Wages, Prices, and Living Standards in China, Japan, and Europe, 1738-1925

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ABSTRACT

The paper develops data on the history of wages and prices in China from the eighteenth century to the twentieth. These data are used to compare Beijing and Canton to leading cities in Europe and Japan in terms of nominal wages, the cost of living, and the standard of living. In the eighteenth century, the real income of building workers in Asia was similar to that of workers in the backward parts of Europe and far behind that of workers in the leading economies in northwestern Europe. Industrialization led to rising real wages in Europe and Japan. Real wages declined in China in the eighteenth and early nineteenth centuries and rose slowly in the late nineteenth and early twentieth. There was little cumulative change in the standard of living of workers in Beijing and Canton for two hundred years. The income disparities of the early twentieth century were due to long run stagnation in China combined with economic development in Japan and Europe.

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> "The difference between the money price of labour in China and Europe is still greater than that between the money price of subsistence; because the real recompence of labour is higher in Europe than in China."
>
> Adam Smith, *Wealth of Nations*, 1776, p. 189.

The comparative standard of living of Asians and Europeans on the eve of the Industrial Revolution has become a controversial question in economic history. The classical economists and many modern scholars have claimed that European living standards exceeded those in Asia long before the Industrial Revolution. Recently, this consensus has been questioned by revisionists,[1] who have suggested that Asian living standards were on a par with those of Europe in the eighteenth century and who have disputed the demographic and agrarian assumptions that underpin the traditional view. The revisionists have not convinced everyone, however.[2]

One thing is clear about this debate, and that is the fragility of the evidence that has been brought to the issue. Most of the comparative studies relied on indirect comparison based on scattered output, consumption or demographic data. The few that attempted comparisons of direct income were largely based on scraps of information about wages and prices in Asia (Pomeranz, *Great Divergence*, Lee and

[1] For instance Pomeranz, *Great Divergence*; Parthasarathi, "Rethinking Wages"; Wong, *China Transformed*; Lee and Wang, *One Quarter of Humanity*; Li Bozhong, *Agricultural Development*, Allen "Agricultural Productivity, Allen, "Mr. Lockyer," Allen, "Real Wages in Europe and Asia"; Allen, Bengtsson, and Dribe (eds.), *Living Standards in the Past*.

[2] For instance, Broadberry and Gupta, "Early Modern Great Divergence."

Wang, *One Quarter of Humanity*). Our knowledge of real incomes in Europe is broad and deep because scholars since the mid-nineteenth century have been compiling data bases of wages and prices for European cities from the late Middle Ages into the nineteenth century when official statistics begin. Apart from Japan, little comparable work has been done for Asia.

This article, by assembling and constructing systematic data on wages, prices and consumption baskets from Imperial ministry records, merchant account books and local gazetteers, is an attempt to fill that gap for China in the eighteenth and nineteenth centuries. These data are then compared to the Japanese and European evidence to assess the relative levels of real income at the two ends of Eurasia. The comparisons paint a less optimistic picture of Asian performance than the revisionists suggest.

Our procedure takes the hypothesis of Adam Smith at the head of this paper as its point of departure. We first compare the "money price" of labour in China and Europe. To do this, we express wage rates in grams of silver earned per day in the two regions. Unminted silver measured in tael (of 37 grams)[3] was a universal medium of exchange in China in this period. The terms on which silver coins exchanged defined the market exchange rate of European and Asian moneys. Next, we compare the "money price of subsistence." This is a more complicated problem since the subsistence foods were different in China and Europe. Our approach is to respect the culinary differences by reducing rice and wheat and other foods to calories and protein. Once that is accomplished, we can see how money wages and the costs of subsistence differed between Europe and China and what those differences imply for

[3] We have used this average; variation was wide and ranged, for only the four most important units, between 36.54 and 37.58 grams. See Peng Xinwei, *Monetary History of China*, p. 669, fn. 4-7.

the “real recompence of labour.”

The rest of the paper is divided into five sections with a conclusion. The first two sections review a variety of Chinese wage data to establish the history of nominal wages from the eighteenth to the twentieth centuries. We concentrate on the histories of Canton and Beijing both because we have the fullest information for these cities and because they are more comparable to the large cities in Europe and Japan for which we have similar information. In section 3, we compare nominal wages in China and Europe to see if Smith was correct about the “money price of labour.” Section 4 turns to the “price of subsistence” and develops consumer prices indices to compare the cost of living across Eurasia. In section 5, we estimate real wage income in Canton and Beijing from the mid-eighteenth century to the 1920s and also report estimates for Sichuan from 1875 to 1925 to see how the leading cities compared to a peripheral rural province. We test Smith’s belief about the “real recompence of labour” by comparing real wage income in Canton and Beijing to its counterpart in other countries. For Japan, we compare Chinese urban incomes to a composite picture of Kyoto-Edo in the eighteenth and early nineteenth centuries and Tokyo for the late nineteenth and early twentieth century, based on Bassino and Ma’s study “Japanese Unskilled Wages.” We broaden the perspective on Asian performance by comparing living standards in Chinese and Japanese cities to London, Amsterdam, Leipzig and Milan as worked out by Allen in “Great Divergence in European Wages.” We conclude with a discussion of the significance of our findings for Adam Smith and the great divergence debate.

1. Wage Levels in Eighteenth- and Nineteenth-Century China

Before we can compare living standards, we must establish the level and trend of nominal wages in China. No single source covers the whole period from the eighteenth century to the twentieth, so we must piece together the wage history of China by combining disparate information.[4] While we concentrate on wages in Canton and Beijing, we also examine wage surveys that cover much of China in order to place the histories of the large cities in a national context. This section discusses sources for the eighteenth and early nineteenth centuries; the next section links these results to nineteenth and twentieth century findings based on other sources.

There are two main sources for eighteenth century Chinese wage data: official regulations of wages paid by the state in government factories and at building projects, and the records of private wages paid in different sectors of the economy. Both have their merits and demerits. The single greatest advantage of wage data in government regulations is their use of the standardized currency unit – silver tael – and their relatively uniform definition of work types, making them ideal for comparison across time and space. Their obvious drawback is the uncertainty of how well these regulated wages reflected conditions in the economy as a whole. Data on non-state wages are also readily available and appear in numerous studies. The problem with private sector wages, however, is a general lack of comparability due to the multiplicity of labour contracts, payment systems, and currency units. Employment contracts could last for a day, a month, or a year, and careful attention must be given to the number of days worked in a month or a year to reduce the payment information to a consistent daily rate. There are many cases that food allowance were also given in addition to cash payment. We want to make sure that

[4] For a survey of existing studies on wages and prices, see Kishimoto, *Shindai Chūgoku*.

our wages are full payment inclusive of the value of food, and we have adopted several procedures to make sure that is the case. Possibly the most difficult issue of all was the quotation of wages in obscure currency units with exchange values that were both highly localized and fluctuating over time. Studies not taking full cognizance of these problems can be very misleading.[5] Our approach is to cross check information as much as possible to establish a reliable range for nominal wages in eighteenth century China.

The most systematic and detailed source of government wage regulations that we have been able to locate so far is the *Wuliao jiazhi zeli* ("Regulations and precedents on the prices of materials") of 1769, a very detailed government inquiry into the prices of buildings materials and the wages paid at construction projects, and an attempt to set these prices and wages for the future.[6] In itself it is a testimony of the high degree of sophistication of the Chinese state bureaucracy in the (second half of the) eighteenth century: at the district level detailed information about prices and wages was collected, which was put together at the level of the province, and finally presented to the Emperor in 1769; together with the final memorandum information

[5] Vogel "Chinese Central Monetary Policy" contains the most comprehensive collection of market exchange rates for various provinces in China for the seventeenth to nineteenth centuries. But these exchange rates do not apply to the case of the co-circulation of multiple versions of silver and copper cash within the same locality, an issue pointed out in Kuroda's recent study "Copper Coins." For a case of neglecting these complicated currency problems in the study of nominal and grain wages, see Kang Chao, *Man and Land.*

[6] See appendix I for a description of the various sources. Digitalized versions of the price and wage data of the provinces Gansu, Zhili, Yunnan and Hunan can be found on the website of the project 'Staat, Handwerk und Gewerbe in Peking, 1700-1900' of the University of Tübingen (www.uni-tuebingen.de/sinologie/shp/databases.

html). See also Song and Moll-Murata, "Notes on Qing Dynasty Handicraft Regulations."

about 1,557 administrative units were described in a compilation of 220 chapters. The original compilation has not been preserved, but we have been able to locate the editions for 15 provinces covering 945 districts. Most contain the daily wages of unskilled and skilled craftsmen for each district; a few are more detailed and present wages for occupations such as master sawyers, carpenters, stonemasons, paint-makers and painters, tailors, plasterers, canopy makers, paperhangers, and cleaners (in Zhili). A few also contain information about additional food provisions and their monetary value, so that the total wage value can be calculated; where no food provisions are mentioned, probably no food allowance was given, as these wage regulations were supposed to cover the entire labour cost of the projects that were monitored in this way.

A virtue of the *Wuliao jiazhi zeli* is its comprehensive coverage, which illustrates broad regional patterns in Chinese wages. For each province we calculated the unweighted average of the wage norms for labourers in all districts. Table 1 presents the results of these calculations for 21 regions. Zhili is divided into a number of sub-regions because of the large wage differences within this province. The total population of these regions in 1776 was c. 214.5 million or 73% of the total population of China of about 293 million[7].

Insert Table 1 here

The pattern that emerges from the *Wuliao jiazhi zeli* is that daily wages in parts of Manchuria (Heilongjiang and Jilin), the home territory of the ruling Manchu dynasty, and the sparsely populated northwestern frontier of Xinjiang, stand out as the highest, followed by areas in and near the capital city of Beijing. Average daily wages in the rest of China seemed to have been fairly uniform, with the coastal Fujian

[7] Wang Yeh-chien, *Land Taxation*, p. 87.

province fetching the lowest 0.030 tael for unskilled labourers. It is somewhat surprising that the two Lower Yangzi provinces of Jiangsu and Zhejiang, supposedly the most productive parts of the empire, had wage levels slightly below the national average (see Map 1 for the regional patterns of the skilled labourers' wage rates).

A second government source is the so-called *Gongbu junqi zeli* (Regulations and precedents on weapons and military equipment by the Ministry of Public Works) of 1813, which contains more government wage regulations on the national scale. The *Gongbu junqi zeli* contains wages for master artisans and unskilled labour that produced armor, helmets, headgear, uniforms, saddles, arms such as swords, bows, arrows, and various types of tents; only the data for unskilled labourers are reproduced here in Table 1.[8] This source shows again that, with the exception of Zhili where Beijing is situated, the norm for average daily wages in most provinces in 1813 was about 0.04 tael, very close to that in the 1769 regulations.

To what extent do these government regulation wages approximate wages in the private sector of the economy? We have collected private wage quotations from two sources. One is the records of the Imperial Ministry of Justice, which summarized judicial cases dealing with wages paid. A sample of 188 manufacturing and handicraft wages was obtained from Peng Zeyi, *Zhongguo jindai shougongye shi ziliao* (Materials for early modern Chinese craft history), vol. 1, pp. 396-414, which is based on judicial records from ca 1740 to 1820. They are contained in the archival documents of the Ministry of Justice, *Qingdai xingbu chao'an* (Copies of archival materials from the Qing Ministry of Justice)[9] Ministry of Justice records also include

[8] See You Zhanhong, "Lun junqi zeli," p. 314. Wages of skilled craftsmen were 0.020 or 0.010 tael higher.

[9] Peng Zeyi, *Zhongguo jindai shougongye*, vol. 1, p. 397, note 2.

information on agricultural wages, and we have obtained a sample of those from the work of Wei Jinyu and Wu Liangkai. We converted these wages (mostly in copper cash) to silver tael based on Vogel's exchanges rates.

Our second source of private sector wages is the archives of the Dutch East Indies Company (VOC). Many VOC ships docked at Canton, which was the city where Europeans were allowed to trade with China in the eighteenth century. The VOC hired many Chinese workers to repair ships and move cargo. A further 63 wage quotations spanning the eighteenth century were obtained from the VOC archives. This is important because Canton was not well represented in the other data sets.

We, thus, have a large, if disparate, sample of wages covering many provinces, industries, and types of employers in eighteenth century China. To extract basic patterns from this information, we estimated a wage function using all of the wages we collected. All wages were converted to daily wages in silver tael (using the dataset of silver/copper ratios by Vogel).[10]

We defined the following independent variables:

- Regions, based on *Wuliao jiazhi zeli*: Manchuria, Zhili, the North (Shanxi, Shaanxi, Gansu, Shandong), the Yangzi Delta (Jiangsu and Zhejiang), the 'Middle' and the South (see Table 1 for the other regions); Canton was also distinguished.
- Branches: agriculture, coal mining, iron industry, construction, textiles, and other industries;

[10] Another problem was how to convert monthly and annual wages into daily wages; a few observations of both daily and monthly or annual wages suggests conversion factors of about 15 (days/month) and 60 (days/year). The next step was to use these conversion factors and estimate dummies for monthly and annual wages in the wage regression. The dummies became close to zero when somewhat different conversion factors were used, namely 12 and 80. In the wage regression shown in table 3, the dummies for monthly and annual wages have, therefore, not been included.

- a time-trend with 1769 as the base year;
- Skill: a dummy for skilled labour was used; unskilled labourers were all agricultural workers, the unskilled labourers in construction and the 'helpers' in other industries;
- Regulation: data drawn from the four public documents setting wages were identified by a dummy for 'regulation.'

The total number of observations was 327, relatively equally spread over the different regions, branches, and periods. There are only four observations for the late seventeenth century. Most observations cluster between the 1740s and the 1810s; no observations after 1820 were included.

Insert Table 2 here

Table 2 presents the results of the wage regression. Two versions are shown corresponding to the two approaches to the problem of food allowances. Both begin with the observation that the wage per day was much greater for people hired on a daily basis than for people hired for the month or the year when their monthly or annual payments are divided by 30 or 360 days, which was notionally the labour time for which they were hired. Many of the daily wages come from the records of the VOC or the *Wuliao* and for reasons noted we believe those wages are complete and inclusive of any food allowance. There are two possible reasons why the monthly or annual wages work out at less per day, and we explored the implications of both readings of the evidence. One possibility is that the employees were not working a full 30 or 360 days; indeed, comparing the monthly and annual wages to the daily wage suggests that they were working 13 or 80 days, respectively. Regression 1 in Table 2 develops that assumption by dividing the monthly and annual wages by 13 and 80 to put them on a daily basis. A second reason of the relatively lower monthly or annual

wages (converted to a daily basis on 30 or 360 days) is that food or boarding allowances were much more common for long-term labor contracts. Clearly, they could not have survived had they been employed at the recorded money rates without supplementary food. For these low paid workers, we add an estimate of the value of a food allowance to the money wage. We take as a model Pomeranz's description of the earnings of a Yangzi farm worker employed by the year in the mid-eighteenth century.[11] Pomeranz reckoned that the cash component of these earnings was 2 – 5 tael, and that the food allowance over a full year was perhaps 5 shi of rice worth 8.4 tael, so the total earnings over the year were 10.4 – 13.4 tael. Dividing by 360 implies daily earnings of 0.035 – 0.045 tael per day.[12] Many of the workers in our sample employed by the month or the year were reported to have a wage of 2 – 5 tael (on an annual basis), which corresponds to the cash component in Pomeranz's calculation. A food allowance of 5 shi of rice over a year works out to about one kilogram of grain per day. The cost of one kilogram of rice in Canton or millet in Beijing was about 0.024 tael per day in the middle of the eighteenth century – just about the same as Pomeranz's estimate for the Yangzi – so we have added 0.024 tael to the daily earnings of those workers earning less than 6 tael per year (0.5 tael per month)[13]. No

[11] Pomeranz, *The Great Divergence*, pp. 319-320.

[12] Pomeranz's calculation is consistent with evidences by Fang Xing et al., *Zhongguo jingji tongshi*, vol. 3, pp. 1879-1881. They show that for annual contract in agriculture, food allowance amounted to 50-70% of total wage payment.

[13] The average of agriculture wages on daily contracts collected in our sample was 0.045 tael. Wages on daily contract were likely to be higher as usually day labourers were more likely to be employed during the planting and harvest seasons. It is unclear whether additional food was provided. A national level survey conducted in the 1930s (Chen Zhengmo, *Gusheng nonggong*) reveals the existence of both types of payment arrangements for daily wages, either with or without food payment, the latter being

adjustments were made for workers earning more than 6 tael. We also estimated the model leaving out the small number of workers earning between 6 and 9 tael per year so we do not include any wage quotations we might have been treating incorrectly. The second approach to the food allowance problem makes fewer increases to the reported wages than the first, and, consequently, the average level of wages is lower. There is little change, however, in the coefficients of most significance for this study.

All independent variables except the time trend are dummies for regions, branches etc.; the standard for comparison is the market wage of a construction labourer in the Yangzi Delta in 1769. The constant in the equation is his wage, which is estimated as 0.0456 tael in equation 1 but only 0.027 tael in regression 2 where estimated food allowances are added to the cash earnings of low income workers only. The time trend is insignificant. The regional pattern mirrors the results from the analysis of the *Wuliao jiazhi zeli*: wages in Manchuria and Zhili were (much) higher than in the rest of the country, whereas the differences between the Yangzi Delta and the rest of the rice region were very small. Wages in Canton were also very high. These results make sense: large cities in Europe, the counterparts of Canton and Beijing, had higher wages than small towns and rural districts in part because the cost of living was higher in the large cities and also because they had to recruit population from the countryside. Manchuria, compared with the rest of China, was abundant in

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higher. But in cases where there was food payment, the portion amounted to about 33% of the total cash wage, much less than for the eighteenth and nineteenth century agricultural wages on annual contracts (Chen, p. 9). Bozhong Li, *Agricultural Development*, p. 94, also seems to indicate that seventeenth-century nominal wage levels may not be far apart from those of the eighteenth to nineteenth century. He discusses wage levels in agriculture (and silk production) in the Yangzi Delta, and estimates the average wage in rice cultivation at 0.06 tael per day, adding "the official standard was 0.04 tael a day which is a bit low compared to the wages in some farms in Huzhou, Zhejiang province."

land and natural resources and its high-wage economy might have been sustained by Qing ruler's restriction on labor immigration for the 18th and 19th centuries. Most industry dummies were insignificant. Finally, the dummy for skill premium is significant; its level in regression 1 is 63% of the wage of an unskilled labourer in the Yangzi Delta.

An interesting difference between the two regressions is the coefficient of "Regulated", which equals one for wage norms set by the state. For regression 1, regulated wages were significantly lower than the non-regulated ones. The difference is estimated to be 37% in this regression. In regression 2, the coefficient is no longer significant. This may mean that adding food allowances to the wages of the low paid workers is the most consistent way of adjusting the data.

We do worry, however, that the wage sample is small and not representative of wages in general. Many of the wage quotations, for instance, are influenced by 'special circumstances.' The wages drawn from the public inquiries were systematically lower than other wages, at least as indicated by the negative coefficient of "Regulated" in equation 1. The Canton wages may have been atypically high for that city because they are drawn from VOC records, and foreign ships may have been overcharged for labour (although they do not seem to have been overcharged for provisions). Since we are arguing that Chinese living standards were lower than recent historians have claimed, we deal with the uncertainties by choosing values for nominal wages at the high end of the relevant range. This biases our procedures against our conclusion. Thus, we estimate nominal wages for Beijing and Canton from the wage regression on the assumption that "Regulated"=0 and that the VOC wages were representative of Canton in general. If these assumptions are overturned, then Chinese living standards were even lower than we find.

The international comparisons we will undertake later in the paper centre on the wages and living standards of construction workers in large cities. We use the regressions in Table 2 to form our estimates of Chinese wages for this exercise. Regression 1 implies that the wage of building workers was 0.0845 tael per day in Canton and 0.0907 tael in Zhili province which includes Beijing. Regression 2 implies a similar value for Canton (0.0853 tael) but a significantly lower value for Zhili (0.0617 tael). We use values of 0.09 tael for both cities, so that we do not understate Chinese performance. Since there was no trend in wages across the eighteenth century, we use these values for the whole period.

2. Wage Levels in Nineteenth- and Twentieth-Century China

Jumping forward in time, our best information on wages in Beijing and Canton is for the early twentieth century. In addition, we have some wage series for Bejing in the nineteenth century, and we have also found data for Sichuan that provide an enlightening comparison.

Our Beijing investigation is anchored on the work of Sidney Gamble (1890-1968) and his associates.[14] Gamble was an American sociologist who lived in China in the 1920s and 1930s. He conducted a survey of workers in Beijing in 1921. This provided the weights for a consumer price index for Chinese capital for 1900-1924, and that index, in turn, was used in a study of real wages for the period. Gamble also had historical interests. He studied the account books of a fuel store in the rural area outside Beijing (hereafter referred to as rural Beijing). From these he abstracted the wages of unskilled workers from 1807 to 1902. This is the most consistent wage series for nineteenth-century China. Gamble and his associates also recorded wage

[14] Gamble, "Daily Wages," Meng and Gamble, "Wages, Prices, and the Standard of Living."

series for unskilled construction workers in Beijing for 1862-1925 using the records of the Beijing guilds for construction workers. These are our 'urban Beijing' data.

While Gamble's nineteenth-century wage series is the most consistent and comprehensive available, much work remains to be done to adapt it to our purposes. The nineteenth-century wage payments were recorded in copper cash, and we need to convert them to silver for comparison with prices and other wages. This helps resolve one of the most difficult problems in interpreting the 1807-1902 wage series. It was broken around the mid-nineteenth century due to the monetary debasement in the period of the Taiping rebellion. We can connect the earlier and later components by converting to silver. This requires knowledge of the silver equivalent of copper cash over the course of the nineteenth century. These conversion factors varied across China, and Gamble reports important information for the Beijing area from the accounts of the fuel store. We derive a consistent copper-silver exchange rate series from this source.

A second issue in interpreting the 1807-1902 series is the question of payments in kind. The fuel store recorded cash wage payments. The question is whether the workers were also given food. Gamble included the value of the food given to construction workers in his 1862-1925 urban Beijing wage series. For the 1807-1902 rural Beijing series, he explicitly stated that food was given in addition to the cash payments, but did not indicate the amount[15]. To be consistent with our earlier research on the wage payment system for agricultural labourers, we doubled Gamble's 1807-1902 rural Beijing series of cash wages to include food payments in kind. The original wage series and copper-silver conversion rates are presented in Appendix II.

[15] Gamble, "Daily Wages," p. 4.

A reassuring finding is that the unskilled Beijing wage c. 1800 implied by Gamble's data is similar to the wage predicted for the same time by the eighteenth century wage regression. The former was about 0.08 tael per day, while the latter was about 0.09 tael. With the tael equal to 37 grams, the Beijing wage equalled three grams of silver per day in the eighteenth century. We compare this wage to wages in leading cities in Europe and Japan.

Our information on Cantonese wages is less comprehensive than that for Beijing. As noted previously, we have estimates of wages in the eighteenth century derived mainly from VOC records and summarized in our wage equation. For the early twentieth century, we use the simple average of six series of union regulated wage rates for unskilled labourers in the construction sector from 1912 to 1927.[16] For the nineteenth century, we have various plausible wage data, but did not include them in our analysis as they were incomplete and scattered series.[17]

In addition to this information for two major cities, we have consulted a useful compilation of daily wages and consumer goods prices at ten-year intervals from 1875 to 1925 for Hejiang county in Sichuan from a local gazetteer.[18] These provide a valuable extension of the geographic coverage at the end of the period we study.

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[16] Department of Peasantry and Labour, Kwangtung Government, *Reports of Statistics*, vol. 3, "The Wage Indexes of Labourers in Canton." Our wage series is the simple average of five types of unskilled labourers in the construction sector.

[17] The *Chinese Depository* reported a wage of about 0.1 tael for a worker in Canton in 1835 (p. 469). The Imperial Maritime Customs Returns report Cantonese wages for 1882-1891 (*Decennial Reports* pp. 561-2). Their levels seem closer to those reported in Gamble 1943. However, the nominal wages roughly doubled for this ten-year period while prices largely remained stable, which seems somewhat implausible.

[18] Chuan and Wang, *Jindai Sichuan*.

In the comparisons reported here, our income measure is the annual earnings that a worker could have gained if he worked full time for a year. We assume that one year's work consisted of 250 days. Obviously, people could have worked more or less than that, and we discuss the implications of those possibilities later. The earnings from full time work provide a useful benchmark for comparing Europe and Asia and for defining the economic strategies of families.

3. Wage patterns in Europe and China

Adam Smith thought that the "money price of labour" was higher in Europe than in China. To test that, we compare the Chinese wages with their European counterparts. Here we build on our earlier studies of European wage rates.[19] For many cities we have assembled daily wages earned by labourers in the building industry. We have been careful to exclude wage quotations where the earnings included food or other payment in kind that could not be valued and added to the money wage. As with China, we have converted the European wages to grams of silver per day by using the market price (in units of account) at which silver coins of known weight and fineness could be purchased.

Figures 1 and 2 graph the daily wage rates of unskilled workers in London, Amsterdam, Leipzig, Milan, and Beijing from the eighteenth century to the twentieth. Figure 1 shows the series from 1738 to 1870. For this period, Adam Smith was half right. Wages were, indeed, highest in London and lowest in Beijing, but the other series show that the world was more complex than Smith thought. The silver wage in Milan or Leipzig was not appreciably higher than the wage in Beijing or Kyoto

[19] Van Zanden, "Wages and the Standard of Living," Allen, "Great Divergence in European Wages."

throughout the eighteenth century. The statistics of other European and Chinese cities show that this similarity was general.

Figures 1 and 2 here

Amsterdam occupies a peculiar position in Figure 1. Nominal wages there were remarkably constant for a century and a half. At the outset the Amsterdam wage was similar to the London wage. The same was true of Antwerp. Indeed, the Low Countries and the London region stand out from the rest of Europe for their high wages in the seventeenth and eighteenth centuries. These high wages were probably due to the active involvement of these regions in inter-continental commerce.

But this pattern changed as the nineteenth century advanced. The industrial revolution raised British wages above Dutch levels. Indeed, the early industrialization of Germany is seen in Figure 1 as a rise in the Leipzig wage.

These developments intensified after 1870 as shown in Figure 2. British wages continued to increase. By the First World War, German wages had caught up with the British level, and Dutch wages closed the gap as well. Italian wages were also growing, but the increase was muted compared to the industrial core of Europe. Outside Europe, Japanese wages before 1870 stayed largely flat, in keeping with the low Italian level. After 1890, Japanese wages, spurred by the industrialization drive in the Meiji era, began to drift decisively above those of Beijing, but continued to stay substantially below the rising trend of early twentieth century European wages.

Chinese wages, in contrast, changed little over the entire period. There was some increase in the silver wage after 1870, but Figure 2 emphasizes that the gain was of little importance from a global perspective. By the First World War, nominal wages in China were very much lower than wages in Europe generally. Taken at face value, Adam Smith's generalization about Chinese and European wages was more accurate

at the time of the First World War than when he penned it in 1776.

4. Price Indices

What of Adam Smith's second generalization? He remarked that "the difference between the price of subsistence in China and in Europe is very great." We can test this generalization by computing price indices. In modern theory, the problem unfolds like this: Suppose an individual or family receives a particular income and faces particular prices. The income and prices determine the maximum level of utility (highest indifference curve) that the individual can reach. Now suppose that prices change. What proportional change in income would allow the individual to reach the original indifference curve in the new price situation? The price index is supposed to answer that question. Comparing the actual change in income to the index shows whether consumer welfare has risen or fallen.

If we compare this theory to the realities of the eighteenth century, we see problems in relating the theory to the world. There are no insuperable difficulties in applying the theory to real income changes over time in either Europe or Asia provided we have full information about wages, consumer prices, and spending patterns. But how do we compare living standards between Europe and Asia? The pattern of goods – particularly foods – consumed in the two regions was radically different. The standard theory of consumer welfare assumes that all of the goods are available in both regions and that there is a 'representative agent' who would voluntarily choose to consume rice, fish, and sake when confronted with Japanese prices and bread, beef, and beer when confronted with English prices. In fact, all goods were not available everywhere, and, moreover, it is unlikely that there were people with flexible enough preferences to voluntarily shift their consumption

between the European and the Asian patterns in response to changing prices. In that case, how can we compare living standards?

Our solution is to substitute objective equivalence for subjective indifference. Workers and peasants in pre-industrial Europe and Asia spent most of their income on food; much of the rest was spent on a narrow range of goods centred on cloth, fuel, lighting, and housing. We specify quantities or spending shares of these so that consumers in Asia and Europe have the same standards of living in objective terms. This is how we operationalize Adam Smith's notion of the "money price of subsistence."

In the case of the non-foods the procedure was simple. Each adult male is assumed to consume the following per year: cloth (cotton or linen): 5.0 square metres; soap: 2.6 kg; candles 2.6 kg; lamp oil:2.6 l; fuel: 3.0 - 5.0 million BTUs; rent: 5% of commodity spending.

A range of values was specified for fuel consumption. The high value was used in northern Europe and the low value in southern Europe. Different values were used on the grounds that more fuel was required to reach the same level of utility in the north in view of the colder climate. Southern European values were used for China and Japan.[20] In the case of food, the procedure was more complicated in view of the radical difference in diet between Europe and Asia. The choices are also of great importance given the large share of spending on food.

The first step was to specify a diet for Europe, which summarizes the spending assumptions for northern Europe (Table 3).[21] The diet is late medieval in inspiration

[20] The discussion of Japan in this paper draws heavily on Bassino and Ma, "Japanese Wages" and their extensions.

[21] Allen, "Great Divergence in European Wages."

in that it does not contain new commodities like sugar and potatoes introduced into Europe after the voyages of discovery. Substitutions were allowed in the diet to adapt it to different parts of Europe. The price of wheat bread, for instance, was used in Mediterranean Europe, while the price of rye bread was used in Germany and Poland. The price of meat used in each city was that of the most common kind. Also, 68.25 litres of wine were used in southern Europe in place of the 182 litres beer for northern Europe. These contain the same quantities of alcohol (8.19 litres) on the assumption that the beer was 4.5% alcohol and the wine 12%. In this way, the same framework was used throughout Europe, but its application was adjusted to each locality studied.

Insert Table 3 here

The same principle guided the comparison of consumer prices and living standards between Europe and Asia. The diet for Japan and each part of China was specified in terms of the culinary norms of the regions, but it was required to yield the same objective characteristics as the European diet shown in Table 3. These characteristics involved calories, protein, and alcohol. The European diet shown in Table 3 yielded approximately 1940 calories per day, and the Asian diets were required to do likewise.

Different diets were specified for different parts of Asia. We designed the Chinese baskets based on a national scale rural consumption survey in the 1930s by the National Agricultural Research Bureau (NARB). The Japanese basket is mostly based on the consumption survey of the 1920s.[22] Rice was a major source of calories in Japan, Canton, and Sichuan. In contrast, little rice was consumed in Beijing. There millet, beans, corn, and wheat were the main sources of calories. The details of the

[22] Department of Crop Reporting, "Crop Reports" Vol. VI, no. 10, pp. 115-117. Rōdō Undō Shiryō Iinkai, 1959, p. 568.

Beijing basket are in Table 4. The specifics of the diet and the annual spending pattern for Canton and Kyoto are shown in Tables 5 and 6. Table 7 provides the conversion standards for calories and proteins.

Insert Tables 4 through 7

The Asian diets were required to yield about 80 grams of protein per day as in the European diet. Asians consumed less meat than Europeans but more beans. Soybeans, in particular, are high in protein, and their consumption allowed the protein requirement to be satisfied without breaching cultural norms.

In addition, the Asian diets were required to yield 8.19 litres of pure alcohol per year. For Japan, this was presumed to be sake and amounted to 41 litres per year (assuming 20% alcohol). Nineteenth-century surveys indicate that the Japanese did, indeed, imbibe this much sake, so the requirement is not in conflict with their cultural norms.[23] Surveys for China, however, suggest that alcohol consumption there was much lower. Whether this reflects preferences or income is less clear. We will consider the implications of this discrepancy later.

Having specified the consumption 'baskets' in Tables 3-6, we need time series of the prices of the items shown, so that the cost of the baskets can be calculated across the eighteenth, nineteenth, and twentieth centuries. We begin with Gamble's study of retail prices in Beijing in 1900-1924 and extend those prices to earlier times and other places using a variety of other sources. These are explained in detail in Appendix III.

The cost of the basket is Adam Smith's "money price of subsistence" and its history is plotted in Figure 3 for leading cities in China and Europe in the eighteenth and nineteenth centuries. As Smith claimed, China had much cheaper subsistence.

[23] Bassino and Ma, "Japanese Wages."

The figure shows the consumer price index for both Beijing and Canton. There was very little difference between the two. This is important because the two cities represent the two agrarian halves of China – the northern small grain region and the southern rice region. Apparently, the integration of China's food markets was close enough to arbitrage away any differences in the price of food when reduced to nutritional characteristics.

Figure 3 here

There were fewer exceptions to Adam Smith's generalization about consumer prices than there were about wages: In most cities, European consumer goods were more expensive than Chinese goods. Leipzig (where rye was the staple grain) was almost an exception to this rule, for prices there were very close to those in China during the eighteenth century. Prices were highest in London followed by Amsterdam and Milan. After 1870, silver prices inflated more rapidly in Europe than in China, so the gap between the two widened. Also, there was a convergence of prices in Europe in the run-up to the First World War. By then, Adam Smith's generalization about Chinese and European prices was correct, as was the corresponding generalization about wages.

5. Comparison of Living Standards

The purchasing power of wages is usually measured by the ratio of the wage to the consumer price index. Our procedure elaborates that approach. In constructing the consumer price index, we specified a notional budget that was intended to achieve a particular level of utility. The budget was an annual budget for an adult male. If the man was supporting a family, the expenditures would have been higher, and we

multiply the cost of the budget by three to represent the annual budget of a family. This increase is roughly in line with the calorie norms for a man, a woman, and several young children. On the income side, we assume the man worked 250 days in the year – roughly full time work allowing for holidays, illness, and slack periods. The ratio of estimated full time earnings to the annual cost of the family budget is a real wage index, and one that specifically answers the question whether a man working full time could support a family at the specified level of consumption. Real wage indices of this sort are called 'welfare ratios.' As we will see, many men did not earn enough to reach the specified level of consumption. Their welfare ratios fell below one, and we will discuss how they adjusted to the deficiency.

Figure 4 shows welfare ratios for unskilled male workers from 1738 to 1923 in the European cities we have been discussing and in Beijing and its hinterland. Several features stand out:

1) Beijing was in a tie for last place with Milan. Italian cities had the lowest standard of living in Europe, so an optimistic assessment of Beijing's performance is difficult. In the late nineteenth century, we have series for both 'urban' and 'rural' Beijing. While the income of 'urban Beijing' was higher than that of more rural areas near the city, some of the gain might be specious since we have not measured house rents, which are generally higher in the city than the country. In any event, 'urban Beijing' only came up to the level of the poorest European cities.

2) The trend in the standard of living in rural Beijing was generally downward from the early eighteenth century to the beginning of the twentieth. The lowest values of the welfare ratio were reached during the Taiping Rebellion. Living standards rebounded in the next decade. After that, the index merely continued along the same downward trend that had preceded the uprising.

3) The urban Beijing index rose noticeably in the early twentieth century and pulled away from the rural index. This may indicate a quickening economy in Beijing that had little impact in adjacent rural areas. The welfare ratios achieved in Beijing in the early twentieth century were still very low on a world scale and only kept pace with the modest gains realized in northern Italy with the onset of its industrialization at the end of the nineteenth century.

4) The most striking feature of Figure 4 is the great lead in living standards enjoyed by workers in the rapidly growing parts of western Europe. The standard of living of workers in London was always much higher than that of workers in Beijing. After the middle of the nineteenth century, London living standards began an upward trajectory and increased the lead over Beijing. While workers in Amsterdam in the eighteenth century also lived better than their counterparts in Beijing, the Dutch economy faltered in the early nineteenth century. By mid-century, however, growth resumed and real wages were climbing to new heights. At the same time, the rapid growth of the German economy was translating into rising real wages for workers in Leipzig. By the First World War, workers in the industrial core of western Europe had greatly increased their standard of living over their counterparts in Beijing. The standard of living there remained low and on a par with the regions of Europe untouched by the industrial revolution.

Figures 4 and 5 here

Figure 5 tests the generality of these conclusions by including all of the Asian welfare ratios for comparison. There was variation in experience, but that variety does not qualify the conclusion that Asian living standards were at the low end of the European range. The history of living standards in Japan and Canton was very similar to Beijing's. Özmucur and Pamuk have found that real wages in Istanbul were at a

level as low as China's, so it may have characterized much of the non-industrializing world in the eighteenth century.[24] There is evidence of rising living standards in Beijing, Canton, and Tokyo after 1870, but the gains were not enough to catch up to the standard of mid-eighteenth century London or Amsterdam let alone the much higher standard of living enjoyed by workers in those cities in the early twentieth century. The divergence of Japanese and Chinese wages really began after the turn of the century. In particular, there was a rapid surge following the industrialization boom during the First World War so that by the mid-1920s, the Japanese welfare ratio was more than twice the levels in China. But even then, the Japanese real wages were still far behind those in most European countries.

Discussion

The low welfare ratios of Asian cities shown in Figure 6 raise the question of how one survived with a welfare ratio less than one. This means that a man working full time could not buy the goods that specify our reference level of well-being. What did low welfare ratios mean?

As shown in our figures, the average welfare ratios for a family of three from the wage earnings of an unskilled labourer were about 0.6 or 0.7. But if the labourer increased his work time to 300 days per year (instead of the 250 days as we assume), and his wife also worked and brought in half the amount of his earnings, that would raise the family welfare ratio to about one without any cheapening of the specified consumption basket. Rice wine amounted to over 15% of spending in the specified budget and contributed little protein and calories. Cutting the rice wine and increasing grain consumption correspondingly would allow a family to reach a welfare ratio even slightly above one with 600 work days per year by both husband and wife. Chinese

[24] Özmucur and Pamuk, "Real Wages and Standards of Living."

and Japanese families in the pre-industrial world could live as well as European labourers in the leading economies – but only by giving up drink and working almost twice as many days per year. (The same was true, of course, for Italian families.)[25]

Our figures show that Sichuan recorded the lowest average welfare ratio (about 0.25) for the nineteenth to twentieth centuries. Since we did not make adjustment for any food payments (the gazetteer was silent on this issue), the Sichuan nominal wages constitute a lower bound estimate. If, following our practise for Beijing wages, we assume food allowance to roughly double the wage payment, the welfare ratio there could attain 0.5 and the same argument would apply.

These examples indicate the three ways in which people could react to wages that were insufficient to purchase the life style corresponding to a welfare ratio of one. The first was by increasing the number of days worked. The number of holidays may have been less than in Europe, where every seventh day was a free Sunday, a custom unknown in Japan or China. But this difference may of course also reflect relative real earnings. Wives worked in early modern China, and their earnings made an important contribution to raising the family's standard of living. The second was by consuming less. By cutting back on non-foods and by concentrating spending on the cheapest sources of calories, a family could sustain itself with less income. Reducing the intake of protein and alcohol was an obvious strategy, and the Chinese budget surveys indicate that less alcohol was consumed than our welfare ratio postulates. The third was by reducing the number of non-earning family members. Fertility control was one

[25] We assumed that alcohol consumption in China and Japan was comparable to European levels, which for China may be unrealistic; since alcohol also accounted for about 19% of the European budget, excluding alcohol from our baskets would not affect our welfare ratio comparison between Asia and Europe.

option. In extreme cases, the wage might be sufficient only to support the worker himself, and he did not have a family.

The strategy of concentrating spending on the items that provided the cheapest calories and protein increases the share of unprocessed agricultural products in spending. After all, in regions of settled agriculture, the least expensive way to get calories is to boil the cheapest grain into a gruel or porridge. In northern Britain, the poorest people ate oat porridge; in the Yangzi Delta, they ate wheat gruel[26]. In the limit, all income is spent on grain, and the consumer price index reduces to the price of grain. There is a long tradition in economic history of trying to shortcut the construction of a consumer price index by using the price of grain as a deflator and computing 'grain wages,' that is, the quantity of grain that someone could consume if all of the income was spent on grain. These indices can be defended as representing the world from the point of view of the very poorest people. Moreover, our European basket may be the result of the high incomes on that continent and may overstate the cost of living in Europe by including much more animal protein, for instance, than the Asian baskets include. That problem can be circumvented by comparing grain wages.

Figure 6 plots four selected series of wheat and rice prices in Europe and China all converted in grams of silver per kilogram. One surprising finding from figure 6 is that there is not much difference in cereal prices between China and Europe. Adam Smith claimed that "rice in China is much cheaper than wheat is anywhere in Europe."[27] This is one issue, however, on which the data do not support Smith's view. There is even less support to Smith's claim if we add that our Chinese grain prices plotted in figure 6 are more likely to be wholesale prices for the Lower

[26] Bozhong Li, *Agricultural Development*, p. 207, fn. 25.

[27] Smith, *Wealth of Nations*, p. 189.

Yangzi and Zhili regions, which are significantly lower than the retail urban prices in Beijing and Canton used in our Tables 4 and 5. If included in figure 6, Japanese rice prices in silver terms would be even higher than Chinese grain prices. All these factors seem to signify that in East Asia high relative grain prices – a well-known phenomenon for the twentieth century – may also have prevailed in the eighteenth century.

Insert Figure 6

Of course, the matter is somewhat more complicated than a simple comparison of wheat and rice prices since other grains were involved as well: Much more millet was eaten in Beijing than rice, rye rather than wheat was the staple grain in central Europe, and poor Europeans ate 'inferior' grains instead of wheat, which was something of a luxury. Scottish crofters, indeed, were subsisting on oatmeal porridge rather than white loaves made from wheat flour. The other grains need to be brought into the comparison as well as wheat and rice. Indeed, the rye consumers of Europe had the least expensive grain. A consideration of oats, the cheapest European food, would only further undermine Smith's claim. The question of relative differences in grain prices across Eurasia raises important issues of cross-national differences in agricultural productivity as well as distribution margins during the early modern period, a complete analysis of which is beyond the scope of this paper.

If grain price in Europe were relatively low, why was the overall cost of living higher in Europe than in Asia as shown in figure 4? The answer is that Europeans consumed their protein and calories in more refined, processed, and – ultimately – expensive ways. Europeans did not eat raw wheat. Instead, wheat was ground into flour, and the flour was baked into bread. Some of the wheat was lost in milling, and baking added significant value to the flour. These processes pushed up the cost of

calories and protein derived from wheat. Converting barley to beer and grapes to wine had a similar effect. Animal rearing is a notoriously inefficient way of extracting calories from the natural environment, and the processing of animal products (cheese making, for instance) further raised costs. In contrast, the milling of rice added little to its value, and small grains were often eaten as porridge in Asia. The latter was a very cheap process; although it was pursued by poor Europeans, too, it was not as common as in Asia. Food processing and the fact that a greater share of the budget went to the consumption of high-quality food was behind the high cost of living in Europe.

If so, by the metric of grain wages, the gap in living standards between northwest Europe and East Asia would even be wider than indicated by welfare ratios. This is confirmed from our data. While the welfare ratio in London is about 2.4 times of that in Beijing, the grain wage is 4.6 times for the same benchmark period of 1750.[28] These considerations again raise the question of the degree to which our spending baskets represent cultural preferences or economic necessity. Did the Chinese eat minimally processed food because they preferred it or because they were poor? If the latter is the case, our procedures understate the degree of their poverty.

Was the real income of unskilled labourers representative of average incomes in eighteenth and nineteenth-century Europe and East Asia? We know that wage labour – particularly short-term labour – was common in early modern China and Japan, although the precise proportion remains elusive. Moreover, if the labour

[28] Welfare ratios for London and Beijing for the 1750 period are 1.67 and 0.7 respectively. The grain wages for London and Beijing are 14.87 and 3.24 kg of grain per day respectively. The grain price for London refers to wheat, for Beijing to millet (from Table 4). Millet could be 20-30% cheaper than wheat. We do not have the retail wheat price for Beijing for this period. All averages are calculated using the 1745-1755 ten-year average.

market in eighteenth century China was as flexible as claimed by the revisionists,[29] there is all the more reason to believe that the wage rates we measure are representative of labour earnings across the economy. In this regard, the wage rate not only reveals the average earnings of a particular social-economic group but also serves as an indicator of the marginal productivity of labour in the economy as a whole.

We have focussed our comparison on the wage income of unskilled labourers. However, the wage regression and the twentieth century wages summarized by Gamble for Beijing all indicate that the ratio of skilled to unskilled wages was about the same in China as in northwestern Europe. While future research is needed, this evidence suggests that our conclusions about comparative living standards would hold true if the comparison was broadened to include all kinds of wage earners.[30]

6. Conclusion

Our investigation of Asian and European wages and prices shows that the situation was more complicated than Adam Smith suggested. Money wages in China were certainly lower than those in the advanced parts of western Europe in the eighteenth century, but wage levels were similar in China and the lagging parts of the continent. By the twentieth century, however, wages in all parts of Europe were higher than in China. The cost of living was almost always lower in China than in Europe where we have measured it. As with wages, living costs were much higher in the leading parts of Europe than in China, and Europe as a whole inflated more than

[29] See Pomeranz, "Great Divergence," chapter 2 for an argument on the flexibility of product and factor markets and labour migration in early modern China.

[30] Van Zanden, "The Skill Premium and the Great Divergence."

China at the end of the nineteenth century.

The upshot of the wage and price comparisons is that living standards were low in China. In the eighteenth century, advanced cities like London and Amsterdam had a higher standard of living than Beijing or Canton. The standard of living in the Chinese cities we have studied was on a par with the lagging parts of Europe, the Ottoman Empire, and Japan. By the twentieth century, enough progress had occurred in even the backward parts of Europe so that their standards of living exceeded that in China. Chinese regions like Sichuan were poorer still. There seems to have been a decline in the standard of living in China over the eighteenth and nineteenth centuries, but most of the difference between Europe and China in 1913 was due to European advance rather than Chinese decline.

In spite of the above, a major surprise is our finding that unskilled labourers in major cities of China and Japan – poor as they were – had roughly the same standard of living as their counterparts in central and southern Europe for the larger part of the eighteenth century. This calls into question the fundamental tenet of the large "Rise of the West" literature that sees Western Europe – as a whole – surpassing the Rest of the World in the early modern era. Our paper shows that it was only England and the Low Countries that pulled ahead of the Rest. The Rest, in this context, includes not only Asia but also much of Europe.

In this regard, Adam Smith neglected regional variation and, thereby, over-generalized the comparison of Europe and China. But our findings also dispute the revisionists' claim that the advanced parts of China such as Lower Yangzi were on a par with England on the eve of the Industrial Revolution. Our study has not explicitly compared wages and prices from urban centers in the Lower Yangzi region, but our data reveal that the Lower Yangzi wages for the unskilled labourers in government

construction projects, agriculture or other handicraft sectors did not stand out from the rest of China. Clearly, our database on China could be greatly improved and we do not claim to have given the final answer to this question. But newly discovered data would have to be very different from what is currently at hand to convince us that pre-industrial Chinese living standards were similar to those in the leading regions of Europe. In this regard, Adam Smith's pessimism looks closer to the truth than the revisionists' optimism.

Appendix I: Our Sources for Chinese Wages, 1686–1902

Official Wage Norms

Suzhou zizhao ju zhi (Treatise on the Suzhou weaving offices), 1686, by Sun Pei, the Director of the two Imperial Suzhou silk manufactures. It concerns organization, finance, and the production processes. Wages are mainly recorded as piece wages, but for the most qualified occupations time wages in form of monthly wages are given. Costs per loom and day and the annual total food provision costs for both Suzhou manufactures are also specified.[31]

Da Qing huidian shili (Collected statutes of the great Qing dynasty, with factual precedents). 1899, the most extensive set of rules and regulations issued by the central government. Economic topics are included if they concern the central government, such as the basic salary and wage system for public construction projects in the capital. They are mentioned for a time range between 1659 and 1736. The so-called "food-provision workers" received much lower money wages than the hired workers who were paid on a daily basis, but considerable food rations in grains.[32]

Wuliao jiazhi zeli (Regulations and precedents on the prices of materials). 1769 ff.

[31] The relevant parts on wages are included in Peng Zeyi, *Zhongguo jindai shougongye*, pp. 90-92. For a detailed analysis and complete translation of this text, see Elke Piontek-Ma, *Der Bericht von Sun Pei*.

[32] *Da Qing huidian shili shili* chap. 952, fol. 4b-5a, pp. 16640-16641.

These norms were set for all central provinces and for some of the border regions. The intention was to come to more realistic calculations of prices and wages in public building than those set in Beijing, since the inter-provincial and intra-provincial market prices of building materials and the market wages for artisans could vary considerably. According to the introductory memorial to these regulations, market prices and wages were investigated in the regions, and that the prices and wages quoted in these volumes were near to market prices at low market activity. The provincial editions for Zhili, Henan, Shandong, Shanxi, Shaanxi, Gansu, Jiangsu, Zhejiang, Guangdong, and Yunnan all carry the same introductory memorial dated 1769. Other editions have no preface, such as those for Hunan, which is a fragment, and "Manchuria" (Shengjing/Jilin/Heilongjiang). Two editions have editorial information suggesting that they are later compilations, such as the 1791 Sichuan and the 1795 Rehe edition. No special edition was ever compiled for Xinjiang, but a few Xinjiang data are mentioned in the Gansu, Sichuan, and Rehe editions.

Gongbu junqi zeli (Regulations and precedents on weapons and military equipment by the Ministry of Public Works), 1813. The Ministry for Public Work, in co-operation with the Ministry of War, was also responsible for the manufacture of armament and army equipment.[33] The 1813 regulations in their first half contain specifications of the quality and quantity of materials required for the manufacture of these items; in the second half (chap. 43-60), the prices of these materials and the wages of the respective manufacturing artisans, recorded by province.

Wages on the Free Market

Qingdai xingbu chao'an (Copies of archival materials from the Qing Ministry of Justice), ca c. 1740 to 1820, wage data extracted in Peng Zeyi, *Zhongguo jindai shougongye shi ziliao* (Materials for early modern Chinese craft history), vol. 1, pp. 396-414. This represents a wide-spread sample which includes scattered wages for different occupations, in

[33] Cf. You Zhanhong, "Lun junqi zeli," p. 314.

different regions, using different means of payment (silver tael or copper coins), covering different time periods (per day, month or year), and spread over a long period. The Ministry of Justice archival records are also the main sources used for agricultural wages presented in the works of Wei Jinyu and Wu Liangkai.

VOC. These are all accounts of ships visiting Canton in the period 1729-1772 (with gaps), specifying the goods bought there, workmen engaged etc. The details of the organization of the VOC in Canton are explained in Jörg, *Porcelain and the Dutch China Trade* pp. 21-73. We specifically used the files in the National Archives The Hague, Archives VOC, no: 4373, 4376, 4378, 4381, 4382, 4386, 4388, 4390, 4392, 4395-4401, 4403, 4405, 4408, 4409.

Appendix II. The Gamble Wage Series

The Rural Beijing Series

The wage series in Gamble, "Daily Wages" which spans almost the entire nineteenth century, was derived from detailed account books of a fuel store in rural Beijing. Gamble presented three series of average wages for the months of May through August, April through September and January through December respectively (p. 61). His careful study reveals the highly seasonal nature in the annual wage patterns which corresponded with the agricultural harvest season. We choose the annual average wage series (January through December) which is the lowest of the three as it includes the rates for the winter slack period. This wage series in copper cash is in the first column of the Appendix Table I below.

The original wage series are all quoted in copper cash. Since Gamble was mainly interested in constructing wage indices, he presented nominal and copper wage indices in Table 6 of his article without explicitly giving the copper-silver conversion rates. Moreover, due to a major debasement around 1860 and a corresponding change of monetary account in the fuel store account books, Gamble broke his silver and copper wage indices at 1860, setting 1845 as a base 100 for the pre- and post-1860s respectively. Thus, it is possible to

derive the index – not the actual rate – of copper-silver exchange from his copper and silver wage indices.

On p. 44 and 69, Gamble did mention the actual silver-copper rates in numbers of *tiao* (copper cash) per silver tael for selected years of 1807, 1827, 1862, 1884 and so on. So our procedure for arriving at a consistent series of copper-silver rates for the nineteenth century is to combine these benchmark copper-silver exchange rates with the derived copper-silver exchange indices.

But a major hurdle is to interpret the value of *tiao*, which usually contains 1,000 copper coins but could vary by regions. On p. 44, Gamble remarked that a *tiao* in that location was equal to 500 copper cash before 1860 and 100 copper cash after 1860. In other words, the copper cash before 1860 circulated in that locality was only half of the value of the official cash. This seems to be corroborated by one of the other rare studies of prices and exchange rates by Yan Zhongping et al.[34] Yan and his associates derived the exchange rate series (1807-1850) from the account books of a merchant store located in Daliu zhen of Ningjin County in Hebei province, about three hundred kilometres from Beijing. In a footnote to their exchange rate table (Table 31 on p. 38), the authors pointed out that value of two copper cash was counted as one. We also compared the copper-silver exchange series of the Yan series and our implicit Gamble series and found that their trends are nearly identical.

Despite their footnote, Yan et al. derived their copper-silver series based on the standard rate of one *tiao* equal to 1,000 cash. Our copper-silver exchange rate series in the second column is similarly derived with the standard of one *tiao* equal to 1,000 cash. Thus, the silver wages in tael in the third column of our Appendix are actually twice higher than the level if we use the one *tiao* equal 500 cash as suggested by Gamble. As Gamble stated on p. 41 that workers were also given food, we adhere to this high silver wage for that locality by assuming the inclusion of additional food allowance equivalent to half of the value of total wage payment.

[34] Yan Zhongping et al., *Zhongguo jindai jingjishi.*

Appendix Table I. The Gamble rural Beijing wage series in copper cash and silver tael, 1807-1902

	Copper wages	Copper/ silver conversion	Silver wages in tael		Copper wages	Copper/ silver conversion	Silver wages in tael
1807	81	979	0.083	1860	255		
1808	83	1,020	0.081	1865	265	5,180	0.051
1812	81	1,078	0.075	1870	287	5,576	0.051
1813	80	1,067	0.075	1871	333	5,892	0.057
1816	87	1,129	0.077	1872	355	6,170	0.058
1817	80	1,123	0.071	1873	382	6,383	0.06
1818	89	1,106	0.081	1874	388	6,611	0.059
1819	87	1,183	0.074	1875	389	6,681	0.058
1820	95	1,159	0.082	1876	370	7,446	0.050
1822	99	1,203	0.082	1877	368	8,325	0.044
1824	83	1,208	0.069	1878	348	8,314	0.042
1825	88	1,192	0.074	1879	375	8,342	0.045
1827	88	1,265	0.070	1880	410	8,510	0.048
1829	95	1,294	0.073	1881	401	8,341	0.048
1830	96	1,329	0.072	1883	387	7,154	0.054
1831	92	1,346	0.068	1884	356	6,722	0.053
1832	89	1,347	0.066	1885	395	7,573	0.052
1835	94	1,251	0.075	1886	402	6,950	0.058
1836	85	1,378	0.062	1887	395	7,024	0.056
1837	96	1,488	0.065	1888	361	7,883	0.046
1838	91	1,553	0.059	1889	421	7,314	0.058
1841	98	1,382	0.071	1890	393	7,254	0.054
1842	100	1,439	0.070	1891	390	7,627	0.051
1845	86	1,823	0.047	1892	372	7,651	0.049
1846	96	2,010	0.048	1893	410	7,212	0.057
1847	87	2,013	0.043	1894	443	6,722	0.066
1848	68	2,049	0.033	1896	448	6,501	0.070
1849	80	2,046	0.039	1900	422	5,312	0.079
1850	94	1,997	0.047	1901	462	5,758	0.080
1852	93	2,018	0.046	1902	470	6,079	0.077
1853	93	2,205	0.042				
1854	90	2,723	0.033				
1856	110	4,970	0.022				
1857	105	3,935	0.027				
1858	130	4,970	0.026				

The Urban Beijing Series

The urban Beijing wages series by Gamble is composed of two parts. The first part is the 1870-1900 the copper cash wages (inclusive of food money) in Gamble (1943, p. 66), converted to silver wages using copper-silver rates from Peng Xinwei (p. 548). We use the Peng Xinwei series as we assume that it may be closer to the rates in urban Beijing. The

second series is the 1900-1924 series by Meng and Gamble (p. 100).

Appendix III. Sources of Chinese Prices

Beijing

Our series of prices for Beijing begin with Meng and Gamble's study of wages and prices in Beijing between 1900 and 1924. For that period they collected the retail prices of most elements of our basket detailed in Table 4. We abstracted the following series (Meng and Gamble, "Wages, Prices, and the Standard of Living," pp. 28, 38-9, 51, 59): wheat flour, lao mi (blackened rice), bean flour,millet,corn flour,pork, sweet oil, peanut oil, foreign cloth and coal balls.

We treated 'sweet oil' as 'edible oil' in our scheme and 'peanut oil' as 'lamp oil.' Coal balls were two thirds coal dust and one third earth, and we converted the price to an energy basis by rating a kilogram of coal balls at two thirds of the energy content of coal, which was itself rated at 27,533 BTU's per kilogram.

To estimate the price of soybeans for 1900-1908, we increased the wholesale price per kilogram of black beans by 50% to allow for trade mark-ups and quality differences. The wholesale price was derived from Lillian Li, "Grain Prices," as will be explained. For 1909 onwards (when the Li series ends), we extrapolated the1908 price forwards based on Meng and Gamble's price series for bean flour.

We had no information on the price of candles, and we assumed their price was the same as that of lamp oil. Based on European precedents, we estimated the price of soap at half of the price of lamp oil.

Our next problem was to extend these series back to the pre-industrial period. It should be noted that in several important respects, Meng and Gamble's data were ideal: they were retail prices of goods that consumers actually bought. In contrast, many historical price series are wholesale prices of intermediate goods. Thus, Meng and Gamble recorded the price of wheat flour in a shop, while historians usually must make do with the price of unprocessed

wheat in wholesale markets.

We tried to take advantage of these ideal features of Meng and Gamble's data in the following way. There are many studies of wholesale grain markets in China. We used Lillian Li's study of grain prices in Zhili province, which includes Beijing. From the graphs in her paper, we could read off the prices of wheat, millet, sorghum from 1738 to 1908 as well as the relative price of black beans to wheat. These were five-year moving averages, so annual fluctuations are suppressed, but that is of little consequence for our study.[35] With these series we extrapolated the retail prices of wheat flour, millet, corn flour, bean flour, and soybeans back to 1738. Our extrapolated series are linked using the average of 1901-04 as our base period. This procedure assumes that the ratio of the retail price of the consumer good to the wholesale price of the unprocessed good remained constant.

The retail prices of other products were extrapolated back to 1738 as follows:

Meat, edible oil, lamp oil, candles – using the price of wheat flour based on the benchmark period of 1901-04 for meat (the average price of pork and mutton), and 1902 for the rest.

corn flour – using the price of sorghum based on 1901-04 benchmark;

rice (lao mi) – using the price of rice in the Yangzi Delta (Wang, "Secular Trends", pp. 40-47), based on 1901-04 benchmark.

Two things can be said in favour of these extrapolations. First, most of the long term agricultural time series inflate at the same rate, so the values projected back into the eighteenth century do not depend critically on which price series is used for the extrapolation. Second, we can check the extrapolations by comparing the values we obtain in the eighteenth century for prices recorded in the VOC records for Canton. The extrapolated prices are similar to prices paid then. This gives us some confidence in our procedure.

The price series of cotton cloth was pieced together from several sources. First, the

[35] Professor Li kindly supplied us with some of the underlying series, which we used in preference to the graphed data.

Beijing retail price of foreign cloth was projected back to 1871 using Albert Feuerwerker's series of the price of cotton cloth imported into China.[36] Imported cloth was measured in pieces which were usually 40 yards long by 1 yard wide (360 square feet). Meng and Gamble's price was the price per hundred feet. We interpret that to mean 100 linear feet from a bolt of cloth, which we assume was three feet wide – a typical width. On those assumptions, the retail price per square foot of foreign cloth in Beijing was about 50% more than the price at which it was landed. This is not an unreasonable markup.

For eighteenth century cloth prices, we reasoned as follows: Pomeranz, who discussed cloth prices and weaving incomes at length estimated the price in his low price scenario at 0.5 tael per bolt.[37] On these assumptions 300 square feet of cloth were worth 4.59 tael, and we interpret this as the eighteenth-century counterpart to Meng and Gamble's price for a 100 foot length of a piece of cloth three feet wide. Pomeranz claimed that cloth prices remained constant over the eighteenth century, and we have assumed the same.[38]

For the years between 1800 and 1870 we were guided by the history of cloth prices in Indonesia. We have a series of the price paid for cotton cloth on Java from 1815 to 1871. From 1815 to 1824, the price was 4.89 grams of silver per square meter, which compares to a Chinese price of 5.12 grams per square meter for the eighteenth century. This correspondence is reassuring since cotton cloth was traded across Asia, so we would not expect extreme differences in its price. Starting in the1830s, the price in Java dropped fairly quickly to a value of about 2.5 grams of silver per square meter and stayed at that level until 1871. That low price is like the value of cloth imported into China – 2.36 grams of silver per square meter in 1871. We have assumed that cloth prices in China followed the same temporal

[36] Feuerwerker, *Handicraft and Manufactured Cotton*, p. 344.

[37] Pomeranz in *Great Divergence*, p. 319 decided that a cloth of 16 chi length cost 0.4 tael. According to Bozhong Li, *Agricultural Development*, p. xvii, a bolt of 20 chi had 3.63 square yards. Hence, the price of cloth was 0.5 tael per bolt.

[38] Pomeranz, *Great Divergence*, p. 323.

pattern as those in Java: we continued the eighteenth-century price derived from Pomeranz to 1830 and then interpolated prices linearly between 1830 and 1871.

The price of energy was also combined from diverse sources. For 1739-1769, we used the price implied by charcoal prices in Zhili province in the 1769 *Wuliao jiazhi zeli*. For 1816, we used the price implied by the price of coal in Beijing given in Timkovski, *Voyage à Péking*, p. 200. From 1900 onwards, we based our energy price on the price of coal balls. One of the striking features of this scattered information is that they should give a fairly constant price of energy. In view of that constancy, we interpolated values for missing years.

We do not have price of alcohol for China. We used the Japanese data which shows that 1 litre of sake equal to 1.31 kg of rice (based on Mitsui Bunko). This ratio is applied to Beijing, Canton and Sichuan with the assumption that processing technology of rice wine was similar in China and Japan.

Canton

For Canton, we used two benchmarks. The first benchmark is based on VOC data as displayed in Table 6 in the text (for VOC data source, see Appendix I). The second benchmark price is for 1927, based on *The Reports of Statistics* compiled by the Department of Peasantry and Labour, Kwangtung Government in 1928; it covers the period of 1911 to 1927.

Sichuan

Our wage and price information is from the reprint of the 1928 Hejiang County Gazetteer, which was also used by Chuan and Wang in *Jindai Sichuan.* As the rice price in the gazetteer seemed implausibly high, we replaced it with import prices from Hsiao Liang-lin, *Chinese Foreign Trade Statistics*, which are likely to be at the lower end of the national price level. Below is the basket price and nutrient composition.

Appendix Table II. Basket of goods: Sichuan prices in 1905

	Quantity per person per year	Price in grams silver per unit	Spending share in %	Nutrients/day Calories	Nutrients/day Grams of protein
Beans	5 kg	3.27	2.7	46	3
Meat	10 kg	3.45	5.8	68	5
Soy beans	42 kg	3.27	23.0	479	42
Rice	95 kg	1.74	27.7	942	20
Wheat flour	25 kg	1.74	7.3	232	9
Edible oil	1 l	4.13	0.7	24	0
Rice wine	41 l	2.28	15.7	151	1
Soap	2.6 kg	2.07	0.9		
Cotton	5 m	7.96	6.7		
Candles	2.6 kg	4.03	1.8		
Lamp oil	2.6 l	4.03	1.8		
Fuel	3.0 M BTU	2.22	1.1		
Rent		28.6	4.8		
TOTAL		595.6	100.0	1,943	80

(1) Prices for 1 kg of wheat and millet are set equal to 100% and 80% of the price of 1 kg rice.

(2) price of soybeans proxied by the price of yellow beans.

(3) Fuel is burning wood (2.31 BTU per 100 kg).

Kyoto and Edo-Tokyo

We use two separate benchmarks; for the first benchmark 1745-54 prices are for Kyoto 1745-54 are from Mitsui Bunko; see Bassino and Ma, "Japanese Unskilled Wages." The second benchmark is for 1915, which is based on price data in Tokyo reported in Ohkawa et al., *Nihon chōki keizai tōkei*, covers the period from 1880 to 1925.

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Map 1. Wage levels for skilled labour in public construction according to *Wuliao jiazhi zeli*

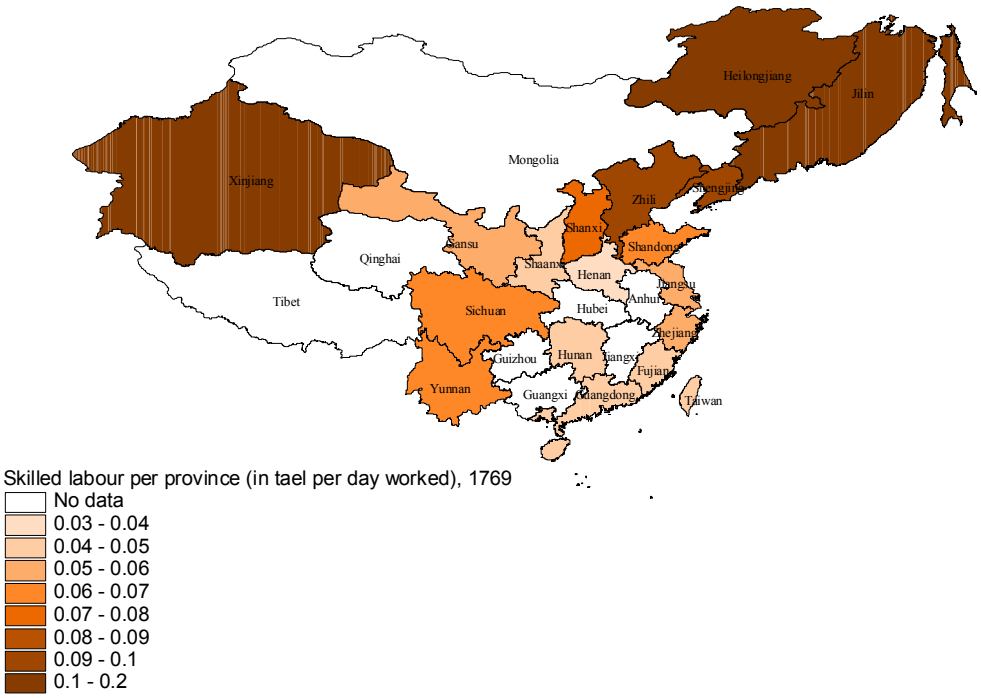


Table 1. Nominal wages of workers in public construction, 1769-1795, and in arms manufacture, 1813 (in tael per day)

	Construction unskilled	Construction skilled	N=	Arms manufacture (unskilled)	Population (millions in 1787)
Manchuria and the Northwestern frontier					
Heilongjiang	0.100	0.191	2/6		
Jilin	0.095	0.160	6		1.0***
Shengjing	0.057	0.100	13		
Xinjiang	0.097	0.110	3		.5?
North					
Rehe*	0.066	0.120	7		
Beijing*	0.077	0.141	24		
Tianjin/Baoding*	0.071	0.112	34		23.0****
Residual Zhili*	0.054	0.081	82	Zhili 0.060	
Gansu	0.044	0.054	48		15.2
Shanxi	0.054	0.073	85	0.040	13.2
Shaanxi	0.044	0.050	74	0.040	8.4
Shandong	0.045	0.061	50	0.040	22.6
Middle					
Henan	0.037	0.039	106	0.040	21.0
Jiangsu**	0.040	0.051	63	0.040	31.4
Zhejiang**	0.040	0.060	63	0.040	21.7
Hunan	0.039	0.050	10	0.040	16.2
Hubei				0.040	
Jiangxi				0.030	
Guizhou				0.040	
Sichuan	0.048	0.062	47	0.040	8.6
Yunnan	0.048	0.068	84	0.030	3.5
South					
Fujian (including Taiwan)	0.030	0.050	9	0.040	12.0
Guangdong	0.040	0.050	89	0.040	16.0
Guangxi				0.040	
Average (unweighted)	0.053	0.081			
Average (weighted by N)	0.047	0.065	901/905		
Average (weighted by population)	0.044	0.060			214.5

* part of the province of Zhili (there are separate regulations for Rehe)

** Yangzi Delta

*** Manchuria as a whole

**** Zhili as a whole

N number of districts for which data are available

Sources for wages: *Wuliao jiazhi zeli* and *Gongbu junqi zeli*, see appendix I and the text; for population data, Wang Yeh-chien, *Land Taxation*, p. 87.

Table 2. Wage regressions for eighteenth-century China, standardized on the daily wage of an unskilled construction labourer in the Yangzi Delta in 1769 (in tael)

	Regression 1	Regression 1	Regression 2	Regression 2
	Coefficient	T-value	Coefficient	T-value
Constant	0.0456	4.00	0.0270	2.86
Trend	-0.0000351	-0.348	0.000125	1.50
Manchuria	0.0902	6.73	0.0831	7.50
Zhili(incl.Beijing)	0.0441	4.36	0.0397	4.74
North	0.0132	1.397	0.0089	1.15
Middle	-0.0022	-0.026	0.0011	0.15
South	-0.000593	-0.056	-0.0029	-0.33
Canton	0.0379	3.55	0.0583	5.50
Skilled	0.0295	4.79	0.0278	5.46
Regulated	-0.0171	-2.21	0.0084	1.31
Iron Industry	0.0092	1.12	-0.0085	-1.25
Coal mining	-0.0093	-0.83	-0.0116	-1.25
Agriculture	-0.0072	-0.744	0.0050	0.52
Textiles	0.0403	3.22	0.0275	2.55
Other	-0.0147	-1.93	-0.0170	-2.60
R^2	0.408		0.452	
F (14,312)	15.34**		19.11**	
N	327		327	

** Significant at 1 percent.

Table 3. Basket of goods: Northern Europe

	Quantity per person per year	Price in grams of silver per unit	Spending share in %	Nutrients/day Calories	Nutrients/day Grams of protein
Bread	182 kg	0.693	28.9%	1223	50
Beans/peas	52 l	0.477	5.7%	160	10
Meat	26 kg	2.213	13.2%	178	14
Butter	5.2 kg	3.470	4.1%	104	0
Cheese	5.2 kg	2.843	3.4%	53	3
Eggs	52	0.010	1.3%	11	2
Beer	182 l	0.470	19.6%	212	1
Soap	2.6 kg	2.880	1.7%		
Cotton	5 m	4.369	5.0%		
Candles	2.6 kg	4.980	3.0%		
Lamp oil	2.6 l	7.545	4.5%		
Fuel	5.0 M BTU	4.164	4.8%		
Rent			4.8%		
TOTAL		414.899	100.0%	1941	80

Note:

(1) Where oil and wine were consumed instead of butter and beer, 5.2 litres of olive oil were substituted for the butter and 68.25 litres of wine for the beer. 5.2 litres of olive oil yields 116 calories per day and no protein; 68.25 litres of wine gives 159 calories per day and no protein.

In Strasbourg, the average prices 1745-54 were 7.545 grams of silver for olive oil and 0.965 grams of silver for wine.

(2) M BTU = millions of BTUs

(3) Prices are in grams of silver per unit. Prices are averages for Strasbourg in 1745-54. The total shown in the price column is the total cost of the basket at the prices shown.

Table 4. Basket of goods: Beijing (1745-1754)

	Quantity per person per year	Price in grams of silver per unit	Spending share in %	Nutrients/day Calories	Nutrients/day Grams of protein
Beans/peas	15 kg	1.053	4.1	139	9
Eggs	52	0.047	0.7	11	1
Meat	15 kg	2.61	10.1	103	8
Soy beans	27 kg	0.833	5.8	308	27
Rice	5 kg	1.418	1.8	50	1
Wheat flour	40 kg	1.374	14.1	372	15
Millet	38 kg	1.029	10.1	362	11
Corn flour	43 kg	0.665	7.3	425	8
Edible oil	1 l	3.983	1.0	24	0
Alcohol (20°)	41 l	1.86	19.7	151	0
Soap	2.6 kg	1.644	1.1		
Cotton	5 m	6.109	7.9		
Candles	2.6 kg	3.286	2.2		
Lamp oil	2.6 l	3.286	2.2		
Fuel	3.0 M BTU	11.133	8.6		
Rent		19.7	5		
TOTAL		394.6	100.0	1944	80

Note: See Appendix III for sources; the price of eggs is estimated assuming the same ratio of egg price to rice price as in VOC data for Canton (33 eggs for one kg of rice).

Table 5. Basket of goods: Canton (1757)

	Quantity per person per year	Price in grams of silver per unit	Spending share in %	Nutrients/day Calories	Nutrients/day Grams of protein
Meat	16	2.447	8.6	110	9
Eggs	52	0.042	0.5	11	1
Soy beans	38	0.856	7.2	433	38
Rice	107	1.407	33.1	1061	22
Wheat Flour	14	1.407	4.3	130	5
Fish	7	2.753	4.2	25	4
Edible oil	1	3.365	0.7	24	0
Alcohol (20°)	41	1.407	16.6	151	1
Soap	2.6	1.682	1.0		
Cotton	5	6.109	6.7		
Candles	2.6	3.365	1.9		
Lamp oil	2.6	3.365	1.9		
Fuel	3	8.799	5.8		
Rent		22.607	5%		
TOTAL		443.3.0	100.0	1945	80

Note: Based on VOC prices in 1757 (see Appendix III), assuming 20 eggs per kg; the price for meat is based on VOC data for beef; the prices of wheat and millet are proxied as 100% and 80% of the rice price, respectively; the price of edible oil is proxied by the lamp-oil price; the price of cotton is the Beijing price in 1745-1754.

Table 6. Basket of goods: Kyoto (1745-1754)

	Quantity per person per year	Price in grams of silver per unit	Spending share in %	Nutrients/day Calories	Nutrients/day Grams of protein
Meat	2 kg	4.90	2.1	14	1
Eggs	52 pieces	0.22	2.5	11	1
Soy beans	48 kg	1.49	15.5	547	48
Rice	98 kg	1.49	31.6	972	20
Barley	8 kg	0.76	1.3	76	2
Buckwheat	15 kg	0.60	2.0	141	5
Fish	3 kg	2.18	1.4	11	2
Edible oil	1 l	5.66	1.2	24	0
Rice wine	41 l	1.95	17.3	151	1
Soap	2.6 kg	2.82	1.6		
Cotton cloth	5 m	5.83	6.3		
Candles	2.6 kg	5.66	3.2		
Lamp oil	2.6 l	5.66	3.2		
Fuel	3.0 M BTU	9.34	6.1		
Rent		22.2	4.8		
TOTAL		462.4	100.0	1947	80

Note: See Appendix III for sources. The prices for eggs and meat (weighted average price of

poultry 0.5 kg, beef 0.5 kg, and pork 1 kg) are extrapolated from data reported for 1915 in Ohkawa et al., *Nihon choki keizai tokei*, by relying on a CPI for 1740-1915 using unit prices for rice, soy sauce, soy paste, sake and charcoal. Fuel is charcoal.

Table 7. Caloric and protein contents

	Unit (metric)	Calories per unit	Grams of protein per unit
Bread	Kg	2450	100
Beans/peas (Europe)	Litre	1125	71
Beans (Asia)	Kg	3383	213
Meat	Kg	2500	200
Butter	Kg	7268	7
Cheese	Kg	3750	214
Eggs	Kg	79	6,25
Beer	Litre	426	3
Soy beans	Kg	4160	365
Rice	Kg	3620	75
Wheat flour	Kg	3390	137
Barley	Kg	3450	105
Millet	Kg	3780	110
Buckwheat	Kg	3430	133
Corn flour	Kg	3610	69
Fresh fish	Kg	1301	192
Edible oil	Litre	8840	1
Alcohol (20°)	Litre	1340	5

Sources: The caloric and protein content are based on Allen (2001) for bread, beans/peas consumed in Europe (fresh with pods, measured in litre), meat, butter, cheese, eggs, and beer. For other items, we relied on US Department of Agriculture (USDA: National Nutrient Database for Standard Reference, http://www.nal.usda.gov/fnic/foodcomp/cgi-bin/list_nut_edit.pl).

Figure 1. Daily wage of unskilled workers, 1720-1870
(grams of silver per day)

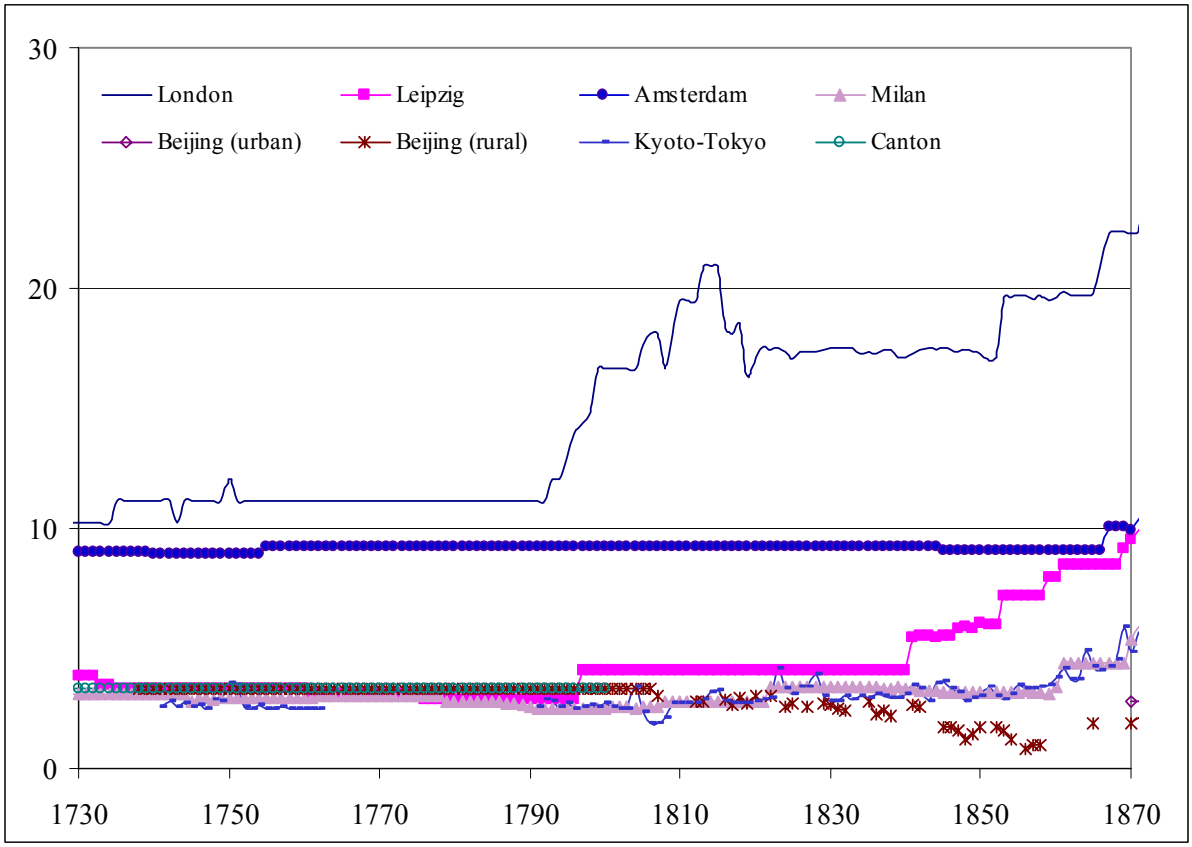


Figure 2. Daily wage of unskilled workers, 1870-1920
(grams of silver per day)

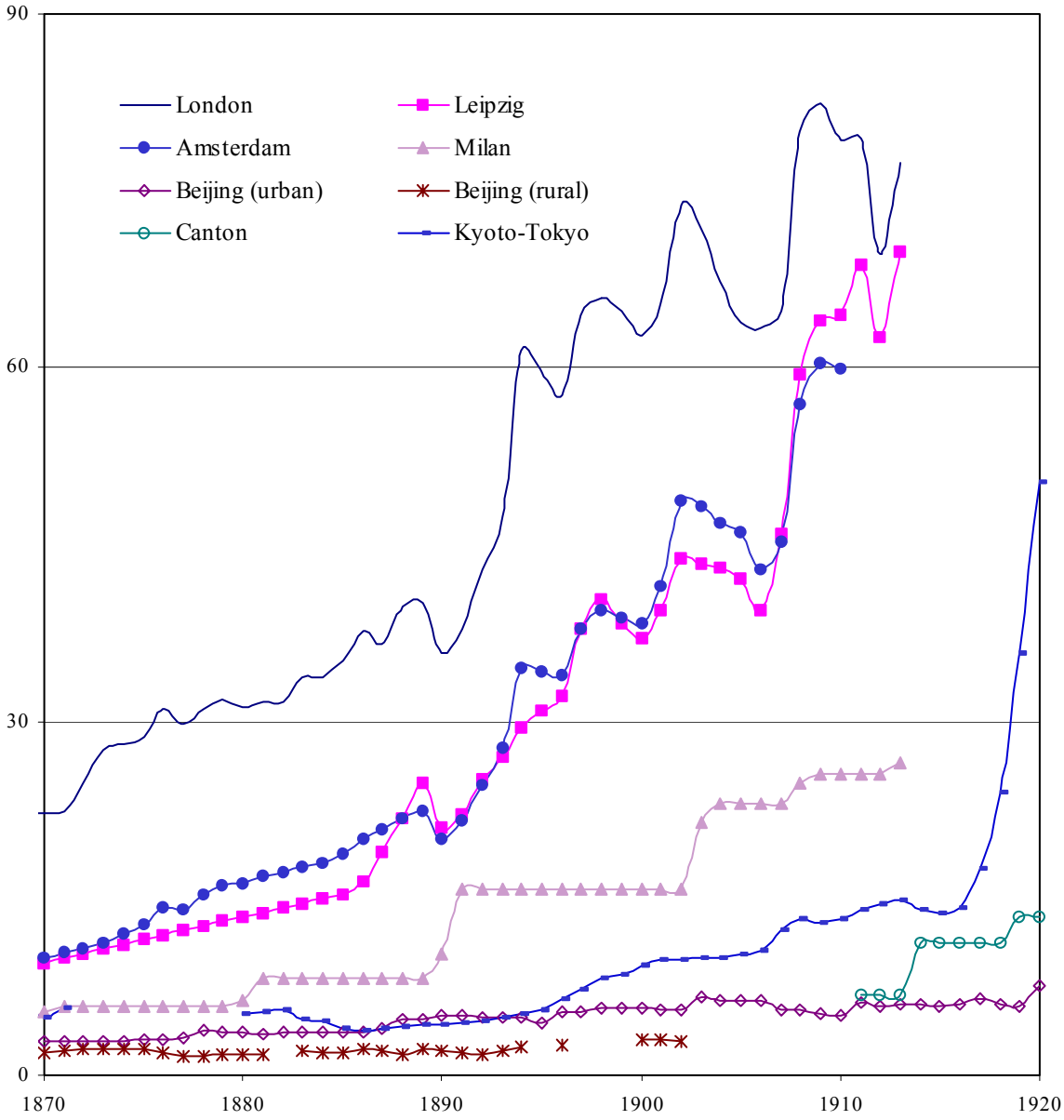
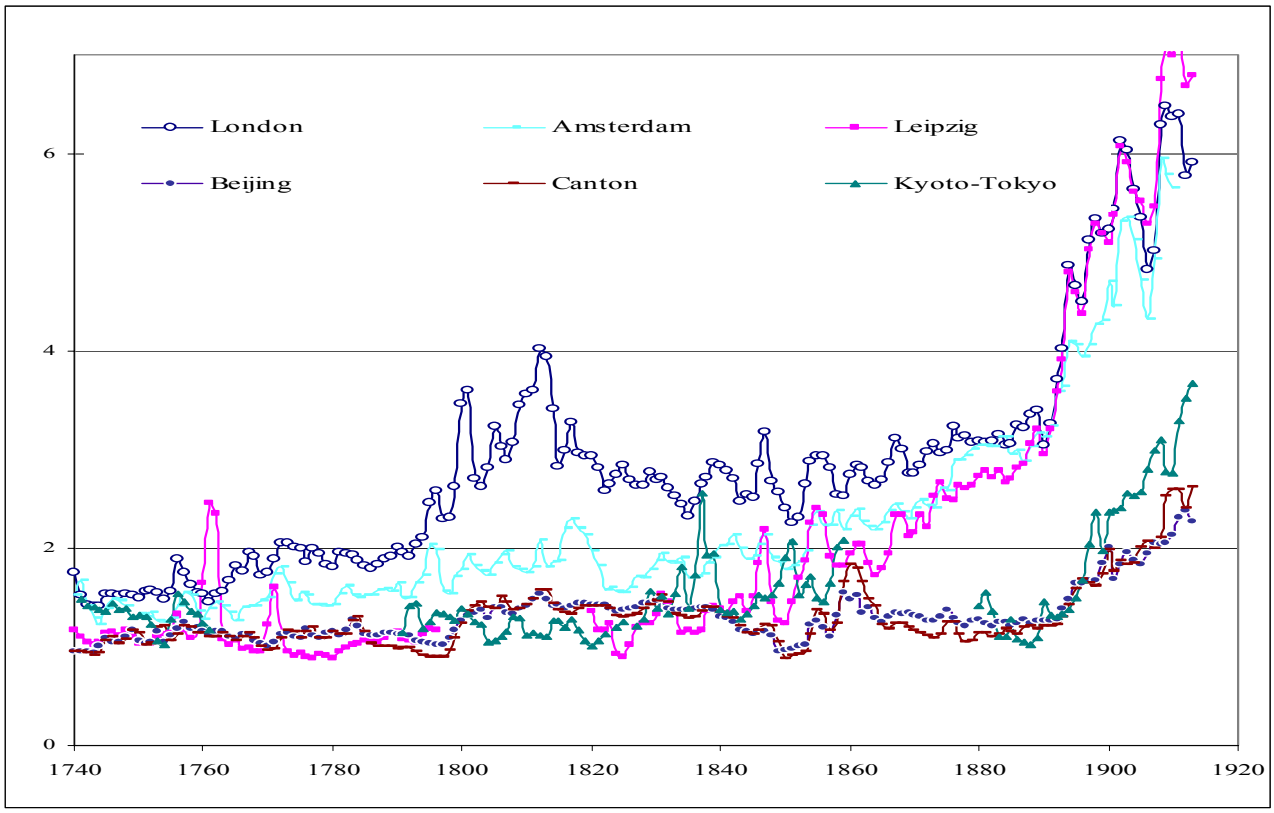


Figure 3. Costs of standard basket, 1740-1913
(grams of silver per day)



Notes: We omitted the price index for Milan to enhance better viewing of graph

Figure 4. Welfare Ratios in Europe and Beijing

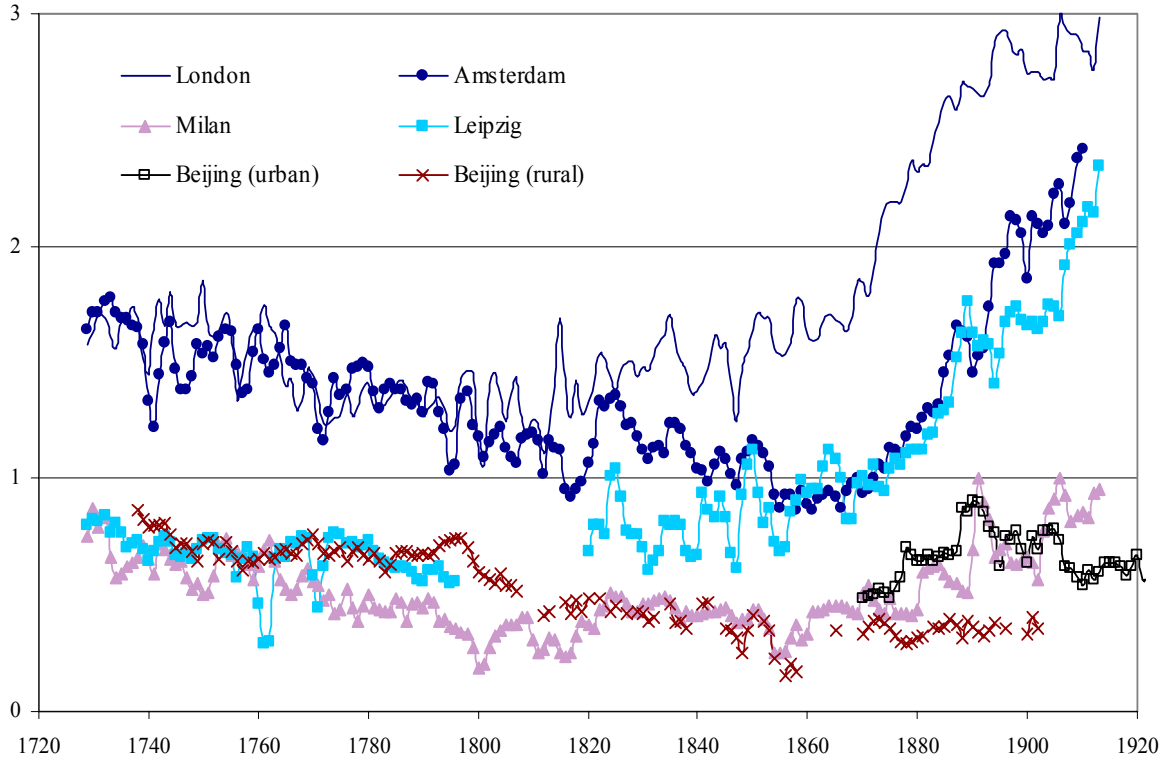


Figure 5. Welfare ratios in London and Asia

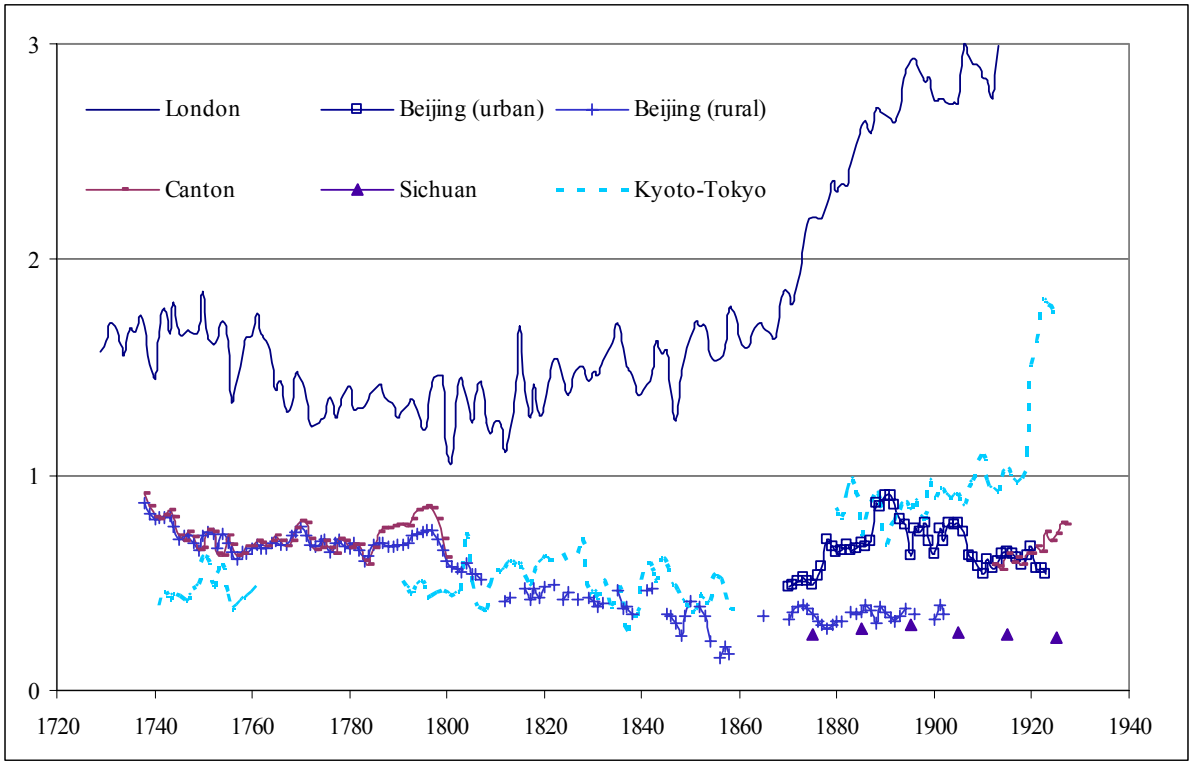
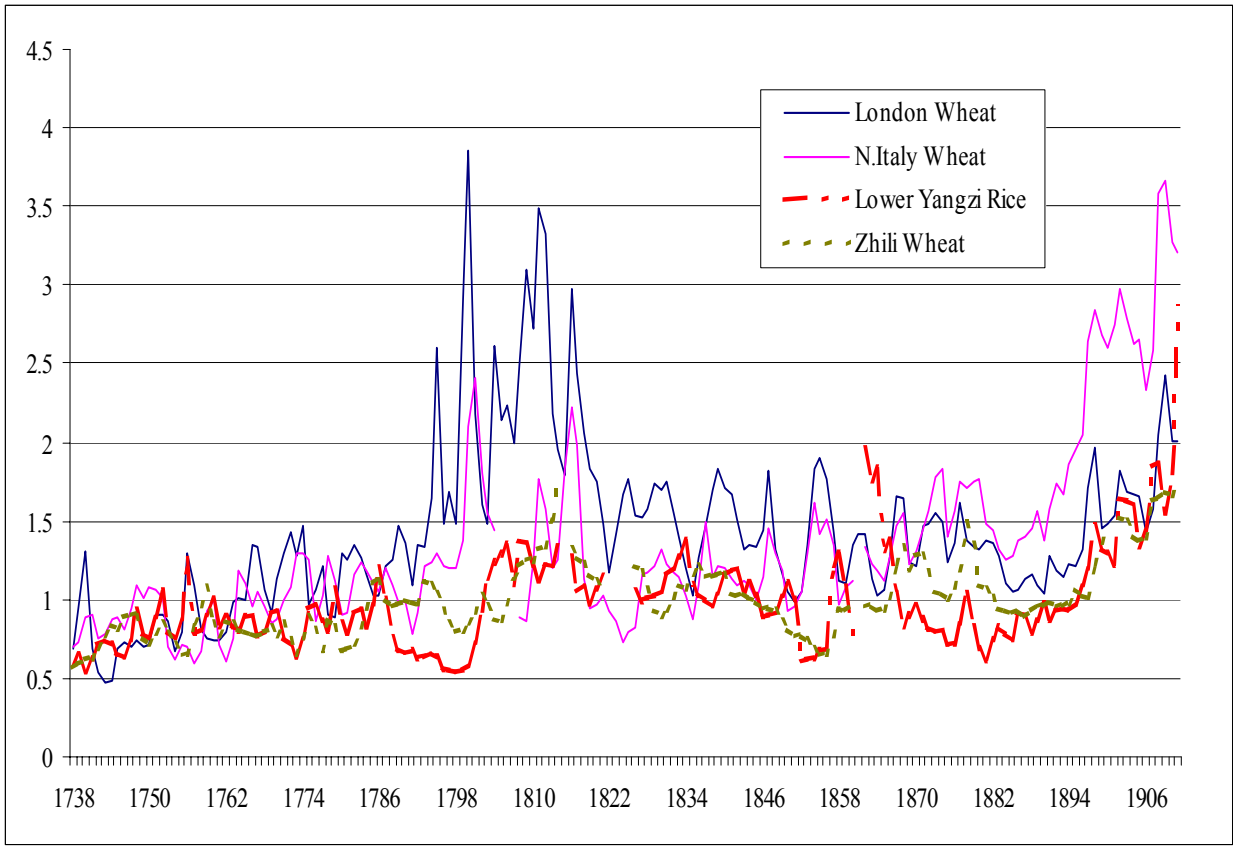


Figure 6. Grain prices in China and Europe (grams of silver per kilogram)



Sources: Lower Yangzi rice price and Zhili wheat price from Lillian Li, "Integration and Disintegration." European prices from Allen (2001).