
DEBATES

New Perspectives on Seven Centuries of Real Wages

David Loschky

University of Missouri-Columbia

SECTION I

Introduction

It is a paradigm's job to bring into coherence our various understandings of the world. We use this fundamental property to evaluate presently constructed real income indices and to argue for the necessity of altering these indices' conceptual bases. Evidence concerning real income per-head comes from many sources. These sources do not always present the same picture. When differences cannot be ascribed to data deficiencies or to formal computational procedures, reconciliation between sources may be achieved only through altering the index's conceptual bases.

Change in English per-head real income looks very differently when viewed from different sources. The Phelps Brown and Hopkins (PBH 1955, 56, 57, 59, 81) real wage index suggests real wages in 1800 were below their level of the mid-1200s. Other measures for real per-head income suggest substantial growth between those two periods. There is, of course, the difference between real income, which is our concern, and real wages, which PBH measure, to consider. But the real-income differences suggested by our various measures are so large that more is at stake than a change in hours worked per year.¹ We argue that an alteration in the conceptual basis for the PBH index will bring our various sources into coherence.

We present various direct measures for real per-head income in Section II and we show these suggest far different changes in real per-head income than the PBH index. Section III takes up the issue of how these various views

¹ WRIGLEY and SCHOFIELD (1981): Nor is it likely to be explained by family size and least of all by changes in the employment of other family members.

can be brought into coherence. It is argued that measurement should include consideration of the household production function. Section IV presents evidence on change in household technology. In Section V we produce an illustrative and adjusted English real wage index. Section VI contains our conclusions.

SECTION II

Direct partial indicators of real income growth

Surely the most comprehensive and intuitively acceptable view of life's conditions in different times is given in literary and historical accounts of daily life. We begin with these comparisons. The vivid impressions of daily life conveyed in literature and letters leave no doubt but that Arthur Young's sturdy yeomen and Jane Austin's village parsons lived a materially richer life than Pier's plowmen, that Samuel Coleridge looked out upon an England the inhabitants of which lived in greater material ease than those seen by Geoffrey Chaucer and that George III ruled a wealthier people than Edward I. Yet as clear as these impressions are, they are denied by the English historian's premier data set, the Phelps Brown and Hopkins real wage index (PBH, 1955, 56, 57, 59, 81). For this series shows real per-head income in 1800 at about 80 percent of its level in the mid-1200s.² Other data support the contention that in fact real per-head income rose far more than shown in PHB.

Because real per-head income indices measure overall life styles, we can evaluate the likelihood of understatement in an index by looking at direct evidence concerning lifestyles. One important aspect of lifestyles is the kind and quantity of housing and furnishings consumed. A second important indicator of one's life style is the percentage of one's income spent on food.

We begin with a direct measure for consumption per-head which draws upon archaeological evidence on housing and upon historical records such as wills and inventories concerned with house furnishings. When reviewing this evidence we keep in mind that the PBH index (1981, pp. 28-31) first shows real income at 56 for 1264-75, then shows it peaking around 97 in 1470-79 and then has real income falling to 38 by 1611-21. That is, real income first

² It is perfectly clear that PHELPS BROWN and HOPKINS intend to present a real wage index and this can differ from a real-income index because of unemployment conditions. But historians want real-income indices rather than real-wage indices and their index has been used to represent change in real income. Our question is, is their series adequate for this purpose. In what follows, our comments and criticisms would not differ a wit had they represented this as a real-income index since the basic issues are the same in both cases.

nearly doubles and then falls back to less than 70 percent of its mid-thirteenth century level by the second decade in the seventeenth century.

Thirteenth and fourteenth century housing standards are graphically outlined in such sources as Bennett (1938) and Coulton (1926, 1927). Common people lived in cruck houses which were built by placing two parallel rows of poles in the ground, tying opposing poles to a ridge pole, thatching over the gradually curved roof until down close to the ground, and then finally making the residual into "walls" by packing interlaced branches with wattle. The arched wall construction could not support upper floors so the most that one found in these houses might be a loft and windows along the sides of the house were a near impossibility. Because there were no fireplaces (only their dim foreshadowing can be found in monastery kitchens) firestones were used. Small fires would be lit on these large flat surfaces and meals were cooked in containers placed on trivets. Smoke drifted up to the ridge, curled around the bacon or hams strung there and seeped out through the thatch. Floors were packed earth; straw and/or reeds were used in an attempt to control dampness. "The Hall" (the space inside this cruck house) could be partitioned into rooms by low walls. There seldom were more than two such rooms and farm animals sometimes occupied one room during winter.³ These were the houses occupied by most people until the mid - to late - sixteenth century.

M.W. Barley (1967, p. 745) describes substantially improved housing standards by the mid-seventeenth century.

The farmhouses of the south-eastern half of England bear witness, then, to a revolution in housing standards during the course of this period. The new standards sprang in part from the greater wealth of the yeomen and husbandmen, and manifested themselves in a great increase in material comfort: glazed windows (often with curtains), chairs and cushions, pewter on the table, and feather beds in the parlors... only poor husbandmen did not aspire to a house of two storeys throughout.

He continues (pp. 750-1):

The ordinary yeoman did not aspire to a brick house, though he certainly wanted an improved fireplace, and from the early Elizabethan period brick began to be used for chimney stacks. Many medieval houses in Staffordshire had upper floors and chimney stacks inserted at this time, though the open-

³ And not only in the winter time. COULTON (1927, p. 267) reports a 1388 London law which "commanded strictly 'he that will keep a pig, let him keep it in his own house'." As modern city dwellers familiar with keeping cats and dogs inside we *may not appreciate* just what it means to think of keeping a pig inside. To put some perspective on this, our ancestors talked of "living like a pig" or "smelling like a pig." And these were people who, keeping large numbers of animals on their farms in barns, were quite familiar with animals, their habits and their smells.

hall house had not disappeared, to judge from references in inventories to 'bacon at the roof.'

Barley (1967, p. 760) reports the assessment of Richard Carew, a contemporary, who describes improvement in housing among Cornish husbandmen by the 1580s. The old standard was:

walles of earth, low thatched roofs, few partitions [few had more than one room], no planching [no wooden floors] or glass windows, and scarcely any chimneys... but now most of these fashions are universally banished, and the Cornish husbandman conformeth himself with a better supplied civilitie to the Eastern pattern.

The point is reaffirmed by Everitt (1967, p. 442):

As the period progressed, the standard of housing definitely improved, and by 1640 four labourers in five (of those who left inventories) lived in cottages with at least three rooms.

General evidence of increased consumption also led Everitt (1967, p. 442) to conclude that:

one telling indication of the rising standard of living amongst the better-off labourers may be mentioned. The furniture of early Tudor cottages was evidently rough carpentry work, of small value, quite possibly constructed by the labourer himself: whereas by Charles I's reign many a cottage possessed at least one article of *joined* furniture, properly constructed by a trained craftsman, carefully described by the neighbours who drew up his inventory, and lending a new touch of modest luxury to his home.

Even labourers, the communities' poorest members, enjoyed improved housing.

It would be wrong to equate the average Tudor cottage with the charcoal burner's hut. It must usually have had vertical walls [these made storeys and windows possible], and by 1640 rarely had less than two rooms. (Barley, 1967, p. 762).

Now during this same time the PBH index shows real incomes in 1611-20 at 68 percent of their mid-thirteenth century level, at 38 percent their level in 1491-1500 and at 39 percent their mid-fifteenth century level. Yet to archaeologists unfamiliar with the intricacies of index numbers, the conclusion is inescapable. Real income, when measured by changes in housing, furniture and such consumption items, rose between the early 1500s and the early to mid-1600s.

According to PBH something like seven and one-half percent of one's money income was spent on housing. Is it likely that real consumption in only this index category rose while it fell in all others? This prospect seems extremely unlikely simply because the improvement is so impressive *and*, one would suspect, were *all* other categories of consumption falling in real terms,

substitution between housing and furnishings, on the one hand, and food, on the other, would have taken place. It is, after all, preferable to live in a drafty and sooty cruck house than starve. The evidence on housing and furnishing, therefore, strongly suggests that real per-head income rose. This conclusion is supported by other evidence on consumption.

No other existing body of direct evidence on consumption is both as well documented and independent of the PBH index. Yet contained *within* the PBH index is evidence on the percentage of income devoted to the purchase of food and the percentage devoted to the purchase of non-food items. Because consumption studies show that the percentage of consumption devoted to food is a good indicator of real income these data, *taken from original PBH data*, provide strong evidence concerning whatever change in real income per-head may have occurred.

PBH weight their index using expenditure data. These data show that the percentage of current income spent on food remained constant at about 80 percent over the nearly seven centuries spanned by their study.⁴ Because the percentage of income spent on food is a sensitive indicator of change in real income, their data on *current* expenditures seem to suggest no substantial change in real income. On the other hand, they also have price series for each of the six sub-categories into which their series is decomposed and these data clearly show that food prices rose relative to non-food prices. This means given the same distribution of money outlay on both food and non-food goods, one's real non-food consumption consistently rose relative to real food consumption. It was this fact of changing quantity weights which provided the justification for Loschky's (1980) and Lydall and Phelps Brown's (1982) recomputation of the original PBH index. When real consumption within the six categories is re-evaluated using these changed prices levels, we find the percentage of one's budget devoted to food falling in a manner consistent with our literary and historical evidence on real incomes per head. This information on the distribution of real consumption between food and non-food is given in Table I below.

These periods have been chosen to correspond to significant PBH dates. They use the years 1451-75 as their base and we continue this usage. We include the years 1775-99 because they include PBH's 1790s data on the distribution of expenditures and the same rationale applies to the period 1876-1900. We compute weights for the years 1601-25 because they encompass the low point in the PBH index, the years 1611-20 cited above. And we compute weights for the period 1621-45 because it corresponds to the years referred to by Barley and Everitt cited above.

Several interesting points emerge. Firstly, we do have the PBH data on the actual distribution of current expenditures for the 1450-60 period and the

⁴ Their data come from the periods 1450-60, the 1790s and 1904-13. These data show 80 percent of current expenditure going for food.

1790s. Using these data and their price series we find that food consumption fell from 80 to 62 percent of the consumers' real budget. This strongly suggests rising real incomes *and yet the PBH index shows real per-head income in the late 1700s at about 50 to 55 percent its level in the period 1451-75.*⁵ Secondly, we have no budget expenditure data for the 1600s so the conclusion that real per-head income in that period is higher than real per-head income in the mid-1400s must be more conjectural than the preceding conclusion. Still, this is *exactly* what these computed weights strongly suggest. Thirdly, we find the data in Table I completely *consistent* with the evidence on housing and house furnishing and *inconsistent* with the PBH index, yet Table I's data come from the PBH index itself.

Table I
PERCENTAGE DISTRIBUTION OF REAL CONSUMPTION

	Food	Nonfood
1451-75 ^a	80	20
1601-25	68	32
1621-45	67	33
1701-25	69	31
1775-99 ^a	62	38
1876-1900 ^a	58	42

^a The PBH budget data show that 80 percent of the budget in current pounds was spent for food in 1450-60 and they base their index in the year 1451-75 based on that data. They also have budget data for the 1790s and for 1904-13 which again show that 80 percent of current expenditures went for food. On these grounds they argue that 80 percent is reasonable for the entire time period. Similarly we presume that 80 percent of the budget was spent on food for each period. This table converts current expenditures into real consumption patterns.

SECTION III

What could reconcile these differences?

Direct evidence concerning housing and limited information on furnishings leaves little doubt that the PBH index seriously understates real income. That conclusion is supported strongly by evidence on the percentage of real household consumption devoted to food purchases.

⁵ We observe that SHAMAS (1983) argues that food took a smaller share of the budget in these later years than held by PBH. But her argument does not deal with the changes in relative prices which are central to the argument presented above.

Given the care devoted by Phelps Brown and Hopkins to the collection and interpretation of their data, it is unlikely we can improve on their data or that errors in these data explain the different impressions we gain of changing per-head real income.

Similarly, it is unlikely that the difference between real wages, which is what PBH present, and real income explains these differences. For instance, the relationship between real wages and real per-head income changes if there are substantial changes in family size. But the current view is that family size did not change substantially between the mid-1200s and 1800. Evidence for this accepted view stems from Wrigley and Schofield's (1981) reconstruction which suggests very small if any changes in crude birth or death rates between 1541 and 1800. We extend this view back to the mid-1200s by referring to Hallam's study (1985) of ages at first marriage and death in the Lincolnshire fenland between 1252 and 1478 which suggests little change between these times and the mid-1500s. We note that Hallam's view is consistent with that of Lee (1978) who estimated crude birth and death series before the publication of Wrigley and Schofield and ran the series back to the mid-1200s. He also finds little if any difference in crude rates between the mid-1200s and 1800.

If our different views of real income cannot be explained by reference to faulty data or to substantial divergence between real-wage and real-income time paths, can they be due to the fact that PBH do not compute an exact or superlative index? While it is perfectly clear that their fixed weight paasche real-wage index cannot track movement around a nonlinear aggregator function, research also strongly suggests that the computation of an exact or superlative real-income index will not reconcile our divergent views. We know proofs can be developed showing that the paasche and laspeyres indices bracket the true index. And laspeyres variants to the PBH index have been computed by LOSCHKY (1980) and by LYDALL and PHELPS BROWN (1982). The outcome of these computations suggests the differences in perspectives cannot be solved by altering the base period for our real-income index.

Our alternative is consider the impact that changing the conceptual basis for the PBH index may have upon our indices. The PBH series, as is true for all published real-income and/or consumer-price series, is computed assuming a direct connection between goods purchases and the underlying utility function. There is in this computation no room for household production. On the other hand, considerable work has been done within the past 30 years which explains behaviour by reference to the household production function.

In what ways would the interposition of the household production function affect real-income indices? Taking first difficulties common to both approaches, in either case, the problem of estimating an exact or superlative index would remain. And the necessity for canonical shifts in these functions remains. There also are differences. Firstly, it is possible in principle to observe household production techniques directly whereas this is patently

impossible when we deal directly with the utility function. Secondly, our real income index should be adjusted upward to allow for shifts in the household production function since, if there have been substantial changes in household technology between the mid-1200s and 1800, the potential exists for developing an index consonant with our other evidence. These factors motivate the computation of an alternative real-income index based upon the household mode.

On the other hand, Pollack and Wachter (1975) raise difficulties with this approach. They argue that individuals engage in activities for two purposes. These are household production *and* for direct satisfaction. If this is the case, then we have joint production and this would mean we cannot statistically disentangle the household production function from the household utility function by direct observation of household activity. The argument is interesting. Nevertheless, it can be countered. Biologists would not accept this argument. All activities lead to neurological and chemical changes in the body and their position would be that it is these changes that an organism seeks to stimulate. People eat to alter blood sugar levels and not because they are hungry or because there is some other satisfaction involved in eating. Similarly, psychologists advocating transactional analysis would argue that activities are pursued for the pay-offs that occur. From that perspective there is no pure pleasure in the activity itself, it is the pay-off that is at stake. There are grounds, therefore, for arguing that all household activities are pursued for the purpose of outcomes consequent upon the household production process.

Let us, therefore, explore the implications of estimating English real income using the household production function. It would, of course, require an extensive investigation into production and consumption techniques to answer that question with any degree of certainty. Yet it is worth considering what evidence we do have.

SECTION IV

Evidence for change in household technology

What evidence do we have for changes in household technology? In an age of largely self-sufficient subsistence farming, grain production is an important household activity, an activity which PBH argue accounted for 20 percent of the household's income.

Direct evidence on wheat output per-acre is available.⁶ The increased out-

⁶ Because wheat is one item 'purchased' by the household, in the PBH index, the fall in its price relative to money wages is already considered in the PBH index. But we use it in this study, because it is well documented, as an example of changes in household production technology. Clearly study of the household production func-

put per-acre we do observe in these data *might reflect* greater labour input per-acre with no change in output per-worker. This is unlikely, however, since we reasonably may expect that the number of agricultural workers per-acre remained relatively stable between 1350 and 1700 or 1800.⁷ Information on capital per-worker remains to be assembled so we cannot deal with this issue here.

Winchester Estate records show that wheat yields were about 10 bushels per-acre though 1350. Of this gross output 2.5 bushels had to be kept back for seed. The net yield, therefore, was about 7.5 bushels per-acre.⁸ By 1700 wheat yields were close to 20 bushels per-acre with seed requirements relatively unchanged so net output was around 17.5 bushels per-acre.⁹ Between

tion is needed if we are to extend our knowledge of real income change further than is done here.

⁷ There are no social tables for the early period so conclusions as to the number of agricultural workers must be conjectural. The population of England in 1360 was estimated by Russell (1948) to be 3,700,000 and of this number we may fairly suppose something like 80 percent were occupied in agriculture. To find the agricultural work force we need the population age distribution, but assuming it remained constant over the period in question we can proceed directly. For 1348 our figure for the number of people working the land is (.8) (3,700,000) which is 2,960,000. By 1700 the population had grown to around 5,500,000 and by 1800 to about 9,200,000. MITCHELL with DEANE (1962, p. 5) DEANE and COLE (1959, p. 62) assert that "at the end of the eighteenth century well over a third of the occupied population earned their living in agriculture" and it would be generous to presume that something like 50 percent worked in agriculture in 1700. Supposing that 35 percent worked in agriculture in 1800 we derive a figure of 3,220,000 and supposing that 50 percent did so in 1700 we obtain 2,750,000. There was, of course, an expansion in farmed acreage between 1350 and 1700 to 1800, considering the colonization of the southwest and the draining of the Fens. What we find, then, is a general supposition that labour per-acre probably did not rise much if at all and that increases in output per-acre are a reasonable approximation, for our purposes, for output per-worker. As noted in the text, we cannot deal with the issue of capital per-worker; the evidence has not been assembled to date.

⁸ These estimates were taken from TITOW (1973, p. 13). CAMPBELL (1983) raises considerations not taken into account by Titow. Among these are the mix of crops, the increases for each crop weighted by its share in total acreage under cultivation and, for our purposes of most interest, the percentage of fallow and changes in that percentage over time. The upshot of these other factors is that 1) with a decrease in the percentage of fallow over time the per-annum yield per-acre would show even greater increases than discussed here and 2) since many other grain crops showed greater increases in yields than wheat alone, the figures reported here for increases in productivity are likely quite conservative. Furthermore, it appears from the Norfolk figures that our yield to seed ratio of four to one may be a bit high also. This would make the estimates given here even more conservative.

⁹ DEANE and COLE (1962, p. 67) report this conclusion of Fussell's. Seed requirements were estimated by Charles Smith, writing in 1766, at 10 percent of the total output. The figure is reported by DEANE and COLE (1962). Another larger estimate

1350 and 1700 output per-acre rose by 17.5/7.5, in other words by a factor of 2.33 which is a compound rate of growth of .24 percent.

Further evidence concerning output per unit of labour input within the household is more impressionistic but theoretical considerations strongly support the contention that household productivity rose. In the first place, it is evident that considerable changes in household production technology occurred since the mid-XIIIth century. *A priori* we expect that these changes must have been adopted because they led to increased productivity. Examples of such changes include the introduction of fireplaces in place of firestones. Fireplaces meant households now had ovens and these could be used, for instance, to bake bread at home rather than baking it in the village oven. The savings in labour time must have been great. Rather than preparing the dough and then going to the village oven, the householder could bake at home while performing other chores. Furthermore, as fireplaces were improved to provide damper controls, and particularly when they were replaced with Franklin stoves, the increased output of heat relative to the input of firewood should have been substantial. The use of wooden floors rather than earthen floors would have meant a considerable improvement in insulation also suggesting increased heating relative to firewood usage. Brick walls or Tudor construction (masonry or plaster over wooden walls) would have had the same consequence. While these examples are limited, they illustrate the point we make here.

This evidence from specific household activities is consistent with national materials concerning technical change. Our closest figures to economy-wide rates of technical change between 1250 and 1900 are growth rates in real per-head income. These estimates for eighteenth-century England and the United States run .3 to .5 percent per year.¹⁰ This growth could be due to changes in factor proportions, to other than constant returns to scale, or to technical change. Furthermore, the estimates are based on fixed-weight index numbers rather than exact index numbers with all the limitations this implies. Yet there are ample grounds for expecting considerable technical change between 1250 and 1900. These grounds include but are not limited to the facts that after the mid-thirteenth century, the English began shifting out of traditional field systems into either homestead farming or into elaborate field systems which allowed for the introduction of grasses and root crops; that a distribution-industrial system, the putting-out system, developed between the mid-thirteenth and the eighteenth centuries; that considerable new production technology was introduced between 1540 and 1640, and that eighteenth cen-

for seed corn is also reported, but the difference in net yields would be about 1/2 bushels per-acre which, in the context of this argument, would be an inconsequential difference.

¹⁰ DEANE and COLE (1962, pp. 79-80). This is the rate for the entire century. Since the publication of these estimates the data have been reviewed by numerous authors.

tury technical change in machinery and in power production brought England out of the handicraft era into the industrial age. Given these facts it is clear that technology improved considerably and, in historical terms, fairly constantly.

SECTION V

An illustrative real income index based upon household production

Our direct quantitative measure for technical change in production activity is growth in wheat yields per-acre. As argued above, there are grounds for holding growth in per-acre yields approximated growth in yields per-worker. Furthermore, direct evidence on household production (bread baking, heat production, insulation, etc. discussed briefly above) supports the view that the household production function shifted by a substantial amount but presently unmeasurable amount. On the other hand, we can measure changes in wheat output per-acre and our evidence shows that between 1350 and 1700 output per-acre rose by 2.33 times. The compound growth required to produce that consequence, slightly over .2 percent per year, is considerably below the .3 to .5 percent per year growth in real per-head income suggested for England and the United States cited above for a somewhat shorter and more modern period. That economy-wide technical change exceeded technical change in wheat production is suggested strongly by the fact that the PBH price index for agricultural goods rose relative to that for industrial goods (PBH, 1981). Consequently, an adjustment of the PBH index by technical change in wheat production likely still will understate true growth in real per-head income. Nevertheless we use this quantitative data on wheat output to adjust PBH. The results appear in Table II below.

Table II
AN ADJUSTED ENGLISH REAL-INCOME INDEX:
GROWTH IN REAL INCOME PER-HEAD FROM 1291-1300 TO

	1691-1700	1791-1800	1891-1900
I. a. Laspeyres	111	129	379
b. Paasche	91	102	259
II. a. The adjustment factor: 1.0024197 compounded.	2.33	2.97	3.78
III. a. Adjusted Laspeyres	(111) (2.33)	(129) (2.97)	(379) (3.78)
	259	383	1433
b. Adjusted Paasche	(91) (2.33)	(102) (2.07)	(259) (3.78)
	212	302	979

As our basic data we use the Lydall and Phelps Brown (1982) Paasche and Laspeyres indices. The adjustment factor is the compound growth rate for wheat discussed above. We compound only *from 1350 on* since our wheat data begin then.

Clearly, these computations are illustrative only because the adjustment factor is based only upon wheat output, because the adjustment presumes neutral technical change, and because the indices almost certainly do not exactly track movements around the household production function. Furthermore, *any* index, exact, superlative or whatever, still would be subject to the limitations discussed by Samuelson and Swamy (1974) and others. On the other hand, indices will be used.

What does our adjustment do to these indices? The adjusted indices show per-head income in 1800 two to three times as high as it was in the mid-1200s¹¹ and this surely accords more with impressions gained from other sources including literary impressions, archaeological evidence and information on the distribution of household real consumption.

SECTION VI

Conclusions

Currently available real wage indices are fixed-weight indices. Because the literature contains no methods for evaluating possible understatement in these indices, we do not know in particular cases if the understatement is serious. Furthermore, no simple methods exist for adjusting such series. This study presents simple and direct methods for both appraising and adjusting for understatement. We apply these methods to a specific case. Our brief investigation of the PBH index using these methods suggests it seriously understates true growth in real incomes. We then adjust the index upward using a limited measure of technical change. The adjusted series must be more accurate than the unadjusted original series, although it is perfectly clear that *no*

¹¹ The differences between the original PBH index and this are large but they are not so large as to discredit them. Differences in growth rates found by GOLLOP and JORGENSEN (1980) when using exact index numbers were often considerable. Furthermore, ALLEN and DIEWERT (1980) find quite different growth rates when using different index number formulae and while this is not exactly what we are dealing with here, the evidence is relevant. Turning to the simple paasche-laspeyres differences, we note once again that GERSCHENKRON's (1951) Laspeyres index was seven times his Paasche and this occurred after only 10 years growth in the Soviet machinery industry. Considering some of the results turned up in the literature, our differences are modest. But, and this is the relevant point, they are about in line with what one would expect given the lifestyle information conveyed in English literature.

index number we can construct will meet accepted theoretical requirements. Yet because indices are essential in this era of governmental accountability and econometric studies, such series will be used, thoroughly theoretically justified or not. It is, therefore, a matter of relative accuracy which is at issue. This being the case, until carefully reconstructed exact indices for real-income figures become available, economic historians, using the methods set forth here, can evaluate understatement in various series and can make crude readjustments within existing series.

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