Japanese Wages and Living Standards in 1720-1913: an International Comparison

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Abstract: This paper calculates welfare ratios for unskilled daily labors for Japan in 1720-1913 and compares with the European series for the same period. Our finding, based on the reconstruction of actual consumption baskets, the price data for two benchmark periods, 1750 and 1884, and linked by real wage index, shows that real purchasing power for Japanese unskilled laborers in Kyoto and later Tokyo in this period were about a third of the level in London, but comparable to Southern European cities.

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How rich or poor was Japan before she embarked on the path of modern economic growth since the Meiji Restoration (1868). Intellectual interest on this question, which seemed to follow the tempo of post-War Japanese economic miracle, surged up to the 1980s, and since then, eased into a phase of rational retrenchment. The pre-War pessimist consensus of a Tokugawa Japan being an extremely backward society was dispelled – a victory for the so-called optimists. But the optimist's romanticized claim of 19th century Japanese living standards being higher or comparable to contemporaneous England did not seem to win the test of time.[1] Two recent assessments give the 1700-1870 Tokugawa economy a slow but positive 0.1% and 0.15% growth rate in real wages and per capita GDP respectively, giving a purchasing power parity (PPP) adjusted 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 were, as most scholars agree, highly

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[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 (2004). For real per capita income growth, see Maddison (2001), p. 255. On p. 264, Maddison gave 1870 Japanese and British per capita incomes at 737 and 3191 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 70s at only 10% of the contemporaneous British level.

tentative.[3] In contrast, price and wage data, despite their problems, were far richer. However, prevailing quantitative studies on Tokugawa wage rates have almost exclusively focused on constructing real growth rates overtime, rather than across nations. This is understandable considering that international comparison even for contemporary times confronts formidable methodological issues.

Recent path-breaking works by Robert Allen (2001a), which constructed standardized consumption basket and utilized the concept of welfare ratio, have made possible comparison of both the trends and levels of five centuries of long-term real wages across Europe. His line of work has been extended beyond Europe most recently, by Ozmucur and Pamuk (2002) and Zanden (2003). In an unpublished manuscript (2001b), Allen extended his real wage comparison to include Japan, India and China. However, his work on the purchasing power of Japanese real wage (1720-1913) converted in caloric terms, is based on the backward projection of the 1882 benchmark period and India basket, both of which, as we will show, incur serious index number problems.

Our current paper adopts Allen's methodology for calculating welfare ratio but utilizes the rich 18th and 19th century Japanese wage and price data compiled by generations of scholars in Japan. Instead of backward projection, we construct two benchmark periods, 1750 and 1884. We also reconstruct Japanese consumption baskets based on various works on Japanese consumption patterns in the 18th and 19th centuries. Our preliminary findings, in contrast to Allen's back projected results, shows the welfare ratios of the wages of the unskilled Japanese laborers were roughly at about a third of the British level in 1750 and 1884. Linking our benchmark welfare

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[3] The only solid GDP type of study is for a prefecture of Chosu in the 1840s by Nishikawa. 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.

ratios with real wage indices, we find the overall welfare ratios of Japanese unskilled wages in the 18th and early 19th centuries were closer to those in Southern and Central Europe than Northwestern Europe. While we need to be extremely mindful of the limitations of real wage comparisons, this current study seems to lend some tentative support to the view that Japanese initial conditions before the Meiji take-off, while not under abject poverty, were not much more favored than those in other developing countries such as Turkey or Java (Indonesia) as revealed by the studies by Ozmucur and Pamuk (2002) and Zanden (2003)

The rest of the paper is organized into 3 sections followed by concluding remarks: section I describes the Japanese consumption baskets, the two benchmark periods, the price and wage data. Section II provides our main result on Japanese welfare ratio based on the two benchmark-years and compares the long-term evolution of welfare ratios for unskilled laborers in Japan and Europe. Section III summarizes the main findings with a discussion.

I. Consumption Basket, Benchmark Years and Prices

Any comparison of living standards without due attention to the drastic differences in consumption diets between Japan and Europe is bound to incur serious biases. In this paper, we construct two consumptions baskets A and B based on available consumption data for staple food in the early 18th, late 19th and early 20th centuries (Kito 1986, 1989, Umemura 1983) and the first surveys for non-staple consumption of the early 20th century (Showa Kokusei Soran). Consumption basket A, with relatively higher quantities of rice, eggs and fish consumption, aims to capture the expenditure of the relatively "well-off" or skilled workers, while the basket B, with relatively higher quantity of barley is for the unskilled workers.

These baskets, despite their drastically different items from Allen's European basket, are equivalent in terms of caloric intake, which are 1940 and 1900 calories per day in Northern and

Southern Europe respectively (Allen 2001a). Overall protein intake in the two Japanese baskets, 64 and 60 grams respectively, are lower than the 80 grams in Allen's European basket. However, the difference may not be as big as it seems in view of the seasonality in protein intake from food consumption in Europe. These two baskets are listed in Table 1 as Japanese Baskets A and B respectively.

Table 1 contrasts our Japanese baskets with what we called the Indian basket compiled and used by Allen for calculating Japanese welfare ratios (2001b). His India basket contains relatively higher shares of rice, eggs and meat and almost no non-rice cereals and buckwheat, which were cheaper sources of acquiring calories than rice for Japanese consumers. It is well-know that soybeans - an item missing in the India basket - rather than animal fat intake, was the major source of protein in the Japanese diet before WWI.

Table 1: Composition of Food Consumption Baskets

	Japanese A (this study)	Japanese B (this study)	Indian Allen (2001b)	Asian (this study)
Beans, liter	4	4	52	3
Meat, kg	2	1	26	26
Eggs, each	24		52	52
Ghi or fat, kg			10.4	
Soy beans, kg	30	20		20
Rice, kg	110	80	143	143
Barley, kg	30	40		
Sake*, liter	41	41		41
Fish, kg	8	2		
Other cereals**, kg	10	50		
Edible oil, liter	2	0.5	2.6	2.6
Calories	1920	1920	1951	1920
Protein (grams)	64	60	63	59

* Or other rice alcohol (not mentioned in Allen (2001b)).

** Including buckwheat

Notes: consumption items are per capita per year; caloric intake is per capita per day.

Alcohol content of 41 liters of Japanese sake is equivalent to that of 182 liters of beer or 68.5 liters of wine (assuming 18° alcohol for sake, 4.5° for beer, and 12° for wine). According to official data (excise tax) consumption of spirit was about 16 liters per capita on average in 1883-1903 (Nakamura 2002), or 25 liters per unit of consumption (adult equivalent with Allen's definition of 5 people for 3 units of consumption).

Although lower than 41 liters, the official figures did not take into account alcohol consumption from moonlight distillation of sake, and other spirits brewed from other cereals. As these non-rice staples alcohol was cheaper than sake, their exclusion in our basket could potentially overestimate the price of the basket. The Japanese and Asian baskets are almost identical to Allen's European baskets for non-food items (composition excluding candles; as a compensation twice as much volume of lamp oil as in Allen).

In Table 1, we constructed a hypothetical "Asian" basket which added a few items such as alcohol to Allen's Indian basket to make it comparable to European baskets compiled in Allen (2001a), and our Japanese baskets. The purpose of the Asian basket is to show that welfare ratios calculated without taking account of the Japanese diet pattern could seriously underestimate the real living standards of Japanese laborers.[4]

For the period 1720-1913, we use item prices for our consumption baskets for two benchmark periods, Kyoto 1750 (average unit-prices for 1745-54)1750 and Tokyo 1884 (average 1882-86). 1750 matched the benchmark period for Europe as adopted in Allen (2001a, 2001b). Allen (2001b) used 1882 as a benchmark period. However, 1882 falls into the period of the so-called Matsukata deflation. After consistency checks based on the calculation of additional benchmark periods (1884, 1900 and 1910, all five-year averages), we confirm that 1884 is a better choice than 1882.

Table 2 lists item prices in terms of silver grams for commodities based on our consumption baskets in the six benchmark periods. Due to the lack of availability, we made estimation for some items based on relative price ratios in the Meiji period, the details of which are explained in the notes to Table 2.

For nominal wage, we use the series in Saito (1998, 2003). Using consumer price index

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[4] We did not include sweet potatoes, the cheapest source of calories, for two reasons. First, it was an insignificant share of food consumption in Kyoto and secondly, there were few unit-price data available before the early 20th century.

constructed by Shimbo (1978), Saito also calculated real wages index. However, Saito's long and

continuous series for 1741-1913 in, in fact, a "patching" of three separate series. It starts with the

series for the Kinai (1741-1868), then connects to Edo-Tokyo (1818-1896) at 1842, and finally

links with the 1896-1913 LTE nominal wages series deflated by the GDP deflator. Both the

Table 2: Unit-prices of the items in the Japanese baskets (grams of pure silver) and relative
rice price (rice = 1)

	Unit prices in grams of silver			Relative price (rice =1)		
	1750	1882	1884	1750	1882	1884
Beans	0.99	1.18	1.01	0.67	0.71	0.67
Meat	6.36	6.19	7.09	4.27	3.72	4.72
Eggs	0.34	0.31	0.23	0.23	0.18	0.16
Soy beans	0.72	1.16	0.97	0.48	0.70	0.65
Rice	1.49	1.66	1.50	1.00	1.00	1.00
Barley	0.76	0.85	0.77	0.51	0.51	0.51
Sake	1.94	2.31	2.09	1.30	1.39	1.39
Fish	1.49	1.66	1.50	1.00	1.00	1.00
Other cereals*	0.61	0.68	0.62	0.41	0.41	0.41
Edible oil	5.66	6.65	5.62	3.80	4.00	3.74
Soap	2.83	1.08	0.89	1.90	0.65	0.59
Linen	4.15	3.66	3.66	2.78	2.20	2.44
Lamp oil	5.66	2.16	1.79	3.80	1.30	1.19
Fuel	**9.93**	36.29	29.23	**6.66**	21.83	19.46

Notes

1. Kyoto 1750 data source is Mitsui Bunko (1989); average prices of spring and fall during the period of
   1745-54 were calculated for white rice, soy paste (miso), soy sauce (shoyu), sake, burning wood,
   candle, and oil, and converted in price measured in the same unit as in Allen (2001a); 1 koku equals to
   180 liters; 1 koku rice is equivalent to 150 kg). Unit price for beans and meat are derived from retail
   unit prices relative to rice in early Meiji (average 1880-84); eggs' and soybeans unit-prices are derived
   from retail price relative to soy paste in early Meiji. Meat (slaughtered hens) and beans' unit-prices are
   derived from wholesale price relative to soy sauce in early Meiji (Noshomusho Tokeiho); for instance,
   the price of 1 kg soybeans was 0.56 of the one for 1 kg soy paste. The price of barley and other cereals
   is derived from the farm-gate price of these cereals relative to paddy in early Meiji (the coefficients are
   0.51 and 0.41 respectively on average for the period 1874-1901; based on LTES price series). Rice,
   miso or soy sauce are selected as reference on the basis of the lowest level of the coefficient of
   variation of the relative price figures in early Meiji. Cotton cloth price is based on Osaka price

(Miyamoto (1963, 200), assuming 1 kan per tan (provisional; to be revised based on the actual coefficient. Provisional assumptions are used for fish (same price per kg as 1 liter of rice), edible oil (same price as lamp oil), soap (per kg 50% of the price of lamp oil per liter). The price of burning wood per M BTU is calculated using coefficients for converting burning wood into M BTU (average for oak and pine reported in Perry (1963)). For 1750, we used burning wood (no price for charcoal in 1750). For 1882 and 1884, we use charcoal. Note that charcoal coal was four times more expensive than burning wood around Tokyo in 1850.

2. Prices in Tokyo 1882, 1884, 1900, and 1910 are calculated in the same way as in Allen (2001b) for rice, beans, soybeans, eggs, cotton cloth. Sake price based on wholesale price relative to rice, average price per liter in 1880-82 is 1.39 time the price of rice per kg (data source: Noshomusho Tokeihyo); Meat price based on agricultural price of hen slaughtered (LTES), assuming 1 kg per hen; the result is slightly higher than the figure for meat price reported in Allen (2001b). Edible oil price is based on Allen (2001b) and the price of rapeseed (provisional). Same assumptions as for Kyoto 1750 for barley, misc. cereals, fish, edible oil, soap. Fuel is charcoal; the price is measure in terms of BTU by relying on Perry (1963).

Kinai and the Edo-Tokyo index series are expressed relative to the average 1840-1844 (set equal to 1). This linking of three disparate series, done largely due to the lack of a single continuous series, were, as Saito and others admitted, highly problematic considering the possible differences in labor quality, definitions and regions. The most serious problem is the period of Japan's forced opening by the Western imperial powers in the mid-19th century, which wrought drastic changes to Japan's monetary systems and price levels.

In spite of these problems, this real wage index as indicated in Figure 1 below, has often been used as an indicator of the lack of real improvements in Japanese real wages between the mid-18th century and late 19th century. It is unfortunate that this thesis has not been more carefully tested. Here we would like to test it by using a rice wage series. In Figure 1, we show Saito's real wage index along the rice wage series (in kgs. of rice) that we constructed by dividing nominal wages by their respective rice prices of the time. The most surprising finding is that rice wages since the Meiji era shot up consistently and significantly above Saito's real wage series. Considering the

disproportionate weight of rice in Japanese consumers' expenditure, this could be an indication of a possible rise in real purchasing power since the Meiji, a phenomenon that seemed to have eluded Saito's original real wage index. This becomes an issue for welfare ratio calculation.

Figures 1: Rice wages and real wage index for unskilled workers in Japan, 1741-1913 (rice wages measured as kg rice per day worked; real wage index 1840-44=100, rice wage: right scale)
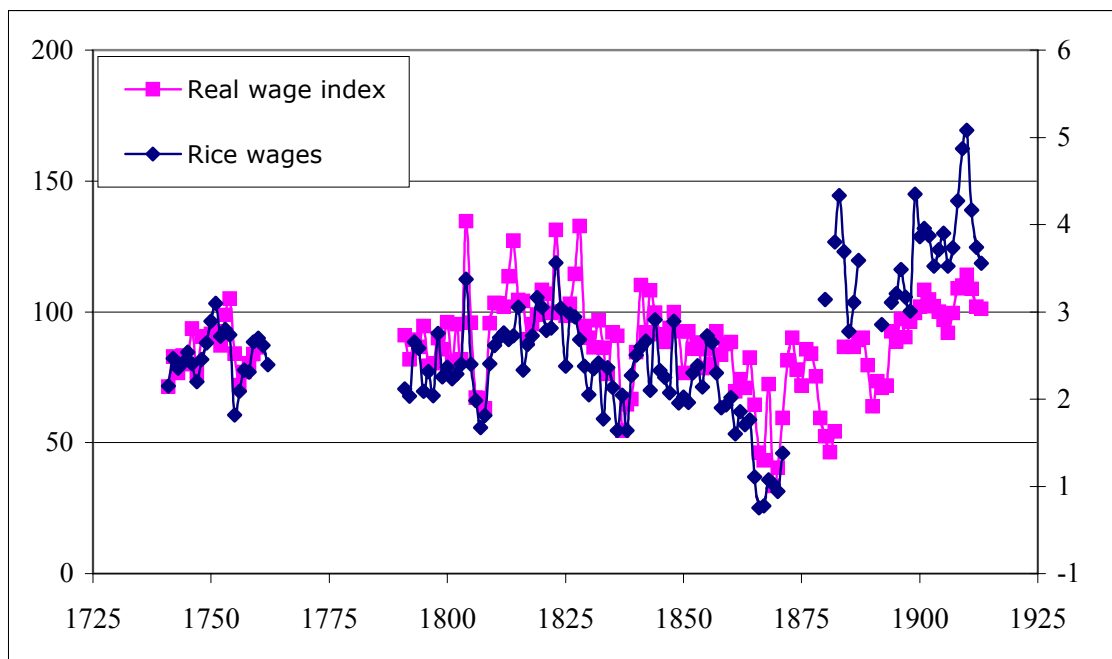
Source: Rice price and nominal wages in Kyoto up to 1868 (Mitsui Bunko), in Tokyo from 1880 (LTES); real wage index series constructed by linking series for Kyoto and for Edo reconstructed by Saito (1978), and LTES series.

II. Wages and Welfare Ratios: an International Comparison

We now apply the Allen (2001a) methodology and calculate the equivalent Japanese welfare ratios using the daily nominal wages multiplied by 250 days (assuming 250 working days per year as in Allen 2001a) and then divided by the expenditure required for the consumption baskets at the three benchmark periods, 1750, 1882 and 1884. The results are presented in table 3. Confirming our early results from the rice wage data, the welfare ratios in the table shows a

substantial jump between the 1750 benchmark year and the 1882 and 1884 benchmark years. Considering the 1882 benchmark being a period of severe deflation, we also include 1884 as a benchmark, which is found to be more reliable and bias-free.

Table 3: Japanese Welfare Ratios for two Consumption Baskets in 1750, 1882 and 1884

| Benchmark year	Japanese basket A	Japanese basket B
1750	0.568	0.642
1882	0.836	0.949
1884	0.848	0.962

Sources: see the text.

Considering the problem of real wage index, we feel that the safest method to measure changes in welfare ratio in Japan from the early 18th to the early 20th is to use the 1750 benchmark series up to 1850, and the 1884 benchmark series for 1875-1913. Figure 2 compares this composite Japanese series with welfare series reported in Allen (xl file: web site) for London and Milan, in both cases based on the benchmark 1750. It appears that the welfare in Kyoto-Tokyo is much lower than in London, but quite similar to that in Milan until the mid-18th century. During the Meiji period, welfare ratio in Tokyo shot above that in Milan. Table 4 summarize the information in terms of average welfare ratio in London, Milan, and Kyoto-Tokyo for different sub-periods and extend the comparison to two other European cities, Madrid and Strasbourg.

Our finding, however, contradicts Allen's (2001b) preliminary works on Japanese welfare ratios for the unskilled workers. His result shows that the Japanese ratios in the 18th and early 19th centuries at about 70 to 80% of that of the London level, about 35% higher than our series. His calculation also puts Japanese welfare ratio higher than most Central and Southern European countries. It is clear now that Allen's calculation is fraught with two problems. First, as we indicated, he applied an India basket which contains a large share of meat, eggs, and other high-price products which would consistently overstate the amount of income needed for Japanese labourer to obtain the required calories and proteins and thus consistently

underestimates the Japanese welfare ratios or real living standards.

Figure 2. Welfare Ratios in Japan and Europe from 1750 to 1913
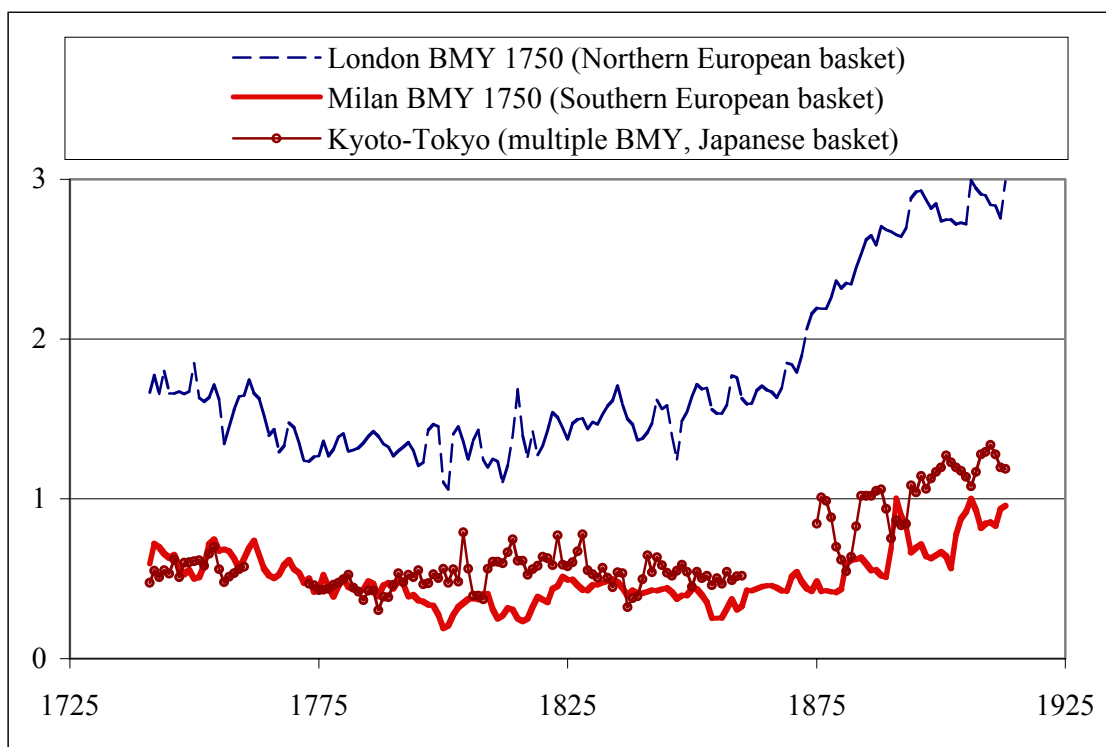
Notes: see the text. Europe Benchmark Year (BM) = 1750; Japan BM = 1750 for 1742 – 1850 and = 1884 after 1875.

**Table 4: Average Welfare Ratios of Unskilled Workers in Japan and selected European Cities**

	1700-1749	1750-99	1800-49	1850-1899	1900-1913
London	**1.58**	**1.42**	1.41	2.15	2.82
Florence-Milan	**0.70**	**0.51**	0.39	0.50	0.83
Madrid	**0.87**	**0.64**	0.95	0.95	1.04
Strasbourg	**0.57**	**0.61**	0.85	0.79	
Kyoto (Jap BM 1750)	**0.56**	**0.54**	**0.64**	(0.51)	(0.69)
Kyoto (Jap BM 1884)	(0.97)	(0.95)	(1.12)	**0.90**	**1.22**

Source: see the text. The number in parentheses the back and forward projection using the problematic real wage index as indicated earlier in the text.

This problem can be most clearly observed in figure 3 which plots the 1882 benchmark

Japanese welfare ratios based on the Japanese and Asian baskets. It shows that welfare ratios based on the Asian basket (adapted from Allen's India basket) is consistently lower than that based on the Japanese basket.

Figure 2. Comparison of welfare ratio in Japan obtained using the Japanese and Asian baskets for the benchmark years 1882 (1750-1913)
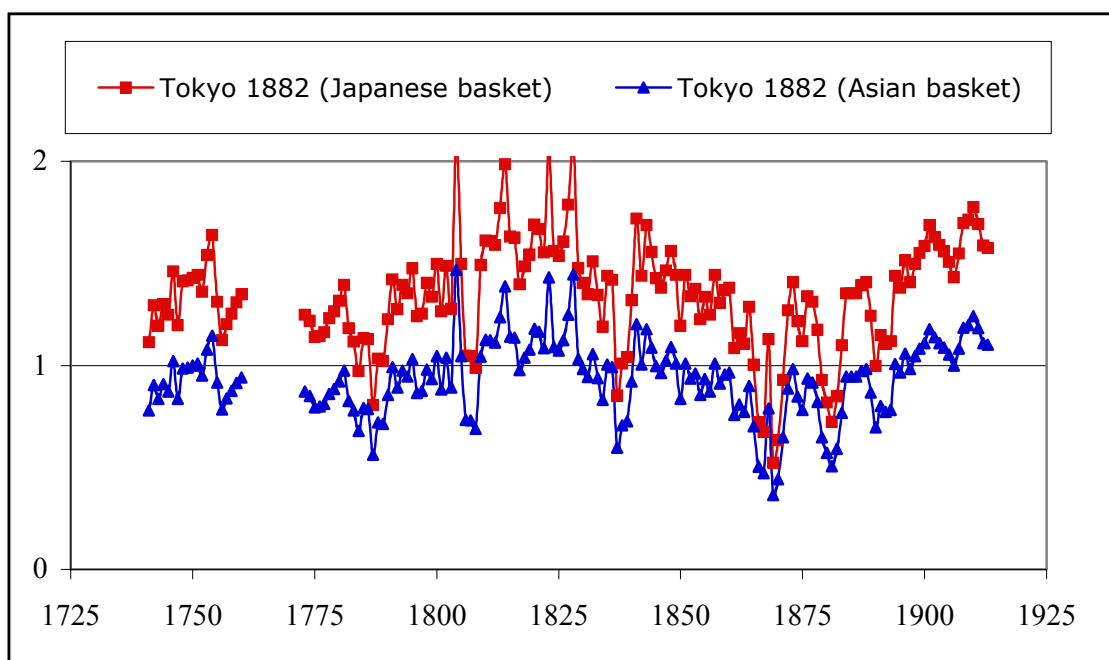
Source: see the text.

However, we know the problem with Allen's series is overestimation rather than under-estimation of Japanese welfare ratios. This is closely linked with the second, or the major problem in his calculation. His welfare ratio is not derived from Tokugawa wages or price series – it was based on the 1882 day laborer's wages and prices in the LTES data. Then the 1882 benchmark welfare ratio was back and forward projected using Saito's real wage index. As we proved earlier, the 1882 (or 1884) welfare ratio based on LTES is rather high and Saito's real wage index did not capture the jump in purchasing power since the Meiji. Allen's back-projected series would grossly overstate the Tokugawa welfare ratios. Luckily, however, his over-estimation was

adjusted downward somewhat by his adoption of the Asian basket. Even though the errors in his calculation did end up canceling out somewhat by accident, that does not change the problematic nature of backward projection method.

III. Summary and Discussion

We have conducted a few robustness checks with other data and are reasonably certain that the wage series and price data, particularly the rice price, used in this study were within the normal range of other Tokugawa price data. In table 5, we provide summary information of Japanese and European wages and income for the two benchmark periods. It shows that our wages expressed in silver and grain units are broadly consistently with other independent studies including some of the papers to be presented in this conference. Table 5 shows most clearly grain wages in Japan relative to Europe were consistently higher than its silver wages. More importantly, Japanese welfare ratios were higher than both of them. In Table 5, we also present Angus Maddison's per capita income estimates (or "guest-estimates" for the 18th century). It is interesting to note that Japanese per capita income as a ratio of Europe were higher in 1750 than in 1884.

Table 5: A Summary Comparison of Japanese and European Wages and Incomes
(Numbers in parentheses are ratios over London with London = 1)

	Silver wages (in grams)		Grain wages (in kgs of bread)		Welfare ratio		GDP per capita (in 1990 Int. dollars)	
Benchmark year	1750	1884	1750	1884	1750	1884	1700	1884
London	11.14	34.36	8.1	15.5	1.68	2.52	1250	3622
Florence-Milan	3.0 (0.27)	8.2 (0.24)	3.3 (0.41)		0.6 (0.36)	0.6 (0.24)	1100 (0.88)	1566 (0.43)
Kyoto-Tokyo	2.8 (0.25)	4.5 (0.13)	2.74 (0.34)	3.95 (0.26)	0.6 (0.36)	0.91 (0.36)	570 (0.46)	836 (0.23)

Note: wage measured in kgs of bread in London and Florence-Milan, the five year average of wage divided five year prices of rice in kg of rice in Kyoto-Tokyo. 1 kg of rice = 1.3 kg of bread. GDP per capita data for Britain, Italy and Japan are from Maddison (2001), p. 206 and p.264 and Maddison (2003), pp.60-61.

To sum up, this paper 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 on the initial conditions for economic take-off.

Our study also reveals important discontinuities 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. More importantly, this result calls attention to a re-evaluation of the economic impact of the transition from Tokugawa to Meiji. Is this substantial jump a confirmation of the argument for the large gains from Japan's opening-up to the world, an argued by Richard Huber in the 1970s? Or on the contrary, the jump in real wage is a reflection of profound changes in labor institutions, commercialization, technology between the Tokugawa and Meiji. As is well-know, side payments to cash wages, self-consumption and household production are predominant features of the traditional Tokugawa society. Ignoring those factors is likely lead to over-simplified underestimation of real living standards of 18th century Japan. It is until we gain a much firmer grasp of the traditional institutions that we will feel more confident about the final interpretation of our real wage findings in this paper.

With Japan being part of the East Asian civilization, we believe our study of Japanese real wages marks a major step towards a more rigorous comparison of global living standards for the 18th and 19th centuries.

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