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JAPANESE UNSKILLED WAGES IN INTERNATIONAL PERSPECTIVE, 1741–1913

Jean-Pascal Bassino and Debin Ma

ABSTRACT

Constructing consumption baskets for the benchmark periods 1745–1754 and 1882–1886, and price indices, we calculate real wages for Japanese unskilled daily laborers in 1741–1913. Matching caloric content and protein contents in our Japanese consumption baskets with those for Europe, we compare Japanese and European urban real wages. Real wages in Kyoto and later Tokyo are about a third London wages but comparable to wages in major Southern and Central European cities for 1700–1900. In Japan, wages are substantially higher in the Meiji period than in the Tokugawa period. These findings have implications for the debate on conditions in Europe and Asia on the eve of the Industrial Revolution.

1. INTRODUCTION

How rich or poor was Japan before she embarked on the path of modern economic growth following the Meiji Restoration (1868)? Intellectual interest in this question, often in curious synchronism with the tempo of the

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post-War Japanese economic miracle, surged up to the 1980s, and since then, has eased into rational retrenchment. The pre-War pessimist consensus that Tokugawa Japan was an extremely backward society has been dispelled – a victory for the so-called optimists. But the optimists' subsequent claim that 19th century Japanese living standards could have been comparable to or higher than contemporaneous Northwestern Europe may represent an overreach.¹ Two recent assessments of this debate have been far more cautious, giving the 1700–1870 Tokugawa economy a slow but positive 0.1 percent and 0.15 percent growth rate in real wages and per capita GDP respectively, yielding a purchasing power parity (PPP) adjusted to 1870 Japanese per capita income at slightly less than a quarter of that of the British level.²

Per capita GDP estimates for Tokugawa Japan have been, as most scholars agree, highly tentative.³ Yet, studies compiled in the past few decades utilizing the far richer Tokugawa prices and wages data have focused almost exclusively on constructing real growth trends over time, rather than absolute levels across nations. This is not surprising in view of the formidable methodological issues that confound international comparisons even for the contemporary period.

Recent path-breaking works by Robert Allen (2001, 2005), which use standard caloric and protein intake from consumption baskets as a benchmark for inter-regional and international comparison, have charted the trends and levels of five centuries of real wages across Europe. Ozmucur and Pamuk (2002) and van Zanden (2003) have extended this line of work beyond Europe. Allen (2005) makes a preliminary attempt to extend his real wage comparisons to Japan, India, and China. Given data and other constraints, however, his calculation of the purchasing power of Japanese real wages (1741–1913) relies on backward projection from the 1882 benchmark year and the use of an Indian consumption basket, both of which, we will show, incur serious index number problems.

This article adopts Allen's methodology for calculating real wages but utilizes actual 18th and 19th century Japanese wage and price data compiled by generations of Japanese scholars and reconstructed consumption baskets based on historical information on 18th and 19th century Japanese consumption patterns. As our Japan–Europe real wage comparison hinges on the caloric and protein contents in their respective consumption baskets, this current study largely focuses on the comparative purchasing powers of unskilled laborers, leaving the comparative studies for skilled laborers or high-income groups to future research that would need to confront more sophisticated issues of cross-national utility and welfare comparison.

Our study reveals that the real wages for Japanese unskilled laborers in Kyoto and Tokyo for the Tokugawa period are roughly a third of the London level but comparable to cities in contemporaneous Southern and Central Europe. We also show that our 1882–1886 benchmark Meiji real wage series is nearly double that of the 1745–1754 benchmark Tokugawa series. With warnings on the limitations of real wage comparisons, this current study seems to lend some tentative support to the view that the pre-Meiji Japanese initial conditions, while not reflecting abject poverty, may not have been much more favorable than other developing countries such as Turkey or Java (Indonesia) as revealed in the studies by Ozmucur and Pamuk (2002) and van Zanden (2003). On the other hand, our finding of a discontinuous jump in real wages between late Tokugawa and Meiji periods raises new doubts about the prevailing view of a stagnant real wage profile for this transition period.

The rest of the paper is organized into four sections. Section 2 briefly discusses the results obtained in previous studies; Section 3 constructs the Japanese consumption baskets; Section 4 presents the main result of our international comparison; and Section 5 summarizes the main findings with a discussion.

2. PRICE AND WAGE SERIES DATA

Research on wage and price series for Tokugawa Japan has been a thriving and productive enterprise in the last several decades.⁴ For the 17–19th centuries, there are several series of nominal wages (Umemura, 1961; Saito, 1978) summarized in a recent book and article by Saito (1998, 2005). One series is for the unskilled day laborers for the Kyoto and Tokyo area for 1741–1867, contained in the Mitsui company records (Mitsui Bunko, 1989). Another series, originally constructed by Sano (1962), is the craftsmen's wages for the Kanto area for 1818–1894. Then there is the more comprehensive wage series compiled by the *Long-Term Economic Statistics* (LTES) project. This LTES series starts at 1880 and links to the present (Ohkawa et al., 1967). There are also available several consumer price indices and other deflators that have been used to derive real wage indices. Clearly, these are disparate real wage series differing in labor quality, definitions, and regions. The real wage series from Mitsui Bunko ends in the 1860s while the LTES series begins in 1885, leaving the 1868–1884 period – the period that saw Japan's historically unprecedented economic and political revolution – in a statistical abyss.

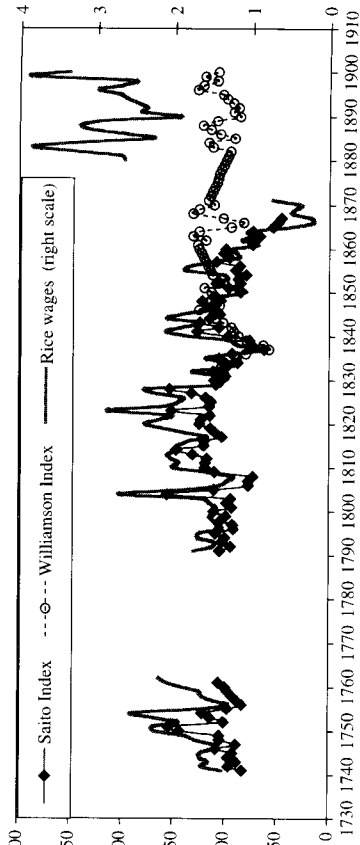


Fig. 1. Real Wage Indices and Rice Wages in Japan, 1741–1913. *Notes:* Saito Index and Williamsson Index (1831 = 100, left scale); rice wages in kilograms of rice per day (right scale). The missing data for the period of 1762–1790 in the Mitsui Bunko records could possibly be due to the loss of archival material. Nominal wages data, which are missing for 1881, 1888–1891, and 1893 in the LTES series, have been interpolated. *Sources:* Rice price and nominal wages in Kyoto up to 1871 (Mitsui Bunko (1989), Tables 6 and 7); in Tokyo from 1880 (LTES volume 8, Ohkawa et al. (1967), p. 245 for wages, p. 153 for rice).

To make up for this gap and arrive at a single continuous series for the Tokugawa–Meiji period, Williamson (1998) “patched” together the Sano and LTES series of real wages. In Fig. 1, we present this “patched” series – the Williamson Index – rescaled to fit alongside the Saito Index (Saito, 1998), which is a real wage index for unskilled laborers in Kyoto.⁵ The Williamson Index indicates overall stagnant Japanese real wages from the Tokugawa to the Meiji period, a trend also confirmed by Saito’s own construction of the Sano’s series (Saito, 2005, Appendix Table 2B). Unfortunately, this often-quoted thesis of Tokugawa–Meiji stagnancy in real wages, despite its problematic methodology, has rarely been rigorously tested.

In Fig. 1, we present the Mitsui Bunko and the LTES day laborers’ real wages in kilograms of rice (in the right scale), that is, nominal wages divided by the current period rice prices, alongside the Saito and Williamson Indices (the year 1741 equal to 100 for both series (see the left scale in Fig. 1)). With rice having a disproportionate weight in consumption expenditure, it is not surprising that for the Tokugawa period, the rice wage index in Fig. 1 tracked fairly well the Saito Index which is deflated by a CPI where rice prices had a great share. The real discrepancy is for the Meiji period where

the level of the LTES-based rice wage rose consistently above that of the Mitsui Bunko-based rice wage for the Tokugawa period. The right scale of Fig. 1 shows that while a day’s work by an unskilled laborer could purchase about 2 kg of rice on average in the Tokugawa era, a day’s pay could buy him over 3 kg of rice in the 1880s and 1890s (both rice prices and nominal wages are presented in the appendix).

Our finding of the jump in rice wages between the Tokugawa and Meiji periods sharply contradicts the stagnant real wage trend as displayed in the Williamson Index. The basis for a stagnant real wage trend in the Tokugawa–Meiji transition period stems from two questionable sources. First is the original craftsmen’s wage series compiled by Sano (1962), which as pointed out in Saito (2005), contains various data problems. Second and more fundamental is the problematic methodology of linking disparate real wage series at overlapping periods without a check on the actual levels of these wages in terms of real purchasing power. This, as we will show below, is a major problem in Allen’s Japanese real wage series, which uses backward projection from the Williamson Index.

3. CONSUMPTION BASKETS

Until recently, studies of wages and prices for Tokugawa Japan have not seriously attempted direct level comparison across countries, obviously hampered by the observed disparities in dietary and consumption patterns between Japan and the West. Our approach here is first to construct consumption baskets at both ends that would satisfy an annual per capita requirement of 1,940 cal and 80 g of protein plus fixed quantities of linen and lamp oil. We then calculate the costs of these respective consumption baskets with price data for our chosen benchmark periods. Thus, the levels of real wages defined as the ratio of daily wages to the cost of a consumption basket (annual expenditures for one adult) serve as our yardstick for the levels of living standards in Japan and Europe (Allen, 2005). As the levels of real wages adopted here are really an index of a laborer’s ability to purchase a combination of calories and proteins as well as fixed quantities of linen and lamp oil, they are similar to the concept of “welfare ratio” used in Allen (2001).⁶

Table 1 reconstructs two consumption baskets A and B based on available consumption data for staple food in the early 18th, late 19th (Kito, 1986, 1989; Umemura, Takamatsu, & Itoh, 1983), and the first surveys for non-staple consumption of the early 20th century (Toyo Keizai, 1980).

Table 1. Composition of Consumption Baskets (per capita per year).

	Japan A (this study)	Japan B (this study)	Europe Allen (2005)	India Allen (2005)
Bread (kg)	4	4	208	52
Beans (excluding soybeans) (l)			52	
Meat (kg)			26	26
Butter (or ghee) (kg)			10.4	10.4
Soybeans (kg)	52	26		
Rice (kg)	114	30		143
Barley and wheat (kg)	10	70		
Fish (kg)	3.5			
Buckwheat and others (kg)	16	75		
Edible oil (l)	1	1		
Linen (m)	5	5	5	5
Lamp oil (l)	2.6	2.6	2.6	2.6

Note: Soybeans are used as a proxy for various processed products: soybean paste (miso), soy sauce (shoyu), tofu, and fermented soybeans (natto). Thus, our annual amount is higher than the actual consumption reported for the 1920s in surveys by the Ministry of Agriculture and Forestry (quoted in Toyo Keizai (1980), volume 2, p. 590). The diet of the inter-war period included meat and milk, and a larger volume of fish. The average per capita consumption for 1921–1925 was 18 kg beans (of which 12.9 kg soybeans), 4.1 kg meat, 2.1 l milk, 1.5 kg eggs, and 8.1 kg fish.

Consumption basket A, with its relatively higher quantities of rice, soybeans, and fish, aims to capture the expenditure of the “normal” or average income group, while basket B, with a relatively higher amount of barley, but lower quantities of rice and soybeans and zero fish, represents the subsistence consumption.

In Table 1, we also present the European consumption basket used in Allen (2001, 2005) alongside our Japanese baskets. The differences in their respective diets are striking – major food items in the European diet, such as bread and meat were nearly non-existent in Japanese consumption. But what is more surprising is that the so-called Indian basket compiled and used by Allen for calculating Japanese real wages is far-removed from the actual Japanese consumption pattern as revealed by our Japanese baskets. His Indian basket allocated too much rice and an implausibly large quantity of meat to Japanese consumers while completely ignoring their substantial intake of soybeans and non-rice grains.

In Table 2, we follow Allen and convert these food consumption baskets into comparable units of calories and proteins. It shows that, with their

Table 2. Calories and Proteins for Food Consumption Baskets (per capita per year).

	Calories				Proteins (g)			
	Japan A	Japan B	Europe	India	Japan A	Japan B	Europe	India
Bread (kg)			1,396				57	
Beans (l)	12	12	160	160	1	1	10	10
Meat (kg)			178	178			14	14
Butter (kg)			207					
Soybeans (kg)	558	279			49	24		
Rice (kg)	1,096	288		1,375	23	6		29
Barley and wheat (kg)	92	646			2	17		
Fish (kg)	10				2			
Buckwheat and others (kg)	148	692			5	22		
Edible oil (l)	24	24		253				
Total	1,940	1,941	1,941	1,966	82	70	81	53

Note: For rice caloric content, we used 3,510 cal/kg reported by Mosk and Pak (1978) rather than 3,573 in Allen (2005). For protein content, we used the 75 g/kg, which is the average of 80 for brown rice and 70 for white rice given by Chang (2000) instead of 100 used in Allen (2005). Mosk and Pak (1978) used 65 but it seems to be for white rice. We used 2450 calories and 100g of protein for bread, 1125 cal and 71 grams for beans (other than soybeans), 2500 cal and 200g for meat, and 7268 cal and 7g for butter, as in Allen (2001, 2005). We used the figures of caloric and protein contents reported by Mosk and Pak (1978) for most other foodstuff: 1050 cal and 181g for fish, 3920 cal and 343g for soybeans, 8800 cal and 0g for edible oil, and 3370 cal and 88g for barley, (caloric and protein contents for barley are used as proxy for barley and wheat; for buckwheat, we used 3370 cal and 108g.

drastically different composition, Japanese baskets provided daily calories and proteins broadly equivalent to Allen’s European and Indian baskets. This is indicative of the long-standing tradition that rice and soybeans rather than meat intake had been the most important and cost-effective source of protein in the Japanese diet. As we show below, the validity of our international comparison of real wages hinges on the correct design and choice of consumption baskets.

4. THE INTERNATIONAL COMPARISON

Our prices and nominal wages for the Tokugawa period mainly come from the published Mitsui company account books (Mitsui Bunko, 1989). We use the benchmark year 1750 (the 10-year average of 1745–1754) for Kyoto to

match with Allen's mid-18th century benchmark for Europe.⁷ As Allen (2005) had no Tokugawa prices and nominal wages but instead used the 1882 benchmark data from the LTES volume based on the India basket to project backward, we also construct a 1884 benchmark (the average of 1882–1886). After consistency checks, we decided to choose 1884 over 1882 to avoid the sharp price movement in the period of the so-called Matsukata deflation. We follow Allen (2005) to add 5 m of linen and 2.6 l of lamp oil in the Japanese budgets. Our price and wage data, all converted in grams of pure silver, are presented in detail in Table 3.

The cost of consumption baskets is clearly sensitive to the basket construction. For example, the costs of Japan basket B, the subsistent level basket in Table 1 that supplied roughly equivalent amount of calories and proteins as that of Japan basket A, would be roughly 40 percent cheaper and would correspondingly give a higher Japanese real wage than from basket A.⁸ But this would also imply that consumers with the cheaper Japan basket B would have to settle for a less desirable diet with inferior crops and no fish. To be comparable to the European baskets which are defined here more for the average income level, we use consistently the Japan basket A. In this regard, our real wage index, given a certain choice of baskets, is also a welfare measure broader than a combination of calories and proteins required for subsistence.

With the information on nominal wages and total costs of budgets, we present our real wages in the last row of Table 3. The comparison shows that despite their much lower nominal silver wages for the mid-18th century, Japanese real wages for unskilled laborers, due to the relatively cheaper cost of the consumption basket, are actually on a par with Milan and at about a third of the level of London. Furthermore, while nominal wages increased from 2.82 to 4.5 g of silver between 1750 and 1884, the total cost of their consumption basket actually declined from 326 to 277 g, leading to a near doubling of real wages for unskilled laborers between these two benchmark periods. The price decline between these two periods is most pronounced for lamp oil, linen, and soybeans, all of which were possibly associated with the opening of the country to international trade since the mid-19th century.

Table 4 presents our Japanese real wages data in 50-year averages for 1750–1913 alongside those for London, Amsterdam, Strasbourg, Milan, and Madrid. Table 4 gives the annual series (our annual Japanese real wages for 1750–1913 are presented in full in the Appendix Table). Both Table 4 and Fig. 2 demonstrate unequivocally that real wages for Japanese unskilled laborers were clearly in the rank of those in Central and Southern European cities, but far below those in Northwestern Europe. It was only in the Meiji

Japanese Real Wages

Table 3. Unit-Prices (in grams of Pure Silver) and Expenditure Shares (Percentage, in Parentheses) in Consumption Baskets.

	England 1750–1759	Northern Italy 1750–1759	Japan (Kyoto) 1745–1754	Japan (Tokyo) 1882–1886
Bread (kg)	1.37 (57.3)	0.91 (53.6)		1.01 (1.5)
Beans (other than soybeans) (l)	0.42 (4.4)	0.58 (8.5)	0.99 (1.2)	
Meat (kg)	3.33 (17.4)	2.32 (17.1)		
Butter (kg)	6.89 (14.4)		1.49 (23.8)	0.97 (18.2)
Soybeans (kg)			1.49 (52.1)	1.5 (61.9)
Rice (kg)			0.76 (2.3)	0.77 (2.8)
Barley and wheat (kg)			2.18 (2.3)	2.19 (2.8)
Fish (kg)			0.61 (3.0)	0.62 (3.6)
Buckwheat and others (kg)		2.32 (6.8)	5.66 (1.7)	5.62 (2.0)
Edible oil (l)	4.87 (4.9)	8.63 (12.2)	5.83 (8.9)	3.07 (5.6)
Linen (m)	3.19 (1.7)	2.32 (1.7)	5.66 (4.5)	1.79 (1.7)
Lamp oil (l)	498 (100.0)	353 (100.0)	326 (100.0)	277 (100.0)
Total cost of basket	11.14	3.44	2.82	4.5
Nominal wages (grams of silver)		0.023	0.01	0.009
Real wages				0.016

Source: Data for prices of rice, soybeans, beans, edible oil, lamp oil (kerosene), and linen in 1882–1886 are retail prices in Tokyo reported in LTES (volume 8, Ohkawa et al., 1967, pp. 153–156), converted to metric units by the ratios mentioned in the source; for barley, wheat, buckwheat, and other grains, for which retail price data are not available, we first calculate the ratio of the farm gate prices of barley, naked barley, and wheat relative to paddy for available years in 1874–1901; then we multiplied that ratio to the actual average retail rice price in 1882–1886; we adopted the same procedure for buckwheat and others (buckwheat, foxtail millet, proso millet, barnyard millet, sorghum); agricultural price data are in LTES volume 8 (Ohkawa et al., 1967, pp. 168–169); we calculated the ratio of wholesale price of fish (salmon and cod) to wholesale price of rice in 1882–1886 and multiplied this ratio to the retail price of rice (wholesale price of fish and rice are from Historical Statistics of Japan, CD-ROM, Tables 17–16). All prices are converted into silver on the basis of 25 g of pure silver per yen as in Allen (2005).

Data for prices of rice and lamp oil in 1745–1754 are based on Mitsui Bunko retail prices in Kyoto (Table 6). Prices of soybeans are available for Osaka in Mitsui Bunko from 1757 (Table 3). Unit-price is slightly higher than the price of white rice in Kyoto (Table 6), considering that the soybeans traded in Osaka were of above average quality, we just assume that the soybeans price in 1745–1754 to be equal to rice prices. Conversion ratio based on the LTES (volume 9, Umemura et al., 1966, p. 250) are: 180l/koku, 150 kg/koku for rice, 129 kg/koku for soybeans, and 3.75 kg/ken. There are no retail prices for fish, barley and wheat, buckwheat and other grains, and linen for 1745–1754. We derived them using their price ratio to rice in early Meiji (beans 0.63, barley and wheat 0.51, buckwheat and other grains 0.41). For price of cotton linen, we used price in Osaka in 1840–1849 (Miyamoto, 1963, pp. 208–210) since raw cotton prices between 1746–1750 and 1846–1850 shown in Harada and Miyamoto (1985, p. 84) remained roughly constant. As lamp oil is rapeseed oil, we used the price of lamp oil as a proxy for edible oil. Rapeseed oil in Japan is comparable to olive oil in Southern Europe used both for lighting and cooking. It is neither a cheap nor a low-quality item, as few alternatives existed (sesame oil was more a condiment than an edible oil). All prices in monme are converted into silver grams assuming 3.11 g of pure silver per monme.

For England and Northern Italy, we rely on calculation by Allen (2005). For Italy, 1 kg edible oil is assumed equivalent to 1 kg butter, in order to be consistent with Allen (2001, 2005). Caloric contents are only slightly different.

Table 4. Real Wages of Unskilled Workers in Japan and Selected European Cities.

	1750–1799	1800–1849	1850	1874	1875–1899	1900–1913
London	0.020	0.020	0.025		0.037	0.040
Amsterdam	0.020	0.016	0.014		0.022	0.031 ^a
Strasbourg	0.009	0.012	0.010		na	na
Milan	0.007	0.005	0.006		0.009	0.012
Madrid	0.009	0.014	0.013		0.013	0.015
Kyoto (BM1750)	0.008	0.008	0.006			
Tokyo (BM 1884)					0.017 ^b	0.020

Source: The Kyoto (BM 1750) series is based on the benchmark 1745 (Table 3) and the Saito Index used in Fig. 1. The Tokyo (BM 1884) series is based on the benchmark 1882–1886 (Table 1) and extrapolated using nominal wages reported in LTES volume 8 (Ohkawa et al., p. 387), deflated by using the consumer price index reported in Ohkawa and Shimohara (1979, p. 387), extended backward for the period 1882–1885 by relying on the early version of the LTES CPI (Ohkawa et al., 1967, p. 135). Series for the European cities are based on the series of welfare ratio constructed by Allen (2001), adjusted for taking into account differences in basket composition; the coefficient of adjustment for London, calculated on the basis of data reported by Allen (2001, 2005), is applied to other European cities.

na = not applicable.

^a1900–1910.

^b1882–1899.

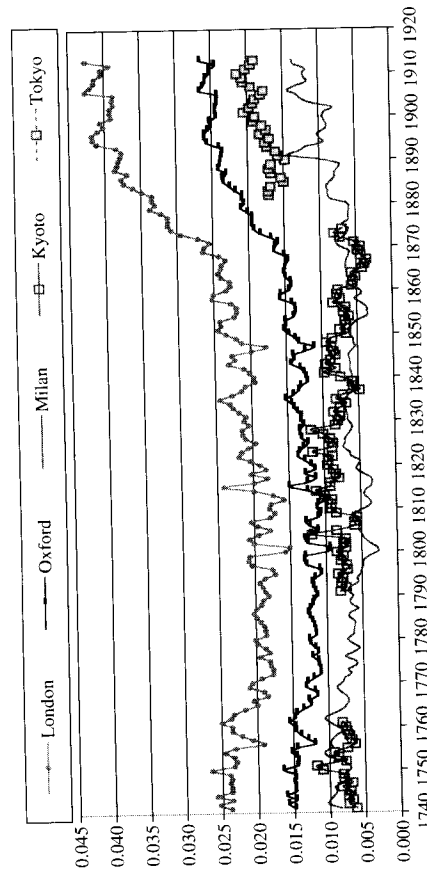


Fig. 2. Real Wages in Kyoto and Tokyo in International Comparison. *Source:* Same as for Table 4.

period that Japanese real wages of unskilled laborers began to rise beyond that of Southern Europe.

5. DISCUSSION AND SUMMARY

It is now possible to compare our real wages with Allen's findings. As indicated earlier, Allen's basket, with a much higher amount of rice and meat and no soybeans, yields a total cost of 540 g of silver based on the 1882 LTES prices, nearly twice the cost of our Japan basket A (see Allen, 2005, Appendix Table 5.3). Thus, his India-basket-deflated real wage for unskilled laborers for the 1882 benchmark, 0.009, is only half of our level for 1884 but happens to be identical to our 1750 benchmark-period level (see Table 3). As Allen used his 0.009 level of real wage to project backward to the Tokugawa period using the Saito Index with the relatively trend-less Williamson index serving as the intermediate link, his back-cast Tokugawa real wages ends up about the same as our 1750 benchmark-based Tokugawa real wages, which are about 0.008 on average for 1750–1874 in Table 3. This is a pure coincidence that should not distract us from the problematic nature of the backward projection method. Furthermore, Allen's series missed the surge in real wages since the Meiji Restoration as revealed in our study.

For our Tokugawa real wages, we did some robustness checks by comparing the nominal wages and prices used in this study with other comparable

series in Saito (1998, 2005). We are reasonably certain that our data, particularly the rice price, used in this study are within the normal range of other Tokugawa data. Thus, the near doubling of our real wages between the Tokugawa and Meiji periods in our data is rather puzzling. Clearly, there are major differences in the objective and methods of statistical compilation between the Mitsui Bunko series and the LTES wages series. Furthermore, our simplified consumption baskets did not take into account such important items as housing rents, burning fuel, alcohol, etc., which might have changed in the Tokugawa–Meiji transition period. Most importantly, the Tokugawa–Meiji transition may have also spelled profound changes in labor institutions and labor contracts such as food allowances or side payments to cash wages. Whether or not this jump in real wages is a statistical illusion or an indication of real economic changes in the Tokugawa–Meiji transition period as argued, for example, by Huber (1971), is an issue for future research.

With these caveats in mind, we provide summary information of unskilled Japanese and U.K. laborers' wages and income for the two benchmark periods in Table 5. The table shows that our wages expressed in silver and grain units are broadly consistent with other independent studies, particularly the recent preliminary work by Peter Lindert et al. (2004) on global price and wage comparisons. Table 5 also reveals that the Kyoto–Tokyo grain wages relative to those in London are consistently higher than their

Table 5. A Summary Comparison of Japanese and U.K. Wages and Incomes (Numbers in Parentheses are Ratios over London with London = 100).

	Silver Wages (g)	Grain Wages (in kilograms of bread)	Real Wages	GDP per capita (in 1990 International dollars)
Benchmark	1.750	1.884	1.750	1.884
London	11.14 (100)	34.36 (100)	8.1 (100)	1.700 (100)
Kyoto–Tokyo	2.8 (25)	4.5 (13)	0.024 (38)	1.250 (46)

Note: Wage measured in kilograms of bread in London and Milan, the 5-year average of wage divided by the 5-year average prices of rice in kilograms in Kyoto–Tokyo. On the basis of the caloric content, adjusted for taking into account the cost of fuel for cooking rice, 1 kg of rice is regarded equivalent to 1.3 kg of bread (the ratio of the caloric contents is 1.43). GDP per capita data for Britain, Italy, and Japan are from Maddison (2001, pp. 206, 264) and Maddison (2004, pp. 60–61). Real wages are averages of 1745–1754 and 1882–1886, respectively.

relative silver wages. Furthermore, the Kyoto–Tokyo real wages relative to those of London are higher than both the relative grain and silver wages. This is consistent with the theme of the recent article by Broadberry and Gupta (2003), which viewed this as an indication of higher relative U.K. productivity in the tradable goods. In Table 5, we also present Angus Maddison's per capita income estimates (or "guesstimates") for the 18th century.

6. SUMMARY

To sum up, this article is a first attempt to make international comparison of 18th and 19th century Japanese real wages using current price benchmarks (rather than Meiji period back-projection). Our finding of a purchasing power of unskilled Japanese laborers being around a third of the London level seems to place Japan in the ranks with Turkey, Java, or Southern Europe in the 18th century. This finding, subject to further tests, would have important implications both for the old debate on Japanese living standards and new understandings of the initial conditions for economic take off. Since Japan is part of the East Asian civilization, we believe our study of Japanese real wages is also a contribution toward understanding the debate over the "great divergence" raised by Kenneth Pomeranz's (2000) recent work on China–Europe comparison and marks a step forward toward a more rigorous comparison of global living standards for the 18th and 19th centuries.

Our study also reveals an important discontinuity in real wage purchasing power between the late Tokugawa and early Meiji. This finding is a clear warning against backward projection methods based on the Meiji benchmark. While further careful research is needed to understand the cause of this discontinuity, it does serve to draw our attention to re-evaluate the economic impact of the transition from Tokugawa to Meiji.

NOTES

1. See Susan Hanley (1983, 1997) for the optimistic assessment of a high living standard in 19th century Japan. For Yasuba's rebuttal and his own assessment, see Yasuba (1986, 1987).
2. For real wage growth, see Saito (2005). For real per capita income growth, see Maddison (2001, p. 255). On page 264, Maddison gave 1870 Japanese and British per capita incomes at 737 and 3,191 respectively, in 1990 international dollars. This is

fairly drastic upward adjustment in comparison with previous exchange rate-based estimates, which would give Japanese per capita income around the 1860s and 1870s at only 10 percent of the contemporaneous British level.

3. The few quantitative GDP studies such as Maddison (2001) and Yasuba (1987) that did extend to international comparison were largely back-of-envelope type of calculations.

4. Comprehensive summary and discussion of studies on Japanese prices and wages can be found in Harada and Miyamoto (1987) and Saito (1998).

5. Real wage series calculated by using nominal wage data reported in Mitsui Bunko, deflated using the consumer price index calculated by Shimbo (1978), which is based on price data reported in the same source.

6. In Allen (2001), the welfare ratio is calculated as the ratio of annual income of a representative household of unskilled worker (daily nominal wage multiplied by 250, assuming 250 working days and no other income) to the minimal expenditures for one household measured as three times the cost of the consumption basket per adult (assuming five persons per household, or the equivalent of three adults in terms of consumption). The real wage level, as defined in Allen (2005) is therefore equivalent to a welfare ratio divided by 750 (250×3); however, it should be noted that the consumption basket used in Allen (2001) also includes fuel and soap.

7. In the Mitsui Bunko records, there is also a nominal wage series for Tokyo (Edo) for 1818–1871. Although with a different trend, the levels for the Edo series are broadly equal to the Kyoto series. Here we use the Kyoto series only for the Tokugawa period.

8. Costs of basket A for 1750 and 1884 benchmark periods would be 236 and 200 g of silver respectively. This would give levels of Japanese real wages at 0.012 and 0.023 respectively, higher than the 0.09 and 0.012 deflated by the cost of Japan basket A.

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APPENDIX. DATA ON NOMINAL WAGES AND RICE PRICES ARE GIVEN IN TABLE A.1 AND REAL WAGE SERIES FOR KYOTO-EDO IN TABLE A.2.

Table A.1. Daily Nominal Wages and Rice Prices in grams of Silver for 1741–1871 and 1880–1913.

Year	Daily Wages (per kg)	White Rice (per kg)	Year	Daily Wages (per kg)	White Rice (per kg)
1741	2.57	1.88	1814	3.22	1.68
1742	2.81	1.73	1815	3.28	1.69
1743	2.58	1.67	1816	2.81	1.57
1744	2.72	1.66	1817	2.71	1.72
1745	2.60	1.58	1818	2.75	1.47
1746	2.66	1.80	1819	2.74	1.28
1747	2.47	1.68	1820	2.77	1.17
1748	2.89	1.69	1821	2.85	1.31
1749	2.80	1.52	1822	2.97	1.46
1750	3.58	1.60	1823	4.17	1.46
1751	3.50	1.55	1824	3.31	1.55
1752	2.57	1.33	1825	3.14	1.63
1753	2.50	1.11	1826	3.42	1.82
1754	2.63	1.04	1827	3.37	1.51
1755	2.49	1.52	1828	3.97	1.68
1756	2.49	1.94	1829	3.02	2.15
1757	2.55	1.69	1830	2.83	1.86
1758	2.52	1.55	1831	2.80	2.01
1759	2.53	1.52	1832	3.00	1.71
1760	2.49	1.33	1833	2.88	2.16
1761	2.49	1.20	1834	3.03	2.50
1762	2.49	1.15	1835	2.92	1.84
			1836	3.11	2.50
			1837	2.88	2.16
			1838	3.00	1.71
			1839	2.80	2.01
			1840	2.83	1.86
			1841	3.02	2.15
			1842	3.97	1.68
			1843	3.37	1.51
			1844	3.42	1.82
			1845	3.14	1.63
			1846	3.31	1.55
			1847	4.17	1.46
			1848	2.97	1.46
			1849	2.85	1.31
			1850	2.77	1.17
			1851	2.74	1.28
			1852	2.75	1.47
			1853	2.71	1.72
			1854	2.81	1.57
			1855	3.28	1.69
			1856	3.22	1.68
			1857	2.88	2.16
			1858	3.03	2.50
			1859	2.92	1.84
			1860	3.11	2.50
			1861	2.88	2.16
			1862	3.00	1.71
			1863	2.80	2.01
			1864	2.83	1.86
			1865	3.02	2.15
			1866	3.97	1.68
			1867	3.37	1.51
			1868	3.42	1.82
			1869	3.14	1.63
			1870	3.31	1.55
			1871	4.17	1.46
			1872	2.97	1.46
			1873	2.85	1.31
			1874	2.77	1.17
			1875	2.74	1.28
			1876	2.75	1.47
			1877	2.71	1.72
			1878	2.81	1.57
			1879	3.28	1.69
			1880	3.22	1.68
			1881	2.88	2.16
			1882	3.03	2.50
			1883	2.92	1.84
			1884	3.11	2.50
			1885	2.88	2.16
			1886	3.00	1.71
			1887	2.80	2.01
			1888	2.83	1.86
			1889	3.02	2.15
			1890	3.97	1.68
			1891	3.37	1.51
			1892	3.42	1.82
			1893	3.14	1.63
			1894	3.31	1.55
			1895	4.17	1.46
			1896	2.97	1.46
			1897	2.85	1.31
			1898	2.77	1.17
			1899	2.74	1.28
			1900	2.75	1.47
			1901	2.71	1.72
			1902	2.81	1.57
			1903	3.28	1.69
			1904	3.22	1.68
			1905	2.88	2.16
			1906	3.03	2.50
			1907	2.92	1.84
			1908	3.11	2.50
			1909	2.88	2.16
			1910	3.00	1.71
			1911	2.80	2.01
			1912	2.83	1.86
			1913	3.02	2.15

Year Daily Wages White Rice (per kg) Year Daily Wages White Rice (per kg) Year Daily Wages White Rice (per kg)

1791	2.55	1.47	1837	3.02	3.70	1891	4.40	1.82
1792	2.86	1.91	1838	2.95	2.51	1892	4.50	1.91
1793	2.80	1.89	1839	2.97	2.31	1893	4.88	1.97
1794	2.57	1.52	1840	3.08	1.71	1894	5.25	2.01
1795	2.75	1.65	1841	3.45	1.65	1895	5.50	2.03
1796	2.52	1.82	1842	3.36	1.79	1896	6.50	2.18
1797	2.55	1.77	1843	2.80	1.70	1897	7.25	2.72
1798	2.63	1.77	1844	3.59	1.73	1898	8.25	3.29
1799	2.57	1.68	1845	3.61	1.91	1899	8.50	2.21
1800	2.74	1.90	1846	3.30	2.10	1900	9.25	2.75
1801	2.57	1.77	1847	3.16	1.99	1901	9.75	2.82
1802	2.52	1.64	1848	2.81	2.07	1902	9.75	2.89
1803	2.49	1.52	1849	2.99	2.15	1903	10.00	3.31
1804	3.37	1.25	1850	3.00	2.76	1904	10.00	3.11
1805	2.36	1.26	1851	3.37	2.77	1905	10.25	3.01
1806	1.93	1.37	1852	3.00	2.00	1906	10.50	3.47
1807	1.90	1.45	1853	2.91	2.22	1907	12.25	3.79
1808	2.13	1.72	1854	3.14	2.30	1908	13.25	3.51
1809	2.75	1.72	1855	3.48	1.88	1909	13.00	2.98
1810	2.74	1.37	1856	3.34	1.87	1910	13.25	2.89
1811	2.75	1.43	1857	3.33	2.22	1911	14.00	3.82
1812	2.75	1.36	1858	3.37	2.91	1912	14.50	4.48
1813	2.91	1.40	1859	3.45	2.91	1913	14.75	4.82

Note: conversion units used: 1 silver momme = 3.11 g of pure silver; 1 koku of rice = 150 kg; 1 yen = 25 g of pure silver; and 1 shō rice = 1.425 kg. Sources: For 1741-1871, based on Mitsui (1989); for 1880-1913, based on Table 6 and LTES (Ohkawa, 1967, Table 5, p. 153; Table 25, column 30, p. 245; missing data for nominal wages interpolated for 1881, 1888-1893, and 1893).

Table A.2. Real Wage Series for Kyoto-Edo (1741-1869) and Tokyo (1882-1913).

Year	Real Wage	Year	Real Wage	Year	Real Wage
1741	0.006	1791	0.008	1841	0.010
1742	0.007	1792	0.007	1842	0.008
1743	0.007	1793	0.008	1843	0.010
1744	0.007	1794	0.008	1844	0.009
1745	0.007	1795	0.008	1845	0.008
1746	0.008	1796	0.007	1846	0.008
1747	0.007	1797	0.007	1847	0.008
1748	0.008	1798	0.008	1848	0.009
1749	0.008	1799	0.008	1849	0.008
1750	0.011	1800	0.008	1850	0.007
1751	0.012	1801	0.007	1851	0.008
1752	0.008	1802	0.008	1852	0.008
1753	0.009	1803	0.007	1853	0.008
1754	0.009	1804	0.012	1854	0.007
1755	0.007	1805	0.008	1855	0.008
1756	0.006	1806	0.006	1856	0.007
1757	0.007	1807	0.006	1857	0.008
1758	0.007	1808	0.006	1858	0.007
1759	0.007	1809	0.008	1859	0.008
1760	0.008	1810	0.009	1860	0.008
1761		1811	0.009	1861	0.006
1762		1812	0.009	1862	0.007
1763		1813	0.010	1863	0.006
1764		1814	0.011	1864	0.007
1765		1815	0.009	1865	0.006
1766		1816	0.009	1866	0.004
1771		1821	0.008	1871	0.008
1772		1822	0.008	1872	0.008
1773		1823	0.008	1873	0.010
1774		1824	0.008	1874	0.009
1775		1825	0.008	1875	0.008
1776		1826	0.008	1876	0.008
1777		1827	0.008	1877	0.008
1778		1828	0.008	1878	0.008
1779		1829	0.008	1879	0.008
1780		1830	0.008	1880	0.008
1781		1831	0.008	1881	0.008
1782		1832	0.008	1882	0.008
1783		1833	0.008	1883	0.008
1784		1834	0.008	1884	0.008
1785		1835	0.008	1885	0.008
1786		1836	0.008	1886	0.008
1787		1837	0.008	1887	0.008
1788		1838	0.008	1888	0.008
1789		1839	0.008	1889	0.008
1790		1840	0.008	1890	0.008
1791		1841	0.008	1891	0.010
1792		1842	0.007	1892	0.008
1793		1843	0.008	1893	0.010
1794		1844	0.008	1894	0.009
1795		1845	0.008	1895	0.008
1796		1846	0.007	1896	0.007
1797		1847	0.007	1897	0.008
1798		1848	0.008	1898	0.008
1799		1849	0.008	1899	0.008
1800		1850	0.008	1900	0.007
1801		1851	0.007	1901	0.008
1802		1852	0.008	1902	0.008
1803		1853	0.007	1903	0.008
1804		1854	0.012	1904	0.007
1805		1855	0.008	1905	0.008
1806		1856	0.006	1906	0.007
1807		1857	0.006	1907	0.008
1808		1858	0.006	1908	0.007
1809		1859	0.008	1909	0.008
1810		1860	0.008	1910	0.008
1811		1861	0.009	1911	0.006
1812		1862	0.009	1912	0.007
1813		1863	0.010	1913	0.006
1814		1864	0.011		
1815		1865	0.009		
1816		1866	0.009		

RELATIVE BRITISH AND AMERICAN INCOME LEVELS DURING THE FIRST INDUSTRIAL REVOLUTION

Marianne Ward and John Devereux

ABSTRACT

We provide new measures of relative UK and US GDP per capita and output per worker for the crucial years between 1830 and 1870. Our estimates are current price comparisons that compare expenditure on GDP for five benchmark years using new price data. They show that the US leads in income per capita and output per worker compared to Great Britain and the United Kingdom. We check our estimates against sectoral productivity data and real wages.

1. INTRODUCTION

The long debates surrounding nineteenth-century living standards, growth and structural change during the early and middle nineteenth century for the US and the UK highlight the importance of this period in each nation's development. Our knowledge of these economies during these years comes largely from information on changes within the domestic economy.

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Year	Real Wage	Year	Real Wage	Year	Real Wage
1767	0.008	1867	0.004	1817	0.007
1768	0.008	1868	0.006	1818	0.007
1769	0.003	1869	0.003	1819	0.009
1770	0.004	1870	0.004	1820	0.010
1771	0.005	1871	0.005	1821	0.009
1772	0.007	1872	0.007	1822	0.009
1773	0.008	1873	0.008	1823	0.012
1774	0.007	1874	0.009	1824	0.009
1775	0.007	1875	0.009	1825	0.007
1776	0.007	1876	0.009	1826	0.007
1777	0.007	1877	0.010	1827	0.007
1778	0.007	1878	0.012	1828	0.007
1779	0.007	1879	0.008	1829	0.008
1780	0.008	1880	0.008	1830	0.008
1781	0.009	1881	0.008	1831	0.009
1782	0.007	1882	0.009	1832	0.007
1783	0.007	1883	0.008	1833	0.007
1784	0.006	1884	0.007	1834	0.006
1785	0.006	1885	0.008	1835	0.006
1786	0.007	1886	0.007	1836	0.007
1787	0.005	1887	0.005	1837	0.005
1788	0.006	1888	0.006	1838	0.006
1789	0.006	1889	0.006	1839	0.006
1790	0.007	1890	0.007	1840	0.007

Table A.2 (Continued)