ECONSTOR

WWW.ECONSTOR.EU

Der Open-Access-Publikationsserver der ZBW – Leibniz-Informationszentrum Wirtschaft
*The Open Access Publication Server of the ZBW – Leibniz Information Centre for Economics*

Floris, Joël; Müller, Consuela; Woitek, Ulrich

**Conference Paper**

# The Biological Standard of Living in Zurich during WWI

Beiträge zur Jahrestagung des Vereins für Socialpolitik 2015: Ökonomische Entwicklung - Theorie und Politik - Session: Health Economics 3, No. C19-V1

**Provided in Cooperation with:**
Verein für Socialpolitik / German Economic Association

Suggested Citation: Floris, Joël; Müller, Consuela; Woitek, Ulrich (2015) : The Biological Standard of Living in Zurich during WWI, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2015: Ökonomische Entwicklung - Theorie und Politik - Session: Health Economics 3, No. C19-V1

This Version is available at:
http://hdl.handle.net/10419/112909

**Nutzungsbedingungen:**
Die ZBW räumt Ihnen als Nutzerin/Nutzer das unentgeltliche, räumlich unbeschränkte und zeitlich auf die Dauer des Schutzrechts beschränkte einfache Recht ein, das ausgewählte Werk im Rahmen der unter
→ http://www.econstor.eu/dspace/Nutzungsbedingungen
nachzulesenden vollständigen Nutzungsbedingungen zu vervielfältigen, mit denen die Nutzerin/der Nutzer sich durch die erste Nutzung einverstanden erklärt.

**Terms of use:**
*The ZBW grants you, the user, the non-exclusive right to use the selected work free of charge, territorially unrestricted and within the time limit of the term of the property rights according to the terms specified at*
*→ http://www.econstor.eu/dspace/Nutzungsbedingungen*
*By the first use of the selected work the user agrees and declares to comply with these terms of use.*

ZBW Leibniz-Informationszentrum Wirtschaft
Leibniz Information Centre for Economics

Mitglied der Leibniz-Gemeinschaft

# The Biological Standard of Living in Zurich during WWI

February 27, 2015

**Abstract**

The paper analyzes the class specific biological standard of living in the city of Zurich during World War I. We find an increase of average human stature for lower class conscripts born during this period, while the average height of conscripts from the upper and middle class stagnated or even decreased, despite the lack of change in the income differential. A potential explanation of this phenomenon could be the changes in access to food and consumption habits, affecting terminal height via changes in milk consumption.

# 1 Introduction

A naive view on the relationship between average human stature and the socio-economic environment around the birth year of a cohort states that if income goes up, nutritional status will improve, which in turn leads to an increase in average terminal height. This does not always hold, examples are the Ante-Bellum Puzzle in the USA and the Early Industrial Growth Puzzle in Europe (Komlos, 2008; Steckel, 1995, e.g.).[1]

Although Switzerland did not participate in the war, trade relations with the beligerent countries were severed. This affected both exports and, more importantly for our research question, food imports (Halbeisen and Straumann, 2012, p. 996-1002). An example is the import of grains: in the period 1906-1922, 84 per cent of domestic consumption of grains and grain products had to be imported (Käppeli and Riesen, 1925, p. 7-8). Because of the specialization of the agricultural sector to produce milk and meat products, animal protein was available to be used in exchange for foreign goods, both with the Entente and the Central Powers (*Kompensationsgeschäfte*), organized and controlled by the *Schweizerische Treuhandstelle* ( S.T.S, Central Powers, 1915/1918) and the *Société Suisse de Surveillance* (SSS, Entente, 1915). Animal protein used in this exchange was of course no longer available for domestic consumption. One would therefore expect a detrimental effect on the biological standard of living of the population born during this period, as reflected by anthropometric measures such as human stature.

We find this expected effect to some extend in Zurich's middle and upper class, but not for the lower class: for this social strata, average height increases by 1-1.5 cm in the period 1911-1920. Class specific measures for the economic standard of living such as real income, on the other hand, show the expected development over the time of the war.

A potential explanation for this phenomenon is access to food. The canton and the city of Zurich tried to regulate the supply of important food stuffs during the war by rationing, thus securing the nutritional status especially of families in need. An example is the emergency milk (*Notstandsmilch*), which

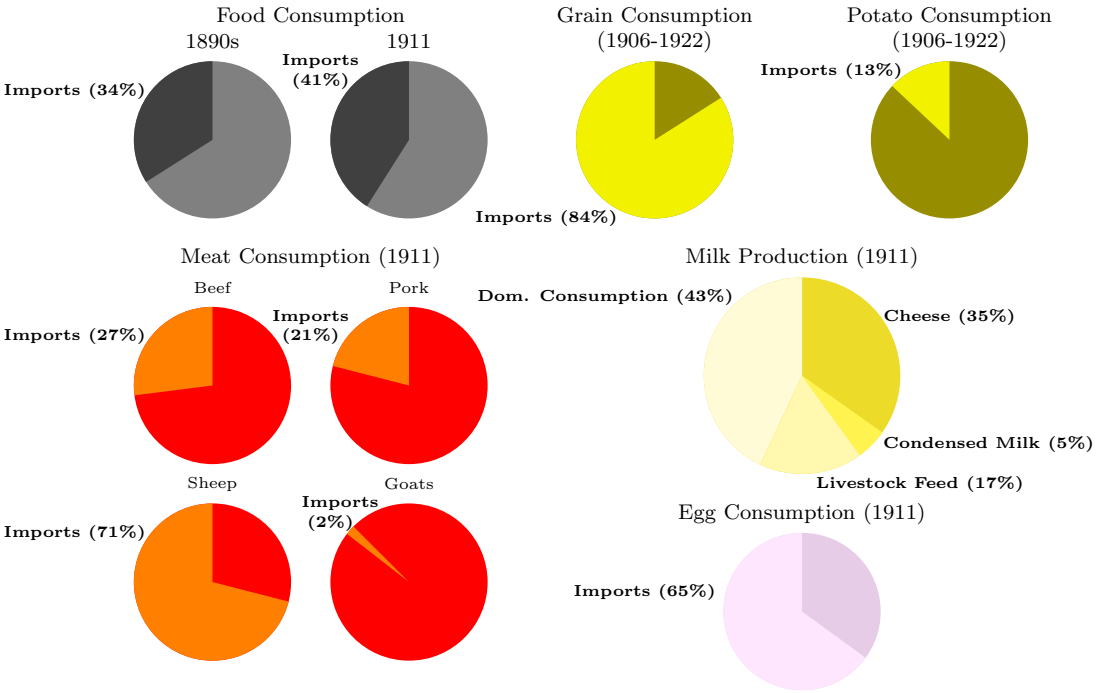
[1] See also Deaton (2007) for modern data.

was provided to elegible families at significantly lower prices (e.g. Käppeli and Riesen, 1925, p. 101). In addition, children in need were provided by breakfast and lunch.

Our analysis follows Gazeley and Newell (2013) who re-assess the changes in British lower class diets through World War I. They find that families of unskilled workmen were slightly better fed in 1918 than 1914, despite of the rise in the cost of food. Average caloric value of foods consumed decreased by about 16% for skilled workers, but not for unskilled workers, so the outcome was a partial levelling of food consumption.

# 2 Nutrition and Welfare System in Zurich

Figure 1: Swiss Food Consumption before and during the War




Source: Käppeli and Riesen (1925, p. 7-8)

Prior to WWI, the Swiss agricultural sector specialized to produce mainly milk and meat products. The consequence was that grains had to be imported (1914: 41 per cent import share in food comsumption, Figure 1).

The dependence on food imports has been seen as a problem, for example by Jöhr (1912) in his analysis of the readiness of the Swiss economy for a possible war.

There were individual trade agreements with France and Germany in case of war, and the Hague Conventions of 1899 and 1907 and the London Declaration concerning the Laws of Naval War in 1909 secured the neutrality of Switzerland. However, the outbreak of the war led to deteriorating trade conditions. In addition, the mobilization in August 1914 withdrew 200000 men from the labour market.[2] Catastrophies such as the harvest failures in 1916/17, the foot and mouth desease in 1920,[3] and the Spanish Flu 1918/19[4] added to the already difficult situation. Between 1914 and 1918, real wages decreased by 25-30 percent. From 1908/12 to 1917, caloric intake was reduced by 25 per cent, with the notable exception of milk and milk products, which remained almost constant at the level of 1908/12 (99.5 per cent, Schneider 1919, p. 12, Table 4). About 17 per cent of the Swiss population obtained assisstance during this period, in the bigger cities about 25 per cent (Bürgi, 2013).

How did the city of Zurich cope with the situation? The welfare system developed slowly. At the beginning of the 20th century, the importance of welfare as expenditure group was not very high: if measured as share of total tax income of the city, welfare expenditure did not exceed 10 per cent before 1914. In the period 1911-1921, the peak was reached in 1919 (38 per cent). It fell again to 10-11 per cent in 1920/21 (Biske, 1953, p. 49). Social expenditure mainly consists of poor relief (introduced 1853), which, until 1929,

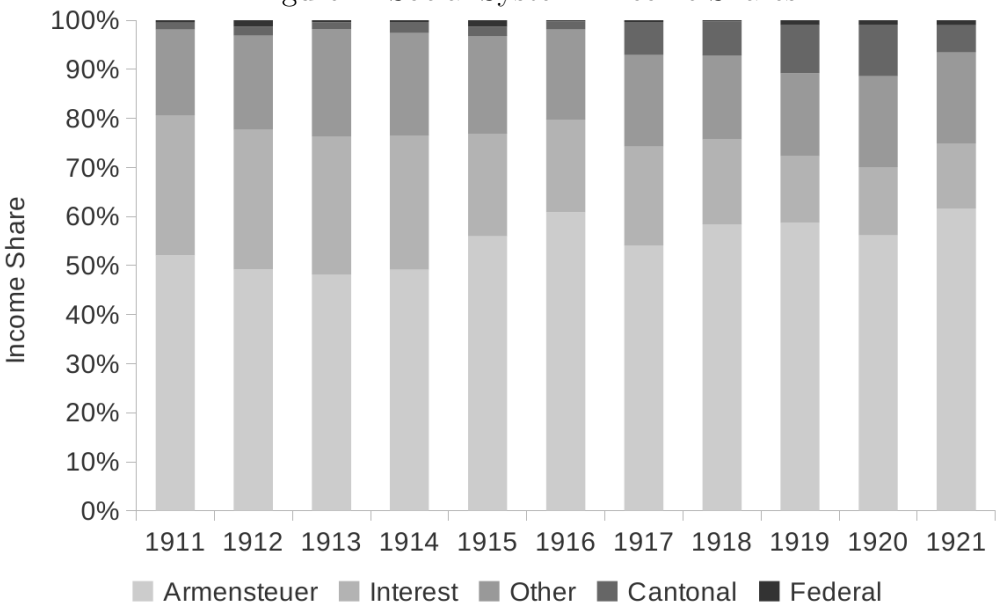
[2]Military service in Switzerland is compulsory since the Federal Constitution of 1848 (Article 18, old Federal Constitutions of 1848 and 1874; Article 59 current Federal Constitution of 1999, Senn 2013). During World War I, there was no compensation for income losses for soldiers, only a relief measure ("*Militärnotunterstützung*") for the families of soldiers (Biske, 1953, p. 220-224). As a consequece of the difficult economic situation, about one third of the soldiers had to apply for family relief (Degen, 2013).

[3]In Zurich, 26.7 per cent of cattle and 17.8 per cent of small livestock were affected (Statistisches Amt der Stadt Zürich, 1922, p. 9).

[4]In 1918, there were 902 deaths related to the flu in Zurich, of which 60 per cent were males, and 50 per cent males in the age group 15-45 years. The peak month was October 1918, with 414 deaths, of which 60 per cent were males (Statistisches Amt der Stadt Zürich, 1923, p. 45-46).

was based on the "*Heimatprinzip*", i.e. only citizens of Zurich were eligible. This institution was supported by a private organisation (*Freiwillige und Einwohnerarmenpflege*) in charge of inhabitants without citizenship.[5] The main income sources for the social system were the poor tax ("*Armensteuer*" and interest income, federal and cantonal contributions were neglegible (Figure 2).

Figure 2: Social System: Income Shares



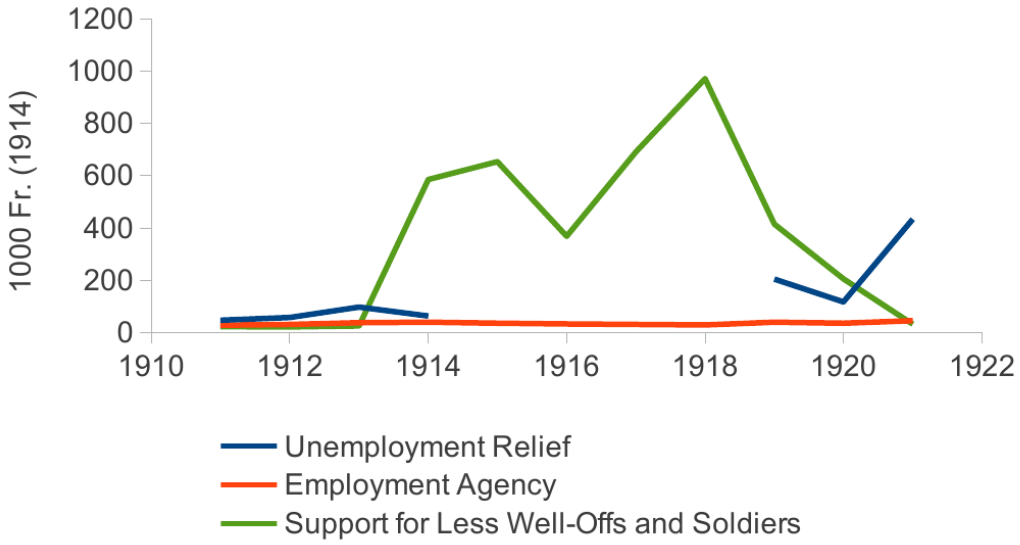

(Biske, 1953, p. 228/239)

While unemployment relief was first organized by the unions, the increasing severity of business cycle downturns made it necessary for the city to intervene, first with public works and mass feeding programs in winters (Teuscher, 1929, p. 16-19). The introduction of unemployment insurance was first attempted in 1898 and again in 1910, but it took the city council until 1914 to finally decide to finance an unemployment insurance fund ("*städtische Arbeitslosenkasse*") (Teuscher, 1929, p. 27). Because of the outbreak of World War I, the start of the program had to be postponed until

[5]In addition, the organisation supported citizens who were to be spared from the humiliation of loosing the right to vote because of poverty (in 1885, there were 643 persons in he canton Zurich excluded from voting for this reason, Anderegg 1903, p. 347).

1931. In the period 1915-1918, unemployment relief was replaced by the support for less-well offs and soldiers, to reach a higher proportion of population (Figure 3). An employment agency ("*Arbeitsnachweis*") was founded in 1900, not only to coordinate supply and demand for labour, but also to provide support for the improvement of the relief system (Biske, 1953, p. 176-181; see Figure 4).

Figure 3: Relief Measures in Zurich, 1911-1921



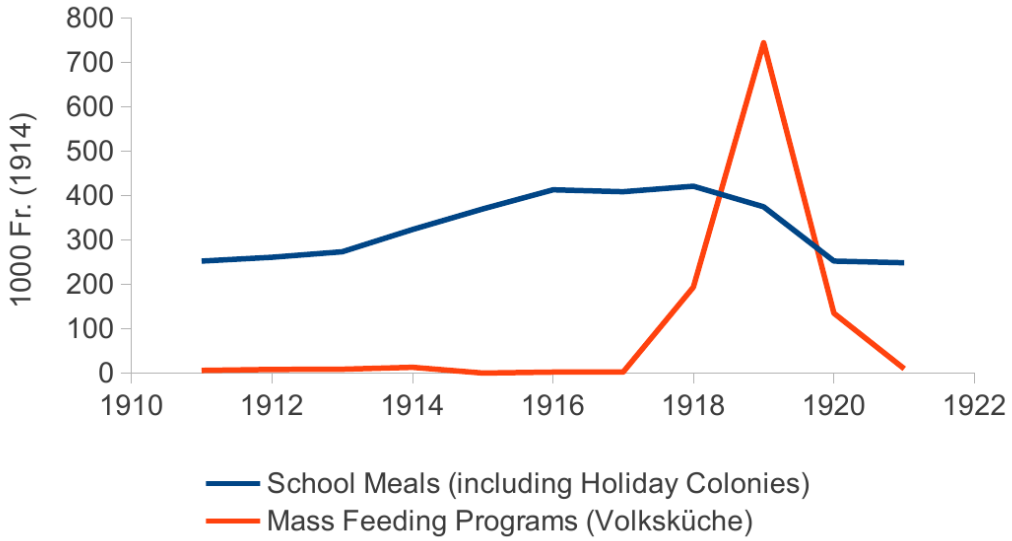

Source: Biske (1953, p. 240). Nominal expenditure is deflated with the consumer price index for Zurich (1914=100, Historical Statistics of Switzerland Online, Table H19, H 24b, `www.fsw.uzh.ch/hstat`)

At the beginning of the 20th Century, school meals (*Schulspeisung*) were introduced. In the absence of unemployment insurance, the free school meals were important for children from families in need. In addition, the city supported private soup kitchens, replaced in 1918 by the *Volksküche* (Biske, 1953, p. 106), supplying the city districts 3, 4, and 5. Children of families in need could get 1l soup per day, in 1915: 1.85 million liters of soup were distributed. In 1916, a meal consisted of either 4 dl. milk or soup with 130g bread. In 1918, 4000 children were supplied with breakfast and lunch, together with adults in need.[6] For the children, breakfast consisted of 7 dl

[6]From August 1918 on, adults obtained 31'000 meals per day in 59 municipalities of

cacao (twice per week), 5 dl milk (once per week), and replacement bread. Lunch was typically soup or stew, mainly vegetarian, sometimes goulash or tripes. Adults obtained a lunch consisting of soup with cooked meat, cheese, and bacon (Kofmehl-Heri, 1997, p. 37 ff.).

Figure 4: Mass Feeding Programs in Zurich, 1911-1921




Source: Biske (1953, p. 240). Nominal expenditure is deflated with the consumer price index for Zurich (1914=100, Historical Statistics of Switzerland Online, Table H19, H 24b, `www.fsw.uzh.ch/hstat`)

In addition to this support in kind, there was also the attempt to regulate prices of important food stuffs. An important example is the regulation of milk prices and rationing of milk ("*Notstandsmilch*"). The dilemma faced was that on the one hand, cheese production was important, because the foreign demand for cheese was high, which could be used in exchange for goods not produced in Switzerland. On the other hand, milk used for cheese production was lost for domestic consumption. Therefore, regulation was necessary, which was first voluntary, but in 1916/17, the state had to intervene. Milk was rationed (Table 1), there were federal subsidies of 3 Rp/l, under the condition that the cantons contributed 1 Rp/l (May 1, 1918). These subsidies were raised on September 1, 1919 to 4 Rp/l (cantonal contribution 2 Rp/l),

the canton Zurich (Staatsarchiv Zürich, n.d., III Ne2).

and on April 1, 1920 the intervention ended (Käppeli and Riesen, 1925, p. 99-109).

Table 1: Milk Rationing in Zurich, 1917-1920 (Daily Rations)

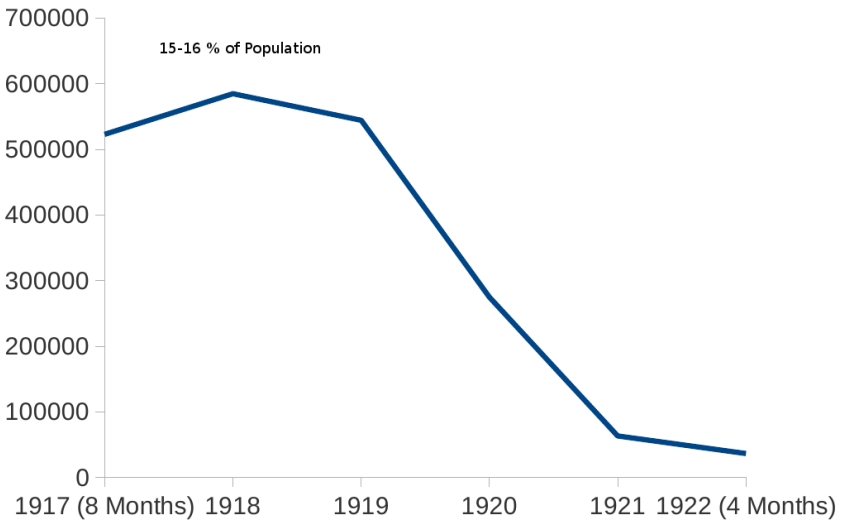
| | Dec 1917 - - June 1, 1918 | June 1, 1918 - Nov 1, 1918 | Nov 1, 1918 - Apr 1, 1920 |
|---|---|---|---|
| | Liter | Liter | Liter |
| Ill, pregnant, or breast feeding women | 1 | 1 | 1 |
| Children | | | |
| $<$ 4 (5) years | 1 | | 1 |
| 4-10 (6-15) years | 0.75 | | 0.75 |
| $<$ 15 years | | 1 | |
| Persons | | | |
| 11-65 years | 0.5 | | |
| 16-60 years | | 0.5 | 0.5 |
| $>$ 65 (60) years | 1 | 1 | 0.75 |

Source: Statistisches Amt der Stadt Zürich (1923, p. 17*)

The effect of this measure was that low-income families had access to cheaper milk, while families not elegible for *Notstandsmilch* had to pay the normal price - but even these families had the opportunity to apply for a price reduction, at least between May 1918 and March 1920.[7] About 16 per cent of total population were elegible for the cheaper milk (Figure 5). Milk prices in the city of Zurich are displayed in Figure 6. The price reduction was substantial, between 18 and 34 per cent for the *Notstandsmilch* and 10 and 18 per cent for the milk at the reduced price.

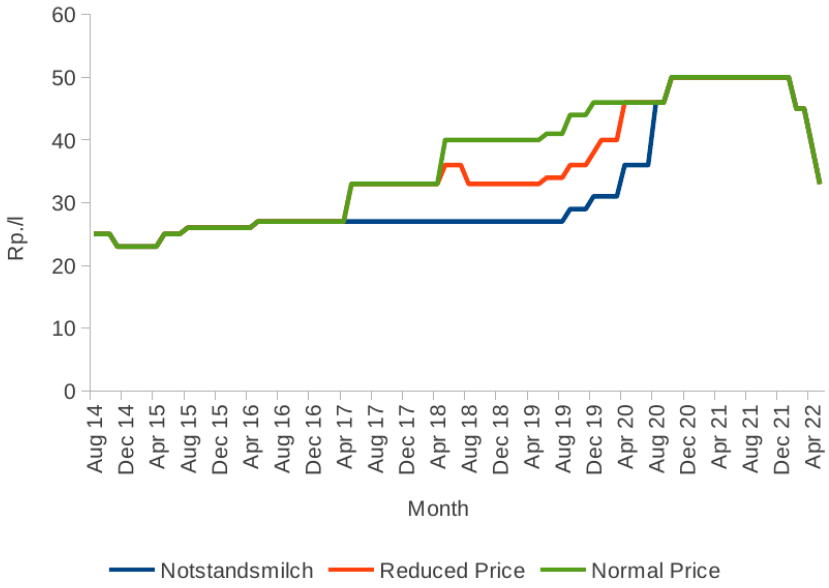
[7] "*Es erschien daher billig zu sein, die verfügbare Mittel nicht mehr wie bisher für die Gesamtheit der Verbraucher, miteingeschlossen die wohlhabenden Kreise, sondern nur noch für die weniger bemittelte Bevölkerung zu verwenden → Abgabe von Konsummilch zu herabgesetzten Preisen an Personen und Familien mit kleinem Einkommen, d.h. die N o t - s t a n d s m i l c h. Der bedürftigen Bevölkerung wurde damit eine Milchpreiserhöhung neuerdings erspart. Die übrige Konsumentenschaft allerdings hatte eine Steigerung der Milchpreise über sich ergehen zu lassen.*" (Käppeli and Riesen, 1925, p. 101)

Figure 5: Number of Supported Persons




Source: Käppeli and Riesen (1925, p. 103); canton Zurich 1918: 13.7-15.4 per cent (Regierungsrat des Kantons Zürich, 1919, p. 84)

Figure 6: Milk Prices in Zurich




Reduced price: it was possible to obtain milk at a reduced price also for consumers who were not entitled to *Notstandsmilch* (About 50 per cent applied). Source: Statistisches Amt der Stadt Zürich (1923, p. 18*)

In 1912, the workers' association (*Schweizerisches Arbeitersekretariat*) collected household budgets from worker' and civil servants' households across Switzerland, thus allowing the calculation of group specific average budgets and cost of living indices. The statistical office of the city of Zurich participated in this first study, contributing 235 budgets (about 30 per cent of the entire sample, Schweizerisches Arbeitersekretariat 1922). The inflation during the war made it necessary to repeat the exercise in 1919, 1920 and 1921 (Statistisches Amt der Stadt Zürich, 1921). This enables us to compare the changes in consumption habits over the period of interest. In Table 2, typical baskets for Zurich employees and workers are displayed (the results are based on 85 families: 44 employees, 34 workers, and 8 servants as head of household). They show that the share of food expenditure for workers is slightly higher for workers. When we look at the food basket in more detail, we see that for both groups, milk is the most important food expenditure item, accounting for 15 per cent of total food expenditure for employees, and 16 per cent for workers, followed by 8-9 per cent for bread (Statistisches Amt der Stadt Zürich, 1921, Table XVII). A change in milk prices by 10 to 34 per cent is therefore important.

Table 2: Expenditure Share per Consumption Unit, 1919

| | Employees | Workers |
|---|---|---|
| Food | 69% | 73% |
| Heating and Light | 10% | 9% |
| Rent | 21% | 18% |

Consumption unit: Quets (in honour of Adolphe Quetelet; birth: 1; annual increase 0.1; terminal values: 3.5 $\rightarrow$ male, 25 years; 3 $\rightarrow$ female, 20 years). Source: Statistisches Amt der Stadt Zürich (1921, Table X)

Can we say something about changes in consumption patterns? Table 3 compares the change in milk consumption from 1912 to 1921 for Swiss employees/civil servants and workers. While expenditure shares decrease for both groups, they decrease less for workers. Turning to consumption, we see that milk consumption for workers increased by 3 per cent, while it decreased

for employees and civil servants. Comparing the results for worker families[8] in Zurich shows that milk consumption increased by 9 per cent (Statistisches Amt der Stadt Zürich, 1921, Table 3).

Table 3: Milk Consumption (Switzerland)

| | Expenditure Share | | Consumption (l per Consumption Unit) | |
|---|---|---|---|---|
| | Laborers | Employees Civil Servants | Laborers | Employees Civil Servants |
| 1912 | 22.8 | 22.4 | 340 | 371 |
| 1921 | 22.2 | 19.4 | 350 | 346 |
| 1912-1921 | -2.6% | -13.4% | 2.9% | -6.7% |

Source: Ackermann (1963, p. 79); Consumption unit: Quets (in honour of Adolphe Quetelet; birth: 1; annual increase 0.1; terminal values: 3.5 → male, 25 years; 3 → female, 20 years).

# 3 Real Income in Zurich during World War I

The household accounts for 1919 make it possible to calculate group specific price indices (workers, employees) for the period 1912 to 1921. The payscale for city employees and the number of employees in each bracket[9] makes it possible to arrive at an estimate for the average annual income of this group. For the workers, we take the wages of skilled construction workers in the city of Zurich and the average hours worked to calculate the average annual income 192-1921.[10] We use retail prices for the city of Zurich[11] and the budgets of 1919, assuming that the normal prices had to be payed by everybody,[12]

[8]Family 1: one couple, 3 children (3, 7, 10 years old); Family 2: one couple, 2 children (3 and 7 years old).

[9]The original data are published in the *Statistisches Jahrbuch der Stadt Zürich*, 1913/14-1922.

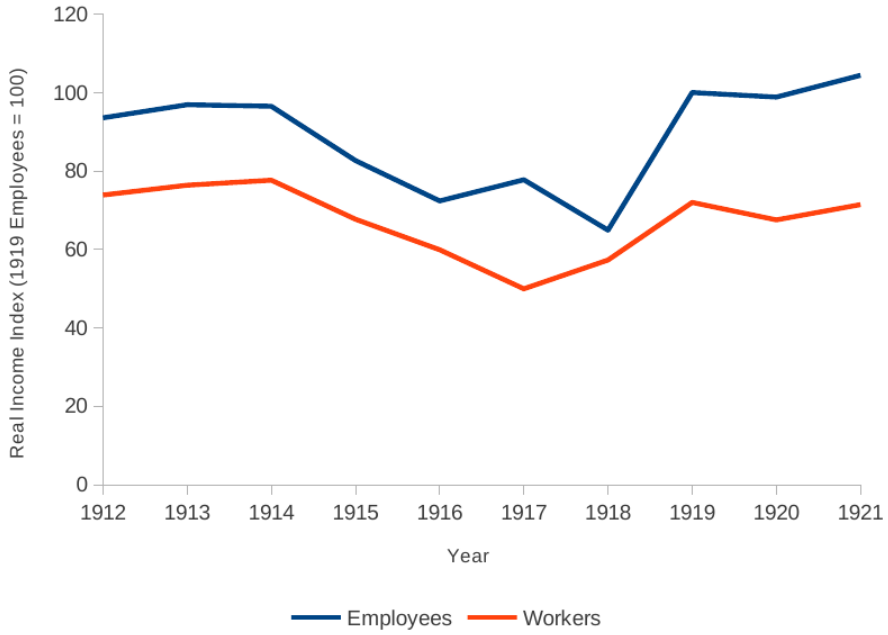
[10]Data source: Historical Statistics of Switzerland Online, Tables F29a, `www.fsw.uzh.ch/hstat`.

[11]Data source: Historical Statistics of Switzerland Online, Table H.27, `www.fsw.uzh.ch/hstat`.

[12]None of the worker families reported in Statistisches Amt der Stadt Zürich (1921) had an annual income low enough to be elegible for *Notstandsmilch*.

to construct group specific price indices for the period 1912-1921. For 1919, the Statistical Office calculates group specific prices, which makes it possible to arrive at a real income index comparable across groups, adapting the procedure in Williamson (1995). The results are displayed in Figure 7.

Figure 7: Group Specific Real Income Indices for Zurich, 1912-1921




The income differential did not vanish over the period of interest. Real income declines for both groups, while it starts to recover earlier for the workers (1917) than for the employees (1918). After 1918, the gap begins to widen.

# 4 The Biological Standard of Living in Zurich during World War I

The data on human stature are from the medical examination records at recruitment (*Sanitarische Rekrutierungskontrolle*) for the city of Zurich, covering the birth cohorts 1909-1921.[13] To implement the federal military organisation law of 1874 ("*Militärorganisation 1874*"), the canton of Zurich created six recruitment districts/centers (later called "*Kreiskommando"*): *Am See*, *Amt und Unterland*, *Oberland*, *Winterthur* and *Zürich*. These centers were responsible for conscription, controlls, inspections, exemption taxes, disciplinary issues and supervision of military sections in the respective district. The organisation structure remained unchanged until the end of the 20th century (Archivverzeichnis Staatsarchiv Zürich). Military service in Switzerland is since the Federal Constitution of 1848 compulsory. footnoteSee footnote 2. With the military organisation law the compulsory military service was put into effect. The former cantonal contingents ("*Stellungsquote*") were abolished, and only the fitness for service was relevant for the decision about recruitment (Kurz 1985, p. 28, 45, Senn 2013). As a consequence, every single male Swiss citizen, as a rule at the age of 19 years, was conscripted and examined to determine the individual fitness of service status, a practice which is still in place today.

In 1875, the conscription procedure was standardised on federal level. The rules for the measurement of stature never significantly changed since then. Precise instructions were given in manuals.[14] For every conscript, information was recorded such as name, occupation, place of origin ("*Bürgerort*"), place of residence, year of birth, height, weight (in Zurich not recorded before 1932), chest and arm circumference, diseases, visual and acustic acuity,

[13] The records are kept at the municipal archives of Zurich (*Stadtarchiv Züurich: VII. 33. Militärsektion und Kreiskommando Zürich*).

[14] "*Instruktionen über die Untersuchung und Ausmusterung der Militärpflichtigen*", published and revised for the years 1875, 1887, 1895, 1912, 1917, 1932, 1941 and 1952. In paragraph 16 of the 1875 instruction was written that height has to be measured with a transportable measuring instrument, as distance between the sole of foot and the cortex. During the measurement, the conscript has to stand to attention, i.e. the body posture has to be as straight as possible (Staub, 2010, 147-148).

decision (fit, decision postponed for 1 or 2 years, exempt for 1 year, fit for landsturm, fit for auxiliary service, unfit), as well as information on earlier conscription examinations.

Our data set consists of 18129 19 years old male conscripts, examined in the period 1928 to 1940 (birth years 1909 to 1921). The social classification of occupations follows Schüren (1989),[15] descriptive statistics can be found in Table 4.

Table 4: Zurich Conscripts: Descriptive Statistics (Number of Observations)

| Birth Year | Total | Lower Class | Middle Class | Upper Class[1] |
|---|---|---|---|---|
| 1909 | 1013 | 642 | 276 | 95 |
| 1910 | 1292 | 806 | 376 | 110 |
| 1911 | 1525 | 972 | 416 | 137 |
| 1912 | 1645 | 1065 | 432 | 148 |
| 1913 | 1465 | 972 | 327 | 166 |
| 1914 | 1417 | 878 | 368 | 171 |
| 1915 | 1468 | 922 | 375 | 171 |
| 1916 | 1513 | 944 | 401 | 168 |
| 1917 | 1059 | 643 | 268 | 148 |
| 1918 | 1463 | 927 | 370 | 166 |
| 1919 | 1514 | 893 | 423 | 198 |
| 1920 | 1883 | 1192 | 471 | 220 |
| 1921 | 872 | 559 | 205 | 108 |
| Sum | 18129 | 11415 | 4708 | 2006 |

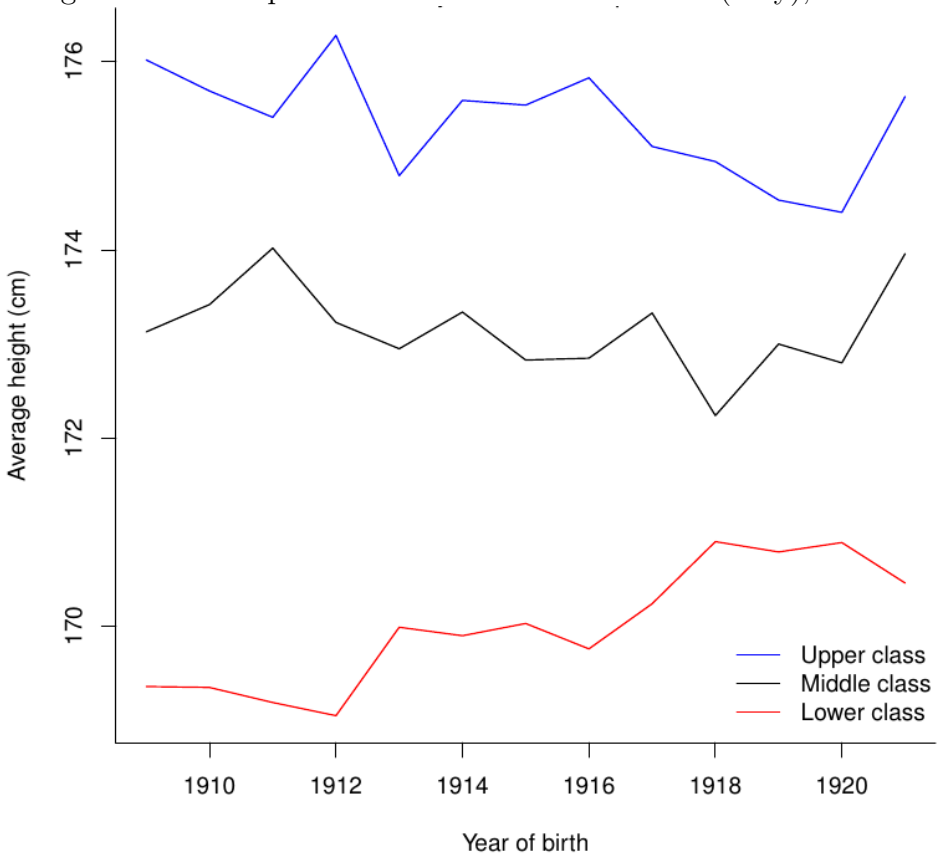
[1] Students

There is a clear difference in average height between the social groups, upper class conscripts are on average 4-5cm taller than conscripts from the lower

[15] We convert Schüren's classification (6 classes) to three groups, where the lower class consists of skilled and unskilled workers, farm labourers, artisans, minor office workers, the middle class of farmers, merchants, masters, inkeepers, mid-range employees and entrepreneurs. Schüren's upper class occupations are entrepreneurs, academic freelance professionals, senior managers, but since we are analyizing 19 years old conscripts, our upper class consists of students.

class. In order to assess the class specific change in the biological standard of living over the war period, we regress individual height on dummy variables representing birth cohort and class (reference group: 1920 lower class). The result of this exercise (Figure 8) shows a pattern we would not expect from the development of the real income differential reported in Figure 7.

Figure 8: Class Specific Human Stature in Zurich (City), 1909-1921




Over the time of World War I, average height seems to converge across social groups: while it goes down by one per cent for upper and middle class between 1911 and 1920, the height of the lower class conscripts increases by 1 per cent. In 1921, when the war time restrictions were finally abolished, average heights start to diverge again.

A potential explanation for this phenomenon is the change in the access to food, especially milk, which was made available to children from families in

need, either through price regulation or in the form of school meals and free breakfast (Section 2). There is a body of literature on the importance of milk for the determination of average height.[16] According to this literature, an increased milk consumption in childhood and adolescence is directly related to an increased average height of a population (Bogin, 1999, p. 277-278). Milk contains inter alia protein, calcium and vitamin D3 (Cholecalciferol). In this context calcium seems to be the most important factor (Bogin 1999, p. 280, Bonjour *et al.* 1997, p. 1287-1294). The most prominent study in favour of the milk hypothesis is Takahashi (1984), finding that the increase in height of children in Japan in the 1960s is mainly due to increased milk consumption. Frederiks *et al.* (2000) explain the increase in height of the Dutch over the last decades by (inter alia) the high consumption of dairy products in the Netherlands, and Baten (2009) shows for nineteenth century Bavaria that local milk production has an significant influence on average height.

There is no doubt that protein or milk consumption is important for human growth. But there is scepticism that protein or milk consumption is the dominating determinant (Steckel, 2003, 2009). As pointed out by Steckel (2003, p. 162), "there is a small mountain of evidence indicating that other things also matter". However, the nutritional status of the Zurich lower class was very low before World War I, as in the rest of Switzerland. Contemporaries complained about the decrease in milk consumption (e.g. Hürlimann, 1880, p. 457-458) as well as the lack of household skills caused by the change in the working environment (e.g. Schuler, 1872, p. 215-216). Children were especially affected, and the reports of the factory inspectors (*Fabrikinspektoren*) as well as the discussion on the lack of fitness for service based on published results of the medical examinations of the conscripts instigated public awareness of the issue of malnutrition (e.g. Wolfensberger, 1997, p. 155). footnoteAs a result of this discussions, travelling cooking courses were privately organized as early as 1879/80 (*Schweizerische Gemeinnützige Gelsellschaft SGG*). Since the courses turned out to be not very successful, the state took over and put the household schools under federal control in

[16]For a literature overview, see Bogin (1999); Hoppe *et al.* (2006).

1899 (e.g. Wolfensberger, 1997, p. 154, 170-176). Given this situation, the changes in access to food and consumption patterns caused by the rationing system and the price regulations during the war period might have had a positive effect on the nutritional status of the working class, especially the children, which is reflected in the convergence of class specific human stature. After the interventions stopped, average height started to diverge again.

# 5 Conclusion

Although Switzerland did not directly participate in World War I, it was affected because trade relationships with the main trading partners were severed. This problem made food rationing necessary, because Switzerland depended heavily on food imports, especially grains. When looking at class specific real income in the city of Zurich over the time of the war, we see that the income differential stays almost constant. However, class specific human stature as a measure for the biological standard of living shows a different picture: while the average height of the upper and middle class conscripts born during the war period stagnated or even decreased, there was an increase in the height of the lower class. An explanation could be the changes in the access to food and consumption patterns: while there is an increase of milk consumption in workers' households, milk consumption decreases for the middle and upper class. An explanation of this phenomenon is provided by the milk hypothesis: an increased milk consumption in childhood and adolescence is directly related to an increased average height of a population.

# References


Ackermann, E. (1963), *Sechs Jahrzehnte. Wandlungen der Lebenshaltung und der Lebenskosten seit der Jahrhundertwende*. Wetzikon: Verlag der AG Buchdruckerei.

Anderegg, H. (1903), "Armenwesen: c) Statistik." In: N. Reichesberg (Ed.), *Handwörterbuch der Schweizerischen Volkswirtschaft, Sozialpolitik und Verwaltung*, Vol. 1, 346–353, Bern: Verlag Encyklopädie.

Baten, J. (2009), "Protein Supply and Nutritional Status in Nineteenth Century Bavaria,Prussia and France." *Economics and Human Biology* **7**, 165–180.

Biske, K. (1953), "Die Aufwendungen der Stadt Zürich für Armenfürsorge und Sozialpolitik 1893 bis 1951." Erweiterter Sonderdruck aus den Zürcher Statistischen Nachrichten, Hefte 1-4, 1953, Zürich.

Bogin, B. (1999), *Patterns of Human Growth*. Cambridge: Cambridge University Press.

Bonjour, J. P., Carrie, A., Ferrari, S., Clavien, H., Slosman, D., Theintz, G., and Rizzoli, R. (1997), "Calcium-Enriched Foods and Bone Mass Growth in Prepubertal Girls. A Randomized, Double-Blind, Placebo-Controlled Trial." *Journal of Clinical Investment* **99**, 1287–1294.

Bürgi, M. (2013), "Weltkrieg, Erster: 5. Soziales." Historisches Lexikon der Schweiz (HLS), 16.07.2013, www.hls-dhs-dss.ch/textes/d/D8926.php.

Deaton, A. (2007), "Height, Health, and Development." *Proceedings of the National Academy of Sciences of the United States of America* **104**, 13232–13237.

Degen, B. (2013), "Erwerbsersatzordnung." Historisches Lexikon der Schweiz (HLS), 20.07.2013, www.hls-dhs-dss.ch/textes/d/D16610.php.

Frederiks, A. M., van Buuren, S., Burgmeijer, R., Meulmeester, J., Beuker, R., Brugman, E., Roede, M., Verloove-Vanhorick, S., and Wit, J. S. (2000),

"Continuing Positive Secular Growth Change in the Netherlands 1955-1997." *Pediatric Research* **47**, 316–323.

Gazeley, I. and Newell, A. (2013), "The First World War and Working-Class Food Consumption in Britain." *European Review of Economic History* **17**, 71–94.

Halbeisen, P. and Straumann, T. (2012), "Die Wirtschaftspolitik im internationalen Kontext." In: P. Halbeisen, M. Müller, and B. Veyrassat (Eds.), *Wirtschaftsgeschichte der Schweiz im 20. Jahrhundert*, 984–1075, Schwabe Verlag Basel.

Hoppe, C., Molgaard, C., and Michaelsen, K. F. (2006), "Cow's Milk and Linear Growth in Industrialized and Developing Countries." *Annual Review of Nutrition* **26**, 131–173.

Hürlimann, J. (1880), "Über die Ergebnisse der Sanitarischen Rekruten-Musterung in der Schweiz während den Jahren 1875 bis 1879. Eine populäre militärärztliche Skizze." Schweizerische Zeitschrift für Gemeinnützigkeit.

Jöhr, A. (1912), *Die Volkswirtschaft der Schweiz im Kriegsfall*. Zürich: NN.

Käppeli, J. and Riesen, M. (1925), *Die Lebensmittelversorgung der Schweiz unter dem Einfluss des Weltkrieges von 1914 bis 1922*. Bern: Verbandsdruckerei A. G. Bern.

Kofmehl-Heri, K. (1997), *Von der Armenspeisung zur Stadtküche: Entstehung und Entwicklung einer sozialen Institution der Stadt Zürich*, Vol. 5 of *Zürcher Beiträge zur Alltagskultur*. Zürich: Volkskundliches Seminar der Universität Zürich.

Komlos, J. (2008), "Anthropometric History." In: S. N. Durlauf and L. E. Blume (Eds.), *The New Palgrave Dictionary of Economics*, second ed., London, Basingstoke: Palgrave Macmillan.

Kurz, H. R. (1985), *Die Geschichte der Schweizer Armee*. Frauenfeld: Huber.

Regierungsrat des Kantons Zürich (Ed.) (1919), *Bericht des Regierungsrates an den zürcherischen Kantonsrat über die kriegswirtschaftlichen Maßnahmen vom 8. November 1917 bis 31. Dezember 1918*. Zürich: Berichthaus.

Schneider, S. (1919), "Die schweizerische Volksernährung vor und während dem Kriege." *Zeitschrift für schweizerische Statistik und Volkswirtschaft* **55**, 7–20.

Schuler, F. (1872), "Die glarnerische Baumwollindustrie und ihr Einfluss auf die Gesundheit der Arbeiter." *Zeitschrift für Schweizerische Statistik* **8**, 201–226.

Schüren, R. (1989), *Soziale Mobilität. Muster, Veränderungen und Bedingungen im 19. Und 20. Jahrhundert*. St. Katharinen: Scripta Mercaturae Verlag.

Schweizerisches Arbeitersekretariat (Ed.) (1922), *Die Lebenshaltung schweizerischer Arbeiter und Angestellten vor dem Kriege*. Olten: Hermann Hambrecht.

Senn, H. (2013), "Armee." Historisches Lexikon der Schweiz (HLS), 16.07.2013, www.hls-dhs-dss.ch/textes/d/D8683.php.

Statistisches Amt der Stadt Zürich (Ed.) (1921), *Die Zürcher Indexziffer. Kosten der Lebenshaltung in der Stadt Zürich*, Vol. 26 of *Statistik der Stadt Zürich*. Kommissionsverlag Rascher & Cie.

Statistisches Amt der Stadt Zürich (Ed.) (1922), *Vieh- und Fleischpreise in Zürich 1911 bis 1922*. No. 30 in Statistik der Statd Zürich, Zürich: Kommissionsverlag Rascher & Cie.

Statistisches Amt der Stadt Zürich (Ed.) (1917), *Statistisches Jahrbuch der Stadt Zürich: 1914 und 1915*, Vol. 10/11. Kommissionsverlag Rascher & Cie.

Statistisches Amt der Stadt Zürich (Ed.) (1918), *Statistisches Jahrbuch der Stadt Zürich: 1916*, Vol. 12. Kommissionsverlag Rascher & Cie.

Statistisches Amt der Stadt Zürich (Ed.) (1919), *Statistisches Jahrbuch der Stadt Zürich: 1917*, Vol. 13. Kommissionsverlag Rascher & Cie.

Statistisches Amt der Stadt Zürich (Ed.) (1923), *Statistisches Jahrbuch der Stadt Zürich: 1918 und 1919*, Vol. 14/15. Kommissionsverlag Rascher & Cie.

Statistisches Amt der Stadt Zürich (Ed.) (1925), *Statistisches Jahrbuch der Stadt Zürich: 1920 und 1921*, Vol. 13. Kommissionsverlag Rascher & Cie.

Staub, K. (2010), *Der biologische Lebensstandard in der Schweiz seit 1800. Historisch-anthropometrische Untersuchung der Körperhöhe (und des Körpergewichts) in der Schweiz seit 1800, differenziert nach Geschlecht, sozioökonomischem und regionalem Hintergrund*. Ph.D. thesis, University of Berne.

Steckel, R. H. (1995), "Stature and the Standard of Living." *Journal of Economic Literature* **XXXIII**, 1903–1940.

Steckel, R. H. (2003), "Commentaries on "Malnutrition and Dietary Protein: Evidence from China and from International Comparisons"." *Food and Nutrition Bulletin* **24**, 162–163.

Steckel, R. H. (2009), "Heights and Human Welfare: Recent Developments and New Directions." *Explorations in Economic History* **46**, 1–23.

Takahashi, E. (1984), "Secular Trend in Milk Consumption and Growth in Japan." *Human Biology* **56**, 427–437.

Teuscher, H. (1929), *Die Arbeitslosenunterstützung in der Schweiz, insbesondere während des Weltkrieges und der Nachkriegskrisis*. Ph.D. thesis, Rechts- und Staatswissenschaftliche Fakultät der Universität Zürich.

Williamson, J. G. (1995), "The Evolution of Global Labor Markets since 1830: Background Evidence and Hypotheses." *Explorations in Economic History* **32**, 141–196.

Wolfensberger, R. (1997), "Die Normierung des Stoffwechsels." In: B. Mesmer (Ed.), *Die Verwissenschaftlichung des Alltags. Anweisungen zum richtigen Umgang mit dem Körper in der schweizerischen Populärpresse 1850-1900*, chap. V, 133–176, Zürich: Chronos.