

Please Note:

This is the last working paper version before this study was submitted and accepted.
Please cite as Baten, Joerg: "Anthropometrics, Consumption and Leisure: The Standard of Living", Sheilagh Ogilvie/Richard Overy (eds.), *Germany: A New Social and Economic History*, vol. III: 1800-1989. London: Edward Arnold, 2003, pp. 383-422.

Jörg Baten

Anthropometrics, Consumption, and Leisure: The Standard of Living

1. What does the 'standard of living' mean for human beings?

A higher standard of living is what all of these Germans wanted.¹

The daylabourer of nineteenth century Bavaria had two dreams: A wonderful meal with as much butter as he could eat and the income to marry. In 1979, while a successful architect in Dresden was bored of travelling to the Black Sea and had the wish to see Southern France, his contemporary colleague in Hamburg wanted to live without the fear of becoming unemployed. The WWI soldier from North Frisia equated standard of living with coming home without major injuries, whilst the Italian construction worker living in Karlsruhe in 1893 had the wish to buy a brick factory back home and to become an entrepreneur with a high income.

These imaginary examples of certain stereotypes of German history shared a common bundle of aspirations (a high income, long and healthy life, good nutrition), but each individual considered one component as being of particular importance: the right to marry, travel and stay in a secure job, life expectancy, nutrition and health, income and social status.² This multidimensionality leads to a large number of possible ways to assess the quality of life. There are quite a number of relevant components and indicators:

Incomes and prices. The real income variable reflects differences of purchasing power among time periods or geographical units and social strata. Measured in terms of indicators such as gross domestic product per capita or real wages, it is the most common indicator of living standards.

Life expectancy. Somewhat complementary to the income approach, the life

¹ For important comments and suggestions, I thank Bernard Harris, Axel Heitmüller, John Komlos, Michael Kopsidis, Sheilagh Ogilvie, Richard Overy, Douglas Puffert, Reinhard Spree, Andrea Wagner, and members of the ECONHIST research group Munich. Michael Haines gave important hints. Financial support of the DFG (German Science Foundation) is thankfully acknowledged.

² On the plurality and other theoretical dimensions of the standard of living see Amartya Sen, *The Standard of Living*. (Cambridge: UP, 1994), esp. p. 1-18; Sebastian Coll/John Komlos, "The Biological Standard of Living and Economic Development: Nutrition, Health and Well-Being in Historical Perspective," in Clara Eugenia Nunez, *Debates and Controversies in Economic History*. Proc. 12th IEHC. (Madrid: Fundacion Ramon Areces, 1998), pp. 219-282., here p. 233-235.

expectancy at birth (or later ages) gives indications about health and longevity. A high income is certainly of much lower value if individuals do not have the time to spend it. *Education.* The ability to read and write, and more sophisticated elements of educational attainment, might allow people to lead a more fulfilled life. It also includes the ability to improve one's purchasing power in the future.

Income inequality. As people often do not value their income in absolute terms, but relative to what they perceive as a possible income, income inequality also effects the perception of living standards. Strong deviations between actual purchasing power and perceived poverty are quite common. To illustrate this, Sen cited the example of the poverty line definition in the U.S. during the 1980s that was still fifty times higher than the average income in India at the same time.³

Social status. Another relative measure for social groups in a society is the social status. Not only purchasing power decides about the happiness of certain groups, but also the way in which the rest of society values their social status.

Leisure. The number of working hours per day or per life time is an important component, particularly if the enormously long working day of children in the 19th century factories is considered.

Other components. There are a large number of additional living standard components, such as the freedom of individual choice, political freedom, or the opportunity to buy certain products.

This multidimensionality of human welfare cannot be fully captured in a concise overview on two centuries of living standards.⁴ Therefore, our strategy will be to find a primary indicator that is measurable over the entire time period and then compare the other components with this indicator. This primary indicator cannot be real GDP per capita, because this has not yet been estimated in a reliable way for the first third of the time period under consideration. In addition, national income estimates for the period before 1945 are still heavily disputed (see Figure 1 for the

³ Sen, *Standard*, p. 18, citing Rhodes Boyson, the U.S. Minister of Social Security.

⁴ Suggestions for further reading include Erich Wiegand/Wolfgang Zapf (eds.), *Wandel der Lebensbedingungen in Deutschland. Wohlfahrtsentwicklung seit der Industrialisierung.* (Frankfurt et al.: Campus, 1982); Wolfram Fischer. (ed.), *Lebenstandard und Wirtschaftssysteme. Studien im Auftrage des Wissenschaftsfonds der DG BANK.* (Frankfurt: Fritz Knapp, 1995); Hannes Siegrist/Hartmut Kaelble/Jürgen Kocka (eds.), *Europäische Konsumgeschichte. Zur Gesellschafts- und Kulturgeschichte des Konsums (18. bis 20. Jahrhundert).* (Frankfurt: Campus, 1997).

most widely cited series).⁵ Somewhat more reliable in the early period are real wage estimates, although these suffer from a lack of information about underemployment and other factors. Life expectancy has been estimated for a number of villages and regions.⁶ Information on educational attainment, leisure and income inequality is still scarce and scattered. We will discuss some of the available information below.

In recent research, a lot of effort has been invested in the study of human stature as an index of living standard. The rationale behind this project is the influence of the quantity and quality of nutrition on the average height of a population. Individual genetic components average out, if the number of studied individuals is large enough. Additional environmental influences are the disease environment and physical exertion from work load. One important advantage of this indicator is its availability, even at low regional levels and for social strata whose income is normally unknown (housewives, noblemen, subsistence peasants and many others). The quantity and quality of nutrition is mostly determined by income, or, more precisely, consumption. Two-thirds of consumption was spent on food in 19th century lower class households, and this share was still as high as 50 percent in the 1950s.⁷ Nutrition itself influences health and longevity.⁸ Undernutrition is also held to be associated with poor intellectual and motoric development of children, so the educational attainment variable might also be correlated in some situations.⁹ Therefore, the height proxy can be thought of as an index of several living standard components. This suggests the use of human stature as a primary indicator for assessing the standard of living in the following. However, it must be admitted that in contrast to other indexes such as the Human Development Index¹⁰ (HDI) proposed by the United Nations, the weighting of

⁵ Ritschl and Spoerer estimated the GDP level of the pre-war and interwar years to be somewhat lower than Maddison estimated on the basis of various Hoffmann estimates, but the growth rates during the 1920s and 1930s, for example, were not significantly modified. Angus Maddison, *Monitoring the World Economy*. (Paris: OECD, 1995), p. 130 and 194-195; Walter G. Hoffmann et al., *Das Wachstum der deutschen Wirtschaft seit der Mitte des 19. Jahrhunderts*. (Berlin et al.: Springer, 1965); Albrecht Ritschl/Mark Spoerer, "Das Bruttosozialprodukt in Deutschland nach den amtlichen Volkseinkommens- und Sozialproduktsstatistiken," in *Jahrbuch für Wirtschaftsgeschichte* 1997-2 (1997), pp. 27-54.

⁶ Arthur E. Imhof (ed.), *Lebenserwartungen in Deutschland, Norwegen und Schweden im 19. und 20. Jahrhundert*. Berlin: Akademie Verlag, 1994.

⁷ Manfred Lohr, "Langfristige Entwicklungen der Arbeitslosigkeit in Deutschland," in Wiegand/Zapf, *Wandel*, pp. 237-335.

⁸ Among a vast literature, see C. E. Taylor, "Infections, Famines, and Poverty," in *Journal of Interdisciplinary History* 14 (1983), p. 486.

⁹ S.R. Osmani, "Nutrition and the Economics of Food: Implications of Some Recent Controversies", in J. Dreze/A. Sen (eds.), *The Political Economy of Hunger*, vol 1. (New York: Oxford UP, 1990).

¹⁰ The HDI gives equal weights to the income, literacy, and life expectancy variable. Declining marginal utility

the different factors in the height variable is not fully clear, because of the complicated and time-variant biological processes that lead to the average stature of a population. However, in combination with other indices of living standard it can provide valuable insights into the development of welfare. Particularly interesting are the time periods when biological indicators (height and mortality) and purchasing power indicators (income and prices) deviate. We will see in the following that this was the case, for example, during the national socialist period. In an international context, the deviation between heights and real wages between the 1820s and 1840s in Great Britain and the U.S. has received much interest. The anthropometric decline during this period of rising income has even led to revised estimates of real income.¹¹ We will see in the following what contribution the evidence on the Germany case can make to this debate.

2. The early nineteenth century: agrarian reforms

During the early 19th century, Germany was clearly an agrarian economy. While the agricultural share of the British economy had declined to 22 percent, the corresponding figure for Germany was still 56 percent.¹² Not surprisingly, the most important debate about living standards of the early 19th century focused on an agricultural issue: the influence of agrarian reforms (often called the 'Bauernbefreiung') on living standards in the 19th century. These reforms profoundly changed the social relations and economic systems of the majority of the population that worked in agriculture. Abolishing serfdom (*Leibeigenschaft*) and feudal obligations increased the trend towards a 'capitalist' agriculture. According to Knapp's famous argument this change in property rights and labour relations increased the productivity of this sector, but only at the expense of widespread rural impoverishment.¹³ In Prussia, the peasants with larger estates had to make redemption payments - often one third to one half of their plot was given to the large land-owners (*Junker*). Knapp also reported that the smaller peasantry often lost their farms and

is assigned to income increases at a high level.

¹¹ Charles H. Feinstein, "Pessimism Perpetuated: Real Wages and the Standard of Living in Britain during and after the Industrial Revolution," in *Journal of Economic History* 58-3 (1998), pp. 625-58.

¹² Knut Borchardt, "Wirtschaftliches Wachstum und Wechsellagen 1800-1913", in Hermann Aubin/Wolfgang Zorn (eds.), *Handbuch der Wirtschafts- und Sozialgeschichte*, vol. 2. (Stuttgart: Klett, 1976), particularly pp. 198-275, here p. 215.

¹³ Georg Friedrich Knapp, *Die Bauernbefreiung und der Ursprung der Landarbeiter in den älteren Theilen Preußens*. (Leipzig: Duncker & Humblot, 1887).

became wage labourers on the large land-owners' holdings.¹⁴ The pauperisation of the lower classes particularly around mid-century has been interpreted as a consequence of this development.¹⁵

Other authors have criticized this view. Henning argued that while the Prussian peasants lost a significant portion of their previous plots, they gained a similar magnitude of property from the division of the commons.¹⁶ As a net effect, the *Junker* received this part of the arable land. The poorer peasants that depended on using the commons were the group that experienced particular hard times. Borchardt noted that the scarcity of land might not have been the largest problem of the East Prussian agriculture, as it was possible to increase the area of arable land by a considerable amount between the early and mid-century.¹⁷ Wehler stressed the aspect of missing credit opportunities for the smaller farmers, although they were still able to survive as a social class and to improve their productivity.¹⁸ The second hypothesized effect, the development of a rural proletariat was attributed by Dickler not to the agrarian reforms, but to a long-run development towards capitalistic agriculture that started already in the 18th century.¹⁹ The historiography that attributed a large part of the responsibility for this to the agrarian reforms might not be free of ideology. The strong political role of the East Albian *Junkers* during the late 19th century until the Nazi period challenged liberal and left-wing economists to stress their robbing of farmer's land. Later GDR economic historians helped to legitimate the collectivization of agriculture by emphasizing this point. In the following we will first consider the timing and some theoretical aspects of the reforms and then assess empirically how different types of agrarian reforms affected living-standard measures in selected

¹⁴ Hartmut Harnisch, "Statistische Untersuchungen zum Verlauf der kapitalistischen Agrarreformen in den preußischen Ostprovinzen (1811 bis 1865)" in *Jahrbuch für Wirtschaftsgeschichte* 1974-4, pp. 149-183; Friedrich Lütge, "Über die Auswirkungen der Bauernbefreiung in Deutschland", in Friedrich Lütge, *Studien zur Sozial- und Wirtschaftsgeschichte. Gesammelte Abhandlungen*. (Stuttgart: Fischer, 1963), pp. 174-223. Knut Borchardt, "Regionale Wachstumsdifferenzierung in Deutschland im 19. Jahrhundert unter besonderer Berücksichtigung des West-Ost-Gefälles," in Wilhelm Abel (ed.), *Wirtschaft, Geschichte und Wirtschaftsgeschichte: Festschrift zum 65. Geburtstag v. Friedrich Lütge*. (Stuttgart: G. Fischer, 1966), pp. 325-339.

¹⁵ Knapp, *Bauernbefreiung*; Harnisch, *Untersuchungen*.

¹⁶ Friedrich-Wilhelm Henning, *Handbuch der Wirtschafts- und Sozialgeschichte Deutschlands, vol. 2: Deutsche Wirtschafts- und Sozialgeschichte im 19. Jahrhundert*. (Paderborn et al.: Schöningh, 1996), p. 70.

¹⁷ Borchardt, *Wachstumsdifferenzierung*; Hans-Ulrich Wehler, *Deutsche Gesellschaftsgeschichte*, vol. I. (München: C.H. Beck, 1987), p. 422 gives much lower estimates.

¹⁸ Wehler, *Gesellschaftsgeschichte*, vol. II, p. 33-53.

¹⁹ Robert A. Dickler, "Organization and Change in Productivity in Eastern Prussia," in William N. Parker/Eric L. Jones, *European Peasants and their Markets. Essays in Agrarian Economic History*. (Princeton: P. Univ.

regions of Germany.

One of the main events of the *Bauernbefreiung* in Prussia was the *Preussische Reformen* of 1807 and 1811 that aimed at clarifying labor and personal relations. In Prussia, the most dynamic period was the 1820s.²⁰ Bavaria and Wuerttemberg were quite late as the main part of their agrarian reforms started after the 1848 revolution. Saxony initiated its agrarian reforms during the 1830s, and gained a reputation for performing it without major disadvantages for its farmers, similar to Hanover and Baden (which started early, but ended late). Financial institutions helped the farmers to pay their obligations, and only very few farmers lost their estates. I would argue that this timing was important: As Prussia performed most of the transformation during the 1820s and the decades thereafter, the hunger crisis of the 1840s hit the farmers with small plots and the landless particularly hard.²¹ The agrarian reforms in Bavaria, Wuerttemberg, and Baden had the additional advantage that they were executed to a large extent after mid-century, when there was no major hunger crisis. In those states, the reforms could not be blamed for the famines of mid-century.

The ethical and juristic issues are almost impossible to judge without a political opinion: Must the feudal obligations be redeemed at all? And if so, should the state cover a certain share, as the government of Baden did? If we follow the leading contemporary view that the feudal lords had to be compensated, a number of economic questions arise: Is it more efficient to impose a long-term obligation on farmers that has a similar effect as an additional tax, or to lose a part of one's plot and to be without debt thereafter? The answers certainly depend both on the initial status of productivity and wealth and on the optimal size and structure for predominant types of agricultural production.

Dickler argued that the long run trend was in any case towards larger units that had the organizational capabilities to export grain. If export grain production along the large East Albian rivers was more productive, in principle the *Junkers* should have been able to pay relatively high wages. A reasonable income distribution might have generated a higher income than an alternative agrarian economy with many small

Press, 1975), pp. 269-292.

²⁰ Harnisch, *Untersuchungen*, p. 157. Even if the whole process lasted up to the end of the century, if the final mortgage payments are considered.

²¹ Hanover also did well although it started early, but northwestern Germany had smaller problems in general, see the discussion below.

sized plots. However, the political system prevented trade unions from struggle for higher wages. The agrarian reforms might in fact have helped to stabilize the *Junker* strata, and these large land-owners certainly prevented political change and increased government spending on education. I would consider the sociopolitical results of the reforms to be their major disadvantages.

In addition, Dickler's view of more efficient large-scale export agriculture applied only to the time period before the 1870s. When Knapp wrote his influential study in the 1880s, the capitalist East Albian system was in crisis again, given that transport technology allowed large scale grain imports from the New World and Eastern Europe. The western and northern German agricultural regions that specialized in meat and dairy products did much better during the "European grain invasion".²²

Is it possible to test empirically the effects of the reforms? While a comparison between Prussia and the other states would be appealing, the different timing suggests a limited reliability of this comparison: Too many other factors changed between the early reforms in Prussia and the mostly late reforms in the other states. However, the evidence that we do have does not support the Knapp thesis: Saxony, having a reputation for its mild type of reform, certainly did not perform well during the 19th century. Nutritional status was among the worst within Germany (see also the map 3 below)²³, mortality rates were above average and income equality was high, as a relatively high income per capita contrast with low wages.²⁴

If one considers the development of living-standard indicators in late-reforming Bavaria over time, the available evidence suggests a stagnation. Heights were not increasing between the 1820s and mid-century and real wages were actually declining (figure 2a and b). Mortality rates were increasing in the 1840s. And, finally, the inequality of nutritional status as well as of wealth²⁵ was significantly rising in Bavaria between the early and middle nineteenth century (Figure 3): While farmers were more

²² Kevin O'Rourke, "The European Grain Invasion, 1870-1913", in *Journal of Economic History* 57-4 (1997), pp. 775-801.

²³ It was not much different around mid-century as the anthropometric evidence suggests, see Ernst Engel, "Die physische Beschaffenheit der militärpflichtigen Bevölkerung im Königreich Sachsen," in *Zeitschrift des Statistischen Bureaus des Königlich Sächsischen Ministeriums des Innern* 4-7 (1856), p. 61-116.

²⁴ The real wages given in Jörg Baten, *Ernährung und wirtschaftliche Entwicklung in Bayern, 1730-1880*. (Stuttgart: Steiner, 1999), p. 49, and the wages published in the periodical *Centralblatt* (1892) are much lower for Saxony than the (total) income estimates reported in Borchardt, *Regionale*, p. 117, world suggest.

²⁵ In the Palatinate region of Bavaria, the share of wealth kept by the top 10% was increasing from 44% around 1840 and 1850 to 50% in 1860 and 49% around 1875 (calculated from recruitment lists at Landesarchiv Speyer).

or less able to keep their height advantage between 1815-19 and 1835-39, unskilled day-labourers lost 2 cm of height. This evidence suggests that the adversity of the mid-century crisis that Knapp attributed to the agrarian reforms also appeared in Bavaria which did not really start its agrarian reform before mid-century.

One opportunity for direct comparison is given by the differences of agrarian reforms within Prussia. In the eastern province of Prussia (to be distinguished from the whole kingdom of Prussia), peasants were mostly 'owned' by the state which treated them relatively mildly, so this type of reform could be labelled "mild". In contrast, former peasants in the eastern provinces of Posen and Pomerania lost a particular high share of their previous plots or became dependent agricultural workers (therefore, reform type "harsh").²⁶ In addition, many farmers in the western provinces of Rheinland, Westfalia, the province of Saxony, and even in Brandenburg were rich enough to redeem their feudal obligations by a lump-sum payment. While this initial setting effect was not caused by government policy, the agrarian reforms can still be called "mild", as a loss of land did not occur to such a large extent. In contrast, Silesian farmers were hit hard by the reforms.

But how could we measure the development of living standards by region? Attempts to quantify regional living standards in Prussia before 1900 always depend on proxy indicators, because the available data are scarce. Borchardt estimated the regional living standards by the numbers of physicians, assuming a constant demand elasticity for medical services over time and across regions (Col. 5 and 6 in Table 1).²⁷ His main finding was a constancy of regional living-standard differentials in Prussia, with only Silesia declining from a middle to a low position, while the Rhineland improved its position. Hohorst constructed income estimates by assuming that the correlation between the agricultural share and income in 1913 (and cattle per capita and income) was constant over time (Col. 3 and 4).²⁸ Because Silesia, for example, had a large industrial population, its income was estimated as relatively high. In this case, it might have been overestimated, because productivity and wages were much lower in

²⁶ Harnisch, *Untersuchungen*.

²⁷ Borchardt, *Regionale*.

²⁸ Gerd Hohorst, *Wirtschaftswachstum und Bevölkerungsentwicklung in Preußen 1816 bis 1914*. (Unpubl. Ph.D. thesis: Münster 1978); Harald Frank, *Regionale Entwicklungsdisparitäten im deutschen Industrialisierungsprozeß 1849-1939*. (Münster/Hamburg: LIT), 1994.

Silesia than in the western districts.²⁹ A higher reliability might be attributed to Hohorst's estimated changes over time: the Silesian industry also stagnated according to his calculations, whereas the Rhenish economy expanded rapidly.

The anthropometric record for Prussia gives the share of conscripts unfit because not meeting the minimum height requirement (Col. 7 and 8). We can employ this indicator for two stages in the agrarian reform process: Firstly, we have rejection rates of those conscripts measured immediately after the strongest wave of the agrarian transformation in 1831, and secondly those measured in 1854, during the mid-century period of nutritional crises.³⁰

We distinguish between the more urban districts (Berlin, Danzig, Stettin, Stralsund) as opposed to the more rural ones, as the effects may have been different. Among the eastern rural districts, the level of nutritional status in 1831 was worst in the provinces of Prussia and Posen and better in Pomerania and Brandenburg. As both mild and harsh types of reform produced both better and worse rejection rates, an influence of the reform probably has to be rejected. The same is true for increases in rejection rates between 1831 and 1854: The increase was lower in the rural part of the province of Prussia than in Posen or particularly in Brandenburg, but higher than in Pomerania. As Posen and Pomerania followed the harsh type of *Bauernbefreiung*, no clear impact of the reforms can be stated.

These enormously high rejection rates were much higher than in the wealthier west. The western provinces did better already in the early period, for example Westfalia had only about 4 percent rejected draftees, the Rhineland 10 percent. Even if they increased considerably between 1831 and 1854, their level was still milder: Westfalian rejection rates increased by 7 percent, the Rhenish by 11 percent. Silesia, the eastern industrial province was not able to improve its poor nutritional status. Interestingly, all districts with declining rejection rates contained the large urban trading centres of the East: nutritional status improved in urban Brandenburg (Berlin's rejection rate declined by 7 percent), Prussia (Danzig –14 percent), and Pomerania (Stettin –4 percent and Stralsund –3 percent). One could conjecture that the agrarian

²⁹ Jörg Baten, "Der Einfluß von Einkommensverteilung und Milchproduktion auf die regionalen Unterschiede des Ernährungsstandards in Preußen um die Mitte des 19. Jahrhunderts: Ein anthropometrischer Diskussionsbeitrag," in *Archiv für Sozialgeschichte* 36 (1996), pp. 69-83.

³⁰ We cannot directly compare this rejection rate with those of other rates, due to data limitations, that are explained in detail in Baten, *Einfluß*.

commercialisation helped to improve urban food supply, but more research is clearly necessary in the Prussian anthropometric record.

Bass estimated the number of population crises between 1816 and 1859 by defining a crisis year as a year in which population growth was more than 50 percent below the long-run growth path (Col. 9).³¹ This procedure might overestimate the number of population crisis years in districts with rapidly growing population (for example, in Berlin), as a higher total growth might imply higher variance, but his estimates are valid for comparisons of rural districts. Bass' results are not in favor of the Knapp thesis that the agrarian reforms were responsible for the living standard crisis around mid-century: In the province of Prussia with its milder transformation, the number of population crises was higher than in the districts with harsher reforms. Pomerania actually did best in this respect, even better than the western provinces, in spite of its strong population growth.³²

In sum, the mortality and nutritional living-standard indicators do not support Knapp's argument that the agrarian reforms caused economic hardship around mid-century. The reforms were milder in the Prussian West, but this part was already doing better from the beginning. Considering differences within the East, no substantial effect on living standard indicators could be discovered. However, the long-run impact arising from stabilising the large land-owner's power by the Prussian type of agrarian reform might have been substantial - even though Henning pointed to the fact the many formerly feudal estates were actually bought by the increasingly wealthy industrialists.³³

3. Industrial development and living standards in the late 19th century

During the 1860s, the structural change of the 19th century towards the industrial sector increased its speed, the large industrial cities attracted large-scale migration, and on the eve of the First World War Germany had become an industrial nation.³⁴ For this time period, the debate on living standards in Germany has concentrated its focus on

³¹ Hans-Heinrich Bass, *Hungerkrisen in Preußen während der ersten Hälfte des 19. Jahrhunderts*. (St.Katharinen: Scripta Mercaturae, 1991), p. 43-47.

³² Baten. *Ernährung*, p. 44

³³ Henning, *Handbuch*, p. 74.

³⁴ See Borhardt, *Wachstum*.

the effects of the industrial development. Similar to the 'pessimist' views on the English industrial revolution, many German economists have argued that this development created the *Soziale Frage*, the question whether the dividends from rapid industrial development were so unequally distributed that working-class living standards did not improve for the first two or three generations.

Would we expect industrialization to be good or bad for late 19th century Germans? On the one hand we would expect higher wages and incomes in industry (the 'modern' sector) during an economic transformation. The modern sector has to pay higher wages to attract workers from the traditional sector, and as industrial production was more capital intensive, labour productivity was higher. On the other hand, Public Health might have been worse in the newly emerging, rapidly urbanising centres of industrial activity. Given the low level of 19th century medical knowledge, a higher income might not have translated into better health. In addition, Smits and van Zanden recently warned us that the productivity gap between industry and agriculture in the 20th century does not automatically apply to the 19th or earlier centuries: In the Netherlands, for example, agricultural productivity was higher than industrial productivity around 1850.³⁵

In the following, we first compare the level of industrialization in regional cross-sections with several living standard indicators, and turn later to the development over time. The most industrialized regions (proxied here by the lowest share of agricultural population) were situated in Saxony, Rhineland and Westfalia (map 1).³⁶ A larger region between Breslau in Silesia, Hildesheim and Potsdam surrounded the Saxon core. The most agricultural regions were those at the eastern border, southern Germany and in the Northwest between Muenster and Mecklenburg. This regional structure did not change much in the following century, as similar maps for 1895, 1925 and 1939 would show. Comparing these differences with the mortality experience in the 19th century, a negative correlation with the industrialisation proxy becomes apparent (map 2): the larger the share of industry, the lower the mortality

³⁵ Jan P. Smits and Jan L. van Zanden, "Industrialization and Income Inequality in the Netherlands 1800-1914" in Clara Eugenia Nunez (ed.), *Trends in Income Inequality during Industrialization*, IEHA Conference B12. Madrid 1998, pp. 91-102, here p. 96.

³⁶ Saxony: districts Dresden, Leipzig, Zwickau. Rhineland: Düsseldorf, Köln, Aachen plus the more agricultural Koblenz and Trier. Westfalia: Arnsberg plus Münster and Minden.

rate.³⁷ The percentage of industrial population might have been correlated with income per capita, as it was in the early 20th century.³⁸ It seems that the higher incomes in industry were sufficient to allow a better provision of nutrition and health-related resources. The most deadly regions were the agrarian East and South, whereas the industrial regions did relatively well, including such heavily industrialised districts as Arnsberg, Düsseldorf or Wiesbaden. An exception to this rule was Saxony, particularly Leipzig and Zwickau had mortality rates above average. On the other hand, northwestern agricultural regions such as Aurich or Schleswig ranked at the top in terms of life expectancy, probably because they specialised in cattle-farming which was a profitable business during this time period (in regions close enough to urban markets), and because the inhabitants of those regions also had direct nutritional advantages: Living in a cattle-farming area allowed cheaper access to protein, as milk was not easy to transport. In addition, Lee argued that it was particularly the labor intensity of grain production that led women to neglect breast-feeding of their children.³⁹ Therefore, the difference between agricultural regions specialized in grain production and those in cattle-farming can explain some of the remaining differences in the mortality variable, and statistical tests support this view.⁴⁰ Protein availability is also reflected in the height of military recruits (map 3). Saxony, the earliest and most rigorously industrialized German state with a low protein production per capita, had very short recruits. Similar levels of malnutrition occurred in Silesia and the Prussian province of Saxony (Magdeburg, Erfurt, Merseburg). Westfalia, the famous late developing industrial centre of iron, steel and coal had tall recruits. The agricultural extremes are found in the favorable nutritional experience of the North-West and in the malnutrition of the agricultural Prussian Northeast and Bavaria.

How do these results compare with other living standard indicators? The few

³⁷ While these mortality rates are not age standardized, the research of Lee the age specific mortality rates supports the raw figures in general, see W. Robert Lee, "Regionale Differenzierung im Bevölkerungswachstum Deutschlands im frühen neunzehnten Jahrhundert," in Rainer Fremdling/Richard H. Tilly (eds.), *Industrialisierung und Raum. Studien zur regionalen Differenzierung im Deutschland des 19. Jahrhunderts.* (Stuttgart: Klett-Cotta, 1979), pp. 192-228, here p. 214.

³⁸ At least for Prussia in 1913, incomes the share of non-agricultural were highly correlated (correlation coefficient 0.79).

³⁹ Lee, *Regionale Differenzierung*, p. 220. Hallie J. Kintner, *The Determinants of Infant Mortality from 1871 to 1933.* (Unpublished Ph.D. thesis: Univ. Michigan, 1982), 220.

⁴⁰ A regression of mortality rates on industrial share and height (as a proxy for protein availability) explains 51% of the variation of mortality rates in 1910-13. The two variables contributes similar shares to the explanation.

available data on educational attainment confirm the East-West differences in living standards. In 1841 literacy rates were as high as 93-98% in the Prussian West. But at the eastern edge of Prussia, Polish speakers had much lower rates; in Posen the rate was 59 percent.⁴¹ Again an exception, Saxony already achieved a literacy of 98.8 percent in the 1840s, whereas both its nutrition and life expectancy record was clearly below average in the 19th century.⁴² Another relevant living standard component is the quality of housing, but while some data are available on urban housing (which was miserable for workers during the 1860s and afterwards slightly improved), we have almost no quantitative information on rural housing.⁴³

A somewhat different picture emerges if we consider changes over time instead of levels. Frank argued that the most rapidly developing industrial districts of the Ruhr region caused the increase in mortality during the 1860s and early 1870s.⁴⁴ In the following, we measure "industrialisation" by the increasing share of industrial occupations between 1849 and 1882. We distinguish those regions with a rapid increase of non-agricultural occupations (more than 10%), from a medium group and from the slow-industrialisers with 5 or less percent increase (figure 4). Between 1859-65 and 1872-75, mortality rates were increasing most strongly in the regions that industrialised most rapidly, whereas the slow industrialisers did not experience much increase in mortality between those early periods. During later periods, however, the rapidly industrialising regions did better: Already in 1879-82 the mortality rates of those regions were lower than the slow industrialising regions, and the trend continued until 1925-28.⁴⁵ The short period of higher mortality in the rapidly industrialising regions in the 1870s can probably be attributed to diseases that spread more easily in large industrial towns, such as cholera, typhus, and tuberculosis.⁴⁶ The Franco-

⁴¹ Hans-Ulrich Wehler, *Deutsche Gesellschaftsgeschichte*, vol. 2. (München: C.H. Beck, 1987), p. 485.

⁴² From 1841 to the early 1880s, average literacy in Germany increased by some 8%, and after 1900 illiteracy had virtually disappeared. Sophia Twarog, "Heights and Living Standards in Germany, 1850-1939: The Case of Wuerttemberg," in Steckel/Floud, *Health*, pp. 285-330, here p. 320. More rigorous studies on alternative indicators of educational attainment in Germany, particularly during the 19th century, are still a desideratum. Hoffmann observed that the share for education and recreation expenses per total private consumption rose slowly from 0.6 in 1850/54 to 1.3 in 1910/13, somewhat higher during the Weimar (2.8) and Nazi period (3.6) and particularly after WWII (5.2). See Hoffmann, *Wachstum*, p. 139.

⁴³ Elisabeth Gransche/Franz Rothenbacher, "Wohnbedingungen in der zweiten Hälfte des 19. Jahrhunderts 1861-910," in *Geschichte und Gesellschaft* 14 (1988), pp. 64-95.

⁴⁴ Frank, *Regionale*.

⁴⁵ Those mortality figures are not adjusted for age, but the development is similar if infant mortality rates are compared.

⁴⁶ Lee, *Regionale Differenzierung*, p. 219.

Prussian war 1870/71 caused additional mortality-related stress.

This - compared with Britain - relatively short period of disproportional mortality effects in rapidly industrialising regions can again be partly attributed to the timing: the difficult nutritional situation in late 18th and early 19th century Europe that supports the 'pessimist' view of the British industrial revolution affected the German industrial regions much less, because they were relatively small at that time. When the German industrialisation became rapid in the 1860s and final decades of the century, food supply was much less of a problem, as agricultural and transport technology were more advanced.

Of course, this does not mean that rapid economic development did not put pressure on the Germans. The enormously long working hours must have had terrible effects, and they also applied to children. Table #2 gives some of the scarce quantitative evidence we have on 19th century working hours. Meinert estimated an incredible 80 weekly working hours in industry for the time period around 1860, but Gömmel's estimate for Nuremberg of 65 was probably closer to the truth. During the late 19th century, the working week declined to 57 hours in 1910/14, leaving more leisure to workers. This downward trend continued steadily, but at a slower rate, during the 20th century.⁴⁷ The enormous increase of leisure during the 20th century is certainly a major component of increased living standards. It can be concluded that the industrial development of the 1850s and 1860s led to deterioration of some components of living standard. However, already during the 1860s, the situation started to improve gradually.

If we consider the development of height and life expectancy over time, the decades of rapid industrialisation from the 1860s to the end of the century can be qualified as a period of progress: Even in rural Bavaria, the 1860s were the turning point after many decades of height stagnation and real wage decline (Figure 2a and b), especially for lower-class women. This corresponds to the fact that during this decade the life expectancy at age 20 increased significantly, and particularly women enjoyed for the first time their natural advantage over men (Figure 5). In a similar vein, Twarog

⁴⁷ Hoffmann, *Wachstum*, p. 213-4; Hoffmann's figures are based on Ruth Meinert, *Die Entwicklung der Arbeitszeit in der deutschen Industrie 1820-1956*. (Münster: unpubl. Ph.D. thesis, 1958), whose weak evidence for the time period until the 1860s has never been checked, except by Rainer Gömmel, *Wachstum und Konjunktur der Nürnberger Wirtschaft (1815-1914)*. (Stuttgart: Klett-Cotta, 1978), pp. 190-1. See also Baten, *Ernährung*, chapter 5, for alternative regional proxies. Good overviews on the development of working hours are

found that male heights in Wuerttemberg increased between the early 1850s and the 1860s, and so they did around 1890.⁴⁸ Life expectancy started to rise continuously in the last decades of the century.

I therefore conclude that German industrial development - in spite of some major drawbacks concerning long working hours and urban crowding - had relatively few and transitory adverse effects on health and living standards, at least if one compares it with the situation of the agricultural regions. The correlation between the share of industrial population and mortality in the German regions was negative around 1850 and 1913, probably because the industrial regions had a higher income. The agricultural regions themselves were far from being homogeneous. Significant differences concerning nutrition, health, and income can be found between the northwestern regions specialized on protein production and the eastern and southeastern regions that were growing the major part of Germany's starches.

4. Times of war, times of uncertainty

4.1 World War I

War, hunger and pestilence had always appeared together. Military blockades created hunger, so they have been often used to weaken the military power of the enemy, and plagues followed famines or reinforced the shortage of foodstuffs. However, it still came as a shock to the German population in 1916/17 that hunger returned, because the preceding three decades had seen an enormous and unprecedented economic development: food shortages seemed to have been banished forever. Even the supply of the scarcest foodstuff of the 19th C, animal protein, increased substantially during the pre-war period. From the early 1890s to the pre-war years, animal protein supply per capita rose by about 26%, from 47g per day to 59g per day.⁴⁹ These absolute numbers must not be directly compared with today's nutritional recommendations: The disease environment, housing situation and hard physical work would have required much more nutrient input to achieve our present net nutritional status. However, the

given in Hans Pohl (ed.), *Die Entwicklung der Lebensarbeitszeit*. (Stuttgart: Steiner, 1992).

⁴⁸ Twarog, *Heights*.

⁴⁹ Estimated from Teuteberg's figures on meat, dairy products and eggs, excluding fish because of its regionally restricted supply. Following Rainer Beck's tables, eggs were assumed to contain 130g protein per kg, milk 33g and meat on average 170g. The increase was rapid until around 1900, with two shorter crises around 1893 and 1901/02, and slow, but steady until 1913. See Rainer Beck, *Naturale Ökonomie*. Berlin 1986; Hans J. Teuteberg,

improvements before WWI were considerable, and the hope of having abolished hunger was ubiquitous. It was rapidly destroyed by the initiators of the World War.

Avner Offer took a closer look at the argument that Germany lost the war mainly because it was short of food.⁵⁰ Before the war, Germany imported 19% of its caloric consumption and 27% of its proteins. As the allied forces were able to suppress most of Germany's food imports during the war, animal protein especially became a major problem: If beef is produced instead of grain with the same amount of inputs, only 12-20% of calories or proteins can be supplied. Pork was slightly more efficient, but still much below 50% of the grain caloric content. Therefore, a German government commission decided to commit the large *Schweinemord* of 1914/15 - one third of the German swine herd was slaughtered between August 1914 and April 1915. This led to increasing grain production, but as the government commission had not enough storage capacity for the additional grain, it had to leave the grain in the farmhouses. As meat prices were rising, many farmers decided to feed the grain to their remaining pigs, and about one third of the civilian grain ration "disappeared", as Offer stated. The large towns - which were growing during the war as workers for the war industries were attracted - suffered particularly from severe food shortages, and the large port towns such as Hamburg or Bremen were not able to import their food stuffs as they did before. But in spite of these enormous problems, Offer concludes that the German population was not really starving. Calories were still available in sufficient amounts, except in the winter of 1916/17 and the summer of 1918. It was mainly the animal protein that was missing during the war.⁵¹

We can measure the impact of the WWI famine and epidemics, by looking at schoolchildren's heights that were measured in Stuttgart from 1911 onwards annually on a broad scale (Figure 6). These data stem from a relatively large industrial city, so we would expect the sensitivity of heights to be greater than in the countryside or in smaller towns. All Stuttgart series declined during the war years, whereas even stagnation of heights in the 20th century would be considered as an indication of

"Der Verzehr von Nahrungsmitteln in Deutschland pro Kopf und Jahr seit Beginn der Industrialisierung," in *Archiv für Sozialgeschichte* 19 (1979), pp. 331-388.

⁵⁰ The following discussion is based on Avner Offer, *The First World War. An Agrarian Interpretation*. (Oxford: Clarendon, 1991), pp. 21-78.

⁵¹ On the flu epidemic during WWI, see J. Winter, *The Great War and the British People*. (Basingstoke: Macmillan, 1986), p. 121.

nutritional problems, because the knowledge of hygiene and medical care increased more or less continuously⁵² during the 20th century.⁵³ Heights of the youngest Stuttgart girls reached the lowest point in 1917, the shortest 8- and 9-year-old girls were measured in 1918. The height of boys reached their lowest points in 1918 and 1919. This different chronology between boys and girls is too small to be interpreted as differential treatment of sexes, but we would not want to leave the possibility unmentioned. More research on 20th century height data is clearly a desideratum.

Heights of growing individuals are most affected in the year following the nutritional insult.⁵⁴ Therefore, the Stuttgart height record confirms the chronology given by other sources: The winter of 1916/17 and the summer 1918 were the worst years of the century in terms of nutritional status.⁵⁵ If we assume that the distribution of proteins between children - on which we have data - and adults was not completely changed (compared with the pre-war years), our data would support the view that nutritional problems must have contributed heavily to the dissatisfaction during the later war years.⁵⁶

⁵² Although one could argue that the knowledge and use of therapeutic techniques and medical care improved much more rapidly after 1945 than previously.

⁵³ Even if the gross nutritional intake of animal proteins did not increase in every year, the nutrients were more efficiently used. Only countries and regions with severe problems did not participate in the increase, for example the Soviet Union or China. In the following discussion of heights, we will not only consider height decline as a signal of nutritional problems, but also its stagnation over a period of five, six or more years. The 20th century - in internationally comparative perspective - was a period of typically continuous increases in physical stature: In the United Kingdom, especially in the prosperous Southeast, children's heights increased continuously. On the following, see Bernard Harris, "The Height of Schoolchildren in Britain, 1900-1950," in Komlos, *Stature*, pp. 25-38. Heights in other places with higher unemployment rates stagnated during crisis years, but normally not longer than a couple of years. In areas such as Glasgow or the Walisian Rhondda, that can be characterised by 'old' industries and high unemployment rates, there was some stagnation until the early 1920s, but afterwards a continuous increase started, see Harris, *Height*, p. 32-34. For example, the height increases in Croydon, a town South of London, can almost exactly be described as a linear trend. The same is true for Swedish heights, whose upward trend was almost perfectly continuous during the 20th century, see Lars G. Sandberg/Richard H. Steckel, "Was Industrialization Hazardous to Your Health? Not in Sweden! in Steckel/Floud, *Health*, pp. 127-159, here p. 150. In the United States, heights in each decade were higher than in the previous one, even during the Great Depression, except African-American females, see Jialu Wu, "How Severe was the Great Depression? Evidence from the Pittsburgh Region", in Komlos, *Stature*, p. 137.

⁵⁴ James Tanner, "Introduction: Growth in Height as a Mirror of the Standard of Living," in Komlos, *Stature*, p. 3; for a detailed time series analysis, see Jörg Baten, "Height and Real Wages: An International Overview" in *Jahrbuch für Wirtschaftsgeschichte*, forthcoming.

⁵⁵ Offer, *First*, p.53. For a more detailed discussion of the demographic impact of war, see the articles in Richard Wall and J. Winter (eds.), *The Upheaval of War*. (Cambridge: UP, 1988), especially pp. 9-42.

⁵⁶ Whether the lacking animal protein also contributed to lower efficiency of workers in the militarily relevant industries or even the soldiers, has to remain in the field of speculation until we know more about this sort of relationships. On the relationship between nutrition, height and efficiency see John Strauss/Duncan Thomas, "Health, Nutrition, and Economic Development," in *Journal of Economic Literature* 36 (June 1988), pp. 766-817.

4.2 Weimar years and World Economic Crisis

The Weimar years are notorious for their unstable economic development (Figure 1). The inflation and hyperinflation posed major problems during the years until 1923/24 (even if some export success was achieved during the milder inflation years of 1920/21). The late 1920s have been characterised by Borchardt as "crisis before the crisis" (indicating a very unstable development), and the World Economic Crisis of 1930-33 was far more severe than in all other countries.⁵⁷ One of Borchardt's most hotly debated arguments was that of the "profit squeeze": The political situation led, according to Borchardt, to a major redistribution of income in favour of the workers and the government so that little profit was left to entrepreneurs and they had little ability or incentive to invest.⁵⁸ Workers not only gained in terms of income, but also leisure (Table 2). At a time when the German government permanently claimed to be unable to pay reparations, considerable expenditure on infrastructure and especially dwelling houses for workers was performed. This led to improved housing conditions - especially for the poorer parts of the society - and improved hygienic conditions, as many densely populated parts of the towns were connected to sanitary systems for the first time. On the other hand, the "profit squeeze" led during the late-1920s to a high level of structural unemployment - even before the World economic crisis - that decreased living conditions of people seeking for jobs.⁵⁹ Therefore, our expectations with regard to the height record are ambiguous: As the poorest parts of the population influence the height record particularly strongly, one could imagine a stagnation due to unemployment and uncertain future prospects, on the other hand redistribution policies could imply increasing heights, if there was enough income to be redistributed.

In large industrial towns such as Stuttgart and Leipzig, heights increased in fact dramatically during this period (Figure 6/7). After recovering to the pre-war level

⁵⁷ Knut Borchardt, "Zwangslagen und Handlungsspielräume in der grossen Wirtschaftskrise der frühen dreissiger Jahre: Zur Revision des überlieferten Geschichtsbildes," in Bayerische Akademie der Wissenschaften, *Jahrbuch* 1979. For a recent overview on the different opinions on the *Borchardt Kontroverse*, see Mark Spoerer, "Weimar's Investment and Growth Record in Intertemporal and International Perspective," in *European Review of Economic History* 1 (1997), pp. 271-297.

⁵⁸ Many views contradicting Borchardt have been formulated, see for example, Carl-Ludwig Holtfrerich, "Was the Policy of Deflation in Germany Unavoidable?," in Jürgen von Kruedener (ed.), *Economic Crisis and Political Collapse. The Weimar Republic 1924-33*. (New York: Berg, 1990); Richard Overly, *War and Economy in the Third Reich*. (Oxford: Clarendon Press, 1994), p. 40, who argues that labor costs were low in international comparison.

⁵⁹ Pierenkemper, *Standard*.

around 1921, heights grew very strongly until around 1931⁶⁰ and continued to increase modestly during the crisis in Stuttgart, but very little, if at all, in Leipzig. The Leipzig height increase between 1919 and 1930 was 6.7 cm. In Stuttgart, girls of this age increased in the same time period by 8.4 cm and boys by 8.7 cm. Even if children's heights are more sensitive to changes in the environment than adult height, because not only the level, but also the speed of growth increases, the contribution of the Weimar years to the overall 20th century height increase was enormous. This amazing height increase is mirrored by household surveys. Spree found that the consumption of starches, especially potatoes, decreased between 1907 and 1927/28, whereas the consumption of protein rich meat (and sugar) increased.⁶¹ The largest part of this increase and improvement in quality probably took place during the middle Weimar years.

Stuttgart schoolchildren continued to become taller during the economic crisis of the 1930-33, while those of Leipzig did not.⁶² The Stuttgart development is somewhat puzzling, because weekly real earnings decreased by 15% between 1929 and 1932, total per capita production fell even by 22% in Germany (national data, see Figure 1).⁶³ On the other hand, Engel's law tells us that basic consumption is much less decreased during such an economic crisis, and German workers consumed quite a few "luxury" items before the crisis on which they could save. If we are looking at aggregate consumption estimates, animal protein consumption fell only slightly, by about 1g per day, or 1.5% (Table 2). If we take into account that probably less protein was wasted or fed to animals during the crisis years, the modest height increase in Stuttgart is not implausible. Other interesting facts in this context are that the composition of animal protein changed considerably: Cheaper, but more nutritious, dairy products were consumed instead of meat (Table 2, Col. 2). The percentage of meat proteins fell by 1.5% between 1929 and 1932/33.

⁶⁰ This reflects - due to the lag structure of heights - the last year before the world economic crisis became really catastrophic.

⁶¹ Spree, Reinhard, "Klassen- und Schichtbildung im Medium des privaten Konsums: Vom späten Kaiserreich in die Weimarer Republik," in *Historical Social Research* 22-2 (1997), pp. 29-80, here p. 47.

⁶² 1931-34 in the height record.

⁶³ Calculated from Gerhard Bry, *Wages in Germany*. (Princeton UP 1960), p. 362.

In addition, Hoffmann estimated that expenditure on medical services continued to increase during the crisis.⁶⁴ The total expenditure on physicians increased dramatically during the late 1920s and continued to increase during the crisis years, from 766m M in 1930 (prices of 1913) to 790m M in 1932 and 803m M 1933.⁶⁵ This figure is based on the number of physicians and does not even capture technological progress that might have increased productivity. Interestingly, aggregate national mortality rates were declining during the Weimar years *and* the World Economic Crisis, reaching their lowest point in 1932, while they were rising somewhat during the early years of national socialism (Figure 8).⁶⁶ The increase in mortality between 1932 and 1935 or 1937 was visible in nearly all age groups, and Spree reported that male life expectancy decreased between 1932 and 1938.⁶⁷

Compared with Leipzig, the disamenities of the economic crisis in Stuttgart were relatively modest, because the entrepreneurs tried to keep their staff as long as possible: the new automobile companies and other modern industries of the Neckar area required large investments in worker's human capital that would have been lost otherwise.⁶⁸ In the more traditionally structured Leipzig area, heights more or less stagnated during the crisis, and unemployment figures were much higher, suggesting a higher vulnerability of this area.⁶⁹

4.3 Nazi period

A really astonishing fact in German anthropometric history is the stagnation of heights during the early Nazi period (Figure 6/7).⁷⁰ The slight decline during WWII

⁶⁴ Hoffmann, *Wachstum*, p. 677.

⁶⁵ In contrast, population grew only from 65.1m to 66.0m in the territory under consideration, see Hoffmann, *Wachstum*.

⁶⁶ Brian R. Mitchell, *International Historical Statistics: Europe 1750-1988*. New York, 3rd ed. (1992), p. 102.

⁶⁷ Stat. Jahrbuch für das Deutsche Reich 1934, p. 33; Stat. Jahrbuch für die BR Deutschland, p 40; Reinhard Spree, "Der Rückzug des Todes. Der epidemiologische Übergang in Deutschland während des 19. und 20. Jahrhunderts," in *Historical Social Research* 23-1/2 (1998), pp. 4-43, here p. 28.

⁶⁸ This can also be measured by Württemberg's overtaking of Baden in terms of industrial production and electricity demand, see Jörg Baten, "Regionale Wirtschaftsentwicklung, öffentliche Elektrizitätswirtschaft und Erster Weltkrieg in Baden und Württemberg: Ein quantitativ-graphischer Vergleich," in *Historical Social Research* 16-3 (1991), pp. 69-112, here p. 104.

⁶⁹ The unemployment rates in Leipzig compared with Stuttgart were: 27% vs.15% in Dec. 1931, 29% vs.15% in July 1932; 29% vs. 17% in Jan. 1933 (unemployed per labour force, source: Statist. Beilagen zum Reichsarbeitsblatt, various issues.)

⁷⁰ The following discussion relates only to the population that was regarded by national socialists as 'German'. It is impossible to state an increasing living standard in Germany without mentioning the parts that suffered or

and the strong nutritional insults during the early post-war years are much less surprising. The nadir of nutrition in 1946/47 is well-documented from other sources, as is the increase thereafter that is clearly documented in the children's height record. But during the early Nazi period, one would expect height increases due to the economic recovery from the crisis of the early 1930s.⁷¹ GDP per capita was significantly increasing, by 43% as Maddison recorded on the basis of Hoffmann (Figure 1).⁷² Much of the additional production was spent on military equipment, therefore not leading to increasing personal consumption, but in most narrative memories of contemporaries, a rising standard of living for those Germans that did not belong to the prosecuted groups was mentioned.

One could also expect improved Public Health due to the enormous attempts of the Nazis to organize the whole population, and particularly children and adolescents in organizations such the *Hitler Jugend* that promoted efforts in this field. Finally, touristic institutions (*Kraft durch Freude*) provided working class consumers with unprecedented opportunities to take holidays away from home.

Not only GDP per capita was rising, but Petzina emphasized a positive real wage trend after 1933. In spite of the official policy of fixing wages and prices to the level of 1933, both nominal and real wages tended to rise, starting from their very low level after the crisis.⁷³ Real wages recovered to their 1928/29 level in 1938 according to Petzina's calculations.⁷⁴ In contrast, Overy argued that real *earnings* failed to regain their 1920s level.⁷⁵ Both authors would agree though that the recovery of real wages was relatively modest compared to the increase of total GDP, leading to an income redistribution in favour of the government and the self-employed or capital owners.⁷⁶

were murdered under the Nazi regime: the Jews, Romas, homosexuals, active left wing politicians and many other groups.

⁷¹ Even if not everyone would accept the decrease in unemployment between 1932 to 1935 at face value. Silverman expressed doubts about the Nazi statistics but did not estimate the degree of falsification, see Dan Silverman, "National Socialist Economics: the Wirtschaftswunder Reconsidered," in Barry Eichengreen and Timothy Hatton (eds.), *Interwar Unemployment in International Perspective*. (Dordrecht: Kluwer Academic Publishers, 1988), pp. 185-220.

⁷² Maddison, *Monitoring*, p. 130 and 194-195; Hoffman, *Wachstum*.

⁷³ Dietmar Petzina, *Autarkiepolitik im Dritten Reich. Der nationalsozialistische Vierjahresplan*. (Stuttgart: DVA, 1968), p. 167.

⁷⁴ *Ibid.*

⁷⁵ Overy, *War*, p. 263-4.

⁷⁶ See Dietmar Petzina, *Die deutsche Wirtschaft in der Zwischenkriegszeit*. (Wiesbaden: Steiner, 1977), p. 148; and recently Mark Spoerer, *Von Scheingewinnen zum Rüstungsboom. Die Eigenkapitalrentabilität der deutschen Industrieaktiengesellschaften 1925-1941*. (Stuttgart: Steiner, 1996).

In addition, the modest recovery of real wages was accompanied by longer working hours: Between 1933 and 1939, every year the number of hours worked per week increased, while the trend during the Weimar Republic had been in the opposite direction.⁷⁷ The leisure component of the standard of living was significantly reduced. But most importantly for the explanation of the height stagnation, the quality of nutrition deteriorated during the Nazi period. The national socialists aimed at changing the strongly integrated German pre-WWI economy into an autarkic economy, in the field of food consumption as in other fields. As Germany had been a strong importer of animal food, this created the strongest problems in terms of animal protein and fat. Contemporaries discussed this issue intensively under the terminus technicus *Fettluecke* (shortage of fat supply).⁷⁸ Consumption of fats as well as animal protein increased much less until 1936 than GDP was rising, because the imports from Denmark and other protein producing countries were lacking (Table 3). In 1937/8, consumption was somewhat higher. However, Overy presented archival material on workers' households that consumed 18% less meat in 1937 than in 1927, whereas starch consumption has somewhat increased.⁷⁹

Preparing WWII, much energy was spent on nutritional issues, as national socialists wanted to avoid the upheavals during the First World War by any means. In addition, the *Lebensraum* ideology was partly based on this type of consideration: If it was impossible to feed enough cattle in an autarkic Germany, occupying land of neighbouring countries in the East was seen as a possibility. During the war, the military and political authorities were very concerned that the soldiers or their families at home might suffer from malnutrition. One strategy was to rob food from the occupied countries. It has been estimated that in 1942/43, some 45% of German grain consumption and 42% of fat and meat had either been stolen from the occupied countries or produced by forced laborers within Germany.⁸⁰

⁷⁷ Bry, *Wages*, p. 48.

⁷⁸ On the *Fettluecke* see Gustavo Corni/Horst Gies, *Brot - Butter - Kanonen. Die Ernährungswirtschaft in Deutschland unter der Diktatur Hitlers*. (Berlin: Akademie Verlag, 1997), pp. 309-314

⁷⁹ Overy, *War*, p. 264. He also stresses the decline on quality that is described in the following.

⁸⁰ L. Burchardt, "The Impact of the War Economy on the Civilian Population of Germany during the First and Second World War," in W. Deist (ed.), *The German Military in the Age of Total War*. (Leamington: Spa, 1985), pp. 40-70, here p. 53, cited from Corni/Gies, *Brot*, p. 554.

Other strategies of the Nazi government to secure nutrition included ideas, whose awkwardness can best be illustrated by an example.⁸¹ As fat was particularly scarce in autarkic Germany, a firm by the name of *Maerkische Seifenfabrik* (Witten an der Ruhr) had the idea of producing artificial fat from hard coal. This fat was not used for industrial purposes - as one might have imagined from the raw material - it was indeed included into the food box of soldiers for human consumption (!). Less surprisingly, it was very unpopular due to its lack of any taste. In order to improve taste, colour and vitamin content, the *Maerkische Seifenfabrik* decided to buy a large plot of land, plant carrots, extract carotin and add it to the artificial fat. From the remaining carrot material, jam was produced. The company bought a large agricultural estate relatively cheaply near the town of Lahr in Baden, by promising that an army research institute would be founded in Lahr.⁸² The idea of creating food from hard coal illustrates how difficult the nutritional situation in an industrial economy striving for autarky can be, and it also illustrates an enormous trust in modern technological methods to improve consumption possibilities under ideological constraints.

5. The two Germanies: differences in conventional and biological standard of living

5.1 Does socialism make you shorter and die earlier?

After the introduction of different economic and political systems in the two parts of Germany, living standards also evolved in different ways. No one would doubt today that conventional living standards in the East German GDR were much lower than in the West German FRG, even if shadow economies might have narrowed these estimates by a few percentage points.⁸³ Van Ark recently estimated that East German value added per person employed in manufacturing in 1987 was only 32% of the West German level.⁸⁴ Kaelble provided figures on the numbers of cars, telephones, books and mailed letters per capita that strongly support the differences in living standards.⁸⁵

⁸¹ On the following see Jörg Baten, "Die wirtschaftliche Entwicklung der Stadt Lahr im 20. Jahrhundert," in *Geschichte der Stadt Lahr im 20. Jahrhundert* edited by Stadt Lahr, pp. 45-66, here p. 56/57.

⁸² After the war, chemical production in other fields was relatively successful, the name was changed to *Imhausen Chemie (Lahr)*, and this firm became famous in the 1980s because it was accused of building a chemical warfare factory in Gaddafi's Lybia.

⁸³ See for a recent overview Oskar Schwarzer, *Sozialistische Zentralplanungswirtschaft in der SBZ/DDR: Ergebnisse eines ordnungspolitischen Experiments (1945 - 1989)*. (Stuttgart: Steiner, 1999).

⁸⁴ Bart van Ark, "Convergence and Divergence in the European Periphery: Productivity in Eastern and Southern Europe in Retrospect," in Bart van Ark/Nicholas Crafts, *Quantitative Aspects of Post-war European Economic*

Although a relationship between lower GDP per capita and factors such as life expectancy and net nutritional status seems logical at first view, several factors might have shifted the GDR on a comparable level with regard to these biological welfare components:

- Firstly, the general level of welfare might have been already so high, that only some of the above-mentioned decent goods were missing, whereas for example foodstuffs were not scarce.
- Secondly, the socialistic redistribution policy might have provided special benefits for the least productive social groups, that might have dropped out of the social security networks in the West. Housing rents were low, and foodstuffs were sold at low prices due to government subventions. Especially meat consumption was strongly subsidized by the state, as Merl emphasized.⁸⁶
- Thirdly, medical services were also provided in the countryside. In contrast, the supply of health related goods in rural Western Germany lagged sometimes surprisingly, while the urban centres consumed much of the advanced medicine.

On the other hand, the supply of some health-related products (for example, specialized drugs) was in general more uncertain in a socialist economy. This might even apply to some perishable, but healthy foodstuffs such as milk. Animal protein might have been achieved from less perishable foods such as bacon that were more resistant to the problems of central planning .

In addition, the lower conventional standard of living and the aim of GDR leaders to catch-up to Western consumption levels implied "dirtier" production methods. The *Braunkohle*-based industrial production in the Southern GDR created enormous health problems. Starting in 1962, the East German Humboldt University undertook specialized epidemiological research comparing morbidity rates in the heavy industrial district of Halle (15.3% of GDR's industrial production) to the relatively unpolluted Neubrandenburg district (1.1% of industrial production).⁸⁷ In

Growth, pp. 271-326, here p. 284. See also Wilma Merkel/Stefanie Wahl, *Das geplünderte Deutschland. Die wirtschaftliche Entwicklung im östlichen Teil Deutschlands von 1949 bis 1989*. (Bonn: IWG Bonn, 1991).

⁸⁵ Hartmut Kaelble, "Europäische Besonderheiten des Massenkonsums 1950-1990", in Siegrist/Kaelble/Kocka, *Europäische*, pp. 169-203.

⁸⁶ Stephan Merl, "Staat und Konsum in der Zentralverwaltungswirtschaft. Rußland und die ostmitteleuropäischen Länder," in Siegrist/Kaelble/Kocka, *Europäische*, pp. 205-241.

⁸⁷ On the following, see Gerhard Würth, *Umweltschutz und Umweltzerstörung in der DDR*. (Frankfurt/Main et al.: Lang, 1985), pp. 70-72.

March 1962, 0.278% of Halle's inhabitants were unable to work because of bronchitis, compared to 0.096% in Neubrandenburg. The corresponding values for September 1962 were 0.096% and 0.045%. This significant difference was - according to the GDR study - caused by the enormous dust in the industrial areas. In Halle, foggy days increased decade by decade from 13.5 in 1891-1900 to 64 days in 1961-68. In 1970, the lung capacity of children from the chemical district of Bitterfeld was much lower than in rural Schwerin. Comparisons of 1700 schoolchildren from Bitterfeld and healthier GDR places found that human growth was retarded by 10 months in the chemical district. By 1978, this retardation was reduced to 'only' six months.⁸⁸ These obvious health problems led to a brief period of public promotion of ecological ideas in the GDR during the early 1970s. An environmental law was published (*Landeskulturgesetz*, 1970), and a Ministry for Environmental Issues was created (1971).⁸⁹ However, the economic problems - among them the two oil price shocks - soon led the GDR government to abandon these experiments.

During the late GDR period, the socialist leaders, who needed Western currencies to import scarce goods, even 'sold' some of the Eastern biological standard of living, if we count environmental pollution as one aspect of welfare. For example, they offered the Schönberg waste disposal area to waste transports from the West, because the FRG had enormous problems to find disposal areas. Officials also tolerated toxic material mixed in the waste.⁹⁰

Life expectancy and to a certain extent human stature confirm the notion of a lower biological standard of living in the GDR. While both indicators displayed a positive and continuous trend in East and West, life expectancy was increasing much less during the later years of the GDR compared with the West, and the level was substantially lower during the last two decades (Table 4).

Until the 1970s, GDR life expectancy might have increased as fast as in West Germany, but one cannot be sure that the GDR government statistics were not falsified. However, the basic mortality statistics for non-infants of the GDR after the mid-1960s have a good reputation, whereas other published figures are clearly

⁸⁸ Regional control groups were also considered.

⁸⁹ *Ibid.*, p. 31. Already in the 1950s, Reinhold Lingner argued for a more ecological style of agriculture, after the GDR's official enthusiasm for the Stalinistic and Soviet type of large industrial production in agriculture deleted many natural hindrances (trees, hedges) against soil erosion, see *ibid.*, p. 23.

⁹⁰ *UmweltMagazin* Juli 1989, pp. 28-31.

problematic.⁹¹ The much slower progress in life expectancy during the 1970s and 1980s is probably no statistical artefact, and the 2.8 additional years for women and 2.6 years for men that West Germans were able to enjoy represented a clear advantage in biological standard of living.

From a regional point of view, Frank considered mortality rates in Eastern and Western Germany and found that - after controlling for age structure - mortality was much higher in any GDR district than in any FRG district in 1985-87.⁹² Particularly high mortality rates (but also a high average age) and low fertility rates were found in the three Saxon districts, whereas the opposite was true for the agricultural North.⁹³

East German heights were also somewhat lower, although different studies arrive at different estimates. Greil finds that East Germans in the 1980s were 178.1 cm and Westerners 178.7 at the same age (20-24 years).⁹⁴

Hermanussen on the other hand reports data in which 18-year-old GDR males were 3.7 cm shorter than Westerners in the 1980s (and girls of this age 2.8 cm), and he argues that his figures (published by GDR anthropologists) were considered to be representative, and that the same is true for the Western figures.⁹⁵ As we cannot examine the exact modalities under which these contradictory measurements were taken, we conclude that East Germans were at least 0.6 cm shorter, and this fact suggests - taken together with the lower life expectancy - a lower biological standard of living in the former GDR.

5.2 Stature and mortality before and after unification

Hermanussen also studied the surprising height increase of East German (male) conscripts after 1990 and found that the difference between East and West decreased from 2.2 cm in 1989 to 1.4 cm (mustering 1992), to 1.1 cm (1993), and to 0.6 cm (1994).⁹⁶ The first convergence step can be partly explained by the previously different age at measurement (17.9 years in the GDR, FRG and the later cohorts of East

⁹¹ Especially all sorts of production figures, and the cause-of-death data were also problematic. See Regina Regina T. Riphahn/Klaus F. Zimmermann, "The Transition's Mortality Crisis in East Germany," *UNU/WIDER - Research for Action* 42 (1997), p. 9/10, who cite Nicholas Eberstadt, "Demographic Shocks after Communism: Eastern Germany, 1989-93," in *Population and Development Review* 20-1 (1994), p. 209.

⁹² Frank, *Regionale*, pp. 198-201. See also the contribution by Timothy Guinnane in this volume.

⁹³ Calculated from the 1984 figures from *Statistisches Jahrbuch der DDR* 1986.

⁹⁴ Holle Greil, "Age- and Sex-specificity of the Secular Trend in Height in East Germany", in Komlos/Baten, *Biological*, pp. 483-496.

⁹⁵ Michael Hermanussen, "Catch-up in final height after unification of Germany" in *Acta Med. Auxol.* 29-3 (1997), pp. 135-141. Astonishingly, children were not shorter according to these studies.

Germans at 19.5 years). But the subsequent decrease of the height differential must have been caused by other factors. Migration is an unlikely explanation, because one wouldn't expect all the tall people to remain in Eastern Germany. Surprisingly, as Hermanussen stated, convergence pertains only to males in the late adolescence years, while children's heights did not increase. Greil added that female heights did not increase either.⁹⁷

The different development for adolescent males and females after unification could be explained by differences in the labour market policies and the provision of child care between East and West. In the former Democratic Republic, the socialist policy of putting women to work and taking special care of children might have resulted in relatively more and better resources being given to these groups, whilst young males might have a higher income expectation in capitalist market economies, so that the intrahousehold resource allocation could have shifted in their favour.

On the other hand, the development of mortality rates in the years following reunification suggests a deterioration for Eastern Germany during this time period, but mainly for middle age groups around 40. Eberstadt and Riphahn/Zimmermann studied the determinants of this surprising demographic development.⁹⁸ They found that certain gender-specific age groups were most at risk: *female* mortality decreased in general, only the age group 35-45 experienced some increase between 1989 and 1991. This age group also died more often among men. Younger males experienced also increased mortality in the first years, but their death rates moved back to normal values relatively fast, while for the East German males around 40 mortality rates were in 1994 still 10-20 percent higher. One could imagine that younger people adjusted more easily to the new situation, while men of 35-45 years are typically in a life phase, in which they want to apply the knowledge they have achieved before. Not being able to do so and instead being faced with uncertainty and often unemployment, they experienced strong psychosocial stress. Riphahn and Zimmermann conclude that the

⁹⁶ Hermanussen, *Catch-up*.

⁹⁷ Greil, *personal communication* (1997).

⁹⁸ Nicholas Eberstadt, "Mortality and the Fate of Communist States," in *Communist Economies and Economic Transformation* 5-4 (1993), pp. 499-517, cited from Riphahn/Zimmermann, *Transition's Mortality*.

increased mortality rates were mostly caused by alcohol overconsumption, and by circulatory and heart problems that were related to psychosocial stress.⁹⁹

It is interesting that women were less sensitive to this development, while they were the main victims of the high Eastern unemployment. Only the mortality rates of the middle-aged women increased after unification. In contrast, the overall female life expectancy improved considerably, mostly because elderly women faced a lower mortality risk than during the GDR period (and, to a lesser extent, the very young). Individual interviews suggested that men suffered more from the psychosocial stress from unemployment, because males might have felt more loss in social status from losing their job, in accordance with traditional gender roles.

6. Conclusion

In contrast to traditional welfare indicators, a special focus on biological components of the standard of living leads to different judgements concerning the time periods of German history. As an astonishingly favorable time period the 1920s stand out. Net nutritional status measured by anthropometric methods (i.e. human stature) increased very strikingly during this period, whereas the other decades between 1910 and 1950 were more or less times of stagnation. One particularly interesting result is the stagnation of heights among urban schoolchildren during the national socialist reign. I argued that this fact was mainly caused by the striving for autarky under the Nazi regime. A significant increase in mortality from 1932 to 1935 and 1937 supports the notion of a declining biological standard of living even for the non-prosecuted groups. After WWII, a stable increase of nutritional status and life expectancy in both East and West Germany started, the former performing weaker especially after the 1970s.

Considering the two Germanies after WWII - in spite of some controversial figures - it can be concluded that not only the material well-being, but also the biological standard of living was lower in the Eastern part. Life spans were significantly shorter in the last two decades of the GDR, and human stature was probably somewhat lower. However, in terms of the mortality development, a catch-up of the East only began very recently, while net nutritional status might have improved for male adolescents somewhat earlier.

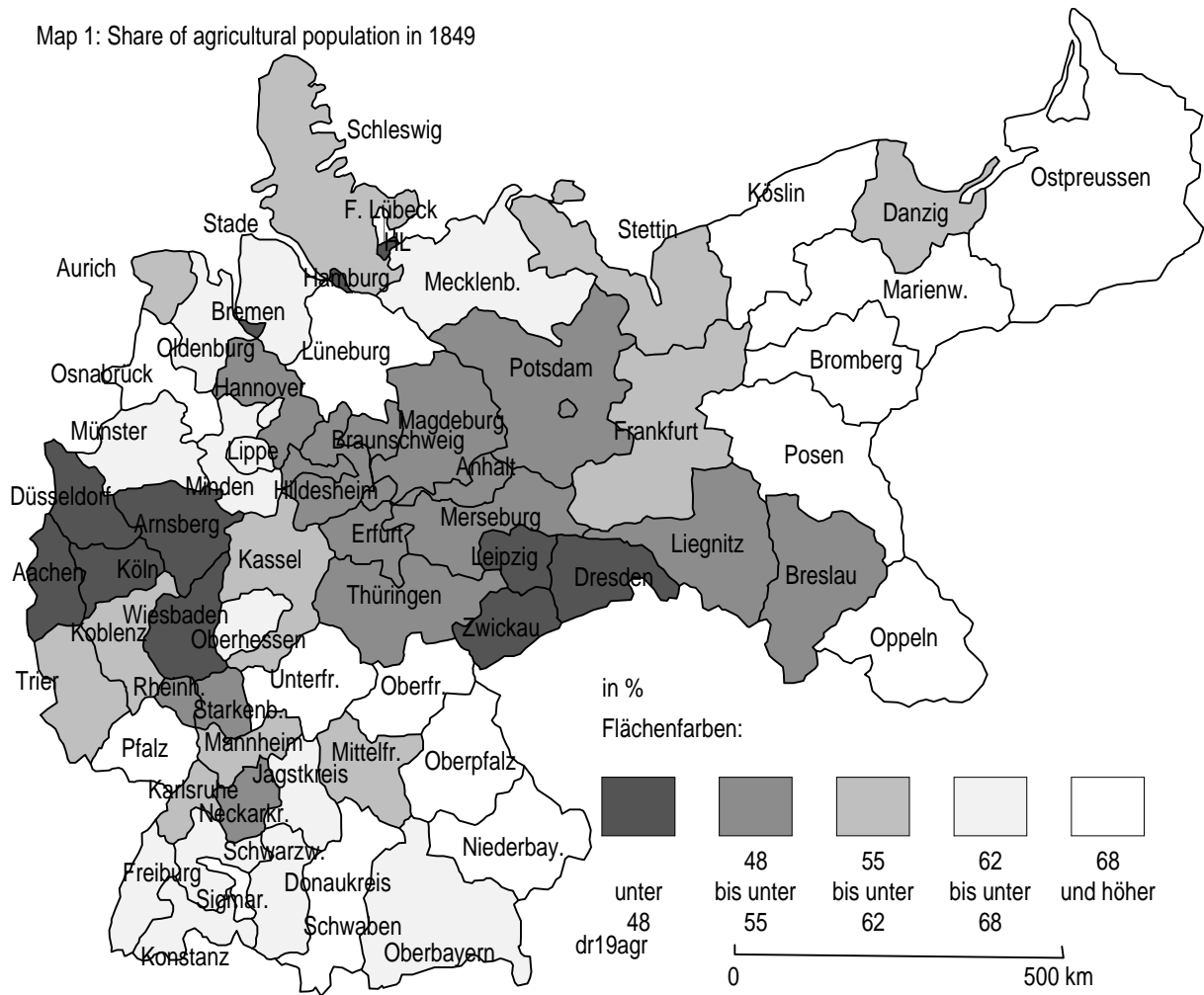
⁹⁹ Riphahn/Zimmermann, *Transition's Mortality*, p. 42. Another explanation that has not been satisfactorily examined is selective migration: If more healthy people left, mortality rates among the remaining might have

The first part of this chapter considered the impact of the agricultural reforms and of the rapid industrial development on 19th century regional living standards. With regard to the agrarian reforms, Knapp's famous argument that the productivity of agriculture was increased at the expense of widespread rural impoverishment was confronted with a variety of empirical evidence. If the different initial stages of welfare - and the timing of the reforms - are taken into consideration, the detrimental welfare effects of the reforms had to be rejected. Regions in which the reforms were judged as particularly harsh did not develop much better or worse than regions of milder agrarian policies. The crisis of living standards around mid-century and the increasing inequality during this period was feasible also in states such as Bavaria where the reforms effectively started later.

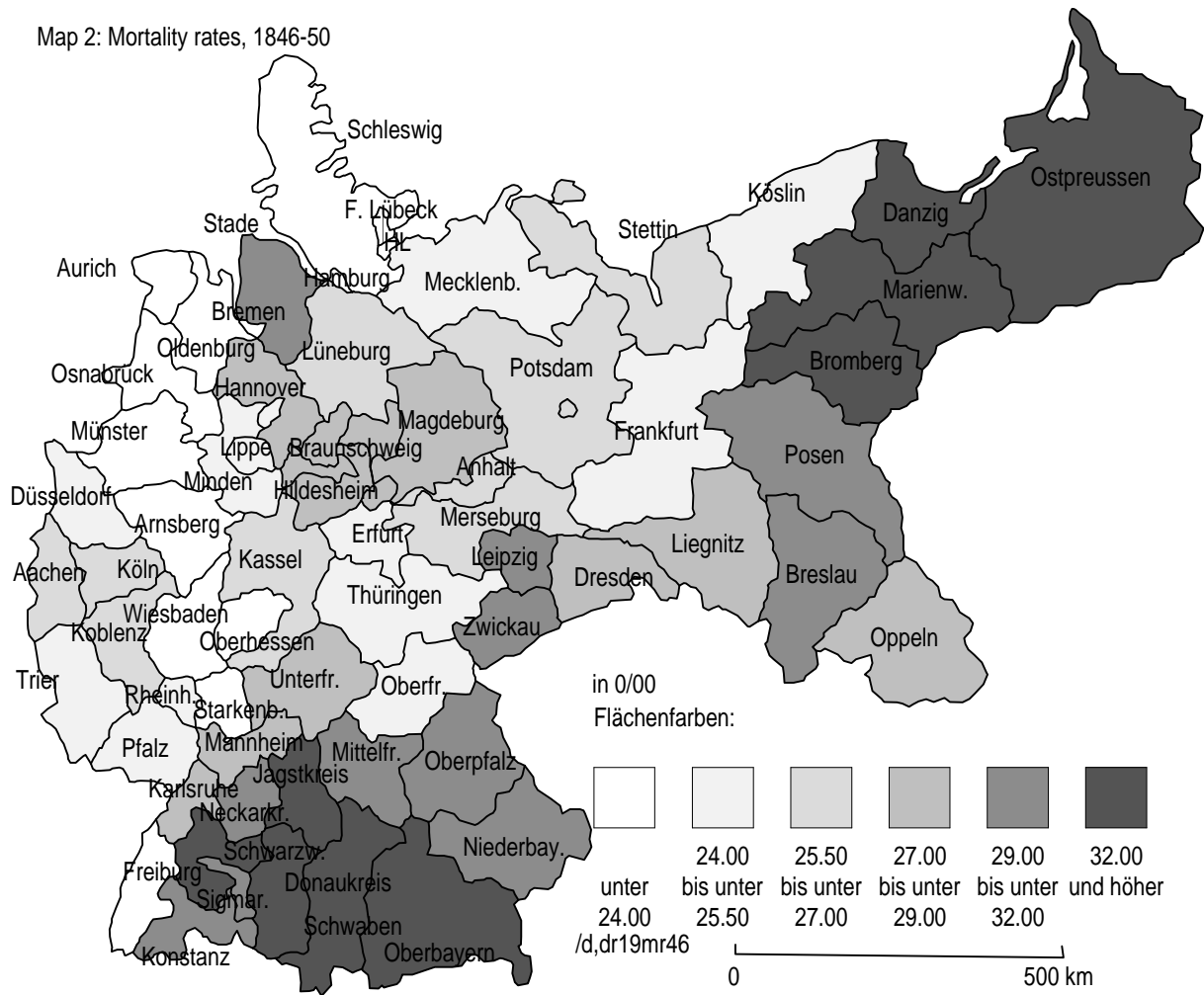
The German industrialisation that greatly accelerated during the 1860s had some harsh, but transitory effects on mortality rates during the 1860s and 1870s. Parts of the population (in particular children and inhabitants of limited regions such as Saxony and Silesia) certainly experienced the worst aspects of industrial development. But compared with the Biological Living Standard record of agricultural regions, the average industrial region did better in most respects: Mortality rates tended to be lower, nutritional status and income were higher than in agricultural regions. In addition, German industrialisation achieved the ability to provide a decent welfare more rapidly, compared with Britain and Belgium, for example. The milder German way of industrialisation was partly caused by its later appearance. The adverse development of the late 18th century and the mid-19th century in Britain and Belgium was not attributed to industrial development. In addition, German politicians had the possibility of learning from the British case, with regard to urban Public Health and Social Insurance policies, to name just two examples.

In sum, this chapter has presented quantitative material to evaluate the effects of some of the most important changes in German social and economic history of the last two centuries. While many of the indicators available are still disputable and have to be improved in future research, the possibilities to assess the living standard impact of policies and structural changes in a quantitative way are important supplements to the contemporaries' - necessarily subjective - judgements.

Map 1: Share of agricultural population in 1849



Map 2: Mortality rates, 1846-50



Map 3: Male height in German provinces (1906)

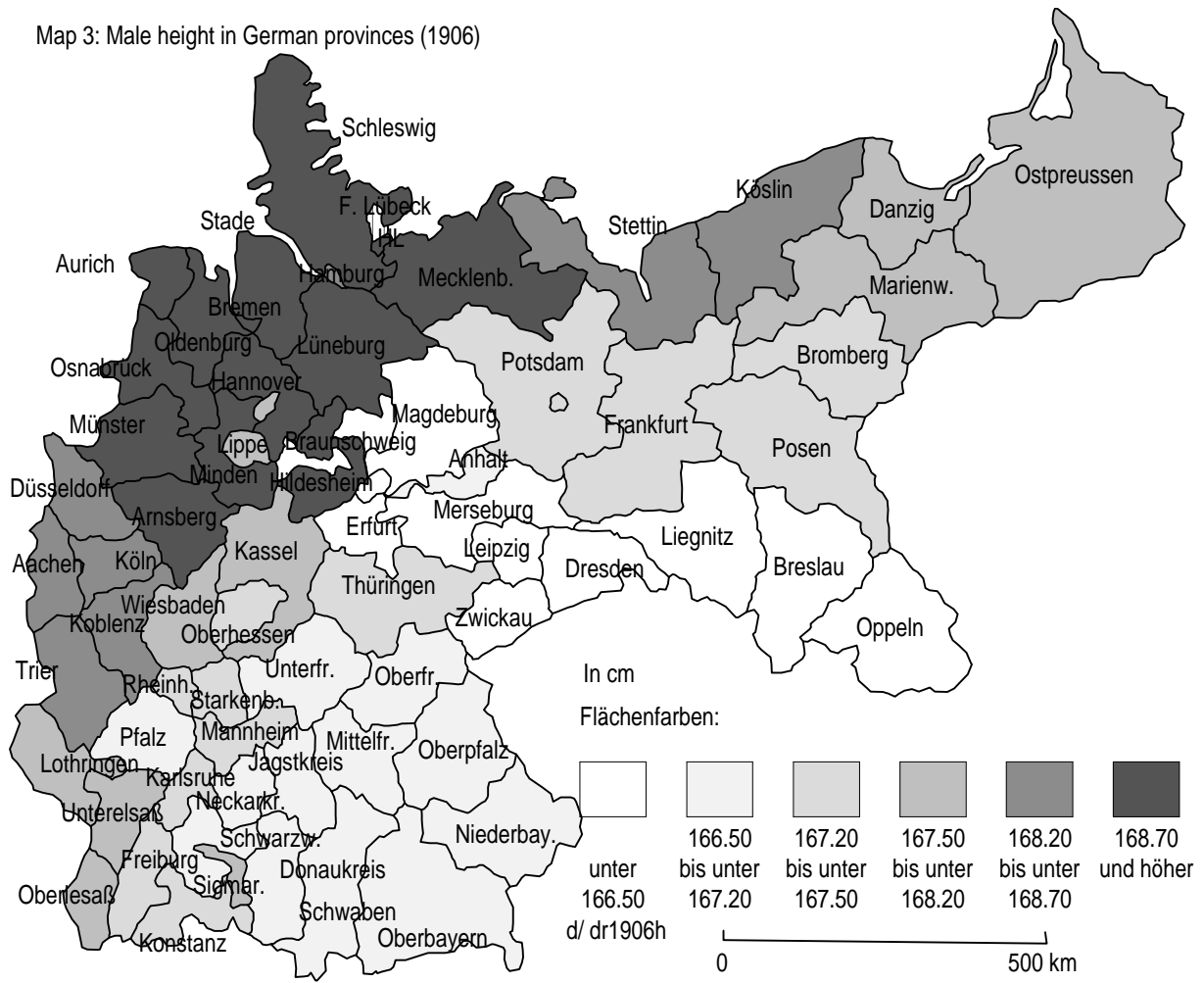


Table 1: Welfare indicators for Prussian provinces

Region	Reform type	"Uncorrected" income		Physicians per capita		Malr Le
		Level, 1831	Growth, 1831-58	Rank, 1825	Rank, 1861	
Eastern rural districts						
Prussia	mild	88.1	1.9	<u>9</u>	<u>8-9</u>	
Posen	harsh	98.9	-3.2	8	9	
Pomerania	harsh	87.1	3.9	<u>7</u>	<u>7</u>	
Brandenburg	mild	99.7	5.1	<u>5</u>	<u>5</u>	
Eastern urban districts						
Prussia (Danzig)	mild			<u>9</u>	<u>8-9</u>	
Pomerania (Stettin/Strals.)	harsh			<u>7</u>	<u>7</u>	
Brandenburg (Berlin)	harsh			1	1	
Industrial and Western						
Silesia	harsh	107.1	-0.9	4	6	
Saxony	mild	105.2	2.1	2	2	
Westfalia	mild	105.9	1.1	3	4	
Rhineland	mild	107.9	21.3	6	3	

Notes on column

(3) "Uncorrected" income estimated by Hohorst, *Wirtschaftswachstum*, p. 45, based on industrial share and cattle per capita (Prussian average=100), see text. Urban districts are not separated.

(4) Percentage growth form 1831 to 1858 (related to income in prices of 1913)

(5) Physicians per capita, the welfare indicator of Borchartt, *Regionale*, rank in 1825: 1=best, 9=worst.

Underlined numbers signify that regional aggregation is not fully congruent.

(7) Rejection rate for height reasons in the Prussian military (an indicator for nutrition), level in 1831

(8) Change of rejection rate between 1831 and 1854 (Source: Baten, *Einfluß*)

(9) Number of population crisis (for definition see text) years per district (Regierungsbezirk), as estimated by Bass, *Hungerkrisen*.

Table 2: Weekly working hours in German industry, different estimates

Period	Gömmel	Meinert*
1811	61.1	
1821	61.1	
1835	62.1	
1845	61.9	
1850	63.5	
1860	64.8	80-85 (1830/60)
1870	66.5	78 (1860/1870)
1880	64.3	72 (1875/1880)
1890	62.5	66 (1885/1890)
1900	58.4	62 (1895/1900)
1913	55.0	57 (1910/14)
1919/23		48
1925		50.5
1929		46
1932		41.5
1935		44.5
1939		48.5
1944		48.5
1950		48
1959		45.5
1970		40
1989		38.6

* 1970 and 1989 from Pohl, *Lebensarbeitszeit*, pp. 21/22. Sources: Gömmel, *Wachstum* (refers to Nuremberg); Meinert, *Entwicklung* (cited in Hoffmann, *Wachstum*, p. 213/4)

Table 3: Protein consumption from milk, meat and eggs (per capita and day)

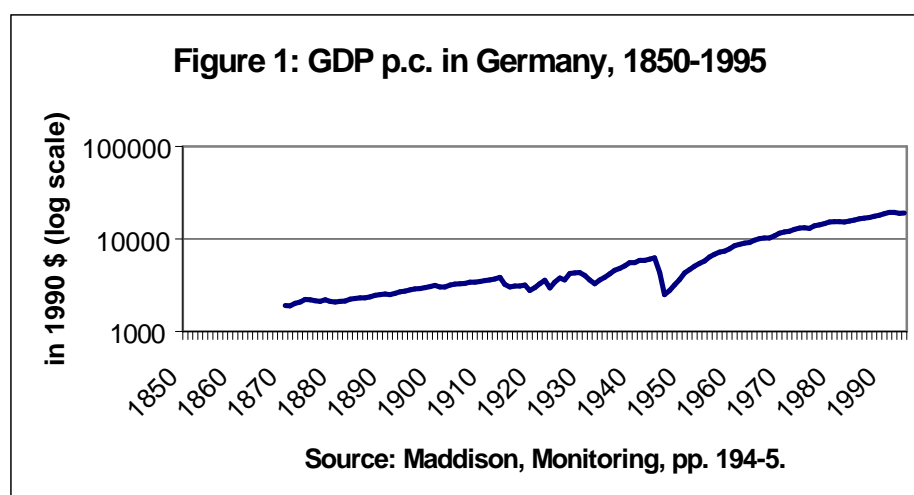
	Protein in g	% of proteins from meat
1890	47.1	37.2
1913	58.8	35.6
1928	60.6	39.5
1929	60.7	38.5
1930	60.3	37.8
1931	60.4	38.2
1932	59.9	37.0
1933	59.5	37.0
1934	61.2	39.8
1935	59.9	39.2
1936	61.1	37.8

Source: Teuteberg, *Verzehr*.

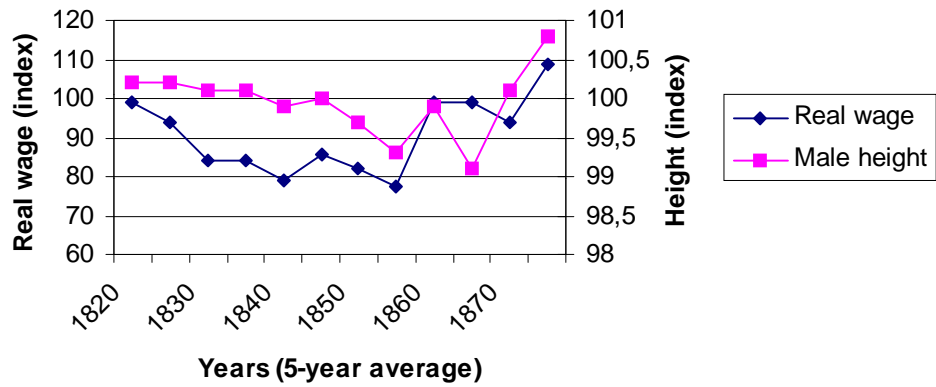
Table 4: Life expectancy in East and West Germany

Base years	West		Base years	East		Difference	
	Men	Women		Men	Women	Men	Women
1969-71	67.3	73.6	1970	68.1	73.3	-0.8	0.3
1975-77	68.6	75.2	1976	68.8	74.4	-0.2	0.8
1980-82	70.2	76.9	1981	69.0	74.8	1.2	2.1
1985-87	71.8	78.4	1986-87	69.8	75.8	2.0	2.6
1988-90	72.6	79.0	1988-89	70.0	76.2	2.6	2.8
1991-93	73.1	79.5	1991-93	69.9	77.2	3.2	2.3
1993-95	73.5	79.8	1993-95	70.7	78.2	2.8	1.6

Sources: Riphahn/ Zimmermann, *Transition's Mortality*, p. 4, who report the values from various issues of the German Statistical Yearbook and, prior to 1991, the Statistical Yearbook of the GDR.



**Figure 2a: Male heights and real wages in Bavaria
(19th century)**



**Figure 2b: Female heights and real wages in
Bavaria (19th century)**

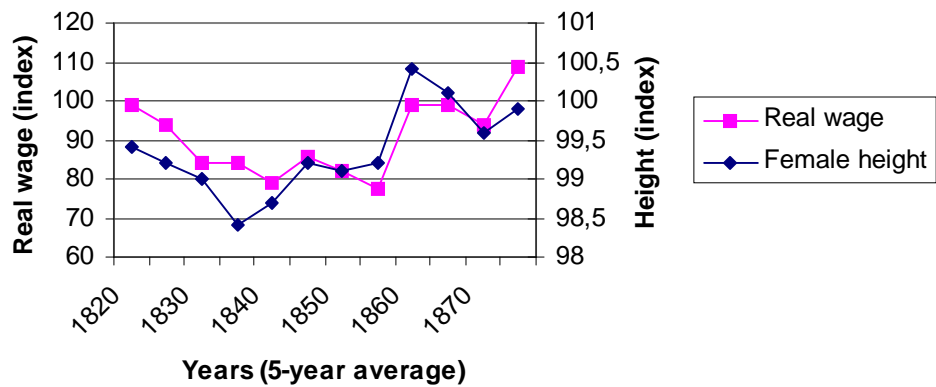


Figure 3: Height inequality in Bavaria

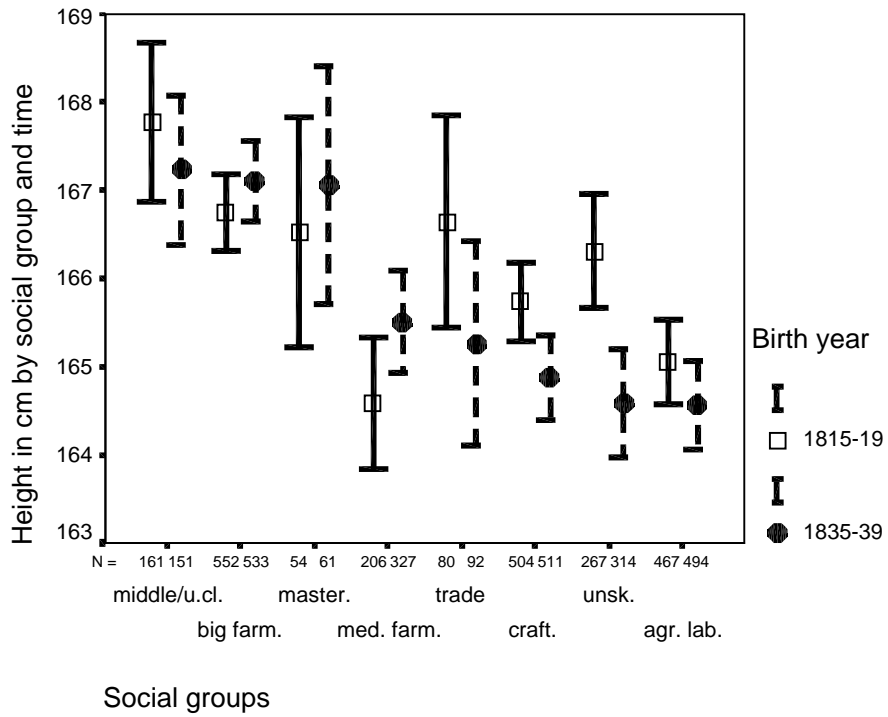


Figure 4: Mortality rates in German districts 1846-1913 by rate of industrialisation (1849-82)

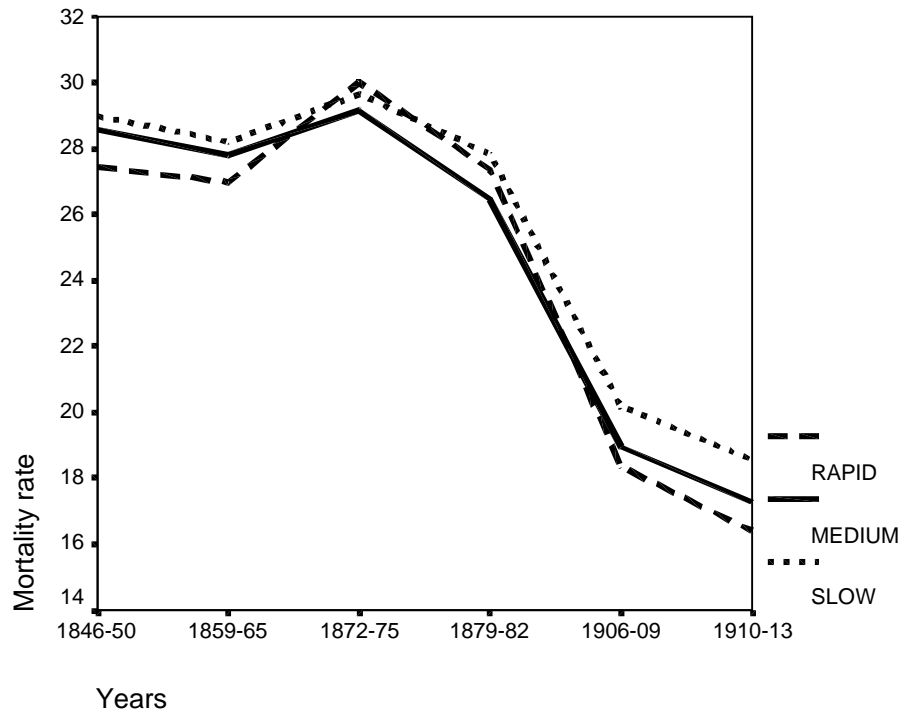
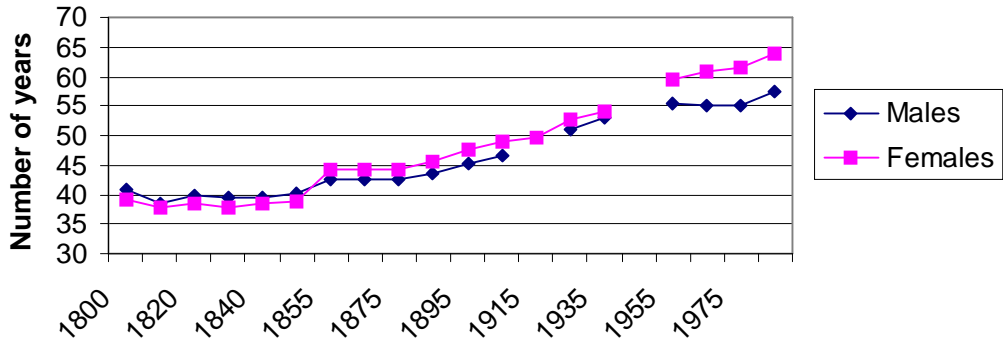


Figure 5: Remaining life expectancy at age 20 in Germany (Periods, after WWII: FRG)



Source: Imhof, *Lebenserwartungen*, pp. 409-410.

Figure 6a: Height of Stuttgart girls

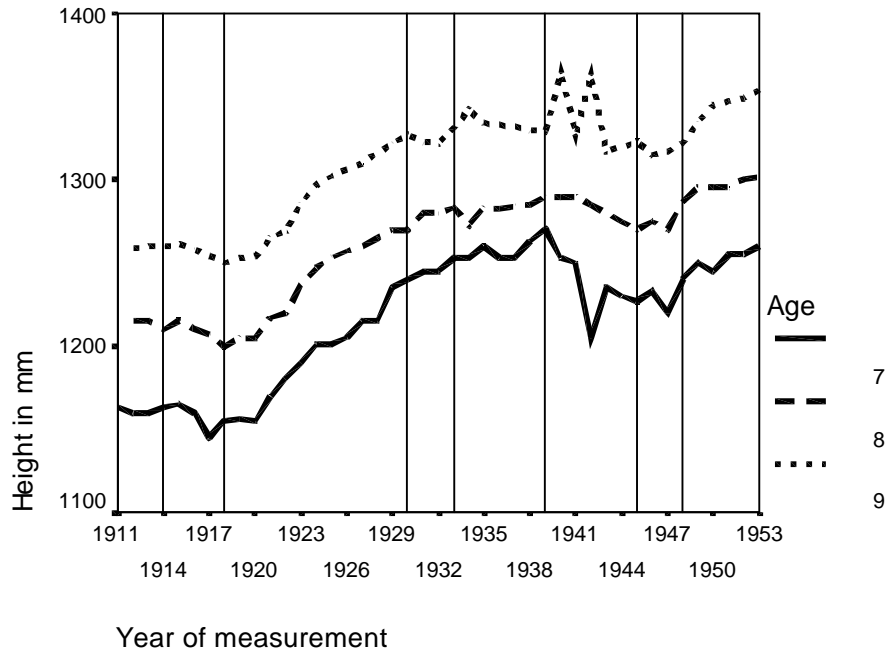


Figure 6b: Height of Stuttgart boys

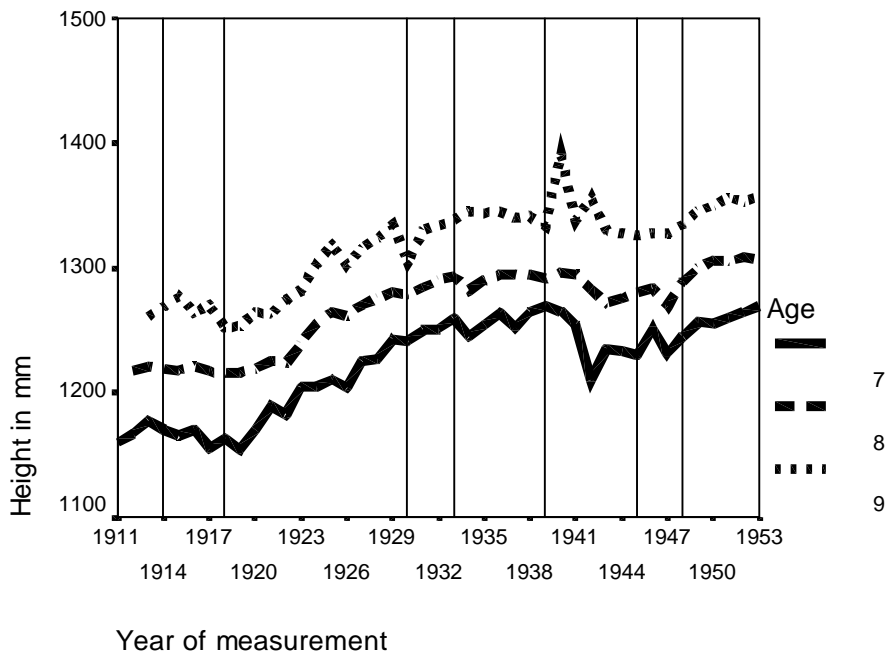
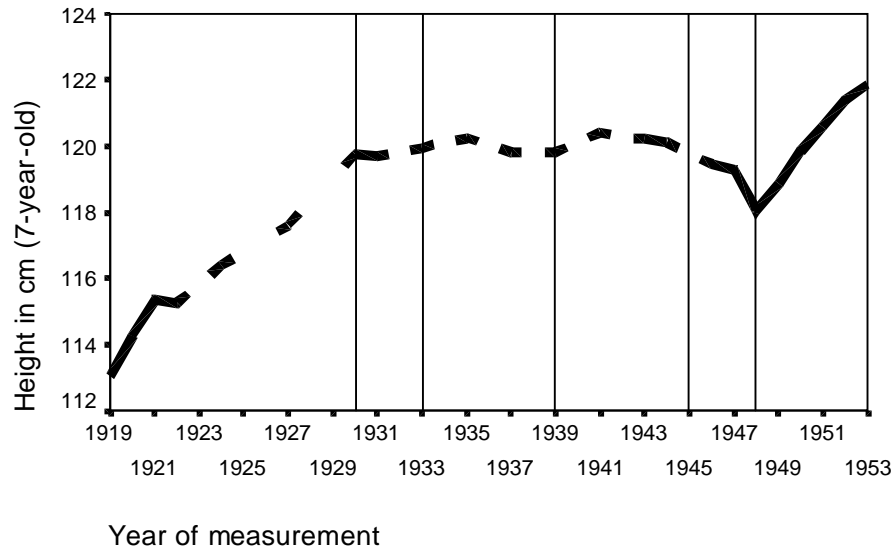


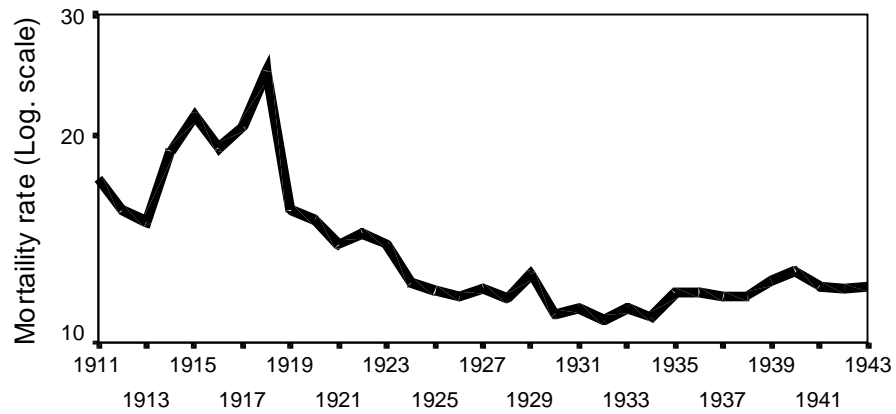
Figure 7: Heights of Leipzig Schoolchildren



Source: Marcusson (1961), p. 13, based on Koch (1953). a:\leipz2.cht

Figure 8: Death rates in Germany

(military losses are excluded)



SJ

Source: Mitchell (1992), p. 102. From 1917, Alsace-Lorraine excluded, from 1919 ceded territories, from 1922 Eup/Upp.Sil