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### The First World War and Working-Class Food Consumption in Britain

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**Abstract:** We re-assess the changes in British working class diets through WW1. The 1918 Sumner Committee's work on this was limited by a lack of consistency across household surveys. Our rediscovered 1904 data allow a cleaner comparison. Though calorie intake was maintained, we find a closing of the nutritional gap between skilled and unskilled workers. We also find reductions in intakes of several key vitamins. These were possibly side effects of the food control system. For many unregulated foodstuffs, such as fruit and vegetables, prices rose dramatically as production fell, and this may have been what caused the fall in vitamin C intake among skilled workers.

**JEL Classification:** N34, N44

**Key Words:** First World War, Britain, food controls, food consumption, nutrition

## **Introduction**

Evidence of the impact of the First World War on food consumption and nutrition mostly derives from the findings of The Working Class Cost of Living Committee of 1918 (hereafter the Sumner Committee). The Sumner Committee was appointed by the Government to enquire into the living standards impact of the increase in the cost of living since July 1914 (British Parliamentary Papers, 1918). They had no suitable 1914 benchmark, so they extrapolated from the published results of the Board of Trade's 1904 survey of expenditures by working class households, adjusting for changes in prices, incomes and family size. The Sumner enquiry was carried out a few weeks before the imposition of a national rationing scheme. The Committee concluded that in June 1918, 'the working classes, as a whole, were in a position to purchase food of substantially the same nutritive value as in June 1914' and that 'families of unskilled workmen were slightly better fed at the later date, in spite of the rise in the cost of food.'

The question of the impact of food policy is of interest because recent contributions to the literature on the 'Home Front' in Britain during the First World War have emphasised the way in which political and economic spheres were increasingly entwined, especially in the period after the fall of the Asquith Liberal government at the very end of 1916. The formation of Lloyd George's coalition government is typically seen as marking a shift to one in which political and military leaders more fully embraced the needs of 'total war'. From the beginning of 1917, it is argued that the government adopted a 'statist-corporatist' approach to wartime production and the direction of labour (Millman, 2000, p.167). Ultimately, the objective of military victory required the state to control, regulate and direct the activities of non-combatants to an extent that was scarcely imaginable in 1914.

According to Gregory (2008, p.196), in the first two years of the war, food shortages were localised and of relatively short duration, as high prices had 'provided incentives for increased supply.' But as the war progressed, shortages and inflationary pressure increased, and demands for state intervention became more persistent. The 1917 enquiry into industrial unrest pointed to increases in the cost of living, along with deep rooted suspicion of profiteering, as the primary causes of discontent, though local factors also played their part in some regions. As a consequence, state control of

food prices and food distribution networks was seen as vital to combat this widespread industrial unrest that had increased sharply in the spring of 1917 and continued to significantly disrupt production until the end of the year (Millman, op. cit., p. 167). In November 1917, more than 0.5 million working days were lost due to strike action, before strike activity declined early in 1918 (Waites, 1987, p.232).

The claims of the Sumner Committee are re-assessed below, using some recently rediscovered returns of the 1904 survey.<sup>1</sup> These extant returns enable us to overcome some of the difficulties of comparison that limited the Sumner Committee's enquiry. In particular, we are able to classify the 1904 households by the head of household's occupational class. This is important because the 1918 enquiry did not solicit details of household income but did collect details of occupation. The Sumner Committee could neither make a clean comparison between pre-war and wartime working class expenditures on the basis of income groups, nor such a comparison on the basis of occupational class.

We find that there were significant shifts in the contents of the weekly food basket between 1904 and 1918 with large increases in consumption of sausages, bacon, bread, margarine and condensed milk and falls in the consumption of, *inter alia*, butter, fruit and vegetables. The average calorific value of foods consumed fell by about 16 percent for skilled workers, but not for unskilled workers, so the outcome was a partial levelling of food consumption.<sup>2</sup> The change in food consumption that occurred during the war lead to reductions in the available quantities of vitamins A and B12 for all workers and additionally reductions in vitamins C, D and riboflavin for skilled workers. We conclude that our research suggests a modification of the conventional view of the effects of food control in the First World War. While energy levels were maintained by a combination of price controls and rationing, the intakes of some key nutrients deteriorated.

In addition we assess whether there is evidence in the data on how household choices in 1918 were affected by price controls and rationing. The household demand for particular foods would likely have changed as a result of changes in household structure and income, irrespective of the impact of the War on supply. In this article, we use the original extant returns of the 1904 Board of Trade's household expenditure

survey to forecast what food consumption would have been in 1918, at prevailing June 1918 prices, given the change in income and demographic structure of households between 1904 and 1918. We are then able to compare predicted consumption in 1918 with actual consumption as recorded by the Sumner Committee. This allows us to make judgements about the probable impact of rationing. We find that although rationing was no doubt important determining the pattern of spending on some key foods, such as sugar and butter, it is also clear that price controls, and the lack of them on some foods, play a major role in understanding the quite radical shifts in consumption between foodstuffs.

### **1. Food Rationing and Price Controls.**

Before the War about 60 percent of the energy value of the British diet was derived from foodstuffs that were imported (Dewey, 1988, p.203). During the War, the State gradually assumed regulatory control of important items of food production and distribution, culminating in a national rationing scheme in the spring of 1918, but the government moved cautiously at first. The Royal Commission on Sugar Supplies was established in the month that War was declared, but for the following two years, it did not intervene to set sugar prices (Bowley, 1920, p.36). The Board of Trade appointed a Departmental Committee on Prices in June 1916, which first reported in September, but made no recommendation for radical intervention.<sup>3</sup> Nevertheless, in the face of continuing Parliamentary pressure, a Royal Commission of Wheat Supplies was established in October 1916 and the establishment of a Food Department of the Board of Trade, with compulsory powers under DORA, in November 1916.

By October 1916, about 2m tons of merchant ships had been lost during the War.<sup>4</sup> This war on British supplies from abroad increased with the German declaration of unrestricted submarine warfare in January 1917. As the volume of tonnage sunk escalated, the retail prices of many foods increased sharply in the first few months of that year (Beveridge, 1928, p2). Only in June, when Lord Devonport was replaced by Lord Rhondda as Food Controller, did the government move to establish almost complete control over most food supplies.

During Lord Rhondda's phase of regulation, the control of the importation, distribution and price of food was predicated on a 'Breadstuffs Policy.' This was based on the premise that whatever else was in short supply, the supply of breadstuffs had to be maintained. It was recognized that it was inefficient to allow the conversion of cereals to animal protein, which would, in turn, be consumed by humans. This led to the government implementing policies designed to reduce the size of flocks of sheep and herds of cattle while maintaining cereal supplies; increasing the acreage devoted to grain, increasing the percentage of flour extracted from wheat, encouraging and then requiring the dilution of wheat with other grains in breadstuff production and restricting the importation of animal feed-stuffs (Beveridge, 1928, pp. 82-3).

Roughly eighty percent of breadstuffs consumed in the UK came from overseas and the maintenance of supply chiefly depended upon securing sufficient imports. The government (through the auspices of the Wheat Commission) took over importation of wheat and other cereals and in April 1917 flour mills came under state and the extraction of flour was regulated (Beveridge, 1928, pp.88-9). The Wheat Commission also attempted to reduce demand by trying to persuade Britons to avoid waste and eat less bread, but unlike most other European combatant nations, bread was never rationed during the war. The policy of the Commission was to ensure a sufficiency of bread to lessen the impact of other foods in short supply.

Local rationing schemes, devised in consultation with the Food Controller, were introduced in December 1917 for sugar, butter and margarine in response to growing food queues. These schemes became ubiquitous in early 1918, although a National Rationing Scheme was not introduced until July 14<sup>th</sup> 1918, with many foods continuing to be rationed after the armistice. In February 1918, butcher's meat was rationed in London and the Home Counties. This was extended to several other districts in March and to the entire country in April under the National Meat Scheme. Bacon and ham were also rationed under the London and Home Counties scheme, commencing in February 1918. Lard was rationed locally from January 1918 and then nationally by July. Tea was rationed locally from April 1918 and by a system of national registration of customers in July. Local schemes also operated for the rationing of jam and cheese (Beveridge, 1928, pp.224-5). Set against this background

of the control of supply and the rationing of certain basic foods to consumers, the Ministry of Food also regulated the price of most foodstuffs during the later stages of the War. The list of foodstuffs for which the Ministry of Food controlled prices, included most items in the working-class diet of 1918 and all of the staple foods, see Beveridge (1928, pp. 163-4).

## **2. The Sumner Committee's findings**

The Sumner Committee carried out a survey of working class household expenditure in the first week of June 1918. About 10,000 forms were distributed and about 1,400 were returned, the vast majority of which recorded household expenditure for the first week of June, with smaller numbers for later weeks in June and July. The timing of the enquiry was chosen to make the results comparable with the earlier 1904 enquiry, though the majority of the responses to the earlier survey were received in August, suggesting that the timing was slightly later.<sup>5</sup> This survey used a modified version of the questionnaire used in the 1904 Board of Trade enquiry. The 1918 questionnaire included more detailed questions on non-food expenditure and the ages of the occupants of the household, but did not enquire about household income.<sup>6</sup>

Like its immediate predecessor, this was not a random sample of working-class urban households, see Gazeley and Newell, 2011). Using a set of criteria relating to occupation, wage-rates and the nature of work undertaken, the budgets were classified into five classes, viz: clerks (householder middle-class), skilled, semi-skilled, unskilled working class households, and 'on service' (householder away in the army or navy). Where quantity data on foods consumed was missing, local price data were used to estimate consumption. At the beginning of June, little produce from the garden or allotment would have been available to households, but some householders recorded producing their own eggs and potatoes and the value of these was added to household expenditure (British Parliamentary Papers, 1918, p.12).

They were also sub-divided by region, corresponding roughly to the regions of analysis used in 1904. According to the Sumner Report, 'Budgets were received from nearly all the large towns and from a great number of districts in England and Wales and South Scotland' (British Parliamentary Papers, 1918, p.13) The Committee did not

have a comparable survey for 1914, so the results of the 1904 enquiry were adapted to provide estimates of working class consumption for July 1914. The Sumner Committee used a sample of household budgets from the 1904 enquiry and on the basis of these a number of modifications were made to the analysis originally published in 1905. First, the published results were re-weighted on the basis of population proportions, as the original enquiry over-represented London and Scotland. Ireland was also excluded from the analysis, as the 1918 survey did not include it. In fact, these modifications made little difference to average working class expenditure, compared with the average calculated from the 1904 survey. Second, the quantities of food purchased in 1904 were adjusted in various ways to reflect the changes that were estimated to have occurred between 1904 and 1914 (British Parliamentary Papers, 1918, pp. 10-11)<sup>7</sup> Finally, the revised quantity estimates were combined with data on changes in relative prices to provide estimates of expenditure in July 1914. The changes resulting from modifying quantities were ‘very slight’ and the Sumner Committee Report maintained that ‘practically the same total expenditure is found whether we apply 1914 prices to the 1904 expenditures as first given or to the revised 1914 quantities’ (British Parliamentary Papers, 1918, p.11) For this reason, in the analysis presented below, which focuses on quantities of food purchased, we make direct comparison between 1904 and 1918.

In comparison with 1904, the households in 1918 were typically older and the number of workers greater. As a consequence, there were fewer families in 1918 with young children than had been the case in the 1904 survey. The Sumner Committee attempted to address changes in wartime household structure by expressing household food consumption in terms of a ‘Standard Family’ in 1914 and 1918, based upon a number of equivalent adults (men). They then inflated or deflated the recorded expenditures by class by the difference between the male equivalent for an average ‘Standard Family’ and the average male equivalent household size for each class.<sup>8</sup> The same adjustment was carried out for the average working class expenditure and quantity of food consumed derived from the analysis of the 1904 budgets, in order to produce 1914 estimates of the consumption of a ‘Standard Family.’

### **3. Reinvestigating the path of food consumption through the First World War**

The results of the 1904 enquiry were published as Cd 2337 in 1905 under the heading ‘*Consumption and Cost of Food in Workmen’s Families in Urban Districts in the United Kingdom.*’<sup>9</sup> 1,033 returns from this enquiry are extant. Gazeley and Newell (2011) provide a detailed discussion of the relationship between this sub-sample and the original enquiry and potential biases in both the recovered returns and the original survey and the implication of these biases for the analysis of average working class consumption behaviour. It is only necessary to re-iterate the main conclusions here.

First, the recovered returns are not a simple sub-sample of the 1,944 returns used in the Board of Trade’s analysis that is published as British Parliamentary Papers (1905). The recovered extant returns include a number of those that were received too late for the Board of Trade’s analysis or were considered to be incomplete in some way. We have carefully reviewed all of those in this category and most are useable. The elimination of those that are problematic in some way reduces the sample to 990 useable returns. We refer to this sample as the Board of Trade recovered returns (hereafter BoTR). Secondly, the geographical distribution of BoTR returns is not a random sample of the original. The BoTR returns include most, if not all, of the original Scottish budgets and correspondingly fewer from England, and especially from London, than the original. Thirdly, the BoTR sample has slightly more children per household and a little higher average food expenditure. Finally, in terms of weekly household income distribution, the BoTR sample has a few more families in both extremes of the distribution, but otherwise the match between the two samples is very close.

The recovery of a sizeable proportion of the original Board of Trade returns for 1904 allows a careful re-examination of the analysis undertaken by the Sumner Committee. The Committee’s investigation was limited by differences between the questions asked in the 1904 and 1918 enquires. The 1918 survey did not collect data on weekly income of the household members and the 1904 data were not analysed by skill group. In consequence, the Sumner Committee was forced to make comparison by skill category in 1918 with the average working-class experience pre-war. As Gazeley and Newell (2011) discuss, this is problematic because the 1904 survey was not based on a good approximation of the distribution of male incomes, as it includes too few low income wage earners



It is not known how well the 1918 survey captured the distribution of male earner incomes, as the respondents were not asked to record their weekly income. We have noted that the 1918 survey oversampled skilled workers. The only feasible comparison is by skill group. To do this, we assign a skill category to each of the heads of households in the 1904 BoTR sample, using their own description of occupation in conjunction with data on their weekly wage. Our classification is based upon Armstrong's (1972) five point taxonomy of nineteenth century social class (unskilled, semi-skilled, skilled, intermediate and professional). Full details of the classification of occupations are given in Appendix 2. This procedure enables the cleanest comparison possible between the results of the 1904 and 1918 household expenditure surveys.

The results of this exercise for the 1904 (excluding Ireland) and the 1918 enquiries are summarised in Table 1. This table reports total household income for the 1904 survey and recorded total expenditure in the case of the respondents to the 1918 survey. We can see from this table that there is a neat graduation by social class of household income and food expenditure among manual workers. The levelling between unskilled and skilled earnings that occurred during the First World War is evident from the income and expenditure data summarised in this table. For instance, the gap in food expenditure between the skilled and unskilled falls from 29 percent to 17 percent. There was little inflation from 1904 to the onset of the war. After that prices doubled to 1918.<sup>10</sup> If the 1918 food expenditures by skill group are deflated to 1904 prices, we find almost no change in real food expenditures for skilled and semi-skilled workers, but a six percent rise for unskilled workers.

Both surveys contain a large proportion of skilled working class heads of households, but this is especially true in the case of the 1904 survey, where nearly three-quarters of all households in the sample have a skilled head, compared with just over half of the sample in 1918. Also, in both surveys, there are relatively few semi-skilled heads of household and a fairly small number of intermediate or clerical heads of household. Total household income in 1904 was roughly half of recorded total expenditure in 1918, reflecting the significant increase in nominal pay and prices during World War One.

*<Tables 1 and 2 about here>*

As already indicated, there are differences in household structure between the 1904 and 1918 surveys. As Table 2 shows, for all skill categories, household size was somewhat smaller in the 1918 survey than it had been in 1904. The household size among unskilled respondents was larger than semi-skilled or skilled households in both surveys. Most of the difference in household structure between 1904 and 1918 is the significantly greater number of children in the earlier survey – especially in the under 10 year old age groups. Offsetting that, there are slightly more children aged 11-14 years and more adults in the 1918 survey, reflecting the older age of the head of household in the later survey.<sup>11</sup>

Table 3 provides a summary of food consumption per head, by skill, in 1904 derived from the analysis of the BoTR sample. We have corrected the geographical bias in the BoTR data by weighting the household budgets from England and Wales and Scotland in relation to their population size recorded in the 1901 census.<sup>12</sup> For consistency with the 1918 enquiry, we have excluded the households from Ireland. In cases where expenditure on a food type was recorded, but the quantity purchased was not, we used the average unit prices derived from the survey returns to estimate the missing quantity data. In keeping with the methodology adopted by the Sumner Committee, the quantity of food grown in the garden or on allotments in 1904 (where known) is also included in these estimates.<sup>13</sup>

The published average values for quantities of food consumed by working-class households in 1904 are compared with those derived from an analysis of the recovered original expenditure records from this enquiry in Table 3. There is a close correspondence for most articles of food. Note that quantities consumed are only reported for a sub-set of foods in the published reports of the 1904 enquiry, whereas it has been possible to derive a full set of food quantities purchased from the extant returns. In the case of bread and flour, bacon, all meat, cheese, butter, margarine, rice and tapioca, tea, coffee and cocoa, the correspondence between the two sets of values are very close. There is, however, significant variation with respect to potatoes.<sup>14</sup>

Within the BoTR sample, the consumption of food per capita generally increases with skill category within the working class, except for bread and flour and margarine, where higher per capita consumption is recorded among the unskilled than the skilled households. Table 4 sets out similar evidence for the June 1918 enquiry. These data have been derived from Sumner, but are expressed in terms of weekly per capita consumption by skill category to make them comparable with Table 3.<sup>15</sup>

*<Table 3 and 4 about here>*

Table 5 demonstrates how per capita consumption changed between 1904 and 1918, by skill group. For all skill types, household consumption of bread, bacon, sausages, offal and tinned meat, milk, condensed milk, margarine, potatoes, coffee, cocoa, jam and syrup were greater in 1918 than in 1904. Note that the smaller increase in the *per capita* consumption of potatoes between 1904 and 1918 than reported in most secondary texts is the result of using a higher base figure derived from the 1904 BoTR data than used by Sumner, see Dewey (1988, Table 6.8 p.208). *Per capita* consumption of bacon and condensed milk were roughly twice what they had been in 1904, while margarine consumption increased greatly, 9-fold on average for skilled workers.

Set against these increases, the *per capita* consumption of flour, butcher's meat (pork, mutton, veal and beef), lard and suet, cheese, butter, sugar, tea and fruit, vegetables (other than potatoes) and dried fruit declined. Thus the list of foods for which *per capita* consumption unambiguously declined between the turn of the century and end of the last summer of the First World War includes many of the items that were staple items of consumption in working class households before the War. Thus wartime price increases and rationing 'restored the restricted diet that had been commonly experienced by the working class in late Victorian and Edwardian times...' (Oddy, 2003, p.90) .

*<Table 5 about here>*

As Table 1 shows, however, total household income/expenditure roughly doubled in cash terms between 1904 and 1918. Taken together with the reduction in household size recorded in Table 2, this rise in nominal household income is greater than the increase in overall consumer prices between the two dates. As a consequence, real *per capita* income modestly increased and hence, in the absence of wartime shortages and rationing, it might be expected that consumption per head would also have increased for most foods.<sup>16</sup> The natural question that follows is what explains the divergence in the consumption across food types during the period. In the next section we present data and statistical evidence that suggests that price movements, some of which were generated by price controls, were the key to the shifts in food consumption.

#### **4: What caused the changes in food spending through the War?**

As we have outlined, the Sumner Committee estimated expenditure and consumption for 1914 by adjusting data from the 1904 survey (British parliamentary Papers, 1918, p.11). These adjustments were not major. In consequence, a comparison of consumption in 1904 with 1918 is going to be little different than a comparison between 1914 and 1918. For this reason we eschew any attempt to reconstruct estimates of consumption in 1914 based upon 1904 data. In order to try to evaluate the impacts of the price and income changes on food expenditures, we estimate a system of demand equations for the main food types and then use 1918 price and income data to construct forecasts of 1918 food expenditures, by main skill group. Our estimates are based on a standard budget share equation for 1904, where the share of food  $j$  in family of type  $k$  is:

$$S_{jk} = a_j + \beta_{1j} \log X_k + \beta_{2j} \log N_k + \beta_{3j} R_k + e_{jk} \quad (1)$$

Here  $S$  is the share of food in total expenditure,  $X$  is total expenditure,  $N$  is family size,  $R$  is the share of children in the family and  $e_{jk}$  is an error term. This equation does not allow for cross price effects and imposes a unit own price elasticity of demand. These restrictions are effectively imposed upon us by the highly endogenous nature of the unit price data we could derive, combined with a complete lack of potential instrumental variables. Appendix Table A1 provides estimates of the

parameters for this equation using the 1904 data, for the food types described in both the 1904 and 1918 household surveys. The Tobit estimation procedure is employed, to account for the natural censoring that occurs in data for a single week's expenditure on some kinds of food.<sup>17</sup> The estimated parameters are generally significant. In most cases the parameters on total expenditure and family size take equal but opposite values as predicted by standard utility theory. For some foods, it was not possible to generate estimates of the parameters of demand. These were storable foods with high percentages of zero recorded expenditure.

We then take price, income and household structure data for 1918 to forecast 1918 food shares by skill group using the parameters from this equation:

$$\hat{S}_{jk}^{1918} = a_j^{1904} + \beta_{1j}^{1904} \log X_k^{1918} + \beta_{2j}^{1904} \log N_k^{1918} + \beta_{3j}^{1904} R_k^{1918} \quad (2)$$

Finally we take these food share forecasts together with income and price data to derive estimates of predicted 1918 quantities of household food consumption by skill category as follows:

$$\hat{Q}_{jk}^{1918} = \hat{S}_{jk}^{1918} * X_k^{1918} / P_j^{1918} \quad (3)$$

Where  $\hat{Q}$  is predicted quantity of food  $j$  for household  $k$  in 1918,  $\hat{S}$  is the predicted share of food  $j$  in household  $k$  expenditure,  $X$  is total household expenditure for 1918 for household  $k$  recorded in the Sumner report and  $P$  is the price of food  $j$  for household  $k$  in 1918.

*<Tables 6 and 7 about here>*

The statistics in Table 7 suggest a limited impact of rationing at prevailing (mostly controlled) prices. It is conventional to think of price controls in this context as price ceilings imposed to restrict profiteering. However, it may be that the levels of the controlled prices also restricted demand. In the case of sugar, our forecast of demand is between 25 and 50 percent higher than the rationed quantity and consumption was at the maximum rationed level. This suggests that sugar rationing had a significant impact. For butter and tea, both subject to shortage, the ration is above the level of consumption found by Sumner, but below our forecast – though in the case of butter

not greatly so. One interpretation of this is that the ration was set too high and the shortages bit hard into consumption. For the other foods where we have numbers in Table 7, lard, meat, bacon and jam, the ration was greater than or equal to actual and forecast levels of consumption, so it seems that the controlled prices were sufficiently high to restrain demand.

Chart 1 summarises the changes in prices and quantities demanded for the main foods 1904-1918 (average per household per week). There is a rough negative correlation across food types. Foods where no controls were attempted, most fruit and vegetables in particular, experienced very large price hikes, and heavy reductions in consumer purchases. For foods where prices were successfully controlled, such as bread, milk and margarine, demand increased strongly. This graph suggests that changes in wartime diet at least partially reflect changes in prices, in addition to any effect from the control of quantities through rationing. Recall also that price controls preceded the introduction of rationing by some time.

*<Chart 1 about here>*

## **5. The nutritional consequences of the First World War.**

Lastly we turn to the assertion made in the Sumner Report, and repeated by Beveridge, that the food planning efforts of the Ministry of Food were eventually successful in maintaining the nutrition of the population through the war. Evaluating the extent to which these diets were nutritionally adequate is fraught with difficulties.<sup>18</sup> The yardsticks by which we could judge these intakes are themselves extremely controversial and subject to change over time, as ‘adequacy’, even ‘nutritional adequacy’ is partly socially determined. Moreover, the standards are also revised in relation to improvements in nutritional knowledge. This is particularly important in this context because the Sumner Committee reported before the dietary

importance of many vitamins had been established. It is also worth distinguishing between the levels of nutritional intake necessary to maintain life and levels of nutritional intake necessary to maintain a *healthy* life. The former are typically very low indeed and quite controversial (Truswell, 1978, pp.4-19). The latter are periodically revised in accordance with changing conceptions of health. They also incorporate a safety margin to allow for individual nutritional variation (Miller, 1978, p.208).

Recommended Dietary Intake or Allowances were developed and designed by nutritionists to evaluate food supplies for population groups, and were not intended as a tool for ‘...assessing either the adequacy of nutrient intakes or nutritional status..’(Harper, 1987, p.526) This is because an individual’s nutritional status can only be identified by clinical assessment. Nevertheless, in general terms, as Harper (*op. cit.*) has observed, ‘if the intake of a nutrient is equal to or greater than the RDA, the risk of nutritional adequacy is remote. If it is less than 50% of the RDA, the risk of inadequacy is high. However, when intake falls between these extremes all that can be said is that the farther intake falls below the RDA the greater is the risk of deficiency.’

The 1991 Reference Nutritional Intake (RNI) values replaced the 1979 Recommended Daily Amounts (RDAs) and the change of language is important here. RDAs were defined as ‘the average amount of the nutrient which should be provided per head in a group of people if the needs of practically all members of the group are to be met’ (Department of Health, 1991, p.1) In contrast, RNI were set so as to define more rigorously what ‘practically all’ meant. RNIs are set at a notional two standard deviations above the Estimated Average Requirement (EAR), and assuming that requirements of a nutrient are normally distributed, this ensures an amount of a nutrient that is adequate for at least 97.5% of the population (Department of Health, 1991, p.3).

We assign individuals in the households in the 1904 survey to broad groups, defined by age and gender.<sup>19</sup> We aggregate individual RNIs to create a household RNI value, which we then compare with the available nutrients for the household derived from the household’s food consumption data. We take the nutritional values of foodstuffs from McCance and Widdowson (1978), adjusted to eliminate vitamin fortification

(Paul and Southgate, 1978). We then create a foodstuff-nutrient matrix and apply it to the data on average consumption by skill type presented in Tables 3 and 4, creating average weekly *per capita* intakes of nutrients.<sup>20</sup> These are presented in Table 8 alongside UK (1991) *per capita* recommended nutritional intakes (RNIs) for the typical 1904 household.

<Table 8 about here>

The results of this exercise confirm the Sumner Committee's findings about energy intakes, but also show that the concentration on breadstuff came at a nutritional price. Calorie intakes for skilled households fell somewhat, but those for unskilled households rose a little on average. Thus there is some reduction in the skill gap in nutrition overall. There is a marked fall, to levels well below the RNI level, in vitamin A. This most likely primarily reflects the switch from butter to margarine. There is also a fall in the measured intake of vitamin C for skilled workers and by 1918 both skill groups are close to the RNI. With respect to the vitamin C shortfall, we should bear in mind that vitamin C is destroyed by heat, light and oxygen and since we know little about the way in which fruit and vegetables were stored and prepared, these estimates are biased upwards.<sup>21</sup> There are falls in other nutrients, notably vitamin B12 for both skill categories and vitamin D for skilled workers. Both are likely to be related to the substitution of margarine for butter and falls in the consumption other dairy products.

The possible health consequences of these changes are as follows: vitamin A is required for growth and normal development and differentiation of tissues and the most obvious signs of deficiency are dryness of the conjunctiva and cornea. The first signs of deficiency are likely to be night blindness; vitamin C prevents scurvy and aids wound healing and the most common early sign of deficiency is haemorrhages, including bleeding gums: vitamin B12 plays a key role in the functioning of the brain and nervous system, while vitamin D prevents rickets developing in children and osteomalacia in adults (Department of Health, 1991, pp. 85-132).

The extent to which the changes in nutrition, occasioned by wartime changes in diet, lead to further specific health consequences cannot be ascertained from these data alone. This is for a number of reasons. First, as already discussed, the levels of intake



required to prevent the manifestation of disease symptoms are typically significantly lower than the RNI. These levels are typically ascertained from depletion studies carried out on volunteer subjects.<sup>22</sup> Secondly, the estimates given in Table 8 relate to the household and assume optimal distribution between individuals. There is evidence from other budgetary surveys from the period to suggest that the wife would preferentially allocate food to her husband, who would receive the greatest share of animal protein, see for example, Spring-Rice (1939) and Pember-Reeves (1913). If this unequal distribution extended to dairy products too, then it is likely that the deficiencies identified would be significantly exacerbated in women. Finally, and most importantly, there is a paucity of epidemiological evidence relating diet to disease for this period. Although towards the end of the war the Medical Research Council funded two investigations into diseases among the working classes related to diet, both of these enquiries concentrated on the incidence of rickets, which is a consequence of vitamin D deficiency (Ferguson and Findlay (1918) and Mann (1922)). Although the incidence of rickets was found to have increased during the war, vitamin D deficiency is only partly determined by diet, as sunlight provides most vitamin D in the summer months.<sup>23</sup> In industrial areas where sunlight was obscured by smoke and light was restricted by building density, diet would have played a greater role.

## **Conclusion**

The Sumner Committee's analysis of the change in working class expenditure across the First World War was limited by a lack of consistency in the information available in the 1904 and 1918 household expenditure surveys. The discovery of a substantial number of the original 1904 household expenditure returns allows a cleaner comparison between pre-war and wartime expenditure behaviour. To make this comparison, we classified the occupations provided by each of the 1904 heads of household using Armstrong's (1972) social class taxonomy.

We concur with the Sumner Committee's central finding that the energy value of the working class diet was broadly maintained during the First World War. We find, however, that the distribution of food expenditure and nutrition did change across the war. There was roughly a 12 percentage point contraction in the gap between skilled

and unskilled households' available energy per capita, which represents a halving of the pre-war differential. This is almost identical to the reduction in the food expenditure gap between the two classes. Our results also sit comfortably with what is known about wage behaviour during the War. The traditional pre-war pattern of wage and earning differentials was modified, with significant gains for unskilled workers relative to their skilled contemporaries – especially from 1916/17 onwards.<sup>24</sup>

The main changes in diets that occurred during the war were the reduction in sugar, cheese, butter, butcher's meat and fruit and vegetables consumption, and the increased volume of bacon, sausages and margarine. We estimate that the likely adverse nutritional effect of these changes was a reduction in vitamins A and B12 for both skilled and unskilled workers and additionally reductions in vitamins C, D and riboflavin for skilled workers. At this level of generality, the adverse impact of the First World War was to make average diets deficient in vitamin A intake, as judged by modern standards of nutritional adequacy. It is not possible, however, to conclude from this that vitamin A deficient diseases would have become widespread.

Food controls intensified and increased in scope during the war, especially from 1917 onwards. We record that for many unregulated foodstuffs, prices rose dramatically, and consumption of these foods fell hard. These were not, in the main, items that were considered at the time to be key foodstuffs, but they were those foods that delivered important vitamins. For instance, for skilled workers, a possible consequence of the price rises for fruit and vegetables, and the general lack of attention to maintaining intakes of them, was a notable reduction in the intakes of vitamins C. It seems likely a lesson was learnt later on in food administration, as during the Second World War the government introduced the vitamins welfare scheme in an effort to protect vulnerable groups from vitamin shortfalls, see Zweiniger-Bargialowska (2000, pp32-3).

It is surprising that the impact of the regulation of food distribution and food pricing has not received more attention from historians. This is especially so in view of the unanimity within the literature that points to the centrality of cost of living increases, particularly food price rises, in causing industrial unrest and significant lost production. The relative price changes we document are the products of the effects of

price and distribution controls, of rationing in some cases, and of shifts in demand caused by the war, as well as shifts in supply caused by the actions of the Ministry of Food and by the hostilities.

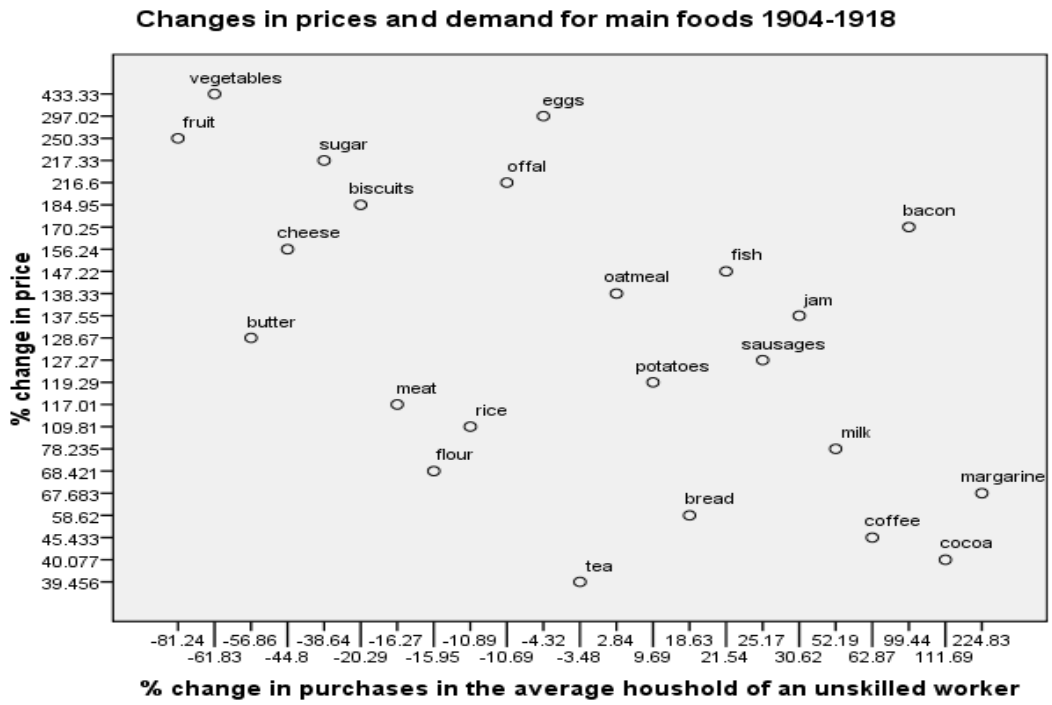
In summary, our evidence concurs with the conventional view that the “Bread First” policy during the First World War contributed to the maintenance of working class diets. However, our analysis reminds us that the closing of wage differentials over the period was also crucially important in this regard. Taken together the impact of these events may have been to stem successfully the growing tide of discontent on the home front.

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**Chart 1: Price and demand changes**



**Table 1: Income and Expenditure 1904 and 1918 by skill category**

	<b>Number of cases</b>	<b>Total Household Income</b> <i>(d per week)</i>	<b>Total Household Expenditure</b> <i>(d per week)</i>	<b>Total Household Food Expenditure</b> <i>(d per week)</i>
<b>1904</b>				
Skilled	547	460 (6.9)		278 (4.5)
Semi-Skilled	56	406 (27.0)		254 (13.7)
Unskilled	108	336 (11.9)		216 (9.2)
Intermediate	63	523 (33.7)		263 (12.1)
Total	783			
<b>1918</b>				
Skilled	566		988 (972)	598 (588)
Semi-Skilled	139		876 (824)	555 (522)
Unskilled	266		790 (833)	513 (541)
Clerical	104		Not given	
Total	1075			

Source: 1904 data derived from the original returns to the Board of Trade survey as calculated by Gazeley and Newell (2011). 1918 data derived from Sumner p.7 and Table III p.15

Notes:

1. The figures reported are for a Standard Family and were adjusted by Sumner to provide comparable estimates for a Standard Family of constant 4.57 persons.
2. In Table 1, the figures in parenthesis in the upper, 1904, part of the table are standard errors of the relevant means. The figures in parenthesis in the lower, 1918, part of the table are our adjustments to the Sumner Committee estimates to reflect differences in household size. These have been calculated by using the inverse of the multiple applied by the Sumner committee; Vis: Skilled have been deflated by 0.984, semi-skilled deflated by 0.941, unskilled increased by 1.054, clerks deflated by 0.806)

**Table 2: Household Structure in 1904 and 1918**

<b>1904</b>	Children aged under 6	Children aged 6 to 9	Children aged 10 to 13	Persons 14 and over	Total persons
Skilled	1.02	0.71	0.61	2.28	5.62
Semi-Skilled	1.11	0.63	0.57	3.43	5.73
Unskilled	1.15	0.97	0.81	3.31	6.24
Intermediate	1.13	0.71	0.70	2.94	5.48
<b>1918</b>	Children aged under 6	Children aged 6 to 9	Children aged 10 to 13	Persons 14 and over	Total persons
Skilled	0.72	0.74	0.86	3.17	5.49
Semi-Skilled	0.72	0.61	0.83	3.12	5.28
Unskilled	1.02	0.85	0.93	3.15	5.95
Clerical	0.45	0.50	0.71	2.97	4.63

Source: 1904 data derived from the original returns to the Board of Trade survey as calculated by Gazeley and Newell (2011). 1918 data derived from Sumner Table II p.14. Note that the reporting of household structure by economic class is ambiguous in Sumner Table II. The age categories as described appear to overlap. Our interpretation is the only one consistent with the data in the table.

**Table 3: 1904 per capita consumption of food by skill category (lbs per week)**

	<b>Average BoT published in Cd.2337</b>	<b>Average BoTR Census weighted</b>	<b>Skilled Workin g-Class</b>	<b>Semi- Skilled Working -Class</b>	<b>Unskilled Working- Class</b>
Bread	n/a	3.77	3.87	3.94	4.26
Flour	n/a	1.73	1.69	1.74	1.56
Bread/Flour	5.61	5.50	5.56	5.68	5.82
Biscuits/Cake	n/a	.17	.20	.10	.08
Fresh meat	n/a	.95	1.00	.94	.83
Sausages	n/a	.05	.05	.03	.04
Bacon	0.25	.27	.30	.23	.18
Offal/t'd meat	n/a	.07	.08	.06	.08
Fish	n/a	.34	.37	.31	.25
Lard/suet	0.17	.18	.19	.20	.13
Eggs	n/a	2.14	2.45	1.75	1.10
Milk	1.57	1.78	1.90	1.59	1.09
Cond. Milk	n/a	.05	.06	.02	.06
Cheese	0.16	.16	.19	.11	.12
Butter	0.33	.36	.38	.36	.25
Margarine	0.03	.02	.02	.01	.06
Potatoes	2.67	3.35	3.59	3.01	2.95
Vegetables	n/a	.92	1.08	.69	.60
Fruit	n/a	.40	.46	.30	.18
Rice/Tapioca	0.18	.22	.23	.18	.20
Oatmeal	0.22	.22	.23	.26	.20
Tea	0.11	.11	.13	.12	.09
Coffee	0.02	.01	.01	.01	.01
Cocoa	0.03	.03	.03	.02	.01
Sugar	0.94	1.02	1.11	.98	.79
Jam	n/a	.23	.26	.13	.18
Syrup	n/a	.06	.05	.09	.07
Dried Fruit	n/a	.14	.16	.12	.08

Notes:

1. All foods measured in lbs per head, except milk (pints per head) and eggs (number)
2. Column (1) derived from Sumner Table 1 p.11. This table reports consumption per week, converted into per capita consumption by dividing by 5.6 persons. Column (2) derived from Cd. 2337 p.5, converted into per capita consumption by dividing by 5.6 persons.
3. The average number of persons in a family by class for Great Britain is : Skilled 5.5; Semi 5.3; Unskilled 6.0; Working Class average 5.6; Clerks 4.6 (Sumner Table II p.14). Per capita estimates have been derived from the *Standard Family* consumption figures reported in Cd 8980, by deflating or increasing (as appropriate) by the inverse of the proportion the Sumner Committee used to express the *budgets of each class* as consumption for a Standard Family of 4.57 persons and then dividing by the average number of persons in a family in each class. Skilled households have been deflated by 0.984, semi-skilled deflated by 0.941, unskilled increased by 1.054, clerks deflated by 0.806 (these figures are the inverse of the proportions used by the Ministry of Labour to adjust household expenditure to a 'Standard Family')



**Table 4: 1918 per capita consumption of food by skill category (lbs per week)**

	<b>Skilled Working-Class</b>	<b>Semi-Skilled Working-Class</b>	<b>Unskilled Working-Class</b>	<b>Clerks</b>
Bread	4.60	4.62	4.80	2.87
Flour	1.47	1.63	1.41	1.84
Biscuits & Cake	0.17	0.13	0.08	0.16
Meat	0.70	0.71	0.70	0.67
Sausages	0.07	0.07	0.05	0.07
Bacon	0.48	0.47	0.39	0.44
Offal & tinned meat	0.11	0.09	0.09	0.09
Fish	0.40	0.28	0.31	0.33
Lard suet etc	0.13	0.14	0.12	0.15
Eggs	1.91	1.58	1.30	1.45
Milk	2.33	1.95	1.83	2.73
Cond Milk	0.09	0.09	0.09	0.06
Cheese	0.08	0.08	0.07	0.07
Butter	0.16	0.13	0.11	0.14
Margarine	0.16	0.16	0.18	0.14
Potatoes	3.58	3.55	3.39	3.15
Vegetables	0.31	0.29	0.24	0.35
Fruit	0.11	0.06	0.04	0.13
Rice & Tapioca	0.23	0.23	0.19	0.25
Oatmeal	0.29	0.21	0.25	0.23
Tea	0.11	0.11	0.09	0.09
Coffee	0.03	0.02	0.02	0.02
Cocoa	0.04	0.03	0.03	0.04
Sugar	0.50	0.50	0.51	0.46
Jam	0.30	0.30	0.25	0.32
Syrup	0.16	0.11	0.09	0.14
Dried Fruit	0.04	0.04	0.02	0.03

Source: calculated from Cd 8980 Working Classes Cost of Living Committee, 1918 *Report of the Committee*, Table IV p.15-16. and Table II p.14.

Notes:

1. The Sumner report provides expenditure, but not the quantity consumed for a small number of foodstuffs, viz: biscuit and cakes; fish, condensed milk, vegetables and fruit. For these foodstuffs, average quantity consumed has been ascertained from the expenditure data using price derived from other sources: biscuits and cakes expenditure divided by prices. based on the June 1918 unit price for biscuits (16.67d per lb) derived from Cmd 76 p.63; fish expenditure divided by prices based on the average of the unit prices for fresh fish (11.36d per lb) and dried fish (10d per lb) given in Cmd 76 p.63. Average price used is 10.68d per lb; condensed milk expenditure divided by 16.67d per lb in June 1918 derived from Cmd 76 p.63; vegetables expenditure divided by twice the wholesale price of peas and onions for 1918-1919. Cmd 1902 p.28 Price used 8d per lb; fresh fruit expenditure divided by twice the wholesale price of cheapest apples and cheapest plums for 1918 from Cmd 1892 p.27 (price used 10.5d per lb).
2. Other food: according to the Sumner Committee Report, haricot beans, honey and dried fruit account for 2/3rds of other food as recorded. Expenditure decomposed on this basis for dried fruit and quantity estimated using the average unit price for currants quoted by Co-operative stores in Jan 1918 given in Cmd 76 p.25
3. Expenditure on meals out and other foods was a similar proportion of total food expenditure for all groups, except clerks who spent roughly double the proportion of any other group; viz: skilled 2.84%, semi-skilled 2.79%, unskilled 2.75%, clerks 5.03%.
4. The Sumner Committee expressed household expenditure for 1918 per standard family. Using

the Sumner Committee's equivalence scale this is 4.57 persons for an average working class household. The equivalence scale employed is: male over 14 =1; female over 14 = 0.83; children 10-14 = 0.83; children 6-10=0.70; children under 6 = 0.50

5. To render the budgets for other skill categories compatible, the Sumner Committee raised the skilled class by 1.6%; semi-skilled by 6.3% and lowered the unskilled by 4.8%. The clerical class and on service class household were 24 % and 17 % smaller than the average, so were increased by those proportions. Sumner Committee p.15.

**Table 5: Ratio of per capita consumption (1918/1904), by skill group**

	Skilled Working-Class	Semi-Skilled Working-Class	Unskilled Working-Class
Bread	1.19	1.17	1.13
Flour	0.87	0.94	0.90
Biscuits & Cake	0.87	1.28	1.05
Butcher's Meat	0.70	0.76	0.84
Sausages	1.43	2.21	1.26
Bacon	1.60	2.07	2.23
Offal & tinned meat	1.46	1.55	1.14
Fish	1.07	0.91	1.23
Lard suet etc	0.68	0.69	0.94
Eggs	0.78	0.91	1.18
Milk	1.23	1.22	1.68
Cond Milk	1.62	4.38	1.53
Cheese	0.42	0.71	0.59
Butter	0.42	0.37	0.45
Margarine	9.45	12.64	3.27
Potatoes	1.00	1.18	1.15
Vegetables	0.29	0.42	0.40
Fruit	0.24	0.20	0.23
Rice & Tapioca	1.02	1.30	0.95
Oatmeal	1.25	0.80	1.26
Tea	0.87	0.92	0.98
Coffee	2.02	1.34	1.76
Cocoa	1.31	1.27	2.27
Sugar	0.45	0.51	0.64
Jam	1.16	2.26	1.38
Syrup	3.10	1.26	1.33
Dried Fruit	0.26	0.34	0.24

Source: calculated from Tables 3 and 4

**Table 6: 1918 predicted weekly working-class per capita consumption of food by skill category (lbs per week)**

	<i>Skilled Working-Class</i>	<i>Semi-Skilled Working-Class</i>	<i>Unskilled Working-Class</i>	<i>Average Working-Class</i>
Bread	5.14	5.17	4.72	5.12
Flour	2.19	2.16	1.84	2.08
Biscuits & Cake	0.07	0.05	0.04	0.06
Meat	0.81	0.80	0.72	0.79
Sausages*				
Bacon	0.15	0.15	0.13	0.14
Offal & tinned meat*				
Fish	0.22	0.22	0.18	0.21
Lard suet etc	0.15	0.15	0.12	0.16
Eggs*				
Milk	2.11	1.97	1.70	1.97
Cond Milk*				
Cheese	0.12	0.13	0.12	0.12
Butter	0.35	0.34	0.30	0.33
Margarine*				
Potatoes	3.69	3.75	3.22	3.56
Vegetables	0.22	0.21	0.17	0.20
Fruit	0.15	0.11	0.08	0.12
Rice & Tapioca	0.47	0.43	0.36	0.47
Oatmeal	0.08	0.07	0.08	0.08
Tea	0.19	0.19	0.14	0.18
Coffee*				
Cocoa	0.00	0.00	0.00	0.00
Sugar	0.73	0.72	0.63	0.70
Jam	0.17	0.16	0.14	0.16
Syrup*				
Dried Fruit	0.04	0.04	0.03	0.04

Notes: It has not been possible to estimate predicted per capita consumption in 1918 for the foods marked \*. In all cases this is due to the very high proportion of zero expenditure on these foodstuffs by households in the 1904 enquiry

**Table 7: Quantities consumed per head of rationed foods, June 1918 (lb per head)**

	<i>Ration June 1918</i>	<i>Sumner (range by class)</i>	<i>Predicted (range by class)</i>
Sugar	0.5lb	0.50-0.51	0.63-0.73
Butter	0.25 or 0.3125lb	0.11-0.16	0.30-0.34
Margarine	0.25 or 0.3125lb	0.16-0.18	
Lard	0.125lb	0.12-0.14	0.12-0.16
Butcher's Meat	16d, about 0.88lb	0.70-0.71	0.72-0.81
Bacon & Ham	0.5lb	0.39-0.48	0.13-0.15
Other Meat	1.75 lb	0.09-0.11	
Jam	0.25lb	0.25-0.30	0.14-0.17
Tea	0.125lb	0.09-0.11	0.14-0.19
Cheese	Varied locally	0.07-0.08	0.12-0.13

Notes:

1. Rationed quantities as provided by Beveridge Table VII, pp.224-5
2. Other Meat figure is for poultry. The commoner types of offal (tripe, heads, trotters etc) were all de-rationed in May 1918.
3. Sumner figures as calculated by the authors, taken from Table 4, predicted quantities from Table 6

**Table 8: Estimated average daily per capita levels of nutrients purchased in 1904 and 1918, by skill of the head of household**

	Skilled, 1904	Unskilled, 1904	Skilled, 1918	Unskilled, 1918	$\Delta\%$ for skilled	$\Delta\%$ for unskilled	RNI <i>per</i> <i>capita</i> for the average BoTR family
Kcalories	2384.9	2001.4	2186.7	2060.1	-8.3	2.9	1984
Protein	70.0	59.8	73.8	70.6	5.4	18.0	34.8
Fat	72.5	52.3	65.9	61.4	-9.1	17.3	76
Carbohydrate	398.4	356.9	360.3	341.2	-9.6	-4.4	264
Vitamin A	438.2	339.6	263.7	242.0	-39.8	-28.7	578
Vitamin B6	1.1	0.9	1.0	1.0	-5.7	16.4	1.12
Vitamin B12	3.1	2.4	2.4	2.3	-22.6	-5.1	1.20
Vitamin C	45.3	31.8	38.6	34.2	-14.8	7.5	36
Vitamin D	2.4	1.5	2.1	2.2	-11.9	50.1	1.0
Vitamin E	2.4	1.7	2.5	2.4	5.7	39.8	10.4
Niacin	9.8	8.8	11.3	11.0	15.8	25.4	13.2
Riboflavin	0.7	0.5	0.7	0.6	-5.2	10.0	1.05
Thiamin	1.1	1.0	1.1	1.1	1.9	13.2	0.86
Iron	9.6	8.4	12.3	11.9	28.8	40.9	10.5
Calcium	455.9	307.8	501.7	399.2	10.0	29.7	665

\* calculated using McCance and Widowsen's RNI as outlined in the footnote 72, and averaged across the BoTR sample. Notes. For nutrients other than Kcalories, units are mg, except for protein, fat and carbohydrate which are in grammes and Vitamins A, B12 and D which are in  $\mu\text{g}$ .

## Endnotes

<sup>1</sup> See Gazeley and Newell(2011) and the discussion of these data in section 3 below.

<sup>2</sup> Here, and throughout, we simply report the average values for the two surveys. We do not attempt formal statistical inference because the Sumner Report did not provide standard errors for the 1918 data.

<sup>3</sup> Broadberry and Howlett (2005, p.224) note the reactive nature of food controls during the period.

<sup>4</sup> Figure provided by Runciman to the House of Commons, October 17 1916. Quoted in Beveridge,(1928, p.23)

<sup>5</sup> British Parliamentary Papers, 1918, p.5. Of the extant 1904 records, about 85 percent record the date they were received. Of these 123 were received in July, 418 in August, 235 in September and the remainder between October 1904 and early 1905..

<sup>6</sup> British Parliamentary Papers, 1918, , p.12. 66 of the 1918 budgets were rejected as being incomplete or unreliable.

<sup>7</sup> British Parliamentary Papers, 1918, *op cit*, pp.10-11

<sup>8</sup> The food needs of individuals were based on the Inter-Allied Scientific Food Commission recommendations. The equivalence scale used was: male over 14 years old =1, female over 14 years old and children 10 to 14 = 0.83, children 6-10 years = 0.70 and children under 6 = 0.5. The average working class family in the Sumner Committee enquiry consisted of 5.60 persons, which translated into a 'Standard Family' of 4.57 equivalent men. Skilled households consisted of 5.5 persons or 4.5 equivalent men, semi-skilled households consisted of 5.3 persons or 4.3 equivalent men, unskilled households consisted of 6.0 persons or 4.8 equivalent men and clerks consisted of 4.6 persons or 3.7 equivalent men. The average expenditures on food (and quantities consumed) for each of these classes was adjusted to make them comparable with the average working-class standard family by inflating or deflating expenditure (and quantities consumed) by the ratio of the number of equivalent men to the standard family. British Parliamentary Papers, 1918, , pp.13 -14

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<sup>9</sup> 1,808 of the 2283 returns were considered usable. These were combined with 136 returns collected from London and suburbs during the 1903 enquiry.

<sup>10</sup> The Office for National Statistics composite price index also roughly doubles between 1904 and 1918 (it has a value of 9.3 in 1904 and 19.9 in 1918, based on 1974 = 100). *Consumer price inflation since 1750*, Table 1 p.43. Thus, if a skilled worker's household earned 460d on average (see Table 1) in 1904, then a similar household spent on average 486.5d in 1918 at 1904 prices.

<sup>11</sup> It was noted in the report that there was 'an absence of a great proportion of men under 45'. British Parliamentary Papers, 1918, p.13

<sup>12</sup> Our weighted sample for 1904 and the 1918 data have approximately the same overall geographical distribution between England and Wales and Scotland, with 12% and 13.7% of households north of the border respectively.

<sup>13</sup> Note that the results of the 1904 enquiry as published by Sumner are a little different from those published in 1905 in Cd 2337. It is not clear why these differences exist. The discrepancy is large and important for potatoes. It is possible that the Sumner report is in error here as the implied unit price is also higher. Cd 2337 gives an average of 16.92 lbs of potatoes (3.02lbs per capita given household size of 5.6 persons), with an average expenditure of 11d, giving a unit price of 0.65d/lb. Sumner reports an average of 14.9lbs, with an average expenditure of 10.75d, giving a unit price of 0.72d/lb. Cd 2337 p, 5 and British Parliamentary Papers, 1918, Table 1 p.11. This value was carried forward as the 1914 and gives an especially low base for comparison with consumption in 1918.

In the BoTR data 35 households state that they grow potatoes in their garden or allotment and 2 households receive potatoes as gifts. Of the 35 households that grow their own, a number provide details of the quantity produced. The average is 10lbs per week and this has been used as an estimate for all households than self-produce.

<sup>15</sup> Sumner expressed consumption in terms of a 'standard family' rather than per capita.

<sup>16</sup> The increase was of the order of 10% over the fourteen years.

<sup>17</sup> It is likely that not all observation of zero purchases for particular foodstuffs are due to censoring, but we have no way of knowing the extent of this problem in our data. We estimated the same equation using OLS, and found very similar results

<sup>18</sup> As we have seen the estimates of per capita consumption of nutritional intakes that we have derived are themselves subject to error because we only have generic descriptions of food purchased (such as 'beef'), not the precise type purchased (such as 'stewing steak off the bone') and do not know how the food was stored, prepared or cooked.

<sup>19</sup> In the 1904 survey the genders of children are generally not given. We assigned household members aged less than 19 years into the following age range groups: less than 1 year, 1-3 years, 4-6 years, 7-10 year, 11-14 years, 15-18 years. The average McCance and Widdowson RDA/RNI values of nutrients for people in these age ranges were assigned to members of these groups.

<sup>20</sup> A small proportion of household food expenditure was on 'other foods' in both surveys. We have assumed that the nutritional content of these unknown foods would be equal to the average nutritional content of all known foods and adjusted our estimates of household nutrition accordingly.

<sup>21</sup> Both surveys aggregate individual fruit and vegetable expenditures. However, the extant returns for 1904 contain about one hundred households who have itemised the fruit and vegetables bought each week. With respect to fruits, expenditure is dominated by the consumption of apples, followed by tomatoes and some expenditure on soft fruits. For vegetables, the major item of consumption is cabbage, but with some expenditure on carrots, peas, turnips and onions. We have constructed aggregate nutritional values for both fruit and vegetables using weighted nutritional values for individual fruits and vegetables listed in these itemised accounts of expenditure from the 1904 survey. It is possible that the fruits and vegetables typically purchased by the households surveyed in 1918 differ slightly from those recorded by households in 1904 due to the slightly earlier timing of the 1918 survey (June-July 1918 compared with July-September 1904). This could influence the calculation of nutrition available in 1918, as the quantity of vitamin C in particular varies between different types of fruit and vegetables.

<sup>22</sup> See the evidence on depletion studies by vitamin type in 1991 Department of Health, *Dietary Reference Values*, pp.85-132

<sup>23</sup> There is no UV radiation in Britain of the appropriate wavelength between the end of October and the end of March. In summer time, cloud cover reduces UV radiation by about 50% and about 60% of effective UV radiation occurs between 11.a.m and 3.00 p.m. In winter vitamin D levels depend upon the exposure to sunlight in the previous summer. Department of Health, *Dietary Reference Values*, 1991 p.124

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<sup>24</sup> Most secondary texts rely on the calculations of the wage-rate skill differential by Knowles and Robertson, (1951, pp.109-27), who show wage differentials narrowing from about 0.60 in 1914 to about 0.80 by 1920.