the review of income and wealth

Review of Income and Wealth
Series 0, Number 0, Month 2021
DOI: 10.1111/roiw.12562

INEQUALITY IN PRE-INDUSTRIAL EUROPE (1260–1850): NEW EVIDENCE FROM THE LABOR SHARE

BY GIOVANNI FEDERICO

New York University – Abu Dhabi and CEPR

ALESSANDRO NUVOLARI

Sant'Anna School of Advanced Studies and CEPR

AND

MICHELANGELO VASTA*

Department of Economics and Statistics, University of Siena and CEPR

The dynamics of economic inequality and its relationship with economic growth in the preindustrial world is increasingly attracting the attention of both economists and economic historians. In this paper, we tackle this theme by introducing new estimates of the labor share in five major European countries (England, France, Holland, Spain, and Portugal) for the period 1250–1850. Our estimates are constructed using an innovative method based on the conversion of real wages in 2011 PPP $. Overall, we find a complex pattern of evolution of the labor share with major fluctuations. Furthermore, using the inequality possibility frontier (IPF) framework, our results suggest that preindustrial Europe was characterized by a negative relationship between the extraction ratio and GDP.

JEL Codes: N33, N01

Keywords: long-term inequality, economic growth, economic history

1. INTRODUCTION

In the past years, inequality has returned to be a major research theme in economics and also in economic history (Piketty and Zucman, 2014; Scheidel, 2017; Alfani, 2019, 2021). Most of the current contributions on income and wealth distribution are based on household-level data, but the alternative "classical" functional approach to income distribution (Dobb, 1975), long neglected, is also enjoying a

Note: We are particularly grateful to Robert Allen, Carlos Alvarez-Nogal, Alexandra de Pleijt, Sara Horrell, Jane Humphries, Ernesto Lopez Losa, Nuno Palma, Santiago Piquero Zarauz, Leandro Prados de La Escosura, Jaime Reis, Leonardo Ridolfi, Carlos Santiago-Caballero, Jan Luiten van Zanden and Jacob Weisdorf for sharing their data with us. We also thank Robert Allen, Alberto Dalmazzo, Franco Franceschi, Edoardo Rappa, Leonardo Ridolfi and Jacob Weisdorf for their valuable suggestions. This paper has benefited from the comments of participants to the 6th CEPR Economic History Symposium (Rome, 2018), to the 16th World Economic History Conference (Boston, 2018), and to the 13th European Historical Economics Society Conference (Paris, 2019).

*Correspondence to: Michelangelo Vasta, Department of Economics and Statistics, University of Siena, Piazza San Francesco 7, Siena 53100, Italy (vasta@unisi.it).

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth
This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

revival (Glyn, 2011). The decline in the labor share in the US and in other advanced countries is one of the main pieces of evidence for the deterioration of the living standards of the working class, and it has attracted significant scholarly attention (Karabarbounis and Neiman, 2014; ILO-OECD, 2015; Cette *et al.*, 2019). This renewed interest has also covered the relations between economic growth and factor shares in the 19th and 20th centuries (Bengtsson and Waldenstrom, 2018; Charpe *et al.*, 2019; Maarek and Orgiazzi, 2019; Bengtsson *et al.*, 2020). This growing literature supplements the more established research tradition in economic history focused on personal income and wealth distribution (van Zanden *et al.*, 2014; Roine and Waldenstrom, 2014; Piketty and Zucman, 2014; Piketty *et al.*, 2018).

The literature on income distribution in the pre-industrial world is less abundant although growing (see Section 2). Most of it deals with wealth inequality, which differs in theory and in practice, from income inequality (Skopek *et al.*, 2014; Berman *et al.*, 2016; Davies and Shorrocks, 2018). There are very few series of factor shares for the period before the Industrial Revolution, and most of them deals with England. Against this paucity of data, the functional distribution of income is sometimes proxied by the wage/land rent ratio (O'Rourke and Williamson, 2005; Madsen and Strulik, 2020), or by the wage/GDP per capita ratio (Williamson, 1997, 1998).

This paper provides comprehensive comparative estimates of the functional distribution of income in pre-industrial Europe. Our estimates supplement the meager evidence on income distribution, but they are also interesting on their own. The functional distribution of income is arguably more relevant in pre-industrial societies than nowadays: in the past, individual incomes were less variegated across different sources, and the distinction between social classes was sharper than nowadays. We estimate yearly series of labor share for five major European economies (England, France, Holland, the largest province of the Netherlands, Spain, and Portugal), from as early as possible, given the available data, to 1850. We start from Williamson's (1997, 1998) intuition to use the wage/GDP per capita ratio as a synthetic measure of inequality. Unlike the wage/rent ratio, it captures returns to all factors, but it does not consider changes in the relative supply of factors and, above all, unlike the Gini or Theil coefficients, it is not comparable across countries.[1] We address these issues with two methodological innovations. First, following Angeles (2008), we estimate the wage bill by adjusting the available series for male unskilled workers for changes in labor supply—i.e., in the number of days worked and in the activity rates of the population. We distinguish workers by gender, level of skill, and type of occupation (causal or daily vs annual), each with a specific wage premium relative to our baseline. Second, we convert the available wage series, originally constructed as welfare ratios (Allen, 2001) into 2011 PPP dollars, so that we can express both the numerator and the denominator in the same units and compute genuine labor shares rather than indexes.

[1]The returns to human capital would appear in the numerator only if wages refer to all workers, whereas they are included by definition in the denominator. The Williamson index is susceptible of a Marxian interpretation. For Marx, the state of the income distribution between workers and capitalists is described by the "rate of exploitation":

$e = (y-w)/w$, which corresponds to $w/y = 1/(1 + e)$.

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

Our estimates break new ground in the historical analysis of the dynamics of inequality in pre-industrial Europe. First, as already suggested by the conventional wisdom on the dynamics of real wages, we find a major cycle in the evolution of the labor share following the Black Death. Inequality declined from mid-14th to mid-15th century and rose until to the beginning of the 17th. Second, less predictably, we find a major divergence across Europe in the 17th century. In England and Holland, the most successful countries of the time, the labor share increased sharply until a peak in the 1680s, mostly as a consequence of an increase in activity rates and working time. Simply put, the Industrious Revolution (de Vries, 2008) reduced inequality. This "second golden age" for workers was short lived: at the beginning of the 18th century, the labor share in England and Holland was back to the level of the 1630s, and it continued to decline in the second half of the century. In the other three countries we consider, France, Spain, and Portugal, the labor share grew very little or not at all during the 17th century, but it declined in the 18th. Thus, the Napoleonic wars marked a historical peak in inequality. Third, we find tentative evidence of a very limited rise in the labor share in the early 19th century, which unfortunately cannot be pursued in the rest of the century for lack of comparable estimates. Last but not least, we explore the relationship between inequality and economic growth adapting to labor share the inequality possibility frontier (IPF) approach by Milanovic *et al*. (2011).

The structure of the paper is as follows. After the literature survey (Section 2), in Section 3 we set out our framework, while in Section 4 we outline the sources of the data used. We present our results for the English case, the most documented one, in Section 5, while in Section 6 we compare them with the trends for the four other countries. Section 7 concludes.

2. Income Distribution in Pre-Industrial Europe

Most recent studies on inequality in pre-industrial Europe rely on fiscal sources, such as taxes on land and housing, including, when possible, also financial assets (i.e., debts and loans). Thus, the results, expressed with Gini coefficients or with the shares of the top 10 percent of the population, measure the inequality in the distribution of wealth (Alfani, 2017, 2019, 2021). Actually, these data might underestimate inequality if fiscal sources exclude the propertyless, even if the bias might be small (Alfani and Di Tullio, 2019). Overall, this line of research shows that inequality in Europe was increasing "almost monotonically" at least from mid-15th century onwards (Alfani, 2019, p. 1177). For instance, Alfani and Di Tullio (2019) argue that the rise in inequality in the Republic of Venice was determined by the growing burden of a strongly regressive taxation. The church and feudal land was exempt from impositions, and most revenue came from consumption taxes. The middle class was being hollowed out to pay for the current and, via debt servicing, past military expenditures of the *Serenissima*. Recently, Alfani *et al*. (2020) show that wealth inequality in Germany decreased from 1350 to about 1450, rose in the following two centuries and declined for the joint effect of the 1627–1629 plague and of the Thirty Years' war. By adopting a different measure of wealth inequality, the wealth/GDP ratio, Madsen (2019) suggests a different story for England from 1200 onwards. The ratio fluctuated in the long

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

run around a factor of five, with rising inequality after the Black Death, in the early 17th century and again in the 18th century and declining inequality from about 1430 to 1550 and in the early years of the 18th century.

The research on income inequality has been severely hampered by the lack of data. As far as we know, there is only a local analysis for some cities in the Low countries (Ryckbosch, 2016) and the country-wide estimate, for Portugal in three benchmark years (Reis, 2017), both based on tax data. According to Ryckbosch (2016), inequality may have declined before 1550 and surely rose after 1650. He explains these trends with changes in the relative bargaining power of urban workers, which depended on the protection by their guilds against competition from rural workers. Inequality in Portugal declined from 1565 to 1700 and increased slightly from 1700 to 1770. Reis (2017) explains this pattern by noting that rural real wages rose thanks to the growth in production of Porto wine and the diffusion of maize as a cheap alternative to wheat.

The historical literature on functional distribution of income is similarly thin. Prados de la Escosura *et al.* (2021) provide series of wage/GDP for Spain 1275–1845, while recent research on other dimensions of economic change has yielded, as by-product, three series of the labor share for pre-industrial England. Clark (2010) has computed the share from the building blocks of his series of nominal GDP from the income side, Madsen (2017) deals with the determinants of changes in wealth/GDP ratio, and Humphries and Weisdorf (2019) with the evolution of the labor market. We will discuss these series in comparison with our estimates in Sections 5 and 6. Lacking actual data, most authors have relied on social tables—i.e., educated guesses by contemporary observers on average income by social classes or occupational groups. The key reference in this line of research is the seminal paper by Milanovic *et al.* (2011), later updated, with additional observations, by Milanovic (2018). Their extended database includes a total of 41 tables for pre-industrial countries, defined as having a GDP per capita lower than 2500 1990 PPP $. Thirteen social tables refer to early modern Europe, with an average of Gini coefficient of 47 percent. Milanovic *et al.* (2011) interpret their data introducing the concept of maximum feasible inequality—i.e., the maximum value of the Gini index consistent with the survival of the mass of the population when an infinitesimal élite appropriates the entire surplus over the subsistence. The envelope of these maximum inequality points is defined as the IPF. This maximum is frequently attained in the actual data at low levels of GDP, as in India in 1750 and 1947 or in Kenya in 1914, whereas the current Gini coefficients for advanced countries are only a fraction of the maximum feasible inequality. Pre-industrial Europe was somehow in the middle, poor but rather distant from the IPF. Drawing on this research, in his well-known synthesis book *Global Inequality*, Milanovic (2016, p. 69) concludes that in pre-industrial societies absolute inequality fluctuated according to "accidental or exogenous events, such as epidemics, discoveries or wars" as long as income remained low. On the contrary, the increase in income augmented the scope for extraction—i.e., shifting away from the IPF. Indeed, as suggested in a pioneering article by van Zanden (1995), the estimates for England (five observations) and Holland/the Netherlands (three) point to a significant growth in

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

inequality without a comparable increase in the ratio between actual and the maximum feasible inequality.

In spite of this dearth of evidence, there is a widespread consensus about the effects of the Black Death on income distribution since the pioneering work by Rogers (1884) on England. The second half of the 14th century and the 15th century had been a "golden age" for the living standards of European workers (Voigtländer and Voth, 2013). This view is mostly based on a simple Malthusian interpretation of the (fairly abundant) wages data. Real wages of unskilled workers increased (Pamuk, 2007; Fochesato, 2018), the skill premium in building trades fell (van Zanden, 2009), and it seems likely that land rent declined as well, even if there are no data for this period. Thus, the drastic fall in the population increased the labor share of unskilled workers and, in all likelihood, also the total labor share, as the number of skilled workers was very small. The population series for England (Broadberry *et al.*, 2015) and the recent work by Jedwab *et al.* (2019) for cities all over Europe imply that the demographic recovery after the Black Death was slow. Thus, one would surmise that the golden age of workers lasted until the end of the 16th century. The population eventually recovered, and in a simple Malthusian world this would have caused a decrease in real wages. In his seminal paper on the "little divergence," Allen (2001) argues that real wages did decline in Central and Southern Europe but remained fairly high in England and Holland. This latter reaction may signal a change in the relation between population and economic growth (Fochesato, 2018). However, Allen's real wage series are still controversial (Geloso, 2018; Stephenson, 2018; Lopez Losa and Piquero Zarauz, 2021). At all events, after the 16th century, any inference from the dynamic of real wages to the labor share is much less straightforward than in the post-Black Death period.

3. Methods

Our accounting framework is very simple. By definition, the labor share (α) in the *j*-th country at time *t* is equal to the ratio of the wage bill to GDP, which can be estimated in nominal terms (subscript *N*) or in real terms (subscript *R*), respectively as:

$$\alpha_{Njt} = \left(W_{Njt} * L_{jt}\right) / Y_{Njt} \tag{1}$$

and

$$\alpha_{Rjt} = \left(W_{Rjt} * L_{jt}\right) / Y_{Rjt}, \tag{2}$$

where W is the yearly wage, L is the number of workers, and Y is the GDP, with the subscript N indicating nominal values.[2] Nominal wages and GDP are deflated,

[2]In the following, we omit the subscript jt for simplicity. Note that our definition includes all labor compensations, including the labor component of the self-employed, which we assume to be equal to the prevailing wage. This avoids a major issue in the current estimates of labor share (Gollin, 2002; Guerriero, 2019).

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

respectively, with an index of cost of living for wage workers ($W_R = W_N/P_w$) and with the GDP deflator ($Y_R = Y_N/P_Y$), so that the relationship between the nominal and real labor shares is:

(3) $$\alpha_N = \alpha_R * P_w/P_y.$$

The nominal labor share measures the percentage of the wage bill on total return to factors, while the real labor share is the percentage of the total purchasing power of the population which accrues to workers. The two measures diverge if the ratio P_w/P_y changes relative to the base year: ceteris paribus (i.e., for the same distribution of nominal income) an increase in the prices of wage goods lowers the workers' share on the total potential consumption—i.e., increases real inequality (Crafts, 2020; Geloso and Lindert, 2020). In this perspective, our framework is consistent with the suggestion to use group-specific price indexes to deflate nominal income for estimating trends in inequality (Hoffman *et al.*, 2002).

We assume the workforce to be composed by i categories (1, 2, … n), each featuring L_i workers, who get a daily wage w_i for d_i days of work. By definition, GDP per capita is equal to GDP per capita y times total population N. Thus, the labor share can be written as:

(4) $$\alpha = \Sigma \left(w_i * L_i * d_i \right) / y * N.$$

We compute the share of workers of the category on population (L_i/N) as the product of the share of the relevant age/gender cohort (i.e., potential workers) in the i-th category (μ_i) on population times the activity rate for that cohort (δ_i):

(5) $$L_i/N = \mu_i * \delta_i.$$

Furthermore, we express the wage of the i-th category as ratio ξ_i to the reference category (w_M)—i.e., unskilled males on daily wages ($\xi_i = w_i/w_M$). Thus, the labor share becomes:

(6) $$\alpha = \Sigma \left(w_M/y * \xi_i * \mu_i * \delta_i * d_i \right).$$

Therefore, our estimate needs wages of unskilled males, GDP per capita, the composition of population by age/gender cohort (μ_i), and three parameters (ξ_i, δ_i, and d_i) for as many categories of workers as possible given the available sources. Equation (6) can be rewritten as:

(7) $$\alpha = w_M/y * \left[\Sigma \left(\xi_i * \mu_i * \delta_i * d_i \right) \right],$$

where the term ζ:

(8) $$\zeta = \left[\Sigma \left(\xi_i * \mu_i * \delta_i * d_i \right) \right]$$

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

includes the differences among categories of workers in relative wages (skill premium and gender gap) and working days, as well as their share on total workforce. In practice, equation (8) highlights the difference between the labor share and the Williamson's measure of inequality (wage/GDP ratio).

In principle, equation (6) can be estimated in nominal or in real terms, and the two can be converted into each other according to equation (3). However, series of GDP at current prices are available only for England, and they have been computed by reflating the series at constant prices (Broadberry *et al.*, 2015, p.201). Thus, we will estimate the labor share in real terms for all countries and use equation (3) to estimate a series of labor share at current prices for England.[3]

For modern societies, data refer to well-specified sectors and long-term contracts are the norm, but, in pre-industrial ones, the distinction between different sectors is hard to keep, while wages and working conditions depended on the characteristics of the workers, and many of them were hired with short-term contracts. In the most detailed case, for England, we consider separately six categories of workers (15–64 years), dividing by gender, and types of contracts (long term or annual vs short term or daily), level of skill (skilled/unskilled, for males only). We estimate separately the share of each category in total income, with specific parameters, and then we sum to obtain the total labor share at constant prices. Our estimates of the labor share refer to labor income only, excluding the income from capital (e.g., handlooms for weavers, agricultural tools for peasants) and from land (for land-owning peasant households).

4. Data and Sources

Given the constraints dictated by the available data on wages or GDP, we have been able to estimate yearly series of real labor shares for 1260–1851 for England, 1276–1851 for France, 1410–1807 for Holland (the province of Amsterdam, not the whole Netherlands), 1501–1800 for Spain, and 1530–1850 for Portugal.[4] We describe the sources of the series in full detail in the Online Appendix, and we report all series in the article's Supporting Information.[5] In this section, we give a broad overview of our series, and we discuss the methods of conversion of the welfare ratios in PPPs.

We measure real wages using welfare ratios (*WR*), which Allen (2001, p. 421) defines as:

[3]These nominal series are obtained by reflating the real series with a price index and then by linking the resulting index to GDP at current prices in a benchmark year. This procedure does not avoid deflation biases and, additionally, causes the level of nominal GDP, and thus ultimately the labor share, to depend on the choice of the linking year. This introduces a further source of distortion, whenever these benchmark years differ across countries and, for this reason, they reflect different price structures.

[4]The series of labor share for all countries are available as Supporting Information in the journal website.

[5]We have looked for structural breaks in all series with a Bai and Perron (2003) test to provide an additional statistical support to our periodization. The results single out 1372, 1521, 1587, 1676, and 1793 as break points for England, 1345, 1477/1525 (according to the method of computation), 1669/1672 and 1762 for France, 1477, 1554, and 1653 for Holland, 1546, 1599/1608 for 1642 and 1719 for Spain and 1613/1647, 1705, and 1802 for Portugal.

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

(9) $$WR = \left(w_N * 250\right) / (C * 3.15),$$

where w_N is the nominal daily wage for the male breadwinner, who is assumed to work for 250 days per year ("Allen's standard"), C is the annual cost of a subsistence basket for an adult and 3.15 is number of baskets necessary for the survival of an average household. Allen assumes this latter to have four members (the breadwinner himself, his wife and two children) and to need three baskets (children consume half an adult basket), plus a 15 percent allowance for rent (5 percent for each consumption unit). Each subsistence basket includes food for a total of 1940 calories per day, fuel, and some basic manufactures. Some of the food items (e.g., eggs, beer, and wheat bread) in Allen (2001) are actually not strictly necessary for mere biological subsistence, as they can be easily substituted by cheaper sources of calories and proteins. In fact, in later works, Allen (2009a, pp. 36–37; Allen *et al.*, 2011) has modified the basket to cut its cost as much as possible, while still keeping the same level of calories. He has reduced the food consumption of all items but cereals to the vital minimum, and he has assumed that people ate the cheapest available cereal, such as oats in England or maize in Southern Europe. This approach is controversial. The assumption of a fixed unchanging basket is theoretically questionable, as the cheapest one could be achieved using different combinations of goods. Allen himself (2017; 2020) and Zegarra (2021) have experimented with a more sophisticated approach for determining the basket, using linear programming given the prevailing prices. Scholars have also criticized Allen's definition of cheapest source of calories for urban population (Lopez Losa and Piquero Zarauz, 2021), his assumptions about the composition of the household (Humphries, 2013; Mijatovic and Milanovic 2021; Horrell, Humphries and Weisdorf, 2021) and the individual caloric needs (Humphries, 2013; Allen, 2015) and the representativeness of wage series (Hatcher and Stephenson, 2018). However, an alternative standard has not yet emerged, and thus we will stick to the Allen's original approach. We deflate the available wage series with a stripped-down "bare-bone basket," which enhances the intercountry comparability and makes computations easier.

We convert the welfare ratios (WR_{it}) into yearly income for male unskilled workers in three steps. First, we compute the monetary value of the food component of the basket (Table 1) in 2011 PPP \$ ($C^F_{\$2011}$), using the standard formula for bilateral (rather than multilateral as for GDP) PPP conversion between the US and another country j (e.g., Inklaar *et al.*, 2018):

(10) $$C^F_{\$2011} = \left[\left(\Sigma P_{USA} * Q_j / \Sigma P_j * Q_j\right) * \left(\Sigma P_{USA} * Q_{USA} / \Sigma P_j * Q_{USA}\right)\right]^{0.5}.$$

The vectors Q_{USA} and Q_j are the quantities for food items and P_j and P_{USA} are prices in local currencies from the ICP World Bank (2015) database for the 2011 round of PPPs (Table 1). Results from this method are subject to biases from change in relative prices and in the range of available goods, but the biases are in all likelihood smaller in the conversion of subsistence baskets, which include only basic foods, than in the computation of total GDP, which includes a very wide

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

TABLE 1
Bare-Bone Baskets Used for the Conversion of Welfare Ratios in 2011 PPP $ (Quantities and Prices)

Good	UoM	England	France	Holland	Spain	Portugal	US	England (£)	France (€)	Holland (€)	Spain (€)	Portugal (€)	US ($)
Oats	kg	155	155	155				1.27	2.39	1.61			1.69
Barley	kg				170	170					2.43	3.70	1.65
Maize	kg						165	1.30	2.47	1.83	2.71	3.92	1.68
Meat	kg	5	5	5	5		5	5.38	5.32	9.84	5.60	7.29	6.81
Beans	kg	20	20	20	20	20	20	1.53	2.06	1.95	1.55	1.54	3.43
Butter	kg	3	3	3			3	5.52	5.94	5.94	8.58	6.53	10.70
Olive oil	l.				3	3					3.70	4.11	8.80
***Daily cost of PPP bare-bone basket in 2011 PPP* $**								**1.29**	**1.24**	**1.28**	**1.31**	**1.35**	

Sources: Allen *et al*. (2011), World Bank (2015), http://www.fao.org/faostat (last accessed 1 March 2020).

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

range of manufactures.[6] Second, following the World Bank approach for poverty lines, we add a fixed mark-up (15 percent) to food expenditures to consider the non-food items (clothing, soap, etc.) of the subsistence basket ($C_{\$2011} = C^F_{\$2011} * 1.15$). To this amount, we add the allowance for rents as in the Allen's original formula (equation 9). Thus, we obtain the yearly cost of subsistence for one adult. By dividing this amount for 365, we obtain the daily costs of the bare-bone baskets of Table 1 (inclusive of non-food items and rent) for all countries.

The cost of the subsistence clusters around 1.25 dollars per day, a value significantly lower than the 2015 poverty line of the World Bank (1.90 in 2011 PPP $), which features more calories (about 2100) and also a wider range of non-food consumption items (Allen, 2017, p.3692). Finally, we compute the yearly real income (W_{it}) implicit in the welfare ratio (WR_{it}) as:

$$W_{it} = w_M * d = WR_{it} * C_{\$2011} * 3.15. \tag{11}$$

Our method is arguably robust to criticisms about Allen's approach. Any increase in the number of calories or in the size of the average household (and thus in the number of baskets) would decrease the welfare ratio, but the effect would be correspondingly compensated by an increase in the unit cost of the basket or in the number of baskets.

We retrieve the GDP series (in 2011 PPP $) for England (Broadberry *et al.*, 2015), Holland (van Zanden and van Leeuwen, 2012), and Portugal (Palma and Reis, 2019) from the 2020 release of the Maddison project (Bolt and van Zanden, 2020), while for Spain and France we rely on recent estimates by Prados de la Escosura *et al.* (2021) and Ridolfi and Nuvolari (2021), which are not yet included in the Maddison project. The series for England, Holland, and Spain (except the early and late years) have been estimated as sum of output of different sectors (Holland is a "tentative" estimate before 1510), while the series for Portugal and France have been obtained with a demand-side approach. We have collected information for the variables necessary for the estimation of the labor shares from various country-specific sources, as reported in Table 2. As said in the Introduction, our search has yielded a complete and reliable set of data for England, while the results for the other four countries are somewhat more fragile. The data on skill premium and gender gap are quite solid, as they are obtained from recent research on the dynamics of wages. The same is true also for estimates of working days, which in most cases rely on specific evidence, while the nationwide percentages of skilled workers are obtained combining the country-specific estimates on non-agricultural rural population by Allen (2000) with the English shares of skilled occupations by de Pleijt and Weisdorf (2017). When possible, we have proxied the missing country-specific series with data from similar countries (e.g., Spain for Portugal and vice versa). Unfortunately, we have been able to find series of wages for annual workers only for England,

[6]For some cereals, the World Bank does not report prices (e.g., maize) or provides only prices for industrial products (such as cornflakes). In these cases, we estimate an implicit price as the retail price of bread times the ratios of producer prices from the FAO Statistical database (www.fao.org), accessed November 2019.

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

TABLE 2
SOURCES USED IN THE CONSTRUCTION OF THE LABOR SHARES ESTIMATES

Variable	England (1260–1850)	France (1276–1850)	Holland (1410–1808)	Spain (1501–1800)	Portugal (1527–1850)
Daily nominal male wages	Farm wages (Clark, 2007); building wages (Clark, 2005)	Ridolfi (2019)	Allen (personal communication)	Lopez Losa and Piquero Zarauz (2021)	Palma and Reis (2019)
Cost of bare-bone basket	Clark (2010)	Ridolfi (2019)	Allen *et al.* (2011)	Lopez Losa and Piquero Zarauz (2021)	Palma and Reis (2019)
GDP 2011 PPP $	Broadberry *et al.* (2015)	Ridolfi and Nuvolari (2021)	van Zanden and van Leeuwen (2012)	Prados de la Escosura *et al.* (2021)	Palma and Reis (2019)
Working days for casual workers	This study (based on Blanchard, 1994); Allen (2001), Humphries and Weisdorf (2019), Horrell and Humphries (2019)	Ridolfi (2019)	de Vries and van der Woude (1997, pp. 616–617); De Vries (2008); van Zanden and van Leeuwen (2012)	As in Portugal	Palma and Reis (2019)
Working days for annual workers	Humphries and Weisdorf (2019)	No	No	No	No
Share of working age cohorts	Wrigley *et al.* (1997)	As in England	As in England	Prados de la Escosura (personal communication)	As in Spain
Activity rate for males	This study and Allen (2019)	As in England	As in England	Prados de la Escosura (personal communication)	As in Spain

(Continues)

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

TABLE 2 (CONTINUED)

Variable	England (1260–1850)	France (1276–1850)	Holland (1410–1808)	Spain (1501–1800)	Portugal (1527–1850)
Activity rate for females	This study, Allen (2019) and Horrell and Humphries (1995)	As in England	As in England	Prados de la Escosura (personal communication)	As in Spain
Gender gap (female wages/male wages)	de Pleijt and van Zanden (2021)	Ridolfi (personal communication), de Pleijt and van Zanden (2021)	de Pleijt and van Zanden (2021)	As in Portugal	Palma *et al*. (2021)
Share of male skilled workers on male workforce	Broadberry *et al*. (2015, p.195); de Pleijt and Weisdorf (2017)	Allen (2000); as in England for non-rural areas	de Vries and van der Woude (1997, p. 61); as England for non-rural areas	Prados de la Escosura (personal communication); England for non-rural areas	Palma and Reis (2019)
Skill premium (wages of skilled workers/wages of unskilled workers)	Clark (2005)	Ridolfi (2019)	Allen (2001)	Lopez Losa and Piquero Zarauz (2016)	Palma and Reis (2019)
Share of annual workers in total workforce	Broadberry *et al*. (2015)	No	No	No	No
Wage gap of annual workers (annual wages/casual wages)	Humphries and Weisdorf (2019)	No	No	No	No

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

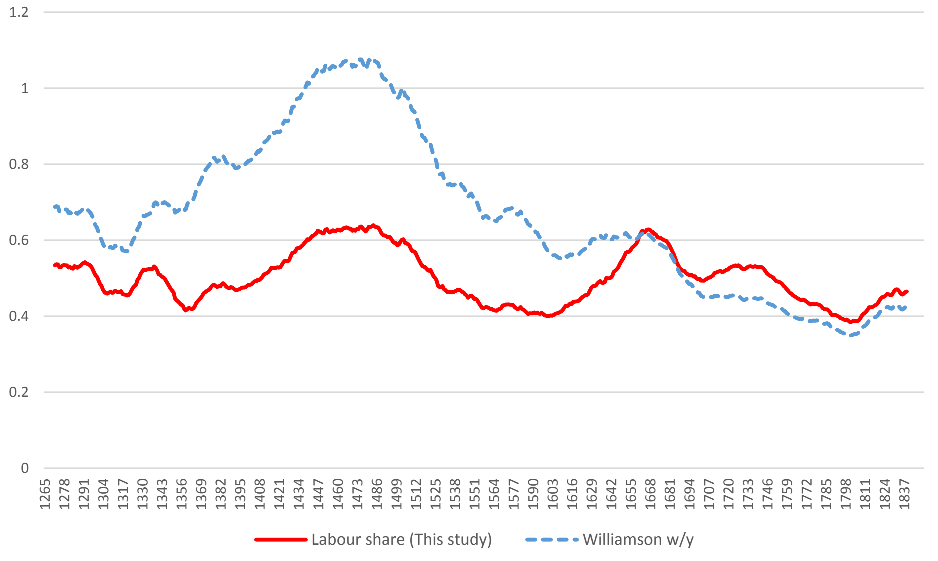

Figure 1. Comparison Between Our Labor Share and Williamson w/y, England (1260–1850).
Note: Williamson w/y is computed assuming 250 working days and L/N = 0.4.

and thus for the other countries we omit the distinction, estimating the wage bill as if all workers were on daily contracts.

5. The Labor Share in England

Figure 1 presents our baseline series of the real labor share for England (equation 6). We smooth yearly fluctuations with a 25 years moving average. In the following, if not otherwise stated (as "original series"), we quote the central year of each 25 year—e.g., 1293 covers the period 1276–1300.[7]

In the long run, English workers got half of the GDP (50.0 percent), possibly a couple of points more including children below 14 years of age, whom we have been forced to omit for lack of data for most of the period.[8] The Black Death killed about one-third of the English population (Broadberry *et al.*, 2015), but this did not cause immediately a rise in the labor share, which in 1362 was still about ten points lower than before it (42 percent vs 52.4 percent). Afterwards, the population continued to decline, and the share started to rise and 1372 turns out to be a break point in the original series. The upward swing of this Malthusian cycle lasted about one century, peaking in the 1480s. This date coincides with the trough of

[7]In the smoothed series, the figures for the years immediately before (or after) the Black Death cover both pre- and post-plague years (e.g., 1347 is the average of 1335–1359), and thus reduce any short-term effect of the plague. Thus, "before the Black Death" and "after the Black Death" refer respectively to the periods 1323–1347, with central year 1335, and 1350–1374, with central year 1362.

[8]Data are available for the period 1780–1820 (Horrell *et al.*, 2020). The total wage bill for children accounted for 1.14 percent on average, with a peak slightly over 1.6 percent during the 1820s (Figure A4 in the Online Appendix).

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

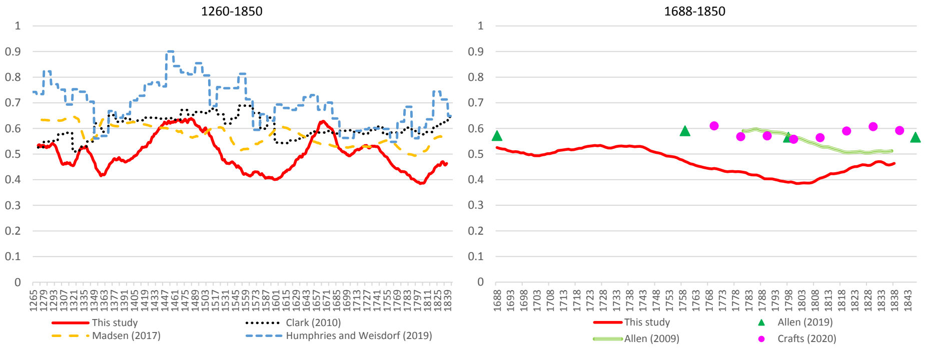

Figure 2. Comparison Between Our Labor Share and Other Estimates, England

population, which, in 1480, was one-fifth lower than at the end of the plague (Broadberry *et al.*, 2015). The labor share remained above 60 percent up to the end of the 15th century, and then it declined throughout the whole 16th century. In 1600, workers got only two-fifths of English GDP, the lowest share since the beginning of the series, and a whisker above the all-time low of the 1790s. Then, their situation improved, and the labor share grew by almost a half, to 62.8 percent in 1667—i.e., back to the peak of the post-Black Death rise. This increase cannot be interpreted as a Malthusian reaction, as the movements of the labor share had no obvious relation with population trends. The English population rose fast to the 1630s, stalled for about a century, and then rose rapidly again. As we will detail later, the second "golden age" of English workers reflected an increase in labor supply with stable wages rather than an increase in wages with stable or shrinking workforce. Furthermore, it lasted much less than the first. The labor share started to decline in the third quarter of the 17th century and continued throughout the 18th, including the first decades of the Industrial Revolution. It hit the all-time low in 1798, and then it recovered somewhat. At the end of our series, in 1838 the labor share was 46.5 percent—i.e., some points lower than its long-run average. Our estimate might undervalue somewhat the positive effect of the increase in skills on the total labor share during early industrialization. In fact, our skill premium refers to construction workers, while a growing number of people was employed in "professional" and "commercial occupations": in 1841 they accounted for about 4 percent of the total workforce and one-quarter of our estimate of skilled workers (Mitchell, 1988, p.104). On the contrary, the overall evolution of our estimates of the labor share is consistent with the results of the recent work on the welfare of British working class by Gallardo-Albarran and de Jong (2021).

We plot, in Figure 1, also the wage/GDP ratio (the "Williamson w/y"), which we express, for the sake of comparability with our series, as a labor share (equation 4) assuming L/N = 0.4 and d = 250 (Allen's standard). The movements of the "Williamson w/y" only vaguely resemble our baseline series. The Malthusian cycle is much wider, and, at its peak, laborers would get over 100 percent of the GDP, which is clearly absurd. On the contrary, the 17th-century cycle is barely visible. By construction, the difference reflects our much more articulated view of historical

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

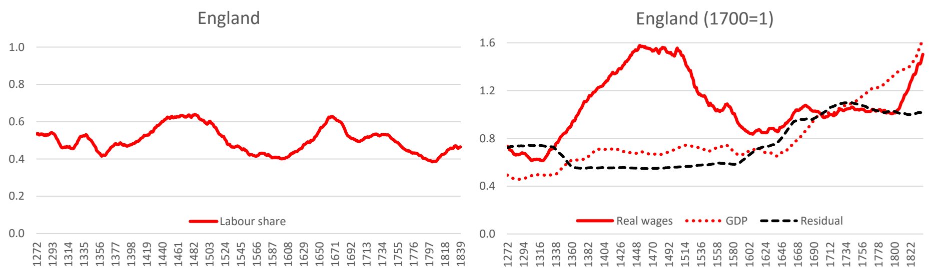

Figure 3. Labor Share and Its Components, England (1260–1850)

change, most notably variations in the number of working days, which we will discuss later in this section.

Figure 2 (left panel) shows that our baseline series differs markedly from the long-run estimates by Clark (2010), Madsen (2017) and Humphries and Weisdorf (2019). This latter is computed as a ratio of real (annual) wages to real GDP by Broadberry *et al*. (2015) and thus, unsurprisingly, the movements are fairly similar (a coefficient of correlation is 0.54), without the 16th and early 17th century dip. However, the average share is much higher, and somewhat implausible (70 percent vs 50 percent for our baseline series). In contrast, the gap in levels is smaller for the two other series (57 percent for Madsen and 61 percent for Clark vs 50 percent), but the movements differ significantly. The coefficient of correlation with our series is respectively 0.16 and 0.19. The series by Clark and Madsen are much more stable than our baseline, ultimately because both authors assume the number of working days to have been constant. Clark (2010, p. 63) estimates a nominal wage bill multiplying his series of daily wages by 300 and then computes the GDP from the income side by adding rents and profits. The numerator of the Madsen series, instead, is an index of labor income based on Humphries and Weisdorf series of annual wages, which assumes a constant number of working days.

Figure 2 (right panel) plots two additional series of labor share since the late 18th century by Allen (2009b) and by Crafts (2020), and the four benchmark estimates of labor shares elaborated from social tables by Allen (2019). All series, including ours, find a clear worsening of inequality during the early stages of the Industrial Revolution—the "Engels' pause" of the title of Allen's (2009b) famous article. The series by Crafts is very similar to ours, with different levels, while according to Allen (2009b) the decline lasted until the late 1810s, with no rebound.[9] The social tables show almost no change in time—it is difficult to assess how much

[9]The differences between the estimates can be explained by differences in sources and methods of computation. Allen (2009b) and Crafts (2020) do not adjust for changes in labor inputs and both use the real earnings series by Feinstein (1988), which covers a wider range of occupations since 1770. In addition, Allen (2009b) uses as denominator the index of real output by Crafts and Harley (1992) rather than the series of GDP by Broadberry *et al*. (2015). Last but not least, Crafts first computes the ratio between indexes of real wages and GDP and then converts it into the labor share by linking to the level around 1800 according to the Colquhoun social table, which is significantly higher than ours (56 percent vs 39 percent).

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

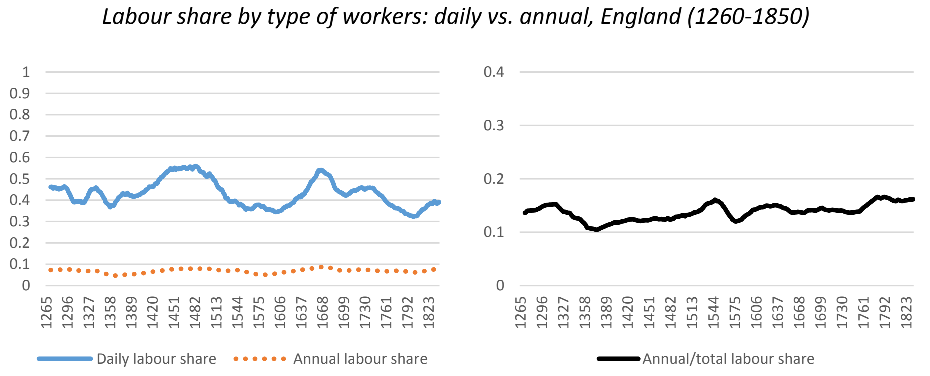

Figure 4. Labor Share by Type of Workers: Daily vs Annual, England (1260–1850)

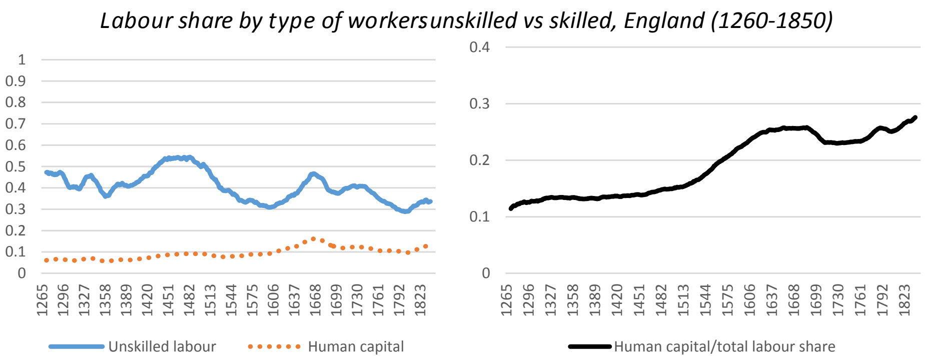

Figure 5. Labor Share by Type of Workers: Unskilled vs Skilled, England (1260–1850)

does this depend on the different nature of the data (nominal vs real shares) or on the procedures adopted to transform the data by social groups into returns to factors.

We start our analysis by focusing on the components of the labor share (equation 7). Figure 3 compares trends in the labor share with its main three components highlighted, the male unskilled wages, the GDP per capita, and the "residual" ζ. This latter and GDP per capita moved very little until the early 17th century, and thus wage movements dominated trends in the labor share, consistently with the standard Malthusian narrative. From the 1620s to the 1820s, the real wages remained broadly stable and thus trends in the labor share depended on the contrasting movements between the positive effect of the rise in the residual and the negative effect of the growth in GDP per capita. The former prevailed in the first 70 years of the 17th century and the latter from the 1660s onwards. In the early 19th century, GDP per capita continued to grow, the residual remained stable, and thus the modest increase in the labor share reflects the rise in real wages.

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

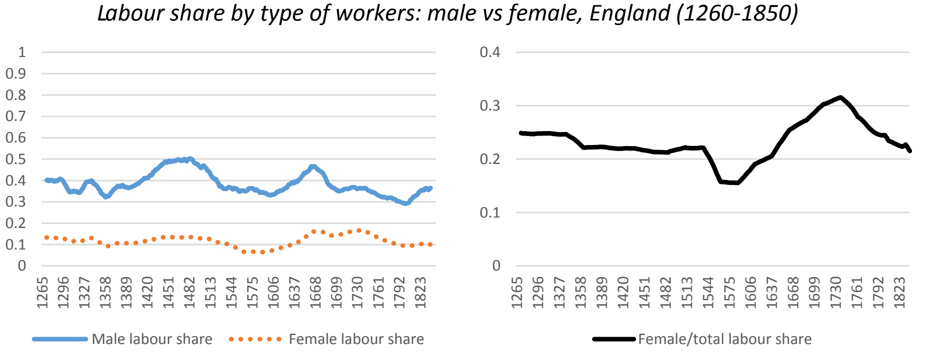

Figure 6. Labor Share by Type of Workers: Male vs Female, England (1260–1850)

It is also possible to analyze trends in the labor share for different categories of workers by looking at their shares, which add up to the total labor share (equation 6). We distinguish between daily and annual workers (Figure 4), unskilled and skilled ones (Figure 5), and males and females (Figure 6). For each of these pairs, we plot on the left the respective shares on GDP per capita and on the right the proportion of, respectively, annual workers, skilled workers, and females on total return to labor. Movements for annual workers (Figure 4) were modest, partly by construction. We have assumed, for lack of data, that they accounted for one-fifth of the workforce for males, while for females, following Horrell *et al.* (2020), we have assumed that women worked with annual contracts from age 15 to 24, and with daily wages from 25 to 64 (on average the share of women with annual contracts amounts to about 30 percent). Furthermore, we have considered that all annual workers were employed for 260 days per year. Their percentage on the total labor share (Figure 4, right panel) fluctuated between one-tenth and one-sixth, because the wider cycles in the wages of casual workers, especially during the Malthusian cycle, were compensated by counteracting variations in working days.

In the late 13th and the first half of the 14th century, skilled workers were paid comparatively well, about double the unskilled ones, but there were few of them and thus they got about 6.5 percent of English GDP (Figure 5, left panel). The skill premium halved after the Black Death and the labor share of skilled workers on GDP decreased by 1.5 percentage point immediately afterwards in the 1350s. In the next three centuries, the skill premium fluctuated around 1.5, without any clear trend, and the proportion of skilled workers rose up to a new maximum in the late 17th century. Thus, this group benefited handsomely of the second golden age of English workers, getting over one-quarter of the labor share (Figure 5 right panel) and about 15 percent of the English GDP (Figure 5, left panel). These levels were not maintained in the 18th, while since the early 19th century is visible a rebound with a maximum (27.6 percent) reached at the end of the period.

The movements of the female labor shares (Figure 6, right) until 1500 depend only on the gender gap, as we assume, for lack of information, that the

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

female activity rate remained constant at 40 percent (vs 90 percent for males). We use the gender gap series by de Pleijt and van Zanden (2021), to be consistent with the estimates for other countries, but the results would have been very similar with the series by Humphries and Weisdorf (2015). The pay of women declined from 84 percent of males after the Black Death to 71 percent in the second half of the 15th century. In the 16th century, the relative pay of women decreased, and the rise in activity rate to a half could not prevent the return to women work to sink to 6.5 percent of GDP (Figure 6, left panel) and to 15 percent of the labor share (Figure 6, right panel) in the 1580s. This was a veritable "dark age" for British women workers, also because possibly their status was worsened by the legislation (Humphries and Weisdorf, 2015). The tide turned in the early 17th century, in spite of a further widening of the gender gap, thanks to the growth of the activity rate. The upward trend of women labor share was reinforced by the increase in their relative pay after 1650. The labor share of women workers peaked in the 1730s at around 15 percent of the GDP, corresponding to almost one-third of the wage bill and then declined substantially. The gender gap widened again to about a half, but most of the decline reflects the partial retreat of women from the labor market during the Industrial Revolution, down to a 45 percent activity rate around mid-century (Horrell and Humphries, 1995).

How robust are these results? In principle, using our framework, one could produce a large number of alternative series of the labor share using different sources (e.g., Allen's wage series) or making different assumptions concerning the parameters. It turns out that our estimates are actually robust both to changes in the main data sources and to plausible variations in the selected parameters. For the sake of brevity, here we illustrate this point with four representative sensitivity tests.

First, Figure 7a plots the original (unfiltered) data and series with three alternative smoothing procedures, the 25 years moving average of our baseline estimate, 11 years moving average, and a local polynomial smoothing, with confidence intervals of 95 percent, constructed with an Epanechnikov kernel function. Notably, all series feature the same "twin peaks" pattern, although the 17th century peak is much less sharp with the local polynomial method.

Second, we compare our "real" labor share, based on the ratio between real wages and real GDP, with the "nominal" one (Figure 7b). We compute the latter by multiplying the "real" labor share by the ratio of our index of prices of bare-bone basket to the GDP deflator (equation 3).[10] The two series are very similar, with an almost identical long run averages (50 percent the real and 50.7 percent the nominal) and very high coefficients of correlation (0.85 and 0.94 after smoothing). The nominal series fluctuates less than the real one before the Industrial Revolution while it remains constantly higher, with a growing gap since the late 18th century. The prices of basic goods in the bare-bone basket, and especially of cereals, grew much more than the GDP deflator, which included prices of manufactures, until a peak in the early 1810s and declined slightly less thereafter.

[10]We use the implicit deflator of GDP computed by Thomas and Dimsdale (2017, accessed on 10 July 2021) using data from Broadberry *et al*. (2015).

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

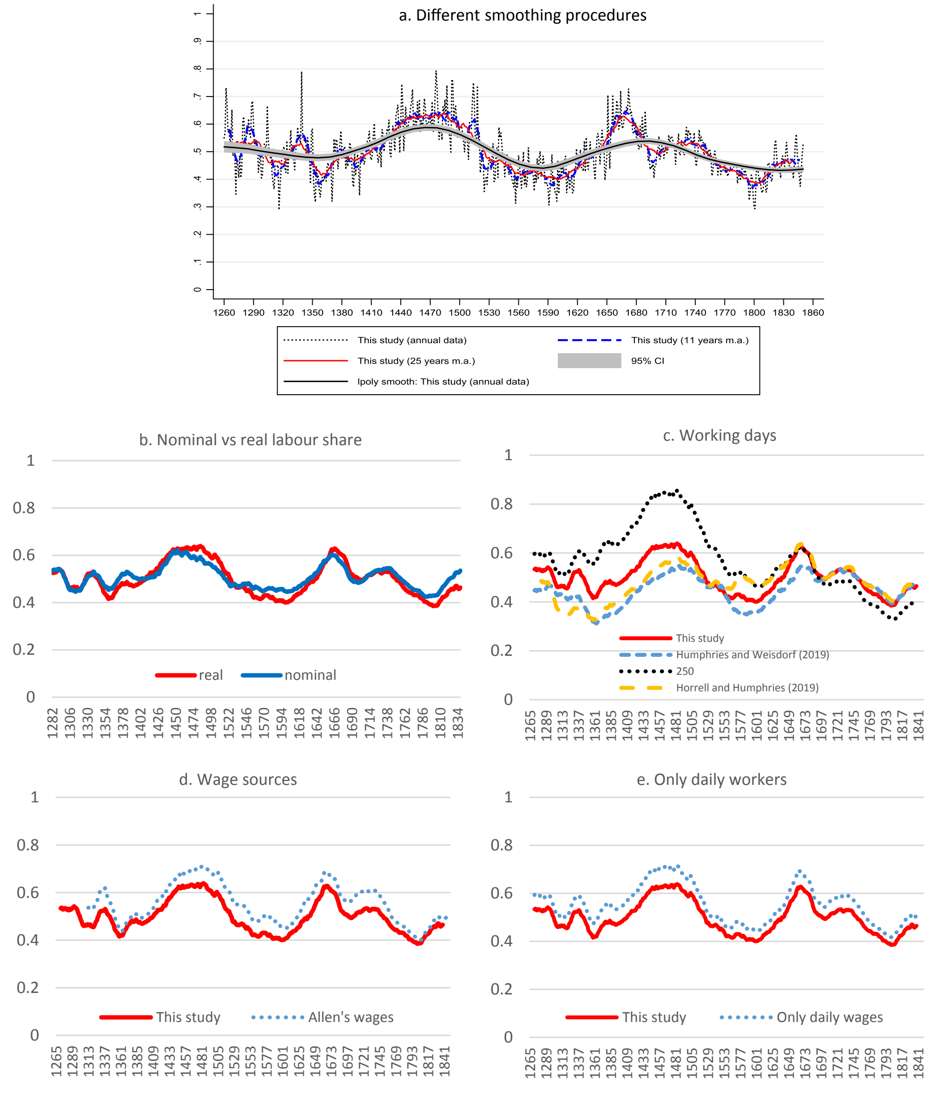

Figure 7. Robustness Checks, England (1260–1850)

Third, we explore the impact of different series of a key-parameter, the number of working days for casual workers (Figure 7c). We re-estimate the labor share with the series of working days by Humphries and Weisdorf (2019) and by Horrell and Humphries (2019) as well as with Allen's standard of 250 days. This latter yields an implausibly high share in the 15th century and a low one in the 18th and early 19th century. The three other estimates coincide almost perfectly after the mid-17th century and quite well in the first four centuries. Our baseline estimate exceeds on average the Humphries and Weisdorf series (2019) by five percentage points, and the Horrell and Humphries (2019) by two percentage points. However,

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

movements are pretty similar, with coefficients of correlation respectively 0.74 and 0.64.

Fourth, we test the effect of computing the labor share with an alternative series of wages and skill premium with the data from Allen that have been widely used in the literature (Figure 7d).[11] The movements are almost identical (coefficient correlation 0.97), even if in this case our series comes out slightly lower.

Fifth, we re-compute our series of the labor share assuming that all workers were casual ones (Figure 7e). This hypothesis is clearly an oversimplification, because we know that there were many workers with long-term contracts. We pursue this sensitivity test because we have been forced to omit annual workers in our estimates for other countries for total lack of data. As expected, the labor share with only casual workers is somewhat higher than the baseline because the wages of annual workers were lower to compensate for the greater security of their jobs (Humphries and Weisdorf, 2019). However, the correlation between the two series is almost perfect (coefficient of correlation of 0.99) and the gap in levels is fairly small. It fluctuates around five percentage points, with few peaks around eight in the mid-15th century.

We can find additional corroboration for our labor share series from two pieces of independent evidence. First, we can compare our labor share with the net savings component of the series of wealth/GDP ratio from 1226 onwards by Madsen (2019, figure 17). Unlike capital gains, savings were likely to move inversely to the labor share as very few pre-industrial workers were able to save anything. The results are mixed. On one hand, in contrast with our results and with the conventional wisdom, the saving component remained essentially flat during the long Malthusian cycle of the 14th–15th centuries. Afterwards, its movements tally well with our estimate: savings rose to a maximum around 1550, when labor share was low, and declined to a minimum in the early 18th century. Second, our estimates are broadly consistent with long-run trends in heights (Galofré-Vilà *et al.*, 2018). These latter remained constant for people born in the late 13th to early 14th centuries, rose to an all times maximum (174.3 cm.) for people born around 1440 and remained high until the mid-17th century. The 18th century was not a prosperous period for workers: the heights of people born after 1750 declined to 169.3 cm, a level not witnessed since the 10th century.

6. The Labor Share in Pre-Industrial Europe

As anticipated, the data for other countries are less robust and detailed than the English ones and all the series, but the French one, are significantly shorter.

[11]We compute the alternative series as an average of wages of agricultural workers for Southern England and construction workers in Oxford and London, weighted with the shares of agriculture on total workforce from Broadberry *et al.* (2015). In Figure 5d, we deflate with the cost of the bare-bone basket estimated using Clark's prices, as in our baseline series. However, the difference with the prices from Allen's website is negligible (see Figure A2 in the Online Appendix). Allen wage and price series are available at https://www.nuffield.ox.ac.uk/people/sites/allen-research-pages (accessed in February 2020).

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

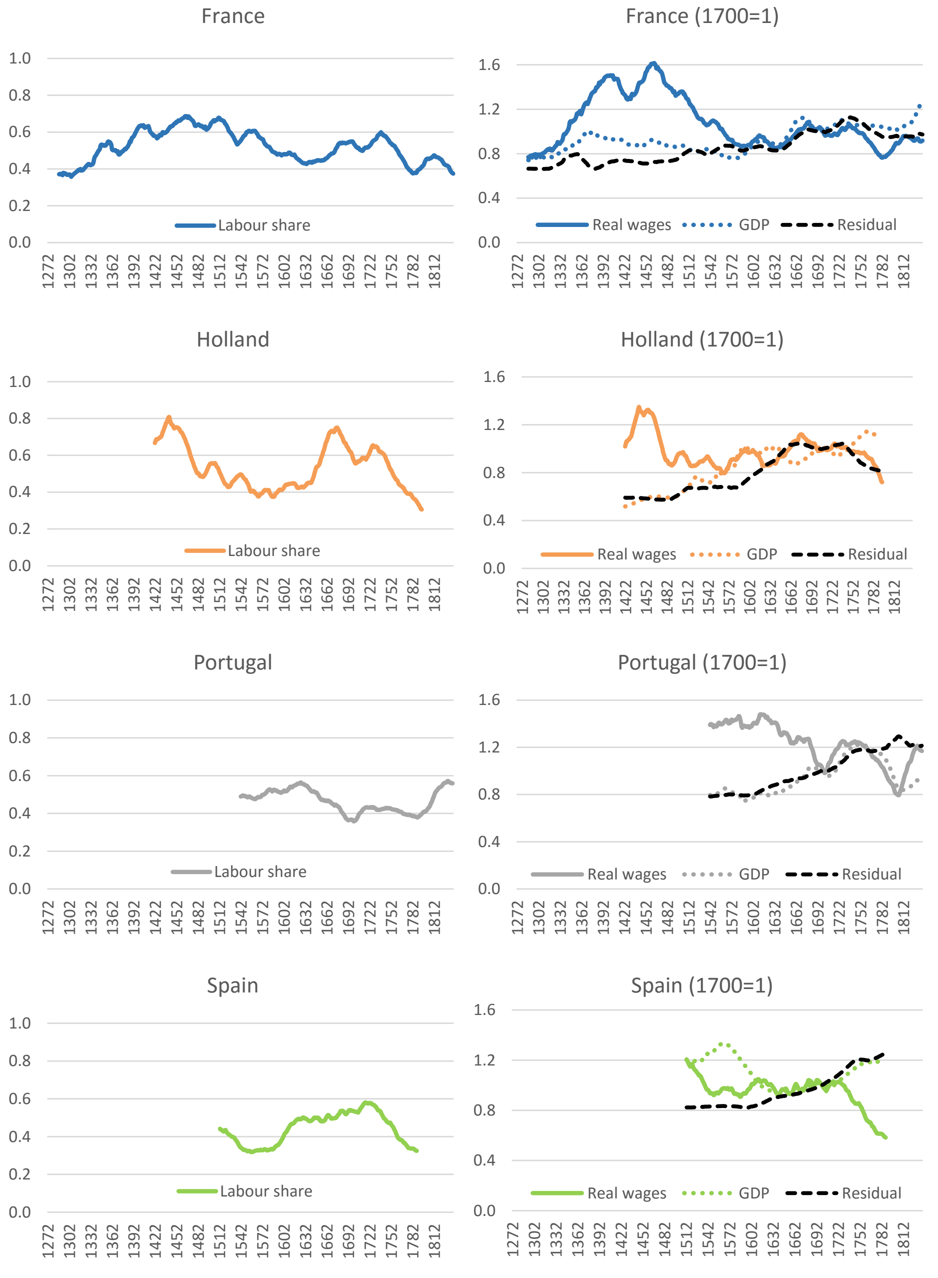

Figure 8. Labor Share and Its Components in Four Countries (1260–1850)
Note: our own elaborations based on the sources of Table 2.

As for England (Figure 1), the real labor share differs substantially from the "Williamson w/y" for all countries but France (Online Appendix Figure A5). We plot the smoothed series in Figure 8.

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

First and foremost, our data confirm that pre-industrial societies were highly unequal. In the long run, labor claimed between two-fifths and a half of the GDP, with values ranging from less than half for the Iberian countries: (44.3 percent for Spain and 46.5 percent for Portugal) to 53.4 percent for Holland, with England (50.0 percent) and France (52.1 percent) somewhat in the middle. The maximum figure in the whole database is 80.1 percent (Holland in 1442) and the minimum 30.5 percent (again Holland, in 1795) but most of the estimates range between 40 and 60 percent. To be sure, our estimate omits income from capital (the tools of the trade) and, for family farmers, also from land but, as said, the contribution from these sources is not likely to have been large. Even adding three or four points, the share of labor in pre-industrial would remain decidedly lower than nowadays. The average nominal share for G20 countries at factor costs, adjusted for self-employment, declined from 70 percent in the 1960s and 1970s to 62–63 percent around 2010 (ILO-OECD, 2015). The mean for less developed countries, which are arguably more comparable to pre-industrial Europe, was likewise substantially higher—about 65 percent in the last two decades of the 20th century (Guerriero, 2019).

In France, as in England, the Black Death triggered a massive Malthusian reaction, mostly determined by wages, while GDP and the residual remained stable or increased very little. However, a closer look to the data shows some relevant differences. First, wages and consequently the labor share had started to grow before the plague: in 1335 it was five points higher than in 1288, the first year of the (smoothed) series. Second, the effect of the Black Death was immediate: from 1335 to 1362 the share increased by one-fifth, from 42.5 to 50.5 percent. It continued to rise until 68.7 percent in 1466. Third, the descending phase lasted a bit more—the lowest point was reached in 1634, with 42.6 percent. Unfortunately, it is impossible to compare these movements with population, as the first nation-wide series starts only in 1550 (Dupâquier, 1988), even if Ridolfi (2019) tentatively argues that the inverse relation between population and wages did not fully disappear until the 1790s. The French labor share remained low in the mid-17th century and then started to grow in the late 1660s, up to 60 percent in 1738. In this latter phase real wages increased very little and GDP remained constant, so that the labor share reflected the rise in the residual. Most notably, the working days rose from 239 in 1641 to 289 in 1750 (Ridolfi, 2019). The second half of the century was a gloomy period for French workers, as their wages collapsed. In 1783, real wages and the labor share were back to the level of the late 13th century. The real wages increase by one-quarter during the Revolution and the Empire, but the start of modern economic growth dampened the rise in the labor share, which peaked just before Waterloo and plunged again afterwards.

The Holland series begins only in 1422 at a quite high level (66.7 percent), rises fast until a very high peak (80.8 percent) 20 years later, in 1442, and then declines to 37.5 percent in 1567, with a short-lived rebound in the early 16th century. Thus, in Holland the decline started earlier than in England and France, consistently with a faster demographic recovery after the plague, and was substantially faster because the negative effects of a 40 percent drop in real wages of unskilled workers

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

was compounded by a 45 percent increase in GDP per capita.[12] Economic growth continued, at a slower rate, in the early 17th century, but the labor share doubled, up to 75 percent in 1676, for the combined effect of a 40 percent rise in real wages and of a 53 percent increase in the residual. The number of working days rose from 230 in 1574 to 300 in 1650 and the female activity rate from 0.5 to 0.61 (as in England, by assumption). After 1676, the labor share started a slow downward trend, losing about ten points in half a century, to 64.6 percent in 1730. The Bai-Perron tests singles out that year as a break point in the original series and indeed afterwards the share collapsed, down to a minimum of 30.6 percent in 1795. All components contributed to the collapse: the residual decline by about one-fifth because of a reduction in real wages of female workers associated also with a drop in their activity rate.

Spanish workers broadly shared the Northern Western trends. The labor share declined by one-quarter from the beginning of the series in 1513 to a minimum in 1557 just above 30 percent and remained flat until 1589. It rose by one-fourth in the following 20 years, continued to grow more slowly afterwards, up to 58 percent in 1723, and then collapsed, returning in 1788 to the minima of the mid-16th century. The collapse(s) of the 16th and 18th centuries were determined by the decline in real wages and the growth of GDP, with substantially stable residual. These trends tally well with the "Williamson index," computed as output per head/wages, by Prados de la Escosura *et al.* (2021, Figure 13), which declines by one-third from 1522 to its local minimum in 1572 and almost halved from 1697 to 1788. The rise in the 17th century was mostly determined by the growing residual. This is mainly due to the large increase in the working days.

In contrast with Spain, Portugal was to some extent an outlier in Europe. The labor share rose slowly in the decades around the turn of the 16th century, collapsed from 56 percent in 1626 to 37 percent in 1690, when elsewhere it was growing, and remained stable around 40 percent throughout the 18th century. The residual has been rising for all the period (the cumulate rise + 52 percent), and thus movements in the labor share were determined by changes in real wages and GDP. The 17th century collapse is the outcome of the combined effect of a 30 percent increase GDP coupled with a 25 percent decline in real wages. The opposite combination, with rising real wages and declining GDP, explains the rise in the early 19th century.

Summing up, our analysis confirms the conventional wisdom about a prolonged Malthusian cycle after the Black Death. Admittedly, this conclusion is based on the experience of England and France only, but it is also consistent with trends in Holland after 1422 and, to some extent, with the movement of the wage/GDP ratio in Spain from the early 14th century to 1513.[13] Afterwards, trends in the

[12]van Zanden and van Leeuwen (2012: Appendix 2) suggest, with the limited available evidence, that the population rebounded very quickly from the Black Death so that by 1400 it was only 10 percent lower than in 1348 and in 1514, the first solid benchmark, 17 percent greater. In England, population was respectively 56 and 54 percent lower than before the Black Death and in France 20 million in 1330 and 10 in 1450 according to Dupâquier (1988, col 2, pp. 515–516) or 16 in 1300, 12 in 1400, and 15 in 1500 according to Malanima (2010).

[13]The "Williamson" index has been increasing in the early fourteenth century, peaking in the 1340, then collapsed down to a minimum in 1373. It then doubled in the following 50 years up to its all-time maximum in 1427, and then started to decline. In 1513, at the beginning of our series, it was about three-fifths of the peak, and back to its level of the 1290s.

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

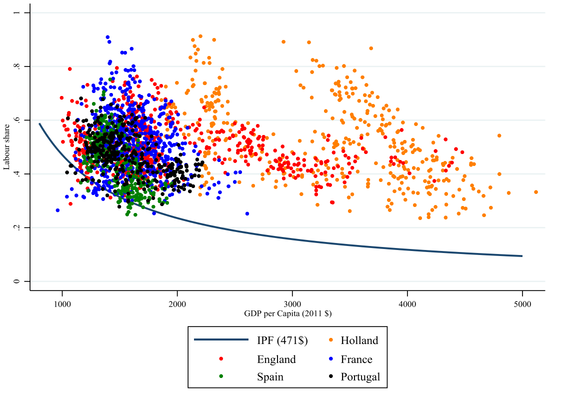

Figure 9. The Labor Share vs the Inequality Possibility Frontier (IPF) in Europe (1260–1850)

labor share in the 17th and early 18th century diverged quite remarkably. Overall, there is a growth in the labor share, with the exception of Portugal. However, unlike the "golden age" of the 14th century, workers earned a greater portion of GDP mostly by working harder. This pattern is consistent with the notion of the Industrious Revolution in England and the Netherlands, as originally proposed by de Vries (2008), but taking place, to a lesser extent and with some lags, also in France, Spain, and Portugal. The second half of the 18th century featured a sizeable decline in labor share, with stagnant or declining wages on the continent.

How does these trends relate to economic growth? To address this question, we use a modified version of the Milanovic *et al*. (2011) framework. We compute the IPF in terms of the labor share as the ratio of subsistence income to GDP per capita. This ratio would be equal to one if GDP per capita is equal to the subsistence level. In this case, all income must accrue to labor. This ratio then declines with the increase in GDP, indicating the portion of income that can be extracted by the élite. Figure 9 compares the IPF with the actual shares (with different colors by country). We reckon the yearly subsistence at 471 2011 PPP $ as the simple average of the cost of the country-specific bare-bone basket.[14]

The GDP per capita of countries in the sample exceeds by far this subsistence level, with most observations clustering between 1000 and 2000 PPP $. At that level of income, most estimates of the labor share are substantially higher than the IPF, but there is also a substantial number of observations with values very close to the IPF. In contrast, the distance between actual labor share and IPF becomes larger for incomes beyond 2000 PPP $, which were reached by England after 1670 and Holland already in 1410 at the beginning of our series. Figure 10 is consistent with the findings proposed by Alfani (2021, figure 7), who has also used the IPF to characterize inequality in Europe in preindustrial period.

[14]These are 469 for England, 465 for France, 452 for Netherlands, 477 for Spain, and 491 for Portugal. The average (471) corresponds almost perfectly to the 300 1990 PPP $ subsistence income for the IPF in Milanovic *et al*. (2011).

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

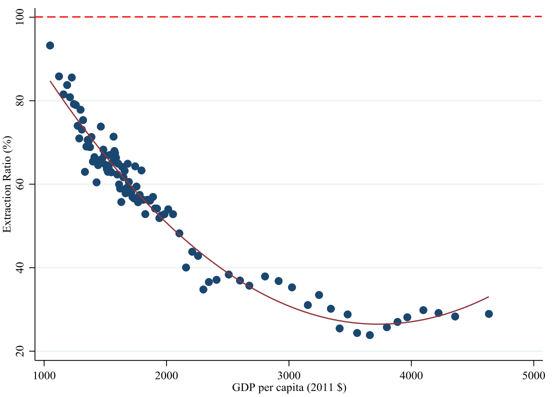

Figure 10. Inequality Extraction Ratio (IER) and GDP Per Capita by Countries

The relation between GDP per capita and income inequality, in our case measured by the labor share, can be further analyzed by computing the inequality extraction ratio (IER)—i.e., the ratio between the minimum level of the labor share according to the IPF for a given level of income and the actual labor share. The ratio is equal to one when the labor share is the lowest possible and decreases when the labor share shifts away from the IPF. Figure 10 plots the IER for all countries with a binscatter diagram (100 equal bins).

Inequality, when measured by labor shares, was inversely related to the level of development up to about 3500 PPP $ as shown by the fitted line. After this latter level, there is a small rebound, which means an increase in inequality. Figure 10 is almost identical, once factoring the different metric (1990 vs 2011 dollars) to the one presented by Milanovic (2018, figure 3) constructed using the Gini index of the social tables. These two pictures of the patterns of income inequality, obtained with different methods from totally different sources, come to the same conclusion. In pre-industrial societies, economic growth (slightly) reduced the iron grip of élites in the extraction of the surplus of income.

7. Conclusions

In the past decade, there has been an outpouring of research on wealth inequality in pre-industrial Europe, but we do not have comprehensive series of income inequality. This paper fills this gap by estimating yearly series of the labor share for five major European countries from the 13th to the 19th century. We use the most recent estimates of GDP, real wages, and labor supply, in particular for working days, for different categories of workers. Relying on these materials, we have constructed our new series. To this aim, we have developed an innovative method to express a standard measure of real wages, Allen's welfare ratio into 2011 PPP $ and we set out a general framework to estimate labor shares within the constraints of the available data. Our method adjusts

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

the Williamson w/y ratio considering different categories of workers and their different supply.

Our estimate confirms the existence of a major Malthusian cycle, caused by the Black Death, in the labor share over the period 1350–1600. The peak of this cycle corroborates the notion that the mid-15th century was a "golden age" for European laborers. Remarkably, we show that paths in inequality diverged after 1600. Dutch and English workers experienced some decades of relative prosperity, using a significant reduction of leisure, consistently with the Industrious Revolution hypothesis (de Vries, 2008). The condition of workers in France, Portugal, and Spain did not improve that much, and the 18th century featured a generalized decrease in the labor share, with a minimum at the end of the century.

Overall, our findings suggest that dynamics of inequality in preindustrial Europe was characterized by a complex pattern of evolution with major fluctuations. Using the IPF framework, we find that there is a negative relationship between the extraction ratio and GDP. The challenge for further research will be to develop models that can probe into its possible causes.

References

Alfani, G., "The Rich in Historical Perspective: Evidence for Pre-industrial Europe (ca. 1300–1800)," *Cliometrica*, 11, 321–48, 2017.

______, "Wealth and Income Inequality in the Long Run of History." in C. Diebolt, and M. Haupert, (eds), *Handbook of Cliometrics*, Springer International Publishing, Cham, 1173–201, 2019.

______, "Economic Inequality in Preindustrial Times: Europe and Beyond," *Journal of Economic Literature*, 59, 3–44, 2021.

Alfani, G., and M. Di Tullio, *The Lion's Share. Inequality and the Rise of Fiscal State in Pre-industrial Europe*, Cambridge University Press, Cambridge, 2019.

Alfani, G., V. Gierok, and F. Schaff, "Economic Inequality in Preindustrial Germany, ca. 1300-1850", Working Paper No. 3, City University of New York, 2020.

Allen, R., "Economic Structure and Agricultural Productivity in Europe, 1300–1800," *European Review of Economic History*, 4, 1–26, 2000.

______, "The Great Divergence in European Wages and Prices from the Middle Ages to First World War," *Explorations in Economic History*, 38, 411–47, 2001.

______, *The British Industrial Revolution in Global Perspective*, Cambridge University Press, Cambridge, 2009a.

______, "Engels' Pause: Technical Change, Capital Accumulation and Inequality in the British Industrial Revolution," *Explorations in Economic History*, 46, 418–35, 2009b.

______, "The High Wage Economy and the Industrial Revolution: A Restatement," *Economic History Review*, 68, 1–22, 2015.

______, "Absolute Poverty: When Necessity Displaces Desire," *American Economic Review*, 107, 3690–721, 2017.

______, "Class Structure and Inequality during the Industrial Revolution: Lessons from England's Social Tables, 1688 to 1867," *Economic History Review*, 72, 88–125, 2019.

______, "Poverty and the Labor Market Today and Yesterday," *Annual Review of Economics*, 12, 107–34, 2020.

Allen, R., J. P. Bassino, D. Ma, C. Moll-Murata, and J. L. van Zanden, "Wages, prices, and living standards in China, 1738–1925: in comparison with Europe, Japan, and India," *The Economic History Review*, 64(s1), 8–38, 2011.

Angeles, L., "GDP Per Capita or Real Wages? Making Sense of Conflicting Views on Pre-industrial Europe," *Explorations in Economic History*, 45, 147–63, 2008.

Bai, J., and P. Perron, "Critical Values for Multiple Structural Change Tests," *Econometrics Journal*, 6, 72–78, 2003.

Bengtsson, E., E. Rubolino, and D. Waldenström, "What Determines the Capital Share over the Long Run of History?", CEPR Discussion Paper No. DP14693, 2020.

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

Bengtsson, E., and D. Waldenström, "Capital Shares and Income Inequality. Evidence from the Long Run," *Journal of Economic History*, 78, 712–43, 2018.
Berman, Y., E. Ben-Jacob, and Y. Shapira, "The Dynamics of Wealth Inequality and the Effect of Income Distribution," *PLoS One*, 11, e0154196, 2016.
Blanchard, I., "Introduction," in I. Blanchard (ed), *Labour and Leisure in Historical Perspective: Papers Presented at the 11th International Economic History Congress, Milan, 1994*, Steiner, Stuttgart, 1994.
Bolt, J., and J. L. van Zanden, "The Maddison Project. Maddison Style Estimates of the Evolution of the World Economy. A New 2020 Update," Maddison-Project Working Paper, WP-15, 2020.
Broadberry, S., B. Campbell, A. Klein, M. Overton, and B. van Leeuwen, *British Economic Growth, 1270–1870*, Cambridge University Press, Cambridge, 2015.
Cette, G., L. Koehl, and T. Phillippon, "Labour Shares in Some Advanced Economies," NBER Working Paper No. 26136, 2019.
Charpe, M., S. Bridji, and P. Mcadam, "Labor Share and Growth in the Long Run," *Macroeconomic Dynamics*, 24, 1720–57, 2019.
Clark, G., "The Condition of the Working Class in England 1209–2004," *Journal of Political Economy*, 113, 1307–40, 2005.
______, "The Long March of History: Farm Wages, Population, and Economic Growth, England 1209–1869," *Economic History Review*, 60, 97–135, 2007.
______, "The Macroeconomic Aggregates for England," *Research in Economic History*, 27, 51–140, 2010.
Crafts, N. F. R., "Slow Real Wage Growth during the Industrial Revolution: Productivity Paradox or Pro-rich Growth?" CEPR Discussion Paper No. DP14762, 2020.
Crafts, N. F. R., and K. Harley, "Output Growth and the British Industrial Revolution: A Restatement of the Crafts-Harley View," *Economic History Review*, 45, 703–30, 1992.
Davies, J. B., and A. F. Shorrocks, "Comparing Global Inequality of Income and Wealth", WIDER Working Paper No. 2018/160, United Nations University, 2018.
de Pleijt, A., and J. L. van Zanden, "Two Worlds of Female Labour: Gender Wage Inequality in Western Europe, 1300–1800," *Economic History Review*, 74, 611–38, 2021.
de Pleijt, A., and J. Weisdorf, "Human Capital Formation from Occupations: The 'Deskilling Hypothesis' Revisited," *Cliometrica*, 11, 1–30, 2017.
de Vries, J., *The Industrious Revolution: Consumer Behaviour and the Household Economy, 1650 to Present*, Cambridge University Press, Cambridge, 2008.
de Vries, J., and A. van der Woude, *The First Modern Economy; Success, Failure and Perseverance of the Dutch Economy, 1500–1815*, Cambridge University Press, Cambridge, 1997.
Dobb, M., *Theories of Value and Distribution Since Adam Smith: Ideology and Economic Theory*, Cambridge University Press, Cambridge, 1975.
Dupâquier, J., *Histoire de la Population Française*, Presses Universitaires de France, Paris, 1988.
Feinstein, C., "The Rise and Fall of the Williamson Curve," *Journal of Economic History*, 48, 699–729, 1988.
Fochesato, M., "Origins of Europe's North-South Divide: Population Changes, Real Wages and the Little Divergence in Early Modern Europe," *Explorations in Economic History*, 70, 91–131, 2018.
Gallardo-Albarran, D., and H. de Jong, "Optimism or Pessimism? A Composite View on English Living Standards During the Industrial Revolution," *European Review of Economic History*, 25, 1–19, 2021.
Galofré-Vilà, G., A. Hinde, and A. M. Guntupalli, "Heights Across the Last 2,000 Years in England," *Research in Economic History*, 34, 67–98, 2018.
Geloso, V., "Were Wages that Low? Real Wages in the Strasbourg Region before 1775," *Journal of Interdisciplinary History*, 48, 511–22, 2018.
Geloso, V., and P. Lindert, "Relative Costs of Living, for Richer and Poorer, 1688–1914," *Cliometrica*, 14, 417–42, 2020.
Glyn, A., "Functional Distribution and Inequality," in B. Nolan, W. Salverda, and T. M. Smeeding (eds), *The Oxford Handbook of Income Inequality*, Oxford University Press, Oxford, 101–26, 2011.
Gollin, D., "Getting Income Shares Right," *Journal of Political Economy*, 110, 458–74, 2002.
Guerriero, M., "The Labour Share of Income Around the World: Evidence from a Panel Data-set," ADBI Working Paper Series No. 920, 2019.
Hatcher, J., and J. Stephenson, *Seven Centuries of Unreal Wages. The Unreliable Data, Sources and Methods that Have Been Used for Measuring Standards of Living in the Past*, Palgrave, London, 2018.
Hoffman, P., D. Jacks, P. Levin, and P. Lindert, "Real Inequality in Europe since 1500," *Journal of Economic History*, 62, 322–55, 2002.

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

Horrell, S., and J. Humphries, “Women’s Labour Force Participation and the Transition to a Male Breadwinner Economy, 1790–1815,” *Economic History Review*, 58, 89–117, 1995.
______, “Children’s Work and Wages in Britain 1280–1860,” *Explorations in Economic History*, 73, 101272, 2019.
Horrell, S., J. Humphries, and J. Weisdorf, “Beyond the Male Breadwinner: Life-cycle, Living Standards of Intact and Disrupted English Working Families, 1260–1850,” *Economic History Review*, forthcoming, 2021. https://doi.org/10.1111/ehr.13105
______, “Family Standards of Living over the Long Run, England 1280–1850,” *Past and Present*, 250, 87–134, 2020.
Humphries, J., “The Lure of Aggregates and the Pitfalls of the Patriarchal Perspective: A Critique of the High Wage Economy Interpretation of the British Industrial Economy,” *Economic History Review*, 66, 693–714, 2013.
Humphries, J., and J. Weisdorf, “The Wages of Women in England, 1260–1850,” *Journal of Economic History*, 75, 405–47, 2015.
______, “Unreal Wages? A New Empirical Foundation for the Study of Living Standards and Economic Growth in England 1260–1860,” *Economic Journal*, 129, 2267–94, 2019.
ILO-OECD, *The Labour Share in G20 Economies*, Report Prepared for the G20 Employment Working Group, Antalya (Turkey), 26-27 February 2015.
Inklaar, R., H. de Jong, J. Bolt, and J. L. van Zanden, “Rebasing ‘Maddison’: New Income Comparisons and the Shape of Long-run Economic Development,” Maddison Project Working Paper No. 10, 2018.
Jedwab, R., N. Johnson, and M. Koyama, “Pandemics, Places and Population: Evidence from the Black Death,” CEPR Discussion Paper No. DP13523, 2019.
Karabarbounis, L., and B. Neiman, “The Global Decline of the Labour Share,” *Quarterly Journal of Economics*, 129, 61–103, 2014.
Lopez Losa, E., and S. Piquero Zarauz, “Spanish Real Wages in the North-Western European Mirror, 1500–1800. On the Timings and Magnitude of the Little Divergence in Europe,” DT-AEHE, No. 1607, 2016.
______, “Spanish *Subsistence* Wages and the *Little Divergence* in Europe, 1500–1800,” *European Review of Economic History*, 25, 59–84, 2021.
Maarek, P., and E. Orgiazzi, “(2019), “Development and the Labor Share”,” *The World Bank Economic Review*, 34, 232–57, 2019.
Madsen, J., “Is Inequality Increasing in r-g? Piketty’s Principle of Capitalist Economics and the Dynamics of Inequality in Britain, 1210–2013,” CAMA Working Paper No. 63/2017, Australian National University, 2017.
______, “Wealth and Inequality over Eight Centuries of British Capitalism,” *Journal of Development Economics*, 138, 246–60, 2019.
Madsen, J., and H. Strulik, “Technological Change and Inequality in the Very Long Run,” CEGE Discussion Papers No. 392, 2020.
Malanima, P., “The Long Decline of a Leading Economy: GDP in Central and Northern Economy, 1300–1913,” *European Review of Economic History*, 15, 169–219, 2010.
Mijatovic, B., and B. Milanovic, “The Real Urban Wage in an Agricultural Economy without Landless Farmers: Serbia, 1862–1910,” *Economic History Review*, 74, 424–48, 2021.
Milanovic, B., *Global Inequality. A New Approach for the Age of Globalization*, Belknap Press of Harvard University Press, Cambridge, MA, 2016.
______, “Towards an Explanation of Inequality in Premodern Societies: The Role of Colonies, Urbanization and High Population Density,” *Economic History Review*, 71, 1029–47, 2018.
Milanovic, B., P. Lindert, and J. G. Williamson, “Pre-industrial Inequality,” *Economic Journal*, 121, 255–72, 2011.
Mitchell, B. R., *International Historical Statistics. Europe 1750–1988*, MacMillan, New York, 1988.
O’Rourke, K., and J. G. Williamson, “From Malthus to Ohlin: Trade, Industrialization and Distribution since 1500,” *Journal of Economic Growth*, 10, 5–34, 2005.
Palma, N., and J. Reis, “From Convergence to Divergence: Portuguese Economic Growth, 1527–1850,” *Journal of Economic History*, 79, 477–505, 2019.
Palma, N., J. Reis, and L. Rodrigues, “Historical Gender Discrimination Does Not Explain Comparative Western European Development: Evidence from Portugal, 1300-1900,” CEPR Discussion Paper No. DP15922, 2021.
Pamuk, S., “The Black Death and the Origins of the ‘Great Divergence’ Across Europe 1300–1600,” *European Review of Economic History*, 11, 289–317, 2007.
Piketty, T., E. Saez, and G. Zucman, “Distributional National Accounts: Methods and Estimates for the United States,” *Quarterly Journal of Economics*, 133, 553–609, 2018.
Piketty, T., and G. Zucman, “Capital is Back: Wealth-Income Ratios in Rich Countries 1700–2010,” *Quarterly Journal of Economics*, 129, 1255–310, 2014.

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth

Prados de la Escosura, L., C. Alvarez-Nogal & C. Santiago-Caballero, "Growth Recurring in Preindustrial Spain?" *Cliometrica*, forthcoming, 2021.
Reis, J., "Deviant Behavior? Inequality in Portugal 1565–1770," *Cliometrica*, 11, 297–319, 2017.
Ridolfi, L., "Six Centuries of Real Wages in France from Louis IX to Napoleon III: 1250–1860," *Journal of Economic History*, 79, 589–627, 2019.
Ridolfi, L., and A. Nuvolari, "*L'Histoire Immobile?* A Reappraisal of French Economic Growth Using the Demand-Side Approach, 1280–1850," *European Review of Economic History*, 25, 405–28, 2021.
Rogers, J. E. T., *Six Centuries of Work and Wages: The History of English Labour*, W. Swan Sonneschein, London, 1884.
Roine, J., and D. Waldenstrom, "Long-run Trends in the Distribution of Income and Wealth," In A. Atkinson, and F. Bourguignon (eds), *Handbook of Income Distribution*, Vol. 2A, Elsevier, Dordrecht, 469–592, 2014.
Ryckbosch, W., "Economic Inequality and Growth before the Industrial Revolution: The Case of the Low Countries (Fourteenth to Nineteenth Centuries)," *European Review of Economic History*, 20, 1–22, 2016.
Scheidel, W., *The Great Leveller: Violence and the Global History of Inequality from the Stone Age to the Present*, Oxford University Press, Oxford, 2017.
Skopek, N., S. Buchholz, and H. Blossfeld, "National Patterns of Income and Wealth Inequality," *International Journal of Comparative Sociology*, 55, 463–88, 2014.
Stephenson, J. Z., "'Real' Wages? Contractors, Workers, and Pay in London Building Trades, 1650–1800," *Economic History Review*, 71, 106–32, 2018.
Thomas, R., and N. Dimsdale, "A Millenium of Macroeconomic Data," Bank of England OBRA Dataset, 2017, www.bankofengland.co.uk/statisitcs/research-datasets
van Zanden, J. L., "Tracing the Beginning of the Kuznets' Curve: Western Europe during the Early Modern Period," *Economic History Review*, 48, 643–64, 1995.
______, "The Skill Premium and the 'Great Divergence'," *European Review of Economic History*, 13, 121–53, 2009.
van Zanden, J. L., J. Baten, P. Foldvari, and B. van Leeuwen, "The Changing Shape of Global Inequality, 1800–2000: Exploring a New Data-set," *Review of Income and Wealth*, 60, 279–97, 2014.
van Zanden, J. L., and B. van Leeuwen, "Persistent but Not Consistent: The Growth of National Income in Holland 1348–1807," *Explorations in Economic History*, 49, 119–30, 2012.
Voigtländer, N., and J. Voth, "The Three Horsemen of Riches: Plague, War, and Urbanization in Early Modern Europe," *Review of Economic Studies*, 80, 774–811, 2013.
Williamson, J. G., "Globalization and Inequality, Past and Present," *The World Bank Research Observer*, 12, 117–35, 1997.
______, "Growth, Distribution and Demography: Some Lessons from History," *Explorations in Economic History*, 35, 241–71, 1998.
World Bank, *World Bank-ICP Price Data 2011*, Washington, 2015.
Wrigley, E. A., R. S. Davies, J. E. Oeppen, and R. S. Schofield, *English Population History from Family Reconstitution, 1580–1837*. Cambridge University Press, Cambridge, 1997.
Zegarra, L. F., "Living Costs and Welfare Ratios in Western Europe: New Estimates Using a Linear Programming Model," *European Review of Economic History*, forthcoming, 2021. https://doi.org/10.1093/ereh/heab007

Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web site:

Supplementary Material

Table A1: Number of Working Days in England

Figure A1: Nominal Wages, Farm and Building Laborers (d per day), (1250–1850)

Figure A2: Cost of Bare-Bone Baskets in England in d. (1250–1850)

Figure A3: Series of Number of Days Worked, Casual Labor

Figure A4: Children Labor Share (1780–1850)

Figure A5: Comparison Between Our Labor Share and Williamson w/y, France, Holland, Portugal, and Spain (1260–1850)

© 2021 The Authors. *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth