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Abstract

Granular microdata is of growing interest within economics and economic history. We present a uniquely detailed database of 21,557 observations of wages and 30,000 observations of prices in rural Denmark for men, women and children, and for both skilled and unskilled workers over the eighteenth century. We construct nominal wages and deflate them using Allen's constant consumer baskets. The real wage series exhibits a considerable fall with the introduction of serfdom, and other changes consistent with known historical events. We present some evidence on skill premiums and gender wage gaps and offer suggestions for future work exploiting this data.

JEL Codes: J31, N33, N93

Keywords: Denmark, microdata, prices, wages

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1. Introduction

The present work introduces a uniquely rich microlevel dataset on wages and prices for the periods 1661-1669 and 1705-1805 for rural Denmark[2]. This has been constructed using data collected by the Danish Price History Project, which ran from 1939 to 2004 at the University of Copenhagen. This data includes wages for a variety of occupations, for 17 different manors and two households, resulting in a total of 21,557 observations. For prices, there are more than 30,000 observations which we use to construct a price index, allowing us to produce a series of real wages. A detailed data description on the prices available are beyond the scope of this study, but have already been described in detail by Andersen and Pedersen (2004). We also discuss avenues for future research that could be answered with the help of the dataset presented here by way of conclusion.

Beyond the uniqueness of the data, why might we be interested in studying wages in Denmark in the eighteenth century? The answer is at least twofold. First, a growing body of literature focuses on constructing and analyzing wage series for different countries for the distant past. Such endeavors were revitalized by the work of Allen, who presented real wages for unskilled and skilled workers for up to 20 European cities, by making use of archival data from the fourteenth century to the First World War. Allen (2001) found a divergence in Europe between 1500 and 1800, as wages fell in most parts of Europe, but were maintained in the North Sea region, namely in England and the Low Countries – the so-called Little Divergence. The debate on this is ongoing, with new data from historical national accounts, real wages and other indicators[3] for various countries being presented (see e.g., Allen 2001, de Pleijt and van Zanden 2016, Humphries and Weisdorf 2018, Stephenson 2018). However, one case where detailed data so far have been missing from the international evidence is Denmark, for which only aggregate wage data, relying on secondary sources, have been constructed (Khaustova and Sharp 2015, Abildgren 2017).

Second, we have limited knowledge of Danish economic development before 1800, as GDP per capita data are missing[4], and real wages have only been constructed for parts of the country. However, this period of Danish history is particularly fascinating. For most of the seventeenth century, Denmark had been at war with Sweden; the state transitioned to an absolutist monarchy in 1660, but the ideas of the Enlightenment and related reforms manifested themselves around the end of the period. The early period covers that of the

[2] Our focus here is on the "Kingdom of Denmark" or Denmark proper, which does not include other territories of the Danish monarchy, such as Norway and the Duchies of Schleswig and Holstein.

[3] Indicators, such as urbanization, book consumption, literacy rates and human capital have been used to show that indeed, there was economic progress in England and the Low Countries as opposed to the situation in the countries from Eastern and Southern Europe (de Pleijt and van Zanden 2016); Dall Schmidt et al. (2018) show that Denmark was experiencing increased urban populations from at least the 1840s.

[4] Hansen (1984) provides estimates of national income, but only starts in 1818, and the data have several drawbacks. However, a group of researchers at the University of Southern Denmark is currently working on a project involving the development of GDP estimates before 1800, with the help of a grant received from the Danish Research Council.

Great Northern War in which Denmark actively took part in 1700 and from 1709 to 1720. This was followed by the reintroduction of "the Danish equivalent of serfdom", or adscription, in 1733. This aimed to tie male farmhands to the estate in the area in which they were born for males between the ages of 14 and 36. Before this, there had been another form of serfdom called "*vornedskab*" that was established at the end of the fifteenth century, on the eastern islands. This was abolished in 1702 for children born after August 25th, 1699, thus having an effect only in 1717 when workers turned 18 years old. However, the adscription introduced in 1733 applied to the entire country. From 1742, it was tightened so that the age group became 9 - 40 years old, and then again in 1764, for the ages 4 - 40 years. Thus, according to Andersen and Pedersen (2004, p. 90), seventeenth- and eighteenth-century agricultural labor markets involved an unequal bargaining process between landowners and workers, and it would be too risky to speak of a labor market in the modern sense.[5] However, as part of a general package of agricultural reforms, the rules were relaxed in 1788 so that they again applied to the ages 14 to 36, and the system was finally abolished in 1800 (Jensen et al 2018). Recently, Lampe and Sharp (2018) have demonstrated that the eighteenth century and the arrival of enlightened elites marked a defining moment in Danish history, laying the grounds for the rapid development the country was to witness in the following century (see also Jensen et al 2019). Our data thus covers a period which is crucial for understanding the process behind Denmark becoming the rich and successful country it is today.

Existing evidence regarding historical wage developments in Denmark date back to Scharling (1869) and Falbe-Hansen (1869) who provided data for the fifteenth and sixteenth centuries for workers receiving salaries and those receiving payment in kind in Copenhagen and in the countryside. Their data are composed of averages across a number of years. For the period considered in the present study, Thestrup (1987) presents annual time series of daily wage data for workers in Copenhagen receiving monetized payments, as well as wages for payments in kind for shorter periods of time. Christensen (1985) has detailed (although not annual) information on many types of agricultural wages (men/women, summer/harvest/winter, etc.) from 1829, whereas for the later years Ølgaard (1976) provides a wealth of data both from the cities and the countryside. In the twentieth century, regular surveys of wages were performed by Statistics Denmark. Recent studies, such as Khaustova and Sharp (2015), construct wage series for men and women in urban and rural occupations and find that Denmark was poor during the eighteenth century, but caught up with the leading European economies over the next century, so that "already by the 1870s laborers in Copenhagen enjoyed some of the highest living standards in Europe". They suggest that the high wages are one possible cause of the process of mechanization of agriculture, which led to high productivity. Abildgren (2017) also makes use of the scattered data available in previous studies, mostly for Copenhagen, to analyze the

[5] Andersen and Pedersen (2004, p. 46) mention, for example, that the owner of the Taasinge manor was said to be able to dictate wages in the 1740s and 1750s.

development of wages in Denmark, and estimates that the average growth rate of wages was between -0.08% and 0.00% for the period 1500 to 1820.

None of the aforementioned studies exploit data anywhere near as rich as those available for the eighteenth century from the Danish Price History. To rectify this, we proceed as follows. The following section provides a description of the data and how the dataset was constructed, and Section 3 presents some real wage calculations. Section 4 concludes with suggestions as to how our data might be used in the future.

2. Data description and building the dataset

As noted above, our dataset on wages constructed in this study for 1661-1669 and 1705-1805 is based on impressive work by the Danish Price History Project, which took more than six decades to complete. A full description of the variables in the database is provided in the data appendix (Table A1), while the sources are given in Andersen and Pedersen (2004). Our database provides extremely rich information on wages and prices, for 17 manors and two households across Denmark. It should be noted that in this study, we used the original quotations, not only the numbers presented in the published volumes (specifically the second volume, Andersen and Pedersen 2004). The resulting dataset consists of 21,557 observations of wages for men, women and children, for a variety of occupations.

The manors are spread across the three main parts of Denmark: Zealand, the eastern island on which Copenhagen is situated; Funen, the central island; and Jutland, the peninsula in the west. Most of the manors are located on Zealand, but the data contain observations over the whole period for all three regions. The data included in the Price History Project were chosen from the manors with a great level of preservation and accessibility. However, the distribution of the manors is relatively proportional with the population distribution, with more manors available for the areas in which the population density was larger. Thus, it can be argued that there is good coverage of the whole country. The island of Zealand, which housed most of the population, had the most manors: Giesegaard, Bregentved, Gisselfeld, Herlufsholm, Holsteinborg, Fuirendal, Sorø Akademi, Lovenborg, Gaunø, and Juellinge. The island of Funen is represented by Tåsinge, Frederiksgave, and Erholm-Søndergaarde. Finally, Jutland is represented by the following manors and a household: Frijsenborg, Støvringgard, Lindenborg, and Odden. Here we present a few of them in a little more detail in order to facilitate a better understanding of the nature of the sources, but a more complete description is provided by Andersen and Pedersen (2004).

First, for Zealand we can start by presenting the Herlufsholm manor. One difference from the rest of the manors is that the wages cover the earliest period 1661-1669, and the coin used for the salaries at the time was the *courant-daler,* which was 0.71 percent of the *rigsdaler*, the coin used for the other manors. Another difference is that it functioned as a Latin school for the children of the upper classes. It should also

be noted that day wages were paid in a denomination of the *rigsdaler*, the *skilling* (sk.) which was worth 1/96 of a rigsdaler. The schoolmaster was the best paid employee with a salary of 9,600 sk. per year, while at the bottom of the scale, teachers supervising the students' homework received only 1,296 sk. per year. The school also had a chapel minded by a sexton receiving 340 sk. per year and ran its own postal service with a postman earning 872 sk. per year. Another interesting feature is that the school had its own brewery manned by a brewer receiving 960 sk. per year, and some assistants. The accounts also include the salaries of other staff responsible for the proper functioning of the school such as clerks, cooks, servants and gardeners. For low skilled workers we only find records for a cowman, a shepherd and fishermen. For this particular manor, the highest paid woman was the washerwoman (960 sk. and a 2,496 sk. subsistence allowance). Also on Zealand, one of the households in our data is Gisselfeld, which has accounts for the period 1706 to 1740. Although these are not very detailed, they include a large number of salaries for different types of servants, such as a doorkeeper, a coachman and a domestic servant. They received between 960 and 2,304 sk. per year together with food allowances worth between 4,992 and 6,656 sk. per year. The accounts also include a number of day laborers whose main tasks were related to the maintenance of the household, such as working in the gardens or park, and receiving 16 sk. per day. A slightly higher wage (18-20 sk.) was received for harder work, such as cutting wood, digging trenches or loading and unloading goods. More skilled workers, for example those cutting bushes, received 32 sk. per day.

Second, we turn to Jutland, where Lindenborg was the second largest estate, and has records for the period 1714-1799. It was bought by a merchant who undertook a large number of repairs and modernized the estate by employing many tradesmen. A gradual shift from cattle to dairy farming led to the employment of women dairy assistants. Many records of day laborers working on the farms and in the tileworks can also be found. Another estate on Jutland which has records for this period, Støvringgaard (1734-1800), constituted the economic foundation of a convent for noble women. The Frijsenborg estate (1777-1800) was the largest in Denmark, having many farms and manors and thus many buildings which needed a large number of full-time employees, such as master builders, joiners, smiths, but also some who were paid by the day, for example bricklayers, carpenters and stonemasons. Agricultural workers are relatively few in number since their land was leased out, but on the other hand, they employed rare professions, such as surgeons, doctors and nurses. A doctor's salary increased from 19,200 sk. to 38,000 sk. from 1777 to 1790, plus a grain allowance, whereas a field surgeon received only 9,600 sk. as of 1784. The nurse was a woman who received the same amount as the washerwoman, namely 768 sk.

Third, for the island of Funen, we have examples such as Taasinge[6], where the owner avoided investments and reduced the wages of day laborers, by contrast with Frederiksgave manor (1773-1800),

[6] Strictly speaking on an island off the coast of Funen.

which pursued its modernization through the construction of new buildings and by improving agricultural techniques. Thus, for the latter, most workers paid by the day were bricklayers, carpenters, builders, and their assistants as well as painters, joiners, and thatchers. As for women, the wage of a housemaid increased substantially over the period, and also included an allowance for sugar and tea, whereas the housekeeper saw only a modest increase.

Besides the wages, our data also contain other detailed information, which are described in brief below.

Payment in kind and annual vs casual workers

Our data contains observations on both casual workers and long-term workers, and thus enables a comparison between the wages of the two categories. 27.2 percent of the observations belonged to longer term workers. These tended to be medium- and higher- skilled people working on the manor, while the others were unskilled and lower-skilled, employed mainly in agriculture and construction. For some occupations, such as bricklayers and carpenters, the records show that both forms of employment were common and that casual workers doing the same job tended to earn more than the others, but this does not provide the whole picture. One difference between the two categories is that 7.36 percent of longer-term workers also received other benefits besides their salary. For example, some servants received allowances for buying sugar and tea, gamekeepers received extra money for buying boots and weapons, administrators received money for buying writing materials and various other manor officials also received money for buying goods important for their work, such as clothes and candles, or for keeping their own horses. Another difference between the two categories of workers is how often they received payments in kind. The data show that nearly 20 percent of long-term workers received some form of payment in kind, as opposed to just one percent of the casual workers. In most cases, the employees were given grains, especially rye and barley, but also oats and flour, while only one employee, who received part of a cow, breaks this pattern. The Danish price history has noted down the value of these goods and our calculations show that, on average, the payment in kind was worth 47.7 percent of the total value of the salary. But this amount varies significantly, with extreme examples, such as a stable worker who received 99 percent of his pay in rye and barley and a doorkeeper who received 83 percent of his pay in kind. At the other end of the spectrum lie the well-paid workers, such as a farm administrator for whom the payment in kind amounted to only 2 percent.

Gender and married/unmarried women's work

It is interesting to note that our data, besides noting gender, also enable us to establish the marital status of most of the women for whom wage observations are available. Specifically, in the denominations of occupations, it is stated in Danish: "*pige*" (girl) and "*kone*" (woman, often older and thus usually married).

Often, it is also noted whose wife or daughter the individual was. We find that 65 percent of the observations are for unmarried women, while only 11 percent were classified as married. The rest could not be classified. One interpretation could be that this distribution, with fewer married women working on the manor, suggests that women had an incentive to delay marriage in order to be able to work and earn more money before starting up a household, which is one of the features of the European marriage pattern (Hajnal 1965).

Number of days worked and season

The number of days worked is also an important characteristic of this dataset. It consists of 331,614 workdays, and in addition to this, the length of employment is mentioned for 436 of our records. This means that the month and day in which employees started and finished working is listed. This allows for the calculation of the number of days per week an individual worked, something much sought after in the literature. These later datapoints are from 13 of the manors, spread across Denmark, and cover most of the century for a range of occupations. The month and season in which they worked is also listed.

Name matching

The dataset offers another valuable detail: the workers' first and last names are listed for some of the observations. By allowing us to trace names, this is an interesting source for revealing how long a person worked for a manor on average and how the worker's salaries changed. To trace a person, we look for those workers whose name shows up at least twice in the records of a manor and who did similar jobs in all the observations. On average, the time between the first and the last observations for one person is a little over 10 years. Because most of the individuals we could track were casual workers, they only worked on the estate for an average of 100 days in this 10-year period.[7] A master mason is the person who could be tracked over the longest period of time, with 44 years between the first and last observations. As a craftsman was usually around 20 years of age when he could get the title of master, this man probably worked well into his sixties. By looking at the evolution of an individual's salaries, it can be observed that the nominal value tends to increase over time, but there is greater rigidity in the wages of full-time employees.

Worker's residence and distance to their work

The data also allows us to make observations on the mobility of workers. Some of the manors had data about the residence of their workers and also where they worked, if this was not on the estate. Figure A1 in the appendix presents the data for one of the manors, where the data was more detailed, Erholm-Søndergaarde. The majority of the employees lived in the vicinity of the manor. In the case of this manor, only three craftsmen were not from the area of the estate and one travelled from the neighboring island of

[7] They could also have worked at home for the rest of the time.

Zealand. This is not surprising because, besides the impact of adscription, the slow means of transportation of the era meant that workers had little incentive to take a job that was not close to their home, as they would have to pay the cost of transportation and board and lodging close to their workplace (Collins 1999). Next, the workplaces not located on the manor can be divided into two categories. The first category covers the area close to the estate, where the owner of the manor paid a series of craftsmen and laborers to do maintenance work on important buildings in the villages, such as churches and schools. The second category of workers, such as messengers and merchants, travelled further from the estate to important cities. The furthest away someone had travelled, in the case of Erholm, was to the city of Haderslev which is in southern Jutland. All in all, we can conclude that people at the time did not travel very far away from their home to their place of employment. We should note, though, that this data does not actually give any information about migration to or from a region in search of a better job.

Building the dataset

To build the dataset, the first step was to organize it by coding the occupational titles and tasks according to HISCO (Historical International Standard of Classification of Occupations) and HISCLASS (Historical international social class scheme). The HISCO system was developed by Marco et al (2002) in order to facilitate comparisons between historical occupations and contains 1,881 of such occupation titles from countries around the world from the sixteenth to the twentieth centuries[8]. HISCLASS was created by van Leeuwen and Maas (2011) to facilitate an evaluation of the skill content of these occupations and to frame them into fewer categories. Each occupation was assessed and assigned by experts based on the Dictionary of Occupational Titles (DOT) system, into one of the following four levels of skills: unskilled, lower-skilled, medium-skilled and higher-skilled according to the competencies required for an average worker.

Additionally, the data was checked for outliers. For example, in some cases the wages of craftsmen are very high because they include the wages of assistants. However, not knowing exactly how many helpers these individuals had and how the wage was divided between the master and his assistants meant that these observations had to be discarded. Another example is the case of teachers, who, in many cases, only received part of their salary from the manor. This meant that many teachers appear to have salaries at the same level as unskilled laborers, and thus these observations also had to be ignored.

Using the system described above, the data can be classified into more than 80 occupations. HISCO codes could not be assigned for seven of the occupations/tasks, and these amounts refer to, for example money for donations, school allowances, pensioners or amounts inherited. Table A2 in the appendix shows the HISCO occupations distributed according to the HISCLASS scheme. If such a classification system had not

[8] It is an historical extension of the ISCO (International Standard Classification of Occupations).

been used, simply dividing the data into skilled and unskilled labor would be difficult. The reason is that each occupation requires a certain set of skills and education to be able to complete the tasks. The housekeeper and the teacher provide an illustrative example. Both occupations can be considered suitable for the skilled category, but the skills needed for the jobs are very different.

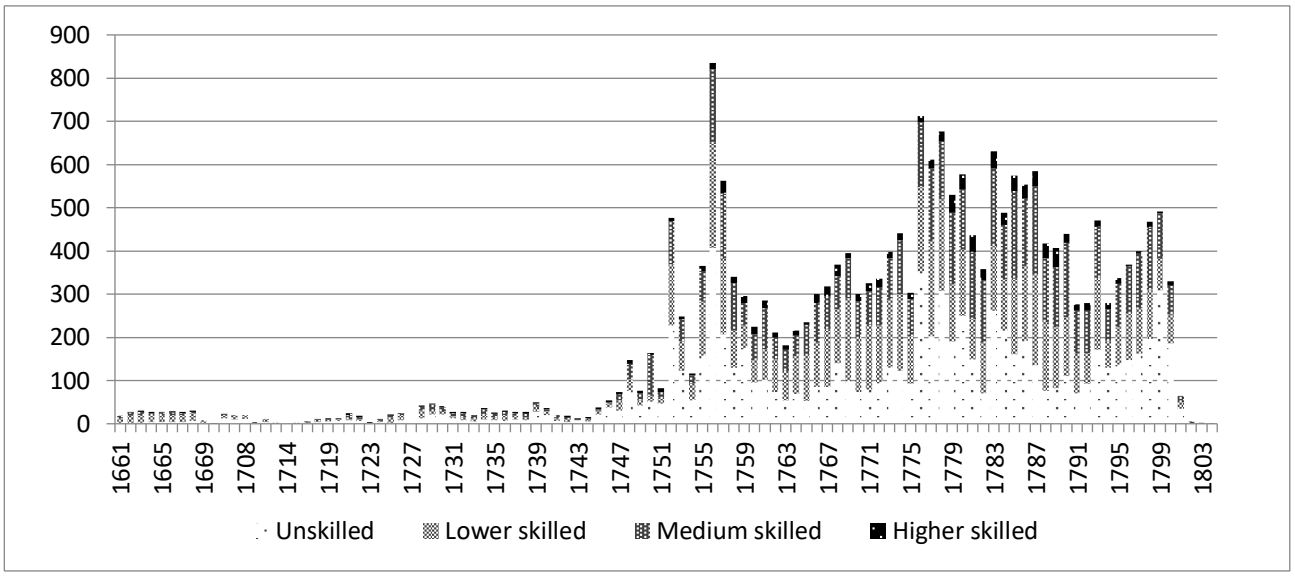

Figure 1. Number of observations divided by HISCLASS: higher-skilled, medium-skilled, lower-skilled and unskilled workers (men, women and children).
Source: Authors' calculations.

Figure 1 plots the number of observations for all workers (men, women and children) distributed according to HISCLASS into unskilled, lower-skilled, medium-skilled and higher-skilled (see de Pleijt and Weisdorf 2017). For the period considered, the observations belonging to the unskilled and lower-skilled groups represent about 70 percent of total observations.[9] The rest are divided between medium-skilled and higher-skilled, the latter category representing just 5 percent of the total observations. A few examples of highly skilled workers are head teachers, surgeons, judges, priests and surveyors. Stonemasons, carpenters, brewers and butchers are a few examples of medium-skilled jobs, while fishermen, painters, and thatchers are examples of lower-skilled workers. The main unskilled occupations were laborers, day laborers, farm laborers and farm servants. In the medium-skilled category, the largest number of observations belongs to stonemasons and carpenters, while for lower-skilled jobs the most common are painters. In the unskilled category the laborers and day laborers represent the largest number of the observations. The tasks of

[9] The workers that would classify as skilled (either medium or high) would presumably be independent masters and their services could then potentially be found in the accounts as goods instead of as wages. The price-material only follows a fixed number of goods, but other goods that were bought during the period did not occur frequently enough to be included in the project.

laborers were usually digging ditches, carrying and assembling stones, working in the stable and loading timber. The farm laborers had slightly different tasks, such as, for example, working the fields, ploughing, harvesting, gathering hay etc. Women did, very rarely, have the same types of occupations as men. Their main occupations were however as washerwomen, domestic servants, milkmaids, seamstresses, weeding the garden etc. For children, jobs like domestic servant and milkmaid are among the most frequent.

For a more detailed classification, Table A3 presents the percentage of observations for all occupations by region and manor as well as the percentage of each class of worker and the percentage of observations of men, women and children. It shows that there are some imbalances in the distribution of occupations across manors which are caused by the different types of economic activities that each manor undertook. For example, Sorø Akademi leased out all its land, so the number of unskilled workers is only nine percent. Most observations are of tradesmen doing maintenance work on the school buildings. At the opposite end of the spectrum, we find the manor of Gisselfeld, where 52 percent of the observations are wages of laborers performing unskilled work. The most developed manors seem to be those in the region of Jutland. In this region, the percentage of female workers is the highest (15.8 percent), followed by a similar level recorded for children. An important aspect is that the medium and high-skilled jobs hold a greater proportion (41.1 percent) than in the other two regions (34.1 percent on Funen). Regarding the division by gender, men represented 82-96 percent of the workers, whereas the children engaged in working tasks represent 3-15 percent.

3. Calculating real wages for rural laborers

As mentioned in the introduction, besides constructing the dataset, we make a first use of our data by constructing a real wage series for rural laborers. This is not to diminish the importance of the micro-data as it is, but the construction of real wages presents a simple opportunity to examine the bigger picture of development and can facilitate international comparisons. This section describes the method used for constructing such a series.

Wages

The first step is to aggregate the data to construct a series of nominal wages, where we restrict our sample to the period after 1705 due to the lack of observations before this. One important feature of the data is that it divides the employees into two categories: full-time employees, who were paid every six months or by the year, and temporary or casual employees (day laborers or even more skilled occupations, like craftsmen), who were paid by the day. For the annual workers there is no need to make an assumption about the number of days worked per week, but in order to compare the two categories, and thus to aggregate

them, we started by computing the daily wage for each worker. To this end, we need to know the number of days worked in a week so that we can estimate the daily wages for full-time employees[10]. There are two sources from which this number can be taken. The first is from Kjærgaard (1994), in which the number of days worked per week is calculated as 5.9 days including holidays, during the eighteenth century. The second source is given in the comments that came along with the raw data. For many of the daily wage observations, these inform us about the dates between which the laborers worked, enabling the calculation of the average number of days worked per week, which also turns out to be 5.9 days. A more detailed analysis about the days worked and seasonality patterns for that time is provided by Jensen et al (2019).

To obtain a representative wage value for each year out of the many observations on wages we have, we apply an OLS regression method similar to that employed by Clark (2005). Again, this is not to diminish the importance of the underlying data, but this method provides a simple way of "averaging" the thousands of individual wage entries. Clark calculates day wage series for craftsmen, laborers and their assistants for the English countryside by estimating regressions which take into account all the available factors that influence wages. Having as a base equation the regression in Clark (2005), we added a few modifications and get equation (1):

$$\ln(W_{it}) = \alpha + \sum_{j=1} + \tau \ln(days_{it}) + \sum_{j=1}^{106} \delta_j year_t^j + \sum_{k=1}^{2} \theta_k season_{it}^k + \sum_{l=1}^{2} \mu_l region_i^l + \varepsilon_{it} \quad (1)$$

where: $\alpha =$ intercept; $\ln(days_{it})$ = period of time worked; $year_{it}^j =$ year dummy; $season_{it}^k$ = season dummy (winter, summer, and no season); $region_i^l =$ region dummy (Funen, Zealand, Jutland); $\varepsilon_{it} =$ error term.

We do not follow Clark in using the joint wages indicator variable and the interaction term. The former is not necessary because in our case there are separate observations for the craftsmen and their laborer's wages. As a robustness check, we nevertheless also introduced the interaction term, by decades in this case, but we find no statistically significant effects, most likely because the data span a much shorter period than the one presented in his paper. Also, the control for the period of time worked (days worked) comes from the fact that the day rates may differ from the rates a worker received when employed full-time. So, the representative wage comes from the prediction in equation (1).

Prices

Next, we deal with the question of how to calculate a representative price level for each year from more than 30,000 observations on prices. We follow the well-known methodology of Allen (2009), in which

[10] As the number of days worked per week multiplied by the number of weeks per month and the number of months worked.

welfare ratios are calculated by dividing the nominal wage by the price of a basket of goods necessary for the subsistence or respectability of a family (see Table A4).[11] The welfare ratio represents average annual earnings divided by the cost of a poverty line consumption bundle for a family. A welfare ratio greater than one indicates an income above the poverty line, while a ratio less than one means that the family is in poverty.

The real wage series

Figure 2 presents the real wages for men and women of three occupations, namely, for day laborers, laborers and agricultural workers (farmhands) for the sake of comparison with the types of occupations commonly used in the literature. Note that since men and women were typically not performing the same tasks[12], the wages are not strictly comparable. Furthermore, there can be gaps in the time series due to the fact that not all the observations for women were used for the present series. The full data are presented in Table A5. We restrict the regression calculation to a minimum of five observations per year, and where we do not have a minimum of five, we do not display any results.

[11] An issue with this is that these baskets are constructed with urban consumers in mind. We choose however to abstract from this issue for the sake of comparability with other work.

[12] More work needs to be done to pick the exact same occupations for men and women even among the laborers and day laborers and among the jobs usually performed by women at that time.

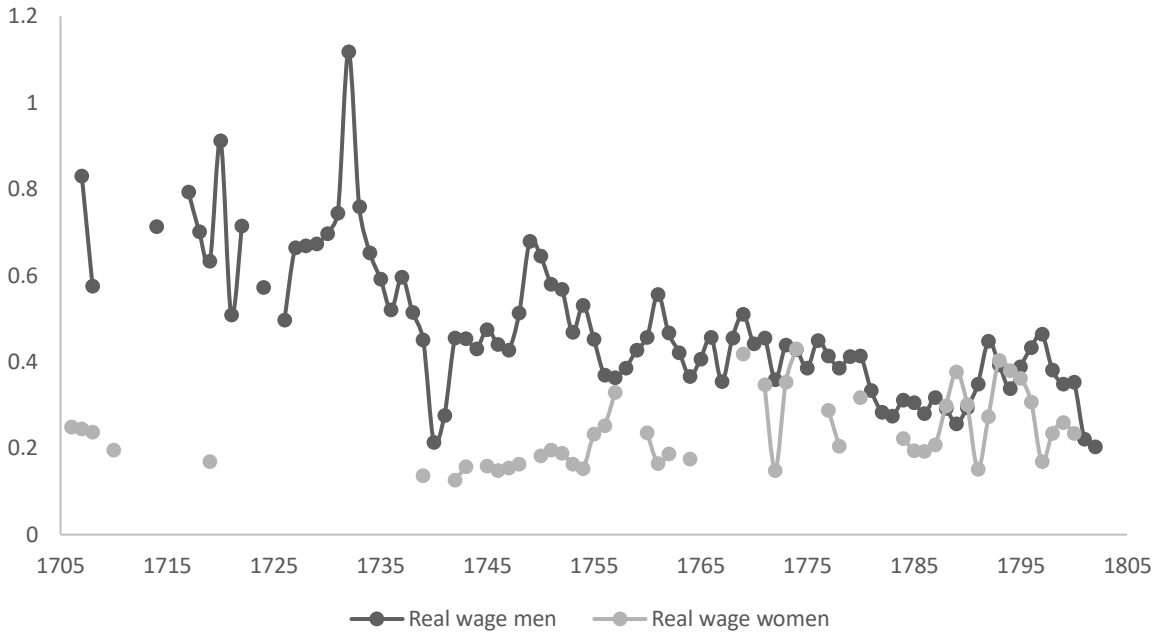

Figure 2: Welfare Rations for Men and Women for three occupations: laborers, day laborers, and agricultural laborers

Note: The nominal wage series resulted from applying the OLS regression method and estimating equation 1 (see text). The real wages were calculated by dividing the nominal wages by the basket constructed based on Allen (2009). The wages are expressed in skilling/day. We calculate the regression with minimum 5 observations per year. Where we do not have a minimum of 5, we do not show any results.
Source: Authors' calculations.

Wages during the period of the Great Northern War show relatively high volatility, compared with the latter part of the century. After the end of the war, a period of increasing wages followed, characterized by the migration of people from small farms to cities, where small-scale industrialization began to take hold. At the beginning of the 1730s an agricultural crisis took place, caused by low demand for Danish agricultural exports and a high cost of labor. This led to the introduction of serfdom in 1733, which is followed by a decline in the wages of unskilled labor. The wages continue to decrease during the 1740s as the manors faced an ecological crisis and cattle plague (Kjærgaard 1994). The deflation of this period makes the spikes in wages during the agricultural crisis very visible. The drop in real wages is also more visible after 1733, as wages were lower and prices started to increase again.

Finally, out data allows us to zoom into the various skill levels, and track the evolution of the real wage series for each HISCLASS category, as presented in Figure 3 and Table A6. We have removed teachers from the sample, since many of them received very low salaries from the manors, comparable to those of laborers, while some of them did receive wages comparable to those of other high-skilled occupations. The reason for this is probably because the contributions from the manor most likely accounted for only part of a teacher's

total salary.

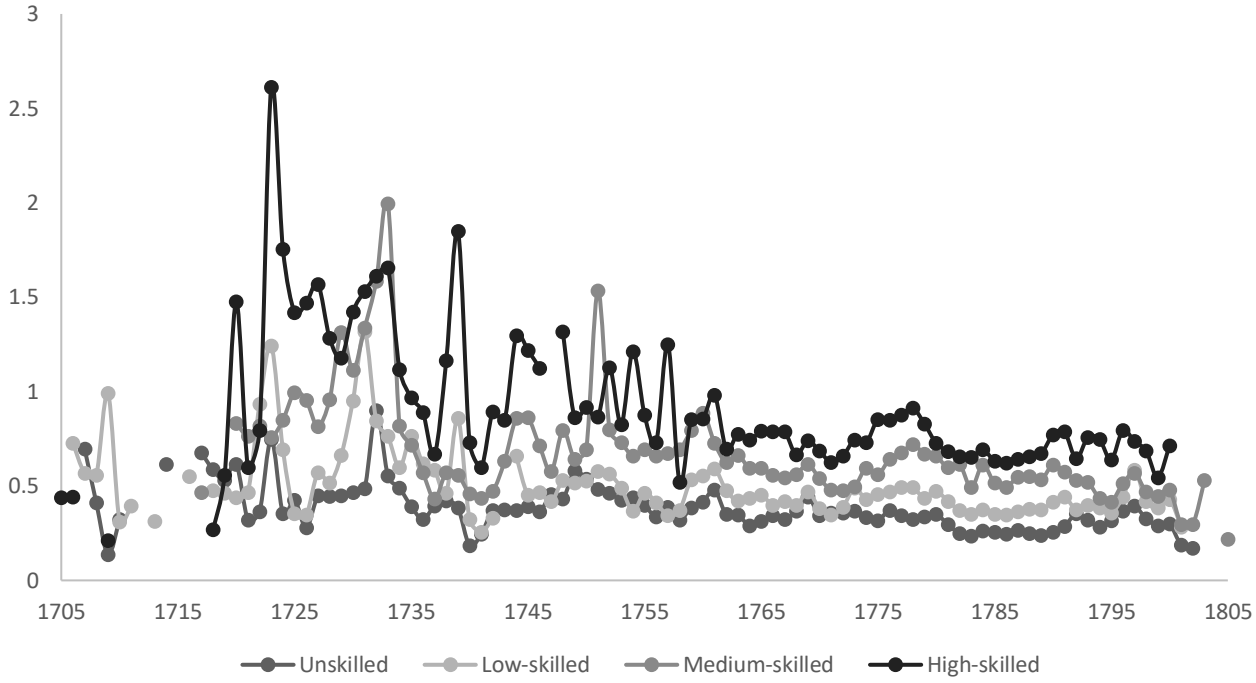

Figure 3. Real wages for men by HISCLASS for unskilled, low-skilled, medium-skilled and higher-skilled workers, 1705-1805

Note: The real wage series results from dividing the nominal wage by the subsistence basket (Allen 2009). Wages are expressed in skilling/day. We calculate the regression with miminum 5 observations per year. Where we do not have a minimum of 5, we do not show any averaged wage value.

Source: Author's calculations

We observe a widening gap between the wages of highly skilled and unskilled workers over the period, but the difference between unskilled and medium-skilled workers (craftsmen) does not increase as significantly. One fact that can be seen from the graph is that the salaries of unskilled workers were similar to those of lower-skilled employees. Lower-skilled occupations included jobs like gardener, stone cutter and paver which were jobs that were also often done by unskilled workers, such as day laborers. It is therefore not very surprising that these wages have similar values. For some observations where names are available, we can observe that the same person often performed some unskilled labor alongside low-skilled jobs. The real wage of low-skilled laborers reaches the same level as that of medium skilled workers during the latter part of the century.

4. Conclusions

We have presented a new database of micro-level data on wages collected by the Danish Price History Project. The result is an unbalanced panel for Danish workers in 19 different manors and households in the

Kingdom of Denmark and comprising 21,557 observations on wages (and more than 30,000 on prices). This data is unusually detailed, containing information on wages for a variety of occupations, for males/females, children/adults, apprentices/masters, skilled/unskilled workers.

The aim of this paper was to document the data and introduce them to the scholarly community. We can imagine several applications of the new database, beyond the obvious comparisons that can be made by constructing real wage series. Specifically, the micro-level nature of the data would permit for example a detailed investigation of the impact of the institution of serfdom for agrarian labor markets. Many authors believe that serfdom prevented the development of modern labor markets in which individuals themselves choose where to work and live, and thereby the move towards a modern capitalist economy. It would for example be possible to test whether there were any effects of serfdom on relative wages.[13] Another line of research made possible by our data might be to look for evidence of an "industrious revolution" or an increase in the number of days worked over this period. Finally, other work based on this data is in progress: it is combined with other sources to test for whether Malthusian mechanisms were at play in the Danish economy in the eighteenth century, or to look for evidence of regional wage convergence, about women's participation and gender gaps, children's work in the rural world, annual workers vs casual workers, urban vs rural workers, or a wealth of other possibilities that might result from having the names and skill levels of the workers.

13 Some preliminary work has been done by Jensen et al (2018).

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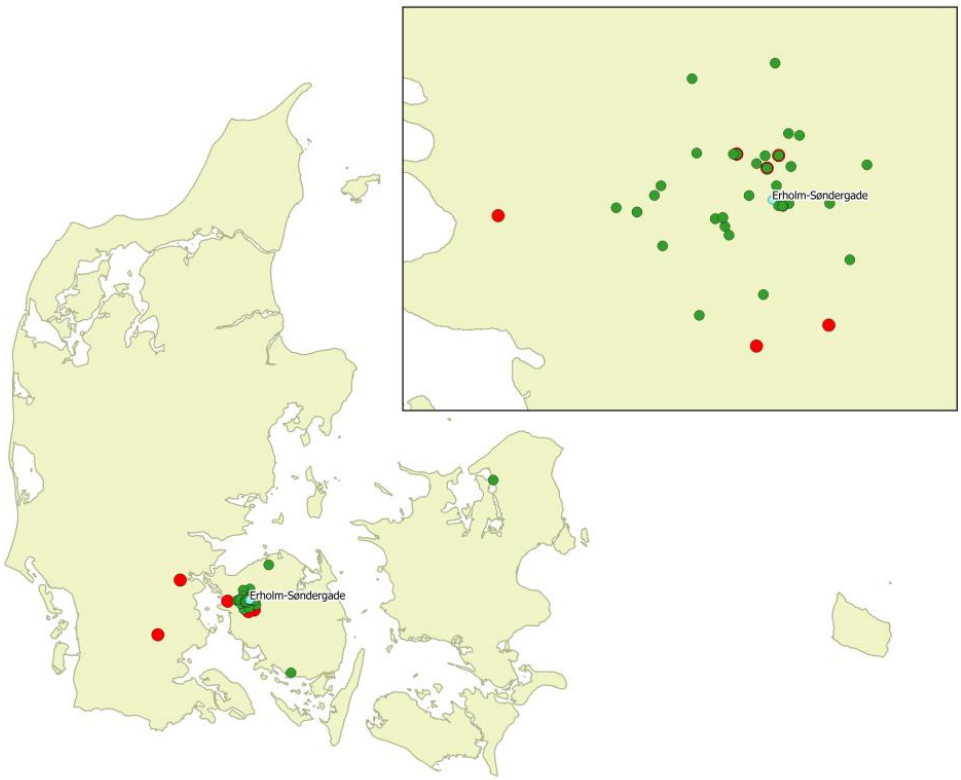
Appendix – for online publication only

Figure A1. Worker residences and workplaces outside the manor for Erholm-Søndergaarde



Note: The square in the upper right offers a zoom into the map. The green dots are the workers' places of residence, while the red ones are the workplaces outside the estate.

Table A1: Description of the variables in the database

Variable name	Variable description
manor name	name of manor were the data was recorded
region	name of region were the manors or estates were situated
year1	year when the work was carried out
year2	given for longer periods, the year when the work was finished
gender	gender of the worker as given in the manor records
type	type of employment as given in the manors' records (full time workers or casual workers)
function/occupation	occupation of the worker in Danish
mester/svend	contains information on whether the workers were apprentices or master craftsmen
child	indicates whether the worker was a child
OccupationEN	occupation of the worker in English
HISCO	classification of occupations according to the Historical International Standard of Classification of Occupations
norm wage rate	day wage for all workers which in the case of full-time workers is calculated by dividing the annual wage to the number of days worked
norm days	Number of days worked which in the case of fulltime workers is estimated from the number of months they were employed
season	the season in which the work was carried out (taken from the comments)
month/season	the month/ season in which the work was carried out (taken from the comments and written in the accounts)
wage period	number of months worked by a full-time employee
total wage	the total wage received by a full-time employee in the given period
wage rate	day wage given in the case of casual workers
days	number of days worked by the casual workers
food/own food	the value of the food received by workers from the manors as payment in kind
materials	the value of the items received from the manor necessary for the worker's job
Food	the type of food received as payment in kind
Kost	if the workers received food and board from the manor (i) or at their own expense (e)
Kone/Pige	marital status of women if known (from names or comments)
names	the names of the workers
residence	the residence of the workers
workplace	town were work was conducted if it was carried out outside of the manor’s grounds and noted in the data
Start Day	day of start of employment
Start Month	month of start of employment
End Day	day of end of employment
End Month	month of end of employment
Period length	number of days between start date and end date of employment
comments	comments written by the Danish Price History Project
other comments	second comment field written by the Danish Price History Project
archive	manorial archive from which the entry was taken from

Table A2: A description of the occupations in our data

HISCLASS classification	HISCO classification
Unskilled	Laborer, day laborer, demolition worker, charcoal burner, logger, livestock worker, agricultural laborer, farm servant, subsistence farmer, doorkeeper, watchman, chimney sweep, bell ringer
Low-skilled	Coachmen, wine bottler, builder, paviour, basket maker, painter, brick and tile moulder (hand), stone cutter, wheelwright, net maker, weaver, stone splitter, fisherman, forester, gardener, dairy, servant at home, correspondence clerk, messenger, postman, barn bailiff
Medium-skilled	Glazier, plasterer (general), wood shipwright, joiner, carpenter, stonemason, bricklayer, potter, watchmaker, smith, cooper, saddler, shoemaker, seamstress, brewer, butcher, grain miller, spinner, nurse, gamekeeper, forest supervisor, policeman, cook, merchant, housekeeper, inspector, organist, deacon
High-skilled	Surgeon, doctor, tax assessor, land surveyor, farm supervisor, minister of religion, head teacher, teacher, notary, government administrator

Table A3: Distribution of occupations by category

Regions and estates	%				%		
	Unskilled	**Lower skilled**	**Medium skilled**	**Higher skilled**	**Women**	**Men**	**Children**
Zealand	**37.1**	**34.0**	**24.7**	**4.2**	**3.7**	**96.3**	**2.7**
Bregentved (1746-1800)	38.6	1.8	59.6	0.0	0.6	99.4	0.7
Fuirendal (1756-1795)	20.0	43.9	24.0	12.1	18.4	81.6	14.1
Gauno (1751-1800)	22.6	34.1	31.8	11.6	2.2	97.8	3.2
Giesegaard (1721-1800)	40.1	39.7	19.0	1.1	0.2	99.8	0.2
Gisselfeld Household (1706 1740)	52.4	30.9	16.7	0.0	25.6	74.4	6.6
Herlufsholm (1661-1728)	14.5	56.4	20.7	8.4	13.2	86.8	22.0
Holsteinborg (1748-1800)	43.6	30.4	25.6	0.4	5.0	95.0	0.8
Juellinge (1726-1748)	33.8	45.6	20.6	0.0	0.0	100.0	0.0
Løvenborg (1752-1794)	42.7	34.5	19.4	3.4	0.7	99.3	0.6
Sorø Academy (1740-1800)	9.4	56.2	33.7	0.6	0.0	100.0	0.0
Funen	**43.1**	**22.8**	**30.1**	**4.0**	**14.4**	**85.6**	**10.1**
Erholm Søndergade (1723-1800)	55.6	15.6	28.8	0.0	8.2	91.8	0.6
Frederiksgade 1773-1800	64.8	18.6	16.4	0.2	21.0	79.0	13.6
Taasinge (1725-1800)	26.7	27.1	39.1	7.2	11.5	88.5	9.9
Jutland	**27.2**	**31.7**	**30.9**	**10.2**	**15.8**	**84.2**	**14.9**
Frijsenborg (1777-1800)	23.5	28.7	36.9	10.9	9.2	90.8	11.4
Lindenborg (1714-1799)	26.1	42.5	27.5	3.9	23.1	76.9	24.9
Odden (1703-1732)	34.8	21.2	19.7	24.2	0.0	100.0	0.0
Støvringgard (and household) (1734-1800)	34.9	18.3	27.8	19.0	15.7	84.3	4.3
Total	**37.1**	**30.8**	**27.1**	**5.0**	**8.4**	**91.6**	**6.5**

Table A4: The contents of Allen's subsistence and respectability consumption basket

	Subsistence	Respectability
Bread	155 kg	234 kg
Beans/peas	20 kg	52 l
Meat	5 kg	26 kg
Butter	3 kg	5.2 kg
Cheese	-	5.2 kg
Eggs	-	52
Beer	-	182 l
Soap	1.3 kg	2.6 kg
Cotton	3 m	5 m
Candles	1.3 kg	2.6 kg
Lamp oil	1.3 l	2.6 l
Fuel	2 mbtu	5 mbtu
Rent	5% of total	5 % of total

Source: Allen (2009)

Table A5: Welfare ratios for men and women

Year	Welfare ratio men	Welfare ratio women
1705		
1706		0.250
1707	0.830	0.246
1708	0.576	0.237
1709		
1710		0.196
1711		
1712		
1713		
1714	0.714	
1715		
1716		
1717	0.794	
1718	0.701	
1719	0.633	0.169
1720	0.912	
1721	0.509	
1722	0.715	
1723		
1724	0.573	
1725		
1726	0.498	
1727	0.664	
1728	0.669	
1729	0.674	
1730	0.696	
1731	0.745	
1732	1.118	
1733	0.760	
1734	0.652	
1735	0.592	
1736	0.521	
1737	0.596	
1738	0.514	
1739	0.451	0.137
1740	0.214	
1741	0.277	
1742	0.456	0.126
1743	0.455	0.157
1744	0.431	

1745	0.475	0.159
1746	0.440	0.149
1747	0.428	0.155
1748	0.513	0.164
1749	0.680	
1750	0.646	0.184
1751	0.581	0.196
1752	0.568	0.189
1753	0.468	0.164
1754	0.531	0.154
1755	0.452	0.233
1756	0.369	0.252
1757	0.364	0.330
1758	0.386	
1759	0.427	
1760	0.458	0.236
1761	0.557	0.165
1762	0.467	0.187
1763	0.422	
1764	0.366	0.176
1765	0.406	
1766	0.456	
1767	0.354	
1768	0.456	
1769	0.511	0.419
1770	0.443	
1771	0.456	0.347
1772	0.360	0.149
1773	0.439	0.353
1774	0.428	0.430
1775	0.386	
1776	0.449	
1777	0.414	0.288
1778	0.386	0.205
1779	0.413	
1780	0.414	0.318
1781	0.333	
1782	0.284	
1783	0.275	
1784	0.311	0.223
1785	0.306	0.195
1786	0.280	0.193
1787	0.318	0.208

1788	0.293	0.298
1789	0.257	0.376
1790	0.295	0.301
1791	0.348	0.152
1792	0.448	0.274
1793	0.393	0.404
1794	0.338	0.379
1795	0.389	0.363
1796	0.433	0.307
1797	0.464	0.169
1798	0.381	0.235
1799	0.348	0.260
1800	0.353	0.234
1801	0.221	
1802	0.203	

Note: Some of the gaps in the time series could be due to the fact that not all the observations for women were used for the present series. We also restrict the regression calculation to miminum 5 observations per year. Where we do not have a minimum of 5, we do not show any results

Table A6: Welfare ratios by HISCLASS

Year	Unskilled	Low-skilled	Medium-skilled	High-skilled
1705				0.439
1706		0.728		0.443
1707	0.697	0.568		
1708	0.412	0.557		
1709	0.136	0.991		0.211
1710	0.325	0.311		
1711		0.396		
1712				
1713		0.312		
1714	0.616			
1715				
1716		0.552		
1717	0.677		0.465	
1718	0.587	0.475		0.268
1719	0.530	0.461		0.557
1720	0.616	0.438	0.833	1.476
1721	0.321	0.467	0.765	0.598
1722	0.364	0.934	0.820	0.795
1723	0.749	1.243	0.759	2.612
1724	0.355	0.692	0.849	1.755
1725	0.424	0.354	0.996	1.419
1726	0.278	0.345	0.953	1.469
1727	0.448	0.570	0.816	1.569
1728	0.445	0.516	0.956	1.284
1729	0.450	0.662	1.313	1.178
1730	0.466	0.952	1.114	1.422
1731	0.484	1.317	1.336	1.531
1732	0.899	0.846	1.586	1.611
1733	0.554	0.764	1.995	1.654
1734	0.489	0.598	0.817	1.117
1735	0.392	0.763	0.718	0.967
1736	0.323	0.618	0.569	0.888
1737	0.394	0.583	0.433	0.668
1738	0.420	0.463	0.571	1.164
1739	0.385	0.857	0.558	1.849
1740	0.184	0.322	0.459	0.731
1741	0.246	0.256	0.435	0.596
1742	0.372	0.332	0.472	0.894
1743	0.374		0.631	0.850
1744	0.370	0.659	0.859	1.295

1745	0.390	0.452	0.863	1.219
1746	0.364	0.464	0.712	1.125
1747	0.454	0.417	0.576	
1748	0.431	0.530	0.794	1.316
1749	0.579	0.515	0.643	0.863
1750	0.535	0.525	0.692	0.916
1751	0.483	0.579	1.535	0.866
1752	0.464	0.563	0.797	1.127
1753	0.425	0.489	0.729	0.825
1754	0.438	0.367	0.660	1.213
1755	0.396	0.462	0.693	0.876
1756	0.338	0.412	0.658	0.731
1757	0.388	0.343	0.672	1.250
1758	0.319	0.371	0.692	0.519
1759	0.386	0.535	0.794	0.851
1760	0.416	0.554	0.887	0.857
1761	0.478	0.591	0.727	0.982
1762	0.349	0.476	0.625	0.696
1763	0.347	0.421	0.662	0.774
1764	0.290	0.435	0.594	0.742
1765	0.314	0.453	0.593	0.792
1766	0.345	0.398	0.557	0.787
1767	0.324	0.417	0.543	0.788
1768	0.366	0.397	0.562	0.667
1769	0.442	0.469	0.615	0.739
1770	0.344	0.382	0.539	0.685
1771	0.357	0.347	0.478	0.624
1772	0.356	0.388	0.476	0.658
1773	0.368	0.489	0.495	0.745
1774	0.335	0.428	0.595	0.729
1775	0.317	0.456	0.560	0.853
1776	0.371	0.468	0.642	0.849
1777	0.344	0.494	0.675	0.877
1778	0.322	0.494	0.720	0.913
1779	0.336	0.435	0.669	0.829
1780	0.351	0.473	0.658	0.727
1781	0.296	0.419	0.597	0.683
1782	0.249	0.371	0.616	0.656
1783	0.234	0.349	0.491	0.652
1784	0.264	0.375	0.612	0.692
1785	0.254	0.352	0.515	0.633
1786	0.247	0.347	0.492	0.623
1787	0.266	0.363	0.548	0.641

1788	0.249	0.377	0.549	0.655
1789	0.238	0.373	0.532	0.672
1790	0.257	0.415	0.613	0.770
1791	0.287	0.441	0.575	0.787
1792	0.353	0.375	0.529	0.646
1793	0.319	0.398	0.520	0.757
1794	0.281	0.385	0.435	0.746
1795	0.317	0.356	0.416	0.639
1796	0.366	0.441	0.513	0.794
1797	0.393	0.583	0.568	0.736
1798	0.327	0.418	0.469	0.686
1799	0.290	0.383	0.446	0.545
1800	0.298	0.428	0.480	0.715
1801	0.189	0.284	0.298	
1802	0.172		0.297	
1803			0.530	
1804				
1805			0.218	

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