

Women's Wages and Empowerment: Pre-industrial Japan, 1600-1890

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Abstract

Using new evidence from servant contracts, 1600-1890, we estimate women's wages in Japan. Women's wages could only sustain 1.5-2 people up to 1900, the lowest recorded in the pre-industrial world. We then show the gender wage ratio was 0.7, higher than in Western Europe. Despite this, Japan had lower female empowerment for two reasons. First, absolute wages were low, so women were not economically autonomous. Second, landownership incomes were mostly earned by men, raising their bargaining positions. Low female empowerment in Japan could also explain the early and universal marriage of its women unlike their empowered Western European counterparts.

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Gender was a key determinant of an individual’s economic outcomes preceding the “grand gender convergence” within the richest societies in the 20th century (Goldin, 2014). Recent evidence from long-run wage studies in pre-modern societies show that there was no gender convergence in typical wages preceding industrialization (Humphries and Weisdorf, 2015). However, there is debate on whether differences in female empowerment across societies can explain diverging development outcomes. Specifically, De Moor and Van Zanden (2010) argue that greater female empowerment in Western Europe allowed women to delay or forgo marriage. This led to the distinct “European Marriage Pattern” of late ages at marriage and high celibacy rates. More recently, De Pleijt and van Zanden (2021) provide evidence that Southwest Europe had lower female to male wage ratios than Northwest Europe, which may explain the “little divergence” within Europe, although these findings remain contested (Palma et al., 2021).¹ If female empowerment also mattered elsewhere, we would expect female empowerment to have been low in the rest of the world where early and universal marriage was the norm. However, there is currently no evidence regarding female empowerment outside of Europe.

This paper uses a novel dataset of 899 female servant contracts in pre-industrial Japan, 1600-1890, to estimate annual wages and the gender wage ratio. This source is suitable for studying women’s wages because servanthood was a common way in which labor was exchanged between households at the time. Using the standard subsistence basket approach by Allen (2001), we estimate annual wages and show women could only afford between 1.5-2 barebones baskets during this period. In comparison, the evidence from Europe (Humphries and Weisdorf, 2015; De Pleijt and van Zanden, 2021) suggests women in many Western European societies could commonly earn between 3–6 barebones baskets during this period. Consistent with the findings for low male wages (Kumon, 2022b), our estimates place Japanese female wages among the lowest recorded within the pre-industrial world.

¹The exact timing of the little divergence is also contested and varied by region. For example, recent evidence from wages in Rome suggests the divergence of Northern Italy occurred as late as the 18th century (Rota and Weisdorf, 2020).

We next examine gender wage ratios among servants. We find that the gender wage ratio in Japan was high and stable at around 0.7. We then show that there is little evidence of the wage ratio being low due to pay discrimination. Using data from the secondary literature, we show that workers performing less physically intensive tasks got paid the same wage regardless of gender. However, there is evidence that task assignments differed across genders. Thus, wage differentials by gender can be attributed to differences in tasks assignment and productivity which mirrors many empirical findings from Western Europe. When we compare the gender wage ratio with contemporary Europe, we surprisingly find that Japan had the highest wage ratios (De Pleijt and van Zanden, 2021). Thus, the initial impression is that Japanese women were among the most empowered in the world.

However, we show that female empowerment in Japan was nevertheless lower than in Europe for two reasons. First, these women had low absolute wage levels and therefore were not autonomous. Using the bargaining framework, we theoretically show why the assumptions behind the use of gender wage ratios are problematic within extremely low incomes societies such as pre-industrial Japan. Instead, we propose a new alternative measure which we call surplus ratios. This measure compares the levels of surplus production beyond subsistence. It's strength is that it also accounts for the absolute wage level in addition to the relative wage level. This alternative measure shifts down female empowerment levels in Japan to levels that were more typical in Western Europe.

A second issue is the need to account for landownership incomes. Due to the relative equality of Japanese society, households earned considerable landownership incomes. It was also primarily a society characterized by male inheritance of lands, much like other societies in this era, so that a divorce would generally involve men keeping the lands. Thus, the bargaining position of the women were much lower than those implied by wage ratios. In contrast, typical households in Western Europe did not own land due to greater inequality. Therefore, the traditional approach of comparing wages ratios made sense within this context and asset ownership was generally not accounted for with a few exceptions (Humphries, 1990;

?). Once we account for landownership in Japan using gender *income* ratios, the ratio drops to 0.5. This places Japan at the lower end of findings from Western Europe. Once we combine the two measures to compute the surplus income ratio, the original findings reverse showing that Japan clearly had the lowest female empowerment at this time.

Our findings contribute to the growing literature on female empowerment and economic development. In recent years, institutions such as the world bank have placed greater importance on female empowerment as a means to develop societies (Bank, 2011). Evidence from developing societies show female empowerment can affect important outcomes such as child health and human capital outcomes (Alami et al., 2020), savings (Doepke and Tertilt, 2019), and female mortality (Calvi, 2020). However, there is relatively little quantitative work on pre-industrial women, with the exception of Horrell et al. (2020). This is due to the lack of basic evidence on women’s wages and bargaining positions. Our contribution is twofold. First, we create the first long-run women’s wage series outside of the pre-industrial West. Second, we propose an alternative measures that overcomes the limits of gender wage ratios.

The new findings from Japan show that landownership inequality affected gender inequality. Paradoxically, the highly unequal societies of Western Europe had greater gender equality and female empowerment because both genders typically owned no land. Therefore, despite patrilineal inheritance of lands being common in this era, it was only in the most equal regions of the world that this led to women being less empowered. These insights are also likely to apply to China which also had a relatively equal land distribution (Kumon, 2021). Therefore, equality in landownership combined with patrilineal inheritance led East Asia to have lower levels of female empowerment than Western Europe. If greater female empowerment allowed women to delay or forgo marriage, as has been argued in the literature (De Moor and Van Zanden, 2010; Horrell et al., 2020), differences in landownership can explain a large part of why Western Europe developed the European Marriage Pattern while East Asia did not. If lower female empowerment also increased fertility, this can also

partially explain East Asia’s early divergence towards a low wage society (Bassino et al., 2019; Kumon, 2022b).

Data

This paper estimates the (implicit) wage of female peasants in pre-industrial Japan, 1610-1890, using servant (*hōkōnin*) contracts. Much like in Europe, these servants were laborers on long-term contracts who lived and worked in their employer’s household. This society was still primarily agricultural (Saito and Takashima, 2016), with 60-75% of output coming from the primary sector, and most servants were employed by agricultural households. Demand for servant labor arose due to the mismatch in household landownership relative to family labor supply. Employing some long-term laborers made sense in the context of a predictable need for labor over the agricultural work year. In contrast, day laborers could be bought in when there was a short term need during busy periods such as when transplanting rice. In exchange for their labor, the servants received food and board as an implicit payment in addition to a wage payment.

We have collected 899 servant contracts in the period 1602-1889. Our research strategy was to collect as many of these contracts as possible from various locations and time periods. We then use a regression estimation approach to control for wage heterogeneity by location.² Some data were collected from original documents in archives while others were from secondary sources. A full list of sources are available in appendix F. The resulting distribution of the observations for rural female servants are given in figure 1. More observations are available in later periods due to survival bias. This means our estimates for the early 17th century are not as reliable. We will show the extent of this issue by estimating standard errors in our regression.

The source allows us to always extract the year, location, sex, contract period, and

²Unlike the focus on household level wages in the past literature (Uemura, 1976), this approach allows us to avoid local biases from driving wage estimates.

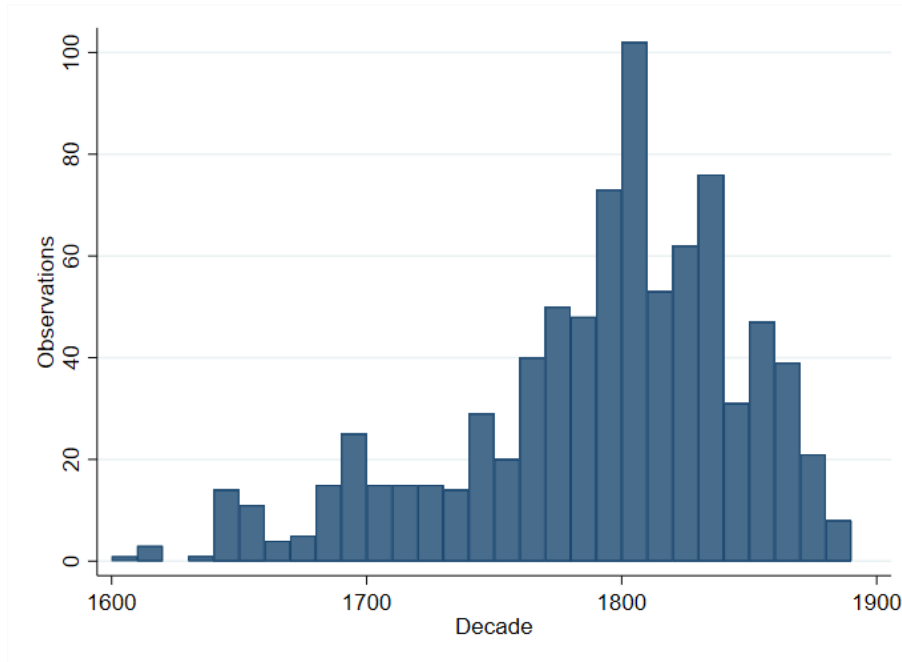


Figure 1: Observations of Female Rural Servants Over Time

payment. In some rare cases, we can observe the age, days of rest, and payments in-kind for clothing. These variables are self explanatory except for the payments which were more complicated. There were four types of payments. First are wage based contracts whereby women were paid for a fixed period of service. Second are loan based contracts whereby a loan, that was partially interest free, was given to the servant’s household upon employment. In this case, the labor of the servant was considered to be paying the interest on the interest free part of the loan. Upon the servant returning the initial loan, the servant could return to their household. Such contracts were more common in the 17th century but gradually became less common over time. Third are a mixture of a loan and wage payment. Fourth are slave based contracts whereby a servant is purchased and owned by the employer. We drop all sales type contracts and focus on the other three types of contracts. We turn the remaining types of data into either a wage or loan payment denominated in silver currency (*monme*). As both wages and loans were mostly received in advance, we additionally correct for this factor. We show the details behind these corrections in appendix A. Importantly, we control for the loan type contract in the regression to convert them into a wage equivalent

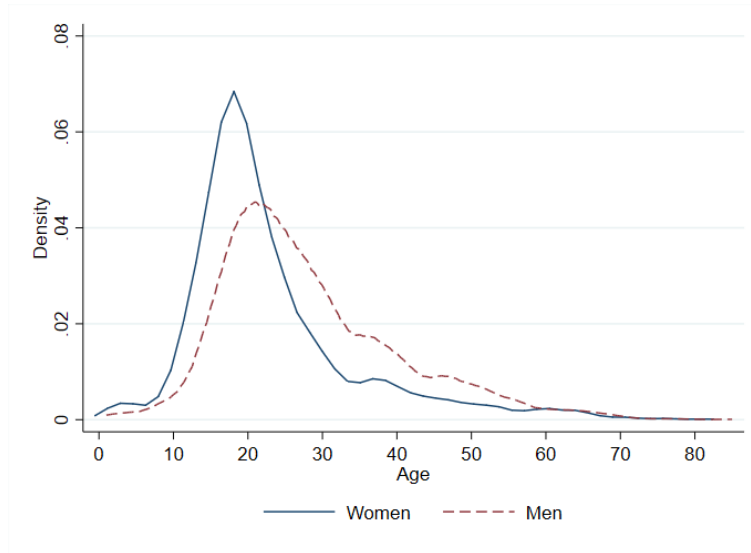


Figure 2: The Age Distribution of Servants in Village Registers

Source: Village Registers Data

payment. Further, we will show that dropping loan type contracts does not affect our results.

Our goal is twofold. The first is create a wage series that is representative of the value of female labor in general. The second is to compare the wages of male and female servants in Japan. There are a number of potential issues in achieving these goals which we address below.

First, there could be market distortions if employers had oligopsony power on the labor market. This could make servant wages lower than the value of their labor. However, we follow the argument by Kumon (2022b) to argue that employers usually employed only a few servants so they lacked oligopsony power with which to bargain for low wages. Servants could also find many potential employers within a few days walking distance from their home village. Therefore, the wages must have been close to competitive market values.

Second, there is potential selection into servanthood. Servants tended to be younger household members. The servant contracts rarely include the age of the laborer so, much like other pre-industrial wage studies, we cannot control for age in our regression. However, we can use a sample of village population registers, which include data on servants and their ages, to see the general distribution of female servant ages. We show the observed ages in

figure 2. The median female servant age was 20 while the mean was 23 while for men it was 25 and 28 respectively. Therefore, servants were younger laborers than what was typical in the population.

This is a problem if there is an age premium on the wage such that older women have higher (implicit) wages. Age certainly mattered to a great degree when employing children because they were generally net consumers of resources until their early to mid teens in a wide variety of pre-industrial contexts (Kaplan et al., 2000; Ogilvie, 2003). Therefore, including girls will bias the estimates downwards. However, we are unlikely to be including young teenagers in our sample because we drop all observations where the wage or loan payment is zero.³ Further, a large number of very young servants are likely to be hereditary servants. Therefore, they would not have been employed via a servant contract from which our sample is based.

Overall, our observations are likely to be from people who are at or beyond their late teens. This means these women have mostly reached their maximum height, typically at age 15, due to an earlier puberty than men so that they are already physically developed.⁴ Therefore, the main advantage that older people will have is due to experience. We cannot measure this among women in Japan. However, among men in Japan during this period, wages peaked at age 41 so that relative to a 20 year old, there was a 5-7% increase in the wage (Kumon, 2022b). This suggests a minor downward bias that does not change our narrative. We also compare the results at the mean relative to the median for robustness.

A third issue is the general lack of job description within contracts. Even when the type of job is specified, there were many types of associated and unassociated tasks that was done. For example, a women employed as an agricultural laborers did a wide variety of tasks such as threshing and transplanting but also did housework and weaving (Aoki, 2001). In general, women were limited to unskilled tasks, with some outliers (Wakita et al.,

³We also drop the few cases when the age is observed and less than 18.

⁴For example, NCD Risk Factor Collaboration dataset shows this is true for a wide range of countries today inclusive of Japan and less developed countries. Men reach maximum height later at age 18-19.

1987), but we know little beyond this.⁵ Consequently, we do not generally know whether variations in wages across women or gender are due to differences in tasks, efficiency, or pay discrimination. This limitation is shared by many female wage studies, especially among those who were servants. However, we address this later using a separate set of data to show the lack of pay discrimination.

Methodology

We use a regression approach to construct a wage estimate following the literature (Clark, 2005; Kumon, 2022b). The specification is as below.

$$Total\ Wage_{i,t} = \exp(\beta_0 + \sum_{d=1}^D decade_d + \beta_2 loan_i + \beta_3 Z_{i,t}) + e_{i,t} \quad (1)$$

We use a poisson regression which allows for a more robust prediction of wages relative to taking logs of the dependent variable (Silva and Tenreyro, 2006). The dependent variable is the total wage received for the entire period of service. The variable of interest is β_d which estimates the average wage by time-period. Estimates are generally made by decade during normal years where nominal wages fluctuated little. The exceptions are during years of currency devaluations and the Meiji restoration which led to large fluctuations, where I deviate from decadal intervals. In periods with low sample size preceding 1750, we also use time-period dummies that span longer periods. We create a dummy for loan and slave type contracts which would automatically account for the implied interest rate on the loan. $Z_{i,t}$ controls for region and the period of service.

We estimate the nominal wage because it was far more stable than real wages at this time as shown in appendix C Kumon (2022b). Statistically, this means greater precision

⁵Some women ended up in very high position within family firms due to a combination of there (temporary) being no male heir in addition to their talent. One example is Mitsui Shuhō, a woman, who managed the Mitsui family business (that later became a major conglomerate) in the 17th century. Such cases show that women entering high skilled jobs was highly situational and rare.

when estimating wages by decade. Using the estimation we predict the nominal wage in each decade for a one year wage contract with region dummies weighted by population. We then further account for the fact that these workers received wages in advance by upwardly adjusting the nominal wage assuming a 20% interest rate.

Finally, we turn this into real wages by using the welfare ratio approach by Allen (2001). We use the barebones basket and the respectability basket of basic goods (food, fuels, and clothing) for Japan in Kumon (2022b). The barebones basket has 2,100 kcals of low desirability foods per day and would be sufficient to subsist a man with low levels of activity. The respectability basket has 2,500 kcals of high desirability foods per day and would be sufficient to subsist a man with medium amounts of activity. Although these are benchmarked on men's calory consumption, we use this measure for comparability purposes.

As the in-kind payment is unobserved, we add the cost of a female barebones basket to the wage which is a common solution in the literature (Humphries and Weisdorf, 2019). When doing this, we account for the lower food consumption needs of women by using the estimates from FAO/WHO/UNU (2004) which suggests women eat around 83% of the calories of men (FAO/WHO/UNU, 2004).⁶ Therefore, assuming women consumed equal amounts of fuels and clothing, the barebones subsistence basket of a typical woman would have cost only 86% of that of a typical man.

There are a number of criticisms that can be made of the basket. First, barebones basket may be too luxurious because peasants could not have eaten rice and instead ate millet or other cheaper grains. However, agricultural statistics from the 1870s show such grains composed around 6% of national grain production and such diets could not have been typical.⁷ As stated by Arizono (2007), the myth that these peasants did not eat rice may have arisen due to peasants commonly cooking rice with other grains. When the samurai saw this food, they did not recognize it as rice because the resulting mixture has a different

⁶We base this on the estimates for 30-59 year olds for each sex.

⁷Further, there was no incentive to produce a cheap grain when one can produce more expensive grains except under certain land quality constraints.

color and look to a bowl of pure rice so they thought peasants do not eat rice. In turn, this perspective of the ruling class became the prominent view in modern Japan.

Second, others may believe the barebones basket does not include enough rice. This is a more viable view because agricultural statistics from the 1870s suggest rice would have been around 45% of grain consumption in rural Japan. Relatedly, servants may have been consuming even more kcals of food than the barebones basket. We therefore conduct robustness tests to show that it is only under extreme assumptions that our results will change to a large degree.

Results

Figure 3 plots the estimated female servant wages and we augment it with servant wage data from the annual statistics of imperial Japan for the period after 1882 (*Dai Nihon Teikoku Tokei Nenkan*). We additionally plot the male servant wages for comparison. The main finding is that women’s wages were generally worth less than 2 basket throughout the entire period preceding industrialization. If we instead use respectability baskets, the estimates suggest women only earned 0.7-1.3 baskets (see appendix D). In either case, the situation was stark for women as they could keep themselves alive but could not reliably feed an additional person. A shock in their real earning, due to harvest shocks, unemployment, or illness could quickly lead to starvation. This finding is consistent with the qualitative accounts of a female laborers at this time (Stanley, 2020).

There were some important fluctuations which mirror the findings for male wages (Kumon, 2022b). The first stage was a decline in wages from 1600-1670 and stability at below 1.5 baskets up to 1750. This was likely due to a large increase in population from 1600 after the end of a civil war that lasted about 150 years. Thereafter, there was a gradual increase in wages up to 1800 where it reached a plateau. This was when population stabilized, potentially due to infanticide (Drixler, 2013), which may have shifted the Malthusian equilibrium.

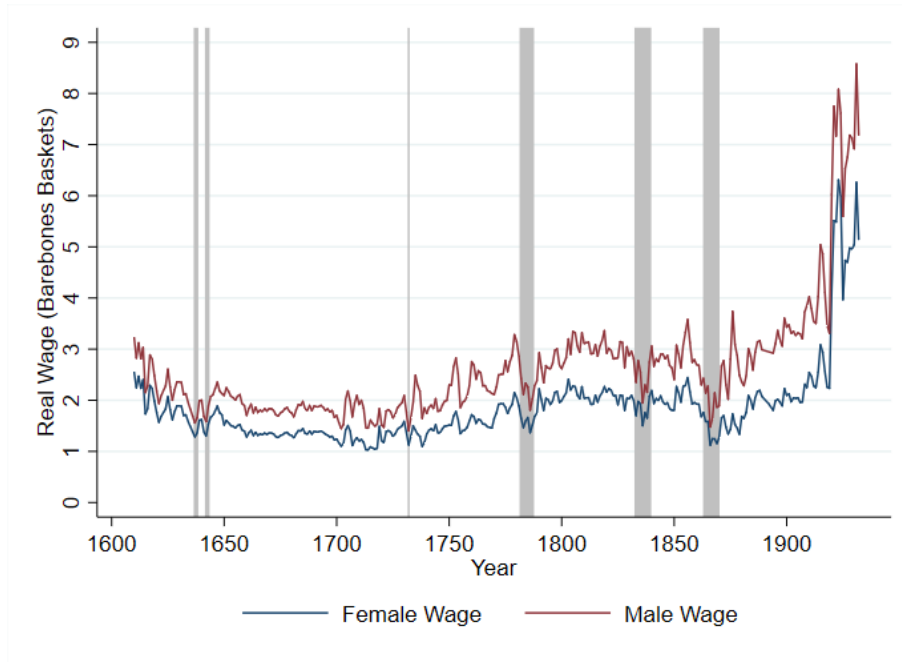


Figure 3: Annual Servant Wages in Japan

Shaded regions indicate periods with major shocks.

Source: Female Servant Dataset, Statistical Yearbook of the Japanese Empire, (Kumon, 2022b)

The break away from extremely low wages only happened after 1900 as Japan industrialized.

A number of factors suggest our estimates are accurate. First, the female wages mirror the male wages that were independently estimated by Kumon (2022b). This would be expected if markets functioned and there was no radical change in agricultural technologies. Second, the wages from the statistical yearbook after 1870 were very close to the wage estimates from our estimates from servant contracts. Thus, the contracts themselves are unlikely to be a biased sample of servants. Third, the standard errors of our estimates are small (see figure 4) and there is high precision for much of the period. Our narrative holds as long as we are within the 95% confidence intervals. The only exception is the early 17th century where we have a small sample size.

We also tested other specifications to test for the robustness of our results. We addressed each of the following concerns by creating alternative estimates. First, loan type contracts differ in nature to wage contracts in a way that leads to bias. To address this, we only use

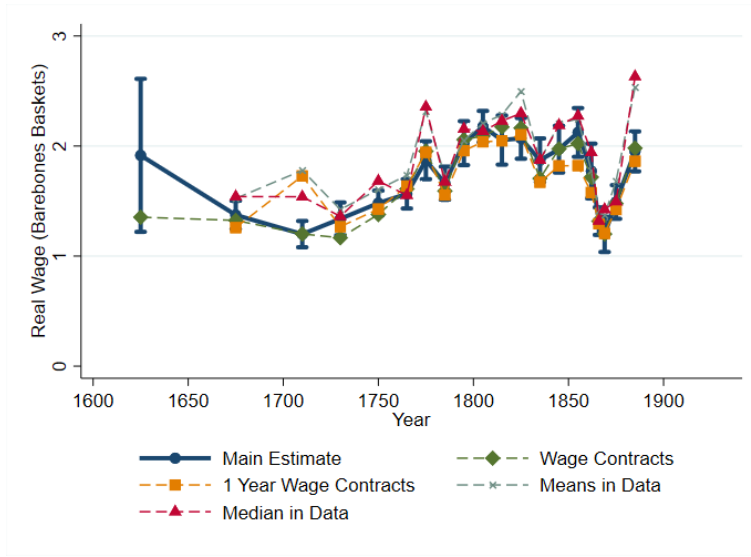


Figure 4: Female Wage Estimates with 95% Confidence Intervals

All robustness checks are dashed. Wage contracts and 1 year wage contracts use regression method. Mean and median in data take the averages within the sample of one year wage contracts. Source: Female Servant Dataset

wage contracts in a separate regression estimate. Second, the duration of contracts may lead to bias in spite of our controls that use dummy for each duration. We therefore conduct a separate regression which only use wage contracts of one year in duration. Third, there could be concern that the regression results are inconsistent with the raw data. We therefore use average/median wages within the sample for one year wage contracts.

We additionally plotted the results from these estimates in figure 4. We find most of the resulting series are similar to our preferred wage series. The differences are largest when we use sample averages/medians but this could be due to the lack of control for regional controls. However, the use of any of the alternative series does not significantly change our conclusions.

There is one remaining assumption, unrelated to the regression, that can affect the level of our wage estimates. This is the amount of in-kind payment. We have so far assumed this was worth one woman's barebones basket. However, we can make a number of other assumptions. If they received a woman's respectability basket, the wage series will be shifted up on average 0.7 (see appendix D for graph). This would instead mean women earned

between 2-2.7 barebones baskets which is better but still makes them poor. However, this would mean servants consumed a large amount of rice amounting to 82% of their grain consumption. This is much higher than the share of rice within grain consumption in rural Japan which is estimated at 45% for 1877-1878 (Arizono, 2007). Therefore, it makes little sense to assign servants this basket which is designed for the rural upper class.⁸

Instead there are two more plausible alternative scenarios based on a peasant consumption study of Japan at this time (Arizono, 2007). First, we could assume these women were eating 2075 kcals (or 83% of a 2,500 kcal basket) of barebones quality foods.⁹ If so, the wage series is shifted up on average by 0.1. Second, we could assume these women were eating 2075 kcals with a basket where 45% of their grain consumption was rice (which as explained above is the average per capita rural consumption in the late 19th century). This would shift up the wage series by 0.25. While plausible, this probably gives servants too much rice as they were the lowest status people within the village and probably ate less rice than average. If reality was closer to these cases, there is little change in the absolute wage level.

Discrimination, Task Division, and Productivity

Unsurprisingly, women's wages were lower than men's wages which fluctuated at between 2-3 baskets. Female wages were around 70% of the male wage and highly stable for most of the period. This is unlikely to be due to women working less days. Although the number of contracts stipulating the days of rest is very limited for women (N=18), the available data suggests they worked 337 days a year compared to men who worked 325 days a year (Kumon, 2022b).¹⁰ Although we cannot be confident about the precision of this estimate, it is unlikely that women worked less than men. Then what was the source of this gender wage ratio?

There are three common explanations. The first is that average wage differences simply

⁸Another reason the respectability basket seems implausible is that this implies gender wage ratios that are 0.74. This would be much higher than anything found in Europe.

⁹To do this, we assume the difference in calories is made up via barley and buckwheat consumption.

¹⁰We have converted the lunar calendar in Japan to the Western calendar in order to have a 365 day year.

reflect differing productivity. The second is that men and women received different pay for performing identical tasks (i.e. gender discrimination). The third is that men and women did not perform the same tasks (i.e. gender division). The first explanation points towards a well-functioning labor market whereas the latter two points towards inefficiencies.

While much of the literature finding the lack of gender discrimination in the pre-industrial West (Cox and Nye, 1989; Van Nederveen Meerkerk, 2010; Burnette, 2015; Drelichman and Agudo, 2020; Burnette and Stanfors, 2020) there are examples of societies where gender discrimination existed. For instance, there is the case of pre-industrial Southwest Europe (De Pleijt and van Zanden, 2021), although debated by (Palma et al., 2021), and 19th century Sweden, in addition to the clear emergence of gender discrimination after industrialization due to the rise of internal labor markets (Burnette, 2015).¹¹ Therefore, it is too early to assume the gender wage ratios in Japan were not driven by gender discrimination.

To examine this, we use detailed records kept by certain employers in pre-industrial Japan from the secondary literature (Aoki, 2001; Takahashi, 2004). If wage differences were due to strength related productivity differences as shown by Burnette (1997), we would expect the wages to be more equal for tasks requiring less strength. Records from one household in Northeast Japan speak to this as they employed both men and women as day laborers in sericulture. The first recorded task was the transferring of silkworms into individual spaces where they began to form cocoons. The second was the process of making moths lay eggs in specific areas to create the next batch of silkworms. Each of these tasks required a large amount of labor within a short period of time.

We show the gender wage ratio in figure 5. It shows that men and women generally got equal pay in both tasks. This is not because this household was progressive and generally paid laborers equally. There was a wage ratio among agricultural servants in this household, much like our earlier findings. A further indicator is the wage ratio among seasonal servants

¹¹Stanfors et al. (2014) show that piece rate workers received equal pay but there was discrimination among time rate workers in the late 19th century Swedish cigar industry. Importantly, they also show that firms employing more women had better survival rates. Thus, discrimination could only be a short run phenomenon.

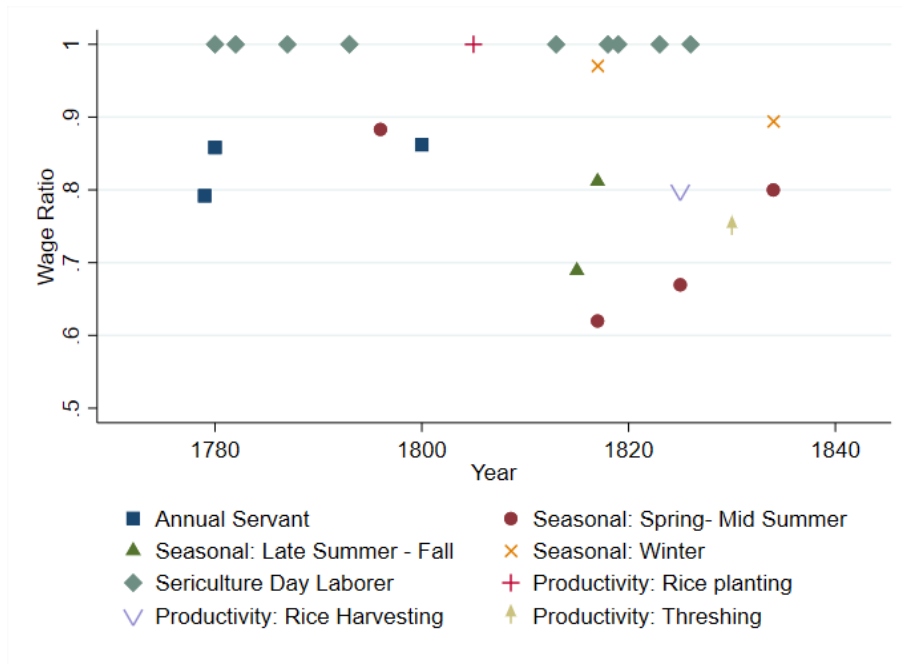


Figure 5: Wages by Type of Work

Source: (Sugano, 1982), (Takahashi, 2004)

that were employed by this household. Agriculture was mostly done from spring to autumn while there were relatively few tasks in the winter. Thus, winter wages should also be more equal. Consistent with this, the evidence shows that both genders received very similar pay in this season.

Further evidence is available from expected productivity within tasks as stated by employers and agricultural manuals of the time (Sugano, 1982). The tasks, planting, harvesting, and threshing, were those in which both men and women participated. We also plot these in figure 5. It shows productivity was expected to be identical in rice planting which was a task involving the least strength. However, harvesting and threshing had lower productivity expectations and fall closer in line with the wage ratios in the agricultural season. Thus, wages appear to be in line with productivity differences.

However, there was a clear gender division of labor. Using diary records from the 19th century Kantō region, Aoki (2001) compares the work records of male and female agricultural servants. She shows that only women worked in the spinning and weaving of cotton, and

housework. In turn, only men transported goods outside of the household. While both men and women worked in agriculture, the more strength intensive tasks such as the tillage and harvesting were dominated by men while women were involved with less strength intensive tasks such as threshing. This is not a peculiarity of this household and there are similar findings in other studies (Takahashi, 2004; Nagashima, 2019).

Japan was no different in this respect from Western European societies where a gender division across occupations clearly existed in the pre-industrial period (Burnette, 1997; Whittle and Hailwood, 2020). In addition to productivity difference, the different tasks performed by servants may also explain some of the difference in pay across genders. This may have led to some inefficiencies in labor allocations. However, within the rural context, this gender division may have mostly been driven by the logic of comparative advantage. As average strength differences are large across genders (Burnette, 1997), there is good reason to expect the emergence of gender division without a loss in efficiency. Thus, the degree to which occupational discrimination, and its resulting economic inefficiencies, led to gender division remains unclear.

International Comparisons

We now compare Japanese female wages to those from other pre-industrial societies. We compare both day wages and annual wages using 2,100 kcal barebone baskets. Day wages are a better indicator of the value of labor per unit of time. Annual wages are a better indicator of annual incomes but not for the value of labor due to variation in the number of days worked across societies. Since we only have annual wages in Japan, we convert them to equivalent day wages by assuming a 325 days of work in a year from the estimate made for Japanese men at this time (Kumon, 2022b). This is slightly below the 338 days worked by women within our sample but the sample size is very small so we stick to the men's

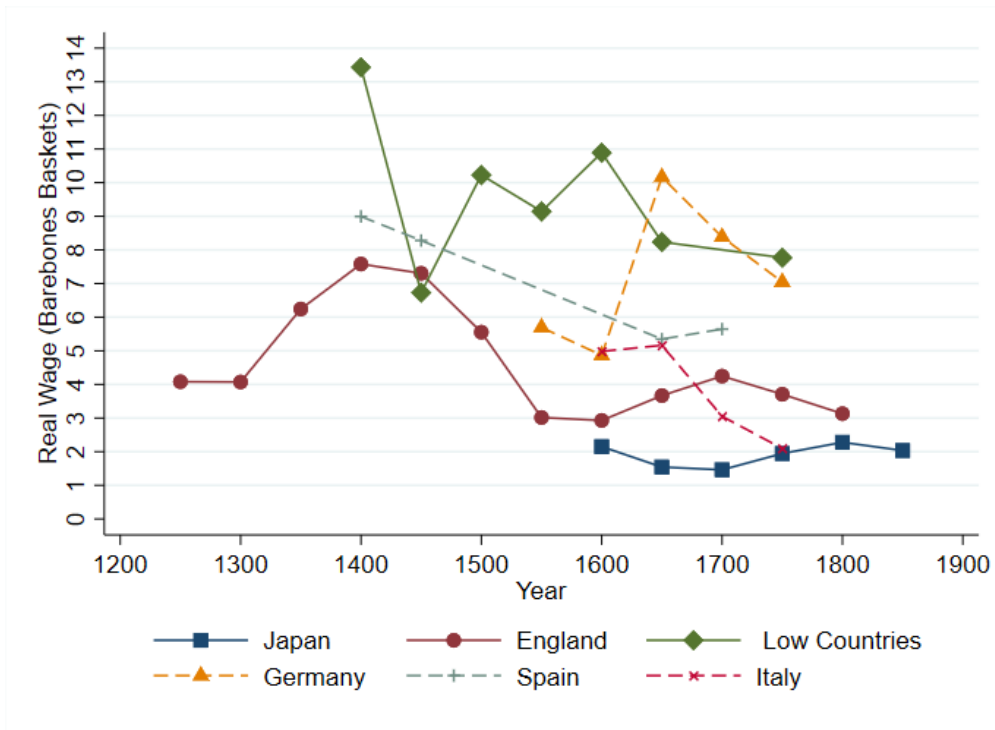
estimate.¹² In doing this, we assume the number of days of work remained stable. This is reasonable for Japan where men’s number of days of work per year saw little change (Kumon, 2022b) unlike in England (Humphries and Weisdorf, 2019).

For comparison, we use the women’s wage series from England by Humphries and Weisdorf (2015) and other European countries by De Pleijt and van Zanden (2021). The English wages include annual servant wages and casual day laborers wages. Annual servants in England tended to be younger unmarried women while casual laborers were mostly married women. Due to the difficulty of converting English female servant wages to day wages, because of variation in the number of days worked over time, we use servant wages for the annual wage comparison and the casual laborer wages for the day wage comparison. For the other European wages, we convert the 1,950 kcal baskets in the original article to 2,100 kcal baskets to make it comparable.¹³

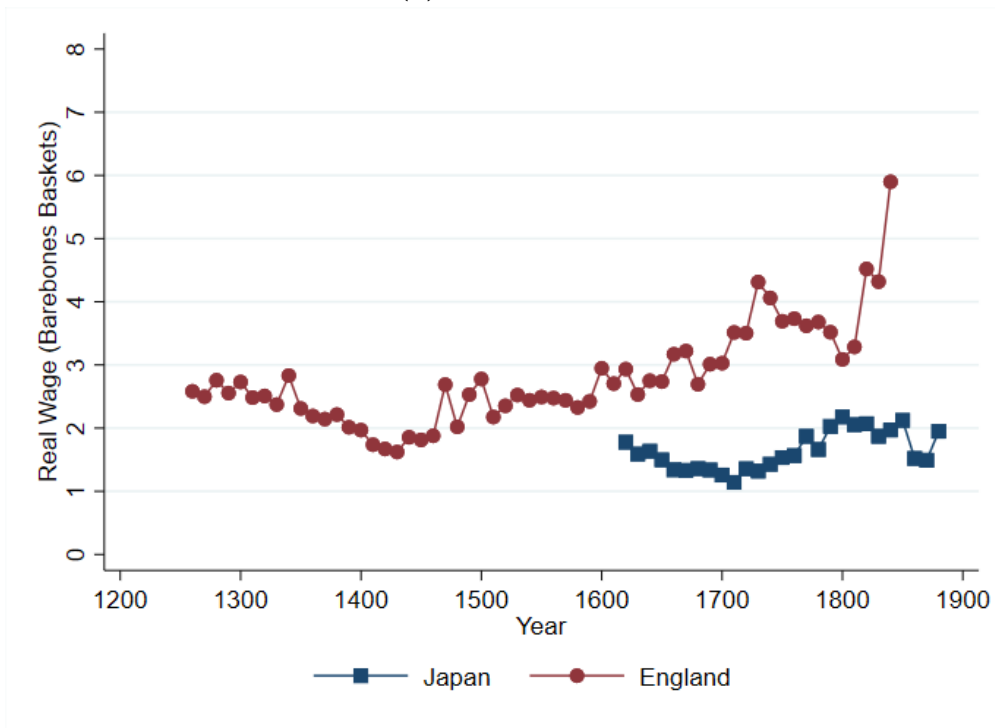
The resulting wage series are presented in figure 6. The day wages in figure 6a show Japanese women to have been clearly poorer than those from other societies. Women in England could mostly afford 3-4 barebones baskets when society had reached a Malthusian equilibrium. Thus, they earned double the income of Japanese women. The data from other European countries suggest their women had even higher wages with the exception of Italy where wages declined in the 18th century. There are two concerns with these data. First, the women’s wages are different from typical findings from men’s wages. Second, the large variation in wages over time in these other societies suggests high standard errors. Therefore, there may be some error associated with estimates other than Japan and England. To address this concern, we conducted a robustness check by combining the gender wage ratios in De Pleijt and van Zanden (2021) with the male wages of Allen (2001). We show in appendix D that using this alternative series does not alter the finding that Japanese women earn the lowest known wages at the time.

¹²The 325 days of work is also closer to that specified at the village level in various sources (Abe, 1998; Furukawa, 1986; Saito, 1998)

¹³We increase the calories by using the secondary grain in the country. The data is available online.



(a) Day Wages



(b) Annual Wages

Figure 6: Women's Wages in Japan and Europe

Source: Female Servant Dataset, (Humphries and Weisdorf, 2015), (De Pleijt and van Zanden, 2021)

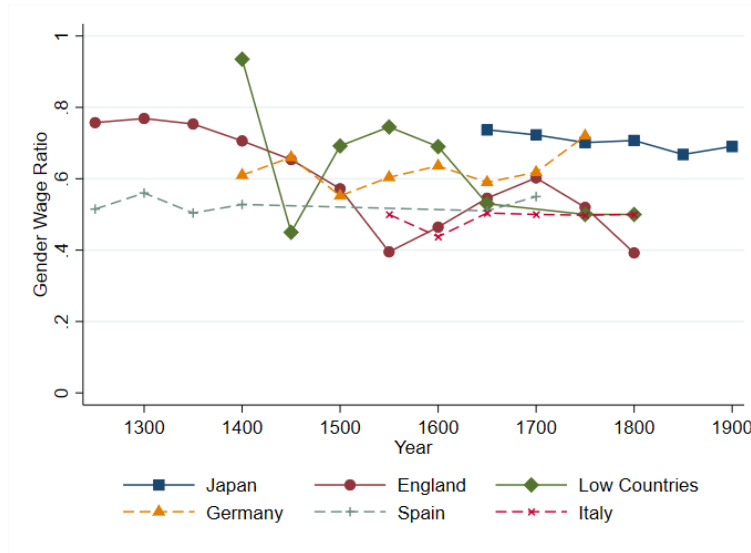


Figure 7: Gender wage ratios

We define the gender wage ratio as the wage of women divided by the wage of men. In the case of England, we use the wage of casual female laborers.

Source: Female Servant Dataset, (De Pleijt and van Zanden, 2021)

The annual wage comparisons in figure 6b show English women’s annual wages were at least between 3-4 baskets in the 17th-19th centuries. Therefore, their annual incomes were also much higher and they could achieve higher living standards. It was only in the period following the black death that their annual wages were comparable to those in Japan. However, it is necessary to keep in mind that the English worked significantly less days to achieve this income (Humphries and Weisdorf, 2019) so that their leisure consumption was much higher.

We next compare the gender wage ratio in Japan with that of a wider range of societies in figure 7. Surprisingly, the gender wage ratio in Japan was consistently high at approximately 0.7. This is higher than the estimates for Southwest Europe although recent work on Portugal suggests Portugal may have had similarly high gender wage ratios (Palma et al., 2021). This is also slightly higher than in Northwest Europe although there are a few periods with exceptions. Therefore, Japanese women earned the lowest wages but earned among the highest relative wages in the pre-industrial world.

An interesting implication of these findings is that the relatively high Japanese gender

wage ratio may partially explain why Japanese male wages were so low. The Malthusian literature has focused on the comparison of male wages but have largely ignored female wages. However, the Malthusian model predicts that the average total income of households should leave households at subsistence level. Therefore, a couple's income, all else equal, should be the same across societies. If gender wage ratios varied across societies, a high gender wage ratio will lead to lower male wages in equilibrium. A rough calculation of the effect is possible if we assume Japan had a gender wage ratio of 0.7 and women worked as much as men. Then Japan would have male wages that are 6% lower than in a society with a gender wage ratio of 0.6 (for example, England in 1700) and 12% lower than a society with a gender wage ratio of 0.5 (for example, pre-industrial Spain). Although real effects are smaller because women worked less in the life cycle due to pregnancy, this can partially explain the early divergence in male wages.

Female Empowerment

We now turn to the implications of the gender wage ratio, $\frac{w_f}{w_m}$, on female empowerment across pre-industrial societies. This has been the favored measure in the literature and taken at face value, we would conclude that women in Japan were more empowered than women in much of Western Europe. However, two corrections are in order before jumping to conclusions.

To see this, we can look at bargaining models which underpin theoretical models of female empowerment (for a recent application, see (Doepke and Tertilt, 2019)). In the simplest form, households are maximizing the following function

$$\max_{c_f, c_m} [u_f(c_f) - u_f^o]^\alpha [u_m(c_m) - u_m^o]^{1-\alpha} \quad (2)$$

subject to the following resource constraints.

$$c_f + c_m \leq w_f + w_m \tag{3}$$

Here, the subscripts m and f denote male and female, c_i denotes private consumption, w denotes the wage, u denotes a utility function, and u^o denotes utility under the outside option of living independently.¹⁴ Marriage can be incentivized by an increase in the utility due to additional benefits such as public goods, economies of scale, or love.

Bargaining power is determined by two parameters. α is the relative bargaining ability of the female and u_i^o is the bargaining position (or the outside option). As either bargaining ability or outside options increase for one household member, he/she gets an increased share of consumption. The first concept of bargaining ability cannot be quantitatively captured. Therefore, the literature has focused on the bargaining position of couples. One way of measuring the relative bargaining position is to take the ratio of $\frac{u_f^o}{u_m^o}$.

The gender wages ratio is a good approximation of relative bargaining positions under two conditions which we examine individually below. First, the income of the individual has to be the (implicit) wage. Second, the utility function, u_i^o , has to be approximately linear (i.e. $u_i^o = \gamma c_i^o$).

Accounting for Landownership

The relative bargaining position of men and women depended on their access to resources. Therefore, an accurate measure of empowerment would be based on income ratios rather than wage ratios. Within pre-industrial Western Europe, there was high inequality so the typical household did not own lands and wages were the dominant source of incomes. Therefore, the past literature from Western Europe was correct in focusing on wage ratios as the measure

¹⁴It is also possible to conceptualize the outside option as less extreme states such as independence via divorce. For example, this could be the formation of a non-cooperative household (Lundberg and Pollak, 1993)

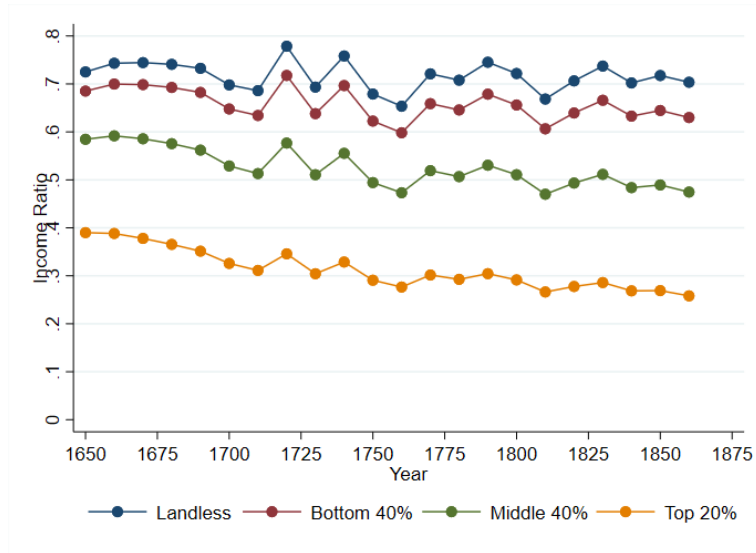


Figure 8: Gender Income Ratios

Source: Female Servant Dataset, (Kumon, 2022b)

of bargaining positions. However, most households in Japan owned lands. Kumon (2021) shows that 84% of Japanese households owned land during the late 17th century to 1870. This income was not small despite the land tax. Households in the middle class would earn 40% more income than suggested by the wage by 1800 (Kumon, 2022b).

More importantly, the land incomes were not distributed equally if a divorce, which was common and legal in Japan (Fuess, 2004), occurred. This is because Japan was a patrilineal society where the women would typically marry into the male household. If a divorce occurred, the man would hold onto the lands. The woman would return to her parents household or become independent and only earn (implicit) wages. It is plausible that divorced women gained access to some of their parent’s land incomes. However, they would certainly be marginal members of the household, especially after a divorce, and their access to such incomes was likely limited. Further, their marriage prospects would also be worse after a divorce. Therefore, due to the inequality in access to landownership incomes, accounting for landownership leads to the female bargaining position to become substantially worse.

Figure 8 shows the gender surplus ratio once we account for landownership in Japan. We

split the households into the bottom 40%, middle 40%, and top 20%. We also assume the woman would only have access to her (implicit) wage income if she divorced. Regardless of the times, the effect of landownership income is large. The original measure based on the wage ratio, shown by the landless class, fall significantly below the surplus income ratio. Even among the poor households in the bottom 40%, the surplus income ratio drops by 0.5–0.1. Among the middle 40%, perhaps the typical household, the surplus income ratio is now mostly between 0.3–0.4 which is also significantly lower. Therefore, ignoring landownership incomes leads to a highly distorted conclusion for female empowerment.

Bargaining under Subsistence Constraints

The second issue is that despite high gender wage ratios in Japan, Japanese women earned very low absolute wages. They could not have been autonomous. One reason for this dissonance is the lack of theoretical motivation for the gender wage ratio.

The issue with the linear utility function is the subsistence constraint. Being below subsistence leads to death and such an outside option is not a feasible bargaining position. Utility only increases after one can subsist. Therefore, a more realistic utility function may be as follows.

$$u_i^o(w_i) = \begin{cases} (w_i - c_{i,sub})^\delta & \text{where } \delta \in (0, 1) \text{ if } w_i \geq c_{i,sub} \\ -\infty & \text{if } w_i < c_{i,sub} \end{cases} \quad (4)$$

where $c_{i,sub}$ is the level of consumption that is necessary for bare-bones subsistence. In the case that $\delta = 1$, the ratio of interest is as follows.

$$\frac{w_f - c_{f,sub}}{w_m - c_{m,sub}} \quad (5)$$

We call this the gender surplus ratio because this is the ratio of surplus production beyond subsistence. We focus on using this measure due to the ease of interpretation. Like the gender

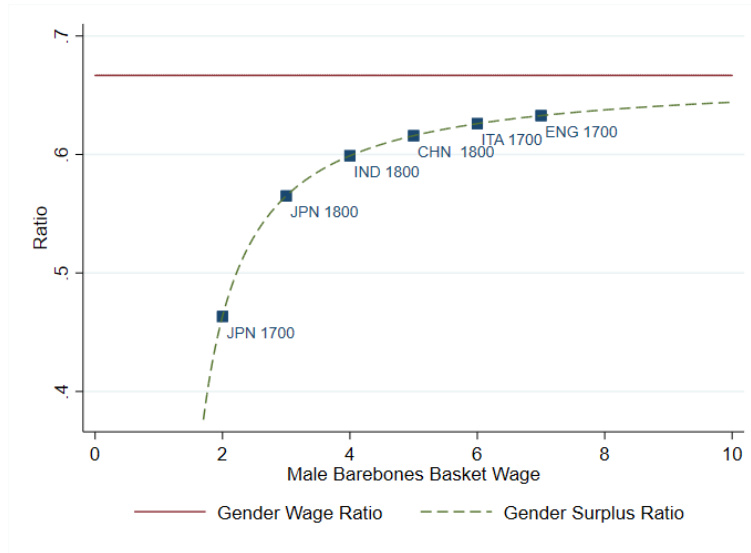


Figure 9: Theoretical Differences: Surplus Ratio vs. Wage ratio

The gender wage ratio is assumed constant at two thirds. We also plot various societies at their barebones wage levels on the surplus ratio curve.

wage ratio, the relative bargaining power of women will increase as the gender wage ratio increases. However, this measure also increases with wages while holding the gender wage ratio constant. Therefore, this measure penalizes female empowerment if women’s wages are too low.

To see this, figure 9 plots the two measures when the gender wage ratio is constant at two thirds but there is variation in the male wage. As w_i increases, the function converges towards the gender wage ratio, $\frac{w_f}{w_m}$. Therefore, the two measures are very similar in relatively high wage societies. However, female empowerment clearly gets much lower once a society, such as Japan circa 1700, is close to the subsistence threshold. Therefore, the alternative measure can make a big difference when comparing female empowerment.

We combine these two corrections and plot the gender surplus income ratio among middle 40% households across pre-industrial societies in figure 10. We assume the comparable households in the West owned no lands, as seems likely from studies of landownership inequality (Kumon, 2021). The notable change is the large downward shift in Japan to around 0.4. Japan was not a society of highly empowered women.

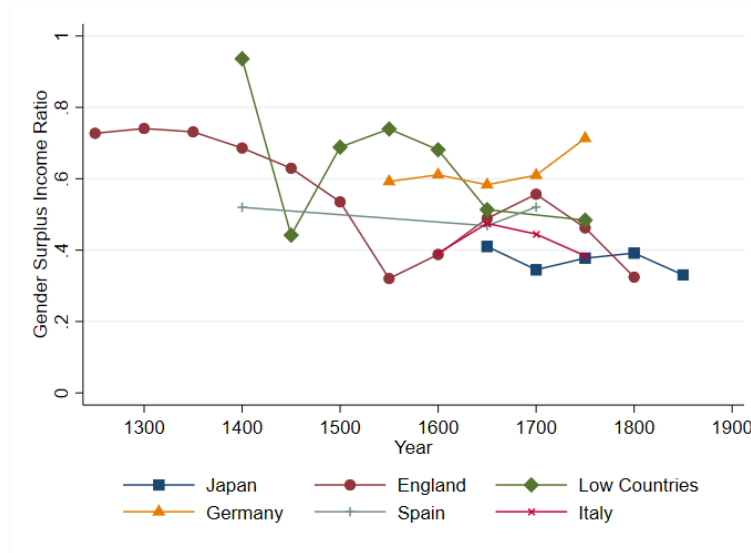


Figure 10: Surplus Income Ratios

We plot the middle 40% household income ratios for Japan and assume the comparable household in the West owned no lands.

Source: Female Servant Data, (Humphries and Weisdorf, 2015), (De Pleijt and van Zanden, 2021)

Other societies do not see much movement because the surplus income ratio adjustment makes a relatively small difference. This is due to the absolute wages of women already being high, so that subsistence was not a concern. In the case of Japan, the adjustment to surplus ratio makes a larger difference by shifting down the curve by 0.1.¹⁵ This is due to the lower absolute wages. However, it was the differences in landownership that made the bigger difference.

We believe these alternative measures improve upon the wage ratio. However, there are some limitations regarding the surplus ratio. We still assume the specification of the utility function. Further, the level of income needed for subsistence remains debatable. Perhaps, women could survive on a barebones basket while working but were concerned about unemployment. In addition, what was a woman living independently to do in old age? She would have no children and need to live off savings. If this was also part of the calculation, the benchmark for long-term subsistence may have been much higher at something closer to 2-3 barebone baskets. If so, Japanese women's bargaining position

¹⁵We also show the surplus wage ratio in appendix E.

Table 1: Marriage Age and Celibacy Rates in Pre-industrial Societies

Country	Period	Female Mean Age at Marriage	Female Celibacy (%)
Northwest Europe			
Belgium	1500-1800	26.4	20.4
England	1500-1800	25.2	11.3
France	1500-1800	24.8	12.0
Germany	1500-1800	26.1	11.4
Sweden	1500-1800	26.6	12.8
Southwest Europe			
Italy	1500-1800	23.7	11.9
Spain	1500-1800	23.5	11.6
East Asia			
Northeast China	1774-1840	18.3	0.2
Japan	1665-1871	21.4	3.7

Northeast China is taken from Liaoning. The marriage age given in Lee and Campbell (1997) for Liaoning is based on the Chinese age of sui so we adjust it down by 1.5 to get to an approximate Western age. Sources: Europe from Dennison and Ogilvie (2014), China from Lee and Campbell (1997), Feng et al. (2001), Japan from Kurosui et al. (1999), Ochiai (2004)

would have been even worse.

Marriage Patterns and Empowerment

A well established fact among modern societies, both rich and poor, is that women want less children than men (Doepke and Tertilt, 2018). This is likely because women shoulder a greater cost related to child birth and child care. Consistent with this, there has been some evidence that increased female empowerment led to later marriages in England (Voigtländer and Voth, 2013; Horrell et al., 2020). While we cannot provide causal evidence, which is currently non-existent in the cross-country context, it is worth discussing how our findings on female empowerment fit into the known facts about marriage patterns.

Table 1 shows the mean age at marriage and celibacy rates within pre-industrial societies. The Western European Marriage pattern of high age at marriage and celibacy rates can be

seen in the entirety of Western Europe Hajnal (1965). Therefore, women lose around 10 years of their most fertile years due to late marriage. Additionally, 10% of women do not marry. In contrast, East Asian women often married around age 20 and almost all women got married.

These findings are consistent with our measure that shows very low levels of female empowerment in Japan. Absolute wages show Japanese women were not economically autonomous like those in the West. Further, the average man in Japan had much greater bargaining power relative to those in the West due to their landownership. Thus, women in Japan were being economically enticed into much earlier marriage. As contemporary China had a very similar economic structure to Japan, involving low wages and high rates of landownership (Kumon, 2021), it is very likely that China also had low female empowerment. Thus, differences in female empowerment across the East and West are theoretically consistent with the early and the (almost) universal marriage pattern in the East.

The key factor behind these differences is landownership inequality. East Asia had much lower inequality, possibly due to adoption (Kumon, 2021), which also led to a low wage Malthusian equilibrium (Kumon, 2022a). Therefore, differences in inequality led to both lower wages and greater incomes for men which in turn led to lower female empowerment.

These findings also contribute to the debate on differences in marriage patterns within Western Europe. De Moor and Van Zanden (2010) argues the South did not fully develop the European marriage pattern and this may be due to higher wage ratios (De Pleijt and van Zanden, 2021). However, others argue that wage ratios were not different between the north and south (Drelichman and Agudo, 2020; Palma et al., 2021). However, we raise the other possibility that lower absolute wages in the south, absent of wage ratios, could have led to lower female empowerment.

Finally, we also acknowledge that non-economic factors also likely contributed to differences in marriage patterns. One institutional factor is the possibility of divorce. Japanese couples often divorced (Fuess, 2004) and the first few years of marriage could be considered

a trial. The lower risk of a permanent miss-match may have encouraged women to marry earlier than those in Western Europe.

Conclusion

Women in pre-industrial Japan married almost universally with many marrying by their early twenties. The structure of income distribution characterizing pre-industrial Japan provides a compelling explanation for this pattern. Japanese women earned extremely low wages, less than two barebones baskets, relative to women in other pre-industrial societies. These women were not autonomous and could not afford to stay single. Furthermore, the equality in Japanese landownership, which may be due to the institution of adoption (Kumon, 2021), meant most men owned land while women did not due to a patrilineal system leading to a large income gap. Thus, from an economic perspective, women in Japan had a worse bargaining position and low levels of empowerment compared to contemporary Western Europe.

One implication is that inequality differences between the East and the West led to the emergence of strong independent women in the West. The West had a very unequal distribution of land which meant that typical men did not own land. Thus, the disparity between incomes of typical men and women was low. Furthermore, high inequality in itself led to a Malthusian equilibrium in which wages reached a high level equilibrium (Kumon, 2022a). This meant women's wages were also much higher allowing them to live in autonomy. Thus, the fundamental factor that led to both economic and cultural differences in the condition and behavior of women may be inequality.

Finally, one interesting question is whether the culture surrounding gender within these societies was persistent. Even today, the gender wage ratio in Japan is 0.78 which is not much higher than the 0.7 observed in the 17-19th centuries. This is also similar to neighbouring South Korea where the figure in 2020 was 0.68.¹⁶ On the contrary, contemporary Western

¹⁶These statistics are taken from OECD statistics in 2020. This is available online at <https://data.oecd.org/>

Europe has much higher gender wage ratios, at 0.86 in Germany, 0.88 in the UK, and 0.91 in Spain. This pattern can also be observed in attitudes. In the world values survey of 2017-2020, a surprisingly high 25% of the Japanese people agreed to the statement, "Men should have more right to a job than women when jobs are scarce". The share agreeing in other East Asian societies were even higher, with 46% of people agreeing in China and 53% in South Korea. In contrast, Western European societies generally had lower shares agreeing, for instance 7% in Germany, 8% in the UK, and 11% in Spain. Despite the convergence in incomes, it remains a puzzle why gender wage gaps and attitudes have not converged. One intriguing possibility is the persistence of gender attitudes that developed over many centuries preceding industrialization.

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Appendices

A Data

We follow the methodology in (Kumon, 2022b) to convert all currencies (gold, silver, copper) and in-kind payments into silver currency using the exchange rate at Edo. Importantly, the exchange rates were similar in both Edo and Osaka so the exchange rate is unlikely to bias the findings.

When payments to servants were through both loans and wages, we convert them into either a full loan or wage payment. This is because the specification does not allow for a mixed payment. In the small number of cases ($N=72$), we convert wage payments to loans if the wage payment was smaller than the loan. If the wage payment is larger than the loan payment, we convert it into a wage payment. We do this by assuming a 20% interest rate and assume the interest payment is the wage equivalent. The main evidence comes from servant contracts where both a wage and a loan carrying interest was received. These were short term loans that tended to be small and comparable to wages in value. In terms of risk premium, the risk of loss is therefore comparable. The median and mean value of the annual interest rate was 20% with some variation between 10-25%. Using the 20% interest rate, we calculate the wage had the servant instead received a payment at the end of each month. However, this assumption also does not drive our results as shown in the robustness exercises.

In order to convert the predicted wage payment while accounting for receiving the wage in advance, we assume an interest rate of 20% to adjust the nominal pay upwards. This interest rate follows from the assumptions above. We convert the payments into the equivalent annual wage income had the servants received their wage at the end of each month. This comes to a 10% increase in the nominal wage value.

Finally we also match the lunar calendar year of Tokugawa Japan, which had 354 days

Table A1: The Consumption Basket per Person per Year 1750–1759

Goods	Quantity		Price (monme)	Share of Expenditure (%)	
	Respectability	Barebones		Respectability	Barebones
Beans (l)	4	4	0.25	0.7	1.1
Soybeans (kg)	40	23	0.42	10.9	10.9
Rice (kg)	152	33	0.40	39.5	14.9
Barley (kg)	11	77	0.28	2	24.5
Fish (kg)	26	5	0.58	9.9	3.3
Buckwheat (kg)	18	82	0.24	2.6	20.3
Sake (liters)	49		0.56	17.7	
Edible oil (l)	3	3	1.78	3.4	6.0
Linen (<i>tan</i>)	2	2	5.35	7.0	12.1
Lamp oil (l)	5.2	2.6	1.78	6	5.2
Total cost of Basket				153.9	88.6
Total Calories				2,500kcal	2,100 kcal

Note: Most of the above follows (Bassino and Ma, 2006). I assume 180 litres/koku, 150kg/koku for rice, and 129 kg/koku for soybeans. I assume prices relative to rice as follows: Beans 0.63, buckwheat and other grain 0.6, and 1.46 for fish. Note that a full rice wage basket costs 60.62 monme for this decade. Source: The price dataset

in a year, to the Western style calendar which had 365 days by using a multiplier. The exception was in years with 13 months. We checked if the wage was higher in leap years but there was no statistically significant increase.¹⁷ We believe this could be because one year in the contract meant 12 months.

B Baskets

We use the same baskets as (Kumon, 2022b) which was based on (Bassino and Ma, 2006). The respectability baskets has 2,500 kcal and the barebones basket has 2,100 kcal and they both have some protein content. The main difference is that the respectability basket has more “high quality” foods. Therefore there is rice instead of barley and buckwheat, some fish, and some sake.

For the other societies, we base the baskets on those created by Kumon (2022b) and

¹⁷The coefficient is insignificant and suggests 1% higher wages in leap years.

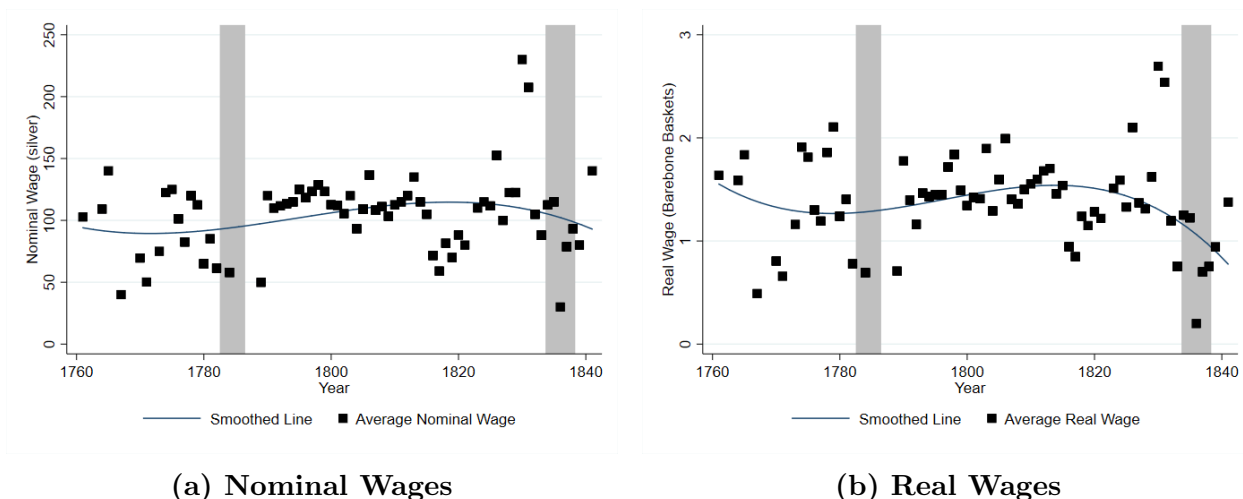


Figure A1: Wages of Servants Employed in a Village near Kobe

Source: Female Servant Dataset, (Humphries and Weisdorf, 2015), (De Pleijt and van Zanden, 2021) Note: The shaded areas are periods of Famine. The smoothed line is generated using a local polynomial estimation of degree 3.

Source: Servant wage dataset

the data is made available online. The prices for Belgium, Germany, and Spain come from Antwerp, Leipzig, and Valencia respectively using the data by Robert Allen.¹⁸ As there was no secondary grain price in Valencia, we used the price ratio of barley to wheat in Madrid and imputed it for Valencia by assuming the same price ratio.

C Nominal against Real Wage Fluctuations

Nominal wages were more stable during this era than real wages due to the reluctance of employers to shoulder risks associated with agriculture. We can see this by looking at female servants employed for one year by a household in Harima province (Uemura, 1976). We plot the nominal and real wages in figure A1

It is evident that both series saw fluctuations. However, when we look at the smoothed line, the nominal wage series is much more stable across decades than the real wage. The observations are also generally more stable for the nominal wage. This means the nominal

¹⁸This is available on his website at <https://www.nuffield.ox.ac.uk/people/sites/allen-research-pages/>

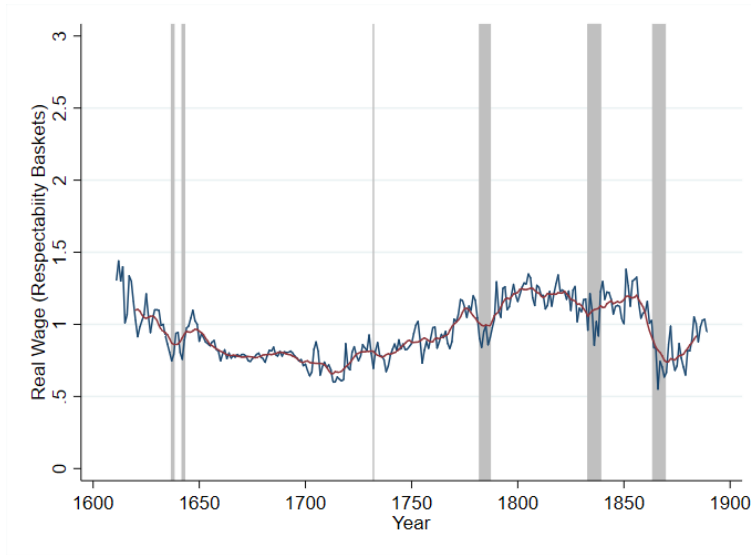


Figure A2: The Wage Series in Respecatability Baskets

Source: Female Servant Dataset

wage can be better estimated than the real wage in any decade.

D Alternative Wage Series

An alternative wage series is to plot the wage in respectability basket assuming the servant received in-kind payment in the form of a barebones basket. This wage series is shown in figure A2.

Another potential wage series is to assume the servant received a different amount of in-kind payment. We create three potential alternatives. The first is to assume a 2,500 kcals of consumption but with lower “quality” foods much like the barebones basket. To construct this, we add more barley and buckwheat in equal portions to the barebones basket. This quantity of calories is more in line with calory requirements FAO/WHO/UNU (2004). A second basket is similar to the preceding basket but we also increase the proportion of rice to 45%. This is based on data used by Arizono (2007) that takes the total production of rice divided by total rural population shortly after the Meiji restoration. He then subtracts 20% of total rice production for city consumption. This suggests 45% of the remaining grain was

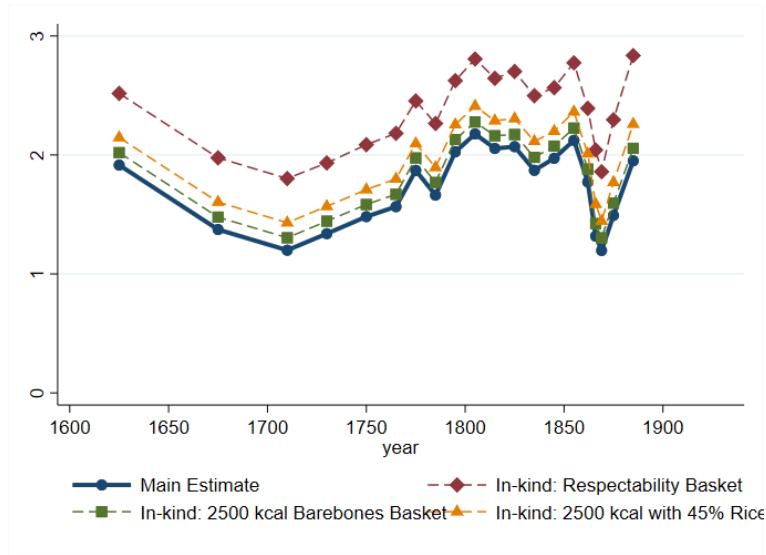


Figure A3: Alternative In-kind Payments

Source: Female Servant Dataset

composed of rice. A third is to assume they received a respectability basket. The resulting series is plotted on figure A3.

The main difference in the series is that if respectability baskets were received, the wage level goes up on average by 0.7. However, if the barebones basket was 2,500 kcal (with women receiving 83% of this), there is very little difference with an increase of 0.1. In the middle, we find the 2,500 kcal basket where 45% of grain consumption is rice. In this case, this increased the series by 0.25 baskets. The choice of baskets does make some difference, although each of these will still keep Japanese women as the poorest people within the international comparisons.

We believe it is unlikely that the in-kind payment was in respectability baskets because servants were the lowest class within the household. The respectability baskets were designed with the upper class peasants in mind and they consumed 82% of their grain calories in rice. A more plausible upper bound is where servants were given the share of rice within grain in rural Japan. This would assume servants foods were served similar food to the middle class rural family. With our preferred upper bound, Japanese women could have earn between 1.4-2.4 baskets.

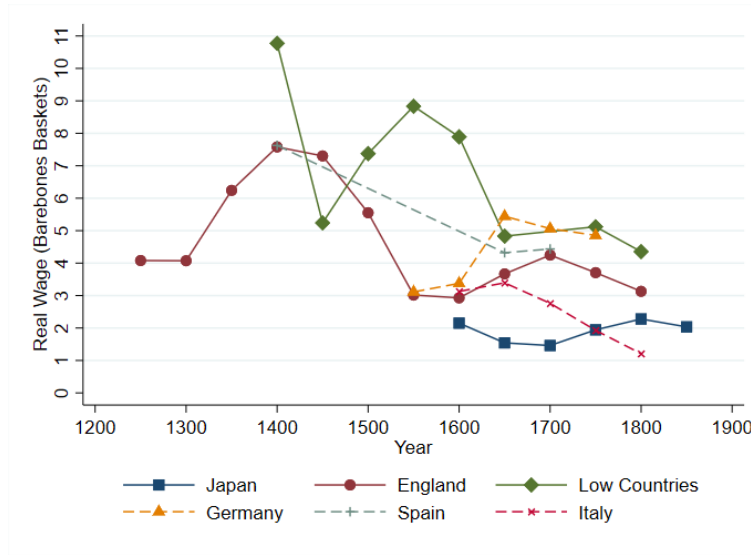


Figure A4: Alternative Women's Wage Series

Source: Female Servant Dataset, (Humphries and Weisdorf, 2015), (De Pleijt and van Zanden, 2021)

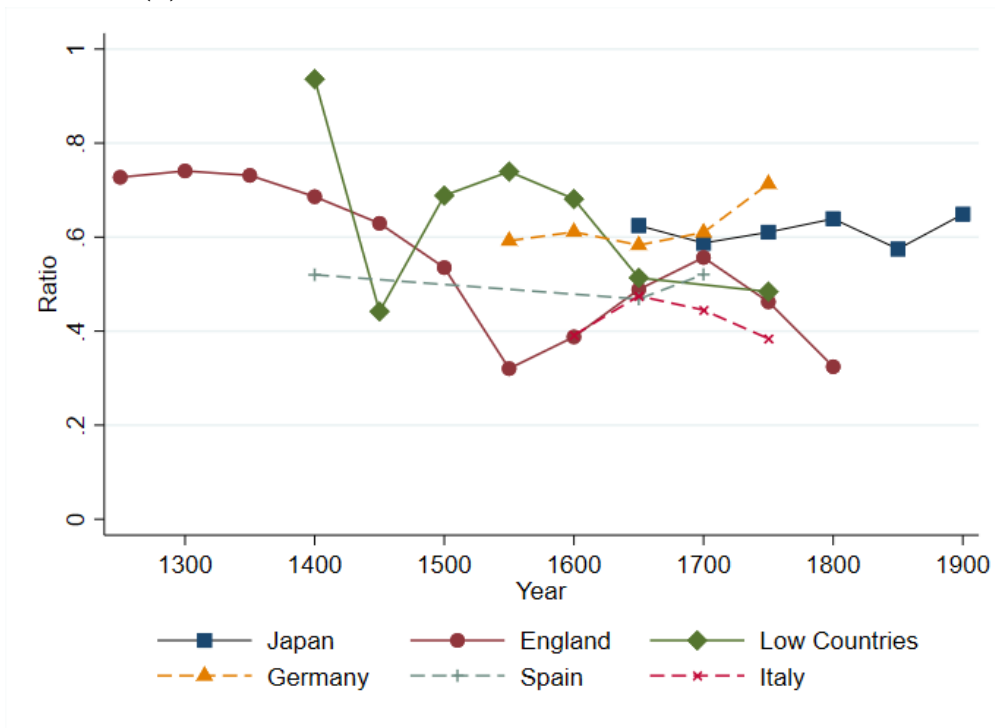
Another concern is that the women's wages fluctuate over half-centuries unlike the male wages. This could be due to data issues which were used to calculate women's wages. To address this, we also show an alternative international wage series. This was generated by using the unskilled male wage in Belgium (Antwerp) Spain (Valencia), Germany (Leipzig), and Italy (Milan) by Robert Allen. We then use the gender wage ratios by (De Pleijt and van Zanden, 2021) to compute alternative male wages. For Japan and England, for which the wage series are better established, we continue using the original wage series. There is slightly less fluctuation in this alternative series for Germany and Belgium. The level is lower but the relative ranking of these countries remain unchanged. Otherwise, the fluctuations remain similar and our conclusions remain unchanged.

E Female Empowerment

Figure A5 shows how the wage ratios change when we change it to surplus ratios without accounting for incomes. In the case of Japan, there is a large decrease of 0.1 when we switch the measure due to the low absolute wage (see figure A5a). There is less decrease in other societies due to higher absolute wages. The overall effect of this within the international context is to bring Japan down to levels seen in Northwest Europe.



(a) Surplus Wage Ratio and Wage Ratio in Japan



(b) Surplus Wage Ratios

Figure A5: Women's Wages in Japan and Europe

Source: Female Servant Dataset, (Humphries and Weisdorf, 2015), (De Pleijt and van Zanden, 2021)

F Sources

As the source reference numbers for the primary sources are too numerous to list, we instead make the full list available in an excel file with our data under the column “source”. Here, we list all of the secondary sources and the primary sources at the collection level. We note that we used only the search engine for Keio University archives because the search included the required information on wages.

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