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# The Benefits of Intervention: Birth Weights in Basle 1912-1920

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# The Benefits of Intervention: Birth Weights in Basle 1912-1920*

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**Abstract**

To assess the impact of interventions on well-being during war time, we analyze data from the birth records at the university maternity hospital of Basle in the period 1912-1920. Birth weight of children from medium SEP families decreased during the crisis years 1918 and 1919, but not for low and high SEP families. A potential explanation is access to food: while high SEP families could compensate for high prices, low SEP families received support, for which medium SEP families were not eligible.

JEL Code: N14, N34, H75, I18

Keywords: Birth Weight, World War 1, Switzerland

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# 1 Introduction

Although Switzerland was not directly affected by the war, it suffered nevertheless, because of the dependence on imports of food and raw materials. Both federal and cantonal measures were implemented to alleviate the situation. We focus on local interventions in Basle and their impact on well-being measured by birth weight in the period 1912-1920,[1] and address the following questions: (1) How did birth weights in Basle evolve during World War 1 in response to turmoil and interventions? (2) To what extent is this response related to the socio-economic background of the parents? We show that mainly families with medium socio-economic background were hit by the deteriorating nutritional situation towards the end of the war. We explain this finding by the fact that families with a high socio-economic background could compensate for food shortage and high prices, while the low socio-economic background population benefited from relief measures starting in 1917.[2]

Measuring early life health conditions is difficult and birth weight is not a problem free indicator (Schneider, 2014; Hanson *et al.*, 2015). Nevertheless, it is a useful anthropometric measure to analyze women's living conditions and short-termed environmental impacts during pregnancy, because fetal development and a newborn's body size are highly affected by the nutritional status and the socio-economic background of the mother (Ward, 1993, 1998; Bogin, 1999; Roche and Sun, 2003; Ward, 2016). It is therefore a direct measure of the biological standard of living at the time of measurement, and has now become widely used among health professionals and policy-makers (WHO, 1986; Ward, 1998).

There is a body of epidemiological and medical literature on the determinants of birth weight.[3] On the population level, about 66 per cent of

[1] The paper builds on Floris (2016, Chapter 7).

[2] A similar point is made by Voth (1995) in his discussion of the Winter (1986) hypothesis on the improvement of British living standards during World War 1. As Voth (1995, p. 296) points out, different parts of society were affected differently by the war and the relief measures, which has to be taken into account when comparing across countries (on the Winter hypothesis, see also Harris 1993). Another related study is Gazeley and Newell (2013), who find a convergence in the nutritional status of skilled and unskilled British workers during World War 1.

[3] For a recent overview on the epidemiological and medical literature see Weaver (2011).

the variation in birth weight is caused by non-genetic environmental factors, 10 per cent to fetal genotype, and 24 per cent to parental genotype. Determinants like mother's age, height, nutritional status, parity, infant sex, gestational age, multiple birth or infant vital status are well known to have an influence on birth weight. But also behavioral aspects such as smoking and drinking habits play a role (e.g. Bogin, 1999, p. 58-63). Furthermore, socio-economic determinants such as income, social status, inequality, the educational level of the mother, female work activity during pregnancy, work-related psycho-social stress, disease environment, housing conditions, neighborhood and access to medical care are related to birth weight (e.g. Naeye and Peters, 1982; Homer *et al.*, 1990; Spencer *et al.*, 1999; Rondo *et al.*, 2003; Nkansah-Amankra *et al.*, 2010; Maddah *et al.*, 2005).

Among economic historians, birth weight has so far attracted much less attention than other anthropometric measures (Ward, 1993, 1998). The few existing studies analyze birth weights for African-American slave children (Steckel, 1986), and, based on case records of maternity hospitals, Norwegian cities (Rosenberg, 1988), Philadelphia (Goldin and Margo, 1989) and Edinburgh, Vienna, Dublin, Boston, and Montreal (Ward, 1998) in the period 1850 to 1930. There is no evidence of an overall increase of average birth weight in any community during the 19th century, but severe economic turmoil led to sharp declines, as has been shown for the Netherlands, Leipzig and St. Petersburg during World War 2 (Wynn and Wynn, 1993; Stinson *et al.*, 2012) or Vienna during World War 1 (Ward, 1998).[4] Newborns of mothers hit by the Dutch famine 1944-45 in their third pregnancy trimester were 200 g to 400 g lighter compared to earlier and later childbirths (Stein and Susser, 1975; Stein *et al.*, 1976, 2008).

First descriptive studies on newborn size were undertaken in Europe in the 18th century, but it was not before the end of the 19th century that it was broadly recognized that social and economic factors influence fetal growth. For a literature overview in a historical perspective, see Tanner (1981); Ward (1998); Schneider (2014); Ward (2016).

[4]The fact that crisis periods such as wars have an impact on birth weight through the channel of the nutritional status of the mother was already discussed in the literature in the direct aftermath of the two world wars (Peller and Bass 1924, p. 241-216, Table II; Solth 1950, p. 678; Solth and Abt 1951). Glatzel (1955, p. 1879, Table 1) shows a range of 50 g (Berlin, Marburg, World War 1) to 700 g (Vienna, World War 1) of average birth weight loss.

The paper is structured as follows: Section 2 gives an overview on the historical background necessary to understand the specific situation in Basle, and Section 3 describes our data set from the maternity hospital, containing not only information on the health status of the newborn, but also on the parents. We discuss the results in Section 4, providing an interpretation based on the war-related interventions (rationing and relief measures), and Section 5 concludes.

# 2 Historical Background

Besides being an export-oriented economy specialized in textiles, watches, and machinery, Switzerland depended also on imports of coal, textile raw materials and grains (Rossfeld and Straumann, 2008, p. 21). This dependence was problematic during war time. As pointed out by Jöhr (1912), 34 per cent of food consumption was imported in the 1890s. This share increased to 41 per cent until 1911 (Table 1). Because of the specialization of the agricultural sector, it was especially grains used as food and livestock feed which caused a problem, with an import share as high as 84 per cent. On the other hand, Switzerland produced more milk than necessary for domestic consumption, and could use cheese in exchange for grains or raw materials.

When the war broke out in summer 1914,[5] trade relations with the surrounding belligerent countries were almost immediately severed. Besides the effects of the war, Swiss agricultural production was also hit by harvest failures in 1916 and 1917, and an outbreak of the foot and mouth disease in 1920. In reaction to the deteriorating situation, food price limits were put in place in 1914 and stayed effective until 1922, and food had to be rationed from 1917 to 1921. The overall organization of the war economy remained rudimentary and there were hardly any social policy measures (Perrenoud, 2013; Bürgi, 2013). A rare example is military relief assistance for families, which amounted to only two hourly wages of the absent father per day for the wife and not even one hourly wage per child per day (Bolliger 1970, p.

[5]For an overview of the period, see Church and Head (2013, p. 193-204).

1-3, Degen 1986, p. 72).

Two institutions controlled foreign trade. On the side of the Allied Powers, it was the Société de Surveillance (since 1915, mainly food, especially grains), while for the trade with the Central Powers, the Treuhandstelle Zürich (since July 1915, replaced in 1918 by the Schweizerische Treuhandstelle) was in charge for coal, iron, and fuel imports (Ochsenbein, 1971, p. 201-246). In the offset agreements, cheese played an important role, but since milk and milk products were needed for home consumption in increasing amounts, cheese exports had to decrease (Figure 1).

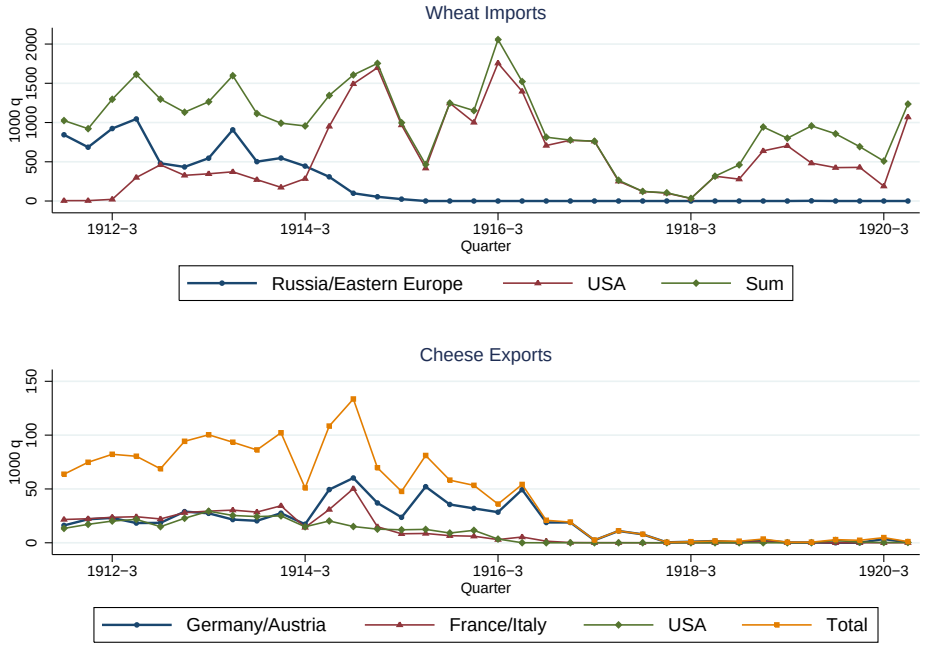
Table 1: Changes in Food Supply and Consumption

| Food Supply (Per Cent) | | | |
|---|---|---|---|
| | Period | Imports | Exports |
| Food in General | 1890s | 34 | 64 |
| | 1911 | 41 | 59 |
| Grains | 1906-1922 | 84 | 16 |
| Potatoes | 1906-1922 | 13 | 87 |
| Beef | 1911 | 27 | 73 |
| Pork | 1911 | 21 | 39 |
| Eggs | 1911 | 65 | 35 |

| Milk Production (1911) | |
|---|---|
| | Share (Per Cent) |
| Domestic Consumption | 43 |
| Cheese | 35 |
| Condensed Milk | 5 |
| Livestock Feed | 17 |

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

Figure 1: Food Imports and Exports, 1912-1920




Data Source: Schweizerisches Zolldepartement (1912-1920)

Rossfeld and Straumann (2008, p. 23-28) describe the effects of the war in five stages: directly after the outbreak of the war, foreign trade stopped, foreigners left the country, and men fit for service were called to arms, without compensation for loss of earnings and with only little pay. This affected about 220'000 men, 12.5 per cent of the employed, who served on average 550-600 days (Tanner, 2015, p. 118, 121). The second stage lasted from spring 1915 to summer 1916 when a short-lived wartime boom started, accompanied by a stabilization of exports and imports. The economy contracted dramatically during the third stage starting in summer 1916, because of the increasing intensity of economic warfare between the Allied and the Central Powers. This affected both exports and especially food imports (Halbeisen and Straumann, 2012, p. 996-1002).

Table 2: Changes in Food Intake

| War Induced Changes in Nutrition (CH) | | | |
|---|---|---|---|
| Year | 1912 | 1917 | 1912=100 |
| Protein (g) | 137.5 | 90.5 | 65.8 |
| Fat (g) | 108.8 | 72.7 | 66.8 |
| Carbohydrates (g) | 583.8 | 424.8 | 72.8 |
| Calories | 4031 | 2789 | 69.2 |

| Milk Consumption (CH) | | | | |
|---|---|---|---|---|
| | Expenditure Share (Per Cent) | | Consumption (l per Consumption Unit) | |
| | Workers | Employees Civil Servants | Workers | Employees Civil Servants |
| 1912 | 22.8 | 22.4 | 340 | 371 |
| 1921 | 22.2 | 19.4 | 350 | 346 |
| Change 1912-21 (Per Cent) | -2.6 | -13.4 | 2.9 | -6.7 |

| Change in Workers' Diet, 1912-1917 (Basle, 1912=100) | | | |
|---|---|---|---|
| Butter | 46 | Vegetables | 105 |
| Meat | 49 | Bread | 106 |
| Eggs | 91 | Cheese | 109 |
| Flour Dishes | 103 | Milk | 128 |
| Potatoes | 103 | Fruits | 207 |

Sources: Schneider (1919, Table 5, p. 13), Ackermann (1963, p. 79), Gigon (1914, Table 1, p. 9), Kühne (1919, Table 1, p. 10); consumption unit: Quets (in honour of Adolphe Quetelet; Engel 1883, p. 58, Engel 1895, p. 4).

From 1916 to 1918, food imports were almost reduced by half (see Figure 1 for wheat imports).[6] Compared to pre-war level, only a third of the foodstuffs could be imported in 1918 (Rossfeld and Straumann, 2008, p. 24-25). By 1918, one sixth of the Swiss population needed relief assistance (one

[6]Wheat imports came mainly from Eastern Europe. With the outbreak of the war, the United States became the most important source for wheat. This stopped in 1917, because of the unrestricted submarine warfare declared by Germany in February.

quarter in the cities). In the end, the fight against speculation and hoarding, the cantonal relief measures and the rationing of foodstuff could not prevent a social crisis (Bürgi, 2013; Perrenoud, 2013), leading to the countrywide general strike (*Landesstreik*, Gautschi 1955). The fourth phase started immediately after the war and lasted until 1921, characterized by the difficulties of re-building peacetime economies in the belligerent countries and the repercussions of these difficulties on Switzerland. In the final phase 1921-1923, the situation culminated in a worldwide economic crisis.

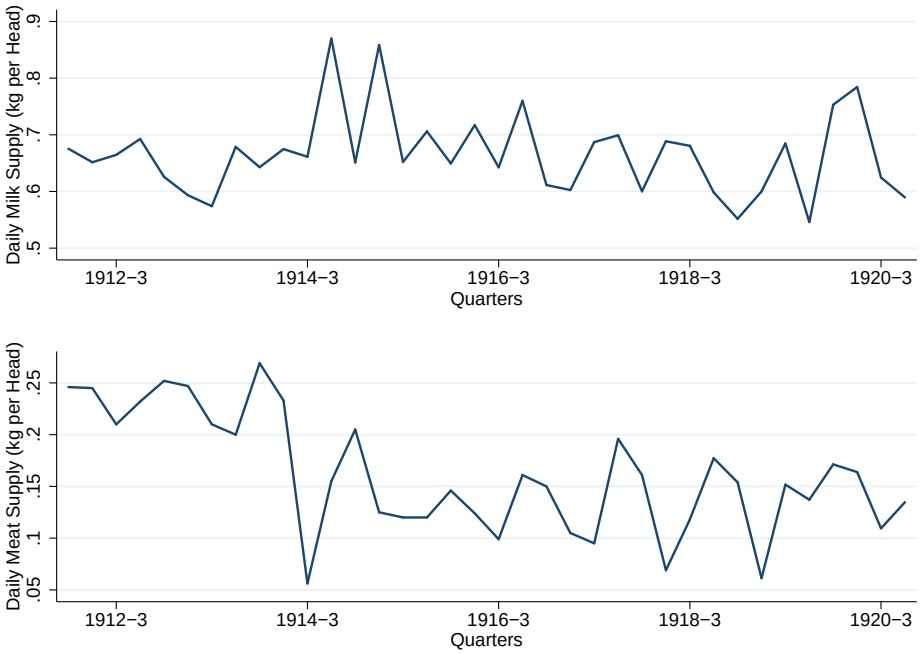
While daily food intake in Switzerland looked favorable in comparison to other countries before the war, the deterioration following the outbreak was severe (Schneider 1917, 1919; Table 2): daily nutritional intake as measured by calories was reduced to levels comparable to poor regions in Italy before the war.[7] But, as Schneider (1919, p. 14) rightly points out, these are averages. Different groups in society might have been affected differently, and there are indications that this is true for milk consumption: between 1912 and 1921, milk consumption of employees and civil servants decreased by 6.7 per cent. For workers, it increased by 2.9 per cent. The fact that with increasing prices (Figure 3), expenditure share and consumption move in different direction for workers' families already point toward policy interventions as an explanation for this change (Table 2).

Food supply in Basle decreased significantly until about 1919 (Figure 2).[8] The lower part of Table 2 shows the effect of the deteriorating situation on workers' diet. The figures are the result of a study conducted by Gigon (1914) in 1912 and Kühne (1919) in 1917 with 8 (respectively 6) male workers from Basle (3 individuals were present in both studies). Their diet was recorded in detail for a week. The results show an expected reduction in meat and butter consumption by over 50 per cent, while the consumption of fruits increased by over 100 per cent, and milk consumption by about 30 per cent.

[7]Reduction: 1914: 4031 kcal; 1917: 2789 kcal. Comparison with Italy (farmers in Abruzzo): 2746.4 kcal, Schneider 1919, Table 5, p. 13.

[8]The peaks in the daily milk supply at the outbreak of the war were due to abnormally high yields in the years 1913 and 1914, which, together with the initial breakdown of exports, led to a reduction in cheese production and an increasing amount of milk available for domestic consumption (Scheurmann, 1923, p. 19-20).

Figure 2: Food Supply in Basle, 1912-1920




Data Source: Statistische Vierteljahreshefte des Kantons Basel-Stadt, 1912-1920

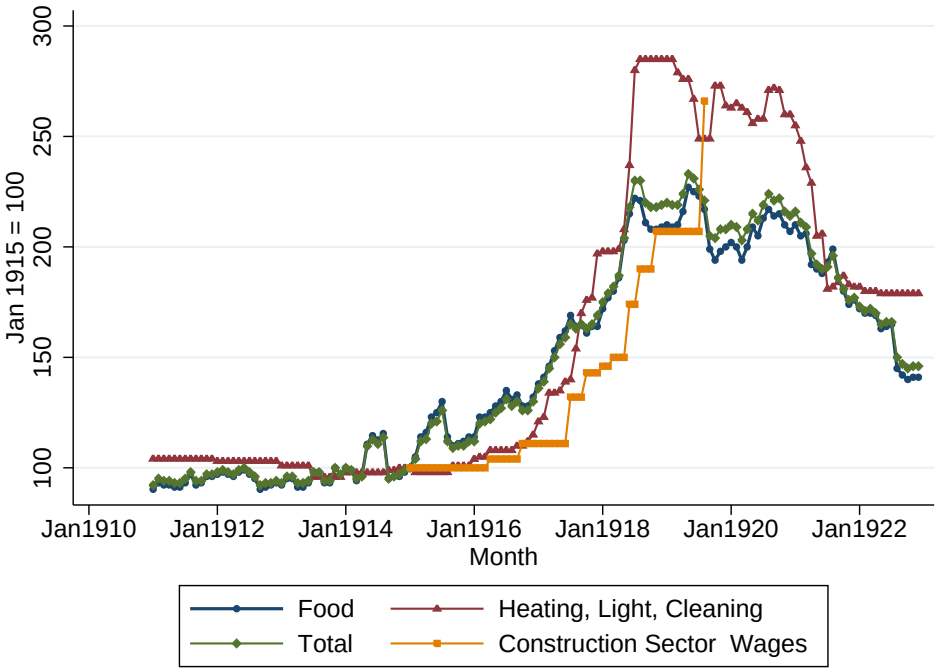
Basel was a bit better prepared for the social consequences of the war than the rest of the country. Under the influence of the Social Democrats,[9] a voluntary cantonal unemployment insurance fund was implemented in 1909 and in 1914, a public health insurance company (*Ökk*) was created. The problems Basle had to face were the same as for other Swiss cities. Especially trade and the construction sector suffered heavily from the ongoing conflict, whereas the chemical industry benefited from the increased demand by the belligerent parties.[10] Despite the implemented measures, the difficult social and economic situation led to unrest. A comparison of price increases and the development of hourly wages in the construction sector illustrates the difficult situation (Figure 3). These wages do not necessarily represent actual

[9]The Social Democrats (*Sozialdemokratische Partei*) were the largest parliamentary group in the cantonal parliament. Since 1910, the party had two members in the governing council (Berner *et al.*, 2008, p. 206-2012).

[10]In the last two years of the war shares of chemical companies paid out dividends up to 25% (Berner *et al.*, 2008, p. 206-2012, Burckhardt, 1942, p. 354-362).

earnings, but Jenny (1919, Table 9, p. 12-13) also reports the actual annual income of eight families in Basle based on household accounts in 1912 and 1919: while the consumer price index (Total) increased by 167 per cent, the increase of annual income (by family member) was 100 per cent (see Table 9 in the Appendix).

Figure 3: Price and Wage Index for Basle, 1911-1922

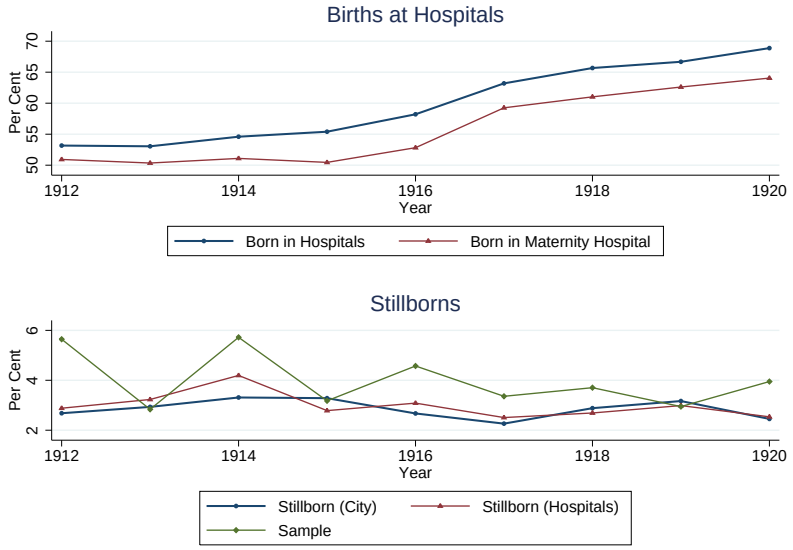



Kleine Basler Indexziffer; source: Statistisches Amt des Kantons Basel-Stadt (1923a, p. 94-95); wages: hourly wages in the construction sector; source: Jenny (1919, Table 12, p. 15).

Since 1915, protest marches against inflation and starvation were organized. The social unrest culminated in Basle in a general strike in 1919 ended by the intervention of the army (Berner *et al.* 2008, p. 206-2012, Burckhardt 1942, p. 354-362). The situation was made worse by the Spanish Flu - the health office recorded 35'000 flu infections (one fourth of the population) with 690 deaths between June 1918 and February 1919 (Degen 1986, p. 79, Berner *et al.* 2008, p.206-2012).

# 3 Data

Figure 4: Births in Basle, 1912-1920




Source: Statistisches Jahrbuch der Stadt Basel (1921, p. 56, 63), Verwaltungsbericht des Regierungsrates des Kantons Basel-Stadt (1912, p. 23; 1913, p. 26; 1914, p. 31; 1915, p. 22; 1916, p. 21; 1917, p. 28; 1918, p. 38; 1919, p. 37; 1920, p. 41)

The individual data come from the birth records of the university maternity hospital (Frauenspital) of the canton Basel-Stadt (Staatsarchiv BS). Detailed data on each childbirth have been routinely recorded since 1888. Along the entire series of control books, each birth record spreads over up to four pages and contains an extensive amount of precise facts about the mother, the newborn and the childbirth. The inventory Sanität X29 contains 16 control books for the period 1912 to 1920.[11] Each of the 16 archived books contains approximately 250 birth records. The register books are carefully maintained and incomplete records are very rare.

Founded in 1868, the maternity hospital was also a teaching hospital, as part of the university hospital (Koller *et al.*, 1970, p. 29-34). The majority

[11] Those books – between one and three per year – are only a third of the initially existing control books (see Table 7 in the Appendix).

of patients came from Basle, which did not change during our observation period: before 1914, the share of residents was about 65 per cent, which increased to 70 per cent after the outbreak of the war, dropping again to 67 per cent in 1918. From 1912 to 1920, between 51 and 64 per cent of all childbirths and more than 90 per cent of all hospital childbirths per year have been given at the maternity hospital of the university (Figure 4). Consequently, the number of childbirths at home or in other hospitals excluded from our study is comparably low.[12] Furthermore, birth records in Basle cover births given by women from both the top and the bottom of the socio-economic strata, as well as complicated and problem-free childbirths.

Table 3: Variables in the Data Set

| Mother | Child | Father |
|---|---|---|
| city district | date of birth | city district |
| civil status | weight and length at birth | civil status |
| SEP | gestational age | SEP |
| date of birth | sex | date of birth |
| height | life or still birth | |
| date of last menstruation | singleton or multiple birth | |
| nutritional status | | |
| body shape type | | |
| parity of the recorded birth | | |

SEP: socio-economic position.

[12] In Zurich, the share of children born at the maternity hospital (kantonale Frauenklinik) was 29.3 per cent in 1912, and increased to 43.6 per cent in 1920. In the same period, the total share of hospital childbirths increased from 40 per cent to 61.2 per cent (Statistisches Amt der Stadt Zürich, 1916, p. 17, 1925, p. 20).

Table 4: Data Characteristics

| | Summary Statistics | | | | |
|---|---|---|---|---|---|
| Variable | Mean | SD | Min | Max | $N$ |
| Mother's Age (y)$^\star$ | 26.2 | 4.9 | 15.6 | 49.7 | 1638 |
| Mother's Height (cm) | 157.5 | 6.2 | 123.0 | 185.0 | 3106 |
| Age at Menarche (y) | 14.9 | 1.9 | 8.5 | 25.0 | 3611 |
| Gestational Age (d) | 278.3 | 20.3 | 84.0 | 396.0 | 3624 |
| Parity | 2.4 | 2.0 | 1.0 | 17.0 | 3711 |
| Length at Birth (cm) | 49.3 | 2.8 | 24.0 | 59.0 | 3581 |
| Birthweight (g) | 3226.3 | 551.8 | 580.0 | 5080.0 | 3680 |

$^\star$ Mother's age is reported at first birth.

| | Shares (Per Cent) | | |
|---|---|---|---|
| Variable | Boy | Girl | Total |
| Stillbirths | 3.9 | 3.5 | 3.7 |
| Multiple Births | 2.6 | 2.5 | 2.5 |
| Birth Weight $<$ 2500g | 7.7 | 8.4 | 8.0 |
| Pregnancy $<$ 37 Weeks | 10.6 | 8.6 | 9.6 |
| Unmarried Mother | 10.9 | 11.2 | 11.1 |

Based on a continuous and unique entry number, nearly 100% of the birth records can be linked to the birth register (inventory Sanität X8). From this second register, additional variables regarding the socio-economic background of the father (if known) are available. Taking both register together, most of the known determinants of birth weight (parity, single/twin birth, gestational age at birth, sex, etc.) are available. Since the occupation of the parents is recorded, these sources provide a unique base for socio-economic differentiation by family background.[13] Our original data transcribed from the archived records contain $N$=3711 births during the years 1912-1920. A list with the available variables can be found in Table 3, and summary statistics are displayed in Tables 4 and 5.

[13]Access to the protected individual data was allowed by the Staatsarchiv Basel-Stadt upon signed contractual agreement. After linking the sources, the data have been fully anonymized.

Table 5: Trend in Birth Weights, Preterm Births and Nutritional Status (Per Cent)

| | Birth Weights | | Preterm Births | | Nut. Status | |
|---|---|---|---|---|---|---|
| Year | $\geq$ 2500g | $<$ 2500g | $\geq$ 37 weeks | $<$ 37 weeks | (1) | (2) |
| 1912-1914 | 92.6 | 7.4 | 91.4 | 8.6 | 86.8 | 13.2 |
| 1915 | 93.9 | 6.1 | 91.3 | 8.7 | 95.7 | 4.3 |
| 1916 | 94.5 | 5.5 | 88.1 | 11.9 | 87.6 | 12.4 |
| 1917 | 94.7 | 5.3 | 91.9 | 8.1 | 92.6 | 7.4 |
| 1918 | 92.3 | 7.7 | 92.4 | 7.6 | 87.6 | 12.4 |
| 1919 | 91.3 | 8.7 | 90.9 | 9.1 | 91.1 | 8.9 |
| 1920 | 94.4 | 5.6 | 90.7 | 9.3 | 89.5 | 10.5 |

Nutritional Status (1): good, overweight; Nutritional Status (2): bad.

Table 6: Socio-Economic Position: Trend (Per Cent)

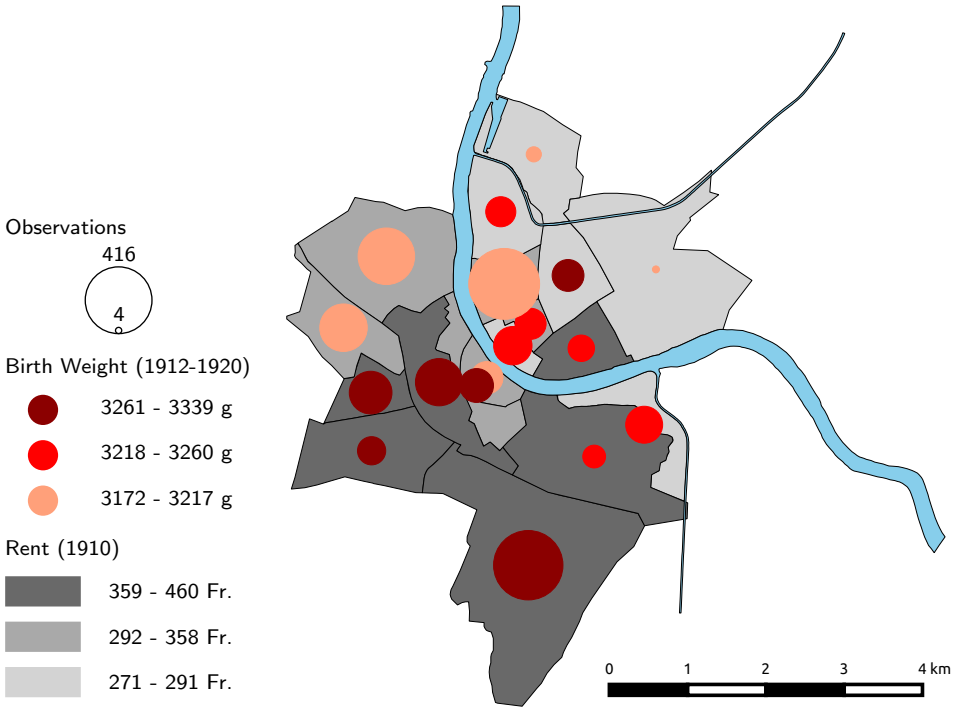
| | Family SEP | | |
|---|---|---|---|
| Year | Low SEP | Medium SEP | High SEP |
| 1912-1914 | 28.5 | 42.1 | 29.4 |
| 1915 | 29.4 | 42.5 | 28.1 |
| 1916 | 23.6 | 44.6 | 31.8 |
| 1917 | 24.3 | 44.5 | 31.2 |
| 1918 | 24.1 | 39.7 | 36.2 |
| 1919 | 21.1 | 38.8 | 40.1 |
| 1920 | 22.4 | 37.1 | 40.5 |

The socio-economic position (SEP) is derived based on the occupation of the father respectively the mother using the classification in Schüren (1989).[14] The result of this classification are six categories, which we aggregate to three groups: low SEP (1,2), medium SEP (3), and high SEP (4,5,6). The reason

[14]The criteria are: education, self-employment, typical income and wealth, and prestige of occupation.

for this grouping was to ensure enough observations in each group (Table 6).[15]

Figure 5: City of Basle: Birth Weights 1912-1920




2595 observations (original data set: 3711); circle area: observations per district (minimum: 4, maximum: 416). Birth weight and rent categories are chosen such that there is the same number of observations in each group.

We use the SEP of the father to measure SEP of the family. In cases this is not possible (456), we use the SEP of the mother. Most mothers indicate "housewife" as occupation (90.3 per cent), nevertheless, we lose only 45 observations for which a classification is not possible (Table 8).

The distribution of birth weights across the city of Basle is displayed in Figure 5, together with information about the socio-economic status of

[15]Comparing the shares of father's occupation with the census shares in 1920 for male occupation groups shows that they are very close (Table 8 in the Appendix).

the quarters based on annual rents from the census of buildings and housing in 1910 Statistisches Jahrbuch des Kantons Basel-Stadt (1921, p. 175). For 2595 individuals, we could assign city districts, which are based on a map from the Statistisches Jahrbuch des Kantons Basel-Stadt (1923, p. 16). Heavier newborns are predominantly in city districts characterized by high rents, already pointing towards a relationship between economic status and birth weight.

# 4 Results

We estimate four versions of the model

$$W_i = \alpha_0 + \alpha_1 T_i + \alpha_2 SEP_i^F + Controls_i + \epsilon_i, \tag{1}$$

where $W_i$ is birth weight of child $i$, $T_i$ is a time dummy (birth years $T$ =1915, 1916, 1917, 1918, 1919, 1920), $SEP_i^F$ the socio economic position of the family, and $Controls_i$ control variables such as mother's characteristics (age, height, body type) and the characteristics of the child (sex, parity). Moreover, we control for the month of birth. The reference category is a boy born 1912-1914 (June, first child), from a medium SEP family, with a strongly built 20-30 years old mother of average height.[16]

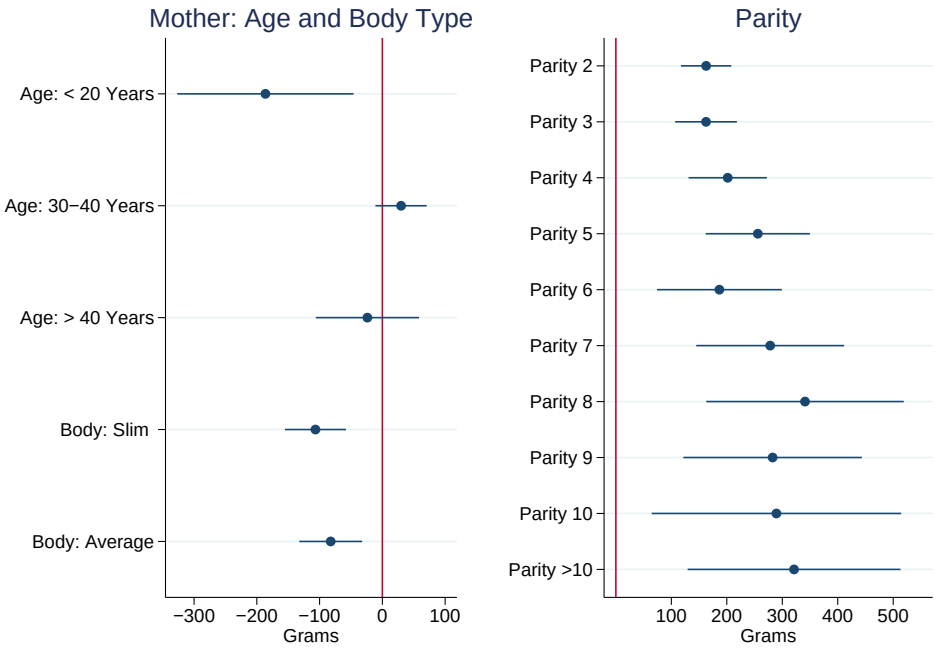
Equation (1) is our first specification, which establishes the time trend (Model 1, Table 10). In the second specification, we include an interaction between time dummies and SEP, in addition to potential channels explaining the reduction in birth weights (nutritional status of the mother, preterm birth, stillborn; Model 2, Table 10). The trend vanishes in our third specification, where we include a variable measuring the number of days a pregnant mother was subjected to rationing (Model 3, Table 10). To demonstrate the impact of rationing on SEP, we use an interaction between rationing and SEP in our fourth specification (Model 4, Table 10).

Mother's age, height, body type, and parity have the expected effect in line with the literature (see the overview in Bogin 1999). Mothers' height is

[16]Note that we exclude multiples from the analysis, losing 94 observations.

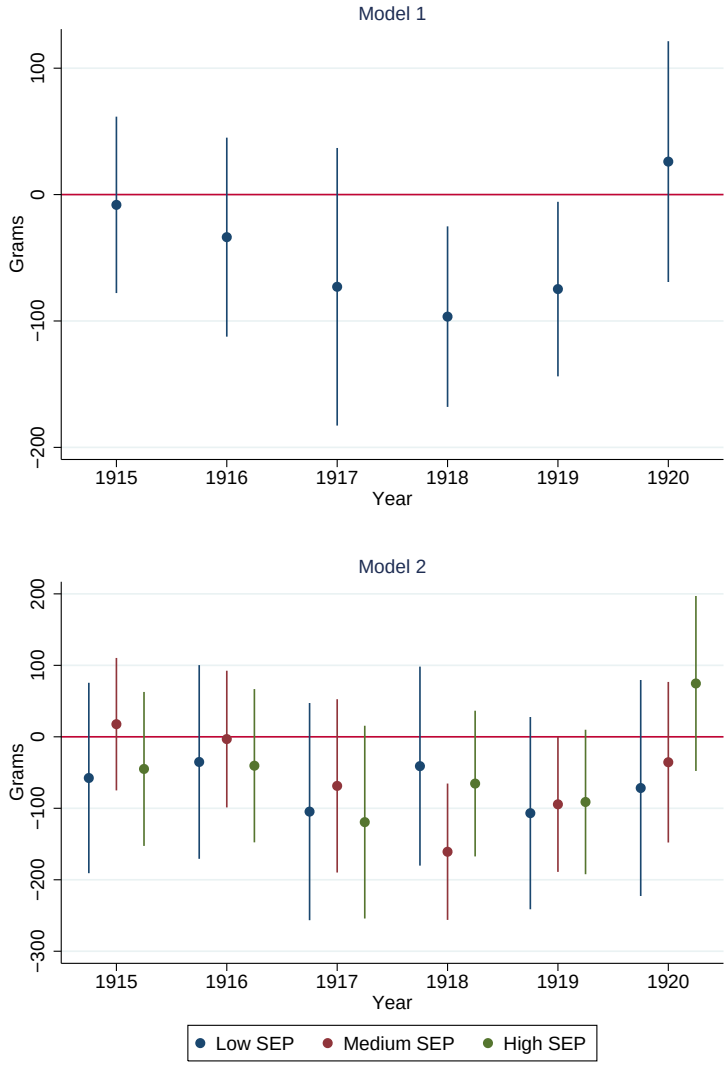
positively related to birth weight. Children from strongly built mothers are up to 100 grams heavier than those with mothers for which the body shape is judged as "slim" or "average". Children from mothers younger than 20 years weight about 200 grams less than those from mothers in the age group 20-30 years. There is no significant difference with respect to age groups 30-40 years and $>$ 40 years. With increasing parity, the weight of the newborn increases (Figure 6).

Figure 6: Mother's Characteristics and Parity




The parameter estimates are from Model 4 (Appendix, Table 10). The bars indicate 95 per cent confidence intervals. Reference category: boy born 1912-1914 (June, first child), from a medium SEP family, with a strongly built 20-30 years old mother of average height.

Figure 7: Birth Weight Trend

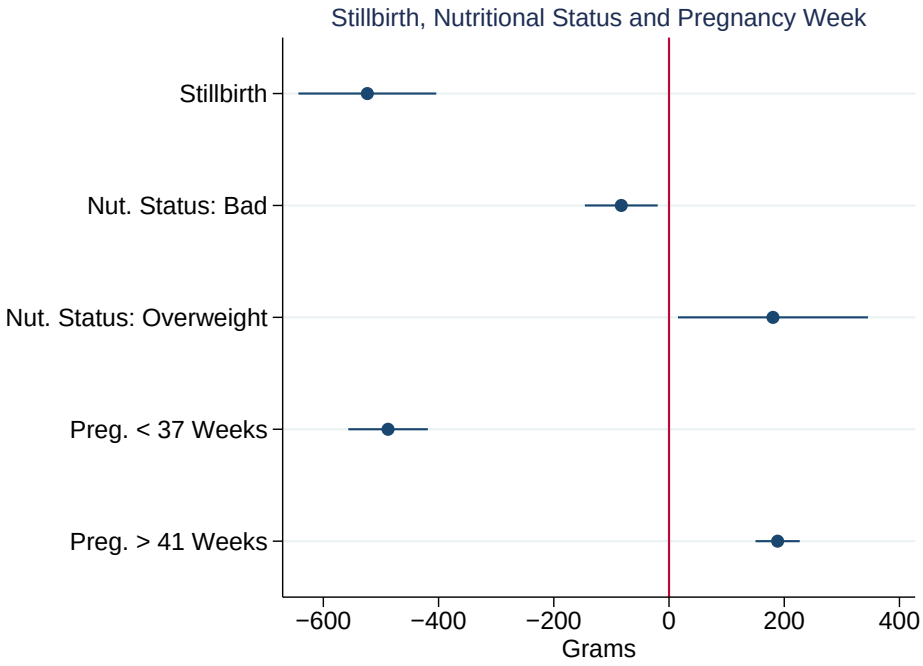



The parameter estimates are from Models 1 and 2 (Table 10 in the Appendix). The bars indicate 95 per cent confidence intervals. Reference category: boy born 1912-1914 (June, first child), from a medium SEP family, with a strongly built 20-30 years old mother of average height.

The overall and SEP-specific time trends are displayed in Figure 7. There is a significant reduction in birth weights in the crisis years 1918 and 1919, a finding which we would expect given the crisis described in Section 2. Our central finding is that if we control for SEP, we see that the trend affects children from medium SEP families, but not those with a high or low SEP

background.

Figure 8: Potential Channels




The parameter estimates are from Model 4 (Appendix, Table 10). The bars indicate 95 per cent confidence intervals. Reference category: boy born 1912-1914 (June, first child), from a medium SEP family, with a strongly built 20-30 years old mother of average height.

Channels through which the economic situation could have influenced birth weight are (1) a deterioration of the nutritional status of the mother, (2) a decrease in the gestational age, and (3) an increase of the number of stillborn children. The effects of the three determinants are remarkably stable across models and have the expected direction (Figure 8, Table 10): a bad nutritional status of the mother leads to a reduction in birth weight by about 100 g compared to the reference category, while an overweight mother has children 200 g heavier (1). Pregnancies lasting less than 37 weeks lead to lighter children (-500 g), while pregnancies longer than 41 weeks lead to an increase in birthweight of 200 g (2). Finally, stillborn children are about 500 g lighter than children born alive (3). We also take into account whether the

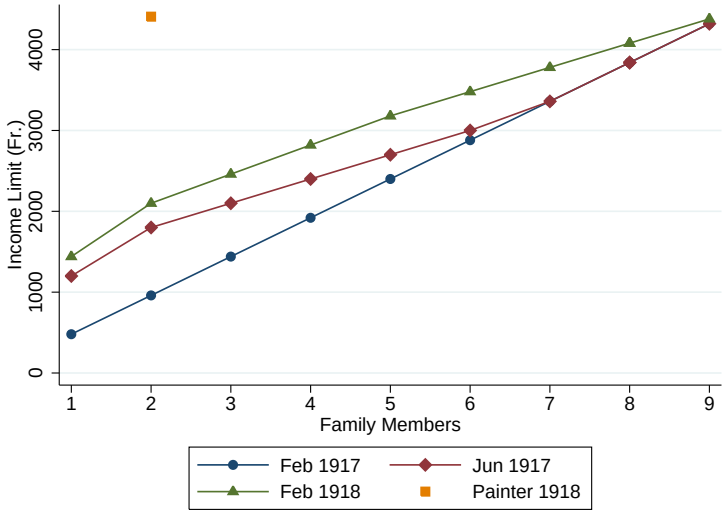
occupation of the father was related to food production or food processing, because this could have had an influence on access to food. However, the parameter turns out to be small and imprecisely estimated (Food Rel. Occ., Table 10).

However, these potential channels cannot explain the change in birth weight over time (Model 2, Table 10). This is in line with the descriptive statistics presented in Section 3. The time trends in Figure 4 and Tables 5 and 6 do not show an obvious break in 1918 and 1919. Nutritional status assessed as "bad" by the hospital fluctuates with peaks in 1916, 1918, and 1920, and the proportion of stillborn children has a peak in 1916. Therefore, including the channels into the regression leaves the birth weight trend unchanged. At least for nutritional status, we would have expected a different result. However, one has to bear in mind that the assessment was subjective, and that it was probably more a description of the status relative to the other patients at a given point in time.

The trend vanishes if we include as additional control the number of days a mother was subjected to rationing during pregnancy (Table 10, Model 3). This is a more accurate measure for exposure to the crisis than just annual dummies, and we construct it in the following way. On the federal level, the first rationing measures were introduced October 1, 1917 (bread and flour, rationed until September 1, 1919). Similarly, butter, cheese, milk, fat, and oil were rationed in 1918, and the measures stayed in place until 1919, some until as late as July 1, 1920 (fat and oil). In addition, there were two days per week without meat between March 5 to June 12 in 1917, and March 8 to July 10 in 1919. In 1919, the federal government declared three weeks of meatless diet between April 11 to April 18 and May 5 to May 19 (Ruchti, 1928-1930, Vol 2, p. 242). Given these dates, we use as "rationing period" the period from October 1, 1917 to April 1, 1920, when milk rationing stopped. With an average gestational age of 278 days (Section 3, Table 4), a child born on October 2, 1917 was subjected to rationing for one day, a child born on October 3, 1917 for two days, and so on, up to July 6, 1918, when exposure was 278 days. Exposure stayed constant until June 28, 1919, and decreased after this date until the end of milk rationing.

In addition to rationing, other measures were put in place to guarantee access to food and to avoid exorbitant price increases. The Federal Council enabled the cantons to introduce price regulations already in August 10, 1914, because a centralized procedure seemed inadequate (First Neutrality Report, Schweizerisches Bundesblatt 1914, Vol. 4, p. 721). But the implementation of these measures did not start before 1917, when food shortage became a problem (Labhardt, 2014, p. 190-194). In Basle, price limits for milk were introduced in April 1916, followed by veal in September 1917, and beef in April 1918. Bread prices were regulated from July 1918 on. Other food items with price limits were potatoes (July 1916), pasta (July 1918), cabbage (October 1918), and turnips (November 1918). In addition, there were price limits for fuel (wood: November 1917, coal: May 1917).[17]

Figure 9: Emergency Relief Measures 1917-1918: Annual Income Limits



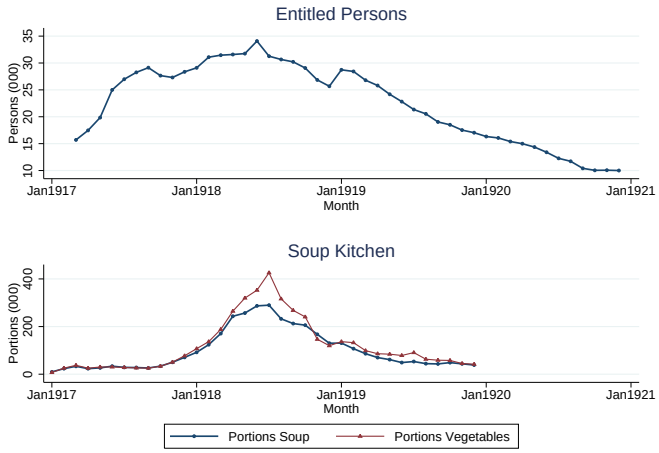

Sources: Justizdepartement Basel-Stadt (1919, No. 67, 95); bulletin of the war relief office, February 13, 1918 (state archive of Canton Basel Stadt, Sanitätsakten O.3.1). For the painter's income, see Table 9 in the Appendix.

These price ceilings applied to everybody, but could not avoid a dramatic increase in the overall price level discussed above (Section 2, Figure 3). There were also attempts to help families in need. Already in August 1914, the

[17] Justizdepartement Basel-Stadt (1919, No. 34, 39, 89, 106, 112, 121, 184, 185, 195, 211).

cantonal government increased the subsidies to the unemployment insurance funds and implemented a relief commission (*Hilfskommission*; Bolliger 1970, p. 5-6).

Figure 10: War Related Relief Measures in Basle, 1917-1920




Sources: entitled persons: state archive of Canton Basel Stadt, Sanitätsakten O.3.1, reports of the commission for food relief (Lebensmittelfürsorge) and the health department (Sanitätsdepartement) to the cantonal government, annual report of the war relief bureau Kriegsfürsorgeamt 1919/20 (p. 42); soup kitchen: annual reports of the war relief bureau ( 1917 (p. 59), 1919/20 (p. 51)

After the failure of the first attempt to organize the food supply by a cantonal commission,[18] a war relief office (*Kriegsfürsorgeamt*) was implemented on Oct. 25, 1917 under the direction of the cantonal government. This institution had the task of organizing relief measures, rationing, price ceilings, and soup kitchens (Gesetz über die Kriegsfürsorge, Justizdepartement Basel-Stadt 1919, No. 130). From February 12, 1917 on, the government distributed food at reduced prices (10 per cent) to families with a monthly per capita income of less than 40 Fr (Justizdepartement Basel-Stadt, 1919, No. 67). Eligibility was re-defined twice, in June 1917 and February 1918, to adjust to the deteriorating situation.[19] The (annual) income limits depen-

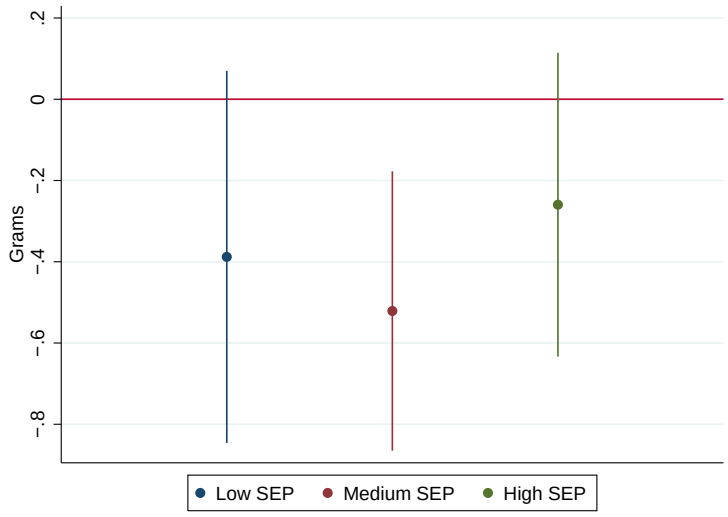
[18]Lebensmittelfürsorgeamt, founded in 1915 (Labhardt, 2014, p. 201-208).

[19]Justizdepartement Basel-Stadt (1919, No. 95); bulletin of the war relief office, February 13, 1918 (state archive of Canton Basel Stadt, Sanitätsakten O.3.1).

dent on the family size, together with the lowest income from Table 9 in the Appendix (painter, 2 family members) are displayed in Figure 9.

Even the family with the lowest income from Table 9 would not have been eligible for food at the reduced prices. At a family size of two, the annual income (4408 Fr.) was above the limit of 2100 Fr. by 110 per cent. Nevertheless, in June 1918, about 34000 individuals were entitled to relief measures, about 24 per cent of the population in 1920.

Figure 11: Interaction Effects of Rationing and SEP (Model 4)




The measures seemed to work: if we interact the rationing days with SEP, it turns out that children from low and high SEP families were not affected, while children with a medium SEP background were: an additional day of rationing led to a reduction in birth weight of about 0.5 g (Figure 11, Table 10, Model 4). If a child was exposed over the entire average gestation period of 278 days, we would observe a reduction of birth weight by 139 g. A possible interpretation of this result is that high SEP families did not suffer from the rationing measures, because they could compensate. Low SEP families were to some extent protected because of the income dependent relief measures described above. Hence, the crisis hit medium SEP families worst, because they could not compensate, and were not entitled to relief.

# 5 Conclusion

In general, crises have a detrimental effect on public health. The overview by Karanikolos *et al.* (2013) on the consequences of the financial crisis for public health across Europe suggests that the severity of the effect depends crucially on policy responses. In terms of birth weight, recent research on Spain shows a marked increase in the prevalence of underweight during the financial crisis (Varea *et al.*, 2016), which, given the results in the literature, can be expected to have negative long-run effects on well-being: an increasing number of studies shows negative long-run effects of adverse early life conditions on educational achievement, morbidity or mortality later in life (e.g. Barker, 1992, 1998; Fogel, 2004; van den Berg *et al.*, 2006; Lindeboom *et al.*, 2010; Weaver, 2011; Almond and Currie, 2011).

Birth weights react to short-term deterioration of economic conditions due to a war, as has been shown for the Netherlands, Leipzig or St. Petersburg during World War 2 (Wynn and Wynn, 1993; Stinson *et al.*, 2012) or Vienna during World War 1 (Ward, 1998), and the city of Basle during World War 1 is no exception. The deterioration of the access to food imports, mainly due to the unrestricted submarine war declared by Germany in February 1917, led to severe problems with food supply. As the rest of the country, Basle introduced price limits, food rationing, and relief measures for the poor. Average birth weights decreased in the years 1918 and 1919 by about 100 g, which is at the lower end of the range 50 - 700 g found in the literature (footnote 4). Not every family was affected in the same way, because the relief measures had the intended effect: the average birth weight of children from low SEP families did not decrease in 1918 and 1919, allowing the conclusion that the nutritional status of the mother did not deteriorate. Similarly, children from high SEP families were not affected, because this part of population could cope with the price increases. Less well off families, however, who despite their situation were not eligible for the relief measures, suffered: for newborns in this group, an additional day of rationing during pregnancy of the mother meant a reduction in birth weight of about 0.5 g.

# Appendix

Table 7: Maternity Hospital Basle: Surviving Records

| Year | Months |
|---|---|
| 1912 | May - July |
| 1913 | May - July, December |
| 1914 | January - April |
| 1915 | February - June |
| 1916 | May - October |
| 1917 | September - December |
| 1918 | January - June |
| 1919 | February - July |
| 1920 | June - October |

Table 8: Family SEP, Frequency Distribution

| | Father's SEP | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mother's SEP | SEP 1 | SEP 2 | SEP 3 | SEP 4 | SEP 5 | SEP 6 | missing | Total |
| SEP 1 | 2 | 2 | 2 | 1 | 0 | 0 | 147 | 154 |
| SEP 2 | 47 | 31 | 76 | 4 | 2 | 1 | 128 | 289 |
| SEP 3 | 17 | 14 | 66 | 12 | 8 | 1 | 111 | 229 |
| SEP 4 | 0 | 1 | 1 | 4 | 4 | 0 | 4 | 14 |
| SEP 5 | 0 | 0 | 1 | 0 | 8 | 0 | 2 | 11 |
| SEP 6 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Housewife | 272 | 240 | 1208 | 769 | 267 | 99 | 45 | 2900 |
| missing | 12 | 9 | 44 | 20 | 7 | 3 | 18 | 113 |
| Total | 350 | 297 | 1398 | 810 | 296 | 104 | 456 | 3711 |

| Male SEP | Low (1,2) | Medium (3) | High (4,5,6) |
|---|---|---|---|
| 1912-20 (Fathers) | 19.9 | 42.9 | 37.2 |
| Census 1920 | 18.8 | 48.1 | 33.2 |

Census 1920: Eidgenössisches Statistisches Amt (1923).

Table 9: Annual Family Income and Expenditure in Basle, 1912 and 1918

| | | 1912 | | | 1918 | | |
|---|---|---|---|---|---|---|---|
| ID | Occupation | Income (Fr.) | Expenditure (Fr.) | Family Size | Income (Fr.) | Expenditure (Fr.) | Family Size |
| 1 | Painter | 3241 | 3063 | 3 | 4408 | 4426 | 2 |
| 2 | Lace Maker | 2112 | 2265 | 3 | 5790 | 5326 | 4 |
| 3 | Carpenter | 1978 | 2142 | 3 | | | |
| | Tram Driver | | | | 5211 | 5442 | 3 |
| 4 | Roadman | 2184 | 2158 | 5 | 6171 | 6177 | 7 |
| 5 | Storekeeper | 2717 | 2686 | 5 | 7568 | 7215 | 8 |
| 6 | Conductor | 3298 | 3201 | 4 | 8445 | 9026 | 8 |
| 7 | Primary School Teacher | 4887 | 4440 | 4 | 9226 | 9139 | 5 |
| 8 | Customs Supervisor | 3618 | 3645 | 6 | 9771 | 9166 | 6 |
| Per Capita Change 1912-1918 | | Income | Expenditure | | Income | Expenditure | |
| 1 | Painter | 100 | 100 | | 204 | 217 | |
| 2 | Lace Maker | 100 | 100 | | 206 | 176 | |
| 3 | Carpenter | 100 | 100 | | | | |
| | Tram Driver | | | | 263 | 254 | |
| 4 | Roadman | 100 | 100 | | 202 | 204 | |
| 5 | Storekeeper | 100 | 100 | | 174 | 168 | |
| 6 | Conductor | 100 | 100 | | 128 | 141 | |
| 7 | Primary School Teacher | 100 | 100 | | 151 | 165 | |
| 8 | Customs Supervisor | 100 | 100 | | 270 | 251 | |
| | Average | 100 | 100 | | 200 | 197 | |

Source: Jenny (1919, p. 12-13)

Table 10: Detailed Estimation Results

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|
| | Est. | SE | Est. | SE | Est. | SE | Est. | SE |
| Low SEP | −24.77 | (25.80) | −25.62 | (44.40) | −25.98 | (44.34) | −43.77 | (29.14) |
| High SEP | 53.03** | (22.20) | 28.79 | (39.65) | 29.20 | (39.60) | 15.09 | (25.36) |
| 1915 | −8.12 | (35.58) | 17.69 | (47.25) | 19.37 | (47.49) | | |
| 1916 | −33.67 | (40.14) | −3.16 | (48.75) | −6.30 | (49.20) | | |
| 1917 | −72.93 | (56.00) | −68.63 | (61.82) | −24.11 | (68.11) | | |
| 1918 | −96.55*** | (36.42) | −160.77*** | (48.64) | 14.11 | (99.13) | | |
| 1919 | −74.75** | (35.21) | −94.44* | (48.21) | −338.88 | (303.24) | | |
| 1920 | 26.10 | (48.57) | −35.54 | (57.28) | 117.51 | (105.39) | | |
| Low SEP × 1915 | | | −75.29 | (80.86) | −75.59 | (80.76) | | |
| Low SEP × 1916 | | | −32.02 | (78.32) | −28.56 | (78.24) | | |
| Low SEP × 1917 | | | −36.00 | (81.11) | −35.12 | (81.01) | | |
| Low SEP × 1918 | | | 119.78 | (83.66) | 122.35 | (83.58) | | |
| Low SEP × 1919 | | | −12.34 | (82.28) | −26.32 | (82.40) | | |
| Low SEP × 1920 | | | −36.06 | (85.22) | −42.77 | (85.19) | | |
| High SEP × 1915 | | | −62.63 | (70.22) | −62.98 | (70.13) | | |
| High SEP × 1916 | | | −37.26 | (65.73) | −33.20 | (65.69) | | |
| High SEP × 1917 | | | −50.73 | (71.22) | −53.64 | (71.14) | | |
| High SEP × 1918 | | | 95.35 | (68.24) | 99.06 | (68.17) | | |
| High SEP × 1919 | | | 3.27 | (68.81) | −16.28 | (69.22) | | |
| High SEP × 1920 | | | 110.18 | (72.29) | 105.26 | (72.21) | | |
| Rationing | | | | | −1.07* | (0.56) | −0.52*** | (0.18) |
| Spanish Flu | | | | | 0.79** | (0.36) | 0.04 | (0.06) |
| Low SEP × Rationing | | | | | | | 0.13 | (0.24) |
| High SEP × Rationing | | | | | | | 0.26 | (0.20) |

Continued on next page

Table 10 continued

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|
| | Est. | SE | Est. | SE | Est. | SE | Est. | SE |
| $<$ 20 Years | $-193.81^{**}$ | (77.45) | $-189.57^{***}$ | (71.88) | $-187.75^{***}$ | (71.81) | $-186.28^{***}$ | (71.60) |
| 30-40 Years | 31.44 | (22.58) | 31.94 | (20.85) | 31.04 | (20.83) | 29.81 | (20.82) |
| $>$ 40 Years | $-32.82$ | (44.67) | $-22.40$ | (41.96) | $-25.24$ | (41.92) | $-23.83$ | (41.93) |
| Mother's Height | $12.66^{***}$ | (1.62) | $11.77^{***}$ | (1.50) | $11.74^{***}$ | (1.50) | $11.52^{***}$ | (1.49) |
| Body Shape: Light | $-132.57^{***}$ | (25.48) | $-99.53^{***}$ | (25.13) | $-101.18^{***}$ | (25.12) | $-106.59^{***}$ | (24.82) |
| Body Shape: Medium | $-98.69^{***}$ | (27.70) | $-77.58^{***}$ | (25.96) | $-78.05^{***}$ | (25.96) | $-82.29^{***}$ | (25.54) |
| Nut. State: Bad | | | $-88.26^{***}$ | (32.49) | $-87.64^{***}$ | (32.49) | $-82.86^{**}$ | (32.24) |
| Nut. State: Overweight | | | $180.02^{**}$ | (84.31) | $179.70^{**}$ | (84.21) | $180.44^{**}$ | (84.08) |
| Food Rel. Occ. | 39.73 | (37.08) | 51.61 | (34.39) | 55.27 | (34.38) | $56.59^{*}$ | (34.26) |
| Unmarried | $-103.15$ | (245.88) | 156.37 | (225.32) | 145.24 | (225.07) | 148.54 | (224.85) |
| Stillbirth | | | $-527.18^{***}$ | (61.21) | $-523.96^{***}$ | (61.19) | $-523.65^{***}$ | (61.03) |
| Parity 2 | $164.42^{***}$ | (25.09) | $163.18^{***}$ | (23.20) | $162.26^{***}$ | (23.17) | $162.73^{***}$ | (23.14) |
| Parity 3 | $150.43^{***}$ | (30.53) | $163.75^{***}$ | (28.42) | $163.07^{***}$ | (28.39) | $162.55^{***}$ | (28.38) |
| Parity 4 | $210.26^{***}$ | (38.72) | $204.78^{***}$ | (36.08) | $203.68^{***}$ | (36.06) | $201.60^{***}$ | (36.03) |
| Parity 5 | $275.49^{***}$ | (51.87) | $258.63^{***}$ | (48.03) | $254.73^{***}$ | (47.99) | $255.93^{***}$ | (47.87) |
| Parity 6 | $130.28^{**}$ | (61.44) | $188.86^{***}$ | (57.51) | $189.44^{***}$ | (57.44) | $186.67^{***}$ | (57.37) |
| Parity 7 | $267.13^{***}$ | (74.35) | $279.03^{***}$ | (68.09) | $279.53^{***}$ | (68.00) | $278.22^{***}$ | (68.00) |
| Parity 8 | $438.75^{***}$ | (95.68) | $334.81^{***}$ | (90.91) | $335.50^{***}$ | (90.82) | $341.02^{***}$ | (90.79) |
| Parity 9 | $200.18^{**}$ | (89.45) | $291.97^{***}$ | (82.22) | $285.15^{***}$ | (82.15) | $282.58^{***}$ | (82.09) |
| Parity 10 | $257.23^{**}$ | (125.36) | $304.46^{***}$ | (114.84) | $305.67^{***}$ | (114.71) | $289.45^{**}$ | (114.66) |
| Parity $>$ 10 | $221.85^{**}$ | (103.33) | $323.74^{***}$ | (98.04) | $328.04^{***}$ | (97.95) | $321.25^{***}$ | (97.86) |
| $<$ 37 Weeks (Preg.) | | | $-491.10^{***}$ | (35.27) | $-475.04^{***}$ | (35.71) | $-487.67^{***}$ | (35.22) |
| $>$ 41 Weeks (Preg.) | | | $187.82^{***}$ | (19.59) | $185.45^{***}$ | (19.59) | $188.50^{***}$ | (19.56) |
| Girl | $-118.45^{***}$ | (19.20) | $-132.45^{***}$ | (17.79) | $-134.19^{***}$ | (17.78) | $-131.85^{***}$ | (17.74) |
| Rationing | | | | | $-1.07^{*}$ | (0.56) | $-0.52^{***}$ | (0.18) |
| Spanish Flu | | | | | $0.79^{**}$ | (0.36) | 0.04 | (0.06) |
| Constant | $3261.99^{***}$ | (34.67) | $3265.27^{***}$ | (36.84) | $3274.66^{***}$ | (36.98) | $3271.27^{***}$ | (31.84) |
| $N$ | 2620 | | 2562 | | 2562 | | 2562 | |
| $R^2$ | 0.11 | | 0.26 | | 0.27 | | 0.26 | |

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