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The Great Divergence in European Wages and Prices from the Middle Ages to the First World War

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This paper traces the history of prices and wages in European cities from the fourteenth century to the First World War. It is shown that the divergence in real incomes observed in the mid-nineteenth century was produced between 1500 and 1750 as incomes fell in most European cities but were maintained (not increased) in the economic leaders. © 2001 Academic Press

Wages and prices have long been central concerns of economic historians, for they bear on such fundamental issues as the pace of economic development, economic leadership, and the standard of living. Unearthing the facts is the first task, and it has been accomplished by the meticulous scholarship of the historians who have written the price histories of so many European cities. While these investigations uncover the indispensable raw data and probe developments in the cities concerned, the material must be collated to reveal the patterns of change from the Middle Ages to the First World War. This paper takes a step in that direction by offering an overview of wages and prices in major European cities from the late middle ages to the early twentieth century.

Such an overview is important for understanding four issues. The first is the "consumer revolution."[2] On the one hand, probate inventories show a marked improvement in the variety and quality of household furnishings, decorations, and "luxury" items among artisans and farmers in England and the Netherlands during the seventeenth and eighteenth centuries.[3] On the other hand, the estab-

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[2] McKendrick *et al.* (1982) and Thirsk (1978).

[3] Brewer and Porter (1993), Berg and Clifford (1999), Shammas (1990), Weatherill (1988), van der Woude and Schuurman (1980), de Vries (1975).

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lished view is that real wages were falling in Europe for most of this period (Braudel and Spooner, 1967, p. 429). If so, how could the farmers and artisans afford the luxuries they were buying?[4]

The second is the history of heights. Much has been learned about their evolution, but the question remains of how body size was related to real income. International data from the late nineteenth and twentieth centuries indicate that height increased with GDP per capita and also with equality (Steckel, 1983, 1995; and Floud, 1994). These results raise the possibility that a more distributionally sensitive indicator like the real wage, which measures the income of a broad swath of the population, may be a better predictor of heights. Less is known about the eighteenth and early nineteenth centuries,[5] and some of the results are contradictory (Steckel and Floud, 1997, p. 9). Pursuing the relationship between stature and income with international comparisons for this period requires internationally comparable real wage data of the sort developed here. On first examination, the wage data would seem to confirm the relationship between income and height for the eighteenth century.

The third issue is the origin of the mid-nineteenth century income gaps whose disappearance has long been studied by historians and which have recently attracted considerable attention from economists in the context of the “convergence” literature.[6] In the mid-nineteenth cenutury, England had the highest income whether it be measured by GDP per head or real wages, and since then the rest of western Europe has caught up or surpassed it. The industrial revolution is the usual explanation for England’s preeminence in the mid-nineteenth century, but that explanation is, at best, partial, since growth in per capita income and real wages was modest in Britain between 1770 and 1850 (Crafts, 1985b, 1989; Williamson, 1984, 1985; Feinstein, 1998). If the industrial revolution was not substantial enough to explain England’s lead in 1850, where did it come from?

The fourth question is not unrelated to the third: How should we see the standard of living debate in an international and long-term context? Considerable effort has been devoted to refining the measurement of British real wages since Lindert and Williamson’s (1983) formulation of the issue (Crafts, 1985b; Feinstein, 1998). From a long-term perspective, how significant were the changes in the real wage between 1760 and 1850? Were English workers better off or worse off than their counterparts on the continent?

This paper provides answers to these questions by using a consistent framework and comparable data to measure real wage changes over time and across space. Much of the raw data comes ultimately from the accounts of large

[4] De Vries (1993) poses the problem and suggests that the availability of new goods led to households to work harder in order to buy them. He also notes the high wages in the Netherlands, which are emphasized here.

[5] The essays in Steckel and Floud (1997) provides a useful summary of results for countries that have been heavily researched.

[6] Baumol *et al.* (1994) provide a survey of convergence literature. Williamson (1995) has since extended the literature by introducing the evidence of wages, as will be discussed.

institutions. While one can fault both the wages and prices recorded in these sources, they are relatively uniform and, in the final analysis, are the only sources comprehensive enough to address these issues. Phelps Brown and Hopkins (1956, 1981) used this material to measure real wage changes in several countries; however, they did not compare wage and price levels between countries, nor did they investigate the histories of as many locations as are studied here. I have improved the weighting of the price index and used the price of bread—the commodity consumers actually bought—instead of the price of grain, as they did. These changes eliminate anomalies in the index, as will be shown.

The real wage indices developed here point to one important conclusion: The dominant pattern in early modern Europe was income divergence. England and the Low Countries had somewhat higher real wages than the rest of Europe in the fifteenth century, but the differential was comparatively small. In the next three centuries, real wages declined by half on the continent, while remaining roughly constant in northwestern Europe. There were fluctuations, of course. The real wage declined in England in the sixteenth century but then—and this is the important point—rose slowly into the early nineteenth century making up the lost ground. In the Netherlands and Belgium, real wages declined slowly, but much more modestly, than elsewhere on the continent. The result was a large gap in real wages between northwestern Europe and the rest of the continent at the beginning of the industrial revolution. Real wage changes were not dramatic anywhere in the first 70 years of the nineteenth century. It was only between 1870 and 1913 that the standard of living in the industrialized parts of the continent rose noticeably above early modern levels. For many Europeans, the escape from mass poverty waited until the twentieth century.

THE WAGE AND PRICE DATA

Sufficient material is currently available to reconstruct the wage and price histories of close to 20 European cities. This paper concentrates on Antwerp, Amsterdam, London, Florence, Milan, Valencia, Strasbourg, Vienna, and Krakow, for which the data are most complete. In addition, results are reported for Naples, Madrid, Paris, Augsburg, Leipzig, Hamburg, Munich, Gdansk, Lwow, and Warsaw, although in these cases there are more gaps in the data.

Building craftsmen and laborers are the workers whose wages are the most frequently reported in the price histories, and it is their wages, consequently, that will be analyzed in this paper. Several issues arise in interpreting these wages. One relates to the time worked. The wage is income per day, but the standard of living depends on total earnings over the year. The question is whether the days worked per year were constant over time and space.

A second question relates to urban size, for wages were higher in large cities than in villages. Rents were also higher in large settlements. In the late 1760s, Arthur Young (1770, Vol. IV, pp. 424–427, 435–438) reported that a laborer's house in Kensington, two miles from the center of London, rented for £5 per year in contrast to the rent in villages 50 miles away which was about £2. Twenty years later, Young (1794, pp. 448–450) found that the houses of the poor in French towns also rented for two and a half times the rent in the countryside. The rent differential offset some of the corresponding wage premium. The international comparisons reported here are confined to leading cities to hold the size effect as constant as possible.

The third issue is whether building tradesmen were representative of workers in general. Factors specific to the construction industry were sometimes significant determinants of building wages. The high wages earned by Madrid masons and carpenters in the seventeenth century are the starkest example, for those wages reflected the very high rate of construction financed by the inflow of American silver. Laborers, however, do not seem to have shared in those gains, so they might not have extended to workers generally. In the seventeenth century, London wages also rose with respect to those of small towns in southern England. Unlike Madrid, however, London laborers' wages rose in step with those of building craftsmen, which suggests that London wage inflation reflected the dynamism of its expanding economy rather than factors peculiar to the construction industry.

To gauge how skewed building wages may be as an indicator of labor incomes, we need to compare them to the earnings of other workers. The price histories occasionally recorded agricultural wages, and they moved in harmony with those of building laborers in the same area. A more substantial test is provided by the British industrial revolution. Lindert and Williamson (1983) and Feinstein (1995, 1998) have both estimated annual earnings for the British working class by using shifting weights to combine the history of wages and hours for many occupations. There is little disagreement between them in this regard. Figure 1 shows Feinstein's series from 1770 to 1882 as well the daily wage of London building craftsmen scaled to the same value in 1780. While there are some discrepancies—average annual earnings grew slightly faster presumably because of the gains from occupational shifts—the two series plot out surprisingly similar trajectories. While the issue of representativeness must be born in mind, the British industrial revolution provides some reassurance that the wages of building craftsmen are indicative of trends in average earnings.

Table 1 summarizes the nominal or silver wage (the wage converted to grams of silver per day) of craftsmen in leading European cities from the fifteenth century to the early twentieth, and Table 2 does the same for building laborers. Divergence was the long-run pattern, but it was not uniform. This can be seen from the table, but many of the important features are highlighted by plotting the wage histories shown in Figs. 2 and 3.

Wage dispersion was least in the first half of the sixteenth century when the highest wage was twice the lowest wage. There was little variation in wages across western and southern Europe; however, nominal wages were lower in Germany and Poland than in Italy, France, or Spain. Data are available for fewer

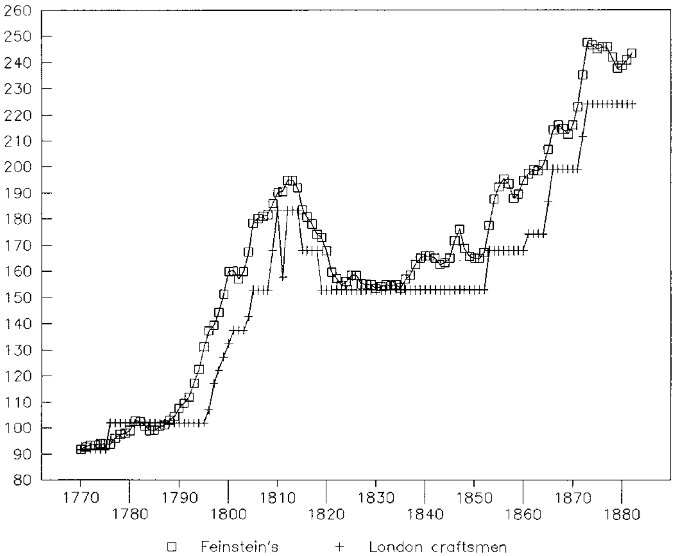

FIG. 1. Comparison of wage series, 1770–1882.

cities in the fourteenth and fifteenth centuries, but the wage distribution looks similarly compressed in that period.

Wage dispersion increased from 1550 to 1650. The price revolution led to a doubling of silver wages in Italy, France, Britain, and the Low Countries. In Madrid, the wage of building craftsmen rose to an extraordinary level that was not shared by laborers in that city or by building workers in Valencia. In contrast to these increases, there was little tendency for silver wages to rise in Germany and Poland during the price revolution.

The second half of the seventeenth century witnessed further divergence in silver wages that continued through the eighteenth century. There was a three-way split: English wages rose to the top, Dutch and Belgian wages remained roughly constant, and Italian and Spanish wages dropped to the levels prevailing in Germany and Poland (although Madrid craftsmen still received a premium).

By 1800, the wage divergence characterizing the mid and late nineteenth century had already been established. London and even rural English wages exceeded those in the Low Countries and were several times greater than those in leading cities elsewhere in Europe. British ascendancy was extended in the first half of the nineteenth century as English silver wages rose to even higher levels and continental wages stagnated, but England's high wage economy clearly preceded the industrial revolution.

PRICES

Did the high nominal wages in the leading economies also indicate that their workers were enjoying a high standard of living? Answering this question requires

TABLE 1
Nominal Wages: Building Craftsmen (Grams of Silver per Day)

	1500–1549	1550–1599	1600–1649	1650–1699	1700–1749	1750–1799	1800–1849	1850–1899	1900–1913
Antwerp	5.2	10.3	12.6	11.8	11.5	11.5	12.8	20.5	53.1
Amsterdam	4.5	7.0	10.4	11.9	11.7	11.9	12.1	21.4	64.1
London	5.0	6.9	11.3	14.5	14.7	17.8	28.9	48.3	106.4
S. Eng. towns	4.2	5.1	6.1	8.4	10.4	12.6	22.0	39.6	87.1
Florence	5.3	7.5	10.6					15.9	35.2
Milan			10.5	8.0	6.1	5.4	6.2	13.2	45.5
Naples	6.8	5.5	7.8		5.9	5.7	6.6		
Valencia	6.5	8.5	10.5	10.3	8.6	7.6			
Madrid	6.2	12.5	20.1	15.1	11.6	10.7	16.5	19.2	32.0
Paris	4.4	9.0	10.6	11.0	8.2	9.3	16.4	34.4	76.3
Strasbourg	5.1	5.5	6.1	8.3	4.4	5.5	10.6	11.7	
Augsburg	3.5	4.2	5.4	6.5	6.0	5.4	5.8		
Leipzig	2.9	3.3	6.8	7.0	6.2	5.0	6.7	22.5	71.9
Munich	4.4	5.0	5.2	4.7	3.8	3.2			74.7
Vienna	4.0	3.9	5.5	5.2	4.8	4.8	3.2	6.6	59.1
Gdansk	2.8	4.7	6.4	7.7	6.7	5.2	8.0		
Krakow	3.8	5.2	4.2	4.1	3.3	3.8	5.2	15.9	35.0
Warsaw		3.6	5.6	4.3	5.3	7.4	10.9	20.1	50.1
Lwow	3.0	4.8	5.2	3.9	3.0	4.3	5.8		
Hamburg								42.6	89.0
Stockholm								28.4	79.6

TABLE 2
Nominal Wages: Building Laborers (Grams of Silver per Day)

	1500–1549	1550–1599	1600–1649	1650–1699	1700–1749	1750–1799	1800–1849	1850–1899	1900–1913
Antwerp	3.0	5.9	7.6	7.1	6.9	6.9	7.7	12.7	32.4
Amsterdam	3.1	4.7	7.2	8.5	8.9	9.2	9.2	16.3	48.6
London	3.2	4.6	7.1	9.7	10.5	11.5	17.7	31.2	71.5
S. Eng. towns	2.5	3.4	4.1	5.6	7.0	8.3	14.6	25.4	57.9
Florence	2.9	3.8	4.7					10.8	25.0
Milan			5.9	4.1	3.2	2.9	3.1	7.3	22.4
Naples	3.3	3.5	5.3	4.8	4.8	3.8	3.8		
Valencia	4.2	6.6	8.8	6.9	5.7	5.1			
Madrid		6.3	8.0		5.1	5.3	8.0	9.7	19.0
Paris	2.8	5.5	6.6	6.9	5.1	5.2	9.9	21.4	52.2
Strasbourg	3.7	3.4	4.3	3.1	2.9	3.3	8.1	9.3	0.0
Augsburg	2.1	3.1	4.0	4.7	4.2	4.3			
Leipzig		1.9	3.5	3.9	3.7	3.1	4.4	14.8	51.6
Vienna	2.7	2.6	4.4	3.5	3.2	3.0	2.1	4.2	43.5
Gdansk	2.1	2.1	3.8	4.3	3.8	3.7	4.8		
Krakow	1.9	2.9	3.4	2.9	2.2	2.9	2.4	7.1	24.1
Warsaw		2.5	3.2	2.7	1.9	3.4	4.9	9.1	26.3

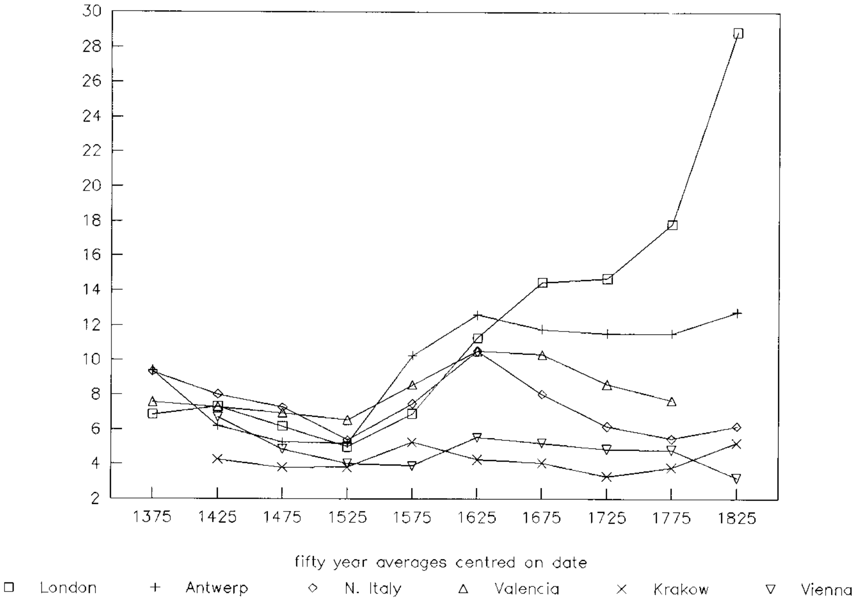

FIG. 2. Masons' nominal wages, 1375–1825 (grams of silver wages per day).

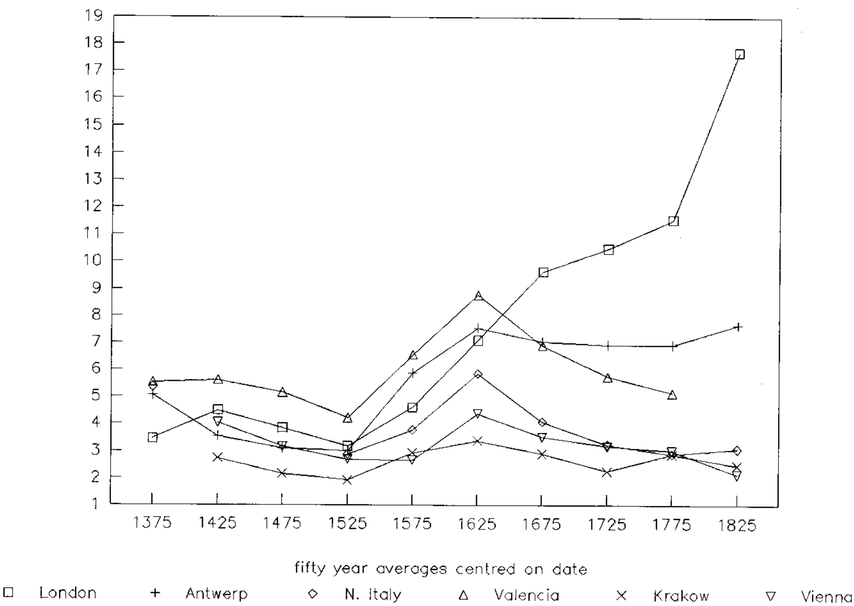

FIG. 3. Laborers' nominal wages, 1375–1825 (grams of silver wages per day).

comparing wages to the prices of consumer goods. The prices used here are drawn from the price histories and so are generally the prices paid by important institutions. As with wages, these prices raise issues of representativeness. Were they wholesale or retail? Grain prices, which play a minor role in this paper, were wholesale, while the bread prices which loom large in the cost of living indices are based on retail information from noninstitutional sources. Most other prices studied—meat, linen cloth, candles, etc.—were those paid by large institutions and so may represent some kind of bulk buying or long-term supply arrangement. Prices changed frequently, however, so it is a mistake to say they were fixed for long periods. Future research with other sources—probate inventories, perhaps—might show that the institutional prices are misleading indicators of the prices faced by ordinary consumers. In the mean time, however, it is important to see what story the institutional prices tell, for they are the only game in town.

In the institutional records, prices were quoted in local units of account and quantities were expressed in local weights and measures. For international comparisons, it was necessary to convert the prices to grams of silver and the quantities to metric units. Peat, wood, charcoal, and coal were used as fuel, and international comparisons required a further conversion to a common calorific standard, so the prices of all fuels were expressed as grams of silver per million BTUs.[7] This procedure is justified by the fact that competing fuels selling in the same market usually sold for the same price per BTU.

Bread was handled differently. Typically, large institutions baked their own bread, so their accounts do not record its price. During the early modern period, however, municipal authories regulated the price of bread, usually, with a "parts plus labor" rule: The bread price was set equal to the cost of the grain necessary for its production plus a markup for the baker's other costs, his income, and municipal taxes. A regression of bread prices on grain prices, the mason's wage rate (a stand-in for the baker's income), and dummy variables for the cities capture this rule. A data set with 1754 observations on the price of bread, the price of the corresponding grain, and the mason's wage was put together with information from London, Milan, Edinburgh, Amsterdam, Antwerp, Paris, Strasbourg, Krakow, Madrid, and Vienna. The following regression was estimated:

$$\begin{aligned}
\text{BREAD} = {} & \underset{(2.9)}{0.063} + \underset{(65.7)}{1.226} * \text{GRAIN} + \underset{(35.7)}{0.017} * \text{WAGE} + \underset{(13.1)}{0.014} * \text{WAGE} \\
& * \text{EARLY} - \underset{(-3.9)}{0.092} * \text{MILAN} + \underset{(8.0)}{0.242} * \text{EDIN} - \underset{(-10.2)}{0.167} * \text{AMST} \\
& \underset{(3.4)}{0.083} * \text{PARIS} - \underset{(-2.2)}{0.043} * \text{STRAS} + \underset{(2.5)}{0.086} * \text{MADRID} - \underset{(-12.5)}{0.272} \\
& * \text{ANTW} + \underset{(9.7)}{0.245} * \text{KRAK} + \underset{(1.6)}{0.038} * \text{VIENNA.}
\end{aligned}$$

[7] Engineering and forestry manuals were consulted for energy equivalents (Perry, 1963, pp. 7–13, 9–16; Summitt and Sliker, 1980, p. 61, *Materials and Technology* 1971, Vol. II, p. 716; McKetta, 1990, Vol. 33, p. 471).

In this equation, BREAD and GRAIN equal the prices in grams of silver per kilogram and per liter, respectively, WAGE equals the silver wage per day of a craftsman, EARLY is a dummy variable equaling one for observations before 1851, and the city names indicate dummy variables equaling one for those cities. $R^2 = 0.92$ for this regression. T ratios are in parentheses.

The regression is plausible and useful. First, experimentation showed that the coefficient of the wage rate was lower after 1850, indicating the industrialization of baking. Second, the coefficient of the price of grain (1.23) is of the right order of magnitude if the equation is interpreted as a cost function. In that case, the coefficient equals the input–output coefficient of grain in bread making. With a liter of grain weighting 0.76 kg, a flour extraction rate of 83%, and 3 lbs 2 oz of flour giving 4 lb of bread (as required by the English assize), 1 liter of grain yields 0.8 kg of bread ($0.76 \times 0.83 \times 4/3.125$), so 1.25 liters of grain are required/kg of bread, which is what the regression coefficient also shows. Third, the regression picks up some significant city-fixed effects, which may indicate tax and regulatory regimes. London is treated as the base case, so its dummy variable is omitted and the coefficients of the included dummies measure deviations from the London level (holding wages and grain prices constant). By this standards, Krakow had the highest bread prices, while Antwerp had the lowest.

The bread equation was used to fill in missing values for the price of bread. This gives more accurate results than the practical alternative of using grain prices. Grain prices leave out both the labor component of bread prices and the city effects captured by the dummy variables.

CONSUMER PRICE INDEX

So far as this paper is concerned, the main reason for studying prices is to construct a deflator for nominal wages, so that their purchasing power can be compared over time and between places. There have been some well-known efforts to construct long-term consumer price indices for the late middle ages and early modern periods—notably Phelps Brown and Hopkins (1956, 1981) indices for England and various continental cities, van der Wee's (1975) index for Antwerp, and Reher and Ballasteros' (1993) index for New Castile—as well as many calculations for the industrial period (many are usefully summarized in Scholliers, 1989), and I have followed their lead in a number of respects, although the indices reported here differ significantly in the treatment of some commodities. There have been no comparable attempts to compare the price level across Europe: Previous real wage comparisons between cities have simply used grain prices as the deflator.[8] This procedure is unsound theoretically since urban wage earners did not purchase grain—they bought bread whose price moved

[8] For instance, Abel (1980 (originally published in 1935), Vigo (1974), Soderberg (1987), and Van Zanden (1999). However, Uselding (1975) uses consumer prices indices in his comparisons for the late 1830s.

differently—and, in any event, workers did not spend their entire income on grain products.

Deflating wages with grain prices instead of a consumer price index suggests unlikely conclusions. They are particularly dramatic for Eastern Europe. Poland was a grain exporter in the early modern period, so grain prices there were particularly low. Deflating Polish wages by the price of rye suggests that the standard of living in Krakow was five times higher than in western Europe in 1500. It was not, as deflation by a broadly based consumer price index shows. Likewise, the standard of living in Krakow would appear to have dropped by a factor of 10 in the early modern period when wages are deflated by rye prices. Again, this is a misleading result.

A price index requires one (or more) baskets of goods to use as weights. The weights should reflect the actual consumption pattern (or patterns). Since different formulae and weights can give different answers (the index number problem), two indices were explored—a Laspeyres and a geometric.

The preferred index of this paper is a Laspeyres index in which the *quantity* of each good is specified and then the price level computed by valuing those quantities at the prices prevailing in each time and place.[9] As will be explained, this index is preferred because the basket of goods is taken to correspond to a "poverty" line. All prices are made relative by dividing them by the cost of the basket of goods valued at the average prices prevailing in Strasbourg in 1745–1754. This choice of a base number has no bearing on the relative levels or trends of real wages reported.

Table 3 shows the items in the consumer price index. It is very much a premodern basket. The European colonization of America and the Indies expanded the consumption of some goods (e.g., sugar) and introduced others (e.g., tobacco, potatoes, tea, and coffee). By the end of the eighteenth century, these were consumed by working people. Introducing new items into a consumer price index raises difficult problems that are usually solved by chain linkage. This requires extremely detailed budget information that is not available for the early modern period. Sugar has been included in some calculations on an experimental basis. Its addition does not affect the overall conclusions, so detailed results are not reported.

One difficulty in comparing prices across Europe is differences in national

[9] Two minor problems arose in computing the consumer price index. First, there were many gaps in the underlying price series. Generally, these were filled by interpolation. As a result, year-to-year fluctuations in the price level are damped, but the general trends and relative levels, which are the concern of this paper, are preserved. Second, some series are missing altogether. In the most important case of bread, the missing prices were estimated with the bread regression equation using dummy variables values for neighboring cities. Other missing series were usually limited to commodities commanding only small shares of spending. In some cases, prices from neighboring cities were used; in other case, prices were interpolated from the series present. Details are given in the appendix.

TABLE 3
Consumer Price Index: Basket of Goods

	Quantity per person per year[a]	Price g silver per unit[c]	Spending share	Nutrients/day[d] Calories	Nutrients/day[d] Grams of protein
Bread	182 kg	0.693	30.4%	1223	50
Beans/peas	52 liter	0.477	6.0	160	10
Meat	26 kg	2.213	13.9	178	14
Butter	5.2 kg	3.470	4.3	104	0
Cheese	5.2 kg	2.843	3.6	53	3
Eggs	52 each	0.010	1.3	11	1
Beer	182 liter	0.470	20.6	212	2
Soap	2.6 kg	2.880	1.8		
Linen	5 m	4.369	5.3		
Candles	2.6 kg	4.980	3.1		
Lamp oil	2.6 liter	7.545	4.7		
Fuel	5.0 M BTU[b]	4.164	5.0		
Total		414.899	100.0%	1941	80

[a] Where oil and wine were consumed instead of butter and beer, 5.2 liters of olive oil were substituted for the butter and 68.25 liters of wine for the beer; 5.2 liters of olive oil yields 116 calories per day and no protein; 68.25 liters of wine gives 159 calories per day and no protein. In Strasbourg, the average prices 1745–1754 were 7.545 g of silver for olive oil and 0.965 g of silver for wine.

[b] M BTU = millions of BTUs.

[c] Prices are in grams of silver per unit. Prices are averages for Strasbourg in 1745–1754. The total shown in the price column is the total cost of the basket at the prices shown.

[d] Nutrients are computed assuming the following composition:

	Calories	Grams of protein
Bread	2450 per kg	100 per kg
Beans/peas	1125 per liter	71 grams per liter
Meat	2500 per kg	200 per kg
Butter	7286 per kg	7 per kg
Cheese	3750 per kg	214 per kg
Eggs	79 each	6.25 each
Beer	426 per liter	3 per liter
Wine	850 per liter	0 per liter

cuisines and climate. Wheat bread was consumed in Spain, while rye bread was the norm in Poland. Likewise, butter and beer were the usual fare in England, while olive oil and wine were their counterparts in Italy. I have allowed these substitutions in the price index. Thus the price of rye bread was used in Antwerp, Amsterdam, Strasbourg, and the cities of Germany, Austria, and Poland, while the price of wheat bread was used for London, Paris, Spain, and Italy. The price of wine was also substituted for beer, and the price of olive oil for butter, depending on local custom.[10] Since the object of the exercise is to compare living standards, the index was modified to reflect climate in the calculation of the real wage: Less fuel was necessary for heat in Spain and Italy, so the fuel ration was set at lower value (2 million BTUs) than for northwestern Europe (5 million BTUs). Had the southern European indices been computed with a northern fuel ratio, the cost of living would have been about 5% greater.

Table 3 shows the quantities used as weights for the Laspeyres index. They were suggested by examining many budgets and weighting schemes. With fixed quantities like these, expenditure shares vary as prices vary, and Table 3 shows the shares implied by the Strasbourg prices of 1745–1754. Bread accounted for 30.4% of spending, beer for 20.6%, meat for 6.0%, and fuel for 5.0%. When seen in a long-term perspective, these shares correspond to the spending pattern of a worker when real incomes were high, such as a fifteenth century craftsman (Dyer, 1989, p. 158).

An important omission from the consumer price index is rent, which was unavailable for most cities. Rent has been included in real wage calculations for some places (e.g., Allen, 1992; Feinstein, 1998; Lindert and Williamson, 1983; van Zanden, 2000) with a detectable—but not a dramatic—impact on the results. The reason that the inclusion of rent does not make more difference is that it generally amounted to less than 10% of expenditure: Horrell (1996, p. 580), for instance, placed rent at 4–5% of English working class spending in the late eighteenth and early nineteenth centuries. Some idea of the bias from excluding rent can be gained by calculating the impact on the consumer price index of a twofold and fivefold jump in rent. With an initial spending share of 5%, a twofold increase implies a 5% rise in consumer prices with a Laspeyres index and a 3.5% increase if a geometric index is used to allow consumers to substitute commodities for (more expensive) housing. A fivefold increase raises these impacts to 20 and 8.4%, respectively. These effects would not be large enough to overturn the conclusions of this paper. Future research, however, should be directed to incorporating rent into the consumer price index.

We can use findings from the British standard of living debate as a check on the consumer price index, just as we did for the wage index. Lindert and Williamson (1983) computed the first nationally representative consumer price index. It was controversial, and revisions were proposed (Crafts, 1985b). Feinstein's (1998) index represents the culmination of this collective enterprise. Figure 4 shows that my index tracks Feinstein's very well when they overlap. My index avoids the problem of the Lindert-Williamson index—namely, the sharp drop after 1820—since it uses the price of linen to measure textile prices rather than the price of cotton that was falling faster than textile prices in general.

[10] A liter of olive oil weighs about 1 kg and contains about as much fat as a kilo of butter, so 1 liter of olive oil was treated as the equivalent of 1 kg of butter. Wine and beer were equated in terms of their alcohol content. Where both products sold in the same market, as in Strasbourg, these equivalences were approximately the same as the relative market prices.

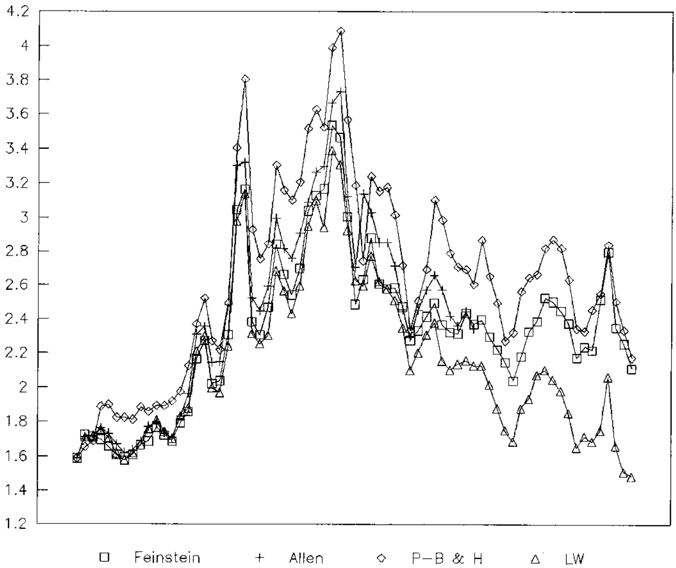

FIG. 4. British consumer prices, 1780–1850.

The Phelps-Brown and Hopkins (PBH) index is also shown in Fig. 4. While it follows the Feinstein index over the long term, the PBH index is much more erratic since it indexes grain prices, which were highly volatile. The PBH index is often higher than the Feinstein index, so using the PBH index to deflate wages understates living standards for much of the industrial revolution.

It is likely that these deficiencies are not confined to that period. The PBH price index and my own indicate the same rate of inflation from the thirteenth century to the nineteenth but differ at key junctures along the way. In particular, the PBH index is 20% less than mine for the fifteenth century when English real wages were at a peak. This difference means that the PBH price index pushes that peak 20% higher than my own. One of the odd features of the Phelps Brown and Hopkins real wage series is that it does not regain its fifteenth century value until the end of the nineteenth century. This peculiarity is due to the underestimate of the price level in the fifteenth century. In contrast, my price index implies that the real wage was marginally higher in the 1850s than in the 1450s. It is possible that the inclusion of new goods in the consumer price index would indicate that living standards in the early industrial period surpassed those of the fifteenth century at an even earlier date, but the present calculations are enough to show that the PBH index is excessively pessimistic.

As a further check on my Laspeyres index, a geometric index was also computed. With the Laspeyres index, the relative quantities consumed are fixed

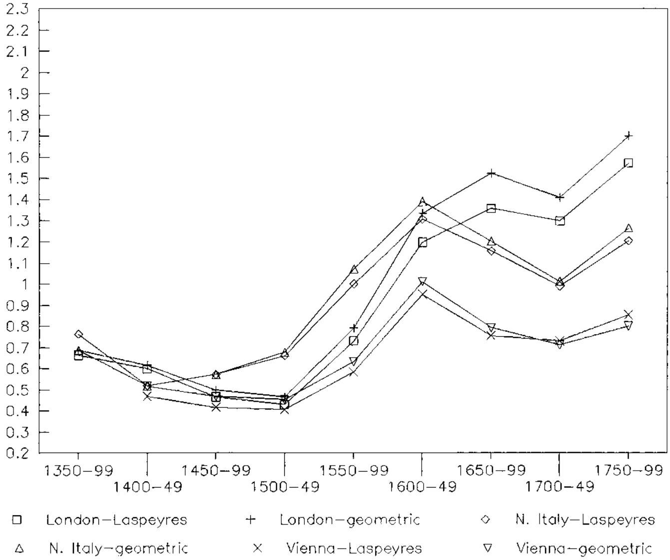

FIG. 5. Alternative consumer price indices (Laspeyres and geometric).

and independent of relative prices.[11] In contrast, the geometric index is a weighted geometric average of the price relatives in which the weights equal budget shares. Consequently, the geometric index allows consumption to vary with price.[12] To heighten any contrast with the Laspeyres index, geometric indices have been computed with the share of bread set at 0.5 and other shares reduced commensurately. A bread share of 0.5 reflects a lower standard of living. There is very little difference between the two indices as Figs. 5 and 6 indicate.

Table 4 and Figs. 5 and 6 show that divergence was the dominant trend with prices, just as it was with wages. Spain experienced the most inflation during the price revolution, presumably because it was the arrival point for American gold and silver. Inflation then was greater in western Europe than in Eastern Europe. Prices were fairly steady in northwestern Europe from 1650 to 1750 but elsewhere they declined. The upshot of these trends was increasing price divergence between the fifteenth century and the late eighteenth century despite the expansion of European trade.

REAL WAGES

The real wage equals the nominal wage divided by the consumer price index. The real wage shows proportional changes and relative levels. It has no absolute

[11] This index corresponds to Leontief, fixed proportion, preferences.

[12] The geometric index corresponds to Cobb-Douglas preferences. Under this assumption, own price elasticities of demand equal one and cross price elasticities are zero.

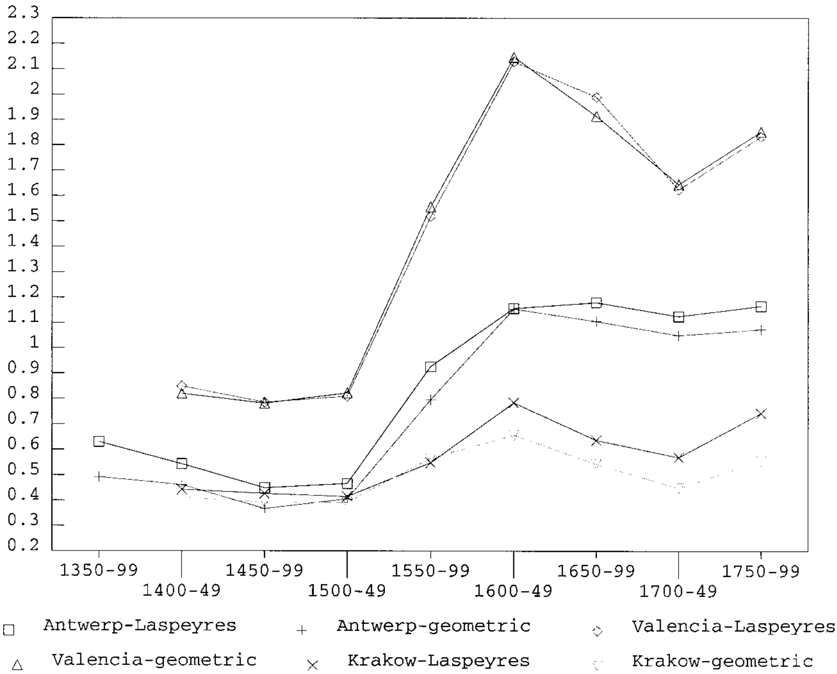

FIG. 6. Alternative consumer price indices (Laspeyres and geometric).

interpretation. To make the results more informative, I compute welfare ratios instead of conventional real wages. The welfare ratio is 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 the family is in poverty.

Annual income is computed on the assumption that the laborer or craftsmen worked 250 days per year (5 days per week for 50 weeks). The maximum number of days worked per year was about 300 in England and the Netherlands in the seventeenth century and somewhat less (275–285) in France once allowance is made for Sundays, religious observances, and saints days. In the middle ages about 45 more saints days were observed each year (de Vries, 1993, p. 111; Bienefield, 1972, pp. 15–19; Persson, 1984, p. 220). The welfare ratio is based on the assumption that illness, injury, bad weather, and economic fluctuations prevented work on every permissible day, and that there was no long-run trend in their incidence. The import of the assumption will be examined later.

The poverty line is computed for a notional family of a man, a women, and two children, and the nonhousing component of their poverty line income is set equal to three times the basket of goods shown in Table 3. That basket is intended to apply to an adult male. It provides only 1941 calories per day, which would put the man in the second decile from the bottom in England and the third in France

TABLE 4
Consumer Price Index (Strasbourg, 1745–1754 = 1.00)

	1500–1549	1550–1599	1600–1649	1650–1699	1700–1749	1750–1799	1800–1849	1850–1899	1900–1913
Antwerp	0.43	0.94	1.15	1.14	1.05	1.10	1.32	1.77	3.40
Amsterdam	0.46	0.89	1.10	1.22	1.17	1.32	1.65	2.46	4.50
London	0.45	0.76	1.25	1.42	1.34	1.64	2.55	2.81	5.08
Florence/Milan	0.66	1.00	1.30	1.13	0.95	1.18	1.66	2.74	5.44
Naples	0.64	0.91	1.08		0.77	1.06	1.63		
Valencia	0.75	1.47	2.01	1.85	1.56	1.74			
Madrid		1.57	2.23	1.72	1.23	1.70	2.17	2.08	3.62
Paris	0.64	1.30	1.57	1.61	1.29	1.43	2.15	3.10	5.70
Strasbourg	0.59	0.95	1.35	1.13	1.03	1.22	1.91	2.39	
Augsburg	0.48	0.87	1.45	1.05	1.07	1.21	1.52		
Leipzig		0.79	1.41	0.97	0.98	0.99	1.17	2.37	5.40
Munich	0.53	0.88	1.12	0.95	0.98	0.98			
Vienna	0.43	0.61	1.01	0.78	0.74	0.85	1.08		
Gdansk	0.38	0.59	0.78	0.84	0.73	0.86	1.67		
Krakow	0.40	0.55	0.73	0.61	0.53	0.65	0.84	1.59	3.48
Warsaw		0.47	0.68	0.53	0.59	0.75	0.84	1.33	2.82
Lwow	0.31	0.52	0.65	0.78	0.64	1.06			

according to Fogel's (1991, p. 45) estimates for the late eighteenth century. It was possible to get by on less, as we will see, but this level of calories and variety of consumption mark a line between respectability and destitution.

Three baskets of the goods shown in Table 3 would have put a four person family at the same level of nutrition as the man. Three baskets of goods yield 5823 calories. If we posit a notional family of one man and one women each doing moderate work, a child aged 4–6 and another 1–3, then the daily calorie requirement would have been 7940 (2800 for the man, 2000 for the women, and 1720 and 1220 for the children) using the norms of the Indian Council of Medical Research in 1981 (Gopalan, 1992, p. 28). These norms are not very different from those for any western country. However, such norms have been disputed. Sukhatme (1977, 1978, 1882a, 1982b) has argued that people adjust to deprivation in a way that allows the Indian norms to be reduced by 30%, implying a daily calorie requirement of 5558 for our notional family. This includes 1890 calories for the man, which is very close to the 1941 calories provided by one basket.[13] Obviously, the exact numbers vary depending on the circumstances, but, given Sukhatme's norms, three baskets of goods was about right to support a family at the same low standard that one basket would have supported a man.

In addition to the items shown in Table 3, a family would have had to pay rent. A minimal allowance is 5% of spending, so I increase the cost of the basket by that amount. A constant markup is an oversimplification since rents were not

[13] Gopalan (1992) reviews the debate.

uniform. Future research should be directed toward incorporating more complete information in this regard.

The welfare ratio that measures the standard of living equals the craftsman's or laborer's daily wage multiplied by 250 days and then divided by 3.15 (3 × 1.05) times the cost of the basket of goods shown in Table 3.

Obviously the calculation is notional in that it makes arbitrary assumptions about the size of the family, who earned income, and the number of days worked per year. Equally clearly, these could—and did—vary. Anyone who objects to these assumptions can ignore them; in that case, the welfare ratio is just a peculiarly scaled real wage index. However, the scaling has two advantages. First, it makes explicit the assumptions that are usually implicit when real wages are treated as measures of living standards. Furthermore, it invites sensitivity tests of these assumptions to gauge their significance. Second, to the degree that the assumptions are reasonable, the welfare ratio has much to say about consumer demand and about health. A welfare ratio of 1.00 means that the maintenance of a barely acceptable (in both the social and biological senses) standard of living would have required that all of a family's income be devoted to rent and the necessities listed in Table 3. There would have been nothing left over for "luxuries." Welfare ratios greater than 1.00 mean that families had extra income over and above their basic needs and so could either buy more basic commodities—their income elasticities of demand were certainly positive—or luxuries. Conversely, values less than 1.00 imply that the family could not afford a decent standard of living under the maintained assumptions. Families could respond by working more hours or by cutting back on food, a course that would have pushed the family down Fogel's calorie distributions into real destitution. In this sense, the basket in Table 3 was constructed to give a rough indication of a passable standard of living.

Tables 5 and 6 and Figs. 7 and 8 show the welfare ratios. Read as real wage indices, the following trends stand out:

The dispersion of real wages was smallest in the early sixteenth century. The low nominal wages in Germany and Poland at this time were matched by low consumer goods prices to produce this uniformity. Wages were marginally higher in northwestern Europe than elsewhere, but wage divergence in the late medieval period was less than in later centuries.

Between 1500 and 1750, real wages in Europe diverged dramatically. Again, it is useful to distinguish three groups: The first is London. While the nominal wage there was the highest in Europe from the seventeenth century onward, there was no comparable real wage premium before the nineteenth century since English prices were so inflated. Real wages fell in the sixteenth century but rose gradually in the seventeenth and eighteenth centuries regaining the lost ground.

The second distinctive group is Antwerp and Amsterdam. The Antwerp wage was high in the late middle ages and fell slowly but continuously until the end of the nineteenth century. Amsterdam had no importance before the early modern period when its real wage jumped to the highest level in Europe. Thereafter it

TABLE 5
Welfare Ratios: Building Craftsmen

	1500–1549	1550–1599	1600–1649	1650–1699	1700–1749	1750–1799	1800–1849	1850–1899	1900–1913
Antwerp	2.41	2.26	2.27	2.13	2.23	2.13	2.01	2.27	3.07
Amsterdam	2.02	1.61	1.93	1.99	2.02	1.83	1.49	1.65	2.85
London	2.19	1.86	1.82	2.07	2.21	2.21	2.31	3.34	4.21
Florence/Milan	1.74	1.53	1.62	1.42	1.34	0.97	0.77	0.91	1.68
Naples	1.85	1.24	1.45		1.40	1.11	0.82		
Valencia	1.79	1.18	1.06	1.13	1.16	0.89			
Madrid		1.61	1.83	1.81	1.91	1.29	1.72	1.87	1.75
Paris	1.41	1.45	1.37	1.40	1.28	1.20	1.72	2.14	2.71
Strasbourg	1.74	1.19	0.94	1.11	0.86	0.90	1.12	0.99	
Augsburg	1.49	0.99	0.78	1.26	1.14	0.91	0.77		
Leipzig		0.85	1.04	1.44	1.27	1.06	1.29	1.76	2.67
Munich	1.72	1.16	0.96	1.00	0.78	0.70			
Vienna	1.87	1.31	1.12	1.34	1.33	1.14	0.86		
Gdansk	1.52	1.59	1.65	1.89	1.87	1.25	1.00		
Krakow	1.92	1.91	1.16	1.37	1.24	1.16	1.30	1.92	1.95
Warsaw		1.54	1.66	1.60	1.84	1.98	2.86	3.04	3.56
Lwow	1.93	1.83	1.63	1.00	0.96	0.81			
Hamburg								2.92	3.31

slowly trended downward in tandem with the Antwerp wage. From a pan-European perspective, there was little difference between the real wage history of these cities.

TABLE 6
Welfare Ratios: Building Laborers

	1500–1549	1550–1599	1600–1649	1650–1699	1700–1749	1750–1799	1800–1849	1850–1899	1900–1913
Antwerp	1.40	1.28	1.36	1.28	1.34	1.28	1.21	1.39	1.86
Amsterdam	1.37	1.07	1.34	1.42	1.55	1.41	1.13	1.25	2.16
London	1.42	1.26	1.16	1.37	1.58	1.42	1.41	2.15	2.82
Florence/Milan	0.92	0.78	0.73	0.72	0.70	0.51	0.39	0.50	0.83
Naples	1.04	0.77	1.01		0.96	0.75	0.47		
Valencia	1.15	0.90	0.89	0.76	0.75	0.59			
Madrid		0.80	0.74		0.87	0.64	0.95	0.95	1.04
Paris	0.89	0.87	0.85	0.87	0.80	0.74	1.08	1.32	1.86
Strasbourg	1.27	0.74	0.70	0.56	0.57	0.61	0.85	0.79	
Augsburg	0.92	0.72	0.58	0.93	0.80	0.71			
Leipzig		0.49	0.61	0.80	0.75	0.64	0.80	1.17	1.90
Vienna	1.24	0.89	0.88	0.91	0.87	0.71	0.54		
Gdansk	1.07	0.73	0.96	1.05	1.05	0.89	0.62		
Krakow	0.97	1.06	0.92	0.96	0.85	0.88	0.60	0.87	1.34
Warsaw		1.11	0.93	1.01	0.67	0.93	1.18	1.36	1.86

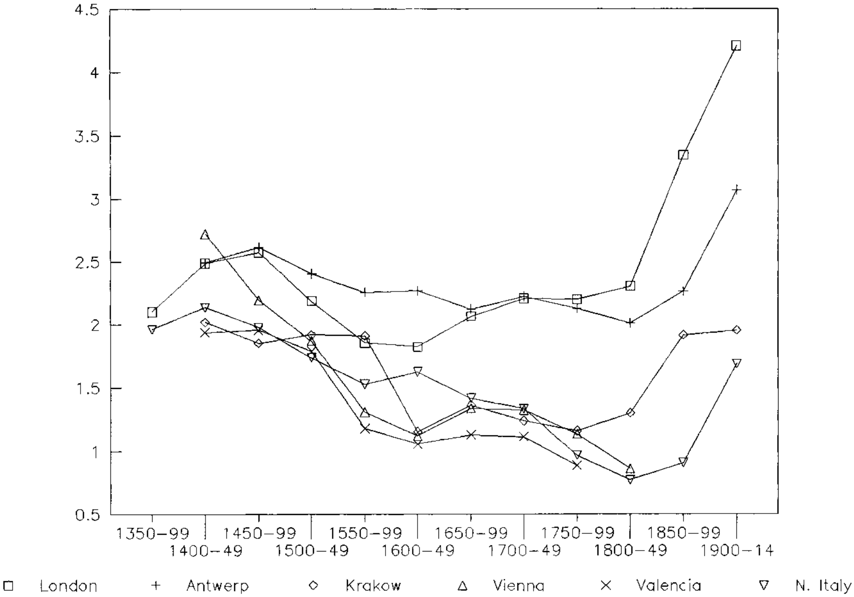

FIG. 7. Welfare ratios for craftsmen (earnings relative to poverty line).

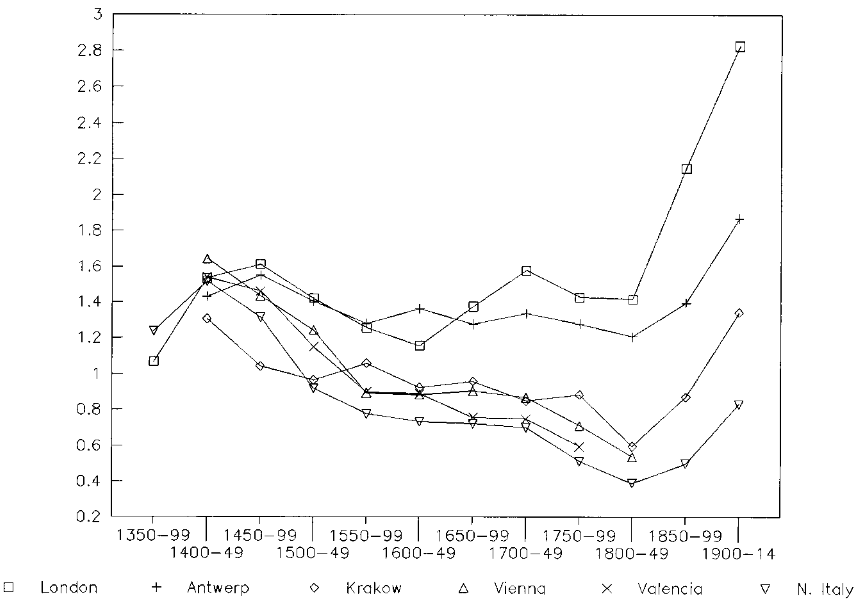

FIG. 8. Welfare ratios for laborers (earnings relative to poverty line).

The rest of Europe composes the third distinctive group. In these cities real wages collapsed between 1500 and 1750. In Milan, Naples, Valencia, Strasbourg, Munich, Vienna, Krakow, Lwow, the real wage fell by about half. This is the region for which the Braudel-Spooner (1967, p. 429) generalization applies. The only exceptions to this trend were capital cities—Madrid, Paris, Warsaw. Furthermore, there was little change in this respect between 1750 and 1850. In other words, the nineteenth century pattern of relative prosperity in England and the Low Countries matched by wretched poverty in the rest of the continent was established by 1750.

If we interpret the real wage series as family income divided by the poverty line, they have much more to tell. Before the Black Death, laborers in London and Florence were impoverished with an income only three-quarters of the poverty line. The population drop due to the plague meant that the real earnings of laborers in the fifteenth century were generally high enough to raise them over that line. In Antwerp, Amsterdam, and London, their incomes remained one-third above the poverty line into the nineteenth century. Elsewhere, however, the real income of laborers collapsed to preplague levels—half to three-quarters of that needed to support a decent standard of living.

Since craftsmen always made more than laborers, their situation was always more favorable, but similar trends obtained. In particular, carpenters and masons in England and the Low Countries had incomes twice that needed to pay for basic food, clothing, and rent, as reckoned here. Much of this surplus went to buy more housing and more food. Hunger is pressing on a diet of 1941 calories per day, which is why the income elasticity of demand for food was between 0.5 and 0.9 (Crafts, 1976; Clark *et al.*, 1995; Shammas, 1984, p. 259). In addition to food, however, the craftsmen of northwestern Europe had the cash to buy the luxuries of the consumer revolution.

Elsewhere on the continent, the welfare ratio of craftsmen fell to 1.00 or lower. Their situation was not as dire as that of laborers, but many would have been straining to earn money to buy necessities. Fogel's (1991, p. 45) finding that the average English man consumed 2700 calories, while average French man consumed 2290, is plausible in view of the lower real wage in France. Furthermore, the market for luxury goods would have been correspondingly diminished. Welfare ratios were higher in the capital cities—Paris, Madrid, Warsaw—and that premium sustained attenuated versions of the consumer revolution (Fairchilds, 1993).

How did workers in southern and eastern Europe survive on the low wages of the eighteenth century? Working more offered only limited scope for improvement—an "industrious revolution" in pursuit of calories. Eating less was a second option, but there was little latitude to reduce calorie consumption. The best alternative was to shift spending toward bread since it was the cheapest source of calories and perhaps also protein. Table 7 demonstrates the point by showing the cost of these nutrients for the foods using Strasbourg prices for

TABLE 7
Cost of Nutrients

	Grams of silver per 1000 calories	Grams of silver per 1000 g protein
Bread	0.283	6.934
Beans	0.424	6.718
Meat	0.885	11.065
Butter	0.476	495.779
Cheese	0.758	13.285
Eggs	1.260	15.938
Olive oil	0.926	—
Beer	1.104	156.818
Wine	1.135	—
Sugar	2.317	—

Source. The prices shown in Table 3 divided by the calories or protein per unit, multiplied by 1000. Sugar assumed to contain 3800 calories/kg.

1745–1754. (The same rankings would be obtained with other prices.) Eating sugar was no improvement, for it was the most expensive source of calories.

Shifting the diet to bread brought some relief, but the situation was dire. If a laborer in southern or eastern Europe worked 275 days a year and spent three-quarters of his income on bread, he could buy about 2.25 kg a day in the mid-eighteenth century. This ration would have provided 5513 calories, which was almost our notional family's requirements (5558 calories) at Sukhatme's reduced norms. Presumably, a few more calories would come from the remaining income, but the bread part of the diet would have given only 1838 calories per adult male, which was dangerously close to the 1500 calories required for basal metabolism. The all bread diet left no scope for adjustment to misfortune: Bad luck could easily lead to starvation.

The low real wages in southern Europe imply bad health and high mortality for much of the population. The crude death rate in France did, indeed, exceed that in England; Fogel (1991, p. 46) estimated that 40% of the difference was due to the greater proportion of the population subsisting on diets in the neighborhood of 1500 calories per adult male equivalent. The evidence of heights paints a similar picture of deprivation in southern and central Europe. Floud's (1992, pp. 231–235) summary of the evidence for the late eighteenth century indicates that the British were the tallest people in Europe followed closely by the Dutch. The French, Italians, and Spanish were shorter. Komlos (1989, p. 99) reports that the Austrians and Hungarians were equally short. The height evidence is consistent with the international differences in real wages in the late eighteenth century, as reported here. It is, furthermore, quite plausible that real wages as low as those of continental laborers would imply a lifetime of nutritional deprivation and, therefore, stunted growth.

ENGLISH WAGES

While eighteenth century wages were low in southern and central Europe, they were high in the Low Countries and, especially, in England. This was the economic basis of the consumer revolution and of elevated stature.

The high real wages in the northern Europe were the result of high nominal wages. These, in turn, reflected a growing productivity advantage that these economies enjoyed during the early modern period. Thus, the shift in economic activity from southern to northern Europe in the seventeenth century did not represent a relocation to a low wage region. In 1620, for instance, building laborers in most Italian cities made 6 to 7 g of silver per day, while their counterparts earned about 7 g in London, Paris, Antwerp, or Amsterdam. Wages were less in the countryside, but uniformly so. While male farm workers in England earned 4 g of silver per day, the wage was 4 or 5 g per day in Montaldeo, a village near Genoa, and 3 g per day outside of Florence. The advantage of northern Europe, therefore, did not lie in cheap labor but rather in high productivity: Exporters in northern Europe could successfully compete against those in the south and pay a higher wage only because their productivity was higher. By the same argument, the eighteenth century rise in English wages above those prevailing in the Low Countries or, indeed, anywhere else on the continent, attests to rising productivity in British manufacturing (cf. Temin, 1997; Berg and Hudson, 1992). The English labor market was so inflated in the late eighteenth century that even the winter wage of men in agriculture exceeded the wage of craftsmen in many parts of Europe. This premium became even greater during the industrial revolution. English construction wages leaped up again in the first half of the nineteenth century, and for this period we know that the wage advance was general. The only way that Britain could pay the highest wages in Europe and dominate export markets as it did was to have the most productive manufacturing sector. Wage history indicates the mid-nineteenth century preeminence was built up over several centuries.

While English nominal wages rose steadily after 1600, real wages rose much less rapidly since consumer prices increased almost as fast as wages. By the eighteenth century, England not only had the most inflated wages of any European country but (with the exception of Spain, whose prices were still influenced by earlier American bullion inflows) the most inflated prices as well. The growing price gap between England and the Low Countries is impressive.

The price index is dominated by food prices, and international trade was not substantial enough to force price equalization across the continent even in grain. The English food market could, therefore, follow its own course. Crafts (1976, pp. 228–235) first pointed out that the high inflation of English food prices during the eighteenth century meant that food output was not growing from 1760 to 1780. Jackson (1985) and Allen (1999) have suggested that the growth pause lasted from 1740 to 1800, despite the vast historiography extolling the supposed output gains due to large farms and parliamentary enclosures. English farmers had to cope with an exceptional growth in money demand due to rapid population growth and high nominal wages. From 1500 to 1740, farm output rose by a factor of 2.25, which was still not enough to prevent food prices from rising (Allen, 1999). In the last decades of the eighteenth century, however, farm output stalled, and prices soared. Landlords gained at the expense of workers, and the growth in real wages was checked until international trade relieved the food bottle neck in the mid-nineteenth century. Ricardo would not have been surprised.

While real wages did not rise greatly from 1500 to 1850, they did not fall either, despite a sevenfold rise in population. Phelps-Brown and Hopkins (1956) found the same pattern in their study of provincial wages, but it is worth emphasizing because it is so different from the continental experience. While the industrial revolution may not have raised the real wage, the economic expansion after 1500 did prevent living standards from falling. Some participants in the standard of living debate have pointed out that the real question is not whether the real wage went up or down from 1750 to 1850, but what would have happened in the absence of the industrial revolution (Ashton, 1948, p. 161; Hartwell and Engerman, 1975, pp. 192–194). Continental comparisons emphasize the pertinence of that question for the early modern period as well, since elsewhere the real wage collapsed in the absence of vigorous economic development.

Indeed, the broad perspective of this paper shifts the ground from under both "optimists" and "pessimists" in the British standard of living debate. Both positions can find support in the indices reported here, but contrary interpretations are also strengthened in both cases. Figure 9, for instance, shows an optimistic Lindert-Williamson (1983) pattern of static real wages until Waterloo followed by slow but steady advance until midcentury. After 1815, the benefits of capitalist economic development were finally trickling down to the working class! This interpretation prompts the next questions: Why no advance before 1815? Why was growth so slow during the industrial revolution? But Fig. 10 calls these questions into question by plotting the real wage from 1264 to 1913. Did the real wage advance from 1815 to 1850 represent a dramatic break with the past? Hardly. The rise in living standards in that period is almost undetectable; it is but one of many minor fluctuations in the course of seven centuries. The gains from 1815 to 1850 were a cycle—and a minor one at that—not a trend.[14] Figure 10 suggests that the important features in British real wage history were the long swings reflecting population changes in the medieval period, the maintenance of a high real wage after economic development gathered strength in the seventeenth century, and the sharp rise in living standards between 1870 and the First World War. Each of the last two periods were decisive breaks with the past—but in different ways.

[14] Schwartz (1985) remarked on the fall in the real wage in London in the eighteenth century. He compared it with wage declines in continental cities, but they were far more substantial, as shown here.

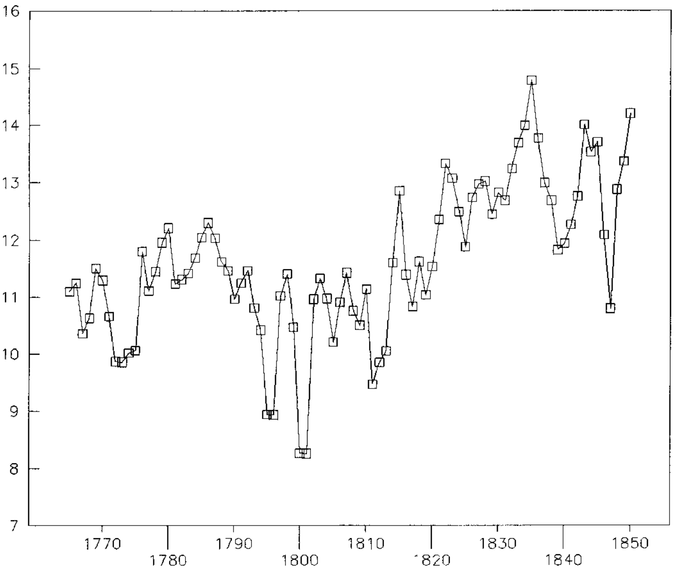

FIG. 9. Real wages of London masons, 1765–1850.

CONCLUSION

The economic expansions of the Netherlands and England during the early modern period were important achievements, for they marked a departure from

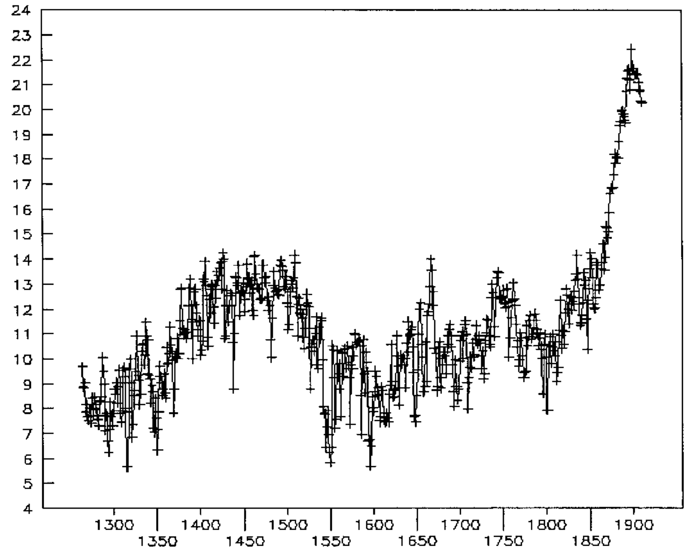

FIG. 10. Real wages of London masons, 1264–1913.

the Malthusian past. For the first time in western history, the economy kept pace with the population. If real wages did not rise dramatically, at least, they did not collapse. Continental Europe was not so lucky, and population growth there resulted in extremely low wages. The result was a substantial income gap with implications for health, consumer demand, and other aspects of life.

It was only after 1870 that real wages rose decisively above medieval levels. Britain led the way with the highest standard of living in Europe. There was also improvement in Germany, the Netherlands, and Paris, if not all of France. Elsewhere in Europe it would be hard to argue that the standard of living in 1900 was really any higher than it had been in the fifteenth century. Significant improvement awaited the great convergence of incomes that occurred in the twentieth century, indeed, only in the post-World War II boom. For that reason, the consumer revolution was a twentieth century phenomenon in most of Europe, as was the rapid increase of heights in southern and central parts of the continent (Floud, 1992, p. 232).

APPENDIX I: SOURCES OF DATA

London

Wages. 1457–1609: Rappaport (1989, pp. 401–407). 1610–1699: Boulton (1996, p. 279). 1700–1860: Schwarz (1985, pp. 36–38). pre-1457 and post-1860—extrapolated with the Phelps-Brown and Hopkins (1955) wage series for provincial towns in southern England

Prices. Bread, 1545–1780: Mitchell and Deane (1971, pp. 497–498). Earlier prices computed from bread equation using wheat price from Rogers (1866–1892, I, pp. 226–234, IV, pp. 282–290).

Beans and meat, 1450–1780: sources detailed in Allen (1992, p. 327). Earlier meat prices extrapolated backward based on the price of cheese.

Butter, 1450–1649: Bowden (1967, pp. 839–845). 1650–1749: Bowden (1985, pp. 843–846). 1750–1826: Beveridge (1939, p. 576). Pre-1450 prices extrapolated backward based on the price of cheese.

Cheese, 1259–1400: Rogers (1866–1892 I, pp. 430–435). 1450–1639: Bowden (1967, pp. 839–845). 1640–1750: extrapolated forward with Bowden (1985, p. 855). 1750–1830: extrapolated forward with Beveridge (1939, pp. 428–429).

Eggs: Rogers, (1866–1892 I, 430–435, IV, 381, V, pp. 372–376), Beveridge (1939, pp. 428–429). The Rogers prices were doubled to put them on a par with the Beveridge prices, which were at London levels.

Beer 1659–1781: Beveridge (1939, pp. 434–436). Earlier figures extrapolated with barley price.

Soap, 1401–1768: Rogers (1866–1892 IV, pp. 395–396, V, p. 740), Beveridge (1939, p. 667). Pre-1400 and 1769–1780—extrapolated from price of candles.

Linen, 1506–1672: Beveridge (1939, pp. 143–145). Earlier and later figures extrapolated with price of scholar's cloth from Beveridge (1939, p. 85–90).

Candles, pre-1400: assumed equal to price of lamp oil, 1400ff: Rogers (1866–1892, IV, pp. 376–380, V, pp. 398–404), Beveridge (1939, pp. 146–147).

Lamp oil: Rogers (1866–1892, I, pp. 635–640, IV, 376–380), Beveridge (1939, 634).

Fuel: price of charcoal from Rogers (1866–1892I, 445–450, IV, 382–387, V, 398–405), Beveridge (1939, p. 78–79).

Consumer price index. 1780–1913: Feinstein (1995, pp. 26, 263–265).

Antwerp

Wages. Mason, 1399–1603: Van der Wee (1963, pp. 457–463). 1604–1790: de Vries (1978, pp. 93–94). 1791–1839: Verlinden and Craeybeckx (1959–1973, II, pp. 1044–1045). 1840–1913: Scholliers (1995, pp. 203–205).

Laborer, 1399–1603: Van der Wee (1963, pp. 457–463). 1604–1913: estimated at 60% of the mason's wage.

Prices. Bread (rye), 1399–1425: extrapolated. 1426–1600: Schollier (1960, p. 31). 1601–1835: Verlinden and Craeybeckx (1959–1973, I, pp. 496–500, 512–515, II, pp. 947–950) occasionally using Brussells prices to fill gaps.

Beans, 1399–1600: Van der Wee (1963, pp. 199–203). 1601–1741 and 1829–1835: Verlinden and Craeybeckx (1959–1973, II, pp. 683–685). 1742–1828: interpolated from the price of rye.

Meat, 1399: Van der Wee (1963, pp. 225–227). 1400–1700: Van der Wee (1975, pp. 436–447). 1701–1835: Verlinden and Craeybeckx (1959–1973, II, pp. 703–705, p. 961).

Butter, 1399: Van der Wee (1963, pp. 210–216). 1400–1700: Van der Wee (1975, pp. 436–447). 1701–1835: Verlinden and Craeybeckx (1959–1973, II, pp. 719–721, p. 959–960).

Cheese, 1399: Van der Wee (1963, pp. 217–224). 1400–1700: Van der Wee (1975, pp. 436–447). 1701–1835: extrapolated with meat price.

Eggs, 1536–1787: Verlinden and Craeybeckx (1959–1973, II, pp. 510–513). Earlier and later values: extrapolated with meat price.

Beer: Amsterdam price used, pre-1500 figures extrapolated.

Soap: Verlinden and Craeybeckx (1959–1973, II, pp. 840–841).

Linen, 1399: assumed equal to 1400 price. 1400–1700: Van der Wee (1975, pp. 436–447). 1701–1835: interpolated with linen series in Verlinden and Craeybeckx (1959–1973, II, pp. 495–500).

Candles. 1399: Van der Wee (1963, pp. 249–253). 1400–1700: Van der Wee (1975, pp. 436–447). 1701–1835: Verlinden and Craeybeckx (1959–1973, II, pp. 824–826).

Lamp oil, 1405–1592: Van der Wee (1963, pp. 245–248). 1593–1816: Verlinden and Craeybeckx (1959–1973, II, pp. 758–760). 1817–1833: interpolated, 1834–1835: Michotte (1934, p. 354). The 1399–1404 and 1817–1833 prices were interpolated.

Charcoal, 1399: assumed equal to 1400. 1400–1700: Van der Wee (1975, pp. 436–447). 1701–1835: Verlinden and Craeybeckx (1959–1973, II, pp. 811–813).

Nineteenth century. There is considerable disagreement between Michotte (1934) and Scholliers (1995, pp. 107–108) as to the rate of inflation in Belgium. Scholliers was preferred.

Amsterdam

Wages. de Vries and van der Woude (1997, pp. 610–611), extended to 1913 with wage index R3 given by Nusteling (1985, p. 256).

Prices. Posthumous (1939, pp. 1004, 1005, 1082, 1964, pp. 133–139, 243–298, 616–620, 300–308, 407–409, 655–657). Nineteenth century bread prices from www.iisg.nl/hwp

Bread prices for 1500–1595 were predicted using the bread equation and the price of rye in Leyden and Arnheim in Posthumus (1964, pp. 445–457), Sillem (1903), and *Jaarsijfers voor het Koninkijk der Nederlanden/Annuaire statistique du Royaume des Pays-Bas.* Portions of the time series for eggs were extrapolated using herring prices and meat prices. Some missing candle prices were extrapolated from prices of Baltic tallow and the price of rapeseed oil. Peat prices for 1500–1559 were extrapolated using the price per scouw and assuming that the price in 1555/1559 was the same as the price in 1560/1564.

Augsburg

Wages and prices: Elsas (1936). Viennese wood series used for price of fuel. The price of lamp oil used for the price of soap. Eggs set equal to the price of meat divided by 15. Cheese in 1502–1579 extrapolated with the price of meat. The Leipzig price of butter was used for the butter price after 1573; earlier years extrapolated the cheese price.

Munich

Wages and prices: Elsas (1936). The price of charcoal taken from Vienna. In 1427–1502, the price of oil was used for candles. Soap was estimated equal to oil throughout. Eggs were estimated as the price of meat divided by 15. The Augsburg price of cheese was used (except for 1621–1622 when the price was interpolated). Prior to 1603, the price of butter was extrapolated with the price of candles, and the price of beans was extrapolated with the price of rye from 1427 to 1537.

Leipzig

Wages and prices: Elsas (1940). The price of linen was the price of "zwilch—billage sorte," missing values for candles were interpolated from the the price of soap, and oil (missing throughout) was estimated equal to soap.

For 1820–1914, the wage of building craftsman or mason from Kuczynski (1961–1967, I, p. 375, II, p. 225, III, p. 420–423, IV, pp. 421–422). The wage of laborers was estimated by multiplying the carpenter's wage by the all-German average ratio of the helper's wage to the carpenter's wage. The nineteenth century price index is also Kuczynski's as reported by Mitchell (1978), but it was rebased to be 3% above the British consumer price index in 1905 in accord with the British Board of Trade's estimate of the difference in the purchasing power of the mark and the pound (Williamson, 1995, p. 184). Implicit inflation between 1796 (when the early modern Leipzig index ends) and 1820 (when the Kuczynski index starts) is consistent with the inflation in wholesale prices in Germany reported by Jacobs and Richter (1935).

Vienna

Wages. 1440–1800: Pribram (1938) and Phelps Brown and Hopkins (1981, p. 94). 1821–1880: laborer's wage taken from Sandgruber (1982, p. 115). Mason's wage assumed to be 60% higher. 1913: International Labour Organization (1923, p. 58, 1926, p. 40).

Prices: Pribram (1938). Bread price 1689–1800 from Pribram. Earlier prices and some gaps filled with the bread equation. Butter prices pre-1631 were extrapolated using the price of candles. Also early cheese prices were extrapolated using butter prices. Soap before 1585 was assumed to equal price of candles. The Munich price of linen was used as no Viennese prices were recorded.

Valencia

All pre-1651 wages and prices: Hamilton (1934, 1936). All 1651–1789 wages and prices: Hamilton's typescripts in the Special Collections Department, William R. Perkins Library, Duke University.

The bread price was computed with the bread equation. The beans were chickpeas, and values for 1551–1789 were estimated from a regression of the recorded price on the price of wheat. Meat prices were used as estimates for the missing cheese prices for 1413–1502 and other odd years. Eggs for 1413–1503 were extrapolated from meat prices. Soap for 1413–1503 was calculated as 80% of the price of oil. The New Castile series for the price of linen was used for for 1501–1551.

Madrid

All pre-1800 material from Hamilton (1934, 1936, 1947).

Missing bean prices were computed from a regression of the price of chickpeas on the price of wheat. The wine series for 1501–1650 given in Hamilton (1934) does not agree with the series for 1651–1800 given in Hamilton (1947), which is about three times the former c. 1650 and also unreasonably high compared to prices elsewhere. The post-1650 series was used to extrapolate the earlier series to 1800 on the assumption that the later series did not change between 1650 and 1651. Soap for 1501–1650 and candles for 1501–1551 were estimated as 1.23 and 1.4 times, respectively, the price of oil.

Madrid prices and wages were continued to 1913 with Reher and Ballesteros (1993, pp. 134–136) and Simpson (1995, pp. 250–252).

Strasbourg

Wages and prices: Hanauer (1878). Bread was pain bis blanc calculated from the tarifs in Hanauer (1878, p. 145). Gaps in the series of candle prices were extrapolated with the price of butter. Before 1525, the price of plain cheese was used, thereafter gruyère. The index was calculated with beer and butter rather than wine and oil.

Paris

Wages. Baulant (1971, pp. 482–483), Durand (1966, p. 476), Rougerie (1968, pp. 98–103). Mason's wages for the period covered by Baulant were estimated at 60% above labourer's wage.

Prices. 1431–1786: Bread, butter, wood, and soap from Hauser (1936, pp. 135–138, 147–151), but there are many gaps. Earlier bread prices computed with bread equation using Baulant (1968) price of wheat, and early prices of butter, wood, and soap were extrapolated from the Strasbourg series. Beans taken to equal the wheat price based on Strasbourg data. Strasbourg prices were used for meat, cheese, wine, candles, lamp oil. The Strasbourg series for eggs was increased by 50%, which agrees with the scattered quotations reported by Hanauer (1936, pp. 140–141).

Nineteenth century cpi. Index for 1840–1913 from Singer-Kérel (1961, pp. 534–535) for ourvier B. Average prices for 1840–1849 for the commodities in the 1431–1786 index were used to extend that index to 1840–1849 when it was linked to the Singer-Kérel series.

Northern Italy: Florence and Milan

Data for Florence and Milan have usually been combined into a single time series since Florentine data are available for 1326–1371 and 1520–1619, while Milanese data begin in 1605 and becomes thick only in 1701. In the overlap, there is little difference in price between the two cities and some series (like wheat and wages) that overlap for longer periods also show similar levels.

1326–1371 (Florence). Wages from de la Roncière (1982, pp. 280, 326) and Goldthwaite (1980, pp. 436–438). The price of wheat was from Goldthwaite (1975), while other prices and wages were from de la Roncière (1982, pp. 67–253). A truncated set of commodities, some of which were estimated from the prices of others, was used for the consumer price index. These commodities were bread (calculated from the bread equation), beans (taken to equal the price of wheat), meat (lamb), cheese (at 1.7 times the meat price), eggs, oil (for cooking and lighting), wine (taken to equal the price of wheat), soap (0.7 times the price of oil), and candles (0.5 times the price of oil).

1520–1619 (Florence). Prices and wages from Parenti (1939). The bread price was calculated from the bread equation. The meat was lamb, the cheese nostrale, the linen tela nera, the fuel was wood. The price of soap was taken to be 0.7 times the price of oil, while the price of candles was 0.5 times the price of oil.

1701–1860 (Milan). Prices and wages from de Maddelena (1974). Bread calculated with bread equation. The price of beans taken to be the price of wheat. I have substituted the price of meat for the price of olive oil instead of using de Maddelena's olive oil price. The price of meat is much more consistent with earlier price ratios among commodities and with the level of olive oil prices in Naples in the eighteenth century.

1861–1913 (Milan). Consumer price index: Mitchell (1978, pp. 778–783). Wages: Hansen (1985, p. 350).

Naples

Wages and prices, 1548–1645, Coniglio (1952); wages and prices, 1734–1806, Romano (1965). Bread was calculated with the bread equation.

Meat—veal price used in 1548–1645. For 1734–1806, the price of cheese was used instead of the price of veal reported by Romano since the veal price was out of line with earlier prices, the price of eggs, and the patterns of prices prevailing in other places, in particular Milan. Cheese fit these patterns better, so I concluded that Romano was reporting an esoteric grade of veal.

Cheese—round used for 1548–1645, white for 1734–1806.

Eggs—1548–1645 values extrapolated from later values using cheese price series.

Wine—estimated at 0.3 g of silver per liter in 1734–1806.

Linen—estimated at 5 g of silver per meter in 1548–1645.

Oil—taken to equal the price of soap in 1548–1573. Romano (1965, p. 78) indicates that the price of cooking oil is per salma, but that gives implausible values. It must have been per staro—as was the price of lamp oil (Romano, 1965, p. 66)—and I have used that conversion instead.

Warsaw

Wages and prices: Adamczyk (1938), Siegel (1936), Siegel (1949). For 1558–1796, the bread price was calculated by equation. The price of oil was used for the price of soap (they were approximately equal in Munich). From 1558 to 1699, the price of cheese was extrapolated backward from 1700 with the price of meat. The price index for 1816–1914 was computed as described in the text but oil, soap, beef, cheese, and linen were excluded.

Krakow

Wages and prices: Pelc (1935), Tomaszewski (1934), Gorkiewicz (1950). The bread equation was used to compute the price of bread from 1495 to 1600. The price of oil was used for the price of soap. For 1409–1600, butter and oil were extrapolated the price of eggs. Beer 1409–1475 was extrapolated. Wood, 1558–1796, was the Warsaw series. It was carried back to 1409 by extrapolating by the wage.

The consumer price index for 1816–1914 was calculated with the same formula as the earlier period except that cheese and linen were excluded. The price of rye bread was computed with the bread equation for short portions of the nineteenth century when it was not reported. This price agrees reasonably with the reported prices. Beer 1859–1914 was extrapolated with the bread price series. Candles 1873–1914 were from Warsaw. The price of wood was used for the price of fuel for 1816–1845. Thereafter, the price of coal was used.

Gdansk

Wages and prices: Pelc (1937), Furtak (1935). The price of bread computed from the bread equation. Cheese 1803–1814 was extrapolated with the price of meat, and beer 1793–1814 was extrapolated with the price of bread. Some scattered egg prices indicate that the price of an egg was one eighteenth of the price of meat, so that ratio was used to calculate missing egg prices. The price of butter was used for the price of soap and for the price of oil.

Lwow

Wages and prices: Hoszowski (1928), Hoszowski (1934). The price of bread was predicted by the bread equation. Beans 1770–1796 were extrapolated with the price of rye. Butter 1519–1600 was extrapolated with the price of meat. Cheese 1701–1796 is the Warsaw series; earlier values are extrapolated with the price of meat. Eggs 1520–1703 were extrapolated with the price of meat. The price of oil is used for the price of soap, and the oil price is the Krakow series. Candles 1520–1700 were extrapolated with the price of butter.

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