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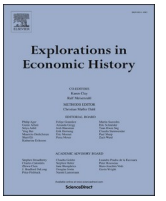

Research Paper

Wages, labour markets, and living standards in China, 1530–1840

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ABSTRACT

This article studies the long-term wage development in China between 1530 and 1840. In the long run, nominal wages moved in tandem with prices, but did not respond as quickly as the increase in prices. Real wages experienced two substantial falls between the 1620s-1650s and the 1740s-1760s, but remained relatively stable in the remainder of the period examined. Rural-urban wage disparities suggest that the agricultural sector, rather than urban industries, continued to absorb surplus labour. A comparison of wages in Lower Yangzi China and England suggests that the wage gap widens after 1700.

1. Introduction

How did wages develop in China in the early modern period? Since the Great Divergence debate, the economy and living standards across the two ends of Eurasia have attracted a considerable intellectual interest. This paper contends that in terms of the purchasing power of wages, Lower Yangzi China started lagging fall behind Northwest Europe around 1700, rather than 1800 or 1850.

From the sixteenth century onwards, China began to enjoy a revival of its economy and commercial growth following a shortage in the money supply in the previous century (Von Glahn 1996; Liu 2011). As the system of hereditary occupations atrophied and the use of coerced labour declined in state manufacturing workshops and factories, private sector started to expand within the Chinese economy (Xu and Wu 2003). The market network continued to grow in the Lower Yangzi delta, and the number of rural markets also increased steadily in northern China (Xu 2000). By the mid-nineteenth century, the point that generally divides the traditional and modern periods in Chinese historiography, China had experienced palpable growth in population and the overall size of the economy.

When comparing the economies at the two ends of Eurasia, scholarly views differ about when the trajectories of development diverged. Based on per capita food consumption, Pomeranz considers that the Lower Yangzi delta and England had similar living standards prior to 1800 (Pomeranz 2000). Studies on family consumption in the Lower Yangzi also challenge the conventional wisdom that the Chinese peasantry lived at subsistence level in early modern times (Huang 2009). However, food consumption may reveal only part of the story. In terms of agricultural productivity, China was on a par with the English Midlands in the eighteenth century or the Netherlands in the early nineteenth century, but a remarkable productivity gap can be observed in manufacturing (Allen 2009; Li and van Zanden 2012). Occupational structure provides another angle from which to examine the structure of the economy. It is generally considered that agriculture as a whole employed the majority of the labour force in early modern China, but the precise size of this 'majority' is under review. A common view estimates it to be around four-fifths (Guo et al. 2019), but recent evidence seems to suggest a much smaller figure, possibly slightly higher than a half (Yang 2022). What appears to be more certain is a long-lasting stasis of

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occupational structure during the course of the eighteenth and nineteenth centuries. Furthermore, this status may be reflected in the level of urbanisation, where a small number of studies suggest that the Chinese urban population showed no sign of increasing over the eighteenth century, while the rural population rapidly increased (Cao 2000, vol.4, 365–8; vol.5, 726–74; Xu et al. 2018, 346). Additionally, recent research on Chinese historical national accounting has found no evidence of intensive growth in early modern times (Broadberry et al., 2018; 2021). These pictures imply high productivity in the agricultural sector, but an infertility of structural change in the economy over the centuries.

Wages offer another approach examining long-term development. In the European context, the standard wage account depicts a Malthusian world where no positive trend in wages was observed after the Black Death, and real wages continued to fall over the centuries. The slower wage decline in England and the Low Countries resulted in living standards in Northwestern Europe outperforming those in other European economies prior to the onset of the Industrial Revolution (Van Zanden 1999; Allen 2001; Clark 2005; 2007). This narrative hypothesises a 'little divergence' within Europe between 1500 and 1750. However, given that this presumes a fixed length of the working year, the influence of wages on living standards may be notably revised under different assumptions (Campbell 2013; Humphries and Weisdorf 2019).

In comparison with Europe, the wage history of China is still being written, largely because historical wages and prices are noticeably more limited. This paper presents a new dataset of wage quotations from the public and private sectors, and a wage index based upon this for the Lower Yangzi region between 1530 and 1840. It finds that in the long run, nominal wages moved in tandem with prices, but did not respond as quickly as the increase in prices. Although real day wages experienced two substantial falls between the 1620s-1650s and the 1740s-1760s, they remained relatively stable – instead of declining faster as suggested by previous research – in the remainder of the period examined. Expressed in the favour of a welfare ratio, the new estimate computations imply no fall in living standards below the subsistence level for urban wage earners in the majority of the periods examined. Equally worth noting is that a persistent wage differential was evident between agricultural/rural and urban sectors, with urban workers paid 1.5 times more on average. This disparity responds to some of the existing views that the agricultural sector, rather than urban industries, continued to absorb surplus labour in rural areas. From a global perspective, a comparison of real wages in the Lower Yangzi and England suggests that the gap in the purchasing power of wages seems to open up after 1700.

2. Labour market in early modern China

The existing literature provides no comprehensive wage estimates before the eighteenth century, nor does it offer a generally accepted wage narrative for the eighteenth century. Based on the work of Pomeranz (2000) and Li (1998); Broadberry and Gupta (2006) offered some preliminary estimates, suggesting that a substantial wage gap existed between the Lower Yangzi and England in the eighteenth century. In his study of long-term economic development, Liu Guanglin (2015) provided estimates of Chinese wages between 1004 and 1805 using a small number of wage records for soldiers, unskilled labourers in irrigation, and other construction workers, as well as low-status professionals such as students and government clerks. Given the limits of his data, Liu's research is more helpful in exhibiting the economic decline between Song (c.960–1279) and Ming China (c. 1368–1644) than wage movements over the sixteenth and nineteenth centuries. A more comprehensive assessment from Allen et al., (2011) suggests that the wage gap between Suzhou (the Lower Yangzi Detla) and London was already significant by the early eighteenth century. In contrast with the picture painted by Broadberry and Gupta (2006), the unskilled wages estimated by Allen et al. were considerably higher, and continued to fall between 1738 and 1850. However, Deng and O'Brien (2016) argued that Allen's et al. wage estimates suffer from sample selection biases and data processing problems. Similar issues of data processing can be found in other scholarly works.[1] Other recent studies also failed to support Allen et al. results (Sun and Li 2020; Jiang and Wang 2020; Peng 2013). Thus, we have neither a comprehensive study on Chinese wages before the eighteenth century, nor an accepted narrative on Chinese wage history for the eighteenth century.

Two questions need to be addressed before we delve into estimating the level and trend of wages in early modern China. The first is whether labour payments in early modern China reflected the factor price of labour. The second is whether wage-dependent labourers in China provide any useful information on the economy and the living conditions of the labour force in general.

The first concern relates to labour payments. Conventional views in the Chinese literature consider labour relations during this period 'feudal', according to one Marxist interpretation, and these relations do not equate to the concept of "employment" in an economic sense (Xu and Wu 2003, vol.1, 18–24; Fu 2007, 250–5). This raises the question of whether labour payments, both cash and in-kind rewards, reflect the factor price of labour.

In fact, abundant evidence demonstrates that labour markets existed in early modern China, especially after the sixteenth century, and labour hiring involved pay over bargaining. Local labour markets were typically referred to as the 'manpower market'(*ren shi*), 'job market' (*gong shi*), and 'hiring market' (*yong shi*), where labourers gathered at plazas, bridges, tea houses, and other places to find and bargain with potential employers (Wu, 1983; Jiang 1995; Fang 2004). The demand and supply of labour in the market can best be demonstrated by the seasonality of payments. In the public sector, government regulations published in 1615, 1690, and 1732 reveal that a premium was paid for craftsmen, artisans, and labourers to work on palace constructions in Beijing during the harvest season.[2] A seasonal payment premium was also found in canal and embankment projects in Shandong and Jiangsu provinces.[3] In the private

[1] For example, GAO, 2008, "*Mingwanli nianjian*" made no distinction between conscription payments, market wages, and administrative costs.

[2] 1615 regulations see *Gongbu changku xuzhi*, vol.7; 1690 regulations see *Kangxi daqing huidian*, vol.132; 1732 regulations see *Yongzheng daqing huidian*, vol.198.

[3] See *Qinding hegong shijia zeli zhangcheng*, vol.1, 122a.

sector, the day wages of unskilled labours could double, triple, and even quadruple during harvest times (Gamble 1943, 46; Huang 1992, 71). In some cases, strikes also played a role in wage bargaining. In eighteenth-century Suzhou, the Lower Yangzi core, strikes, particularly by skilled workers, were not rare and the local government had to intervene in disputes, mediating and carving out payment agreements on steles.[4]

The intra- and inter-provincial movement of labour was also common, particularly after the seventeenth century. Emigrants from Zhili (nowadays Hebei) and Shandong provinces were commonly found in Beijing, and Shandong was a major source of labour input in Manchuria from the eighteenth century onwards (Wang 1997, 150; Tang 2004, 773). Studies of nineteenth-century Beijing and the surrounding markets provide evidence for inter-regional integration: wages (cash payments and in-kind rewards) could be sticky in the short-term, but tended to respond and adjust to commodity and currency prices on the market in the long-term, even in industries where guilds existed (Peng 2013, 23–5). These examples demonstrate the existence of matching process between labourers and their employers, and payment setting involved bargaining and negotiating.

The second concern relates to the importance of wage-dependent labour in the Chinese context. In Northwestern Europe, a growing percentage of rural workers became proletariats and sold their labour in the city in return for wage payments. These wage-dependent workers may ranged between one-fourth to half of the labour force in early modern times (Van Zanden 2009, 117). By comparison, waged labourers comprised a minority of the labour force in early modern China; correspondingly, the level and trend of wages may not represent the incomes of the population under working, and give little useful information about the economy and living standards in general.

While the current evidence suggests that waged labour absorbed a minority of the Chinese labour force, there have been misinterpretations about the size of this minority that should clarified. In some English scholarly works, the share of wage labour in early modern China is given as approximately 3 per cent of the population, but in the original Chinese literature cited, this estimate is for the agricultural sector nor the whole economy.[5] Even in the agricultural sector, estimates often exhibit considerable variations. Higher estimates indicate that 16 per cent of rural workers were employed on wages including day labourers and monthly-work farmhands, but this figure could be as low as from 1 to 3 per cent which usually refers to workers under long-term or yearly contracts (Xu and Wu 2003, vol.1, 70; Li and Jiang 2005, 310; Li, Wei, and Jiang 2007, 335–6; JING and LUO, 1959; Chao and Chen 2006, 224; Tang 2004, 780). Recent inquiries even imply much higher figures than these conventional estimates: Yang (2022) suggests that agricultural labourers in North China can be around a half of the agricultural labour force between 1761 and 1890. The figure may be lower in the Lower Yangzi but could still reach about 20 %.

Although wages were not the main source of earnings in rural China as a whole, waged work often provided supplementary incomes. Long-term contracts for yearly agricultural workers were unpopular in rural China, but short-term farmhands often appeared in records. Many of the latter had landholdings of their own and were hired when they had completed their own work (Fei 1980, 179). A sample of 197 villages in late nineteenth-century Shandong, a major agricultural province, suggests that approximately 40 per cent of all hired farmhands, including short-term and long-term, may have possessed their own land (JING and LUO, 1959). In some cases, tenant and wage farmers also possessed land. In parts of Shandong poor peasants rented out their small plots of land and were then employed as waged workers to cultivate the land they had rented out (Tang 2004, 731).

The public sector also provided regular employment opportunities for rural labour that extended beyond working as wage farmhands. Along the Grand Canal, the government undertook maintenance work on a regular basis between October and March (in the Chinese calendar). Local embankment construction and maintenance were also carried out on a regular basis, especially in the cities and towns in the Lower Yangzi core.[6] These hydraulic projects often occurred in the off-season, and each project hired hundreds or thousands of rural workers. In other parts of the private sector, such as the printing industry, skilled workers could switch between farming and wage activities during different seasons of the year (Zhang 1989, 757). Estimates suggest a larger proportion of full-time labour in urban areas than in rural areas, but the evidence is scattered.[7]

To reiterate, there is clear evidence supporting the existence of labour markets in early modern China. Although full-time wage earners may have been a minority, they were more common than has been suggested in both agriculture and non-agricultural sectors of the economy. Moreover, more workers were engaged in secondary wage activities.

3. Data sources and processing

Compared with Europe, wage and price records in early modern China are limited especially before the eighteenth century. To address this, I pooled evidence on wages in the public and private sectors to construct a wage index for China between 1530 and 1840, and then derived a wage series for the Lower Yangzi delta. In total, 6006 quotations of wages were collected. Wages in the public sector

[4] See *Mingqing Suzhou gongshangye beikeji*, pp.63-78.

[5] Xu and Wu (2003) claimed in *Zhongguo ziben zhuyi*, vol.1, 70, that "… in the Lower Yangzi Delta… they (hired labours) were no more than one per cent of the population" (translated from Chinese). But in the footnote, the authors referred to studies on agriculture rather than the other sector of the economy. This figure is then widely cited in the English literature and generalised as the overall size of wage-dependent labours. See, for examples, Deng and O'Brien (2016), "a survey," p.1061; van Zanden, *The Long Road*, p.117.

[6] See the 1933 version of the Gazetteer of Wujiang County, vol.20, vol.21 for hydraulic projects near Suzhou, the 1936 version of the Gazetteer of Shanghai County, vol.11 for Shanghai, and Wu's *Huaixi nianbiao* (1929) for Huai River.

[7] Fang suggests that in Zhouzhuang, Suzhou, wage labours might count about 20 per cent of local population in the mid-19th century. See Fang, *Jiangnan de laodongli*, 6.

include payments to doormen and runners (ya yi) in prefectural and county governments, to construction labourers working on the Grand Canal and riverbank, and skilled and unskilled workers in the construction, handicraft, and service industries in Beijing. Wages in the private sector include woodblock engravers in the Lower Yangzi and a variety of scattered quotations for other occupations across China. To construct consumer price indices, three price series were available which I discuss in detail below.

3.1. Wage data

The first wage data set contains 1017 quotations of remunerations to *yi*/ya *yi* (sub-official functionaries) between 1530 and 1640. No records were included after 1640. The data were collected from China's local gazetteers (difang zhi) published in the sixteenth and seventeenth centuries. This data set covers nine provinces out of fifteen in sixteenth-century China, and the time period and regional distributions of sources are reported in Table 1.

Yi comprised the largest cohort of personnel in local governments. These workers were levied or hired to provide labour services as doormen, runners, mail carriers, and police. Because *yi* were developed from corvée labour, their remuneration was expected to capture their living costs or meet the bare minimum for survival rather than the market rate. Not all *yi* records in local gazetteers satisfy this assumption. I selected only doormen (menzi), runners/lictors (zaoli), and doormen of the state school (ruxue menzi) for the following reasons. First, they could be found in all local governments. Second, payment budgets for these services did not contain stipends for tools or supplies.[8] It is important to note that these three works should not be confused with a type of stipends in the government's bookkeeping — in the literature, the latter was also classified as "*yi*" (service) but were in fact a form of stipend paid to government officials. The most common stipends were the so-called *chaixin zaoli* ("log and runner/lictor"), *mafu* ("groom"), *ruxue shanfu*, and *ruxue zhaifu* ("servants of state schools").[9] Third, remunerations for these three types of works can be converted to day rates. In most cases, *yi*'s remunerations in local gazetteers were expressed either in payment per job per person or per person per year. No exact length of the working year is given. A close examination of government bookkeeping practices alongside the day rates of labour services from other official documents reveals that the 'yearly' payments of these *yi*'s are calculated from their day rates multiplied by 360 days of work.

Given the widespread imposition of non-statutory tax surcharges by local governments, one potential concern is that the setting of *yi* payments could be arbitrary and provides no meaningful information on labour costs. A cross-check on the raw data indicates that budget records in local gazetteers published before the mid-seventeenth century contained information on labour costs; unfortunately, this is no longer the case after the mid-seventeenth century, due to the changing practices of fiscal and accounting institutions. The raw data before 1644 reveals clear pay differences among jobs and regions, both within and between provinces. However, pay budgets on regular *yi*, except for the doormen of state schools, were all set at 6 *taels* of silver per annum, regardless of the type of work and region, and remained unchanged after 1652. Further details can be found in Appendix 2. Therefore, I exclude all *yi* data in local gazetteers published in Qing period (1644–1911).

A further concern is to what extent *yi* data before 1644 reflect labour costs. To test the mechanism of pay setting for conscripted labour, a sample was compiled including both *yi* and market rates paid in the public sector between 1571 and 1620. I selected the following cities for this test: Beijing, Dongchang, Yanzhou, Xuzhou, and Yangzhou. These cities were connected by the Grand Canal where both market and non-market wages for embankment and canal construction/maintenance could be found. As the majority of market wage records come from Beijing, other cities are used only as control groups. Estimations indicate that, on average, market wages were 35 per cent higher than the pay for conscripts. The full test results are reported in Appendix 2. One interpretation of this difference is that conscript payments equated to the cost of their living expenses, and the estimated market premium was likely to be the cash component of wages on the market (*gongyin* or *gongqian*). In early seventeenth-century Lower Yangzi, cash components were around 20 per cent of a hired farmhand's wage, with the remainder being foods and other payments in-kind.[10] The portion of cash wages for unskilled urban workers were higher, usually ranging between 20 and 40 per cent (Deng and O'Brien 2016, 1063). The market premium found in the test falls into the range of the cash component of unskilled wages. As reported later in Fig. 3 and Appendix 1, this premium is also consistent with the cash component of unskilled wages estimated in this paper, both including and excluding *ya yi* dataset.

The second data set contains 689 wage records in the public sector (other than *ya yi*) between 1571 and 1840. It was collected from various sources and includes artisans, craftsmen, and labourers employed by the governments in Beijing and Rehe, as well as hydraulic labourers (canals and riverbanks), mainly in Yanzhou, Dongchang (North China), Xuzhou, and Yangzhou (the Lower Yangzi). The wages collected are either in day rates or rates per working day (gong), and include both payments in-kind and cash. Industrial and locational distributions are reported in Table 2.

Wages in Beijing were collected from four sources: Miscellaneous Notes of Wanping County Government (Wanshu zaji), Factory

[8] From the 16th century onwards, costs on office supplies were gradually removed from *zaoli*'s remunerations and became a separate category in local budgets. A contrary example is the payment on prison guards, which included the spending on instruments of torture.

[9] See also HU, 2012, *Mingdai guanfeng* on this.

[10] *Manyan zhaicao* (曼衍斋草) recorded that a long-term contract for the mulberry field workers was paid with 2.2 *taels* of silver per annum in cash and food payments of 7.2 *shi* of rice (or 8 *taels* equivalent) per annum in early-seventeenth-century Lower Yangzi. In total, it gives 10.2 *taels* of silver per annum, or 0.028 *taels* per day. Another quotation from *Shengshi nongshu* (沈氏农书) shows that a long-term farmhand was paid 5 *taels* of silver in cash, 5.5 *shi* of rice, 1 *tael* of travelling expenses, 0.3 *taels* of farm tools, and 1.2 *taels* of firewood and liquor. This gives in total 13 *taels* of wage payment, or 0.036 taels per day if divided by 360 days.

Table 1
Number of Ya Yi Payment Records by Period and Region, 1530-1640.

Period	*Freq.*	*Percent*	*Cum.*	*Region*	*Freq.*	*Percent*	*Cum.*
1530-1540	113	11.11	11.11	Beijing	16	1.57	1.57
1541-1550	136	13.37	24.48	North Zhili	74	7.28	8.85
1551-1560	116	11.41	35.89	Anhui	123	12.09	20.94
1561-1570	90	8.85	44.74	Shandong	118	11.6	32.55
1571-1580	134	13.18	57.92	Guangdong	83	8.16	40.71
1581-1590	86	8.46	66.37	Jiangsu	98	9.64	50.35
1591-1600	118	11.6	77.97	Jiangxi	82	8.06	58.41
1601-1610	92	9.05	87.02	Henan	34	16.52	74.93
1611-1620	60	5.9	92.92	Zhejiang	168	3.34	78.27
1621-1630	12	1.18	94.1	Huguang	89	8.75	87.02
1631-1640	60	5.9	100	Fujian	132	12.98	100
Total	*1,017*	*100*		*Total*	*1,017*	*100*	

Source: see the text

Instructions of the Ministry of Work (Gongbu changku xuzhi), Collected Statutes of the Great Qing (*Daqing huidian*), and the printed primary source on the payroll records of the Ministry of Imperial Household (*Neiwufu zaobanchu qianliang kupiao*), as well as accounting records on yearly maintenance projects in Rehe (*Nianbu suixiu hushi yongguo yinliang qingce*). Miscellaneous Notes is a private publication and contains wage quotations on various artisans and labourers hired by the local government in Wanping and central government in the city of Beijing between 1588 and 1593. Factory Instructions is an official publication around 1615 and contains records on wages and materials for construction and crafting projects, including payments on standing craftsmen and casual workers. The Collected Statutes are official publications on the administrative regulations, laws, and cases between the mid-seventeenth and late-nineteenth century, while payroll records of the Ministry of Imperial Household and accounting records in Rehe construction/maintenance projects are printed archive materials. All recorded scattered wages, budgetary and issued, for artisans, craftsmen, and building labourers employed by the central government in Beijing between 1659 and 1840. Whether it was in Beijing city or Rehe (a place where the emperors stayed during the summer), the court applied the same payment standards on palace constructions. In fact, records on Rehe projects suggest that many artisans who worked in Rehe were hired from Beijing, and therefore, in the dataset, wage records in Rehe and Beijing are grouped into one. Furthermore, it is important to note that construction wages in Rehe's bookkeeping remained unrevised after 1790 when the government began to substantially raise construction wages on canal and embankment projects. These revised payment standards comprised an 'allowance' (*jintie*) in addition to the 'exemplary wages' (*lijia*). Unfortunately, however, I found no sufficient evidence to revise the exemplary wages in Rehe. There would have been a risk of underestimating construction wages after 1790 if the 'exemplary wages' were included. Hence, wage quotations in Rehe after 1790 were omitted from the data set.

Wages on hydraulic projects were collected from diverse sources, including local gazetteers, Veritable Records of the Ming (Ming shilu), Collected Literature of the Ming (Huangming jingshi wenbian), Overview of River Administration (Hefang yilan), the Collected Statutes of the Great Qing (*Daqing huidian*), and The Complete Book of Hydraulic Projects in the Lower Yangzi Delta (*Chongjun Jiangnan shuili quanshu*). Except for local gazetteers that materials are selected publications of the memorials of officials and contain a mix of budgetary and issued wage payments.

The third data set contains 3773 records of cash wages for woodblock engravers employed by Buddhist temples in Suzhou, Hangzhou, Jiaxing, Zhenjiang, and Songjiang between 1601 and 1686, the core cities in the Lower Yangzi delta. These cash wages were collected from the printing costs of Buddhist scriptures, Jiaxing Tripitaka (Jiaxing zang, also referred to as Lengyan zang, Wanli zang, or Jingshan zang). As the project was under the supervision of the same group of people, these skilled workers were employed by the same employer, worked for the same project, and were paid according to the same rate. Except for the year 1620, wage records between 1601 and 1644 are consecutive. Following the dynastic change in 1644, no records are available for 1647, 1649, 1658, 1659, and 1678–85. Locational distributions of these wages are reported in Table 3.

Pay records in the Jiaxing Tripitaka should represent the market rate during this period.[11] The project was mostly funded by public donations and a large number of scriptures recorded the names of donors, the dates of payment, and the costs of engraving, calligraphy, and the woodblock (pearwood). In some cases, scriptures also recorded the names of volume editors, engravers, and calligraphers. Engravers' wages are expressed in piece rates (silver tael per 100 words) which can be converted into day rates, presuming that an

[11] When Jiaxing Tripitaka was initiated in Mount Wutai in the 1570s, the cash wage standard to woodblock engravers was 0.04 *taels* of silver per 100 words, which was claimed to be the common piece rate in North China. LIU, 1994, *Zhuozhong zhi*, 14 shows that the same piece rate was paid in Beijing. When the workshop moved to the Lower Yangzi in the 1590s, the piece rate was set as 0.035 *taels* of silver, which was close to the standard paid by *Jigu ge* (0.03 *taels*), one of the most famous printing workshops in the mid-seventeenth century (see YE, 1999, *Shulin qinghua*, p.154). Mao Jing, the owner of *Jigu ge*, was also one of the major donors to Jiaxing Tripitaka. Many engravers worked for *Jigu ge* also appeared in Jiaxing Tripitaka.

Table 2
Number of Public Sector Wage by Industry and Location, 1571-1840.

Industry	*Freq.*	*Percent*	*Cum.*	*Location*	*Freq.*	*Percent*	*Cum.*
Printing	12	1.74	1.74	Beijing	225	32.66	32.61
Construction	385	55.88	57.62	Rehe	371	53.83	86.50
Handicraft	264	38.32	95.94	Other North	38	5.52	92.92
Service	28	4.06	100	Lower Yangzi	55	7.89	100
Total	*689*	*100*		*Total*	*689*	*100*	

Source: see the text

Table 3
Number of Woodblock Printing Costs Records by Location, 1601-1686.

Location	*Freq.*	*Percent*	*Cum.*
Jiaxing	524	13.89	13.89
Hangzhou	1,916	50.78	64.67
Suzhou	489	12.96	77.63
Zhenjiang	795	21.07	98.7
Songjiang	39	1.03	99.73
Other	10	0.27	100
Total	*3,773*		

Source: See the text. "Other" includes Guangji and unknown locations.

average engraver carved 125 words a day (in Song font).[12] A considerable proportion of cash wage records in the original texts are the total of the payments made, rather than separate entries, for both calligraphers and engravers (*xie gong* and *ke gong*). I extracted the engravers' piece rates by presuming that the pay ratio between them remained the same throughout this project.

The fourth data set contains 527 scattered wage records collected from secondary literature, as well as printed primary sources on labour disputes stored in the Qing empire's central and local judicial archives. They cover the period from 1724 to 1840, and except for Xinjiang and Mongolia, encompass nearly all eighteenth- and nineteenth-century Qing territory. Table 4

I discuss the processing of this dataset along with the others below. To pull these wage records together for analysis, two additional steps of processing are needed: valuing payments in kind and currency conversions. One difficulty with interpreting historical wages in China comes from wage formation. In early modern times, payments in kind accounted for a significant proportion of wages in China, especially for unskilled labours. In the private sector, long-term contracts were mainly, even mostly in many cases, remunerated with payments in kind, particularly in rural areas. In-kind rewards normally included daily meals and accommodation, and additional grain and clothes were also common, as usually paid by the end of the year or contract. For short-term contracts, the cash component is generally larger, and employers paying by the day and month did not always offer meals and accommodation; this depended on the industry and the case. Ideally, payments in kind would have been valued on a case-by-case basis, but the original text often provided no indication of this. As an alternative strategy, I take a reference level from those records that are known to include both cash payments and in-kind rewards. If a wage record was too low when compared to the common level of total wage, it was assumed to be the cash portion of the pay only (payments in kind were often unrecorded in the private sector). In the public sector, similarly, skilled (and highly-skilled) workers were paid in two different ways. Wage quotations for regular/permanent artisans and craftsmen often recorded only their daily or monthly allowance of food and other in-kind rewards. Additional payments on workdays were recorded separately as in many cases they were issued by a different government body. These workers were referred to as food provision craftsmen and were mainly found in the court's manufacturing workshops and silk factories. In comparison, wage quotations for casual labourers and workers were usually total wages with cash and in-kind payments included. These casual workers were referred to as *waigu* (external employment), and appeared more frequently in government records after the mid-seventeenth century when the imperial law in 1645 formally removed the forced hereditary status of artisans and craftsmen (Wei 1986; Fan 1995). To avoid underestimation, workers in public sectors are distinguished between those with additional food allowance and those without. Table 5 reports the identification.

Second, with respect to currency conversions, cash wages were often issued in local currencies, and thus required careful read. In the public sector, wages were mostly expressed in silver numeraire, but the weight and purity standards of silver currencies varied between and within the central departments and local authorities (Deng 2008, 336). The most common standard was the so-called *kuping* weight, where one *tael* of silver equalled 36.9 gs in the sixteenth century or 37.3 gs after the mid-seventeenth century (Qiu 1992, 419; 512). In the private sector, payments involved both silver and copper currencies. Standard coins (*zhiqian*) served more like a numeraire for bookkeeping rather than a transaction intermediary, and in fact, a variety of local coins were more popular in the market. For instance, there was the 'capital coin' (*jingqian*) which circulated in North China, including Shandong province, North Zhili, and Beijing. This was traded at a ratio of 2:1 against the standard coin (*zhiqian*). Conversely, in Northeast China (Manchuria), wages

[12] A woodblock engraver was able to carve at least 100 to 110 words in *Song* font per day, or 130 to 160 for those with more experience. On average, I presume that 125 words was the usual workload. See Zhang, *Zhongguo yinshuashi*, p.747; *Qingneifu keshu dangan shiliao huibian*, vol.2, p.454; *Lidai keshu gaikuang*, pp.558-9.(Shanghai xinsijun lishi yanjiuhui yinshua yinchai fenhui, 1991)

Table 4
Number of Private Wage Records by Period and Region, 1724-1840.

Period	*Freq.*	*Percent*	*Cum.*	*Region*	*Freq.*	*Percent*	*Cum.*
1724-1730	15	2.85	2.85	Northeast	52	9.87	9.87
1731-1740	34	6.46	9.30	Beijing	26	4.93	14.8
1741-1750	33	6.26	15.56	Central	67	12.71	27.51
1751-1760	39	7.40	22.96	North	127	24.10	51.61
1761-1770	18	3.42	26.38	South	55	10.44	62.05
1771-1780	8	1.52	27.89	Lower Yangzi	41	7.78	69.83
1781-1790	11	2.09	39.98	Northwest	54	10.25	80.08
1791-1800	44	8.35	38.33	Southwest	105	19.92	100
1801-1810	134	25.43	63.76				
1811-1820	94	17.84	81.59				
1821-1830	53	10.06	91.56				
1831-1840	44	8.35	100				
Total	*527*	*100*		*Total*	*527*	*100*	

Source: See the text

Table 5
Identified Wage Formation by Datasets.

Dataset	*Both cash and in-kind*	*Cash only*	*Yi**	*Total*
yi	/	/	1017	1017
public sector	549	99	41	689
printing worker	63	3,710	/	3,773
other private sectors	121	406	/	527
Total	*733*	*4,215*	*1,058*	*6,006*

* public sector data also include conscripts working on state-organised hydraulic engineering.

were commonly marked in 'eastern coin' (*dongqian*) or 'market coin' *(shiqian)* which traded at a ratio of 6:1 against the standard coin. Unless wages were explicitly marked in the standard coin, wage records from North and Northeast China were treated as being in local currencies. Fig. 1 plots all raw data converted into silver *tael*.

3.2. Price data

To estimate the living standards of wage labour in early modern China, the standard practice deflates nominal wages with the cost of a basket of consumer goods. However, once again, price data is noticeably limited for the Chinese case. A common approach for resolving this is to take rice and grain prices as a benchmark of the consumer price index. Another approach is to extrapolate the consumer price index by applying the movement of rice prices to the cost of a consumption basket at a specific point in time, or to interpolate a time series of consumer prices with scattered data.

Empirical studies have indicated that rice prices were highly correlated with other commodities in early modern and modern China (Peng 2006, 33–40; Wang 2007, 20–3). To a certain extent, rice was used as a currency in kind in fifteenth- and sixteenth-century China when commodities were often valued against the weight of rice (Li 1988). Rice price was also a benchmark for converting taxes paid in kind into money payments. Although it may not capture short-term fluctuations, the price of rice provides a reference for the movement of prices on other commodities in the long term.

Rice and grain prices for the period examined in this paper are available from three sources. First, Peng Xinwei's decadal price index of rice (1530–1840) captures the average and national level of rice prices (Peng, 2015, 497). Second, Wang Yeh-Chien's yearly price index of Suzhou rice in 1638–1840 is more representative of the top-grade rice.[13] Third, Peng Kaixiang's yearly consumer price index (1644–1840) which is mainly computed based on grain prices, and is consistent with Wang's index.

These price indices are often used to extrapolate consumer prices. For instance, Allen et al., (2011) provided the costs of two consumption baskets for Beijing and Suzhou, respectively in 1750. For Suzhou/Shanghai, the authors extended Shanghai's twentieth-century retail prices with Wang Yeh-Chien's Suzhou series.

Allen's Suzhou basket provides a starting point for estimating living standards in early modern China, but appears to underestimate the weight of food consumption and overestimate the weight of energy consumption for poor people in the Lower Yangzi region. Although no price details are indicated for each item in Allen's Suzhou basket, Table 6 compares Allen's Beijing barebone and respectable baskets with HUANG Jingbin's Lower Yangzi basket. The latter represents the average level of household consumption in a peasant family in the Lower Yangzi.

In Table 6, the major differences between Allen and Huang's baskets are the weights of food, light (candles and lamp oil), and fuel consumption. In Allen's bare-bones basket, food comprises 65.82 per cent of the expenditure on basic needs – which I define as every

[13] The Qing Dynasty Grain Prices Database of Academia Sinica provides the prices of top-grade rice which match Wang's Suzhou rice series.

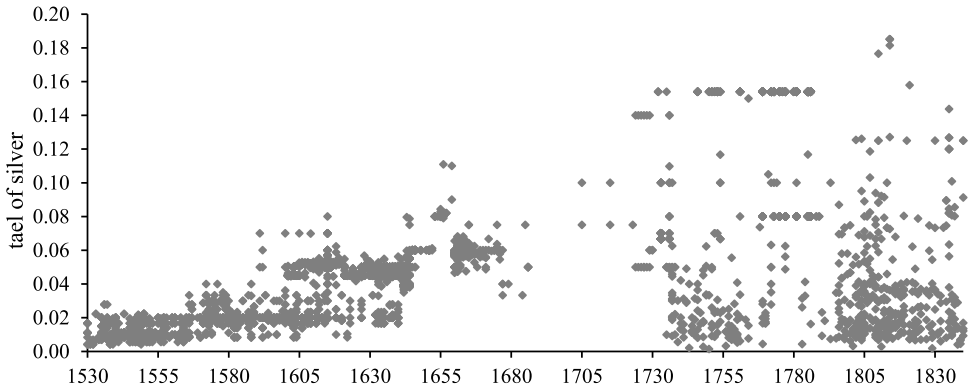

Fig. 1. Raw data converted into silver Tael, 1530–1840 ($N = 6006$).
Source: See the text.

Table 6
Annual Consumption of Around 1745 (grams of silver).

Allen's Beijing basket, barebone			Allen's Beijing basket, respectable		Huang's Lower Yangzi basket, average		
Basic needs	*Cost/ person*	*Weight*	*Cost/ person*	*Weight*	*Basic needs*	*Cost/ 5 ppl*	*Weight*
bread			172.90	34.61%	rice	779.57	52.78%
sorghum	85.92	46.80%			vegetables	220.07	14.90%
beans	16.80	9.15%	33.60	6.73%	& meat/fish		
meat/fish	6.12	3.33%	63.24	12.66%	oil/cooking	111.9	7.58%
eggs			3.85	0.77%			
beer/rice wine		97.02	19.42%				
oil/cooking	12.00	6.54%	20.80	4.16%			
(food consumption 65.82%)			(food consumption 78.26%)		(food consumption 75.26%)		
soap	2.15	1.17%	4.29	0.86%	soap	n/a	n/a
linen/cotton	18.42	10.03%	30.7	6.15%	linen/cotton	220.07	14.90%
candles	4.29	2.34%	8.58	1.72%	candles	22.38	1.52%
lamp oil	4.29	2.34%	8.58	1.72%	& lamp oil		
fuel	33.6	18.30%	56.00	11.21%	fuel	123.09	8.33%
total	183.59	100%	499.56	100 %	total	1477.08	100 %

Source: Allen's baskets see Allen et al., ''Wage,' 25. Costs per person are calculated based on unit price and quantity consumed for each item. Huang's basket see Huang, *Minsheng yu jiaji*, 307-8.

item in Allen's basket, including food, flavouring/cooking oil, clothing, candles/lamp oil, and fuel. In Allen's respectable basket, however, this figure raises to 78.26 per cent. In Huang's estimates of average family consumption, foods count for 75.26 per cent of basic needs. On the other hand, light and fuel consumption constitute 22.98 per cent of total spending in Allen's barebone basket, or 14.65 per cent in the respectable basket, compared to 9.85 per cent in Huang's.

Notably, both Allen's barebone basket and Huang's basket display a similar spending distribution between "staple food" (e.g., rice, noodle, or bread in Chinese cuisine) and "side dish" (vegetables, meat, and others), with these make up approximately 70 per cent and 20 per cent of food consumption, respectively. At a barebone level, the diet is expected to be predominately staple foods, with its proportion declining as income increases. This is reflected in Allen's respectable level of food intake where staple food accounts for 44 per cent of food spending. Even if we presume that the spending on staple food and side dish remains consistent at the barebone and average levels, and decreases significantly only at a respectable level, a barebone basket should allocate a greater weight of spending on food than either an average or a respectable basket.

Accordingly, two aspects of Allen's basket need to be modified: first, the structure of household consumption in the Lower Yangzi region; and second, the selection of a 'cheap' source of calories for a subsistence level of food intake. Huang's consumption structure is more representative of mid-eighteenth century Lower Yangzi for three following reasons: first, Huang estimated these expenses according to direct evidence and records of the eighteenth century; second, the weight of a 'subsistence' level of food intake in Allen's basket was expected to be higher than Allen's respectable basket or Huang's estimations, but we observed the opposite; third, Allen assumes the same level of energy consumption in Europe and China (3 BTU for subsistence and 5 BTU for respectable levels), but the weight of energy consumption can vary significantly in the two regions, as evidenced by the differences in Allen and Huang's baskets. Fuel consumption in the Lower Yangzi was expected to be lower than that in Beijing, given a warmer climate in the former region. Given that Chinese employers usually supplied meals and living places for long-term contracts (and sometimes short-term contracts too), an unskilled labourer's spending on light and energy could be even lower. For these reasons, we need to modify China's consumption baskets used by Allen.

Based on Huang's calculations, I reconstructed a bare-bones level of consumption in Table 7 for the Lower Yangzi around 1745,

while retaining the key assumptions from Allen. Following Allen's approach, food consumption in the new basket provides 1940 calories per day from the cheapest available carbohydrate. Instead of top-grade rice, I averaged per unit costs for inferior rice along with barley as the cheapest available carbohydrate in the Lower Yangzi region, setting the consumption per person per year as 171 kgs. In eastern parts of the Lower Yangzi, such as Jiading and Songjiang (the area of cotton planting), barley (and sometimes wheat) were popular substitutes for rice in certain seasons, especially for poor people (Li 2000, 98; Huang 2009, 56–7). Prices of rice (inferior), barley, and beans come from the prices database of Academia Sinica and are a twelve-month average for Jiangsu province.[14] Consumption of beans, meat/fish, and cooking oil were set to be the same as in Allen's basket (20 kg, 3 kg, and 3 kg per person per year, respectively). To be consistent with Huang's basket, this food expenditure was set to be 75.26 per cent of the total spending. The weight of clothing expenditure followed Allen's basket. The weights of light and energy spending were replaced by Huang's suggestion.

It is important to note that the weight of food consumption in the new bare-bones basket was computed based on Huang's consumption structure for an average family of five (including one couple and three seniors/juniors). This structure may still underestimate the weight of food consumption for poor people, especially at the 'subsistence' level. Therefore, this new basket represents only a theoretical situation that follows Allen's assumptions on calorific intake.

4. Wage index, 1530–1840

To be consistent with the existing literature, the day wage of an unskilled construction labourer in the Lower Yangzi was selected as the basis of estimation. The following model was defined for the wage quotations reported previously:

$$\ln(wage_i) = \alpha + \sum_{t=1}^{31} \beta_t \cdot period_{t,i} + \sum_{j=1}^{8} \eta_j \cdot region_{j,i} + \sum_{k=1}^{7} \gamma_k \cdot industry_{k,i} + \sum_{j=0}^{3} \sum_{p=0}^{3} \cdot \delta_{j,p} \cdot skill_{j,i} \cdot food_{p,i} + \sum_{m=0}^{2} \theta_m \cdot payment_{m,i} + \sum_{l=0}^{4} \rho_l \cdot miscellaneous_{l,i} + \sum_{o=0}^{4} \varphi_o \cdot woodblock_{o,i} + \varepsilon_i$$

where $wage_i$ is the log of the daily wage of labour$_i$; α is the constant term; $period_{t,i}$ is the period of observation grouped into 31 sequential periods from 1530 to 1840. Except for 1641–1650, which is further divided into 1641–1644 and 1645–1650 to capture the dynastic change of 1644, all other periods are decennial. Regarding the remainder of the model, $region_{j,i}$ is a dummy for eight regions in China, including Northeast, Beijing, North, Northwest, the Lower Yangzi, Middle, South, and Southwest. Beijing is listed separately as previous literature suggests that its wage levels are significantly higher than those in other areas of North China. $industry_{k,i}$ is a dummy for occupations, and contains seven categories, including, *ya yi*, agriculture, construction, printing, handicraft, service, and mining; $skill_{k,i}$ and $food_{p,i}$ are an intersection that captures whether $labour_i$ is unskilled, skilled, or highly skilled, and whether an observed wage record contains cash payment, payment in kind, or both. As previously mentioned, the cash portion of wages displayed considerable variation based on skill level. Consequently, it is expected that wage formation would vary with skill levels. $payment_{m,i}$ is a dummy specified for the *ya yi* data source. It indicates whether the payment was issued from the government or the conscription agent.[15] Finally, $miscellaneous_{l,i}$ and $woodblock_{l,i}$ are two dummies specified for the data source of printing workers, and capture whether the printing cost contains additional spending on woodblocks and other miscellaneous. Full results are reported in Table A1 and A2, Appendix 1.

4.1. Nominal wage

Considering the diversity of regional economies in China, the index of estimated wage trend holds greater significance than the absolute values of national average wages. The subsequent discussion primarily focuses on wage development. Fig. 3 presents wage indices derived from three estimation strategies, clustered to region and weighted by regional population as well as occupational structure.[16] Wage predictions for 1691–1700 are interpolated with the average of 1681–1690 and 1701–1710. The main estimates present a wage index predicted using all wage data reported previously. To address the concern that *ya yi* data may generate estimation bias, the series 'without yi' removed them and re-estimated the trend. To address the concern that payments in kind may not be correctly identified in the main estimates, I extracted the coefficient of cash components from the main regression and added a

[14] https://mhdb.mh.sinica.edu.tw/foodprice/about.php

[15] In the government's bookkeeping, there were two ways of paying these conscripted labourers. One was called *guangei* (官给), which means the payment was issued by the government. The other was *datao* (打讨), where the government issued tax receipt (*youtie* 由帖) to the conscription agents and specified the amount of fees to be collected from people subject to conscription. Payments issued from *datao* approach were usually collected from multiple taxpayers and divided between, and this made the bookkeeping figure under *datao* lower than under *guangei*. There was in essence no payment difference between two approaches.

[16] Occupational structure follows Yang's (2022) estimates. The adjustment was made by the occupational weight of agricultural worker. No adjustment was made for urban industries as there is no statistically significant wage disparity among them. Population weights are calculated by the share of population in each region suggested by Cao, *Zhongguo renkoushi*, vol.4; vol.5. I adopted different shares of population for each province, based on Cao's estimates, in the following sub-periods: 1530-1630, 1631-1680, and 1681-1840. Between 1631 and 1680, China experienced widespread famines, rebellions, and the dynastic change. In particular, population was declining, at different rates, between 1631 and 1644, and the civil war eventually ended by the end of the Revolt of the Three Feudatories in 1681.

Table 7
Revised Costs of a Subsistence Basket in the Lower Yangzi in 1745.

Consumption	*Quantity per person per year*	*Cost/unit (grams of silver)*	*Total cost (grams of silver)*
rice(inferior)/barley[1]	171kg	0.46	78.66
beans[1]	20kg	0.50	10.05
meat/fish[1]	3kg	2.04	6.12
cooking oil[2]	3kg		11.29
soap[2]			1.97
linen/cotton[2]			16.86
candles/lamp oil[3]			15.16
fuel[3]			
Total			140.11

Notes and source:
[1] Per unit costs for rice(inferior) and barley are averaged to simulate food consumption for poor people in the Lower Yangzi. Prices are taken from https://mhdb.mh.sinica.edu.tw/foodprice/about.php
[2] Expenditures on cooking oil, soap, and cloth are calculated using their weights in Allen's basket.
[3] Expenditures on candle/lamp oil and fuel are calculated using their weights in Huang's basket.

theoretical basket of consumption, given the available price data, in the Lower Yangzi.[17] This is denoted as 'predicted cash payment with a basket'.

The overall tendency shown by the three specifications is consistent, whereas no sign of continuous decline is found, and nominal day wages in China continued to increase over 1530 and 1840 in general. Trends derived from the 'main estimates' and 'without conscripted' are nearly identical. The index constructed by the predicted cash payment with a theoretical basket of consumption was more volatile in the 1620s-1660s and the 1740s-1760s. This is probably caused by the presumption that payments in kind always increased and reduced synchronously with market prices. However, this presumption is less likely to hold during a time of hyperinflation or rapid growth in prices when it is probable that employers will switch to a cheaper bundle of in-kind rewards. This model makes prices alone the determinant of wage movements, not the demand and supply of labour, as payments in kind usually comprise 60 to 80 per cent of unskilled wages in the Chinese market. For these reasons, I prefer to use the wage index constructed from the 'main estimates'.

In the main estimates, five major increases are observed in the 1560s, 1640s/50 s, 1680s, 1720s, and 1790s. It appears that wage setting in the Chinese market responded to the price movements presented in Fig. 2 in the long run. In the first half of the sixteenth century, nominal wages remained fairly stable until the 1560s, which coincided with a further fiscal monetisation from that period onwards. The second major upward trend began in the 1640s and reached a peak in the 1650s. This substantial rise in wages may have resulted from the widespread plague (particularly in the northern territory), rebellions, and hyperinflation during the Ming-Qing transition. The northern territory, where rebellions first began, may have experienced an earlier wage increase than the main estimates suggest. In the Qing period, the nominal wage exhibited three major rises in the 1680s, the 1720s, and the 1790s along with a temporary surge in the early decades of the nineteenth century.

The wage indices in Fig. 3 are derived from a pooled data sample across the whole of China. Fig. 4 and Table 8 display two more series with a concentration on the printing and construction industries in the Lower Yangzi and Beijing, respectively. Fig. 4 plots the estimated yearly cash components of wage paid for handwriting templates and woodblock engraving in Jiaxing Tripitaka project. These two jobs received cash wages in piece rates, and food allowance was likely to have been issued in a day rate, but unrecorded. In some cases, a bonus in cash was given. Between 1601 and 1636, payment standards for writing template and engraving were 0.004 *taels* of silver and 0.035 *taels* per 100 words, respectively. Cash wages began to increase from 1637, and then surged between 1645 and 1652 when the new regime occupied the Lower Yangzi and drove out the Ming residuals in the region. Notwithstanding a sizeable drop in prices in the second half of the century, cash wages did not fall at the same time. Compared with the first half of the century, cash payments increased by a quarter, and reached 0.005 *tael* and 0.045 *tael* for templates and engraving, respectively, in the second half of the century.

Table 8 presents regulated construction wages in Beijing between the 1610s and 1790s. Regulation wages in two other locations, Rehe and Yongding River, are also reported in Table 8. Rehe was the royal mountain resort where emperors stayed during the summer, and Yongding River was a waterway near the city of Beijing. These construction wages were counted in silver numeraire, but in some cases were paid in copper coins or a mix of silver and copper currencies.[18] Unskilled wages are in day rates and skilled/highly-skilled wages are usually in workday rates (*gong*).

Regulated construction wages in Beijing increased more dramatically than the printing wages in the Lower Yangzi during the dynastic change, and fell but then remained unchanged throughout the second half of the eighteenth century. Regulated wages in Beijing were generally classified into six categories: interior work (*neigong/hongmen neigong*), exterior work (*waigong/hongmen*

[17] Based on the ratio indicated in Allen (2001) and Allen et al. (2011), I multiplied the costs of a barebone basket presented in Table 7 in this paper by 2.65 to simulate a respectable basket, divided it by 365 days to simulate daily consumptions, and extrapolated by a combination of Peng Xinwei and Peng Kaixiang's price indices (Fig. 2) to generate a basket series for the entire period.
[18] See *Guangxu daqing huidian shili*, vol.214, 14a-15b; vol.220, 1a-7b.

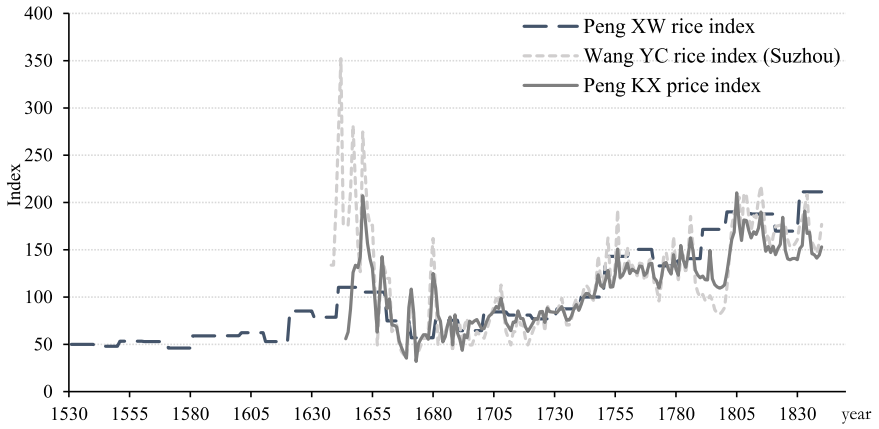

Fig. 2. Price indices, 1530–1840 (1745=100)
Notes and Source: Peng Xinwei's decadal rice prices see Peng, *Zhongguo huobishi*, 497; Wang Yeh-chien's yearly Suzhou rice prices see Secular Wang, 'Trends of Rice Prices in the Yangzi Delta, 1638—1935,' in Chinese History in Economic Perspective, 40–5; Peng Kaixiang's consumer price index see Peng, *Qingdai yilai de liangjia*, 168–76, Appendix 5.

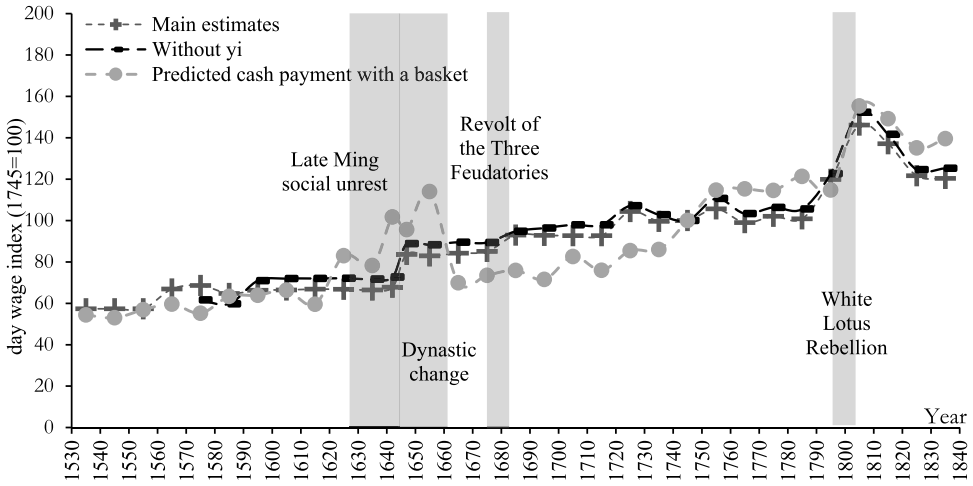

Fig. 3. Indices of unskilled day wages in China, 1530–1840 (1745=100)
Notes: "Late Ming social unrest" shown in the figure started from 1628 when peasant rebellions enlarged in Shaanxi province; the dynastic change is marked between1644 and 1661.

waigong), harvest season (*changgong*), off-season (*duangong*), craftsmen (*jiang*), and labourers (*fu*). From 1736 onwards, payments in harvest and off seasons were standardised at the same level.[19] Wages for palace construction and maintenance in Rehe shared the same payment standards as those in Beijing. By contrast, wages for embankment projects in Rehe and Yongding River were considerably lower. Many of the craftsmen who worked on the Rehe and Yongding River projects were hired from Beijing, so sources of labour input should not be a major reason for wage differences.[20] A more plausible reason is that palace projects were more likely to seek the best craftsmen, and therefore set a wage premium. Furthermore, this premium is evident among labourers employed for *neigong* and *waigong* in Beijing.

Table 9 compares my estimates for nominal unskilled wages in the Lower Yangzi (derived from the main estimates) with the estimates from Broadberry and Gupta (2006), and Allen et al., (2011). My estimates show that the wage level was considerably lower than suggested by Allen et al., and continued to grow over the period examined. Allen et al.'s predictions of unskilled wages in Suzhou are closer to the skilled wages, as Deng and O'Brien (2016) argued. For comparisons, my estimated skilled wage in the Lower Yangzi is also reported in Table 9.

[19] *Guangxu daqing huidian shili*, vol.952, 5b.
[20] For example, a memorial in 1801 shows that stonemasons hired on Yongding River maintenance project this year were hired from Beijing. See document no. *Gugong*091972 reprinted in *Gongzhongdang Jiaqingchao zouzhe*, volume 10, p.345.

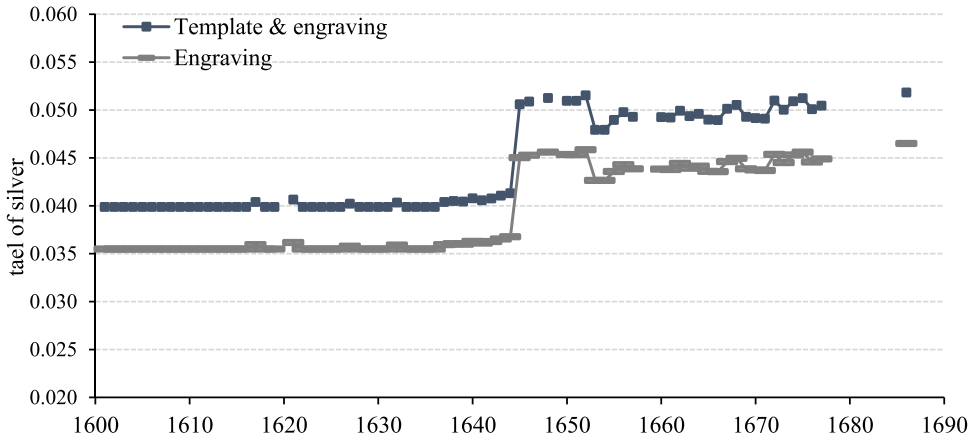

Fig. 4. Cash wages in piece rate in Lower Yangzi's printing industry, 1601–1686.
Source: See the previous text. These are the cash payments of the wages, in-kind payments are excluded.

Table 8
Regulated Construction Wages in Beijing City and Nearby Locations (day/workday rates, silver tael).

Location	Job type	1610s	1650s	1660s	1720s	1730s	1740s	1750s	1760s	1770s	1780s	1790s
Beijing	Interior, carpenter/stonemason/ bricklayer master (harvest season)	0.08	0.24	0.22	0.18	0.154	0.154	0.154	0.154	0.154	0.154	0.154
	Interior, carpenter/stonemason/ bricklayer master (off-season)	0.07	0.19	0.14	0.14	0.154	0.154	0.154	0.154	0.154	0.154	0.154
	Exterior, carpenter/stonemason/ bricklayer master (harvest season)	0.07	0.22									
	Exterior, carpenter/stonemason/ bricklayer master (off-season)	0.06	0.17	0.14								
	Interior, labourer (harvest season)	0.05		0.08	0.08	0.08						
	Interior, labourer (off-season)	0.045		0.07	0.07	0.08						
	Exterior, labourer (harvest season)	0.05										
	Exterior, labourer (off-season)	0.04		0.07	0.07							
Rehe	Carpenter/stonemason/ bricklayer master (palace construction)					0.154	0.154	0.154	0.154	0.154	0.154	0.154
	Carpenter/stonemason (embankment construction)											0.12
	Labourer (palace construction)					0.08	0.08	0.08	0.08	0.08	0.08	0.08
	Labourer (embankment construction)											0.075
Yongding River	Carpenter/stonemason (embankment construction)					0.12	0.12	0.12	0.12	0.12	0.12	0.12
	Labourer (embankment construction)					0.07	0.07	0.07	0.07	0.07	0.07	0.07

Notes and source: Beijing's regulated construction wages in 1610s come Gongbu changku xuzhi, vol.7. Wages paid at Shanling gongsuo are selected because the job categories matched the samples in the 1650s collected from Guangxu qinding daqing huidian shili, vol.952, 4b-5b. 1730s-1790s are collected from Neiwufu zaobanchu qianliang kupiao. Rehe wages come from bookkeeping records reprinted in Rehe dangan. Yongding River wages were found to be the same in two sources published in 1743 (Zhili wudao chenggui) and 1815 (Jiaqing Yongdinghe Zhi). I assume they remained unrevised, as regulated wages in Beijing and Rehe neither received adjustment during this period.

An upward wage trend results a new interpretation on the relationship between prices and wages. A static or falling trend of nominal wage may imply that wages are entirely indifferent to price changes, despite the noticeable price rises in the eighteenth and nineteenth centuries (as in Fig. 2). Nonetheless, the new wage series in this paper lends no support to this assumption. Instead, the new estimates suggest that wages and wage-setting mechanisms reflect certain market conditions, as discussed in Section 2. A further discussion on wage data and interpretation is attached in Appendix 3.

Table 9
Comparisons on Estimated Day Wage of Unskilled Labourers in the Lower Yangzi (silver taels).

	Broadberry and Gupta (farming)[1]	Allen et al. (Suzhou, construction)[2]	This paper	
			(unskilled urban/construction)[3]	(skilled urban/construction)[3]
1500-1549			0.038	0.056
1550-1599	0.040		0.043	0.064
1600-1649	0.040		0.046	0.069
1650-1699		0.090	0.057	0.086
1700-1749		0.088	0.064	0.096
1750-1799	0.045	0.086	0.069	0.104
1800-1840	0.045	0.085	0.086	0.129

Notes and Source:
[1] Broadberry and Gupta., *The early modern great divergence*, p.18.
[2] Allen et al., 'Wages.'
[3] Data see the text. 1500-1549 is the average of 1530-1549.

4.2. Regional differences

Table 10 presents the estimated results for regional differences. Macro-regions are classified as follows: the Lower Yangzi includes Jiangsu and Zhejiang provinces; North China includes North Zhili, Henan, Shandong, and Shanxi provinces; Central China includes Anhui, Jiangxi, Hunan, and Hubei; and South China includes Fujian and Guangdong. Beijing is reported separately, as nominal wages there were the highest among all the regions. The Lower Yangzi lies on the second tier, followed by the southern coastal provinces. Nominal wages in northern and central regions were among the lowest.

One possible cause of these regional variations is labour productivity, but price differences between regions also played a role. To further test this, given the lack of comprehensive regional price data, Table 10 reports the regional effect of the sample restricted to the remunerations for conscripted government workers between 1530 and 1640 separately, where the baseline is set as a prefectural doorkeeper in Zhejiang province and no market rates are included. Fig. 5 categorises the result into provincial levels.

Remunerations on conscripts are consistent with the overall regional pattern. Because conscripted labourers were developed from corvée duties, Fig. 5 is more likely to reflect regional costs of living instead of labour productivity. Again, the remuneration was the highest in Beijing, reflecting the elevated living costs in this mega city. By comparison, payments in prefectures and counties surrounding the city of Beijing were significantly lower, and North Zhili as a whole was only 65 per cent of Beijing's level. Among all provinces where data are available, two provinces of the Lower Yangzi, Jiangsu and Zhejiang, offered the highest payment for conscripted labour. Following the Lower Yangzi, the southern part of the North China Plain, Shandong province, and southern coast, Guangdong, and Fujian provinces ranked in the second tier. Hinterland provinces such as Huguang were among the lowest. City size also affected remunerations for conscripts, as payments were generally higher in large cities and lower in small cities and towns.

4.3. Skill premium and sectoral wage differential

On average, a skill premium (1.4:1) is evident between skilled and unskilled workers during the period tested. With the construction industry as a baseline, no statistically significant wage differential among the urban industries classified (construction, handicraft, and service) was found after controlling for the regional effect. One interpretation of these results is that there was a certain degree of integration of labour markets in urban areas, and a substantial wage differentiation between industries was yet to form during the periods examined.

More important in the test results is the rural-urban wage gap. A statistically significant disparity is observed between agricultural and non-agricultural wages where the latter is on average 1.5 times higher than the former. Although regions with a higher degree of commercialisation and integration may exhibit less disparity, we are unable to estimate regional premia due to data limits. This rural-urban differential in general suggests that the wage gap already existed before the nineteenth and twentieth centuries when China's industrialisation slowly began (Wang 1997, 168). The price difference between rural and urban areas played a role but cannot adequately explain the wage gap.[21] It is also likely that the agricultural sector, instead of urban industries, continued to absorb a substantial amount of the labour force and depressed agricultural/rural wages. We may find support for this interpretation from China's occupational structure and urbanisation rate during these two centuries where no structural changes were found to have occurred (Yang 2022; Xu et al., 2018).

Theoretically, the wage gap between industries or sectors generates incentives for the labour movement, and eventually causes wage convergence. In practice, however, this convergence may not happen if the growth of the labour force outpaces the industry's demand for labour and negatively impacts the man to land ratio. It is difficult to measure precisely the growth of the Chinese rural labour force over the periods examined, but population estimates suggest that population growth accelerated in the eighteenth century, possibly reaching 200 to 300 million by the mid-eighteenth century, and eventually 400 million by the mid-nineteenth

[21] Wang's *Jindai zhongguo jiage*, p.100, provides an example of wheat's retail prices in Shanghai and rural prices in Wujin, Jiangsu between 1912 and 1936.

Table 10
Regional Wage Levels as Percentages of the Lower Yangzi.

Region	*1530-1840 (N=6,006)*	*1530-1640** (N=1,017)
Lower Yangzi	100%	100%
Beijing	118%	113%
North	84%	78%
Central	71%	72%
South	90%	84%

Note and source:
* For 1530-1640, results are estimated from ya yi remunerations, averaged based on provincial levels in each macro-region. Full test results for 1530-1640 are reported in Table A3 in Appendix 2.

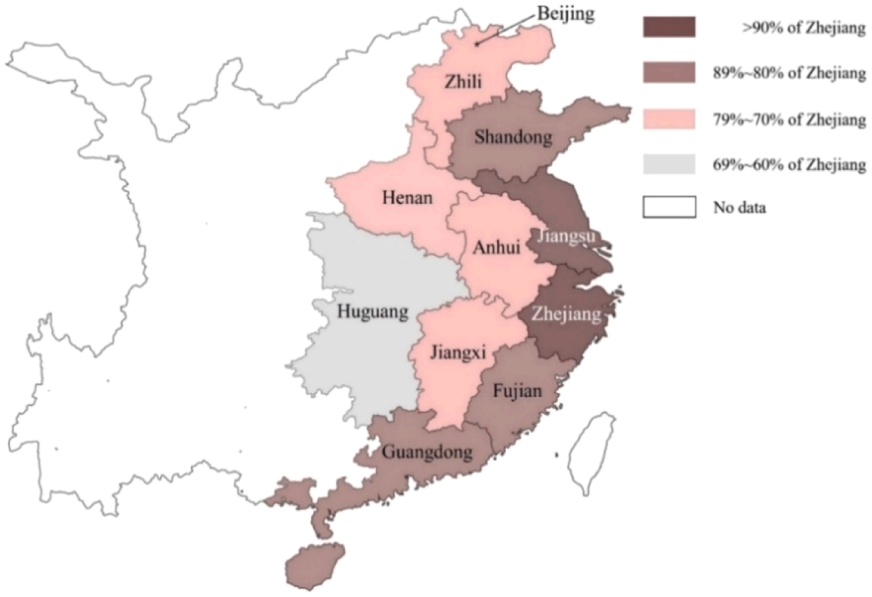

Fig. 5. Living wages in China proper, standardised on the payment of a doorkeeper in a county government in Zhejiang province, 1530–1640
Notes and Source: Inner China territory map is obtained from the China Historical Geographical Information System (https://chgis.fairbank.fas.harvard.edu/). Beijing (marked in star) is the city of Beijing rather than Shuntian prefecture, as the latter contained several subordinate counties and pay varied greatly within Shuntian prefecture. South Zhili is further divided into Anhui and Jiangsu, as the wage difference was too large between the two. Details see Table A3 in Appendix 2.

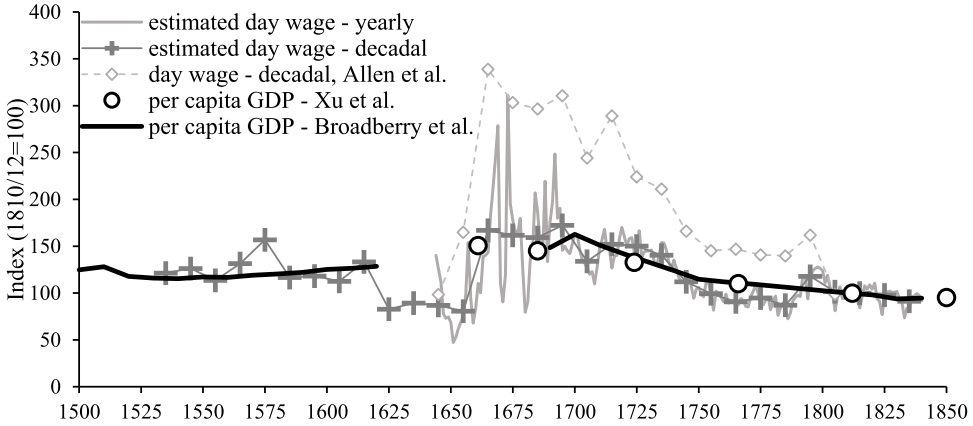

Fig. 6. Real day wage and per capita GDP indices for the Lower Yangzi, 1500–1850
Notes and Source: Allen's et al. wage series see "Wages;" Per capita GDP from Broadberry et al., "A Restatement," 970–2, and Xu et al., "Chinese National Income," 385.

century (Cao 2000, vol.5, 831–2; Chao 1986, 41; Lee and Wang 2001, 28). Studies on agricultural development also tend to imply that the consequent pressure on the land strengthened labour intensification throughout the century (Zhao and Chen 2006, 219; Huang 1985; 1990).

Given the abundant textual evidence on intra- and inter-regional labour movement, this rural-urban wage gap should not be interpreted as an absence of labour mobility, but limited employment opportunities in China's urban industries as a whole. The equilibrating movement of labour between the rural and urban sectors may not be subject entirely to the wage differential but more to the employment capacity in the urban sector. In addition, reliance on the family as a social safety net in China was likely to affect the outflow of migrants from rural areas. The rural-urban wage gap may affect the labour input strategy of individuals, but when it concerns family strategy, the wage differential alone does not suffice as an explanation. In rural communities, the relief mechanism provided by families and clans gave rural labourers the means to survive even when they were unemployed. Moreover, the prevalence of landownership and family farms also helped to absorb family workers who could not find any external work opportunities. Such a social safety net in rural communities made family labour input quite flexible and able to absorb surplus labour under the diminishing marginal return from the land (Zhao and Chen 2006, 320; Huang 1990, 71).

4.4. Real wage and living standard

To illustrate the long-term movement of real wages, Fig. 6 presents new evidence of indexed real day wages in the Lower Yangzi along with the previous work and indices for per capita GDP. In the long run, China experienced two major falls in real wages that coincided with widespread social unrest in the mid-seventeenth century and rapid population growth in mid-eighteenth century. Real wages remained stable until a substantial fall occurred after the 1620s. From the mid-seventeenth century onwards, a substantial improvement is observed. This was partly caused by a surge in nominal wages following the 1644 dynastic change and partly by a fall in prices, especially after 1660. Thereafter, real wages remained high until another major fall occurred between the 1740s and 1760s, but this then stabilised (rather than collapsed as previous research suggests). Although nominal wages and prices tended to move in tandem over the long run, wage increases were not as fast as price increases, implying that the labour supply on the market affected wage setting in addition to prices.

To cross-check the real wage trend estimated in this paper, per capita GDP estimates from Xu et al., (2017) and Broadberry et al., (2021) are plotted in Fig. 6. Their GDP estimates were inferred from an output approach which aggregated the output values from the agricultural, industry, and service sectors. Overall, my real wage estimates exhibit a pattern consistent to that of per capita GDP where a substantial improvement was observed in the second half of the seventeenth century, but diminished over the eighteenth century. Noting that real wages estimated in this paper differ substantially from the predictions of Allen et al., (2011). This is evidenced by the magnitude of wage improvement after 1644 and subsequent fall after 1700 in Fig. 6. The decline in real day wage after 1700 is considerably milder than suggested by the previous work, and no sharp drop is observed after 1800. Nevertheless, estimates on real wages and per capita GDP tend to imply an absence of intensive growth in the Chinese economy over the centuries.

To set the development of real wages into the context of living standards, I took the case of the Lower Yangzi and measured the purchasing power of unskilled wages in terms of welfare ratio. Allen (2001) and Allen et al., (2011) developed the 'welfare ratio' approach to compare real wages across countries. This ratio measures 'whether a man working full time could support a family at the "bare-bones" level of consumption' (Allen et al., 2011, 26). The higher the welfare ratio is above one, which is a theoretical level of subsistence, the better the living standard. A few key assumptions underlie this approach. First, the day wage is multiplied by a fixed length of working year, 250 days, to estimate annual incomes from wage earnings. Second, an adult's cost of living is multiplied by 3.15 to simulate the annual consumption for a family of four (two adults and two children, counted as one adult), including 5 per cent of rent spending.

Despite possible marginal errors, the computation implies no fall in living standards below the subsistence level for urban wage earners in the majority of the periods examined. In prosperous times such as the 1660s-1730s, a theoretical annual income from 250 days of work would enable an unskilled male labourer to support 1.68–1.98 times annual family consumption at a bare-bones level. In the remainder of the periods, welfare ratios were lower but still ranged between 1.2 to 1.5. The theoretical level of subsistent living, marked as 1, can be observed in times of dynastic change and the 1830s (right before the Taiping Rebellion in the 1850s). Interpretations of living standards in rural areas require more caution. Even though wages were lower, the majority of rural workers did not live solely on wage earnings. More often, wage activities were a supplementary source of income in addition to the yields from farming. Moreover, rural/agricultural wage earners would benefit from lower prices in the countryside and received in-kind rewards such as daily meals, accommodation, and clothes. Thus, lower wages in rural areas did not necessarily translate into worse living standards.

Two further considerations may further stabilise the living standard in the long run. First, the welfare ratio approach infers living standards from individual rather than family incomes. Taking the example of a peasant family in the Lower Yangzi, sericulture or textile weaving often provided additional incomes to supplement either farming or wage earnings. These activities usually involved the participation of the female labour force in the household.

Second, annual incomes inferred from day wages rely entirely on a theoretical (and fixed) length of working year, but falls in day wages may possibly be compensated by the increasing number of days of work. We were unable to estimate the actual length of the working year due to the lack of annual wages in the dataset. As an alternative, I present in Fig. 7 an estimated minimum working year to purchase a family consumption basket at a bare-bones level in the Lower Yangzi. Based on day wage earnings, Fig. 7 shows how many days an unskilled male labourer had to work to maintain the bare-bones level of consumption defined in Table 7 (multiplied by a theoretical family size of 3.15). The results indicate that the minimum length of the working year generally increased from the

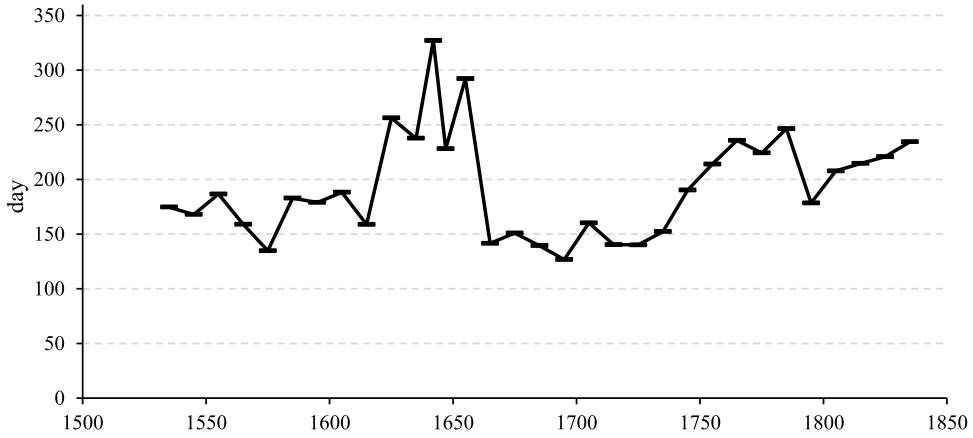

Fig. 7. Estimated minimum working year to purchase a barebone level of family consumptions in the lower Yangzi
Notes: The minimum working year = *a* barebone level of family consumption basket / unskilled day wage. The cost of a barebone level of consumption basket in 1745 is defined in Table 7, and costs in other years are derived from price indices reported in Fig. 2. Unskilled day wages in the Lower Yangzi are derived from regression results.

eighteenth century onwards, but it is by no means certain that Chinese labourers increased their working year simply to maintain a minimum level of consumption. Taking the first half of the nineteenth century as an example, the estimated minimum working year ranged between 200 and 230 days in the Lower Yangzi, while other studies have suggested that the actual working year may have reached 300 to 330 days (Li 2008; Jiang and Wang 2020). This difference implies that on the one hand, living standards in the Lower Yangzi may still remain stable even if real day wages declined, while on the other hand, the living standard derived from day wages may differ from the picture inferred from annual wage earnings.

5. Discussion: wage divergence

What implications could the new wage series have for the comparative living standards between China and leading economies in Europe? Pomeranz argues that living standards in the Lower Yangzi delta were comparable to those in England as late as 1800. At the core of Pomeranz's (2000) argument is the claim that per capita food consumption was as high in the Yangzi delta region of China as in the most developed parts of Europe. However, Broadberry and Gupta (2006) contend that the high grain wage in the Lower Yangzi did not translate into a high silver wage, which suggests lower productivity in the tradable sector in early modern China. To be consistent with previous studies, I use the welfare ratio approach as a starting point for comparison. The observations in this paper lend support to the view that wage earners in Lower Yangzi China secured food security, but the diverging trend in the purchasing power of wages between Lower Yangzi China and England may have begun circa 1700.

Figs. 8 and 9 presents the living standards inferred from day rates in the context of previous work (decennial welfare ratios). I focus particularly on the Lower Yangzi and London. The decadal 'welfare ratio' measures the number of consumption baskets for a family of 3.15 that an unskilled male labourer could afford. Again, the higher the 'welfare ratio', the higher the living standard.

A comparison of living standards through the welfare ratio approach requires careful interpretation. The 'London (Stephenson)' series in Fig. 8 is worth noting in particular. Stephenson (2018) contends that the London building wages constructed by Allen are the charge out rates for contractors, and are 20 to 30 per cent higher than the average level.[22] This difference has a considerable impact on real wages and living standards comparisons.

Allen et al., (2011), using data shown by 'Lower Yangzi (Allen et al.)' and 'London (Allen)', suggest that the divergence in real wages between the most advanced part of China and England may have occurred before 1800. However, the authors overestimated both nominal wages in the Lower Yangzi and the costs of living in the Lower Yangzi (especially for a bare-bones basket). If we correct for this, illustrated by the comparison between 'Lower Yangzi (this paper)' and 'London (Allen)', there is an enduring gap in living standards, and wage divergence may never happen.

However, if we compare construction wages in the Lower Yangzi with London's construction wages suggested by Stephenson (2018), real wages in the Lower Yangzi and England (London and Oxford) were moving towards par before 1700. The gap then opens up in the early decades of the eighteenth century and have widened further after 1740 as living standards in the Lower Yangzi declined.

Diverging trend in real wages between the Lower Yangzi and England occurred during the early decades of the eighteenth century. This conclusion is subject to two key assumptions. First, there was a fixed length of the working year (250 days) for all countries. This assumption allows a comparison of annual incomes, but the recent studies have emphasised that the actual length of the working year could differ substantially from this narrative. In the case of England, Humphries and Weisdorf (2019) show that the assumption of

[22] Stephenson, "'Real' wages," pp.115-6; See also Stephenson, "the average craftsman;" in Hatcher and Stephenson, 2018, *Seven Centuries of Unreal Wages*, pp.119-23.

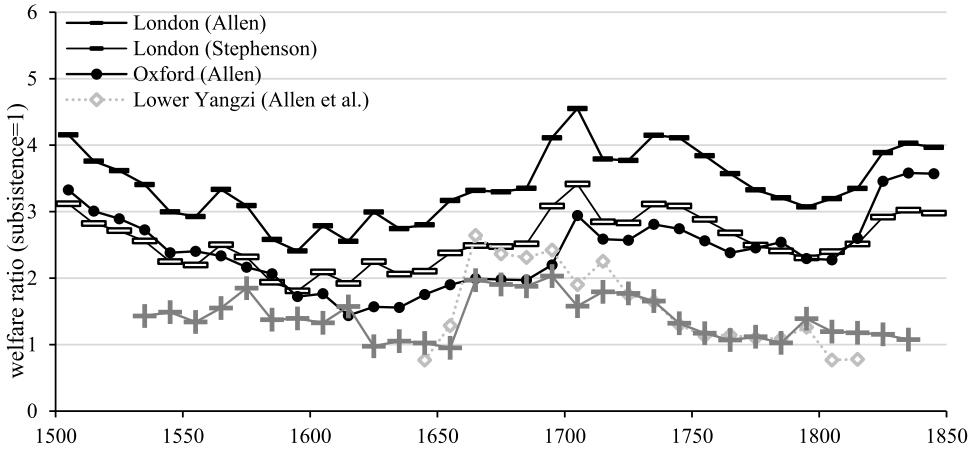

Fig. 8. Estimated living standards in England and Lower Yangzi, 1500–1850
Notes and Source: Welfare ratios are computed using unskilled construction wages and the barebones level of consumption baskets. Wage and price data for the Lower Yangzi see the previous text; London and Oxford's data come from Allen, "The great divergence". London (Stephenson) is calculated based on Stephenson, "'Real' wages," 115–6.

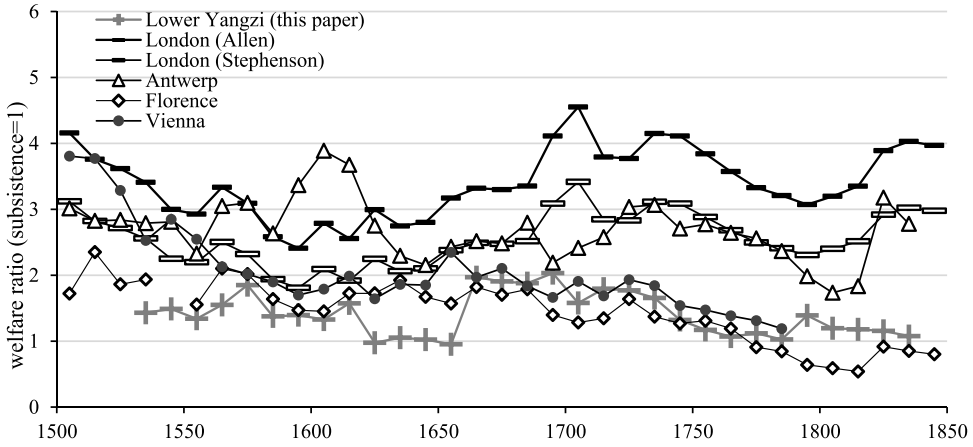

Fig. 9. Estimated living standards in Europe and Lower Yangzi, 1500–1850
Notes and Source: Welfare ratios are computed using unskilled construction wages and the barebones level of consumption baskets. Wage and price data for the Lower Yangzi see the previous text; European data come from Allen, "The great divergence". London (Stephenson) is calculated based on Stephenson, "'Real' wages," 115–6.

constant working days may significantly overestimate real wages before 1600. A similar issue may also emerge in the case of the Lower Yangzi, and the decline in wages inferred from living standards after 1700 may be slower, or even compensated, if we allow for an increasing length of the working year in China. Second, the Chinese living standards discussed in this paper are largely confined to urban wage earners. In the case of England, wage differentials between urban and rural areas are eliminated once the costs of living are considered, and this suggests that wage incomes should fairly represent living standards in each sector of the English economy (Clark 2007). However, it is difficult to draw a precise conclusion regarding the extent to which the living standards of rural and urban labourers represent each other in China, especially when we go beyond food security and consider non-food consumption.

6. Conclusion

What were the level and trend of wages in early modern China? Using a new collection of wage data, this paper presented a new chronology of wage development in the Lower Yangzi Delta that sheds new insights into Chinese and global economic history.

In the context of Chinese economic history, this paper argues that wages remain an important source of information for our understanding of the long-term economy and living standards in China. Contrary to the notion that wages do not relate to the factor price of labour, the new wage series presented in this paper provides evidence that wages and wage-setting mechanisms reflect certain market conditions. Between 1530 and 1840, nominal wages moved in tandem with prices but did not respond as quickly as the increase in prices. But no persistent improvement in real wages was observed. Real day wages remained relatively stable before 1620, but

witnessed a sharp decline during the 1620s and 1640s due to empire-wide unrest, rebellion, dynastic change, and inflation. A substantial improvement occurred after the 1650s, and wages remained high as the core regions in China began to recover from the destruction caused by the dynastic change. Another significant fall occurred between the 1740s and 1760s. Considering the potential increase in the length of working year, the decline in real wage earnings might be slower than the annual income inferred from day wage rates.

In the context of global history, this paper contends the Great Divergence between Lower Yangzi China and the leading European economies may occur around 1700 instead of a later time suggested by the California School. Living standards inferred from real day wages in Lower Yangzi China and England moved in par before 1700, but the wage gap opens up at the turn of the century when English wages started to rise. This gap was further widened after the 1740s when Chinese wages declined coinciding with rapid population growth. These wage developments in early modern China do not suggest cumulative changes in the economy over the centuries.

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Data availability

Data will be made available on request.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.eeh.2023.101569.

Appendix 1. Test results on wage regression

Table A1
Regression Results on Nominal Daily Unskilled Wage, Standardised on the Log of Payment of an Unskilled Construction Labourer in the Lower Yangzi in the 1530s (main specification) / in the 1570s (without ya yi) (Fig. 3).

	Coefficient	
Region	Main specification	without ya yi
Lower Yangzi	(ref.)	(ref.)
Northeast	0.2700326***	0.263826***
	(0.071)	(0.049)
North	-0.1631444***	-0.1442207***
	(0.015)	(0.026)
Northwest	-0.417572***	-0.4231385***

(*continued on next page*)

Table A1 (*continued*)

	Coefficient	
Region	Main specification	without ya yi
	(0.078)	(0.055)
Beijing	0.179825**	0.1786494***
	(0.052)	(0.041)
Central	-0.2893547***	-0.4626854***
	(0.013)	(0.042)
South	-0.1021191***	0.0520486
	(0.001)	(0.039)
Southwest	-0.4276022***	-0.4313679***
	(0.069)	(0.046)
Industry		
construction	(ref.)	(ref.)
agriculture	-0.5291359***	-0.5179556***
	(0.084)	(0.094)
printing	-0.055524	-0.0761535
	(0.075)	(0.054)
handicraft	-0.051356	-0.0488406
	(0.045)	(0.042)
service	-0.102472	-0.09674
	(0.059)	(0.066)
mining	-0.109894	-0.1242
	(0.077)	(0.075)
ya yi	-0.5622518***	/
	(0.050)	
Skil level # in-kind payment		
*unskilled*with both cash and payment in kind*	(ref.)	(ref.)
*unskilled*with cash pay only*	-1.092061***	-1.080996***
	(0.042)	(0.040)
*skilled*with both cash and payment in kind*	0.4070766***	0.406416***
	(0.066)	(0.068)
skilled with cash pay only*	-0.081451	-0.0832775
	(0.076)	(0.073)
*highly skilled*with both cash and payment in kind*	0.686809***	0.6879133***
	(0.029)	(0.031)
highly skilled with cash pay only*	0.2772646***	0.2827783***
	(0.050)	(0.043)
*unskilled*ya yi*	-0.090254	/
	(0.053)	
Payment method (control for *yi* only)		
agent issued	(ref.)	/
gvt. paid	0.6474197***	/
	(0.039)	
Miscellaneous		
no miscellaneous cost	(ref.)	(ref.)
level 1	0.099473***	0.1007015***
	(0.003)	(0.004)
level 2	0.1104217***	0.1108316***
	(0.003)	(0.004)
level 3	0.1334162***	0.1324975***
	(0.006)	(0.007)
Woodblock		
no woodblock cost	(ref.)	(ref.)
level 1	0.1731902***	0.1634216***
	(0.030)	(0.022)
level 2	0.2261425***	0.2325128***
	(0.034)	(0.038)
level 3	0.1852809**	0.1899298**
	(0.054)	(0.057)
_cons	-3.929208	-3.241149
R2	0.93611	0.8957
N	6,006	4,944

Notes: ** significant at 5%; *** significant at 1% level. Standard errors in brackets. Period dummies are not reported due to length.

Table A2
Estimated Wage Indices (1745=100), Basket Costs, and Welfare Ratios in the Lower Yangzi.

Period	Nominal	Real	Basket cost (grams of silver)	welfare ratio
1530-1540	57.36	108.3	76.879	1.4308
1541-1550	57.36	112.64	73.920	1.4881
1551-1560	57.36	101.4	82.113	1.3396
1561-1570	66.9	115.65	81.571	1.5278
1571-1580	68.62	139.67	70.960	1.8451
1581-1590	64.77	104.68	90.884	1.383
1591-1600	66.32	105.26	91.028	1.3906
1601-1610	66.48	100.47	96.009	1.3273
1611-1620	66.84	119.04	81.463	1.5727
1621-1630	66.78	73.85	131.272	0.9756
1631-1640	66.46	79.66	121.166	1.0524
1641-1644	67.79	74.59	147.068	0.9854
1645-1650	83.69	89.03	159.648	1.1762
1651-1660	82.95	72.00	187.933	0.9511
1661-1670	84.23	149.04	92.448	1.969
1671-1680	85.08	144.26	99.580	1.9058
1681-1690	92.99	142.17	100.523	1.8782
1691-1700	92.83	153.74	91.244	2.0311
1701-1710	92.67	119.48	115.179	1.5785
1711-1720	92.67	135.81	100.895	1.7942
1721-1730	104.34	133.99	113.349	1.7702
1731-1740	99.62	125.29	117.710	1.6552
1741-1750	100	100	147.546	1.3211
1751-1760	105.62	88.62	175.254	1.1708
1761-1770	99.02	80.93	180.968	1.0691
1771-1780	102.04	84.64	177.436	1.1182
1781-1790	100.85	77.64	192.744	1.0258
1791-1800	119.87	105.19	165.895	1.3897
1801-1810	146.15	90.52	235.445	1.1958
1811-1820	137.14	89.25	228.190	1.1791
1821-1830	121.65	87.38	208.316	1.1544
1831-1840	120.38	81.45	218.834	1.076

	Population weight			Occupational weight	
Region	1530-1630	1631-1681	1681-1840	1761-70	
Lower Yangzi	0.2094	0.2208	0.1759	Agriculture	0.562
Northeast	0.0186	0.0065	0.0032		
Beijing	0.0066	0.0054	0.0064		
Middle	0.2637	0.3003	0.2442		
North	0.2028	0.1874	0.2147		
South	0.1066	0.1311	0.1281		
Northwest	0.1200	0.1043	0.1157		
Southwest	0.0649	0.0361	0.0975		

Note: Occupational structure follows Yang's (2022) estimates. Population weights follows Cao, Zhongguo renkoushi, vol.4; vol.5. I adopted different shares of population for each province, based on Cao's estimates, in the following sub-periods: 1530-1630, 1631-1680, and 1681-1840.

Appendix 2. YA YI DATA

Fig. A1 presents the daily payments of *ya yi* recorded in local gazetteers and *Fuyi Quanshu* (The Complete Book of Taxation and Corvée) before and after the dynastic change in 1644. All data are originally expressed in "yearly" rates with a theoretical working length of 360 days. 1017 data points are collected before 1644 and contain three types of *ya yi*: doormen, runners/lictors, and state school doormen. 1365 data points are collected after 1644 (1652 in particular) and contain 16 types of services, including doormen, runners/lictors, state school doormen, foot messengers, polices, horsemen, patrol archers, prison guards, coroners, grain measurers, granary janitors, treasury janitors, lantern carriers, night watchmen, sedan-chair bearers, and parasol and fan bearers.

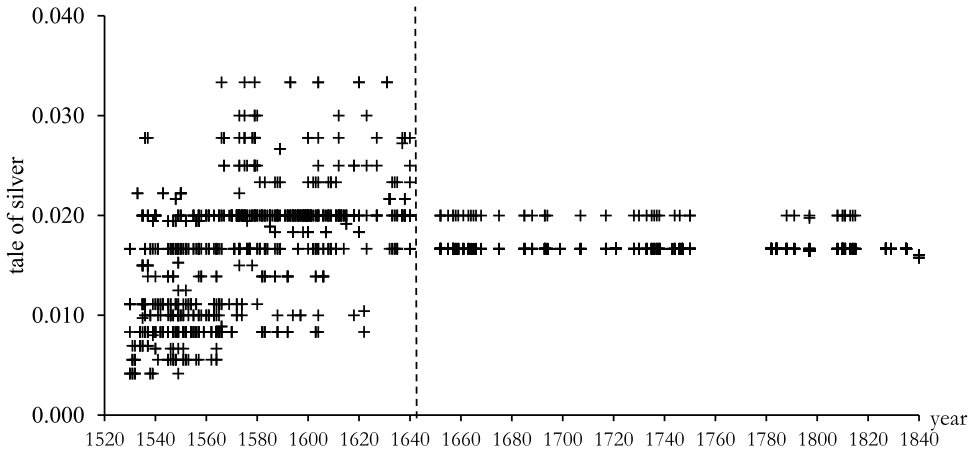

Fig. A1. Ya Yi Pay Before and After 1644, Converted into Day Rates ($N = 2382$).

Unprocessed pay records in local gazetteers published before 1644 exhibited variations not only among different jobs but within and between provinces. Typically, large prefectures (such as major cities) and counties functioning as or attached to a provincial and prefectural seat offered higher pay than smaller prefectures and counties. Moreover, payments often varied between counties subordinate to a single prefecture. These features indicate that pay budgets before 1644 contained some information regarding regional labour costs.

In contrast, pay records in those local gazetteers published after the dynastic change (after 1652 in particular) do not provide meaningful information on labour costs. Except for state school doormen, who received an annual budget of 7.2 *taels* of silver, the other 15 types of services in the sample uniformly received a budget of 6 *taels* of silver per annum. As shown in Fig. A1, pay standards of the sample *ya yi* remained completely unchanged between 1652 and 1840. In many regions, this 6-*tael* standard was lower than the one set in the mid-sixteenth century.

Moreover, pay records after 1652 exhibit no variations within and between provinces. One reason for this is that local gazetteers and *Fuyi Quanshu* documented only the budgets sanctioned from the land-poll taxes. In the gazetteers of Yongzhou Prefecture, Yuezhou Prefecture, and Jingde County, where changes in pay were documented in detail, a universal cut-off on local funding, *ya yi* quotas, and *ya yi* payments was found between 1652 and 1657. Subsequently, pay standards remained entirely unchanged throughout the eighteenth and nineteenth centuries. *Ya yi*'s stipends or additional payments from tax surcharges, both statutory and non-statutory, were not recorded in these documents. In the official salt gazetteers (*Yanfa Zhi*), *yi* who served in local salt fields and bureaus received significantly higher pays covered by salt tax surcharges, which were legalised after 1723, instead of land-poll taxes. For instance, in Shuangen salt field, Guangdong province, a storehouse janitors(*cangfu*) received a monthly pay of 1 *tael* of silver from the legalised salt surtaxes in the 1730s. This equates to 12 *taels* per annum or 0.0333 *taels* per day, which was double the pay standard for a janitor found in local gazetteers. See the 1762 version of the Salt Gazetteer of Liangguang District (*Liangguang Yanfa Zhi*), vol.19, 13a.

To further demonstrate these, Table A3 below presents the regression results on regional effects restricted to *ya yi* data before 1644.

Table A3
Regression Results on Regional Differences of Yi Payment, Standardised on the Log Daily Payment of A County Doorman in Zhejiang Province in the 1530s (Fig. 5).

	Coefficient
Region	
Beijing	*0.134106***
	(0.058)
North Zhili	*-0.2154288****
	(0.027)
Shandong	*-0.1684872****
	(0.020)
Henan	*-0.2724795****
	(0.035)
Zhejiang	*(ref.)*
Jiangsu	*-0.0805441****
	(0.247)
Anhui	*-0.2203888****
	(0.023)
Jiangxi	*-0.2123033****
	(0.026)
Huguang (Hunan&Hubei)	*-0.3986561****
	(0.025)

(*continued on next page*)

Table A3 (*continued*)

		Coefficient
Guangdong	*-0.1498****	
		(0.021)
Fujian	*-0.1707989****	
		(0.024)
Administrative level		
County	*(ref.)*	
Prefecture	*0.0625363****	
		(0.011)
Job		
Doorman	*(ref.)*	
School doorman	*0.0312864***	
		(0.013)
Runner/lictor	*0.1085087****	
		(0.015)
Payment method		
agent issued	*(ref.)*	
gvt. paid	*0.6249869****	
		(0.026)
constant	*-4.61572*	
R2		0.8194
N		1,017

Notes: ** significant at 5%; *** significant at 1% level. Standard errors in brackets. Period dummies are not reported due to length.

Although that pay records on *yi* before 1644 contained information on labour costs, they do not represent market rates. As discussed in the body text, a sample was compiled to include both *yi* and market rates paid in the public sector between 1571 and 1620. The distribution of industries and locations are reported in Table A4 below. *Yi* data include doormen, runners, state-school doormen, and labourers working on embankment and hydraulic engineering. Market rates include wages on a variety of skilled and unskilled workers in construction, handicraft, and service sectors, mostly collected from Beijing. A few market wages on labourers working on hydraulic projects, classified as 'service' and 'construction' are collected from the rest of the cities. If there is a pay difference, then: market premium = market wage – non-market wage.

Table A4
Wage Records by Industry and Location, 1571-1620.

Industry	*Freq.*	*Percent*	*Cum.*	*Location*	*Freq.*	*Percent*	*Cum.*
Construction	64	31.53	31.53	Dongchang	16	7.88	7.88
Handicraft	21	10.34	41.87	Yanzhou	28	13.79	21.67
Service	118	58.13	100	Beijing	72	35.47	57.14
				Xuzhou	37	18.23	75.37
				Yangzhou	50	24.63	100
Total	*203*	*100*		*Total*	*203*	*100*	

I specify and run the following regression:

$$\ln(wage_i) = \alpha + \beta_t \cdot period_{t,i} + \sum_{h=1}^{2} \theta_h \cdot market_{h,i} + \sum_{l=1}^{2} \varnothing_l \cdot admin_{l,i} + \sum_{k=1}^{3} \varphi_k \cdot industry_{k,i} + \sum_{j=1}^{5} \phi_j \cdot region_{j,i} + \sum_{m=1}^{2} \Pi_j \cdot skill_{j,i} + \varepsilon_i$$

where $wage_i$ is the log of the daily wage of labour *i;* α is the constant term; $period_{t,i}$ captures time effect; $market_{h,i}$ indicates whether the observation is a *yi;* $admin_{h,i}$ indicates whether the observation is in a prefecture or county level; $industry_{k,i}$ is a dummy for occupations, including construction, crafting, and service industries; depending on their jobs, *yi* are either classified into construction or service industries. $region_{j,i}$ is the location of the observation; $skill_{j,i}$ indicates whether the observation is skilled or unskilled labour. The base is set as the regulated wage of an unskilled construction labourer in Beijing in the 1570s.

The dummy variable $market_{h,i}$ is expected to be statistically significant if there is a difference between the payments issued by the government to *yi* and non-*yi* workers in the public sector. Estimate results in Table A5 show that the dummy variable $market_{h,i}$ is statistically significant, 35 per cent higher than the pay on *yi*.

Table A5
Market Premium Regression Test, Standardised on the Log of Daily Wage of An Unskilled Labourer in Beijing.

	Coefficient
Period	-0.0103117
	(0.009)
Market premium	
yi	(ref.)
market	**0.3549772*****
	(0.028)
Administrative level	
county	(ref.)
prefecture	0.093013***
	(0.025)
Skill level	
unskilled	(ref.)
skilled	0.4946621***
	(0.142)
Industry	
consturction	(ref.)
handicraft	-0.0516751
	(0.138)
service	-0.1000185***
	(0.028)
Region	
Beijing	(ref.)
Dongchang	-0.3460898***
	(0.043)
Yanzhou	-0.3434411***
	(0.040)
Xuzhou	-0.3661488***
	(0.040)
Yangzhou	-0.3265154***
	(0.039)
_cons	-3.487538
R^2	0.8316
N	203

Notes: ** significant at 5% level, *** significant at 1% level; standard errors in bracket.

One interpretation of this difference is that conscript payments equated to the cost of their living expenses, and the estimated market premium was likely to be the cash component of wages on the market (*gongyin* or *gongqian*). In fact, a few government invoices indicate that the pay of government doormen and runners was supposed to cover daily necessities. In December 1578, for instance, an invoice from Jinan prefectural government, the provincial seat of Shandong, recorded that 1.34 *taels* of silver for "firewood and rice money" (*chaimi yin*) were issued to the assistant prefect's doormen for that month. See the example in *Zhongguo Mingchao Dangan Huizong*, vol.99, p.248. The assistant prefect of Jinan prefecture was assigned two doormen. A total monthly pay of 1.34 *taels* of silver converts to 0.67 taels for each or 0.0223 *taels* per day. This matches the pay records in local gazetters. In Yanzhou, another major prefecture in Shandong, the pay standard of a prefectural doorman in the local gazetteer was 8 *taels* of silver per annum in around 1573, or 0.0222 *taels* per day when divided by 360 days of work. County doormen received lower pay, with 6 *taels* per annum or 0.0167 *taels* per day. See the 1573 version of the Gazetteer of Yanzhou Prefecture, reprinted in *Tianyige cang Mingdai fangzhi xuankan xubian*, vol.55, *Wanli Yanzhou Fuzhi,* vol.26, *minyi*, 9b.

Similarly, the same amount of "firewood and rice money" was documented in another invoice of January 1579, issued to doormen of a *fenshou dao* of Shandong Province (Commissioner in Charge of a General Administration Circuit), a senior official in the provincial government. See *Zhongguo Mingchao Dangan Huizong*, vol.99, p.251. Furthermore, an invoice from a garrison in the Liaodong district, Northeastern China, demonstrates that the doormen of battalion captains were also provided with funds for clothing. See *Zhongguo Mingchao Dangan Huizong*, vol.99, p.214.

APPENDIX 3. DISCUSSIONS ON THE 1769 EDITION OF REGULATIONS AND PRECEDENTS ON THE PRICES OF MATERIALS (WULIAO JIAZHI ZELI)

Allen et al.'s (2011) sources of Chinese building wages mainly come from the 1769 edition of Regulations and Precedents on the Prices of Materials (*Wuliao Jiazhi Zeli*). This collection consists of official reports on the prices of building materials and the wages paid in construction projects. However, the original texts provide very limited information beyond the location and wage for each job quoted, and jobs are vaguely defined. The majority are either labelled as 'labourer' (*fu*) or 'craftsman' (*jiang*). No information is given as to the types of projects for which wages were quoted. Consequently, there is a potential risk in assuming that all 'craftsmen' in the Regulations and Precedents possessed the same skill level, and that high wages in certain regions were due to locality rather than skill.

One example in Shandong province highlights this concern. In the 1769 edition of Regulations and Precedents, the day rate of a skilled building craftsman in Shandong province was quoted as 0.061 *taels* of silver.[23] However, another wage quotation for building craftsmen from the Archive of Confucius Family Mansion (*Kongfu Dangan*) shows that the day rates of a building craftsman and a nanmu carpenter in Qufu, Shandong province, were 0.14 *taels* and 0.154 *taels* of silver, respectively, for work on the Temple of Confucius in the 1720s-1730s. The former is the same payment standard of a building craftsman that Allen et al. quoted from the Regulations and Precedents for Beijing (0.141 *taels*),[24] and the wage of a nanmu carpenter is also consistent with Beijing's regulated construction wage presented in Table 8 (0.154 *taels*). The fact that the project was sponsored by the emperor suggests that the same payment standards were likely to have been applied to these craftsmen, rather than applying local rates in Qufu, as those hired for Beijing's palace projects.

In Allen et al.'s estimates, the day rate of an unskilled labourer in Beijing's construction industry was around 0.09 taels of silver in the 1760s. In this paper, it is estimated to be 0.0776 taels (derived from the main estimates), the same as the day rate (0.077 taels) quoted by Allen et al., (2011, 12) from the 1769 edition of Regulations and Precedents on the Prices of Materials (Wuliao jiazhi zeli).

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