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BY
Stefan Öberg

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Did the poor pay more? Income-related variations in diet and food quality among urban households in Sweden, 1913–1914s

Stefan Öberg[1]
University of Gothenburg
stefan.oberg@gu.se

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Abstract

We investigate the behaviors used by households to economize on their spending on food using data from a budget survey of urban households in Sweden in 1913–1914. Higher-income households bought higher-quality varieties of both luxury and staple foods. But changing the composition of the diet was a much more important way to adjust spending on food than changing the quality of the foods bought. Higher incomes allowed households to increase the variability of their diets as well as to increase the enjoyability of the staple foods that dominated diets at the time.

Keywords: household consumption; food consumption; dietary change; quality elasticity; LONGH Cohort.
JEL classification: N34, I31, D12.

[1] Unit for Economic History, P.O. Box 625, 405 30 Gothenburg, Sweden.
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1 Introduction

Sweden was still a relatively poor country in the early twentieth century. There was no starvation—except possibly during the blockade during the First World War—but many households struggled to make ends meet. Cheap starchy staples, such as bread and potatoes, still dominated the diet even if the shares of, for example, animal products and fats had started to increase (Juréen, 1956; Lundh 2013; Morell, 1990; Neset, 2004). We know that it was necessary for households to economize on the foods consumed (Hirdman, 1983), but it is still largely unknown how they did this. In this paper we investigate how urban households economized on their food consumption to get sufficient amounts of as varied and enjoyable foods as possible. Specifically we investigate if there were systematic differences in the quality of the food bought by households with different levels of income. We also investigate to what extent the households changed the composition of their diets to adjust their spending on food.

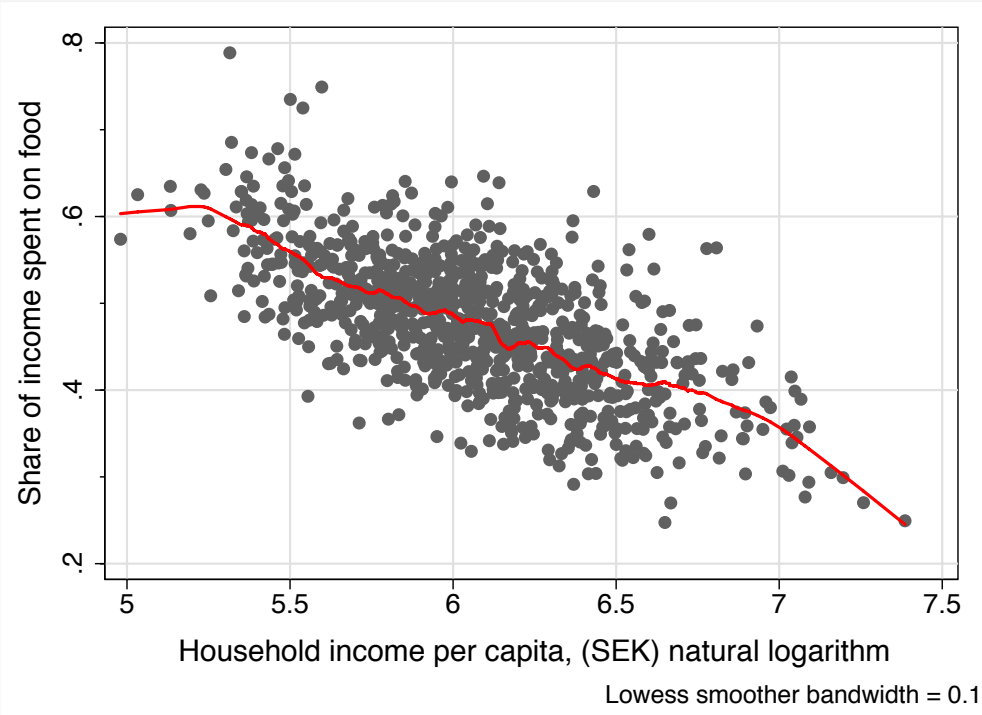
We use data from a household budget survey carried out by the Swedish Royal Board of Social Affairs in 1913–1914 (Socialstyrelsen, 1917).[2] The included, mostly working-class, households were living in cities or towns and were predominantly families with children. The survey collected detailed information on all incomes, expenditures and quantities of foods consumed during a whole year. Much of the collected data was published on household level (Socialstyrelsen, 1919). We have transcribed this household level information and use it in our analyses for this study.

The early twentieth century urban households we analyze show the well-known patterns in the association between earnings and expenditures on food. The households earning less spent a larger share of their incomes on food—the expected Engel curve pattern (Figure 1). Despite this attempt to secure a sufficient level of food consumption there was a close association between the total household income and the amount of money spent on food. The gap between the reference line and the estimated association in Figure 2 widens with higher incomes. This indicates that the food expenditure increased less than incomes, again confirming the Engel curve pattern. In practice this meant that households that earned less money per person had to reduce the quantity of food

[2] The Swedish Royal Board of Social Affairs was the national authority responsible for social welfare and services.

consumed and buy cheaper types of food.[3] In this paper we do not study the quantity of food consumed but rather if households changed the quality and composition of their diets to economize on their spending on foods and beverages.

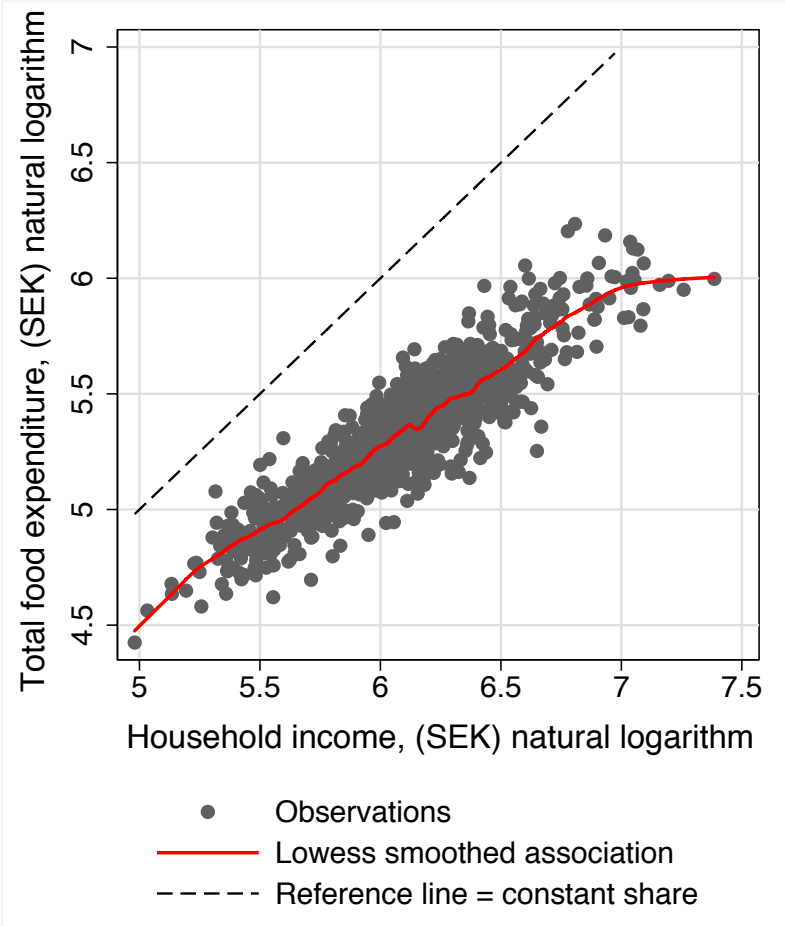
Figure 1. The share of income spent on food by level of income per capita among urban households in Sweden, 1913–1914



Note: The share of income spent on food is correlated with the natural logarithm of the household income per capita with Pearson's correlation coefficient, $r = -0.66$. The line is the prediction from locally weighted regressions and was estimated using a lowess smoother (the lowess command in Stata 14.1) with bandwidth 0.1.

[3] We have not yet established the scales to use for estimating the nutrient contents of the food. We have therefore not tried converting all the food items and beverages consumed to their energy or nutrient equivalents to investigate this further.

Figure 2. The association between the total food expenditure and total income per capita among urban households in Sweden, 1913–1914



Note: The total food expenditure is correlated with the natural logarithm of the household income with Pearson's correlation coefficient, r = +0.90. The line estimating the association is the prediction from locally weighted regressions and was estimated using a lowess smoother (the lowess command in Stata 14.1) with bandwidth 0.1.

We investigate the changes of food quality by calculating the average amount spent per unit by the households for twenty-six different food items and beverages and two aggregated food groups. We have information on the total expenditure and amount consumed during a whole year. We divide the total expenditure by the total amount consumed to calculate the 'unit values', in other words the average amount spent per unit. The twenty-six categories are broad enough (for example potatoes, rye flour or fresh pork) to each cover a range of different varieties. The unit value is an average across all the different varieties bought and purchases made during the whole year and

should therefore not be confused with the (time- and place-specific) price of a specific good in the market.[4] The unit values we observe and analyze are averages across many different prices. They will therefore change upwards and downwards as a result of a number of different factors. They are, for example, influenced by the mix of varieties of different quality bought within each food or beverage category, the price-levels of the different stores used, as well as different types of discounts and market imperfections. We will nonetheless discuss the differences in unit values as being differences in 'quality', in line with the practice in previous research (e.g. Bils and Klenow, 2001; Deaton, 1997; Gibson and Kim, 2013; Prais and Houthakker, 1971).

It is difficult to have a clear *a priori* expectation of the association between household income and unit values. One obvious expectation is that households with higher incomes spent on average more per unit on their food. But it is also possible to argue the opposite. If, for example, households with lower incomes were more constrained with regards to time or money in their shopping this could lead to them paying on average more per unit than richer households. The lower-income households could for example have had more difficulties to transport themselves and the goods, and to store the food in their homes. This in turn could have prevented them from using cheaper stores and quantity discounts. We can only observe the total, net effect of all factors influencing the unit values spent by the households. We can therefore only investigate which of the possibly counteracting patterns was dominant. Any systematic pattern is therefore a strong indication that there was a mechanism increasing or reducing the unit values spent by households with different levels of income.

We also investigate if households with different levels of incomes changed the composition of their diets to adjust their spending on food. Different types of foods are more or less expensive. Shifting the diet towards foods with lower prices could have been another behavior used by the households with lower incomes to reduce the amount spent on foods. Here the expectation is that households with lower (higher) incomes shifted their diets towards foods with lower (higher) prices. Below we compare the relative importance of the two behaviors mentioned as ways for the households to economize on their spending on food.

[4] The differences between prices and unit values is discussed at some length by for example Deaton, 1997, Ch. 4–5.

The paper is organized as follows. After a review of previous research, we introduce the data and methods used for the study. We explore the degree of between-household variations in incomes and household size as well as in the unit values and amounts consumed of the included food items and beverages (Tables 1–3). We then present results regarding the 'quality elasticity' across all these food items and beverages (Table 4), before we turn to estimating the 'quality elasticity' for each food item or beverage separately (Table 5). We then use indices of changes in quality (Figure 3) and diet (Figure 4) to investigate which factor had the strongest impact on the total amount spent on food.

We find evidence of that households with higher incomes spent slightly more per unit on the food they bought. The households spent on average more per unit on some more luxury foods, such as fresh veal or lamb meat, and on liquor. But we also find a relatively strong association for several staple foods, for example potatoes and hard rye bread, indicating that the households with higher incomes spent more on also these foods to improve their quality. Even if we do find support for changes of quality, changes of the composition of the diet seem to have been a much more important behavior for adjusting the amount spent on food.

2 Previous research

Much of the research analyzing if households with different incomes spend different amounts on food investigates whether or not the poor pay more for their food. This discussion is closely related to the analysis of unit values because many of the reasons as to why poor households pay on average more or less for their food are the same as the reasons why the unit value of a food category differs from the price of a good. Most of the current research on these issues concerns low- and middle-income countries or the USA. The poor sometimes face substantially higher prices than others in low- and middle-income countries. Mendoza (2011), for example, shows that the poor almost always pay a much higher price for water and credit than others. This pattern has been termed the 'poverty penalty'. Counteracting any poverty penalties present in an economy would increase the opportunities for the poor to participate in the economy as consumers, producers and distributors (Mendoza, 2011; Prahalad, 2006). The issue

therefore has important implications for economic development in these contexts. The question also has important policy implications in the USA because of the highly unequal access to food outlets and to healthy and adequate food in the population there.

In low-income countries there is a pattern that lower-income households spend on average more per unit for their food—in other words there is a 'poverty penalty' also with regards to food—as a consequence of them not being able to make use of quantity discounts (for example Mussa, 2015). In high-income countries it is, in contrast, higher-income households that spend more per unit on their food (Aguiar and Hurst, 2007; Beatty, 2010; Broda, Leibtag and Weinstein, 2009). Prais and Houthakker (1971) analyzed data from a household budget survey of working class households carried out in Britain in 1937–1938. They found that households with higher incomes spent on average more for their food also in this early twentieth century population. The conflicting results from different contexts make it meaningful to investigate this issue also among the Swedish early twentieth century, urban households studied here.

There are several different ways in which a household can adjust the amount they spent on food. They can—besides changing the quality or the composition of the diet—also change their shopping behaviors or use different types of stores. These changes can work to create either a positive or a negative association between the household income and the unit values. There is evidence supporting both patterns. This is, as mentioned, one of the motivations for the present study.

Households can lower the amount spent for their food consumption by increasing the time spent in home production. Aguiar and Hurst (2007) find support for this using present-day data from the USA. They also find that households can lower the price of the food they buy by investing more time in shopping and shopping more frequently. Households with a higher shopping frequency also had a higher propensity to use different discounts and saved more money in this way. Aguiar and Hurst (2007) find that the opportunity cost of time (measured in a number of different ways) was negatively associated with the frequency of shopping for food and positively associated with the average unit value. One of the patterns they find in support of this is that households with higher incomes spend, on average, slightly more per unit for the same food products than households with lower incomes.

Beatty (2010) also finds that lower-income households in Britain in 2001–2006 on average pay less for their food than households with higher incomes. One of the reasons for this is that a larger share of the diets of these households is made up by foodstuffs for which there are quantity discounts. In this present-day, high-income context it therefore seems as if quantity discounts are not a mechanism behind a 'poverty penalty', but rather the opposite (see also Broda et al., 2009). This is in contrast to what has been found in low-income countries where lower income households pay on average more per unit for their food, at least partially, because they cannot make use of quantity discounts (Mussa, 2015).

Stores of different types, with different levels of service and in different locations typically charge different prices for the food (Broda et al., 2009). The choice (or need) of a household to buy their food in a certain type of store and/or in a specific location, could therefore increase or decrease the amount paid for food. One potential reason for why households with different levels of income spend more or less on the food they buy is that stores in neighborhoods with different average levels of income charge different prices.

That different types of stores charge different prices does not create any important differences in the amount spent on food by households with different incomes in present-day USA. There are few systematic differences in the type of store used by households with different levels of income (Taylor and Villas-Boas, 2016). There is also no evidence of that US households with different levels of income shop at outlets charging different prices (Kurtzon and McClelland, 2010). But prices could also vary systematically within types of stores, between places. If prices are systematically different in neighborhoods with different levels of income this would lead to households with different levels of income facing different price levels in their neighborhoods. A review of studies on the USA from 1997 found that the average prices were slightly higher in lower-income than in higher-income neighborhoods (Kaufman, MacDonald, Lutz and Smallwood, 1997). A more recent review, also of studies on the USA, instead found that prices were on average higher in higher-income neighborhoods (Rogus, 2015). We should therefore not necessarily expect that the patterns observed today have been constant over time.

Kaufman et al. (1997), as mentioned, find that poorer households in the USA face slightly (<1%) higher prices than the national average. Despite this the poorer households spend less per unit for the foods they buy. The causes behind this disparity is that they choose products with lower quality and are better at using other methods for reducing costs, such as different types of discounts. Broda, Leibtag and Weinstein (2009) compare the different reasons behind that US households with higher incomes pay on average more per unit for their food. They find that most of the higher amount spent by higher income consumers is a result of them buying higher quality versions of the same foodstuffs. Manig and Moneta (2013) find a similar result for present-day Russia. They use different methods than we do for this study but have a similar aim in their analysis of household survey data from Russia 2000–2002. They find that households with higher incomes did not demand any more food. Instead the higher-income households spent their money to improve the quality of their food rather than to increase their intake of food energy.

Gibson and Kim (2013) analyze data from a survey of food outlets in metropolitan areas of Vietnam and from a household survey carried out in the same areas at the same time. Their results are similar to the ones from the USA. They find a weak association between neighborhood income-level and prices of foods in different types of outlets. The weighted average food price was 4.5% lower in low-income compared to high-income neighborhoods in the survey of food outlets.[5] But they find a much different pattern when they analyze unit values of foods from the household survey. The households in the lowest income tertile paid on average 18% less for the same category of food compared to the households in the highest income tertile (Gibson and Kim, 2013, p. 200). The income tertiles for areas and households would only overlap completely if there was perfect income segregation. It is still striking that the poorest households that also lived in the poorest neighborhoods spent on average less per unit for their food than the richest households, despite facing higher prices for these foods than in the richest neighborhoods.

The association between the unit value and the level of income of the household is called the 'quality elasticity' (Deaton 1997). The 'quality elasticity' can be different for

[5] The differences found were thus small and were not statistically significant (Gibson and Kim, 2013, p. 199). The pattern was not a linear gradient across the neighborhoods with different levels of income. The price was 2.5% higher in the low-income neighborhoods when compared to the middle-income group.

different foods. Broda et al. (2009), for example, find that the unit values of fresh produce were five times as sensitive to income, in other words had higher 'quality elasticities', compared to other categories of foods.

Prais and Houthakker (1971) similarly found that meat and fish had the highest 'quality elasticities' in the British household budget survey from 1937–1938. These are the foods that today have the highest average price elasticities (Green et al., 2013). We should expect that households with higher incomes would be more prone to buy more expensive foods since we expect the price elasticity to be lower for them than for households with lower incomes. This is the pattern found today when comparing price elasticities of lower-and higher-income households, and in lower-income countries compared to in higher-income countries (Green et al., 2013). The lowest price elasticities are today found for cereals, fruits and vegetables and fats and oils (Green et al., 2013). If the price elasticities were similar in Sweden in 1913–1914 as they are on average globally today, we should expect lower 'quality elasticities' for these foods.

There are also other alternative or complementary mechanisms that could influence diets of groups with different levels of income. Bennett (1941) proposes that the cost per energy unit is a major influence on the composition of the diet of populations. In this framework the first priority for people was, and is, to get enough energy. At low levels of income these calories will come from the cheapest source. When Bennett was writing his paper the cheapest source of food energy was starchy cereals and tubers, jointly called 'starchy staples'. As incomes rise and the access to sufficient food energy becomes more secure, diets can and will shift towards foods that contain more of other nutrients but which are more expensive per energy unit, such as vegetables and animal products. At the time when Bennett was writing his paper (published in 1941) fats and sugar too were more expensive than the starchy staples per energy unit, and so were foods whose consumption increased with income. Bennett drew these conclusions based on country-level statistics from the early twentieth century. Grigg (1996) found support for the patterns proposed by Bennett also in statistics from the latter part of the twentieth century. He, for example, finds that log GDP per capita explained 73 percent of the between-country variation in the share of food energy coming from starchy staples around 1990.

The change of the composition of the diet of populations discussed by Bennett can be found in the historical development of single countries and also to some extent when comparing across countries at different levels of income. This uniform development has more recently been described as the 'nutrition transition' (Drewnowski and Popkin, 1997; Popkin, 1993, 2006).

Nelson (1993) shows how the differences in diet between households in Britain with different levels of income changed over the twentieth century. The amounts consumed of different foods changed in similar ways over time in higher- and lower-income households. But there were also always systematic differences in the diets. The higher-income households consumed more varied diets with higher amounts of animal products, fats, sugar and vegetables. The lower-income households compensated the lower intake of everything else by consuming more bread, flours and grains. The differences in diets between the higher- and lower-income households in Britain therefore mirror the developments of diets seen over time within Britain, and other countries. The higher-income households were further along in the 'nutrition transition' than those with lower incomes.

Bennett's 1941 paper focuses on the consumption of wheat (and was published in the journal *Wheat Studies*). Besides the changes of the composition of the diet he also discusses how there can be shifts within food groups, and specifically among starchy staples. Rising incomes can lead to a shift of the consumption of starchy staples from less towards more preferred foods in the category, for example from rye to wheat (Bennett, 1941, pp. 41–42). This is an intermediate step in the dietary change after the requirements for food energy have been met but before incomes have risen enough to allow a shift away from starchy staples towards other foods.

The idea that the cost per energy unit of foods is a major influence on diets has in recent years been further developed by Drewnowsky and coauthors (Drewnowski and Darmon, 2005; Drewnowski and Specter, 2004). They extend the explanatory framework to include differences in diets within populations. Poorer segments of populations will consume more of foods that are cheaper per energy unit, such a starchy staples, sugar and fat. The higher consumption of these cheap, energy-dense but nutrient-poor, foods in groups with lower incomes is suggested to be an explanation of the higher prevalence of obesity in low- compared to high-income groups within high-income countries.

We apply some of the methods used in the literature today, for example 'quality elasticities', to investigate the behaviors of these early twentieth century urban households. We don't know of any study other than Prais and Houthakker (1971) that tests this for an historical population. By doing this we can learn more about both how these the Swedish households economized on their food expenditures. We also investigate if households with different levels of income changed the composition of their diets to adjust their food expenditures. We can therefore evaluate which was the more important way for the households to adjust their food expenditures. The analyses of the changes of the quality of the food items and food groups, flours, and grains bought allow us to investigate if the changes of the composition of the diets were combined with shifts of the consumption of staples as suggested by Bennett (1941).

3 Data

The data we use come, as mentioned, from a household budget survey carried out by the Swedish Royal Board of Social Affairs in 1913–1914 (Socialstyrelsen, 1917). The survey included households living in cities or towns. Most households were families with children and both parents present. The absolute majority of the men had working class occupations with the rest having lower 'non-manual' occupations (as classified in the HISCLASS scheme; van Leeuwen and Maas 2011). Also the men with 'non-manual' occupations were actually working in mostly manual occupations, being for example janitors, policemen or mailmen.

The participating households kept book of all their incomes, expenditures and consumed amounts in a set of pre-printed diaries during a whole year, Autumn 1913–Autumn 1914. Every three months they sent a diary to the Board of Social Affairs where staff checked the books and wrote back to the households if anything was missing or seemed strange. They also corrected obvious mistakes and summarized the entries over the three months. After the end of the study period they transferred the quarterly summaries to forms, checked everything again and then summarized over the year. These summaries of the incomes, expenditures and consumed quantities over the whole year were published on household level for households living in eight different cities or towns; Eskilstuna, Uppsala, Västerås, Helsingborg, Malmö, Göteborg,

Jönköping and Gävle (Socialstyrelsen, 1919). This is the data that we have transcribed and analyze for this study.

The data used for this study is one part of a larger dataset being used in the project Socioeconomic dimensions of diet and health during the 20th century: A longitudinal study (funded by the Swedish Research Council; VR Dnr 2015-00961, PI Christer Lundh). This project is creating an historical cohort, the LONGH Cohort, by following up the individuals living in the households that participated in the surveys. We will collect information on their date and cause of death and, for the men, their height, weight etc. at the conscript inspection. The cohort will be analyzed by an interdisciplinary team to study the influences of living conditions and nutrition on growth and health.

The Board of Social Affairs had a specific category of households in mind for the survey: families with children and both parents present in which the man worked in a working class occupation. They did not think that poor households would be able to complete the task of filling out the books for a whole year. The households also earned more than the average for their worker category. The households included were therefore relatively well-off and orderly households with the capacity to put in all the work it must have meant to participate in the survey. The most important problem with the data we use is that the sample therefore is not representative or random. While the households were not representative of households in Sweden at the time, we have no particular reason to expect that they were not representative with regards to how they tried to economize on their spending on food. We therefore argue that the associations we find in the data could be representative for lower- and middle-income households even though the sample is not. We are missing the poorest and the richest households from the sample. This is highly unfortunate since having information on them could have allowed us to investigate if there were threshold income effects for the associations.

The sampling method used consisted of looking for volunteers. There was a local representative in the different cities and towns that recruited people they thought were suitable. Some worker categories, for example policemen and railway workers, are overrepresented and so it seems as if the representatives looked for participants among their colleagues and friends.

The households were paid a small amount of money to participate and could also be awarded prices for especially well-kept books. This remuneration must be considered low considering all the work it must have meant filling out the books. Despite this about 70 percent of the households that started filling out books kept up the recording for a full year (Socialstyrelsen, 1917, p. 11). The Board of Social Affairs reports that some of the participating households saw the investigation as an opportunity to get a better grasp of the household's economy.

The data we analyze does not contains the quantities bought at each purchase, only the total amount consumed during a year. We can therefore not investigate if it was possible for the households to get quantity discounts on the food they bought. A large share of the households were members of a consumer cooperative. They report the dividends from these cooperatives as an income and so this discount is not included in the unit values. Excluding the dividends makes the unit values correspond more closely with the quality of the food items and beverages bought. The dividends were small and only made up on average 0.3 percent of the total household income (Socialstyrelsen, 1917, p. 40). Excluding the dividends should not influence the estimated associations because they were so small and because the exclusion slightly increases both the income and the average unit value. We also don't know where the households bought their food, and so do not know if there were additional systematic differences in the costs to the households inferred by the travel to and transportation from the stores. What we do know is the average unit value of twenty-six food items and beverages bought and consumed by the households. These average unit values include, for example, the differences in quality, quantity discounts and differences in the average price level of different stores, but excludes the transportation costs and dividends from consumer cooperatives.

The data was, as mentioned, thoroughly checked and can therefore be expected to be of high quality. We still carried out extensive checks of the data and excluded 25 observations of expenditures and consumed quantities when the calculated unit values were obvious outliers.

4 Methods

Unit values can most often only be calculated for more or less narrow categories of food. This is the case also in our data where we, for example, have data on the categories fresh oxen meat and wheat flour. There could therefore be differences within these categories with regards to the quality of the actual food items bought. Stores of different types and in different locations charge different prices. The choice of stores used will therefore also influence the unit values. There are also often possibilities to make use of different types of discounts, for example quantity discounts, to reduce the amount spent on a food item. Unit values can also vary between households because of 'market imperfections', meaning that the households didn't know that they could buy the same item at a lower price somewhere else. The household could also have to accept to spend more because they could not afford to transport themselves and the goods to and from a store with lower prices. All these factors, and more, could have influenced the unit values we calculate from our data for this study.

Not all factors influencing the unit values will be directly related to the actual quality of the food items. But all are in different ways related to the 'quality' of the experience for the consumers. All the possible ways to reduce the average amount spent per unit is associated with some kind of cost to the household. If the households could spend more per unit to buy their food in a store that is conveniently located, while not having to be on the lookout for discounts or price differences this would reduce the transaction costs and increase the 'quality' of the shopping experience for the household.

We can analyze the income-related variation in the unit values of twenty-six food items and beverages and two food groups. We use the method proposed by Deaton (1997, Chapter 5) to estimate the 'quality elasticities' (see also Gibson and Kim, 2013, p. 200).[11] This regresses the natural logarithm of the unit value on the natural logarithms of household income and household size. This is equivalent to relating the unit values to the natural logarithm of the per capita income in the regressions. The regression coefficients on the natural logarithm of household income when also including the natural logarithm of household size turn out to be identical to the coefficient on the natural logarithm of the household income per capita when including only this variable

[11] Deaton (1997, Chapter 5) discusses in detail how it can be estimated because he suggests they can be used as an intermediate step in deriving price elasticities from data on unit values.

(results not shown). We chose to follow the specification in Deaton (1997) and include the natural logarithms of household income and household size as separate variables.

To increase the comparability of our results we calculate income per capita rather than using the equivalence scale applied by the Board of Social Affairs (Table A2). We also ran the models including the natural logarithm of the number of consumption units (as defined in Table A2) in the households instead of the number of household members. The results were almost identical to the ones presented below (results not shown).

We include indicator variables for cities and for each food item or beverage as control variables. It is possible to estimate potential additional effects on the unit values from intra-household allocation by including variables of the household composition. We do not include any such variables because they would reduce the interpretability of the association with household income. We did try adding the share of children under the age of 13 years in the households in the regressions. The results were almost identical to the ones presented below (results not shown). The potential effects from intra-household allocation will be investigated in a future study.

We estimate regressions with two different specifications: one including all food items and beverages in the same model, and one estimated separately for each food item or beverage. Households that did not spend anything on or consume anything of a specific food item or beverage are excluded from the estimation for that category. We therefore have different numbers of observations for the different foods and beverages (Table 1).

We adjust for differences in the average unit values for the different food items and beverages by including indicator variables in our combined regression. In the 1910s there were still important differences between regions in Sweden in the level of income, costs of living and diet (Collin, 2016). We can see these differences in the summary statistics for our sample and in the reference budgets and price levels presented by the Board of Social Affairs for different areas of Sweden (Tables 3, A1 and A3 respectively). Not all of the differences in diet were a result of the differences in the level of income and food prices. There were also differences in the availability of foodstuffs and in preferences. The type of meat most commonly eaten, the mix and amounts of the different dairy products and the balance between potatoes and bread, for example, differed somewhat between the regions. The most important regional difference in diets was the type of bread consumed and if it was bought as bread or

baked from flour. In the south of Sweden it was common to buy loaves of rye bread. These were specific enough to the south to not be included among the foods which the Board of Social Affairs collected prices on in their survey.

We want to exclude these regional variations when we analyze the associations between household income and unit values. In the regressions we include indicator variables for each of the cities covered to control for the differences in averages between them. The combined regressions presented in Table 4 are also weighted using area-specific consumption baskets. For our indices of changes of quality and composition of the diets, presented below, we use area-specific prices and consumption baskets in the calculations.

Including the indicator variables for the cities in the regressions risks adjusting away part of the variation in unit values and incomes that would be relevant to include in the estimation of the 'quality elasticities'. We still chose to include these indicators in the models. We tested running the regressions without including the indicators for the cities and the results were very similar to the ones presented below (results not shown). The only substantial difference is a weakening of the 'quality elasticity' for rye flour. This is, as mentioned, one of the foodstuffs which shows the largest regional variation due to the differences in habits regarding what type of bread the households consumed and if they baked it from flour or bought baked bread.

We estimated the 'quality elasticity' across all food items and beverages using weighted least squares regressions with the following specification:

Equation 1.

$$\begin{aligned}\ln Unit\ value\ of\ food, v_{i,j,m} \\ &= \alpha + \beta_1 \ln Household\ income_{j,m} + \beta_2 \ln Household\ size_{j,m} \\ &+ City_m \boldsymbol{\beta}_m + Food\ item_i \boldsymbol{\beta}_i + \varepsilon_{i,j}\end{aligned}$$

The dependent variable, $v_{i,j}$, is the natural logarithm of the unit value for a specific household and food or beverage. The 'quality elasticity' is the coefficient on the natural logarithm of the total household income, β_1. The model also includes the natural

logarithm of the total number of people living in the household, in other words the household size. An increase of the household size meant that the available resources had to be divided among a larger number of people. We therefore expect a negative coefficient on the household size, β_2, that should be of the same (absolute) size as the coefficient on the household income. As mentioned before, because the model is adjusted for the household size the 'quality elasticity', β_1, can be interpreted as the effect on the unit value from changing the household income per capita. The model also includes indicator variables for cities and food items and beverages. The standard errors were clustered at the household level to allow the residuals to be correlated within each household.

The regressions are, as mentioned, weighted least squares regressions in which we use the area-specific budget shares of each food item or beverage as the weights (Table A4). Butter, unskimmed milk and wheat flour, for example, have higher weights than vegetables or fish. Because the regressions are weighted they estimate what corresponds to the consumption basket weighted average association between unit values and household income.

We also estimated the 'quality elasticity' for each of the twenty-six food items and beverages and for two food groups separately. These regressions are not weighted because they only include one item at the time. The standard errors in these regressions are robust to heteroscedasticity. These regressions are specified as follows:

Equation 2.

$$\begin{aligned}\ln Unit\ value\ of\ food, v_{j,m} \\ &= \alpha + \beta_1 \ln Household\ income_{j,m} + \beta_2 \ln Household\ size_{j,m} \\ &+ City_m \boldsymbol{\beta}_m + \varepsilon_j\end{aligned}$$

We present the results from the regressions in Tables 4 and 5. In Table 4 we report summary results from five separate regressions in five columns. In Table 5 each row reports summary results from one of 28 separate regressions.

Prais and Houthakker (1971) use an index to summarize the overall differences in quality, i.e. unit values, of the diet of households with different levels of income (compare also with Aguiar and Hurst, 2007). We follow this approach and also add a corresponding index for changes in the composition of the diet. The indices are constructed as Laspeyres indices keeping all but the unit values or the consumed quantities in the numerator constant at their area-specific values. The area-specific prices and consumption baskets are presented in the Appendix in Tables A1 and A3.

Equation 3.

$$Index\ of\ quality\ changes, I_j^Q = \frac{\sum_{i=I} v_{i,j}\bar{q}_{i,r}}{\sum_{i=I} \bar{p}_{i,r}\bar{q}_{i,r}}$$

Equation 4.

$$Index\ of\ dietary\ changes, I_j^D = \frac{\sum_{i=I} \bar{p}_{i,r}q_{i,j}}{\sum_{i=I} \bar{p}_{i,r}\bar{q}_{i,r}}$$

The unit value spent per unit of food item i by household j is, as before, denoted $v_{i,j}$. The quantity consumed per capita by household is called $q_{i,j}$. The reference quantities and prices for food item i in area r are called $\bar{q}_{i,r}$ and $\bar{p}_{i,r}$ respectively. The outcome of the index of quality changes is one value per household showing how much less or more they spent on their food given their unit values compared to if they had bought it at the reference prices. The total expenditure corresponding to both the household-specific unit values and the area-specific reference prices are calculated using the area-specific reference consumption baskets. The outcome of the index of dietary changes is one value per household of how much they spent on their food given their diet compared to how much they would have spent if they consumed like the area-specific reference budget. The total costs of both the household-specific diet and the area-specific reference consumption baskets are calculated using the area-specific reference prices.

5 Results

There was substantial variation in the unit values of all food items across households (Table 1). The variation is somewhat higher for meats and fish than for dairy products. The variation is also high for some staples, for example potatoes and hard rye bread. There was less variation in the unit values of the apparently relatively standardized products, sugar, wheat flour and brown beans. The highest variation in unit values was for beer and the variation for liquors is also in the high end.

There was a very large variation between the households in the amounts consumed of the different food items and beverages (Table 2). Overall the households consumed a quite meager diet consisting primarily of starchy staples. They consumed on average almost two liters of potatoes along with two-thirds of a kilogram (kg) of flours (besides the bread) per person and week. Milk was also an important foodstuff for the households of which they consumed on average more than half a liter per person and day. Other animal products were luxuries. The people living in the households ate on average only about 40 grams of meat and two eggs per person and week. Butter and margarine was in comparison consumed in larger quantities; almost 250 grams per person and week. The households also consumed relatively large quantities of sugar: 55 grams per person and day. This overall pattern was similar across the households but there was also, as mentioned, a very large degree of variation even for the foods that all households consumed, such as eggs and milk.

Table 1. Summary statistics of unit values in the sampled Swedish urban households 1913–1914

	Unit value (SEK)	*Standard deviation*	*Coefficient of variation (%)*	*Obs.*
Panel A. Food items:				
Fresh meat, oxen	1.20	0.14	12	905
Fresh meat, veal	1.10	0.23	21	850
Fresh meat, lamb	1.29	0.20	16	615
Fresh meat, pork	1.32	0.16	12	901
Preserved meat, beef	1.42	0.28	20	501
Preserved meat, pork	1.48	0.19	13	879
Preserved fish, salted herring	0.43	0.10	22	881
Preserved fish, dry cod	0.61	0.14	23	354
Dairy, unskimmed milk	0.14	0.01	9	906
Dairy, skimmed milk	0.07	0.01	16	850
Dairy, butter	2.23	0.14	6	900
Dairy, margarine	1.45	0.10	7	874
Dairy, cheese	1.50	0.22	14	905
Dairy, eggs	0.07	0.01	9	906
Bread, hard rye	0.46	0.11	24	717
Flour, wheat	0.32	0.02	7	908
Flour, rye	0.25	0.04	14	710
Grains, oats	0.41	0.08	19	903
Grains, rice	0.52	0.10	19	887
Vegetables, peas	0.33	0.08	23	862
Vegetables, brown beans	0.47	0.06	12	769
Vegetables, potatoes	0.05	0.01	20	902
Sugar	0.63	0.02	3	908
Coffee	2.30	0.32	14	907
Beers	0.42	0.19	44	550
Liquor	1.74	0.43	24	555
Panel B. Food groups:				
Flours	0.32	0.03	10	908
Grains	0.44	0.08	18	908

Note: Calculated from the household level data published in Socialstyrelsen (1919).

Table 2. Summary statistics of the consumed quantities in the sampled Swedish urban households, 1913–1914

	Unit	*Quantity*	*Standard deviation*	*Coefficient of variation (%)*
Panel A. Food items:				
Fresh meat, oxen	kg	7.1	4.37	62
Fresh meat, veal	kg	2.6	2.48	94
Fresh meat, lamb	kg	0.8	1.19	148
Fresh meat, pork	kg	6.5	5.59	87
Preserved meat, beef	kg	0.3	0.52	176
Preserved meat, pork	kg	3.5	2.96	85
Preserved fish, salted herring	kg	3.4	2.98	88
Preserved fish, dry cod	kg	0.3	0.64	215
Dairy, unskimmed milk	lt	143.0	71.18	50
Dairy, skimmed milk	lt	52.3	58.07	111
Dairy, butter	kg	7.6	5.17	68
Dairy, margarine	kg	4.7	4.10	87
Dairy, cheese	number	3.5	2.16	63
Dairy, eggs	kg	113.8	68.79	60
Bread, hard rye	kg	8.3	10.58	127
Flour, wheat	kg	26.4	18.03	68
Flour, rye	kg	6.9	12.80	185
Grains, oats	kg	4.8	4.17	87
Grains, rice	kg	1.3	1.07	83
Vegetables, peas	kg	1.5	1.36	89
Vegetables, brown beans	kg	0.7	0.74	110
Vegetables, potatoes	lt	101.3	45.42	45
Sugar	kg	20.1	7.48	37
Coffee	kg	4.2	2.03	49
Beers	lt	4.9	11.22	229
Liquor	lt	2.2	3.71	169
Panel B. Food groups:				
Flours	kg	34.9	26.19	75
Grains	kg	6.8	4.81	70

Note: Calculated from the household level data published in Socialstyrelsen (1919).

Table 3. Summary statistics of incomes and household sizes in the sampled urban households 1913–1914, by area of Sweden

	Mean	*Standard deviation*	*Coefficient of variation (%)*
Panel A. East (Eskilstuna, Uppsala, Västerås)			
Total household income (SEK)	1,880	468.4	26
Total household income (SEK), ln	7.5	0.24	—
Household size	4.3	1.62	38
Household size, ln	1.4	0.36	—
Observations	*215*		
Panel B. South (Helsingborg, Malmö)			
Total household income (SEK)	1,843	430.7	23
Total household income (SEK), ln	7.5	0.22	—
Household size	4.3	1.57	36
Household size, ln	1.4	0.36	—
Observations	*323*		
Panel C. West (Göteborg)			
Total household income (SEK)	1,861	438.4	24
Total household income (SEK), ln	7.5	0.22	—
Household size	4.4	1.59	36
Household size, ln	1.4	0.34	—
Observations	*201*		
Panel D. Southeast (Jönköping)			
Total household income (SEK)	1,623	373.2	23
Total household income (SEK), ln	7.4	0.22	—
Household size	4.7	1.87	40
Household size, ln	1.5	0.38	—
Observations	*86*		
Panel E. Middle (Gävle)			
Total household income (SEK)	1,883	524.0	28
Total household income (SEK), ln	7.5	0.26	—
Household size	4.8	1.78	37
Household size, ln	1.5	0.39	—
Observations	*83*		

Note: Calculated from the household level data published in Socialstyrelsen (1919).

Examples of the amounts consumed per year of also other foodstuffs can be seen in the appendix Table A1. The amounts stated there are per year for one 'consumption unit'; in other words, one adult man. The Swedish Board of Social Affairs, as is the case also for other equivalence scales, assumed lower consumption for women and children. Young children were assumed to consume a only small fraction of an adult male's requirement. An adult man was therefore assumed to consume more than the amounts mentioned above while children were assumed to consume less. In most cases that might have been accurate but it also suggests radically reduced amounts consumed of the already scarce foods, such as animal products, for these children.

The total incomes of the households were in contrast very similar in the four areas (Table 3). The exception is the southeastern area where incomes were somewhat lower. This is consistent with the pattern seen in regional wage data for Sweden from 1922 (Collin, 2016). An annual income of 1,880 SEK in 1913 corresponds roughly to $10,800 (2015 price level).[12] The level of variation between the households is similar in all five areas. The average household size is also similar across areas with just slightly larger families in the southeastern and middle areas of Sweden. The level of variation in household size is again very similar in the different areas.

We now turn to the analyses of whether or not there were income-related differences in the average amount spent per unit on foods and beverages. We find that there was a statistically significant, positive association between the household income and the unit value of the foods bought by the household, in other words a positive 'quality elasticity' (Table 4). The 'quality elasticities' in Table 4 correspond to a consumption basket weighted average of the association for the twenty-six individual food items and beverages we have data for. There were some differences in the levels of income and unit values between the eight cities that risk being included in the 'quality elasticity'. We see this by comparing Model 1 and 2 in Table 4 where the 'quality elasticity' is reduced from +0.047 to +0.032 when we include dummy variables for the cities. Model 2 assumes that the relative prices of the different foods were the same in all eight cities. Relaxing this assumption in Model 4 by including interactions between the indicators for the different foods and cities increases the overall explanatory power but has no effect on the 'quality elasticity'. We can therefore conclude that there was indeed a

[12] We used the Historical Currency Converter for the transformation (http://www.historicalstatistics.org/Currencyconverter.html).

positive ‘quality elasticity’. The size of the coefficient implies that a doubling of the total household income was associated with the household on average increasing the amount spent per unit on their food by about three percent.

Table 4. Results from WLS regressions estimating the overall ‘quality elasticity’ across 26 food items and beverages among Swedish urban households, 1913–1914

	Model 0	*Model 1*	*Model 2*	*Model 3*	*Model 4*
Total household income, ln	—	+0.047 ***	+0.032 ***	—	+0.032 ***
Household size, ln	—	–0.037 ***	–0.030 ***	—	–0.030 ***
Control variables:					
Food items and beverages	Yes	Yes	Yes	Yes	Yes
City	No	No	Yes	Yes	Yes
Interaction: City * Foods	No	No	No	Yes	Yes
Observations	20,805	20,805	20,805	20,805	20,805
R-squared	0.9906	0.9907	0.9912	0.9939	0.9940

Notes: Each column reports summary results from a different specification of a regression involving all food and beverage items. The dependent variable is the natural logarithm of the unit value of each food for each household. The regressions included, in addition to the natural logarithm of total household income and household size, indicators for twenty-five of the twenty-six food items and beverages and seven of the eight cities. The unit values are weighted in the regressions by the area-specific budget weights for each food (Table A4). The standard errors are clustered at the household level.
Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

The effect of household income on unit values is therefore statistically significant but substantively weak. We can also see that almost all of the variation in the unit values is explained by different foods having different prices (Model 0). Adding the log of household income increases the explanatory power only minutely (Compare the R-squares for Model 1 with Model 0 and for Model 4 with Model 3.). The explanatory power of the variation between the cities in levels of income and prices (Model 2) and in relative prices of foods (Model 3) is also very small. We also tried analyzing the

absolute deviations of the household-specific unit values from the area-specific reference prices relating it to the natural logarithm of the household income per capita. These results also confirm that the household income explains a small (c.1%) share of the variance in (deviations in) unit values (Table A5).

The log of the size of the household had a negative association with the unit value. The size of the coefficient is very similar in size to the coefficient on income. This is the pattern we expect from how the model was derived and since an increase in the size of the household reduced the resources available per person.

Income was associated with the average unit value for some individual food items and beverages, but not all (Table 5, Panel A). The association is positive—meaning that higher incomes were associated with higher average unit values—for twenty-four out of the twenty-six food items and beverages. The 'quality elasticity' is statistically significantly negative only for sugar, meaning that richer households spent on average less per unit for sugar. The positive association was strongest for liquor. There are some other more luxurious goods with strong positive associations; fresh veal and lamb meat, cheese and coffee. But there are also many staple foods with statistically significant and relatively strong positive associations; hard rye bread, rice, potatoes and skimmed milk. The association is also statistically significantly positive for oats, unskimmed milk and wheat flour.

The richer households were using some of their higher incomes to spend more per unit on staples too. This is confirmed when we analyze the unit values of flours and grains as aggregates (Table 5, Panel B). The amount spent and consumed of these aggregates also includes other flours and grains that were consumed less and so were not reported separately, such as barley and potato flour and wheat and barley grains. The households with higher incomes shifted their consumption of flours and grains towards the versions of these foods that had higher unit values.

Table 5[13]. The 'quality elasticity' for 26 food items and beverages among urban households in Sweden, 1913–1914

	Total household income, ln (coeff.)	*Household size, ln (coeff.)*	*Obs.*	*R-squared*
Panel A. Food items				
Sugar	–0.014***	–0.002	908	0.426
Beers	–0.005	–0.037	550	0.043
Dairy, butter	+0.0001	–0.010*	900	0.470
Dairy, margarine	+0.004	–0.014**	874	0.273
Vegetables, peas	+0.004	–0.013	862	0.534
Vegetables, brown beans	+0.009	–0.005	769	0.181
Preserved fish, salted herring	+0.011	–0.031**	881	0.463
Flour, rye	+0.011	–0.009	710	0.304
Dairy, eggs	+0.012	–0.019**	906	0.218
Flour, wheat	+0.014*	–0.013***	908	0.622
Preserved meat, pork	+0.021	–0.039***	879	0.228
Fresh meat, pork	+0.024	–0.028***	901	0.157
Dairy, unskimmed milk	+0.024***	–0.026***	906	0.498
Preserved fish, dry cod	+0.032	–0.057**	354	0.350
Preserved meat, beef	+0.033	–0.004	501	0.049
Grains, oats	+0.034*	–0.060***	903	0.480
Coffee	+0.038**	–0.055***	907	0.462
Fresh meat, oxen	+0.040**	–0.043***	905	0.298
Dairy, skimmed milk	+0.049***	–0.017	850	0.578
Fresh meat, lamb	+0.056***	–0.039***	615	0.416
Vegetables, potatoes	+0.061**	–0.045***	902	0.358
Grains, rice	+0.067***	–0.075***	887	0.575
Bread, hard rye	+0.090***	–0.053***	717	0.597
Dairy, cheese	+0.104***	–0.076***	905	0.416
Fresh meat, veal	+0.146***	–0.106***	850	0.297
Liquor	+0.297***	–0.093***	555	0.294
Panel B. Food groups				
Flours	+0.025**	–0.027***	908	0.583
Grains	+0.043***	–0.069***	908	0.631

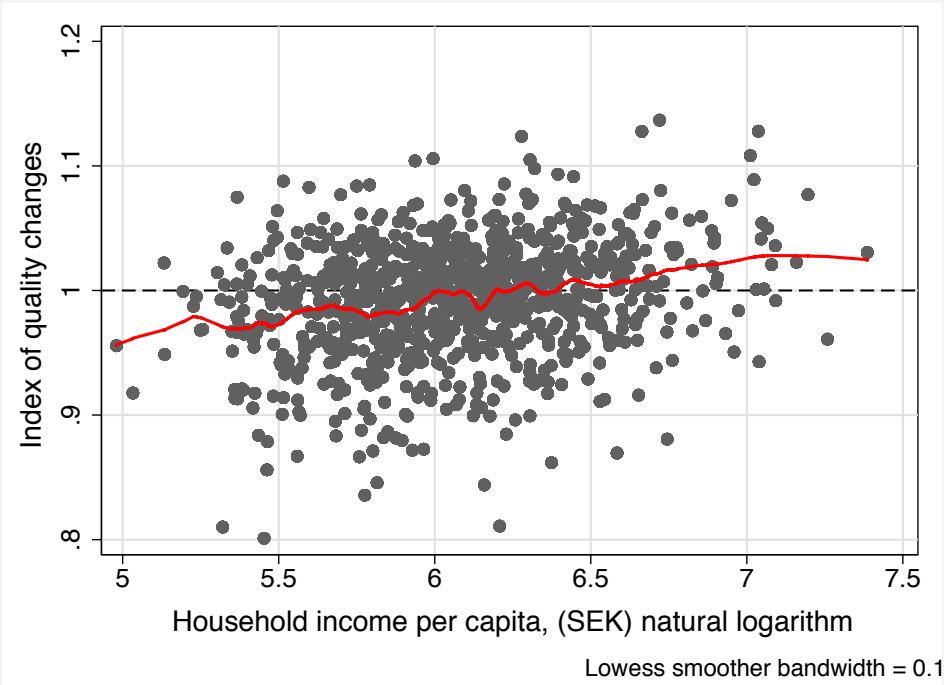
[13] Note: Each line in the table reports summarized results from one separate regression. The dependent variable is the natural logarithm of the unit value of each food for each household. The regression included, in addition to the natural logarithm of the total household income and household size, indicator variables for seven out of the eight cities. The standard errors are robust to heteroscedasticity.

Statistical significance: *** p<0.01, ** p<0.05, * p<0.10.

The log of the household size again has a negative association of similar strength to the one for income. We tested if the absolute values of the two coefficients were statistically significantly different using Wald tests. The size of the coefficient on household size is only statistically significantly different from the coefficient on household income in three cases; sugar, skimmed milk and liquor. Increasing the household size, in other words increasing the number of children, did not reduce the average amount spent per unit of these foods as much as expected. We cannot know for sure but one explanation could be that sugar and skimmed milk were used for children and so were prioritized in families with children. The corresponding explanation for liquor is that this was consumed only by adults. Adding children to the household therefore influenced the choices made with regards to liquor less than for other foods.

We also calculated our 'index of quality changes' for all households. This divides the total cost of the area-specific consumption basket (Table A1) at the household-specific unit values with how much the same basket would have cost at the area-specific price level (Table A3). The index is equal to one if the household spent exactly the same amount as expected from the references prices. Figure 3 plots the index values against the natural logarithm of the total household income per capita. Variation in unit values led to changes in the amount spent to acquire a reference budget. At the extremes the households spent twenty percent less and fourteen percent more on their food than expected from the reference prices. Higher-income households spent on average more than lower-income households (Figure 3). The index of quality changes is correlated with the natural logarithm of the household income per capita with Pearson's correlation coefficient, $r = +0.26$ ($p = 0.000$). The association is thus not very strong but the pattern is clear and statistically significant.

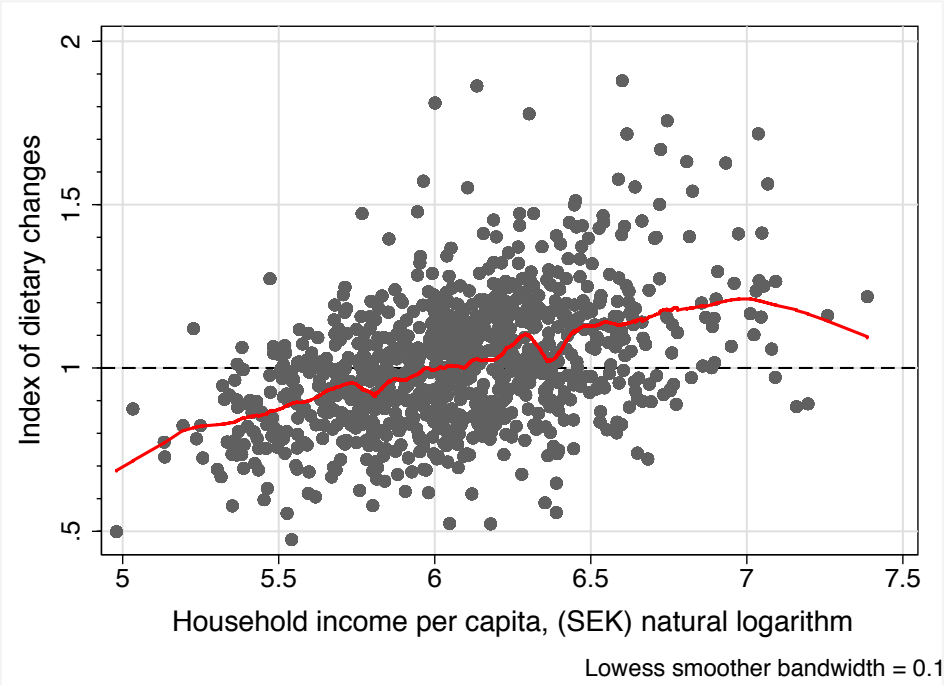
Figure 3. The association between our 'index of quality changes' and household income per capita among urban households in Sweden, 1913–1914



Note: The line is the prediction from locally weighted regressions and was estimated using a lowess smoother (the lowess command in Stata 14.1) with bandwidth 0.1.

We also calculated our 'index of dietary changes' for each household. This shows how much overall food expenditure varied as a result of households' choices on what foods to buy and consume. The index equals one if the consumed basket led to the same overall amount spent as the area-specific reference consumption basket, both valued using the area-specific reference prices. There is much more variation in the values of this index than in the 'index for quality changes' (note the differences in the scales of the Y-axes in Figures 3 and 4). At the extremes the households spent 53 less and 88 percent more on food than expected from the reference consumption basket as a result of their choices regarding the composition of their diet. The index of dietary changes is correlated with the natural logarithm of the household income per capita with Pearson's correlation coefficient, $r = +0.44$ ($p = 0.000$). The association is stronger than it was for the 'index of quality changes' and is statistically significant also in this case. Households with higher incomes consumed more expensive diets.

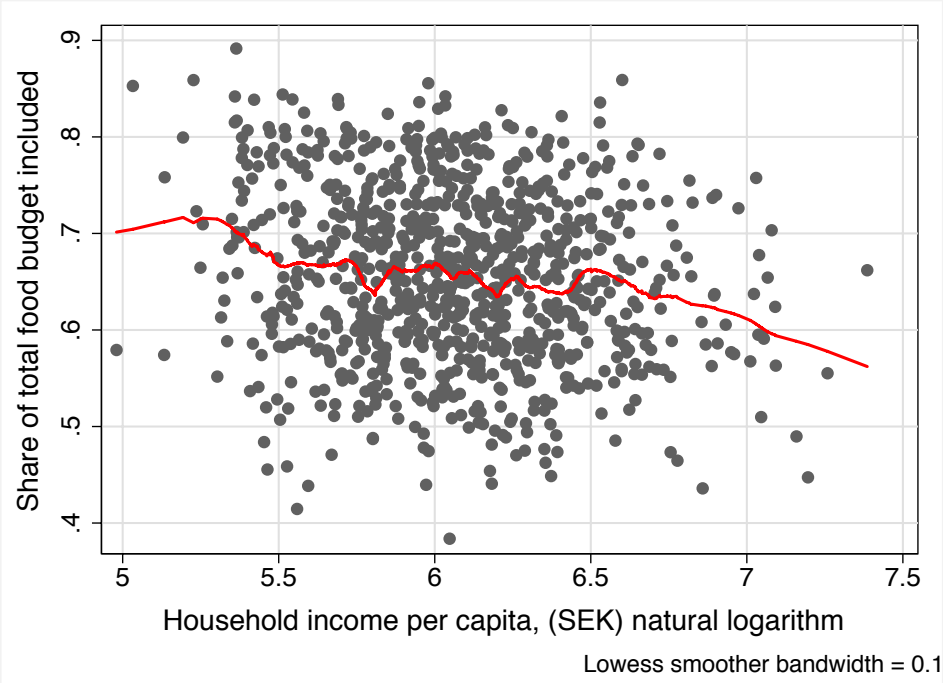
Figure 4. The association between our 'index of dietary changes' and household income per capita among urban households in Sweden, 1913–1914



Note: The line is the prediction from locally weighted regressions and was estimated using a lowess smoother (the lowess command in Stata 14.1) with bandwidth 0.1.

Our 'index of dietary changes' most likely underestimates how much dietary changes influenced the variation in overall spending on food. The higher-income households also tended to consume more of the food items and beverages not included among the twenty-six food items and beverages for which we have access to information on both amount spent and quantity consumed (Figure 5). Spending on these twenty-six food items and beverages together made up about two-thirds of the total spending on foods, beverages and tobacco. The share was on average somewhat higher in low-income as compared to high-income households. The food items and beverages not included among the twenty-six are, except for the different types of soft bread, less common foods that are likely to have been more expensive than others. The association between household income and the share of the total expenditure on included foods, beverages and tobacco is not strong but statistically significantly negative (Pearson's correlation coefficient, $r = -0.15$, $p = 0.000$).

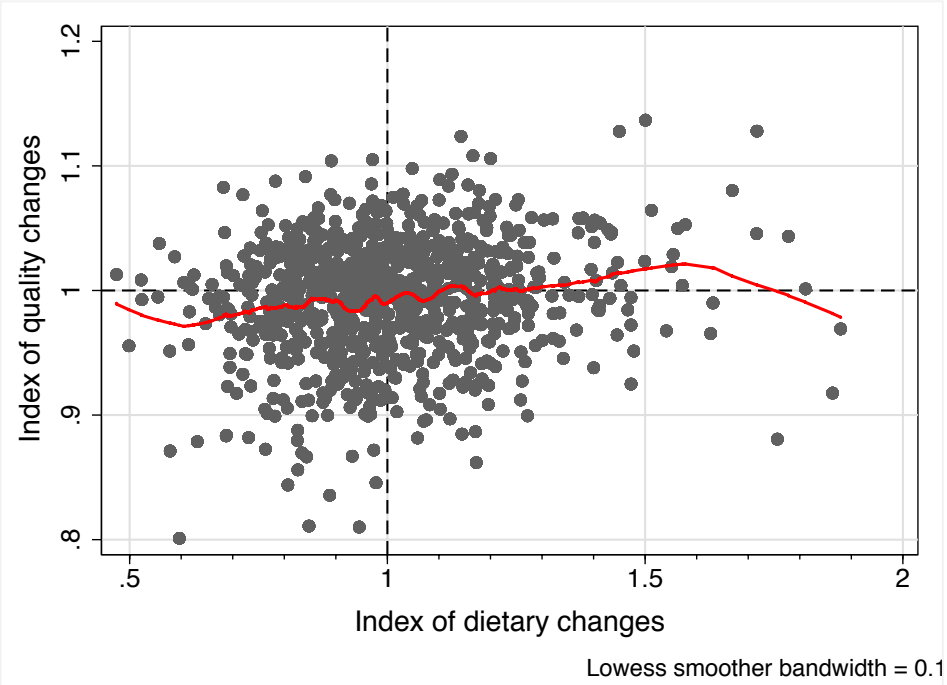
Figure 5. The association between the share of the total food budget covered by the 26 studied food items and beverages and household income per capita among urban households in Sweden, 1913–1914



Note: The line is the prediction from locally weighted regressions and was estimated using a lowess smoother (the lowess command in Stata 14.1) with bandwidth 0.1.

The two indices were only weakly, if positively, associated (Figure 6, Pearson's correlation coefficient, r = +0.15, p = 0.000). The two different behaviors for economizing on food expenditures were more often coinciding than not but there was a large degree of variation in behavior. Choosing higher or lower quality varieties of foods with different unit values was common among households consuming both more and less expensive budgets.

Figure 6. The association between our 'index of dietary changes' and our 'index of quality changes' among urban households in Sweden, 1913–1914



Note: Note the different scales of the X and Y axes. The line is the prediction from locally weighted regressions and was estimated using a lowess smoother (the lowess command in Stata 14.1) with bandwidth 0.1.

6 Concluding discussion

We find clear evidence that higher-income households in the cities and towns of Sweden in 1913–1914 spent on average somewhat more per unit on the food they bought. There was no 'poverty penalty' with regards to food in Sweden in the early twentieth century, or at least any such penalty was counteracted and dominated by the households' behaviors to economize on the spending on food. Higher-income households spent more per unit on liquor and some luxury foods, such as fresh meats. But they also spent money on raising the quality of several staples, such as potatoes and hard rye bread.

The urban households in our sample, as we saw, consumed a quite meager and monotonous diet. The dietary patterns that we observe in the Swedish urban households

in 1913–1914 included many other foods than the cheapest starchy staples. But the diets still had starchy staples, milk, fat and sugar as the most important components. Despite these households being relatively well-off compared to many others at the time, they and their diets must be considered poor. Given the dominance of starchy staples in the diet it is very likely that there were plenty of room to improve on the variability and enjoyability of these diets by spending more on these foods. Households with higher incomes seem to have been choosing more enjoyable and/or higher quality versions of the staples. Another reason for the higher unit values for these households could be that they changed their shopping behavior, using nicer stores and spending less time and effort trying in other ways to reduce the amount spent on these foods. This would also be an improvement of their welfare but would not necessarily have been reflected in the quality or nutrient contents of the food.

Bennett discusses this pattern with regards to wheat. Rising national incomes historically meant that people were substituting other starchy staples with wheat. The aggregated consumption of wheat therefore at first increased with income. When later incomes had increased even more the consumption shifted towards other foods. Historical dietary changes therefore seem to have been influenced by a hierarchy of needs and ranked preferences for different foods. As long as incomes are so low that it is problematic to provide the food energy needed within the budget, an increased income will be spent on more staples to secure against hunger. At slightly higher incomes there is room for a shift towards preferred staples, such as wheat, or higher quality versions of staples. Still higher incomes mean that consumption can shift towards more expensive foods, such as animal products and vegetables. Our results regarding households with different levels of income indicate a similar pattern. Swedish urban households in the early twentieth century seem to have been in the intermediate step where they spent their increased incomes on improving on the staples while also starting to shift their diets towards other foods.

Even if the association between the household's income and the unit values of the food items and beverages it bought was consistent and statistically significant, it explained very little of the total variation in unit values between households. The overall influence of changes in unit values compared to reference prices on total expenditure on food was also relatively modest. Changes of the composition of the diet had a much stronger

influence on spending. This variation was also more closely related to the level of income. We therefore conclude that changes of the composition of the diet was a much more important behavior for the households when economizing on food expenditure.

All households, richer and poorer, consumed animal products and vegetables. Still our results indicate that there was still room for increasing this consumption, as well as spending more on staple foods. The better-off households spent their higher incomes on increasing their consumption of more expensive foods, increasing the variability of their diet and, to some extent, improving its quality. All these shifts would have both made the diet more enjoyable as well as reducing problems with, for example, micronutrient undernutrition. The better-off households were pioneering the dietary shifts that occurred in Sweden overall in the following decades. This, in turn, points towards rising incomes being an important explanation for the dietary changes of the twentieth century.

References

Aguiar, M. and Hurst, E. (2007). 'Life-Cycle Prices and Production', *American Economic Review*, Vol. 97, no. 5, pp. 1533–59. http://doi.org/10.1257/aer.97.5.1533

Beatty, T. K. M. (2010). 'Do the Poor Pay More for Food? Evidence from the United Kingdom', *American Journal of Agricultural Economics*, Vol. 92, no. 3, pp. 608–21. http://doi.org/10.1093/ajae/aaq020

Bennett, M. K. (1941). 'Wheat in national diets', *Wheat Studies*, Vol. 18, no. 2, pp. 35–76.

Bils, M. and Klenow, P. J. (2001) 'Quantifying Quality Growth', *American Economic Review*, Vol. 91, no. 4, pp. 1006–30. doi:10.1257/aer.91.4.1006.

Broda, C., Leibtag, E. and Weinstein, D. E. (2009). 'The Role of Prices in Measuring the Poor's Living Standards', *The Journal of Economic Perspectives*, Vol. 23, no. 2, pp. 77–97. http://doi.org/10.1257/089533009788430580

Collin, K. (2016). *Regional wages and labour market integration in Sweden, 1732–2009*. Dissertation manuscript, Unit for Economic History, Gothenburg.

Deaton, A. (1997). *The analysis of household surveys: a microeconometric approach to development policy*. Johns Hopkins University Press, Baltimore, Md.

Drewnowski, A. and Darmon, N. (2005). 'The economics of obesity: dietary energy density and energy cost', *The American Journal of Clinical Nutrition*, Vol. 82, no. 1, pp. 265S–73S.

Drewnowski, A. and Popkin, B. M. (1997). 'The Nutrition Transition: New Trends in the Global Diet', *Nutrition Reviews*, Vol. 55, no. 2, pp. 31–43. http://doi.org/10.1111/j.1753-4887.1997.tb01593.x

Drewnowski, A. and Specter, S. E. (2004). 'Poverty and obesity: the role of energy density and energy costs', *The American Journal of Clinical Nutrition*, Vol. 79, no. 1, pp. 6–16.

Gibson, J. and Kim, B. (2013). 'Do the urban poor face higher food prices? Evidence from Vietnam', *Food Policy*, Vol. 41, pp. 193–203. http://doi.org/10.1016/j.foodpol.2013.05.003

Green, R., Cornelsen, L., Dangour, A. D., Turner, R., Shankar, B., Mazzocchi, M. and Smith, R. D. (2013). 'The effect of rising food prices on food consumption: systematic review with meta-regression', *BMJ*, Vol. 346, no. f3703. http://doi.org/10.1136/bmj.f3703

Hirdman, Y. (1983). *Magfrågan: mat som mål och medel: Stockholm 1870–1920*. Rabén and Sjögren, Stockholm.

Juréen, L. (1956). 'Long term trends in food consumption: A multi-country study', *Econometrica*, Vol. 24, no. 1, pp. 1–21.

Kaufman, P., MacDonald, J. M., Lutz, S. M. and Smallwood, D. (1997). *Do the Poor Pay More for Food? Item Selection and Price Differences Affect Low-Income Household Food Costs*. United States Department of Agriculture, Agricultural Economic Report No. (AER-759). Retrieved from http://www.ers.usda.gov/publications/aer-agricultural-economic-report/aer759.aspx

Kurtzon, G. and McClelland, R. (2010). *Do the Poor Pay More Store-By-Store?* Bureau of Labor Statistics WP 437. Retrieved from http://www.bls.gov/ore/pdf/ec100050.pdf

van Leeuwen, M. H. D. and Maas, I. (2011) *HISCLASS: A Historical International Social Class Scheme*. Leuven University Press, Leuven.

Lundh, C. (2013) 'Was There an Urban–rural Consumption Gap? The Standard of Living of Workers in Southern Sweden, 1914–1920', *Scandinavian Economic History Review,* Vol. 61, no. 3, pp. 233–58. doi:10.1080/03585522.2013.794162.

Manig, C. and Moneta, A. (2013). 'More or better? Measuring quality versus quantity in food consumption', *Journal of Bioeconomics*, Vol. 16, no. 2, pp. 155–78. http://doi.org/10.1007/s10818-013-9174-4

Mendoza, R. U. (2011). 'Why do the poor pay more? Exploring the poverty penalty concept', *Journal of International Development*, Vol. 23, no. 1, pp. 1–28. http://doi.org/10.1002/jid.1504

Morell, M. (1990). 'Den svenska folkkostens förändringar i samband med det industriella genombrottet', *Näringsforskning*, Vol. 34, no. 3, pp. 86–91.

Mussa, R. (2015). 'Do the Poor Pay More for Maize in Malawi?', *Journal of International Development*, Vol. 27, no. 4, pp. 546–63. http://doi.org/10.1002/jid.3054

Nelson, M. (1993). 'Social-class trends in British diet, 1860–1980'. In C. Geissler and D. J. Oddy (eds.), *Food, diet, and economic change past and present*. Leicester University Press, Leicester, pp. 101–20.

Neset, T.-S. S. (2004). 'Reconstructing Swedish Food Consumption from Hospital Diets After 1870', *Ecology of Food and Nutrition*, Vol. 43, no. 3, pp. 149–79. http://doi.org/10.1080/03670240490446786

Popkin, B. M. (1993). 'Nutritional Patterns and Transitions', *Population and Development Review*, Vol. 19, no. 1, pp. 138–57.

Popkin, B. M. (2006). 'Global nutrition dynamics: the world is shifting rapidly toward a diet linked with noncommunicable diseases'. *The American Journal of Clinical Nutrition*, Vol. 84, no. 2, pp. 289–98.

Prahalad, C. K. (2006). *The fortune at the bottom of the pyramid*. Wharton School Publ., Philadelphia.

Prais, S. J. and Houthakker, H. S. (1971). *The analysis of family budgets* (2. impr., abridged, with a new preface). University of Cambridge, Cambridge.

Rogus, S. (2015). 'Do the Poor Pay More for Food? A Review of Food Price Disparities in Urban Environments'. *Journal of Hunger and Environmental Nutrition*, Vol. 10, no. 4, pp. 549–66. http://doi.org/10.1080/19320248.2014.962775

Socialstyrelsen. (1917). *Levnadskostnaderna i Sverige 1913–1914*. Kungl. Boktryckeriet / P. A. Norstedt and Söner, Stockholm. Retrieved from https://gupea.ub.gu.se/handle/2077/34331

Socialstyrelsen. (1919). *Levnadskostnaderna i Sverige 1913–1914. Del III. Hushållsräkenskaper*. Kungl. Boktryckeriet / P. A. Norstedt and Söner, Stockholm. Retrieved from https://gupea.ub.gu.se/handle/2077/34331

Taylor, R. and Villas-Boas, S. B. (2016). 'Food Store Choices of Poor Households: A Discrete Choice Analysis of the National Household Food Acquisition and Purchase Survey (FoodAPS)'. *American Journal of Agricultural Economics*, Vol. 98, no. 2, pp. 513–32. http://doi.org/10.1093/ajae/aaw009

Appendix

Table A1. Reference consumption basket per year per consumption unit (adult male) in 1913–1914, by area of Sweden

Food item or beverage	*Unit*	*East*	*South*	*West*	*Southeast*	*Middle*
Fresh meat, oxen	kg	9.0	11.1	13.2	10.6	11.7
Fresh meat, veal	kg	4.6	3.8	3.8	3.8	4.0
Fresh meat, lamb	kg	0.8	1.4	1.4	1.9	1.2
Fresh meat, pork	kg	8.5	15.6	8.3	9.1	8.5
Preserved meat, beef	kg	0.6	0.5	0.2	0.6	0.7
Preserved meat, pork	kg	6.4	4.7	4.5	7.1	3.3
Preserved fish, salted herring	kg	7.7	3.1	4.5	5.9	9.9
Preserved fish, dry cod	kg	0.7	0.3	0.6	0.3	0.5
Dairy, unskimmed milk	lt	254.9	198.2	238.4	273.2	293.7
Dairy, skimmed milk	lt	138.0	38.9	120.2	67.1	99.6
Dairy, butter	kg	14.6	10.0	10.5	13.6	13.8
Dairy, margarine	kg	6.2	10.3	8.1	2.2	8.7
Dairy, cheese	kg	4.9	4.7	5.9	6.4	5.5
Dairy, eggs	number	177	164	200	182	132
Bread, hard rye	kg	27.2	1.5	9.5	4.5	35.7
Flour, wheat	kg	64.6	19.4	63.3	51.2	63.7
Flour, rye	kg	22.9	2.2	28.0	57.7	11.5
Grains, oats	kg	9.8	4.4	9.1	11.2	10.4
Grains, rice	kg	2.7	1.5	2.6	2.2	2.9
Vegetables, peas	kg	3.0	1.8	2.6	1.8	3.7
Vegetables, brown beans	kg	1.0	1.5	0.8	1.0	1.2
Vegetables, potatoes	lt	142.4	185.2	179.3	179.9	172.8
Sugar	kg	32.0	30.2	34.7	34.2	33.3
Coffee	kg	6.1	7.1	6.2	6.7	6.6
Beers	lt	4.6	8.0	8.6	2.0	3.9
Liquor	lt	2.0	5.0	2.6	1.2	1.6

Source: Socialstyrelsen (1917, tab. 7).

Note: The amounts are for one consumption unit, meaning one adult man. Women and children were assumed to consume less food (see Table A2).

Table A2. The consumption weight assumed for different age groups and sexes in the household budget survey carried out by the Swedish Board of Social Affairs, 1913–1914

	Age group (years):							
	0–3	4–6	7–9	10–12	13–14	15–16	17–18	19–
Sex	*Consumption weight compared to an adult (≥19 years) man*							
Man	0.1	0.2	0.3	0.4	0.5	0.7	0.9	1.0
Woman	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8

Source: Socialstyrelsen (1917, p. 17).

Table A3. Reference prices of food items and beverages in 1913–1914, by area of Sweden

Food item or beverage	*East*	*South*	*West*	*Southeast*	*Middle*
Fresh meat, oxen	1.19	1.15	1.24	1.10	1.13
Fresh meat, veal	1.15	0.97	1.11	0.98	0.90
Fresh meat, lamb	1.17	1.13	1.38	1.22	1.01
Fresh meat, pork	1.28	1.14	1.25	1.25	1.28
Preserved meat, beef	1.41	1.37	1.35	1.27	1.32
Preserved meat, pork	1.43	1.27	1.52	1.39	1.47
Preserved fish, salted herring	0.38	0.38	0.50	0.38	0.39
Preserved fish, dry cod	0.59	0.52	0.66	0.50	0.67
Dairy, unskimmed milk	0.14	0.13	0.14	0.14	0.15
Dairy, skimmed milk	0.06	0.06	0.06	0.07	0.08
Dairy, butter	2.14	2.06	2.33	2.15	2.15
Dairy, margarine	1.44	1.42	1.47	1.38	1.41
Dairy, cheese	1.37	1.38	1.66	1.45	1.38
Dairy, eggs	0.07	0.06	0.06	0.07	0.08
Bread, hard rye	0.37	0.51	0.54	0.48	0.36
Flour, wheat	0.31	0.30	0.33	0.31	0.31
Flour, rye	0.25	0.26	0.28	0.25	0.24
Grains, oats	0.37	0.35	0.47	0.38	0.36
Grains, rice	0.44	0.47	0.58	0.47	0.41
Vegetables, peas	0.27	0.32	0.39	0.31	0.28
Vegetables, brown beans	0.46	0.47	0.49	0.47	0.44
Vegetables, potatoes	0.06	0.04	0.05	0.05	0.06
Sugar	0.63	0.64	0.64	0.63	0.64
Coffee	2.04	2.12	2.49	2.24	2.03
Beers	0.36	0.41	0.37	0.37	0.37
Liquor	1.74	1.68	1.45	1.82	1.88
Total cost of the reference budget	**233**	**188**	**236**	**227**	**242**

Source: Socialstyrelsen (1917, tab. 9). The area-specific reference consumption baskets are presented in Table A1.

Table A4. Reference budget shares of the included food items and beverages 1913–1914, by area of Sweden

Food item or beverage	*East*	*South*	*West*	*Southeast*	*Middle*
	Budget share (percent)				
Fresh meat, oxen	4.6	6.8	6.4	5.6	5.5
Fresh meat, veal	2.3	2.1	1.6	1.7	1.5
Fresh meat, lamb	0.4	0.9	0.8	1.0	0.5
Fresh meat, pork	4.7	9.6	4.6	4.8	4.5
Preserved meat, beef	0.4	0.3	0.1	0.4	0.4
Preserved meat, pork	3.9	3.5	2.8	4.2	2.0
Preserved fish, salted herring	1.3	0.8	0.8	1.0	1.6
Preserved fish, dry cod	0.2	0.1	0.1	0.1	0.1
Dairy, unskimmed milk	15.3	13.6	14.7	16.5	18.2
Dairy, skimmed milk	3.6	1.1	3.7	1.9	3.3
Dairy, butter	13.4	11.4	10.0	13.0	12.2
Dairy, margarine	3.8	7.4	4.9	1.4	5.1
Dairy, cheese	2.9	3.8	3.8	4.1	3.1
Dairy, eggs	5.3	4.8	6.2	5.1	4.4
Bread, hard rye	4.3	0.4	2.0	1.1	5.3
Flour, wheat	8.6	3.1	8.7	7.1	8.1
Flour, rye	2.5	0.3	3.1	7.0	1.1
Grains, oats	1.6	1.0	1.5	1.8	1.5
Grains, rice	0.5	0.4	0.5	0.5	0.5
Vegetables, peas	0.3	0.3	0.4	0.3	0.4
Vegetables, brown beans	0.2	0.4	0.2	0.2	0.2
Vegetables, potatoes	3.7	4.5	4.0	3.3	4.3
Sugar	8.7	9.5	9.6	10.1	8.8
Coffee	5.4	8.7	6.1	6.6	5.5
Beers	0.7	1.5	1.4	0.4	0.6
Liquor	1.5	3.6	2.1	0.9	1.2

Note: Calculated from the values in tables A1 and A3.

Table A5. Results from WLS regressions analyzing the household level deviations from the area-specific reference price among Swedish urban households, 1913–1914

	Model 0	*Model 1*	*Model 2*	*Model 3a*	*Model 3b*
Household income per capita, ln	—	+0.034 ***	+0.033 ***	—	+0.033 ***
Control variables:					
Food items and beverages	Yes	Yes	Yes	Yes	Yes
City	No	No	Yes	Yes	Yes
Interaction: City * Foods	No	No	No	Yes	Yes
Observations	20,805	20,805	20,805	20,805	20,805
R-squared	0.0333	0.0443	0.0535	0.0976	0.1077

Notes: Each column reports summary results from one specification of a regression involving all food and beverage items. The dependent variable is the household-specific unit value minus the area-specific reference price (Table A3) of each food for each household. The regressions included, in addition to the natural logarithm of the household income per capita, indicators for twenty-five of the twenty-six food items and beverages and seven of the eight cities. The unit values are weighted in the regressions by the area-specific budget weights for each food (Table A4). The standard errors are clustered at the household level.

Statistical significance: *** p<0.01, ** p<0.05, * p<0.1