., 2017), Rawski surveys a number of quantitative studies documenting trends in mortality, physical stature, meat consumption, real wages and relative grain prices. In contrast to generalised support for what he sees as a consensus narrative of eighteenth-century Qing prosperity, Rawski finds a range of conclusions in the recent quantitative literature. However, much of this evidence is based on tiny samples from particular regions, industries and social classes, so care must be taken in moving from this micro evidence to judgements about the key macro variables. We construct a table from the studies for each variable and consider the preponderance of the directions of change, concluding that they tend to support a declining trend in per capita food supply and GDP per capita.

Real wages

Although it is possible to find a range of outcomes in the Chinese real wage literature from 1700 to 1850, most of the existing studies find a significantly downward trend, in line with the negative growth of GDP per capita found by Broadberry et al. (2018; 2021) and Xu et al. (2017). The results are summarised in Table 1. We begin with a number of recent studies conceived as contributions to the Great Divergence debate. Broadberry and Gupta (2006) provided grain wages during the late Ming period (1573–1644) and the mid-Qing (1736–1850), which show a decline of 33%. Allen et al. (2011) estimate real wage trends based on welfare ratios for workers in Beijing, Suzhou/Shanghai and Canton between 1738 and 1850. These estimates are derived from daily wages deflated by the cost of a subsistence basket of goods, which ensures that a male labourer can support a family consisting of himself, his wife and 2 or 3 children. Allen et al. (2011, p. 27) find a decline in the welfare ratio from 1.7 in 1738 to 1.0 by 1850, a very similar proportional decline to that exhibited by the BGL GDP per capita series. The recent study by Liu (2024) of real wages in the Lower Yangzi region between 1530 and 1840 also makes use of the welfare ratio approach and finds a close correlation with the BGL series of GDP per capita from 1500 to 1850. A careful study by Guo (2012), which allows for a distribution of different qualities of land in both the north and south before aggregating them together and dividing by the number of farmers to arrive at the equivalent of the grain wage, finds a decline of 40% between the mid-Qianlong (1760s) and the mid-Jiaqing (circa 1810) periods, again very much in line with BGL. Chao (1980, pp. 159–161) reports declining real earnings of farm workers between 1744 and 1829 for both annual and monthly labourers paid in copper cash.

TABLE 1 Trends in Chinese real wages.

Sample	Period	Change in real wage	Source
Grain wage for hired farm labourers in Yangzi delta	1573–1644 to 1736–1850	−33%	Broadberry & Gupta (2006, p. 18)
Welfare ratios for unskilled male workers in Beijing, Canton and Suzhou/Shanghai	1738–1850	−41%	Allen et al. (2011, p. 28)
Welfare ratios for Lower Yangzi agricultural and urban workers	1520–1840 1700–1840	−33% −45%	Liu (2024, p. 17)
Grain wages for farmers in North and South China, regional weighted average	1760s to c.1810	−40%	Guo (201, p. 15)
Real daily and monthly earnings for farm workers, paid in copper cash	1744–1829		Chao (1980, pp. 159–161)
Grain wages for prosperous farmers in Jiangnan	1573–1620 to 1821–1850	−2%	Rawski (2025, p. 279), based on data from Li (2002)
Daily real wages of unskilled workers in the suburbs of Beijing	1829–1832 to 1856–1858 1829–1832 to 1896–1898	−40% −22%	Gamble (1943, p. 72)

Rawski's (2025, p. 279) main counter to this evidence of declining real wages is a series that he constructs himself from data reported in Li (2002) on labour cost per mu taken from agricultural handbooks in prosperous Jiangnan districts, which Rawski deflates by the price of rice per shi. The numerator is the average cost to a farmer of having work done on a unit of land rather than the earnings of an individual labourer, but even if this is ignored, it turns out that the series actually shows a slight downward trend between 1573–1620 and 1821–1850. Rawski discusses one more series by Gamble (1943), based on complete accounts for many stores in and around Beijing during the period 1807–1900. The unskilled male real wage series presented by Gamble (1943, p. 72) is derived by deflating the silver wage with a price series derived from the same sources, covering the weighted geometric index of the silver prices of grains, flours and condiments for 20 scattered years of the period from 1829 to 1900. This series shows a decline in the real wage of 40% between 1829–1832 and 1856–1858, and 22% between 1829–1832 and 1898–1900. However, rather than reporting this series, Rawski chooses to deflate the copper wage by separate series for agricultural and handicraft prices denominated in copper for rural Ningjin county, 200 miles southwest of Beijing. This indicates a small decline of 8% in the real wage between 1807 and 1850 if the copper wage is deflated with the handicraft price series, but a small increase in the real wage using the agricultural price series. However, any advantage gained from using a copper price series rather than converting the copper wage series into silver terms is surely offset by the disadvantage of using a price series for a different location.

Relative grain prices

There is a substantial amount of information available on the price of grain relative to other products, displayed here in Table 2. As with real wages, it does not yield a uniform picture, but again the majority of studies show an increase in the relative price of grain during the period

TABLE 2 Trends in relative grain prices.

Sample	Period	Change in relative price	Source
Silver price of rice relative to non-grain commodity prices in Suzhou	1698–1702 to 1838–1842	+60%	Wang (1992, pp. 39–47) and Peng (2006, pp. 169–173)
Silver price of wheat in Zhili relative to rice in Suzhou	1738–1742 to 1838–1842	+1.4%	Li (2007, pp. 114–115) and Wang (1992, pp. 39–47)
Price of cotton measured in rice units in Yangzi delta	1700–1709 to 1840–1849	−35%	Zhai (2023)
Copper price of farm products relative to handicraft products in Ningjin	1800 to 1850 1800–1809 to 1840–1849	+7.1% −6.9%	Yan (1955, p. 38)
Copper price of rice relative to cotton price in Suzhou	1780–1789 to 1860–1869 1750–1759 to 1780–1789	+21% −71%	Usui (1981, pp. 93–107)

1700–1850. The first series discussed by Rawski is the silver price of rice relative to Peng's (2006) general price index in Suzhou, a city in the Yangzi delta. This suggests an increase of 60% in the relative price of rice between 1698–1702 and 1838–1842. The second study uses Li's (2007) series for the price of wheat in the northern city of Zhili to establish that the price of northern wheat moves closely in line with the price of southern rice for the slightly shorter period of 1738–1742 to 1838–1842. This suggests that the relative price of grain was rising in both the north and the south of China, at least expressed in terms of silver. This impression of a rising relative price of grain is reinforced by Pomeranz (2000, p. 290), who notes that there was no trend in cotton cloth prices between 1750 and 1850 to offset the rising grain price.

However, Rawski is concerned about changes in the exchange rate between copper and silver and reports the results of studies by Yan (1955) and Usui (1981) which consider relative prices expressed in terms of copper. Yan (1955) compares the copper price of agricultural products to handicraft products in Ningjin (Zhili), as recorded in the account books of a single firm, covering a relatively short period from 1807 to 1850. Although this does show a small increase in the relative price of agricultural products between 1800 and 1850, this turns into a small decrease if the comparison is between the decadal averages 1800–1809 and 1841–1850. Although Usui's (1981) data on rice and cotton price quotations in terms of copper for Suzhou cover the period 1755–1867, there is an enormous gap between 1756 and 1785 in the case of rice price quotations and between 1755 and 1781 in cotton price quotations, and both series have many more years with no observations. Rawski's approach to establishing trends from these scattered observations is to fit a single OLS line to the time series data for each variable and compare the slopes of the lines. When all observations are included, the rice price displays a strong positive trend and the cotton price trend is almost a flat line, thus suggesting an increase in the relative price of rice. However, when an outlying cotton price observation in the middle of the sample is removed, this results in a stronger positive trend in cotton prices, thus reversing the trend in relative prices. To make this case comparable with the other studies in Tables 1 to 5, we have organised the data on the basis of decade averages and calculated the percentage changes in relative prices during two periods. For the period 1780–1789 to 1860–1869, when averages can be calculated for all decades for both variables, the copper price of rice rose by

21% relative to the price of cotton. However, in the earlier short period between 1750–1759 and 1780–1789, the copper price of rice fell by 71% relative to the price of cotton. Deng and O'Brien (2015, p. 253) find a sharp rise in the relative price of rice after 1820, but little change between 1700 and 1800.

Mortality trends

Rawski points to a study by Lavely and Wong (1998, p. 724) which concludes that 'evidence for a decline of Chinese life expectancy in the decades prior to 1850 is problematic'. However, it is worth reproducing in Table 3 all the eighteenth and nineteenth century results from the studies considered by Lavely and Wong (1998, p. 721), with four of the five studies concluding that there was a substantial decline in life expectancy between 1700 and 1850. The study of a southern Chinese family by Yuan (1931) shows a decline of male life expectancy at birth (e_0) from 37 years in 1700–1749 to 34 years by 1800–1849. Telford's (1990) analysis of genealogies from Tongcheng county, Anhui province, results in a more substantial decline in male life expectancy from 46 in 1690–1709 to 33 in 1790–1809. In Liu's (1985) study of the Zhejiang Shen lineage, male life expectancy fell from 38 in 1725–1754 to 32 by 1815–1844. Lee et al. (1995) find a decline in life expectancy for both sexes from 43 in 1798–1801 to 33 by 1837–1840, which Lavely and Wong (1998, p. 723) somehow manage to construe as fluctuations with no discernible trend.

Faced with this evidence, Lavely and Wong mention defects in the genealogical data, such as the omission of infants and children and the incomplete and inconsistent reporting of births

TABLE 3 Trends in Chinese height samples by birth cohorts.

Sample	Period	Change in height	Source
Chinese prisoners in USA	1820 to 1890	−2.4 cm	Baten et al. (2010, p. 351)
Chinese prisoners in Australia	1810 to 1890	−2.1 cm	
Migrants to USA	1850 to 1890	−1.4 cm	
Migrants to Australia's Northern Territory	1850 to 1900	−2.2 cm	
Migrants to Australia's Queensland	1850 to 1900	−2.1 cm	
Migrants to Australia's Melbourne/Victoria	1850 to 1900	−1.5 cm	
Migrants to Indonesia	1835 to 1860	−1.2 cm	
Notional trend of secular height of southern Chinese	1810 to 1900 1810 to 1850	−1.5 cm +0.5 cm	Baten et al. (2010, p. 52)

and deaths. But it is not obvious why these defects should almost always lead to a spurious downward trend in life expectancy. It is surely worth bearing in mind that genealogies were more common among the elite, who were insulated from the worst effects of an economic downturn on food supply, which should make it hard to find a decrease in life expectancy. It is thus noteworthy that the one case to indicate an upward trend in life expectancy is the study of the Qing nobility by Lee et al. (1994), with e_0 increasing from 22 in 1700–1710 to 32 in 1830–1840. Our conclusion is that, as with the real wage and relative price evidence, the majority of studies on trends in life expectancy are quite consistent with a downward trend in living standards between 1700 and 1850.

Physical stature

Very little quantitative evidence on Chinese average heights during the Qing dynasty has been published. However, the little that exists is reproduced here in Table 4, taken from Baten et al. (2010, pp. 351–352), the only published paper that Rawski refers to. This shows a clear downward trend in the first 7 series covering a wide range of heights for Chinese prisoners and migrants, including Chinese prisoners in the United States, Chinese prisoners in Australia, migrants to the United States, separate series for migrants to Australia's Northern Territory, Queensland and Melbourne/Victoria, and migrants to Indonesia (Baten et al., 2010, p. 351). Rawski does not mention any of these series, but refers only to a 'notional trend of secular height of southern Chinese in the 1810s to 1920s' (Baten et al., 2010, p. 352). But rather than reporting the clear downward trend of this series during the nineteenth century as a whole, Rawski (2025, p. 278) notes only that it shows a slight upward trend for men born between 1810 and 1850.

Apart from this, Rawski also mentions a study by Chen et al. (2012), which makes use of records of criminal investigations for a sample of 6000 males and 3000 females born between 1660 and 1850 to conclude that there is 'very little in the way of a trend in adult stature between 1660 and 1800'. However, this is based on a presentation at a conference in 2012 rather than a paper available in the public domain, so it is difficult to assess.

TABLE 4 Trends in Chinese life expectancy.

Sample	Period	Change in e_0	Source
Guangdong lineage (males)	1700–1749 to 1800–1849	−3 years	Yuan (1931, pp. 168–169)
Tongcheng lineages, Anhui Province (males)	1690–1709 to 1790–1809	−13 years	Telford (1990, p. 133)
Zhejiang Shen (males)	1725–1754 to 1815–1844	−6 years	Liu (1985, p. 52)
Liaoning villages (males and females)	1798–1801 to 1837–1840	−10 years	Lee et al. (1995: 177)
Qing nobility (males)	1700–1710 to 1830–1840	+10 years	Lee et al. (1994: 401)

Meat consumption

Although Rawski (2025, pp. 278, 279) includes a short section on meat consumption, the evidence for this can only be described as impressionistic. The one study to offer a quantification of trends, by Huang (2009), suggests that meat consumption declined by 20% among Lower Yangzi farm households between the mid-eighteenth and mid-19th centuries and is reproduced in Table 5. Apart from that, Rawski points to a small number of somewhat vague suggestions by authors who think meat consumption per capita may have either decreased slightly (Pomeranz, 2005, p. 30; Pomeranz, 2022, p. 488) or increased slightly (Perkins, 1969, p. 307; Lee et al., 2000, p. 81). But the only quantitative evidence is of decline.

ERROR MARGINS

Rawski suggests that our error margins are too narrow and proposes to widen them sufficiently to make it possible for the trend in per capita grain supply to have been positive as well as negative or stagnating. He shows that with a big enough increase in the error margins, by reducing the lower bound figure for 1700/1710 and increasing the upper bound figure for 1840/1850, he can achieve his goal of making it impossible to rule out a positive trend. Table 6 places Rawski's calculations in context.

Table 6a shows the BGL estimates of the cultivated acreage, the grain share of the acreage and the grain yield, which when multiplied together yield total grain output. This is then divided by the population to arrive at per capita grain output. The central BGL estimates show a substantial decline of per capita grain output from 1240 jin in 1700/1710 to 650 jin in 1840/1850. With the BGL error margins, which are ±5% for cultivated acreage, grain yield and population, although it is possible to generate a smaller decline in per capita grain output from a lower bound figure of 1066 jin in 1700/1710 to an upper bound figure of 754 jin in 1840/1850, it is not possible to generate a positive or even a stagnating trend without going beyond the error margins.

It is worth noting that this calculation depends on combining the lower bound estimates for the cultivated area and grain yield with the upper bound estimate for population in 1700/1710, and the upper bound estimates for the cultivated area and grain yield with the lower bound estimate for population in 1840/1850. But this is to ignore completely the relationship between population and the cultivated area, which are strongly and positively correlated, with a correlation coefficient of 0.98 using BGL's decadal estimates of population and land from the 1690s to the 1840s. To assess the implications for food supply per capita of increasing population in a way that is consistent with the relationships between population and the cultivated area in Qing dynasty China, or indeed in almost any real world economy, it would be necessary to increase the cultivated area rather than decrease it. Within the subjective error margins methodology applied to national accounting, it would be usual to ask the sensitivity of GDP per capita or food

TABLE 5 Trends in meat consumption per capita.

Sample	Period	Change in meat p.c.	Source
Lower Yangzi farm households	c. 1750 to c. 1850	−20%	Huang (2009, p. 103)

TABLE 6 The effect of increasing error margins on Qing per capita grain supply trends, 1700/1710–1840/1850.

A. With BGL error margins

		1700/1710				1840/1850			
Variable	**Units**	**BGL estimate**	**Error margins**	**Lower bound**	**Upper bound**	**BGL estimate**	**Error margins**	**Lower bound**	**Upper bound**
Cultivated area	million shi mu	886	±5%	842		1265	±5%		1328.3
Grain share		0.71		0.71		0.659			0.659
Grain yield	jin per shi mu	272	±5%	258		321	±5%		337.1
Grain output	billion jin	171.1		154.4		267.6			295.0
Population	million	138	±5%		144.9	412	±5%	391.4	
Per capita grain output	jin	1240		1066		650			754

B. With Rawski error margins

		1700/1710				1840/1850			
Variable	**Units**	**BGL estimate**	**Error margins**	**Lower bound**	**Upper bound**	**BGL estimate**	**Error margins**	**Lower bound**	**Upper bound**
Cultivated area	million shi mu	886	±11.3%	786		1265	±5%		1328.3
Grain share		0.71		0.71		0.659			0.659
Grain yield	jin per shi mu	272	±7%	252.96		321	±7%		343.5
Grain output	billion jin	171.1		141.1		267.6			300.7
Population	million	138	±33.9%		184.8	412	±6.1%	386.9	
Per capita grain output	jin	1240		763.8		650			777.2

Source: Estimates for cultivated area, grain share, grain yields and population from Broadberry et al. (2018). Error margins in part A from Broadberry et al. (2018) and in part B from Rawski (2025).

supply per capita to the change of an individual series by an amount equal to the average margin of error over a period of time, as in Broadberry et al. (2018, p. 980). But what Rawski does is to combine three such experiments at the same time, ignoring the links between the three highly correlated variables of population, land and grain yields. The consequences of ignoring these interrelationships are not particularly large when the error margins are ±5%, but when they are increased to the levels suggested by Rawski in Table 6b, they become dramatic.

Table 6b increases the error margins for 1700/1710 in line with Rawski's calculations to ±11.3% for cultivated acreage, ±7% for grain yields and ±33.9% for population. For 1840/1850, Rawski sticks with error margins of ±5% for cultivated acreage but increases the error margins to ±7% for grain yields and 6.1% for population. He is then able to show that it is just possible to fit a marginally positive increase of per capita grain output from 764 jin in 1700/10 to 777 jin in 1840/1850 within the error margins. Since agriculture was the largest part of the Qing economy, Rawski sees this as a reason for ruling out a negative trend in GDP per capita. It must be emphasised, however, that this depends on ignoring the interrelationships between variables that are fundamental in a system of historical national accounts. In our view, this is sufficient on its own to reject Rawski's conclusion that BGL cannot establish a major downward trend in per capita grain supply for 1700–1850.

So far, however, we have not challenged Rawski's suggestion that it would be reasonable to increase the error margins for population in 1700/1710 from ±5% to ±33.9%. Here, it is helpful to bear in mind another aspect of the subjective error margins approach to national accounting. This is the distinction between random and systematic error. When dealing with a systematic error in a known direction rather than a question of random sampling error, Feinstein and Thomas (2002, pp. 156, 157) state that the appropriate solution is not to increase the error bands, but rather to correct the series as accurately as possible for the systematic error, using all the available information. In setting the error margins for our adjusted (BGL) population series, the appropriate reference point is the other population series, shown here in Figure 1, which includes Ho (1959), Perkins (1969), McEvedy and Jones (1978), Liu and Hwang (1979) and Lee and Wang (1999). This would not suggest the need for an enormous increase in the error margins.

The reason for Rawski's concern is the recent work of Cao (2024), who has produced estimates for the population in 1630 and 1680 which are strikingly out of line with the consensus built up around the work of Ho (1959) that we had noted in Broadberry et al. (2021, p. 966). Cao's (2024) figure of 185 million in 1680 is also strikingly out of line with his earlier estimate of 160 million in Cao (2000). The question then arises as to how we should treat an author who suggests a massive deviation from the consensus. Rawski thinks we must necessarily widen the error bands as if the estimates could be either too high or too low but may be expected to be scattered evenly around the unknown true values. But this makes little sense when there is a large systematic error in one direction, which is clearly the case with Cao's estimates of China's population during the Ming-Qing transition. To see this, consider Figure 2, which shows the deviation of Cao's population estimates from the consensus estimates represented here by Broadberry et al. (2018).

The first thing to note from Figure 2 is that for most of the nearly 500-year period covered by the data, the two series are very consistent. The discrepancy comes only with Cao's estimates for 1630 and 1680, which deviate from the BGL estimates by as much as +60% in 1630 and + 47% in 1680. But there are very good reasons to accept the consensus view that population peaked around 1600, as China began to experience frequent famines, natural disasters and peasant uprisings from this point (Ho, 1959, pp. 262–265). So, to see population rising by 50 million

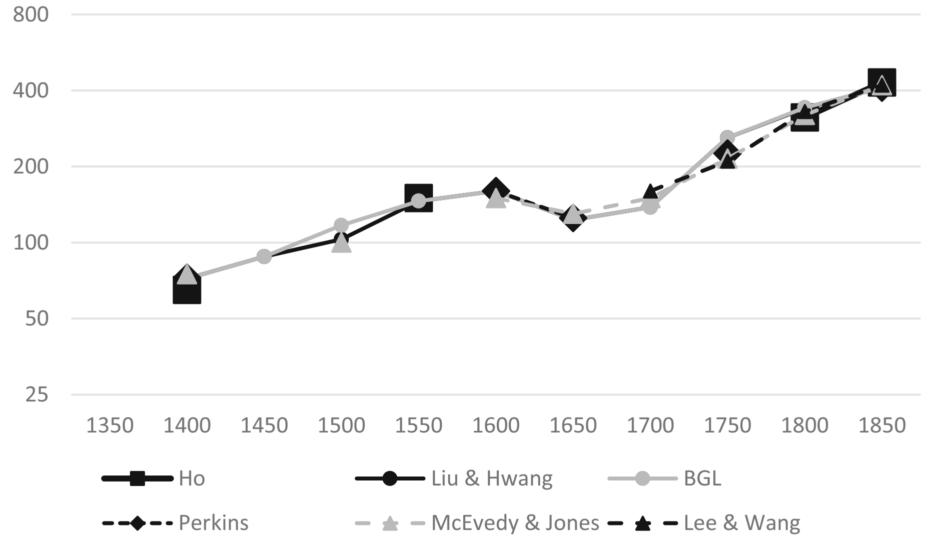

FIGURE 1 Chinese population: Consensus estimates (millions). *Source*: Ho (1959, pp. 277–278); Liu and Hwang (1979, pp. 81–82); Broadberry et al. (2018).

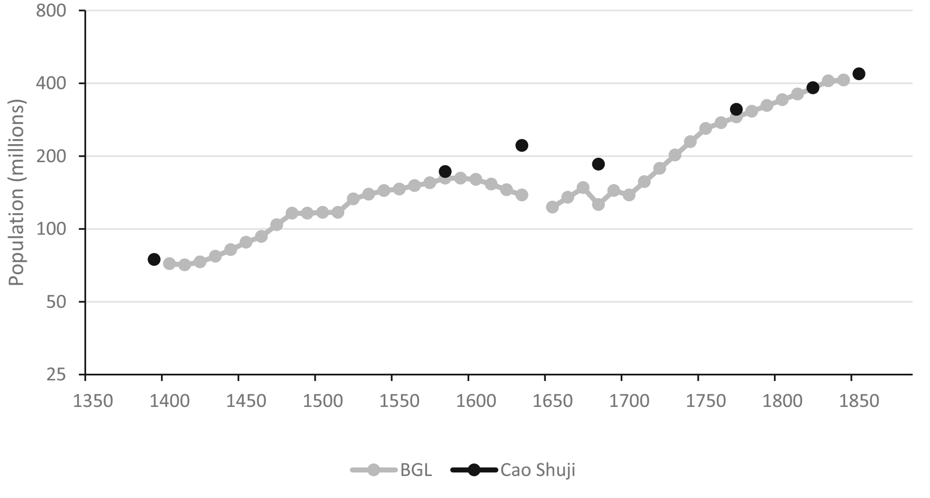

FIGURE 2 Chinese population: BGL and Cao estimates (millions). *Source*: Broadberry et al. (2018); Cao (2024).

between 1580 and 1630 when the consensus view is that it fell by 24 million is rather staggering and Shi (2017, p. 179) was spurred to write 'I think his estimates are too high to believe'. At this point, we would therefore not wish to adjust the population series on the basis of Cao's new estimates, which are heavily dependent on a bottom-up approach at a high level of regional disaggregation.[1] Furthermore, even if we did increase the population during the Ming-Qing transition, this would necessarily require changing the cultivated area in the same direction so that any change in the food supply per capita would not be on the drastic scale suggested by Rawski.

[1]This will be discussed further in the section on regional analysis.

Turning to the cultivated area, we are relying on the work of Shi (2017), who has massively expanded the availability of information on Chinese agriculture during the Qing dynasty. In Figure 3, Liu and Hwang's (1979) series generally coincides with the black triangles representing Perkins's (1969) estimates, demonstrating an early consensus on the cultivated area during the Qing dynasty. However, following Shi's (2017) extensive work on Qing agriculture, BGL adopted his estimates which therefore coincide with the BGL series from the late seventeenth century. The differences between the BGL and the Liu and Hwang series are of the order of 10% during most of the Qing dynasty, which could be accommodated within two-sided error bands of ±5% or 6%, but may in fact be better regarded as a systematic bias, since they are always in the same direction.

Following Rawski, we have so far focused on the implications of changing the error margins around population, the cultivated area and grain yields for the trend in food supply per capita. In considering the implications of an increase in population for GDP per capita, it would also be necessary to take account of the implications for a number of other sectors of the economy besides agriculture, where population affects output. This can be a direct effect in industries such as building and textiles or services such as housing and domestic services, where the output measure has been scaled using population. It can also be an indirect effect in services such as commerce, through the output of the affected industries which feed into commercial activity. Put simply, if you change the key scaling variable in a pre-modern economy, it must affect almost everything else.

NEXT STEPS

There are points in Rawski's final substantive section that we can agree with and indeed have tried to implement in our own research. Below we develop some thoughts on regional analysis and the complementarities between quantitative and qualitative research.

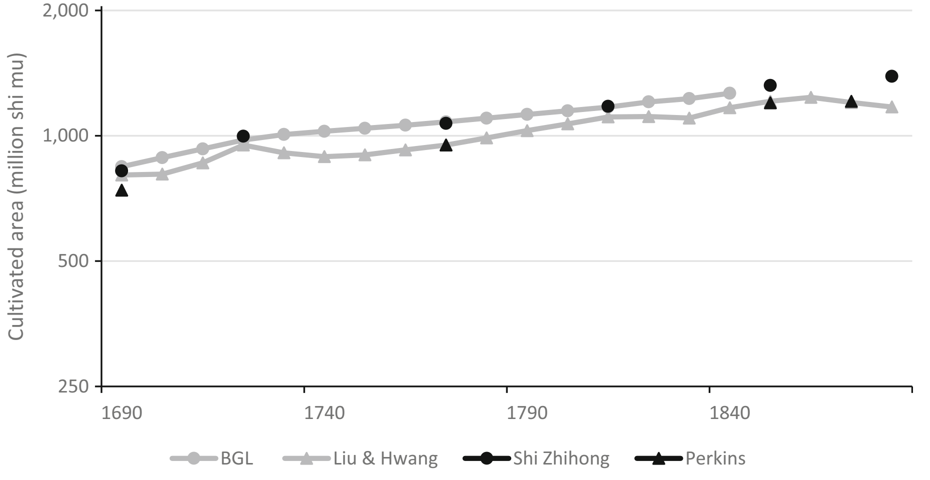

FIGURE 3 Chinese cultivated area (million shi mu). *Source*: Broadberry et al. (2018); Liu and Hwang (1979); Shi (2017); Perkins (1969).

Regional analysis

We agree with Rawski that it is important to consider regional variation in the economic performance of China. Broadberry et al. (2018; 2021) provided the first quantitative estimates of GDP per capita for the leading Chinese region, the Yangzi Delta. This has been developed further by Broadberry and Guan (2022), who have provided a regional breakdown of GDP per capita into seven macro regions for four benchmark years during the Ming and Qing dynasties. In addition, Broadberry et al. (2025) have developed a comparative approach to regional variation in China, Japan and India, exploring the implications for the timing of the Asian Little Divergence, while Broadberry and Zhai (2025) have incorporated Zhai's (2023) estimates of GDP per capita in the Yangzi Delta into a growth accounting study of the role of innovation in the Great Divergence.

However, while endorsing the regional approach, we must also recognise the need to strike a balance between a bottom-up micro approach to establishing macro totals and a top-down approach working from the macro totals and disaggregating to the regional level. The bottom-up approach may be subject to a downward bias from incomplete coverage or an upward bias from double-counting if regional boundaries are unclear, while the top-down approach may ride roughshod over the extent of regional variation. These issues may be expected to be particularly important in the case of Chinese GDP per capita since the surviving imperial summary records such as the *Shilu* (veritable record) for the Ming and Qing dynasties tend to focus on the national totals, while the underlying micro data on which these were based have survived only to the extent that they were reproduced in *Difang zhi* (local gazetteers) (Wilkinson, 2000, p. 220). We believe that Cao's (2024) refocusing on the bottom-up approach, beginning at the county level and working up to the provincial and national totals, has led to an over-estimation of population growth during the Ming-Qing transition, compared with Ho's (1959) more top-down approach focusing on macro trends in Chinese population. The range of outcomes in the different micro studies surveyed by Rawski (2025, pp. 275–282) suggests that if they are to be used to construct macro aggregates in a bottom-up approach, then it is necessary to have a regionally representative sample and a set of regional weights, as in Broadberry et al.'s (2015) study of economic growth in Britain between 1270 and 1870. At the moment, Broadberry and Guan (2022) have used regional weights within a top-down approach, disaggregating Chinese GDP by region, but Zhai's (2023) work on GDP in the Yangzi Delta using local gazetteers holds out much promise for the future if it can be applied to other regions.

Quantitative and qualitative methods

Advocacy of combining quantitative and qualitative methods is unlikely to be something that many people would oppose. Nevertheless, there are questions that can usefully be asked about the way in which it should be done. Rawski's first example suggests that there are people who dogmatically use only quantitative information and turn their backs completely on qualitative information, while his second example suggests the opposite extreme of people who use only qualitative information and deliberately ignore any quantitative information. His third example is then meant to illustrate how these two extremist positions can be brought together by a more enlightened scholar who embraces both quantitative and qualitative methods.

However, this is an over-simplified picture of the way most economic historians conduct their research. In the end, for clarity on something like economic growth, it is not really possible to completely ignore all quantitative information on things such as the population numbers, the cultivated acreage, grain yields, and other output indicators. But equally, it is not possible to ignore the context in which the quantitative data were produced, which involves asking questions such as: 'why were the data collected?' 'are the units of measurement comparable?' 'did the people reporting the data have a vested interest in projecting a particular trend?' and 'has a historiography built up around a particular view?' These points about the perspective of the people collecting the data and the historiography built up around the reporting are the things that concern us most about the combination of quantitative and qualitative research. This point has already been raised in the Introduction, where we challenged Rawski's attempt to characterise our work as contradicting a pre-existing consensus in the literature that the eighteenth century was a period of prosperity in China. Rather, we pointed to a parallel Malthusian literature dating back to the Qing dynasty, which characterised the eighteenth century as a period of rapid population growth and declining living standards.

It may well be that the Qing elite who wrote up the records at the time saw the eighteenth century as a successful period as population expanded. But this was to value extensive growth just as Europe was beginning the transition from extensive growth to intensive growth, where an increase in output per capita would become more highly valued than just an increase in output. These ideas can be seen in the work of Wangling (1995) on economic development and government policy in eighteenth-century China, based on the *Qing Shilu* and gazetteers. Although Wangling notes some concerns about population growth being raised at the time, it is quite possible that for a while Chinese extensive growth could offer increasing opportunities to elite merchants transporting and distributing grain to more people, thus earning more income at the expense of the poorer classes and keeping elite expressions of concern in check. However, this idea of success was clearly no longer sustainable by the nineteenth century, particularly after the Opium Wars and the Taiping Rebellion, but the data seem to be telling us that the problems were already there in the eighteenth century.

There is one other aspect of the qualitative approach that we would like to make here, which was first raised by Broadberry et al. (2018, p. 992) but has yet to be addressed by those who believe in eighteenth-century Qing prosperity. Everybody seems to agree that China was very poor by the mid-nineteenth century. If there was no period of trend decline before this, then China must always have been very poor. But that seems to conflict with everything we know about China from the Song to the Ming. If we add to that not merely stagnation during the eighteenth century but a boom, then projecting backwards from 1800, the masses must have been surviving on substantially less than subsistence. How would Rawski explain that?

CONCLUSION

Thomas Rawski challenges the findings of recent quantitative work that finds steep reductions in Chinese per capita real GDP during 1700–1850. He sees this as inconsistent with qualitative evidence underpinning a long-standing consensus of eighteenth-century prosperity, which leads him to suggest widening the error margins around the main series needed to estimate per capita grain supply, the main component of GDP per capita. However, we show that no such consensus has ever existed, and that reaching back to the late eighteenth century, classical economists such as Smith (1776) and Malthus (1798) characterised eighteenth-century China as experiencing a period of rapid population growth leading to declining living standards as a result of diminishing returns, and that this view lives on in the work of economic historians of China and books on the wider history of China (Chao, 1986; Fairbank, 1992; Huang, 1985, 1990; Shi, 2017).

The first part of Rawski's paper sifts through the quantitative evidence on what he sees as the probable consequences of falling post-1700 per capita food supply, in the expectation of finding generalised support for what he sees as the consensus narrative of eighteenth-century Qing prosperity. However, most of this evidence is based on very small samples and covers only particular industries in a small part of China, so care must be taken in moving from this kind of micro evidence to conclusions about macro trends for the whole of China. For each variable, we construct a table from the studies selected by Rawski, and ask if the majority are consistent with a declining trend in per capita food supply and GDP per capita. For real wages, relative grain prices and mortality trends, we find strong support for declining food supply per capita and almost none suggesting positive growth. And although there is much less quantitative evidence for physical stature and virtually no hard data for meat consumption, the little that does exist is also consistent with declining per capita food supply.

In the second part of his paper, Rawski shows, rather unsurprisingly, that if you make the error margins sufficiently large, it becomes possible to accommodate stable or rising, as well as declining trends in per capita grain supply. This is a singularly unhelpful conclusion and strikingly at odds with Rawski's (2025, p. 274) stated aim that 'This essay aims to narrow the range of plausible long-term outcomes for China's economy during the 150 years preceding the Taiping uprising (1850–1864)'. Fortunately, however, we show that there are very good reasons to reject Rawski's wider error margins. First, the most important proposed change is to widen error margins around population from ±5% to ±33.9%, which hardly fits Rawski's (2025, p. 283) description of 'modestly enlarged error margins for BGL's grain calculations'. Second, Rawski proposes this change because of a sharp upward revision of Cao's (2024) population estimates for 1630 and 1680, away from a consensus that has existed since Ho's (1959) work identifying 1600 as the population peak during the Ming–Qing transition. Cao's estimates for the rest of the period between 1400 and 1850 are consistent with the consensus estimates since Ho (1959). Third, at the same time as he increases his upper bound population estimate for 1700/10 by 33.9%, Rawski reduces his lower bound cultivated area by 11.53%. Combining these two changes from the BGL central values leads to a massive reduction in the lower bound per capita grain output in 1700/1710 by 48%, so that it is possible to have a very slight increase in grain supply per capita between the lower bound figure for 1700/1710 and the upper bound figure for 1840/1850. However, it is well known that the population and cultivated area are very strongly and positively correlated in China as in other countries, so this cannot be regarded as a random variation from the central values, which the subjective error margins approach requires.

In the third section, Rawski outlines what he sees as the next steps, involving a focus on regional analysis and combining quantitative and qualitative research. While we are sympathetic to these broad aims, we also note that in endorsing the regional approach, it is necessary to strike a balance between a bottom-up micro approach to establishing macro totals and a top-down approach to working from the macro totals and disaggregating to the regional level. And in combining qualitative and quantitative approaches in the context of economic growth, we would emphasise different aspects of the qualitative approach to those discussed by Rawski. In particular, we would draw attention to the possibility that the surviving qualitative records may be biased towards the distorted perspective of the elite classes, who may have been able to benefit from extensive growth which was at the same time immiserising the masses.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in OPEN ICPSR at https://www.openicpsr.org/openicpsr/project/105383/version/V1/view.

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