ISSN 1471-0498

DEPARTMENT OF ECONOMICS

DISCUSSION PAPER SERIES

POVERTY LINES IN HISTORY, THEORY, AND CURRENT INTERNATIONAL PRACTICE

Robert C. Allen

Number 685
December 2013

Manor Road Building, Manor Road, Oxford OX1 3UQ

Poverty Lines in History, Theory, and Current International Practice

By

Robert C. Allen

Professor of Economic History
Department of Economics
Oxford University

Nuffield College
New Road
Oxford OX1 1NF
United Kingdom

email: bob.allen@nuffield.ox.ac.uk

2013

Measuring the standard of living has been a longstanding problem for economists and historians. A direct approach is to calculate the purchasing power of wages. The real wage is the ratio of the nominal wage to a measure of the price level. A common short cut is to use the price of grain as the measure of prices, in which case, the real wage becomes a 'grain wage' indicating the quantity of grain that can be purchased with a day's labour (Braudel and Spooner 1967, van Zanden 1999). An attraction of this procedure is that it provides an absolute measure of the standard of living. However, people consume more than grain, so it is preferable to measure the price level as a weighted average of the prices of the goods that workers consume. The weights should reflect consumer spending patterns. A limitation of this approach, as usually practised, is that the resulting real wage can only be interpreted as an index of relative income levels and has no absolute interpretation.

In Allen (2001, 2007) and Allen et al (2011), attempts were made to provided an absolute interpretation of real wages even when inflation is measured with an index of consumer goods prices. These studies examined mainly the wages of men employed in the building industry. The worker's annual earnings were computed by multiplying the daily wage by the number of days worked in a year (often taken to be 250). The earnings were divided by the annual cost of maintaining a family at a specified poverty line. The ratio of annual earnings to the cost of annual subsistence equalled the 'welfare ratio' of the family (Blackorby and Donaldson 1978). When the ratio equalled one, the worker earned just enough to keep his family at subsistence. Values greater than one equalled a surplus over subsistence, while values less than one equalled a deficit. The implications of a deficit depended on how 'subsistence' was defined.

The subsistence wage was a cornerstone of the classical economists (Ricardo, Malthus, Marx). They regarded English labourers as the bottom rung of the income hierarchy with incomes 'at subsistence' since they were the main beneficiaries of the Old Poor Law, which provided income supplements to keep labourer's consumption at subsistence–and no higher. The empirical counterparts to the classic theories were the surveys of budgets collected in David Davies' *The Case of Labourers in Husbandry* (1795) and Sir Frederick Eden's *The State of the Poor* (1797). Davies' and Eden's descriptions of spending are not problem free. They were often incomplete, but by combining details from several budgets a comprehensive view of family incomes and expenditure and can be assembled. The two prove to be in balance, and the quantities and prices of the main items consumed are known, so the budgets can be assessed for nutritional adequacy and so forth.

Table 1 shows the 'respectability basket' put together from Eden's work. The name identifies this was the standard of living to which a labourer in the south of England aspired. The table shows the consumption pattern for a man for one year.[1] The food items can be reasonably well determined from descriptions like Eden's and Davies'. When the basket is evaluated for other parts of the world, the contents are varied to reflect local food availability. Thus, olive oil and wine replace butter and beer in the Mediterranean, and price of the usual common meat or bean is used in each locality. The non-food items are harder to pin down, and the apparel component is represented by only a single item–linen or cotton cloth. This simplification was introduced since the cost of the budget must be calculated for many places

[1]The particular representation in Table 1 is intended to be a medieval or early modern version of the budget in that it excludes the new goods (potatoes, sugar, tea) introduced from Asia and America. These exclusions were made so that the budget could be priced in the middle ages and in countries where these new goods were not consumed.

over centuries to measure real wages, and light cloth is the only item of dress whose price is consistently reported on this scale. Likewise, the rental cost of housing is represented by a 5% charge on the other items in the budget since the cost of housing cannot presently be measured for the times and places that interest historians.

Two features of the budget should be highlighted since they will be subjects of discussion in this paper. The first is the calorie content of the diet which works out to be 1940 kcalories per day. This appears to be a minimal standard and not atypical of the budgets in Eden and Davies. The second is the 'scaling factor' used to relate the family's subsistence cost to that of an adult male. On the assumption that a family consisted of a man, a woman, and two children, it was assumed that a family corresponded to three adult male equivalents, so the cost of the budget in Table 1 was multiplied by three to determine the annual subsistence cost of the family. There has been some discussion of the correctness of the value (Allen and Weisdorf 2011, Humphries 2012), and it is reassuring that detailed calculations by Floud et al. (2011, p. 46, 165-7) found that, indeed, the calorie requirement of the average person in England in the eighteenth and nineteenth centuries equalled 76% of the requirement of the average adult male, i.e. three adult males corresponded to four people in the overall population.

Figure 1 shows the welfare ratios for six cities in Eurasia when subsistence is calculated according to the respectability budget of Table 1. For labourers in London and Amsterdam, the results are in line with the views of the classical economists, for these workers earned only marginally more than subsistence. In the fifteenth century, workers in Florence and Vienna lived as well, but by the eighteenth century, their real wage had fallen to less than half of the respectability standard. Living standards were similarly low for wages in Delhi and Beijing.

What could the families do to make ends meet? Income could be increased if the man worked more or if the women and children earned money, but the chances of closing the gap were not good when the man earned less than half of the cost of the basket. In that case, spending economies would have to be made. These were possible because the respectability basket was, in fact, a high cost basket. Beer, meat, even bread were expensive sources of calories.

Costs could be cut by eliminating the expensive calories from the diet and by reducing the consumption of non-food items. Table 1 shows 'subsistence' baskets defined in this way. They are based on a diet in which most calories come from the cheapest available grain (oats in northwestern Europe, maize in the Americas and northern Italy, millet in northern India, sorghum in Beijing, and wheat flour today in many parts of the world), legumes are an important source of protein, butter or oil provides some fat, and meat or fish are rare luxuries. Diets along these lines, in fact, were common in many parts of the pre-industrial world.

For comparative purposes, a 'Northern' basket is also defined in Table 1. People in Northern Britain consumed an oat based diet in the eighteenth century (Dr. Johnson defined oats to be 'a grain, which in England is generally given to horses, but in Scotland supports the people.'), and that is an inspiration for the oat-based subsistence basket. However, many people in Northern Britain ate a more varied diet when they could afford it. Table 1 shows a stylized version. It is included since a diet based on coarse grain, potatoes, and milk is common in India and other poor places today.

Figure 2 shows the welfare ratios implied by the subsistence baskets. The geometry is similar to Figure 1, but the ratios are all higher since subsistence baskets cost less than respectability baskets. Workers in central and eastern Europe and in Asia ended up with

subsistence ratios equal to about one in the eighteenth century. A man's earnings were just enough to keep the family at the level of income corresponding to the subsistence basket in Table 1. It is remarkable that the classical economists were wrong about the standard of living of the English labourer. His real income was, in fact, higher than that of workers in most of Eurasia. Indeed, in London in the eighteenth century labourers earned four times subsistence. English workers did not consume four times the oatmeal specified in Table 1; rather, they upgraded the quality of the food the consumed to the bread, beef, and beer of the respectability basket.

The welfare ratio using the respectability baskets was worked out in the 1990s, and since then great advances have been made in measuring food adequacy and poverty in developing countries. The United Nations Food and Agricultural Organization and the United States Department of Agriculture have established food security and insecurity lines and estimated the number of people in the world below them. The World Bank has established its $1 per day poverty line and undertaken poverty assessments for many countries. These indicate national poverty lines that reflect national conditions and do not necessarily equal the $1 per day standard.

The question explored in this paper is how these modern lines relate to the respectability and subsistence ratios. The indices are closely related. However, it is also discovered that the historical measures can be brought into closer alignment with the modern ones by raising the calories content of the basket from 1940 to 2100 and by increasing the scaling factor from three adult male equivalents per family to four. Given the assumptions about family size, this means the standard of 2100 calorie per day standard becomes the per capita norm rather than the norm per adult male equivalent. This change turns out to be warranted by activity levels in the past as well as by the aim of establishing consistency with modern measures. The first change increases the annual cost by about 5%, while the second increases it by one third

These themes will be developed by considering the food security lines and the poverty lines in turn.

Food security lines

Since 1996, the United Nations Food and Agricultural Organization (FAO) has published annually *The State of Food Insecurity in the World*. Since 1997, the US Department of Agriculture (USDA) has published a *Food Security Assessment* dealing with 70 developing countries. Both reports specify a per capita calorie consumption level that marks the division between security and insecurity. The USDA sets the frontier at approximately 2100 calories per day "depending on the region." (USDA 2010-20, p 1 n2) The FAO specifies country specific cut-offs that range from about 1750 calories per person per day to 1950 calories. The FAO figures are derived from a demographic model that relates calorie requirements to the population age distribution and physical activity levels. It is primarily differences in the former that account for the differences in calorie requirements.

Both reports specify higher calorie consumption than either the respectability or subsistence baskets. These set calorie consumption at 1940 calories per day, a figure seemingly at the upper end of the FAO range. There is an important difference, however, for the historical baskets apply this figure to an adult male rather than to the average person in the society. On the assumptions that a family had four members and equalled three adult male equivalents, the implied calorie consumption is 1455 calories per person per day (three

quarters of 1940). As it happens, this corresponds to the average calorie intake of someone in the poorest decile of the Indian population (Suryanarayana 2009, p. 35). Setting the calorie intake at this level makes some sense in the case of the subsistence basket, which is intended to track to the minimal cost of survival. However, 1455 calories per person is arguably too low to provide the man with enough nutrition to do the labourer's job that generates the income in the numerator of the welfare ratio.

We can use the FAO's demographic model to set a more appropriate standard. The model requires the age structure of the males and females, and I have used values from the 1841 English census, which is the first to provide sufficient detail. The height of men and women at each age must also be specified. There is historical information about the heights of men, but the heights of women and children are less well established. As it happens, FAO (2008b, pp. 20-1) gives an example of its calculations, and the average height of men in that example is 166 centimetres, which was the average height of British men in 1841 (Floud et al. 1990, Cinnarella 2008). On the assumption that other heights were in proportion, I have applied the heights in the FAO example to England in 1841. One must also assume a Body Mass Index (BMI) for each age to compute weight from height. For adults, the FAO assumes the low value of 18.66 since the aim is to compute a minimum calorie requirement, and I follow their lead. Next, from these data, calorie requirements for basal metabolism for each age-sex group can be computed with equations developed by the World Health Organization and FAO.[2] Finally, total energy expenditure for each age-sex group is calculated by multiplying the calories required for basal metabolism by the physical activity level (PAL) of the group.

The physical activity level is computed by applying physical activity ratios (PAR) to an individual's annual time budget. The PAR is the ratio of energy expended in an activity to the energy required for basal metabolism in the same time period. The FAO (2001, pp. 36, 92-6) reports PAR's for a variety of domestic, agricultural, industrial, and recreational activities. These range from sleep (PAR = 1) to eating, chatting, or watching television (PAR = 1.4) to caring for children (PAR = 2.5) to planting maize (PAR = 4.1) to carrying wood (PAR = 6.6).

The PAL equals the fraction of the year spent sleeping multiplied by 1.0 plus the fraction spent watching television multiplied by 1.4 and so forth for all uses of time over the year. FAO (2001, p. 36) presents rough calculations for light, medium, and vigorous lifestyles. The corresponding PALs are 1.53, 1.76, and 2.25. (FAO, 36) No distinction is made in these examples between work days and non-work days, and length of the work day is shorter than the length of work days in the past or today in many less developed countries. Whether these features balance out is unclear.

Respectability and subsistence ratios have usually been calculated for building labourers and craftsmen. To determine the PAL for men doing these jobs, time budgets have been elaborated based on conditions in the past. The PAL for women is also need to compute the overall calorie requirement, so a corresponding time budget has been worked out for a

---

[2]FAO (2008b, p. 18). The equation given for women age 18-29 is clearly erroneous. It should be noted that the equation given for women 18-29 is erroneous and was not used to compute the calorie requirements shown in the example on pp. 21 despite what it says there. From the example, I inferred the equation total energy expenditure = PAL *(451.5 + 15.688 * body mass in kilograms).

woman on the assumption that she was a spinner. The PAL for a woman who was mainly performing domestic tasks was similar.

The time budget for a building labourer is show in Table 2. Key parameters are taken from Voth (2000, pp. 118-33). In London in the mid-eighteenth century, people normally worked five days per week with Sunday and Monday being the days off. Consequently, it is assumed that the work year was 250 days, the number often adopted for welfare ratio calculations. The remaining 115 days were non-work days. Again, following Voth, I assume that people slept seven hours per night, and the work day was 11 hours. This is not as arduous as it appears since people spent 2.5 of the 11 hours eating breakfast, dinner, and tea. (Later in the evening, they ate a fourth meal during leisure time.)

Within this framework, I have allocated time among characteristic activities. Labourers were allotted several hours per day of strenuous activities like carrying wood and digging as well as the somewhat less strenuous tasks of cleaning, loading, and walking. Craftsmen were assumed to be carpenters and spent much of their time on the moderate activities of nailing and roofing, although some time was also spent sawing and carrying wood. Spinning was not a strenuous activity, since it was performed sitting down and did not involve heavy lifting. Indeed, spinning probably required no more energy than the daily routine of a women who earned no money. Both men and women were assumed to have devoted much of their leisure to non-strenuous activities like eating, drinking, playing cards, listening to sermons, etc. The most strenuous leisure activities were not overly energetic–personal care and cooking.

Tables 2-4 show the hours assumed to have been devoted to the various activities and the corresponding PARs. The implied annual PALs are similar to the FAO's calculated values. The PAL for the spinner (light work) is 1.74. The carpenter's PAL was 1.87 and the labourer's 2.16. Different assumptions would, of course, give different values, but the orders of magnitude are clear.

When the PAL values for the labourer and spinner are inserted in the demographic model based on English data for 1841, the average calorie requirement comes out at 2105 calories per person per year–almost precisely the USDA assumption[3]. (Had we used the carpenter's PAL instead of the labourer's, the calorie requirement would have been cut to 1990 per day.) The labourer himself is allocated 3160 calories per day averaged over non-working as well as working days. The spinner receives 2057 calories per day on average, and the children receive less. These calorie supplies are sufficient for their activities according to the FAO model.

In view of these results, it is reasonable to compute welfare ratios following the USDA model with a per capita calorie consumption of 2100. When the welfare ratios equal one, the budget is adequate for a labourer to earn the income to perform his job.

Raising the calorie content of the baskets to 2100 calories per person per day lowers welfare ratios everywhere but has no appreciable impact on relative rankings. Figure 3 shows the results. The patterns are the same as Figure 2, although the absolute values are smaller. Workers in northwestern Europe continued to earn several times subsistence throughout the period. The earnings of workers in central and southern Europe and Asia dropped below subsistence at the end of the eighteenth and beginning of the nineteenth centuries. These

---

[3]The activity level of children must also be specified, and that has been set at 'strenuous.'

were, indeed, hard times. Either the labourers whose earnings are studied here were unmarried, so their wages did not have to support wives and children, or the other family members were put to work to bring family earnings up to subsistence.

World Bank Poverty Line

While one can, in principle, define a food security line with precision, the same is not true of a poverty line. The canonical poverty line is the World Bank's 'dollar a day' line, which is variously stated more precisely as $1 per day in 1985 prices, $1.08 in 1993 prices or $1.25 per day in 2005 prices. These values themselves are overly precise; indeed, the original analysis suggested a range of $.75 to $1.00 per day, which was later truncated to simply a 'dollar a day.'

The World Bank Poverty Line was not set by the Bank's defining a poverty budget along the lines of the respectability or subsistence baskets. Instead, the approach was statistical. Ravallion, Datt, and van de Walle (1991) examined the correlation between national poverty lines and GDP per capita for thirty-three countries ranging from the very poor to the very wealthy. They found that poverty lines increased with income, and, more surprisingly, clustered around $1.00 per day for the poorest countries. The 1990 *World Development Report* popularized this '$1 per day' poverty line, although in a nuanced fashion, for the report actually considered a range from 75¢ to $1 per day. "This range was chosen to span the poverty lines estimated in recent studies for a number of countries with low average incomes–Bangladesh, the Arab Republic of Egypt, India, Indonesia, Kenya, Morocco ,and Tanzania....The lower limit of the range coincides with a poverty line commonly used for India."[4] Ravallion, Chen, and Sangraula (2009) updated the analysis with a much larger sample and concluded that the $1 per day line had risen to $1.25 per day in 2005 due to inflation.

The World Bank Poverty Line has been highly controversial due to its method of construction. First, it is not clear what standard of comfort it represents since it was not set equal to the cost of a specified basket. Reddy and Pogge (2010), for instance, have argued that the World Bank should set an explicit standard adequate to meet basic needs. Ravallion (2010) has rejected a constant basket on the grounds that poor people vary their consumption in response to prices. One can overstate this, however. In the past, poor people were tightly constrained and ate mainly grain, legumes, and minimal quantities of animal protein and fat. Substitution consisted of choosing the cheapest kind of grain, the cheapest source of animal protein, and so forth. This sort of variation can be easily accommodated in the measurement of poverty, as has been done with the respectability and subsistence baskets.

Defining the poverty line as 'a dollar a day' has led to intractable disputes over price indices since comparing poverty levels across countries requires translating the dollar a day into local currencies. The World Bank procedure has been to use purchasing power parity (PPP) exchange rates for consumption. This is open to the objection that the set of prices indexed is broader than the range of goods purchased by the poor–and, hence, distorting.

---

[4]World Bank (1990, p.27). Strangely, Chen and Ravallion (2001, p. 285 n.6) specify the countries as 'Bangaladesh, China, India, Indonesia, Nepal, Pakistan, Tanzania, Thailand, Tunisia, and Zambia.' The data points for Egypt, Kenya, and Morocco lie among these ten and apparently support the dollar a day standard in the original study.

Likewise, updating the line over time raises analogous problems since inflation rates differ between countries and national prices indices differ from those relevant to the poor, so the effects are not captured by the evolution of the PPP exchange rates. These problems could all be avoided by defining poverty explicitly in terms of a basket of goods (allowing for local adjustment in response to food availability) that could be priced anywhere at any time.

While the World Bank refuses to propose a basket of goods to define the international poverty line, the various national poverty lines that form the basis of the dollar a day line were themselves based on their own baskets (or, in a few cases, on a sense of what that basket might have been). This is clear in the 2005 revision where most of the data come from poverty assessments using an explicit budgeting procedure. It was also true for the original $1 a day line, although the procedures were less standardized. The upshot is that the World Bank Poverty Line depends on the poverty line baskets of the poor countries in the dollar a day group. By examining their baskets, we can see what the dollar a day line means, and how it relates to the historical poverty lines we have discussed.

The Ravallion, Datt, van de Walle, Chan (1991, p. 34) data set included fifteen countries with poverty lines less than or equal to $1/day. It would be desirable to find the poverty line baskets of all of these countries, but that is not possible. In a few cases, lines were chosen with only a vague reference to the consumption of the poor. In his study of Pakistan, Naseem (1973, p. 321) noted that a satisfactory poverty line "would require a considerably detailed investigation" into nutrition requirements, geographical variation, and the structure of prices. "In the absence of a detailed investigation for the precise estimation of the poverty line, we have chosen two arbitrary benchmarks for the rural areas of Pakistan" as well as two higher benchmarks for urban areas. These lines were set with an eye towards the incomes of the poor–Naseem alluded to the Indian poverty line– but without an explicit budget.

Many poverty lines are taken from World Bank staff reports written in the 1980s, and many of these are either unavailable or provide too few details to be useful. In his study of the Dominican Republic, Musgrove (1984, p. 115, cf. 1986, p. 356) reported that "there has not yet been a detailed calculation establishing a minimum adequate budget," however, he did estimate a poverty line "based on the total spending and food spending of households in the second decile of total income, with an upward adjustment to compensate for their estimated short fall in caloric intake." Unfortunately, the resulting basket was not reported. The poverty line for Nepal was a modification of a Nepalese Planning Commission line that stipulated an average consumption of 2250 calories per person per day and assumed that food amounted to only 65% of consumption expenditure–a very low value (World Bank 1989, Vol. II, pp. 176-7). Further details are unavailable. Likewise the poverty line for China is based on two different Chinese government poverty lines, neither of which is spelled out in detail, or on relative poverty lines equal to 35% and 50% of average income. In the absence of information about the prices people actually paid for food, "we use several different expenditure-based poverty lines, including the official poverty line, without attempting to assign nutritional equivalence." (Ahmad and Wand 191, p. 236)

We are in better shape with poverty lines defined by independent social scientists as they provide more details of their methods. The food baskets for studies of Egypt, Tanzania, and Kenya are shown in Table 5. The Egyptian basket was intended to reflect the actual consumption pattern of the median household in a random sample drawn from 18 villages in Egypt in 1977, although the food quantities were all reduced in the same proportion so that the diet gave the calorie content corresponding to norms at the time. (Radwan and Lee 1986,

pp.. 17, 82-3). The Tanzanian diet contained only four foods and was intended to be 'deliberately austere.' (Jamal 2001, p. 38). The Kenyan diet with only maize and beans took simplification to the extreme. "Using only two staple commodities to compute a basic subsistence diet for small-holders in Kenya is bound to underestimate the cost of a realistic minimum diet, which would also contain small amounts of more palatable and expensive foodstuffs, such as meat, vegetables, dairy products, and sugar." (Crawford and Thorbecke 1980, p. 317). It will be no surprise that the costs of these diets vary enormously although they are all treated equivalently in inferring the dollar a day poverty line.

The measurement of deprivation and poverty has been studied in India since the late colonial period, and it remains contentious (Sukhatme 1961, Deaton and Kozel 2005). In 1962 the Indian Planning Commission chose the value of 20 rupees per month (in 1960/1 prices) as the minimum consumption level that should be a target of the fifth Five Year Plan. The Commission did not explain how it reached this figure, but a strong possibility, suggested by Rudra (2005, p. 373-6), is that it was based on the research of P.V. Sukhatme. He was a leading Indian statistician who investigated food issues, he was head of the statistics division of the FAO from 1952-70, and he lectured on "The food and Nutrition Situation in India" at the annual sessions of the Indian Society of Agricultural Statistics in the 1950s and 1960s (Sukhatme 1965, p. vi). He published various estimates of low cost diets that met nutritional objectives (eg. Sukhatme 1961, p. 498). In 1965, he published an influential assessment of India's food needs. His 'minimal level'diet, evaluated in 1960/1 prices, cost 15.63 rupees per month (Sukhatme 1965, pp. 120-1). Low income rural households at the time devoted approximately 79% of their spending to food (National Sample Survey 138, Table 1.6.0). Applying this percentage to the cost of Sukhatme's diet implies a total monthly expenditure of 19.8 rupees. This calculation would justify the Planning Commission's choice.

A weakness of this figure is that Sukhatme's diet contained more expensive foods than poor people consumed. Dandekar and Rath (1971, p. 7) observed that rural households with expenditures of 13 to 15 rupees per month in the NSS 1960/61 probably consumed about 2250 calories per person per day, which was adequate for the work they did. A more precise analysis of this group's spending shows that they consumed 2311 calories per day at a cost of 11.03 rupees for food and a total expenditure of 14.04 rupees per month. This was only 70% of the Planning Commission's 20 Rupee line, and it became the Indian point in the original World Bank Poverty Line data set (Ravallion, Datt, van de Walle, and Chan 1991, p. 34).

The Indian poverty line has been revised several times, most recently by the Tendulkar (2009) Commission. In the preceding generation, the established procedures for updating the poverty line to reflect inflation had generated a rural line that was no longer credible. Furthernore, despite a rise in real income as conventionally measured, per capita calorie consumption in rural India declined from 2266 calories per person in 1972/3 to 2047 in 2004/5 (Suryanarayana 2009, p. 35.) Apparently people were buying more expensive foods and more non-food items as their incomes rose. This behaviour calls into question the use of a calorie standard to set a poverty line. As a result, the Tendulkar (2009) Commission adopted the prevailing urban poverty line of 578.8 rupees per month as the national standard (as this one, unlike the rural one, had not been discredited) and worked out a new rural line from the differences in rural and urban prices. While explicitly renouncing a calorie basis for the poverty line, the line was none-the-less validated by showing that people at the line received adequate nutrition. A breakdown of expenditure for urban families on the line was provided (Tendulkar 2009,p. 32). These details indicate that the poverty line lay at about the average consumption pattern of the third and fourth declines of the urban population in the

2004/5 national sample survey, and from this information we can work out a budget that would generate the 2005 Indian poverty line. Table 6 shows Sukhatme's 1965 budget, the budget assumed by Dandekar and Rath (1971, p. 7) and built into the World Bank Poverty Line, and the budget implicit in the 2005 poverty line.

To establish the relationship between the 'dollar a day' line and the historical subsistence baskets, we can compare the baskets directly as well as their cost. They differ in three important ways. The first is the calories supplied per day. All other things equal, more calories implies a higher costs. The second is the range of foods. Generally, the more calories are derived from foods other than the basic carbohydrate, the more expensive is the diet. The third is the proportion of the spending devoted to food. More spent on non-food items raises costs. The historical baskets have somewhat lower than average calorie contents. The respectability and northern baskets contain more goods than the subsistence basket and look more like the Egyptian and Sukhatme baskets than the Kenyan and Tanzanian baskets. The subsistence basket has many similarities to the Kenyan and Tanzanian baskets, as well as the Dandekar-Rath basket for India. The non-food shares of the historical baskets are lower than those of most of the modern baskets.

The baskets can also be compared in terms of their cost. Table 7 shows estimates of the cost of historical subsistence baskets evaluated with prices from online shopping in the United States conducted mainly at the end of 2012. Most prices come from Safeway for delivery in San Francisco, and a few nonfood items come from other suppliers. The dollar a day line was recalibrated as $1.25 in 2005. If it is increased in line with the US consumer price index, it becomes $1.47 at the end of 2012. Comparison with Table 7 shows that the rice, maize, and wheat flour baskets bracket this figure with a mean of $1.58. Only the oatmeal basket at $2.47 per day looks out of line with the international poverty line. This provides some validation for the historical baskets in terms of World Bank practise.

The correspondence between the subsistence baskets and the $1 per day poverty line turns out to be looser when the subject is investigated over a longer time frame. Most of the relevant food and energy prices are available since 1980 in the US Bureau of Labor Statistics 'average retail food and energy prices' and the others can be inferred by extrapolating prices in Table 7. Figure 4 plots the cost of the various historical baskets valuing them with US prices. There was always a range in values with the wheat flour basket invariably the cheapest and the oatmeal basket the most expensive. In 1985 most baskets cost about $1 per day and in 2005 they bracketed $1.25 per day.

The modern poverty line baskets can be valued in US retail prices. Figure 5 shows the results for the Indian poverty lines. The Dandekar-Rath line lies between the cost of the maize and wheat flour subsistence baskets. The Sukhatme line, which is equivalent to the Indian Planning Commission 20 Rs line, and the 2005 line were both more expensive and greatly exceeded the 'dollar a day' standard as well as the other poverty lines.

The diversity in the value of different poverty lines is highlighted even more by Figure 6. The Egyptian line was extremely expensive and greatly exceeded the 'dollar a day' standard despite being in the original data set. Its exceptional cost is no surprise in view of its expensive foods and high non-food spending share. The Sukhatme-Planning Commission line and the 2005 line are the next most expensive. The various historical baskets and the Dandekar-Rath line, as well as the poverty lines for Kenya and Tanzania lie at the bottom.

The discrepancies among the poverty lines may reflect differences in the relative prices between countries. We can illustrate the problem with US and Indian prices in 2009 (Table 8). The prices received by farmers in the two countries were similar when converted

at the market exchange rate of rupees to the dollars. Rice was the most expensive grain followed by wheat and then by maize and oats. In India, the ratios of the prices of processed consumer goods to the corresponding farm prices were small. Consumers paid only a 5% mark-up on rice, and wheat and maize flour cost 38% - 77% more per kilo. In the United States, on the other hand, the corresponding mark-ups were much greater, presumably reflecting higher wage rates, and the disconnect between retail and farm gate prices was enormous. Wheat flour sold at more than double the farm gate price of wheat, and rice at the retail level was almost five times as expensive as it was on the farm. Maize flour and oatmeal were marked up by factors of 17 and 24 over the farm gate prices of corn and oats. The effect of these mark-ups was to make maize and oats the most expensive products in US super markets whereas they were the cheapest products on the farm, and maize was one of the cheapest foods at any point along the food chain in India.

Did the differences in relative prices affect the rankings of the various baskets? Figures 7-9 value the baskets with Indian rural retail prices and then convert the results to US dollars using the World Bank's PPP exchange rates for private consumption. Figure 7 shows that the historical subsistence baskets based on wheat flour, rice, and maize all cost less than the 'dollar a day' standard (in contrast to Figure 4 where US retail prices were used). The significance of this is called into question, however, when the Indian poverty lines are expressed in US dollars. The Sukhatme-Planning Commission line is the highest but certainly on the low side of a 'dollar a day'. The Dandekar-Rath line is very low, indeed, being little different from the wheat historical basket. Figure 8 adds some of the other lines discussed. As in Figure 5, the Egyptian and Sukhatme-Planning Commission lines are the most expensive with the latter giving the best tracking of the 'dollar a day' standard. The 2005 Indian line was lower. Once again, the Dandekar-Rath line for India, the historical wheat subsistence basket and the poverty lines developed for Kenya and Tanzania cost less than a 'dollar a day' but were close to each other.

The question motivating these comparisons was the relationship between the historical baskets and modern poverty lines. The comparisons revealed a greater range in the value of modern poverty baskets than was anticipated. The comparisons depend in detail on the prices used to value the baskets, but the following were generally true: The respectability and northern baskets are on a par with the more expensive modern baskets like those of Egypt and those proposed by Sukhatme and in Tendulkar Commission for India. The subsistence basket has a cost like the baskets proposed for Tanzania or Kenya or the Dandekar-Rath poverty line for India.

An Inter-Temporal Price Issue

Table 7 raises a small mystery: For earlier periods in American history, a maize-based basket was used, and yet the wheat-based basket was clearly less expensive in 2011. Was the use of the maize basket in earlier years a mistake or had relative costs of the baskets changed? While the oat basket was never the cheapest in the Americas, its extremely high cost vis-à-vis wheat in 2011 raises the same question with respect to Northwestern Europe where an oat-based basket was used for historical calculations.

In fact, wheat emerged as the cheapest source of calories during or after the Industrial Revolution. Figure 10 shows the price paid per pound for oatmeal and wheat flour by Greenwich Hospital from 1748 to 1902. Before Waterloo, oats were always cheaper by a substantial margin, and this had been the relationship since the middle ages. From about

1815 to the 1870s, Greenwich Hospital paid similar prices for wheat flour and oat meal. From the 1880s onward, wheat flour was substantially cheaper and remains so. The fall in the price of wheat was a consequence of the global market in wheat that emerged in the nineteenth century and the immense exports originating from Australia, Russia, Argentina, and North America.

Maize remained the cheaper source of calories in the Americas later than oats in Europe. Figure 11 shows the retail price of wheat flour and corn meal in Boston from 1785 to 1930. Before the 1890s, corn meal was always cheaper. From 1890 to 1925, the prices were similar. After 1925, wheat dropped below maize. Its unfortunate that the Bureau of Labor Statistics stopped publishing Boston prices in 1930, so we cannot track the evolution since then. Certainly today, wheat flour is much cheaper than maize flour.

It was always clear that different subsistence baskets should be used in different parts of the world since the cheapest grain was different in different places. The implication of Figure 11 is that baskets are not constant over time. They should also be changed from time to time to reflect changes in relative food prices

Conclusion

This paper has explored the interface between historical real wage indices and modern food security and poverty lines in an effort to connect our understanding of the past to the present. Connection requires consistently defined indicators. In this case, the main issue is the deflator used to adjust income differences for differences in the prices of consumer goods.

Analysis of the logic and practice of food security lines suggests that we can improve the historical measures by raising the calorie content of the food basket to 2100 calories and interpreting the basket to apply to each person rather than to an adult male equivalent. These changes would bring the baskets into alignment with modern food security lines, as well as the nutritional assumptions underlying many poverty lines. Furthermore, explicit calculations indicate that this calorie standard is consistent with the energy requirements of people living in earlier times.

Analysis of the World Bank poverty line indicates that a subsistence basket based on 2100 calories per person is consistent with the ‘dollar a day’ line under many assumptions. The analysis does highlight many of the unsatisfactory features of the World Bank Poverty Line, however, that result from its method of construction. Perhaps the World Bank can learn a lesson from historians and settle on an explicit definition of poverty that can be applied across space and over time. Historical research indicates that this is practical. The benefits in terms of transparency and intelligibility would be large.

Table 1

Historical Baskets

		Respectability	Subsistence	Northern
bread	kg	182		
grain	kg		170	121
beans/peas	kg	34	20	
potatoes	kg			163
meat	kg	26	5	5
butter	kg	5.2	3	5
cheese	kg	5.2		3
eggs	kg	52		
milk	litres			220
beer	litres	182		120
sugar	kg			1.4755
tea	kg			1.4755
soap	kg	2.6	1.3	1.3
cloth	metres	5	3	3
candles	kg	2.6	1.3	1.3
lamp oil	litres	2.6	1.3	1.3
fuel	Mill BTU	5	2	2
calories/day		2103	2099	2101
food share				86%

note:
Grain- This diet assumes the grain was oats. Different quantities are used for other grains, eg maize (182), rice (187), millet (184), wheat flour (195).
subsistence-
Northern-65 kg of barley plus 56 kg of oatmeal

Table 2

Labourer's Annual Time Budget

			days at work		days not at work	
labourer (male)						
	PAR		hours	PAR*hours	hours	PAR*hours
rest hours						
sleep	1		7	7	7	7
personal	2.3		1	2.3	1	2.3
eating	1.4		1	1.4	4	5.6
drinking	1.4		2	2.8	3	4.2
chores	2.3		2	4.6	2	4.6
misc	1.5		0	0	7	10.5
work hours						
digging (a	5.6		1.5	8.4	0	0
loading (m	3.2		2	6.4	0	0
cleaning e	4		2	8	0	0
carry wood	6.6		2	13.2	0	0
walking	2.3		1	2.3	0	0
eating	1.4		2.5	3.5	0	0
total hours =			24	59.9	24	34.2
work hrs/day =			11	2.495833		1.425
days/year =				250		115
				623.9583		163.875
PAL =				2.158447		

Table 3

Carpenter's Annual Time Budget

			days at work			days not at work	
carpenter							
	PAR		hours	PAR*hours		hours	PAR*hours
not at work							
sleep	1		7	7		7	7
personal	2.3		1	2.3		1	2.3
eating	1.4		1	1.4		4	5.6
drinking	1.4		2	2.8		3	4.2
chores	2.3		2	4.6		2	4.6
misc	1.5		0	0		7	10.5
work							
nailing	3		4.5	13.5		0	0
roofing	2.9		2	5.8		0	0
sawing	6.7		0.5	3.35		0	0
carry wood	6.6		0.5	3.3		0	0
walking	2.3		1	2.3		0	0
eating	1.4		2.5	3.5		0	0
			24	49.85		24	34.2
work hrs/day =			11	2.077083			1.425
				250			115
				519.2708			163.875
PAL =				1.871632			

Table 4

Spinner's Annual Time Budget

			days at work			days not at work	
spinner (female)							
	PAR		hours	PAR*hours		hours	PAR*hours
rest hours							
sleep	1		7	7		7	7
personal	2.3		1	2.3		1	2.3
eating	1.4		1	1.4		4	5.6
leisure	1.4		1	1.4		3	4.2
cooking	2.1		2	4.2		2	4.2
houseworl	2.8		1	2.8		7	19.6
work hours							
spinning	2.2		7.5	16.5		0	0
loading (m	3.2		0	0		0	0
cleaning e	4		0	0		0	0
carry wood	6.6		0	0		0	0
walking	2.3		1	2.3		0	0
eating	1.4		2.5	3.5		0	0
total hours =			24	41.4		24	42.9
work hrs/day =			11	1.725			1.7875
days/year =			2750	250			115
				431.25			205.5625
PAL =				1.744692			

Table 5

Some Modern Baskets underlying
the World Bank Poverty Line
(Kilograms per person per year)

	Egypt	Tanzania	Kenya
wheat	34.2		
maize	33.6	188.2	136.9
millet	1.1		
flour	44.7		
rice	22.7		
macaroni	54.2		
beans/pulses	20.9	37.6	58.7
meat	5.5		
poultry/fish	3.6		
eggs	3.4		
oil/fat/butter	7.8	5.4	
milk	3.4		
cheese	8.2		
potatoes	12.1		
onions	8.0		
tomatoes	13.7		
other veg/fruit	6.6		
sugar	14.8	11.47	
Kcal/day	2114	2200	1715
food share	60%	75%	75%

sources:
Egypt–Radwan and Lee (1986, p. 83)for food consumption per adult equivalent, p. 84 for ratio of food to total, and p. 86 for ratio of people to adult equivalents. The quantity of beans and pulses were increased in proportion to the calories derived from the consumption of cooked beans and falafel, the quantities of which are not reported.
Tanzania–Jamal (2001, p. 38). This appears to be a published version of the source cited by Ravallion, Datt, van de Walle, and Chan (1991).
Kenya–Crawford and Thorbecke (1980, p. 316) for diet per adult equivalent and p. 318 and 319n16 for the ratio of people to adult equivalents.

Table 6

Indian Poverty Line Budgets

	Sukhatme	Dendekar-Rath	Tendulkar (implicit)
grain	147.10	204.67	122.52
starchy roots	16.79		
legumes/pulses	37.96	20.09	9.80
milk	73.37	14.60	29.07
oil	6.57	2.33	7.32
meat etc	2.56	1.54	7.92
fish & eggs	6.94		
sugar	18.25	6.69	8.1
salt & spices			2.96
fruit & veg	50.01		61.64
other food		2.38	17.04
intoxicants			1.78
clothing		7.91	
fuel & light		1.52	
miscellaneous		[1.3 R.]	
Kcal/day		2311	1960
food share		79%	56%

Note: all food is kilograms/person/year. Clothing is metres of cloth, fuel & lighting is in millions of BTUs (derived from implicit consumption of kerosene). The 1.3 Rupees shown as ‘miscellaneous’ is the spending on miscellaneous items in NSS 138, Table 1.6.0 for 13-15 Rs. per person per month.

Table 7

The Cost of Subsistence Budgets in USA in 2011

Barebones subsistence at 30 jan 2011				Prices of Delivery to area code 94115, San Francisco, CA.							
www.safewway.com											
		oat	rice	maize	wheatflour	prices		oat	rice	maize	wheatflour
						$/unit					
wheat flour	kg				195	$1.10					$214.13
oat porridge	kg	170				$3.69		$626.91			
rice	kg		185			$1.96			$362.25		
Flour corn	kg			182		$2.43				$442.87	
red kidney beans	kg	20	20	20	20	$4.28		$85.56	$85.56	$85.56	$85.56
meat-beef roasting	kg	5	5	5	5	$7.70		$38.49	$38.49	$38.49	$38.49
butter, unsalted	kg	3				$9.68		$29.04	$0.00	$0.00	$0.00
vegetable oil	l		3	3	3	$2.46		$0.00	$7.38	$7.38	$7.38
soap	kg	1.3	1.3	1.3	1.3	$5.48		$7.12	$7.12	$7.12	$7.12
candles	kg	1.3	1.3	1.3	1.3	$3.27		$4.25	$4.25	$4.25	$4.25
oil (lighting) (veg o	l	1.3	1.3	1.3	1.3	$4.64		$6.03	$6.03	$6.03	$6.03
cotton cloth	sq m	3	3	3	3	$4.66		$13.99	$13.99	$13.99	$13.99
coal	mill BTUs	2	2	2	2	$23.21		$46.41	$46.41	$46.41	$46.41
charcoal	mill BTUs					$242.33		$0.00	$0.00	$0.00	$0.00
No 2 home heating	mill BTUs					$25.50					
total								$857.81	$571.48	$652.11	$423.37
rent allowance @5%								$42.89	$28.57	$32.61	$21.17
total per person ($)								$900.70	$600.06	$684.71	$444.54
cost per day ($)								$2.47	$1.64	$1.88	$1.22

Table 8

Indian and USA prices, 2009

United States prices $/kg				
		farm		retail
		$/kg		$/kg
wheat		$0.25		$0.51
rice		$0.37		$1.76
maize		$0.16		$2.73
oats		$0.14		$3.35
Indian prices				
	farm	farm	retail	retail
	Rups/kg	$/kg	Rups/kg	$/kg
wheat	12	$0.25	16.54	0.341698
rice	18.2	$0.38	19.21	0.396858
maize	9	$0.19	15.92	0.32889

Figure 1

Respectability Ratios

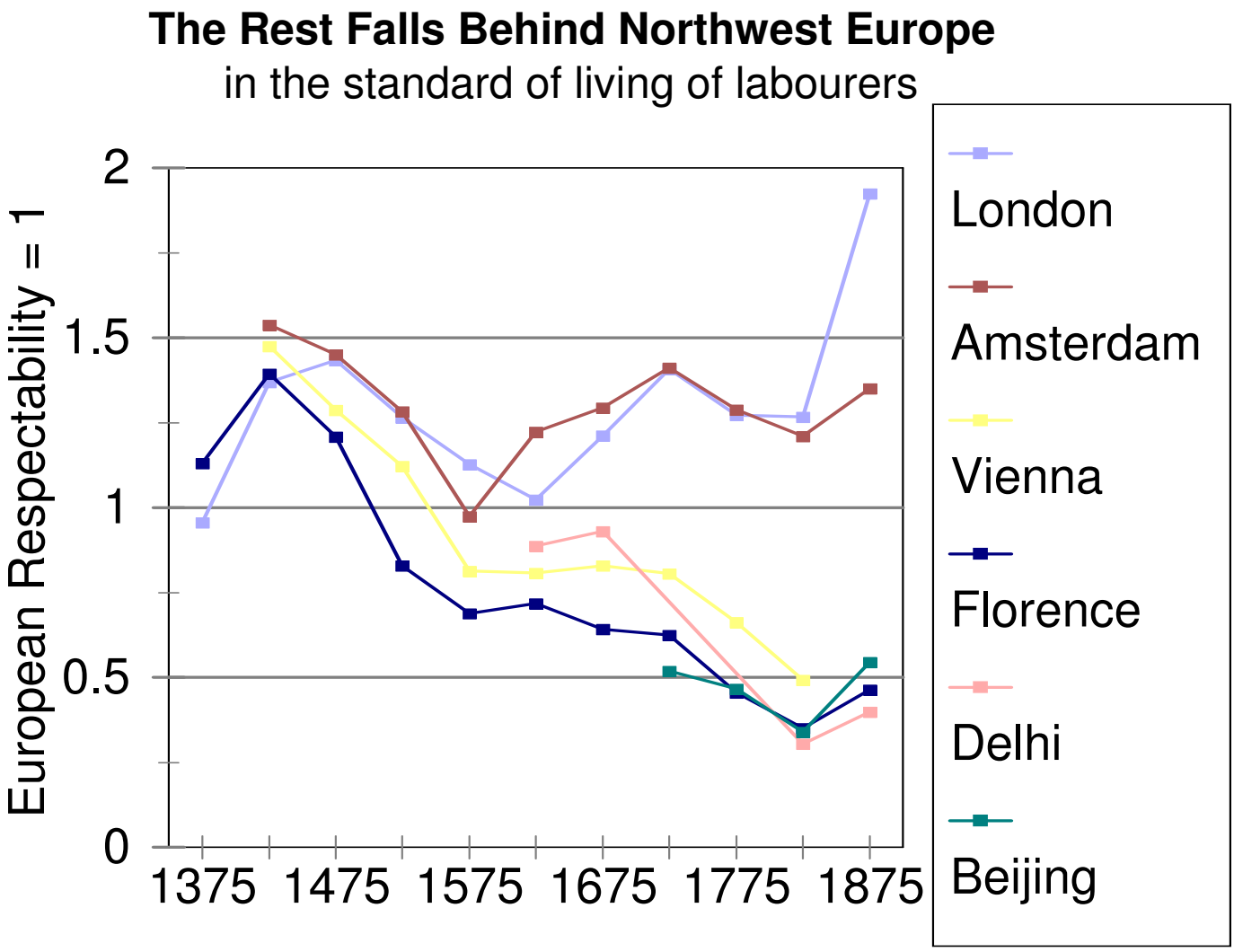


Figure 2

Subsistence Ratios

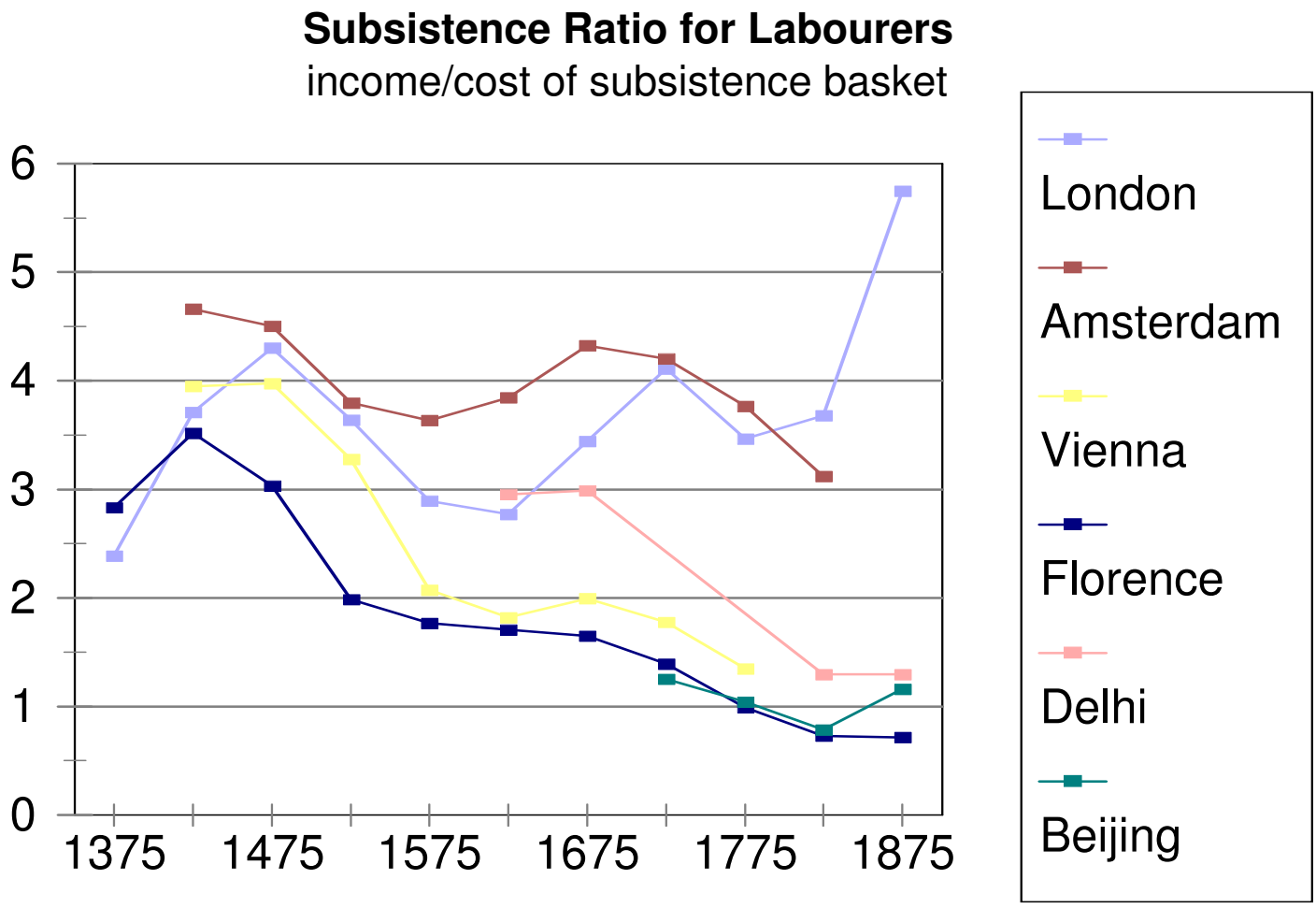


Figure 3

Subsistence Ratio (new basis)

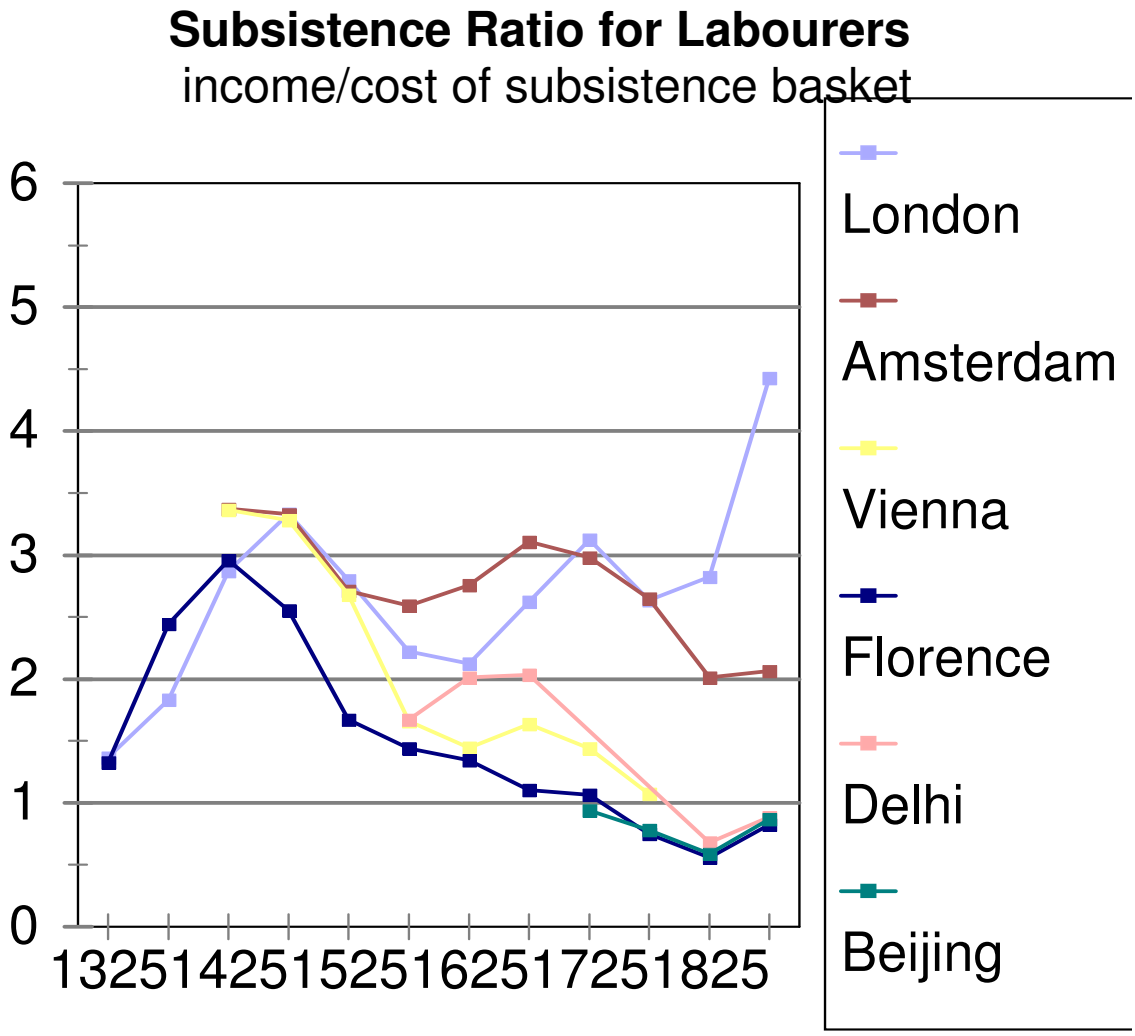


Figure 4

Historical Subsistence Baskets valued in US retail prices

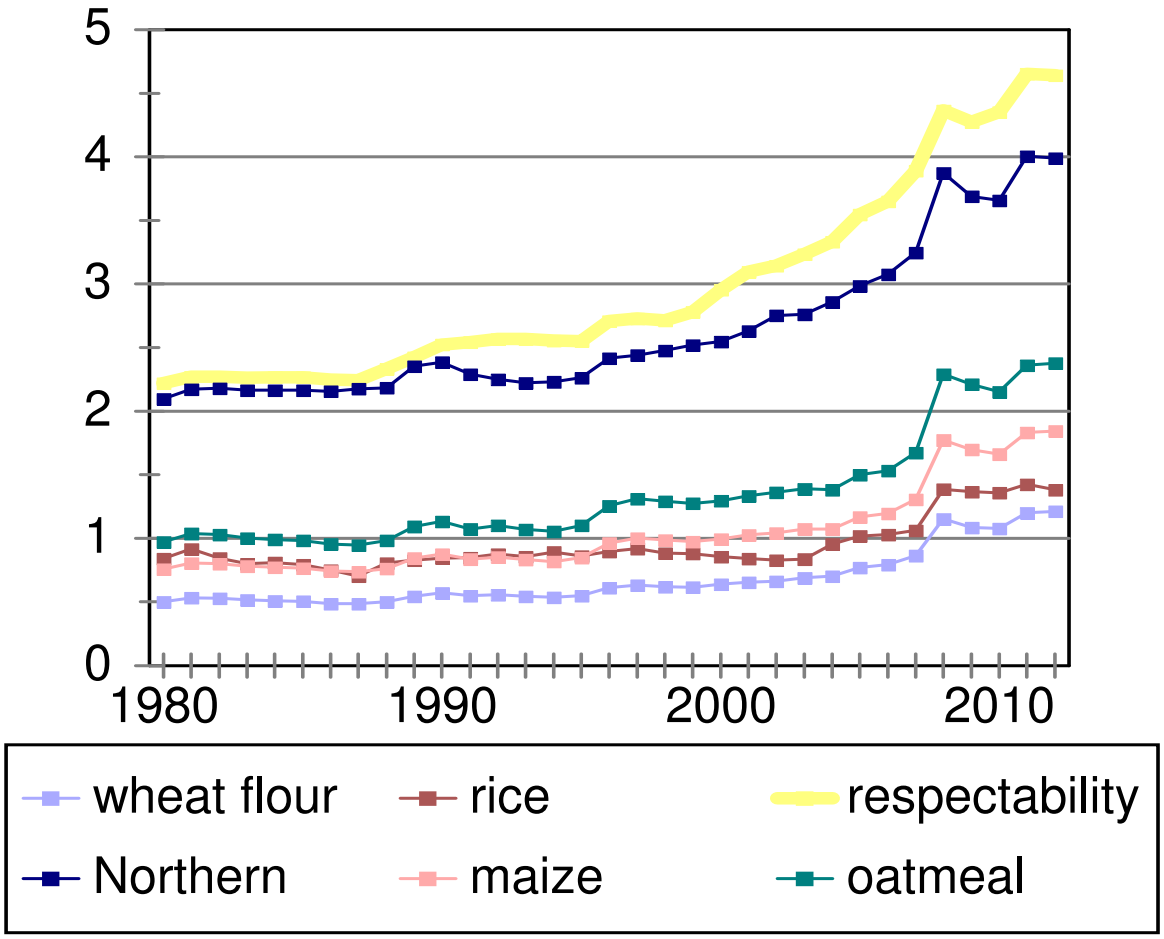


Figure 5

Indian Poverty Budgets valued in US retail prices

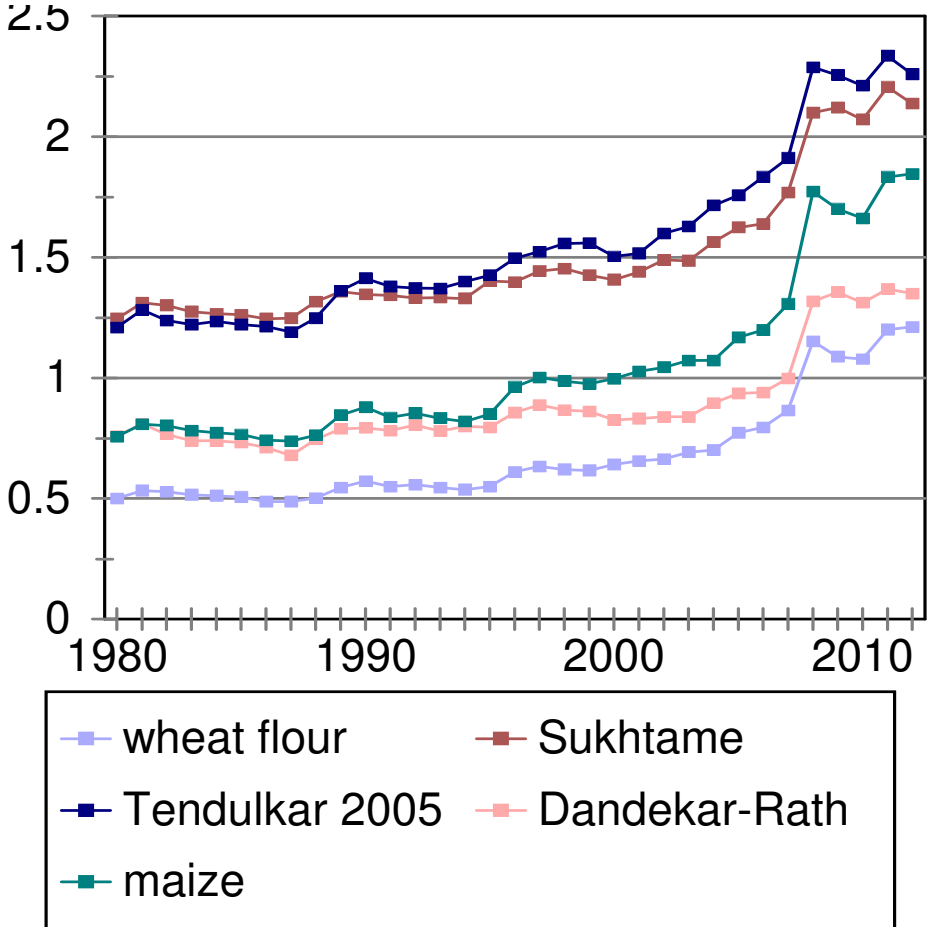


Figure 6

Modern Poverty Budgets valued in US Retail Prices

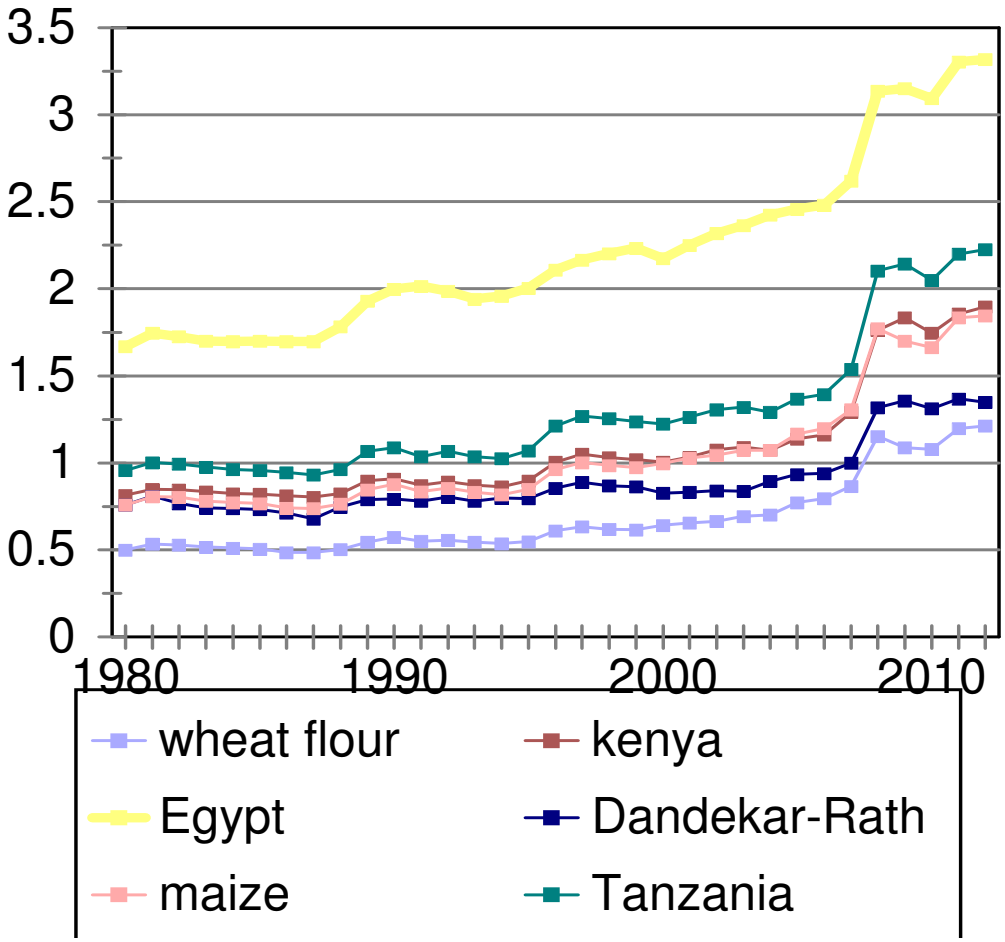


Figure 7

Historical Subsistence Baskets Valued in Rural Indian Prices

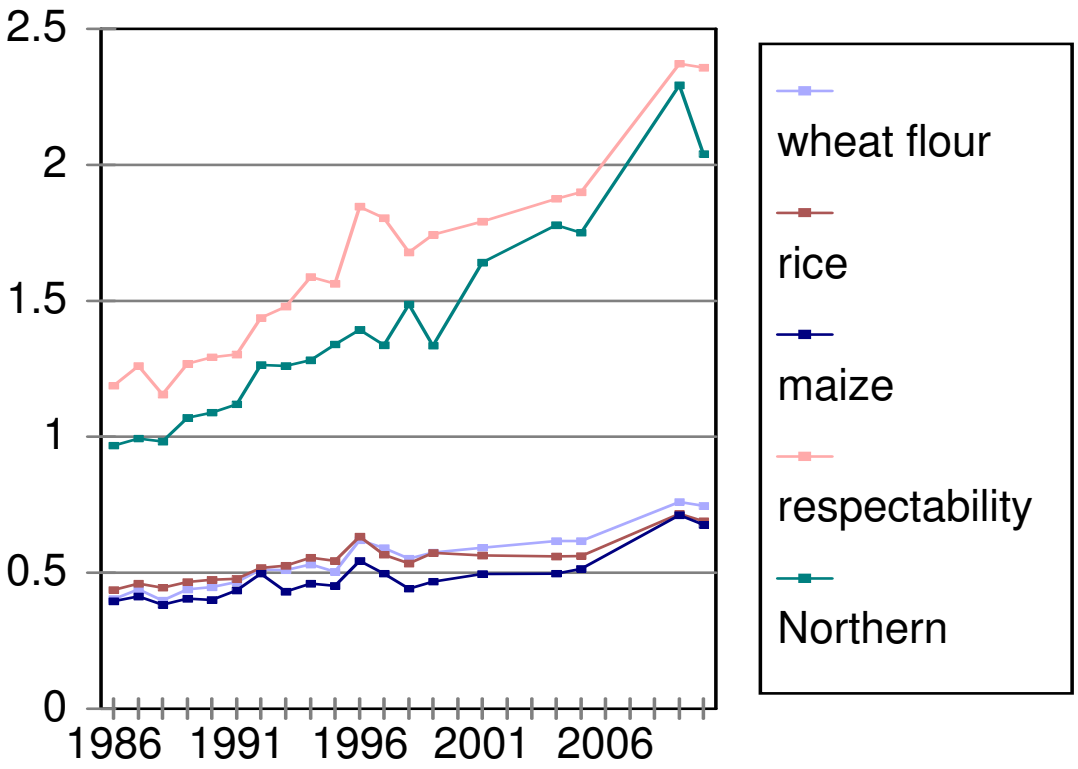


Figure 8

Indian Poverty Budgets value in Rural Indian Prices

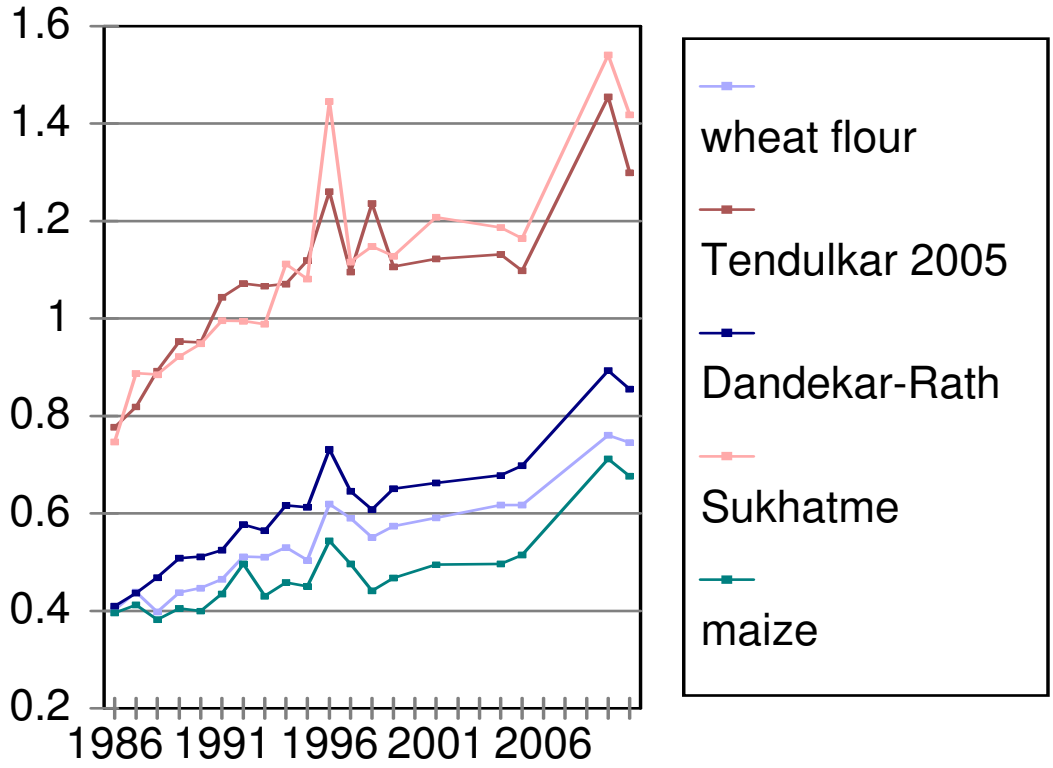


Figure 9

Modern Poverty Budgets valued in Rural Indian Prices

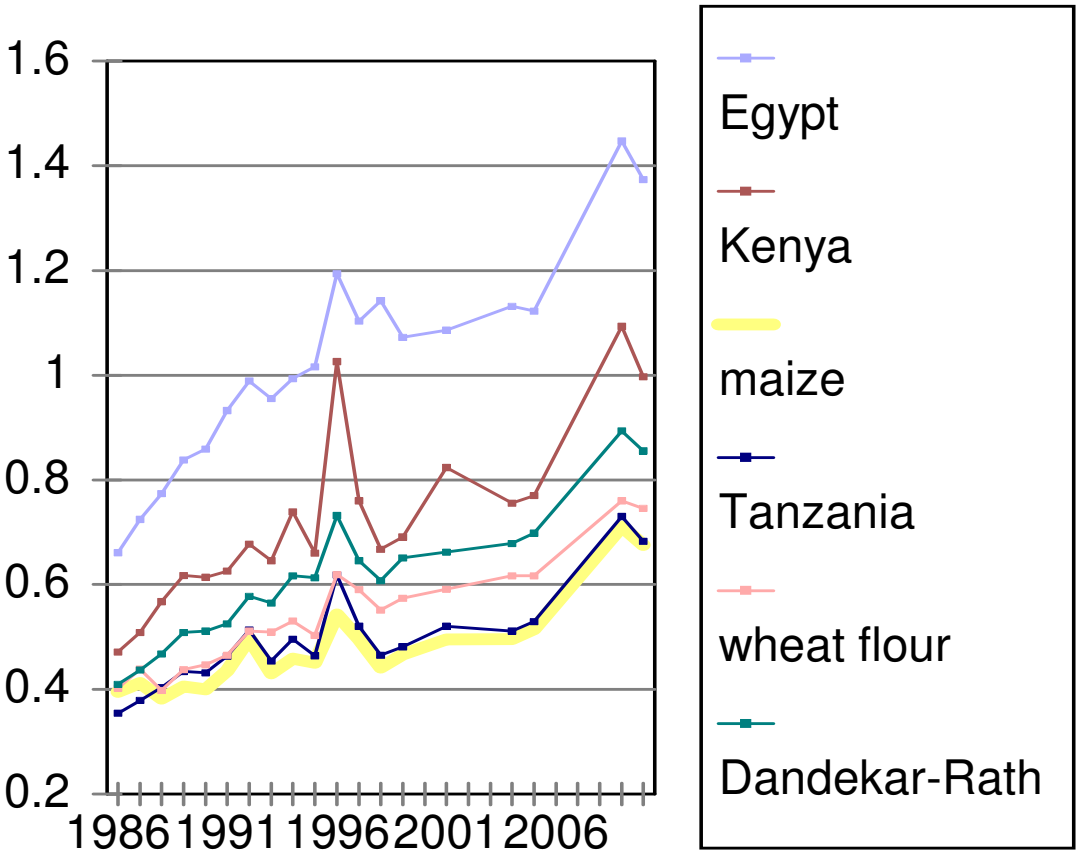


Figure 10

Price Paid by Greenwich Hospital for Wheat Flour and Oatmeal

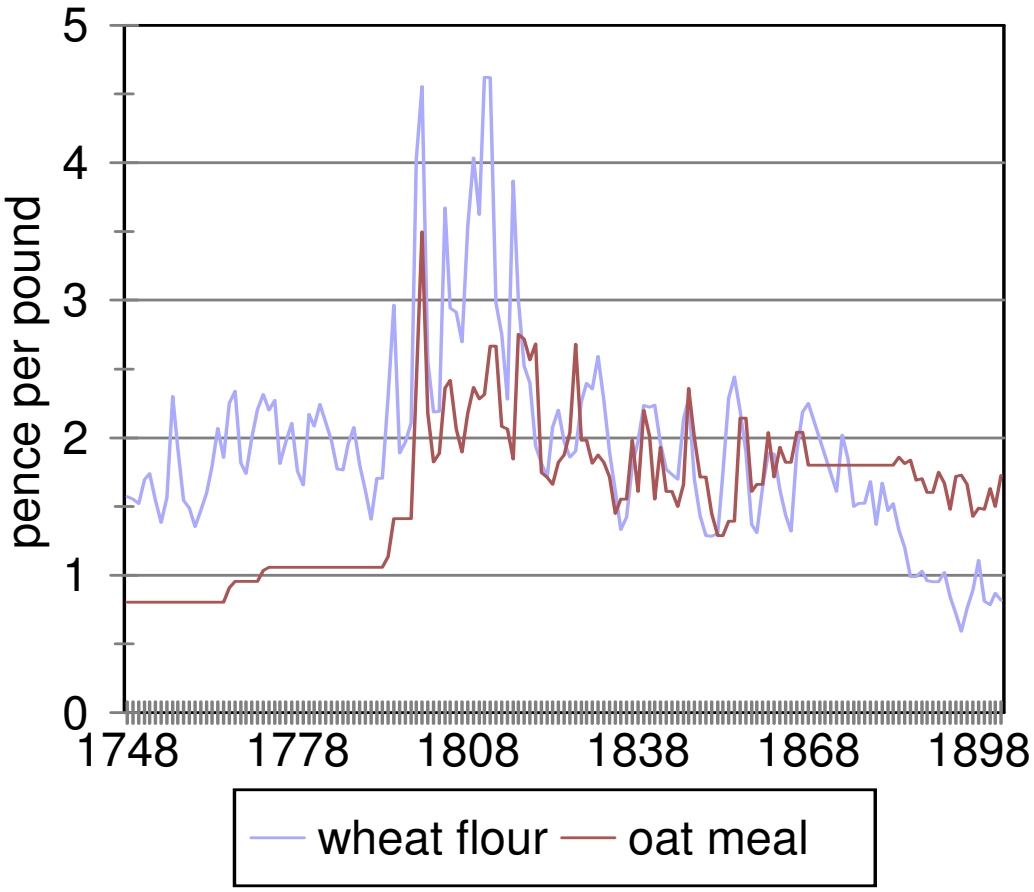
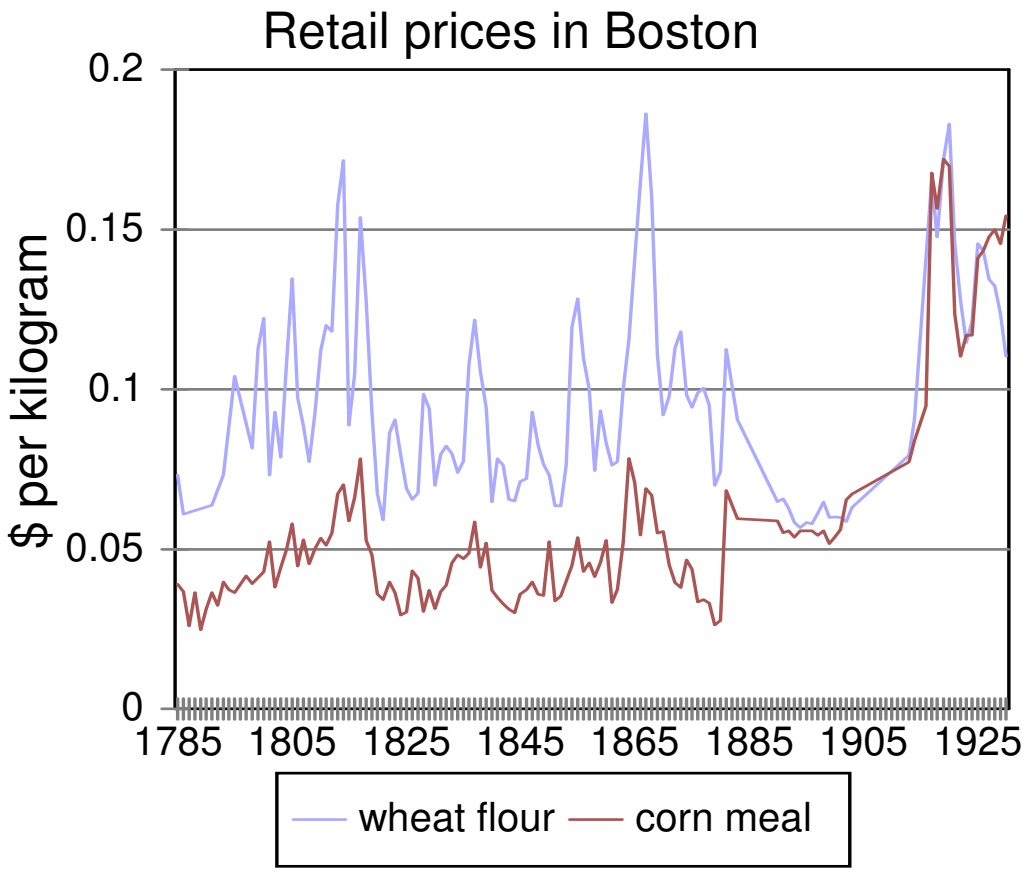


Figure 11

Retail Price in Boston for Wheat Flour and Corn (Maize) Meal



References

Ahmad, Ehtisham and Wang, Yan (1991). “Inequality and Poverty in China: Institutional Change and Public Policy, 1978 to 1988,” *World Bank Economic Review*, Vol. 5, No. 2, pp. 231-257.

Allen, Robert C. (2001). "The Great Divergence in European Wages and Prices from the Middle Ages to the First World War," *Explorations in Economic History*, Vol. 38, October, pp 411-447.

Allen, Robert C. (2007). “India in the Great Divergence,” Timothy J. Hatton, Kevin H. O’Rourke, and Alan M. Taylor, eds., *The New Comparative Economic History: Essays in Honor of Jeffery G. Williamson*, Cambridge, MA, MIT Press, pp. 9-32.

Allen, Robert C. (2009a). *The British Industrial Revolution in Global Perspective*, Cambridge, Cambridge University Press.

Allen, Robert C., Bassino, Jean-Pascal, Ma, Debin, Moll-Murata, Christine, van Zanden, Jan-Luiten (2011). “Wages, Prices, and Living Standards in China,1739-1925: in comparison with Europe, Japan, and India," *Economic History Review*, Vol. 64, pp. 8-38.

Allen, Robert C., and Weisdorf, Jacob (2011). "Was there an ‘Industrious Revolution’ before the Industrial Revolution? An Empirical Exercise for England, c. 1300-1830," *Economic History Review*, Vol. 64, pp. 715-29.

Allen, Robert C. (2011a). *Global Economic History: A Very Short Introduction*, Oxford, Oxford University Press.

Blackorby, Charles and Donaldson, David. (1987). “Welfare ratios and distributionally sensitive cost-benefit analysis,” *Journal of Public Economics*, Vol. 34, pp. 265–90.

Braudel, F.P., and Spooner, F. (1967). “Prices in Europe from 1450 to 1750,” *The Cambridge Economic History of Europe from the Decline of the Roman Empire,* Volume 4, *The Economy of Expanding Europe in the Sixteenth and Seventeenth Centuries,* ed. by E.E.Rich and C.H. Wilson, Cambridge, Cambridge University Press, pp. 374-486.

Chen, S., and Ravallion, M. (2001). “How did the World’s Poorest Fare in the 1990s?” *Review of Income and Wealth*, series 47, No. 3, pp. 283-300.

Cinnirella, Francesco (2008). "Optimists or Pessimists? A Reconsideration of Nutritional Status in Britain," *European Review of Economic History, Vol.* 12 (3), pp. 325-354.

Crawford, Eric, and Thorbecke, Erik (1980). “An Analysis of Food Poverty: An Illustration from Kenya,” *The Pakistan Development Review*, Vol. XIX, No. 4, pp. 311-335.

Dandekar, V.M., and Rath, N. (1971). *Poverty in India*, Poona, Indian School of Political Economy.

Davies, David (1795). *The Case of Labourers in Husbandry Stated and Considered*, Bath.

Deaton, Angus, and Kozel, Valerie (2005). *The Great Indian Poverty Debate*, Delhi, Macmillan India Ltd.

Eden, Sir Frederick Morton (1797). *The State of the Poor*, London, J. Davis.

Food and Agricultural Organization of the United Nations (2001). *Human Energy Requirements: Report of a Joint FAO/WHO/UNU Expert Consultation*

Food and Agricultural Organization of the United Nations (2008a). *The State of Food Insecurity in the World*

Food and Agricultural Organization of the United Nations (2008b). *FAO Methodology for the Measurement of Food Deprivation: Updating the minimum dietary energy requirements*.

Floud, Roderick, Fogel, Robert, Harris, Bernard, Hong, Sok Chul (2011). *The Changing Body: Health, Nutrition, and Human Development in the Western World since 1700*, Cambridge, Cambridge University Press.

Floud, Roderick, Wachter, Kenneth, and Gregory, Annabel (1990). *Height, health and history : nutritional status in the United Kingdom, 1750-1980*, Cambridge, Cambridge University Press.

Humphries, Jane. (2012). "The lure of aggregates and the pitfalls of the patriarchal perspective: a critique of the high wage economy interpretation of the British industrial revolution," *Economic History Review*, on-line publication.

Jamal Vali (2001). "Chasing the Elusive Rural-Urban Gap in Tanzania," *Journal of Contemporary African Studies*, Vol. 19, No. 1, pp. 25-38.

Musgrove, Philip (1984). "Household Income Distribution in the Dominican Republic: A First Look at New Survey Data," in *The Collection and analysis of Economic and Consumer Behavior Data: In Memory of Robert Ferber*, Bureau of Economic and Business Research & Survey Research Laboratory, University of Illinois, pp. -121.

Musgrove, Philip (1986). "Distribución del Ingreso Familiar en la República Dominicana, 1976-1977: La Encuesta Nacional de Ingresos y Gastos Familiares," *El Trimestre económico*, Vol. 53, pp. 341-92.

Naseem, S.M. (1973). "Mass Poverty in Pakistan: some Preliminary Findings," *The Pakistan Development Review*, Vol. XII, No. 4, pp. 317-360.

Radwan, Samir and Lee, Eddy (1986). *Agrarian Change in Egypt: An Anatomy of Rural Poverty*, London, Croom Helm.

Ravallion, M. (2010) "How *not* to count the poor: A Reply to Reddy and Pogge." in *Debates*

in the Measurement of Poverty, ed. By Joseph Stiglitz, Sudhir Anand and Paul Segal, Oxford University Press, pp. 86-101

Ravallion, M., Datt, G., van de Walle, D. (1991). "Quantifying Absolute Poverty in the Developing World," *Review of Income and Wealth*, series 37, No. 4, pp. 345-61.

Ravallion, M., Datt, G., van de Walle, D., Chan E. (1991). "Quantifying and Severity of Absolute Poverty in the Developing World," PRE Working Paper 587, World Bank.

Ravallion, M. and Chen, S. (1997). "What can New Survey Data Tells Us about Recent Changes in Distribution and Poverty?" *The World Bank Review*, Vol. 11, No. 2, pp. 357-82.

Ravallion, M., Chen, S., and Sangraula, P. (2009). "Dollar A Day Revisited," *World Bank Economic Review*, Vol. 23, No. 2, pp. 163-84.

Reddy, S.G., and Pogge, T. (2010). "How *not* to count the poor," in *Debates in the Measurement of Poverty*, ed. By Joseph Stiglitz, Sudhir Anand and Paul Segal, Oxford University Press, pp. 42-85.

Sukhatme, P.V. (1961). "The World's Hunger and Future Needs in Food Supplies," *Journal of the Royal Statistical Society*, Series A (General), Vol. 124, No. 4, pp. 463-525

Sukhatme, P.V. (1965). *Feeding India's Growing Millions*, London, Asia Publishing House.

Suryanarayana, M.H. (2009). "Nutritional Norms for Poverty: Issues and Implications," Concept paper prepared for the Expert Group to Review the Methodology for Estimation of Poverty.

Tendulkar, S.D. (2009). "Report of the Expert Group to Review the Methodology for Estimation of Poverty," Government of India, Planning Commission.

United States Department of Agriculture. (2010). *Food Security Assessment, 2010-2020*,

van Zanden, J.L. (1999). "Wages and the Standard of Living in Europe, 1500-1800," *European Review of Economic History*, Vol. 3, pp. 175-197.

Voth, Hans-Joachim (2000). *Time and work in England, 1750-1830*, Oxford, Clarendon Press.

World Bank (1989). *Nepal Social Sector Strategy Review*, Report No. 7498-NEP, two volumes.

World Bank (1990). *World Development Report*.