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Population and Economic Change in Nineteenth-Century Eastern Europe: Prussian Upper Silesia, 1840-1913

Author(s): Michael R. Haines

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*Population and Economic Change in  
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I

**A**LTHOUGH its precise course is not always predictable, the “demographic transition” from high levels of fertility and mortality to lower levels appears to be a necessary, though not sufficient, condition for modern economic growth.<sup>1</sup> Such a transition did indeed accompany and influence economic growth and development in nineteenth-century Germany. This paper focuses on an area of eastern Germany, Prussian Upper Silesia (*Regierungsbezirk Oppeln*), for the period 1840-1913, and seeks to describe the course and nature of population change as well as to explore possible interactions with the process of modernization and economic growth. In particular, it asks whether the course of population change itself was altered by the rate, composition, and timing of economic growth.

Upper Silesia is an area of east-central Europe now completely within Poland but most of which, in the nineteenth century, belonged to Prussia. Prussian Upper Silesia (henceforth called Oppeln) was located at Prussia’s south-eastern extremity, west of the Oder River just southwest of Russian Poland and north of Austrian Moravia and Galicia. This area is of particular interest for several reasons. It is essentially part of eastern Europe, where the demographic transition came at a later date than in most of western or central Europe.<sup>2</sup> The portion belonging to Prussia in the nineteenth century contained

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<sup>1</sup> For a concise summary of the demographic transition, see Ansley J. Coale, “The Demographic Transition Reconsidered,” International Union for the Scientific Study of Population, *General Conference: Liege, 1973* (Liege, 1974), Vol. I, pp. 53-72. On modernization, see Simon Kuznets, *Modern Economic Growth: Rate, Structure, and Spread* (New Haven, 1966), esp. pp. 34-63.

<sup>2</sup> D. V. Glass and E. Grebinik, “World Population, 1800-1950,” in H. J. Habakkuk and M. M. Postan, eds., *The Cambridge Economic History of Europe*, Vol. VI, Part I (Cambridge, England, 1965), pp. 60-138; Heinz Rogmann, *Die Bevölkerungsentwicklung im preussischen Osten in den letzten hundert Jahren* (Breslau, 1936), pp. 51-72.

both a large agricultural region and a district of heavy industry, based on coal mining and ferrous metallurgy which developed rapidly after 1850.<sup>3</sup> It thus provides a regional development case study with both important agricultural and industrial sectors. Moreover, Oppeln contained a mixture of Germans and Poles, which provides contrasts of ethnic differences in demographic behavior. The statistics for the area were quite good and improved over the nineteenth century, particularly at the *Kreis* level. The Prussian Statistical Office provided ample reliable material in sufficient geographic detail to allow a study of economic regions within Oppeln.

This article will concentrate on the predominantly agricultural areas, which had over 94 percent of the population in 1840 and still over 60 percent in 1910.<sup>4</sup> Section II deals with demographic change over the period 1830-1914. Section III discusses how the natural increase in population was "absorbed" over time and gives a possible explanation of the delay in fertility response during Oppeln's demographic transition. Section IV makes some concluding observations and also discusses some findings from a series of cross-sectional analyses of fertility and nuptiality for Oppeln's *Kreise* for the periods 1873-1882, 1893-1897, and 1907-1912.

## II

A picture of demographic change for Oppeln's agricultural *Kreise* is given in Figure 1 and Table 1. A notable feature is the extreme variability in the rate of natural increase (RNI) during the three decades prior to 1860, especially in the 1840's and 1850's, and the smaller fluctuation and sustained higher level after about 1860. A similar picture appears for the industrial region, but with more extreme fluctuations.

For the agricultural region, the pre-1860 demographic situation

<sup>3</sup> For a description see Norman J. G. Pounds, *The Upper Silesian Industrial Region* (Bloomington, Indiana, 1958).

<sup>4</sup> The agricultural areas are based on an ethnic and economic division of the 15 original largely agricultural *Kreise*. Sub-Region I (5 *Kreise*) was German and agricultural. Sub-Region II (6 *Kreise*) was Polish and agricultural. Sub-Region IV (4 *Kreise*) was Polish and agricultural, but became more industrial late in the century. The industrial area (Sub-Region III) consisted of the original *Kreis* Beuthen (Bytom) which was subdivided into 3 *Stadtkreise* and 4 *Landkreise* after 1873. Some of the agrarian counties were also subdivided, so that Oppeln had 26 *Kreise* by 1926. The whole agricultural area consisted of Sub-Regions I, II, and IV. See Michael R. Haines, "Economic-Demographic Interrelations in Developing Agricultural Regions: A Case Study of Prussian Upper Silesia, 1840-1914" (Ph.D. Dissertation, University of Pennsylvania, 1971), ch. 1 and pp. 70-71.

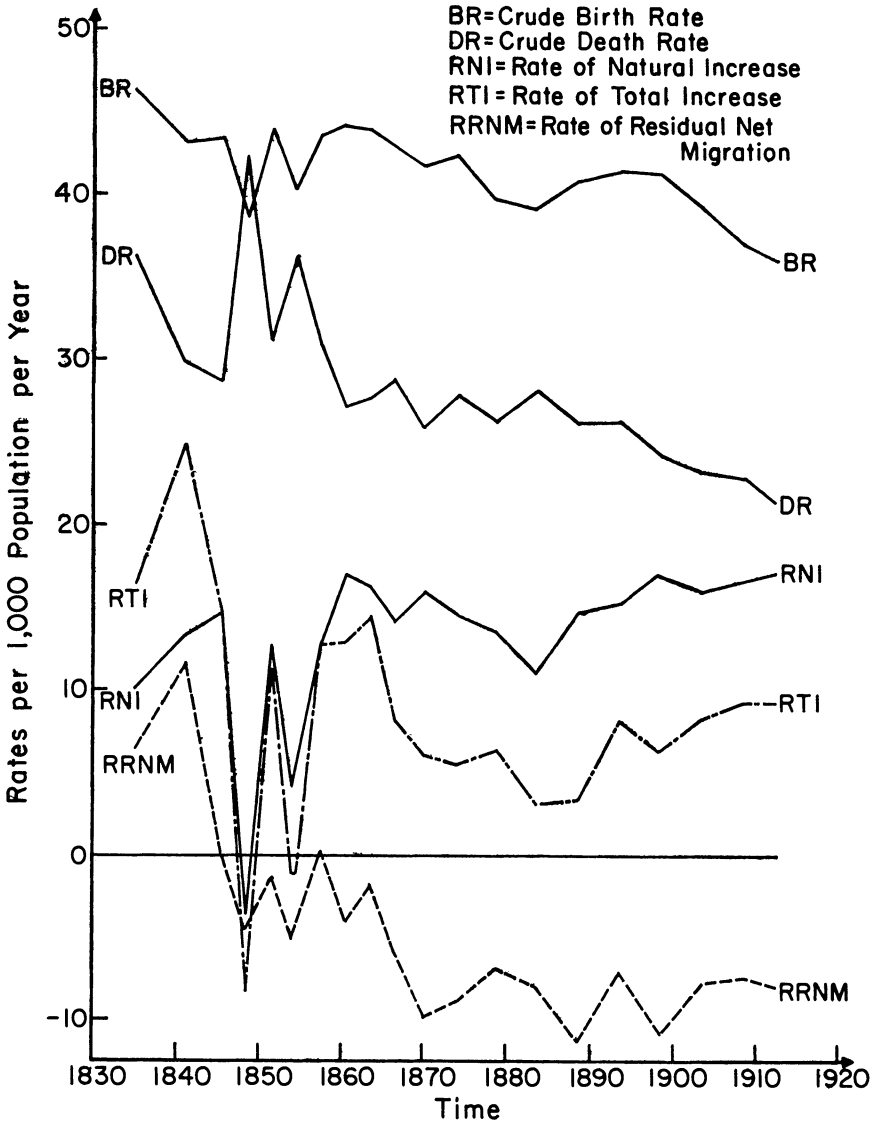


FIGURE 1  
COMPONENTS OF POPULATION CHANGE IN THE  
AGRARIAN REGIONS OF OPPEHN, 1831-1913

TABLE I  
CRUDE DEMOGRAPHIC RATES: INTERCENSAL PERIODS

| I. Agrarian Region of Oppeln |                                     |                                 |                  |       |       |        |
|------------------------------|-------------------------------------|---------------------------------|------------------|-------|-------|--------|
| Period                       | Average<br>Mid-Period<br>Population | (Per 1000 population per annum) |                  |       |       |        |
|                              |                                     | CBR                             | CDR <sup>a</sup> | RNI   | RTI   | RRNM   |
| 1831/37                      | 708,821                             | 46.26                           | 36.27            | 9.99  | 16.38 | +6.39  |
| 1837/43                      | 841,732                             | 43.19                           | 29.90            | 13.29 | 24.88 | +11.59 |
| 1843/46                      | 883,872                             | 43.42                           | 28.78            | 14.64 | 14.57 | -0.07  |
| 1846/49                      | 891,856                             | 38.50                           | 42.21            | -3.71 | -8.30 | -4.59  |
| 1849/52                      | 859,912                             | 43.85                           | 31.14            | 12.71 | 11.28 | -1.43  |
| 1852/55                      | 909,527                             | 40.29                           | 36.25            | 4.04  | -1.13 | -5.17  |
| 1855/58                      | 925,668                             | 43.51                           | 30.92            | 12.59 | 12.73 | +0.14  |
| 1858/61                      | 961,986                             | 44.18                           | 27.13            | 17.03 | 12.92 | -4.11  |
| 1861/64                      | 1,002,261                           | 43.94                           | 27.67            | 16.27 | 14.39 | -1.88  |
| 1864/67                      | 1,036,414                           | 42.82                           | 28.80            | 14.02 | 8.05  | -5.97  |
| 1867/71                      | 1,061,799                           | 41.64                           | 25.82            | 15.82 | 6.06  | -9.76  |
| 1871/75                      | 1,086,660                           | 42.30                           | 27.90            | 14.40 | 5.52  | -8.88  |
| 1875/80                      | 1,117,686                           | 39.77                           | 26.27            | 13.50 | 6.67  | -6.83  |
| 1880/85                      | 1,143,522                           | 39.11                           | 28.12            | 10.99 | 3.02  | -7.97  |
| 1885/90                      | 1,161,135                           | 40.83                           | 26.23            | 14.60 | 3.33  | -11.27 |
| 1890/95                      | 1,194,460                           | 41.45                           | 26.29            | 15.16 | 8.05  | -7.11  |
| 1895/1900                    | 1,237,078                           | 41.27                           | 24.27            | 17.00 | 6.28  | -10.72 |
| 1900/05                      | 1,284,427                           | 39.22                           | 23.20            | 16.02 | 8.24  | -7.78  |
| 1905/10                      | 1,341,821                           | 37.00                           | 20.38            | 16.62 | 9.19  | -7.43  |
| 1910/13                      | 1,367,969                           | 35.96                           | 18.89            | 17.07 | 9.19  | -7.78  |

| II. Industrial Region of Oppeln |         |       |       |       |       |        |
|---------------------------------|---------|-------|-------|-------|-------|--------|
| 1831/37                         | 49,165  | 61.61 | 44.73 | 16.88 | 30.97 | +14.09 |
| 1837/43                         | 64,278  | 53.30 | 36.34 | 16.96 | 55.25 | +38.29 |
| 1843/46                         | 79,599  | 49.64 | 34.07 | 15.57 | 39.94 | +24.37 |
| 1846/49                         | 84,758  | 46.80 | 49.58 | -2.78 | 3.10  | +5.88  |
| 1849/52                         | 89,848  | 57.94 | 36.34 | 21.60 | 34.88 | +13.28 |
| 1852/55                         | 100,468 | 51.08 | 41.76 | 9.32  | 39.36 | +30.04 |
| 1855/58                         | 120,354 | 57.53 | 35.02 | 22.51 | 77.68 | +55.17 |
| 1858/61                         | 139,980 | 57.55 | 30.35 | 27.20 | 26.99 | -0.21  |
| 1861/64                         | 157,066 | 55.52 | 34.99 | 20.53 | 48.57 | +28.04 |
| 1864/67                         | 180,438 | 55.40 | 39.68 | 15.72 | 44.22 | +28.50 |
| 1867/71                         | 213,642 | 52.74 | 34.35 | 18.39 | 49.90 | +31.51 |
| 1871/75                         | 256,302 | 54.33 | 36.02 | 18.31 | 41.86 | +23.55 |
| 1875/80                         | 294,543 | 50.79 | 31.60 | 19.19 | 33.49 | +14.30 |
| 1880/85                         | 324,894 | 49.54 | 32.28 | 17.26 | 24.06 | +6.80  |
| 1885/90                         | 374,741 | 51.56 | 28.33 | 23.23 | 32.49 | +9.26  |
| 1890/95                         | 447,306 | 55.62 | 27.96 | 27.66 | 37.79 | +10.13 |
| 1895/1900                       | 548,944 | 54.88 | 26.01 | 28.87 | 43.53 | +14.66 |
| 1900/05                         | 665,688 | 51.30 | 24.20 | 27.10 | 34.48 | +7.38  |
| 1905/10                         | 778,254 | 46.82 | 23.33 | 23.49 | 28.48 | +4.99  |
| 1910/13                         | 866,770 | 41.48 | 21.16 | 20.32 | 28.48 | +8.16  |

<sup>a</sup> For 1831-1837 to 1858-1861, CDR for Oppeln less Region III was assumed to be .985 of the CDR for Oppeln as a whole, based on the relationship for the period 1862-1874.

Notes: CBR = Crude Birth Rate; CDR = Crude Death Rate; RNI = Rate of National Increase = CBR-CDR; RTI = Rate of Total Increase =  $\ln(P_1/P_0)/t$ , where  $P_0$  is the initial population of the period,  $P_1$  is the final population,  $t$  is the number of years in the period and  $\ln$  is the natural logarithm; RRNM = Residual Rate of Net Migration = RTI-RRNM (- = net out-migration; + = net in-migration).

was similar to many pre-industrial populations.<sup>5</sup> Vital rates, especially death rates, fluctuated considerably, with death rates occasionally exceeding birth rates, as in the late 1840's. The coefficient of variability<sup>6</sup> of the annual CDR was 0.1721 for 1831/60, as opposed to only 0.1080 between 1861 and 1910. The mortality peak in the late 1840's (the "Hungry Forties")<sup>7</sup> was accompanied by a slump in the birth rate (in both the industrial and agricultural regions) and was followed by a sudden slump in death rates and a sharp rise in birth rates in the early 1850's. This was succeeded in turn by another less

<sup>5</sup> Excellent discussions of the demography of pre-industrial populations may be found in E. A. Wrigley, *Population and History* (New York, 1969), chs. 3 and 4; and H. J. Habakkuk, *Population Growth and Economic Development Since 1750* (Leicester, England, 1971), pp. 7-24. See also Dorothy S. Thomas, *Social and Economic Aspects of Swedish Population Movements, 1750-1933* (New York, 1941).

<sup>6</sup> The standard deviation divided by the mean.

<sup>7</sup> This was a period of extreme economic and social dislocation caused by crop failures and depression in the textile industries, especially linen. See Helmut Bleiber, *Zwischen Reform und Revolution: Lage und Kämpfe der schlesischen Bauern und Landarbeiter in Vormärz 1840-1847* (Berlin, 1966).

TABLE 1 (Continued)

- Sources: 1861-1913: Vital statistics and populations: Prussia, Statistisches Landesamt, *Preussische Statistik*, passim.
- 1831-1861: Populations: 1831: J. G. Hoffmann, *Neueste Übersicht der Bodenfläche, der Bevölkerung und des Viehstandes der einzelnen Kreise des preussischen Staates* (Berlin, 1833), pp. 53-55.
- 1837: J. G. Hoffmann, *Die Bevölkerung des preussischen Staates nach dem Ergebnisse der zu Ende des Jahres 1837 amtlichen aufgenommen Nachrichten* (Berlin, 1839), pp. 257-258.
- 1843: C. F. W. Dieterici, *Statistische Tabellen des preussischen Staates nach der amtlichen Aufnahme des Jahres 1843* (Berlin, 1845), pp. 211-213.
- 1846: C. F. W. Dieterici, *Die Bevölkerung des preussischen Staates nach der amtlichen Aufnahme des Jahres 1846* (Berlin, 1848), p. 12.
- 1849-1858: Prussia, Statistisches Landesamt, *Tabellen und amtliche Nachrichten über den preussischen Staat für das Jahr 1849* (Berlin, 1851), pp. 128-145; *für das Jahr 1852* (Berlin, 1855), pp. 27-28; *für das Jahr 1855* (Berlin, 1856), pp. 22-23; *für das Jahr 1858* (Berlin, 1860), pp. 38-39.
- Vital Statistics: Oppeln, 1831-1848: Prussia, Statistisches Landesamt, "Über die Anzahl der Geburten, neu-geschlossenen Ehen und Todesfälle im preussischen Staate, 1816-1854," *Mittheilungen des Statistischen Bureau in Berlin*, 9. Jahrgang (1856), pp. 131-154.
- 1849-61: *Tabellen und amtliche Nachrichten . . .*, passim. *Preussische Statistik*, Bd. 5.
- For Region III, for 1831-1861 total births were available in *Preussische Statistik*, Bd. 48A (1879), p. 24. Births were obtained for the remaining *Kreise* by subtraction. When data on stillbirths were unavailable, they were estimated at 3 percent of total births and subtracted to give livebirths. Deaths were estimated for the regions by assuming that the crude death rate of the agricultural regions was .985 of that for Oppeln for the period 1831-1861.

severe mortality peak and a decline in the late 1850's when another brief economic depression occurred. Such short periods when relatively more births and fewer deaths "made up for" previous periods of low or negative natural increase can be observed for other pre-industrial populations. Their essential disappearance after about 1860, combined with a drop in the average level of mortality, led to a widening gap between fertility and mortality. As mortality declined, fertility eventually also declined (as indicated by the crude birth rate), but less rapidly. There was even an upward swing in fertility from the early 1880's to the late 1890's. These events combined to keep natural increase (RNI) at a high level with no upward or downward trend. This phenomenon seems to have been characteristic of much of eastern Germany in this period,<sup>8</sup> and was true for both the industrial and agrarian regions of Oppeln.

The question naturally arises as to whether age structure was interacting with vital rates so that crude rates give a misleading picture of the age specific rates. It is difficult for two reasons to separate changes in crude fertility rates into changes in age structure and changes in age-specific rates. First, no age data are available for the 1850's to confirm whether these swings were age induced. Common sense suggests some role for age structure. Second, no age-specific fertility data were collected in Prussia until the twentieth century. Such data as are available allow calculation of a General Fertility Ratio (live-births per 1000 women aged 14-49) which is partly standardized for differences in the age structure of the female population. Table 2 shows that it rose between 1849 and 1867 and again between 1875 and 1900 before falling distinctly between 1900 and 1910. Thus appears a period of *rising* fertility (that is, 1875-1900) following the mortality decline during the demographic transition. This is not a wholly unusual phenomenon and has been observed recently for a number of less developed societies as well as for western European industrial areas in the late nineteenth century.<sup>9</sup>

Another notable aspect of Table 2 is the contrast between the extremely high fertility of the Polish-speaking industrial region (III) and the more moderate levels of the total agricultural region and

<sup>8</sup> Prussia, Statistisches Landesamt, *Preussische Statistik*, Vols. 48A and 188; Rogmann, *Bevölkerungsentwicklung*, pp. 51-72.

<sup>9</sup> Riad Tabarrak, "Toward a Theory of Demographic Development," *Economic Development and Cultural Change*, 19 (Jan. 1971), 257-276; E. A. Wrigley, *Industrial Growth and Population Change: A Regional Study of the Coal Field Areas of Northwest Europe in the Later Nineteenth Century* (Cambridge, England, 1961), ch. 7.

TABLE 2  
GENERAL FERTILITY RATIOS,<sup>a</sup> OPPELN AND ITS REGIONS: 1849-1910

| Year                | Regions <sup>d</sup> |       |       |       |                   |             |
|---------------------|----------------------|-------|-------|-------|-------------------|-------------|
|                     | Agricultural Regions |       |       |       | Industrial Region | All Regions |
|                     | I                    | II    | IV    | Total | III               |             |
| 1849 <sup>b,c</sup> | 148.7                | 154.4 | 160.1 | 154.2 | 192.0             | 157.5       |
| 1867 <sup>c</sup>   | 141.8                | 162.5 | 165.4 | 156.7 | 202.8             | 163.7       |
| 1871 <sup>c</sup>   | 142.7                | 164.1 | 164.2 | 157.2 | 198.6             | 164.6       |
| 1875 <sup>c</sup>   | 144.4                | 161.7 | 162.9 | 156.6 | 198.5             | 165.0       |
| 1890                | 135.2                | 159.6 | 160.3 | 152.3 | 199.0             | 164.2       |
| 1895                | 136.0                | 168.3 | 172.2 | 160.0 | 219.0             | 176.5       |
| 1900                | 130.5                | 167.9 | 173.8 | 159.2 | 219.2             | 178.0       |
| 1905                | 120.6                | 158.0 | 164.6 | 149.9 | 202.1             | 167.8       |
| 1910                | 113.2                | 148.0 | 156.9 | 142.2 | 181.3             | 156.6       |

<sup>a</sup> Livebirths per 1000 women aged 14-49.

Average livebirths 1847-1851 estimated from births in 1849 for each region and the ratio of births in 1847-1851 to births in 1849 for Oppeln. Births for each region in 1849 were multiple by the ratio

$$\left( \frac{B_{1847/1851}}{B_{1849}} \right) \text{Oppeln.}$$

<sup>c</sup> Some interpolation and adjustment of age structure necessary to arrive at females 14-49 at each census date.

<sup>d</sup> For a definition of regions see footnote 4.

Source: Prussia, Statistisches Landesamt, *Tabellen und amtliche Nachrichten für den preussischen Staat für das Jahr 1849* (Berlin, 1852); *Preussische Statistik*, passim.

also between the markedly lower fertility of the German-speaking agrarian sub-region I versus all the other Polish-speaking sub-regions (II, III and IV). The German sub-region also initiated its fertility decline much earlier (ca. 1875) than the adjacent Polish areas because it hardly participated in the increase in birth rates in the 1890's. This reflects, in miniature, the spread of declining fertility in general from west to east; that is, from the German-speaking population of central Europe to the Slavic populations of eastern Europe.<sup>10</sup> Oppeln's overall demographic picture was dominated, however, by the Poles who made up about two-thirds of its population.<sup>11</sup>

Changes in mortality were also a major factor in rising RNI after the 1860's. The CDR for the industrial area appears to have declined

<sup>10</sup> A comprehensive treatment of fertility in Germany in the late nineteenth and early twentieth centuries may be found in John Knodel, *The Fertility Decline in Germany, 1871-1939* (Princeton, 1974). Ethnic differentials are discussed on pp. 141-146.

<sup>11</sup> Haines, "Economic-Demographic Interrelations," pp. 21-22.



consistently after the 1860's, but the agrarian region seems to have experienced a relative plateau in CDR's between the 1860's and the 1890's (See Table 1 and Figure 1). In both areas, variability of mortality decreased markedly and periodic mortality peaks disappeared after the 1860's.

Here, too, there is a question of the relative roles of age structure and age-specific mortality in the decline of the crude death rate. If age-specific death rates are standardized to a single age-specific mortality structure, and a standardized crude death rate is computed (that is, direct standardization), then the effects of changes in age-specific mortality can be more easily seen. The male CDR for Oppeln declined from 36.13 in 1864/65 to 21.52 in 1910/11. When the 1910/11 age-specific death rates are applied to the 1864 age structure, the directly standardized CDR is 22.47. This indicates that 93.5 percent of the mortality decline from 1864/65 to 1910/11 may be accounted for by a decline in age-specific mortality.<sup>12</sup> For females, the decline in the actual CDR was from 30.91 in 1864/65 to 19.04 in 1910/11. The directly standardized CDR using the 1864 age structure and the 1910/11 age-specific death rates is 18.41. This implies that, for females in Oppeln, the 1864 age structure was *more* favorable to lower mortality than that in 1910, given the 1910/11 age-specific mortality pattern. It is clear that age structure changes played little role in the mortality decline and age-specific mortality declines were crucial.

As to differential mortality, the industrial region had higher CDR's (See Table 1) despite an age structure more favorable to lower mortality. There was a higher proportion of persons in the healthiest ages (15-49) in the industrial region than in the agrarian areas but counterbalancing this was also a higher proportion in the high mortality years, 0-4.<sup>13</sup> Since age specific mortality data were not published for *Kreise* in this period, only an indirect standardization of death rates is possible. Using the actual detailed age distributions

<sup>12</sup> That is,  $(36.13-22.47)/(36.13-21.52) = .935$ .

<sup>13</sup> Age distributions for 1849, 1875, and 1910:

|               | 1849 |       | 1875<br>(Percentage in age group) |       | 1910 |       |
|---------------|------|-------|-----------------------------------|-------|------|-------|
|               | 0-4  | 15-49 | 0-4                               | 15-49 | 0-5  | 15-49 |
| Indus. Region | 17.6 | 50.0  | 16.5                              | 51.4  | 19.1 | 48.3  |
| Ag. Region    | 15.9 | 47.0  | 14.1                              | 46.8  | 16.6 | 45.0  |

from the census of 1875<sup>14</sup> and the age specific death rates for Oppeln as a whole, an indirect standardization yields the following results:

ANNUAL RATES PER 1000 POPULATION

|         | Oppeln:<br>CDR | Industrial Region |                       | Agrarian Region |                       |
|---------|----------------|-------------------|-----------------------|-----------------|-----------------------|
|         |                | Actual<br>CDR     | Standard-<br>ized CDR | Actual<br>CDR   | Standard-<br>ized CDR |
| Males   | 29.81          | 35.42             | 30.02                 | 28.30           | 29.75                 |
| Females | 24.42          | 28.54             | 25.75                 | 23.40           | 24.05                 |

As may be seen, the differentials in death rates are reduced but not eliminated by standardization to the average age specific mortality of the entire *Regierungsbezirk*. The favorable effect of a higher proportion of persons 15-49 in the industrial region could not fully counterbalance the unfavorable effect of a higher proportion of infants and small children. An additional factor in maintaining a higher overall CDR in the industrial region was the higher proportion of males in this region, due to differential male net in-migration to the industrial region and differential male net out-migration from the agrarian region.<sup>15</sup> The larger weight attached to males, who had higher average mortality than females, would thus contribute to a higher CDR for the industrial region. The reverse held for the agrarian region.

The declines in age-specific mortality which took place after the 1860's were concentrated in the childhood and teenage years. Table 3 presents some measures based on life tables calculated for males and females for 1864/65 and 1910/11.<sup>16</sup> Expectation of life at various

<sup>14</sup> The census of 1875 provided the most detailed age data for *Kreise*.

<sup>15</sup> Sex ratios (males per 100 females) were generally higher in the industrial region than in the agrarian region, especially in the ages 15-59. For example, in 1871, the sex ratio for ages 20-29 was 102 for the industrial area, versus only 77 for the agrarian region (where there was differential net out-migration of males); *Preussische Statistik*, Bd. 30.

<sup>16</sup> The functions in Table 3 are defined as follows:

$$l_x = \text{population surviving to exact age } x \text{ (i.e., beginning of an age interval) of } 100,000 \text{ born to a "synthetic" cohort.}$$

$$e_x = \text{expectation of life at exact age } x.$$

$${}_nq_x = \text{probability of dying between exact age } x \text{ and age } x + n \text{ (i.e., during an age interval)} = 1 - (l_{x+n}/l_x).$$

The abridged life tables which produced these functions were computed by translating the actual central death rates ( ${}_nM_x$ ) for each quinquennial age group to  ${}_nq_x$  functions using the Reed-Merrell method, except for the first year of age. In this age interval, infant deaths were related to the births which were at risk. The other life table func-

ages ( $\hat{e}_x$ ) showed considerable improvement at all ages, but most for the youngest years. For children at birth, the average gain in  $\hat{e}_x$  between 1864/65 and 1910/11 was 9.5 years for males and 10.7 years for females. It is not surprising that infants and young children would show the greatest improvement in  $\hat{e}_x$ , since gains in expectation of life are cumulative toward younger ages. Columns (6) and (11) of Table 3 [which give  $({}_nq_{x1910/11}) \div ({}_nq_{x1864/65})$ ] provide a measure of reduction in the relative probability of dying for each age interval between 1864/65 and 1910/11 for males and females separately. A lower ratio shows a greater gain in chance of surviving. The greatest gains were for the age groups 1-4 and 5-9, for both males and females, with considerably smaller gains being made in the groups 20-29 and 30-39, and still smaller gains in the first year of life. In addition, such gains as were made in infant mortality did not occur much before 1900. Infant mortality rates (infant deaths per 1000 live births) did not decline for either the industrial or the agrarian regions until after the early 1890's (See Table 4).

The trend in infant mortality by regions reveals a considerable amount by itself. There existed in Oppeln, after 1876/80 (when infant mortality was first reported by *Kreis*), a rough equality in infant mortality between the industrial and agrarian regions. This held true until 1900, when infant mortality in the agrarian region began to fall more rapidly than in the industrial district. It leads to the suspicion that the factors causing the higher overall mortality in the industrial areas and those leading to a reduction in mortality peaks and declines in CDR's in both regions were different from those affecting infant mortality. The relatively high IMR in Oppeln was closer to levels in eastern than in western Europe at this time and was rather high by standards of developing areas today.<sup>17</sup> The concentration of mortality declines in the ages between one and twenty, with relatively slow and tardy decline of infant mortality,

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tions were computed using standard techniques except for  $L_0$  and  ${}_4L_1$ , which required the estimation of separation factors. See Henry S. Shryock *et al.*, *The Methods and Materials of Demography*, Vol. II (Wash., D.C., 1971), chs. 14 and 15 and Appendix B for the methodology.

<sup>17</sup> Infant mortality rates for Europe during the period 1906/08 were Oppeln: 201; Germany: 176; Austria: 202; European Russia: 272; England and Wales: 121; France: 143; Norway: 67. Current IMR's for developing nations range from about 30 to over 100, often lower than in Europe about 70 years before. See Germany, Statistisches Reichsamt, *Vierteljahresheft zur Statistik des deutschen Reichs*, 1910; United Nations, *Demographic Yearbook*, 1973.

TABLE 3  
SELECTED LIFE TABLE FUNCTIONS,<sup>a</sup> MALES AND FEMALES, OPPELN, 1864/65 AND 1910/11

| Age Group<br>(1) | Males        |              |              |              |                                     |         | Females      |              |               |       |                                      |  |
|------------------|--------------|--------------|--------------|--------------|-------------------------------------|---------|--------------|--------------|---------------|-------|--------------------------------------|--|
|                  | 1864/65      |              | 1910/11      |              | (6)<br>$(\frac{0}{n}q_x)_{1910/11}$ | (7)     | 1864/65      |              | 1910/11       |       | (11)<br>$(\frac{0}{n}q_x)_{1910/11}$ |  |
|                  | (2)<br>$l_x$ | (3)<br>$e_x$ | (4)<br>$l_x$ | (5)<br>$e_x$ |                                     |         | (8)<br>$l_x$ | (9)<br>$l_x$ | (10)<br>$e_x$ |       |                                      |  |
| (x)              |              |              |              |              | $(\frac{0}{n}q_x)_{1864/65}$        |         |              |              |               |       |                                      |  |
| 0                | 100,000      | 33.23        | 100,000      | 42.73        | .8301                               | 100,000 | 35.80        | 100,000      | 46.48         | .8608 |                                      |  |
| 1-4              | 75,275       | 43.02        | 79,560       | 52.63        | .4794                               | 79,236  | 44.12        | 82,125       | 55.53         | .4862 |                                      |  |
| 5-19             | 61,332       | 49.07        | 72,453       | 53.91        | .5150                               | 65,003  | 49.97        | 74,952       | 57.15         | .5039 |                                      |  |
| 20-29            | 55,019       | 35.27        | 68,612       | 41.51        | .7294                               | 58,421  | 39.93        | 71,128       | 44.84         | .8040 |                                      |  |
| 30-39            | 50,827       | 31.79        | 64,799       | 33.64        | .7671                               | 54,780  | 32.23        | 67,564       | 36.93         | .7346 |                                      |  |
| 40-59            | 45,829       | 21.35        | 59,911       | 25.97        | .9296                               | 49,821  | 24.93        | 63,071       | 29.19         | .6637 |                                      |  |
| 60 & Over        | 29,574       | 12.19        | 40,157       | 13.14        |                                     | 33,177  | 11.87        | 49,086       | 14.18         |       |                                      |  |

<sup>a</sup> For a definition of the functions used and the methods of life table construction, see footnote 16 in the text.

Source: Population Age Distributions and Deaths by Age: Prussia, Statistisches Landesamt, *Preussische Statistik*, Vols. 10, 17, 229, 233, 234.

TABLE 4  
 INFANT MORTALITY RATES:  
 OPPELN AND REGIONS OF OPPELN 1831/1913  
 (Five Year Averages)<sup>a</sup>

|           | <i>Oppeln</i> | <i>Industrial Region</i> | <i>Agricultural Region</i> |
|-----------|---------------|--------------------------|----------------------------|
| 1831/35   | 209           |                          |                            |
| 1836/40   | 195           |                          |                            |
| 1841/45   | 202           |                          |                            |
| 1846/50   | 218           |                          |                            |
| 1851/55   | 218.6         |                          |                            |
| 1856/60   | 204.8         |                          |                            |
| 1861/65   | 227           |                          |                            |
| 1866/70   | n.a.          |                          |                            |
| 1871/75   | n.a.          |                          |                            |
| 1876/80   | 212.2         | 205.4                    | 214.4                      |
| 1881/85   | 221.7         | 216.8                    | 223.5                      |
| 1886/90   | 206.3         | 210.4                    | 204.7                      |
| 1891/95   | 213.1         | 217.4                    | 210.9                      |
| 1896/1900 | 202.5         | 207.8                    | 199.4                      |
| 1901/05   | 195.6         | 206.0                    | 188.7                      |
| 1906/10   | 195.1         | 203.6                    | 188.7                      |
| 1911/13   | 193.4         | 203.6                    | 185.8                      |

<sup>a</sup> Deaths under one year of age per 1000 livebirths.

Source: Prussia, Statistisches Landesamt, *Preussische Statistik*, Vols. 48A, 188, passim.

was characteristic of most of western Europe in the nineteenth century. E. A. Wrigley has observed: "In general death rates fell much more among children and teenagers than among adults. . . . Infant mortality showed no tendency to fall in most parts of western Europe until the last years of the century."<sup>18</sup> It is clear that at least one area of eastern Europe followed this pattern; and this supports the idea that common factors were working to reduce mortality in both areas. Finally, the less rapid decline of infant mortality in the industrial area might possibly be due to the higher birth rate, if higher birth order children, who are usually more frequent with a higher birth rate, were subject to higher mortality.<sup>19</sup>

In assessing the cause of the mortality decline after 1860, it is difficult to separate the different influences of various factors: for example, rise in levels of living and nutrition, advances in public health, and progress in medical science and technology. Advances in public health and medicine were frequently independent of levels

<sup>18</sup> Wrigley, *Population and History*, p. 169.

<sup>19</sup> This is true for some contemporary populations. Joe D. Wray, "Population Pressure on Families: Family Size and Child Spacing," in National Academy of Sciences, *Rapid Population Growth* (Baltimore, 1971), pp. 409-418.

of per capita income and economic development.<sup>20</sup> Nevertheless, the age-specific pattern of mortality improvement in Oppeln, especially the slow reduction of infant mortality, points to factors connected with levels of living and public health<sup>21</sup> more than to medical science as the origin of the mortality decline. Since the largest number of infants die in the first days and weeks of life, before they are weaned and mostly from intestinal and respiratory infections, environmental conditions (especially food quality and contamination) have less to do with survival for them than for older children and teenagers. Declines in infant, as opposed to childhood, mortality are more closely associated with specific medical knowledge of infections.<sup>22</sup> Public health measures, on the other hand, did succeed in suppressing or alleviating many diseases which were especially common among children and teenagers, such as tuberculosis, whooping cough, scarlet fever, and diphtheria. The latter two may also have undergone a spontaneous alteration in nature, making them less virulent. Thomas McKeown and R. G. Record argue that overcoming much the same group of infectious diseases was responsible for the mortality decline in England and Wales in the later nineteenth century.<sup>23</sup> They were overcome mostly through improved levels of living (that is, nutrition and shelter), better sanitation, and changes in the epidemiology of scarlet fever.

In an attempt to trace the origins of the mortality decline in Oppeln, Table 5 presents data on cause of death for 1875/78 and for 1904/07. The last column gives the relative decline in death rates from each cause. Columns (3) and (4) give the percentage of the total death rate for each cause and provide an idea of the relative importance of each cause or group of causes. The increase in deaths from infectious disease (category 5) between 1875/78 and 1904/07 is misleading. It resulted from the growth in the share of the industrial region, with relatively higher levels of infectious disease mortality, in the total population of the area. Both the agrarian and the industrial regions showed small declines in mor-

<sup>20</sup> George Stolnitz, "A Century of International Mortality Trends, Part I," *Population Studies*, 9 (July 1955), 32-34.

<sup>21</sup> On public health in late nineteenth-century Germany, see Alfons Fischer, *Geschichte des deutschen Gesundheitwesens*, Bd. II (Hildesheim, 1965), pp. 285-344.

<sup>22</sup> Wrigley, *Population and History*, p. 170.

<sup>23</sup> Thomas McKeown and R. G. Record, "Reasons for the Decline of Mortality in England and Wales During the Nineteenth Century," *Population Studies*, 16 (Nov. 1962), 84-122.

TABLE 5  
CAUSE OF DEATH: OPPELN, 1875/78 AND 1904/07

| (1)<br>Cause of Death             | 1875/78                           |                                       | 1904/07                           |                                       | (6)<br>Col.(4) ÷ Col.(2) |
|-----------------------------------|-----------------------------------|---------------------------------------|-----------------------------------|---------------------------------------|--------------------------|
|                                   | (2)<br>Deaths per<br>100,000 Pop. | (3)<br>Percent of Total<br>Death Rate | (4)<br>Deaths per<br>100,000 Pop. | (5)<br>Percent of Total<br>Death Rate |                          |
| 1. Congenital Birth Weakness      | 313.4                             | 11.52                                 | 260.6                             | 11.33                                 | .832                     |
| 2. Weakness of Old-Age            | 246.6                             | 9.06                                  | 248.7                             | 10.82                                 | 1.008                    |
| 3. Childbirth                     | 21.7                              | 0.80                                  | 11.8                              | 0.51                                  | .544                     |
| 4. Violence and Accident          | 67.0                              | 2.46                                  | 64.6                              | 2.81                                  | .964                     |
| 5. Infectious Disease, of which   | 963.2                             | 35.39                                 | 969.2                             | 42.16                                 | 1.006                    |
| a) Tuberculosis                   | (251.2)                           | (9.23)                                | (201.2)                           | (8.75)                                | .801                     |
| b) Pneumonia                      | ( 75.4)                           | (2.77)                                | (198.7)                           | (8.64)                                | 2.635                    |
| c) Typhus                         | ( 84.1)                           | (3.09)                                | ( 4.8)                            | (0.21)                                | .057                     |
| d) Dysentery & Diarrhoea          | ( 85.0)                           | (3.12)                                | ( 79.8)                           | (3.47)                                | .939                     |
| e) Whooping cough                 | (101.3)                           | (3.72)                                | ( 80.0)                           | (3.48)                                | .790                     |
| f) Diphtheria                     | (156.2)                           | (5.74)                                | ( 33.3)                           | (1.45)                                | .213                     |
| g) Scarlet Fever                  | (110.9)                           | (4.08)                                | ( 73.0)                           | (3.18)                                | .658                     |
| 6. Other Respiratory              | 44.4                              | 1.63                                  | 101.1                             | 4.39                                  | 2.277                    |
| 7. Circulatory                    | 9.8                               | 0.36                                  | 95.6                              | 4.16                                  | 9.755                    |
| 8. Cancer & Tumors                | 16.5                              | 0.61                                  | 41.6                              | 1.81                                  | 2.521                    |
| 9. Nervous System, Brain & Stroke | 120.9                             | 4.44                                  | 93.1                              | 4.05                                  | .770                     |
| 10. Kidneys & Excretory Disease   | 7.0                               | 0.26                                  | 30.2                              | 1.31                                  | 4.314                    |
| 11. Other                         | 559.0                             | 20.54                                 | 333.7                             | 14.51                                 | .597                     |
| 12. Unknown                       | 351.7                             | 12.92                                 | 48.8                              | 2.12                                  | .139                     |
| 13. Total                         | 2721.3                            |                                       | 2299.0                            |                                       | .845                     |

Source: Prussia, Statistisches Landesamt, *Preussische Statistik*, Vols. 43, 46, 50, 55, 195, 199, 208, 214.

tality from infectious disease over the period.<sup>24</sup> Among infectious diseases notable declines occurred in tuberculosis, typhus, whooping cough, diphtheria, and scarlet fever. These were diseases which greatly affected children and teenagers and which, in the cases of tuberculosis and typhus, responded to better sanitation. Smallpox, one of the few diseases eradicated by medical science in this period, was only a minor cause of death by the 1870's, accounting for only 0.6 percent of total deaths in 1875/78. Cholera, a major killer between the 1830's and the 1860's, was virtually eliminated by the 1870's, almost solely through better sanitation. Some diseases which affected infants did decline somewhat (congenital birth defects and diarrhea/dysentery), but preliminary studies of cause of death in the 1890's indicates that these declines could only have occurred after about 1900. Such declines were counterbalanced by increases in death rates from pneumonia and other respiratory disease. Pneumonia-related respiratory infections were especially common among infants. Further, they responded little to public health and environmental improvement and remained major causes of death until the discovery of sulfa drugs and antibiotics. As might be expected, deaths associated with cancer, tumors, circulatory disease, kidney and excretory disease, and old age (*Alterschwäche*) increased as the population aged, and infectious diseases of many types subsided. Increases in deaths from pneumonia and respiratory infections may be attributed, as has been said, to lack of medical advance and relative ineffectiveness of public health in this area. Finally, the declines in the categories "Other" and "Unknown" give reason to believe that some of the decreases of infectious diseases might have been more pronounced if diagnosis had earlier been more precise. The apparent increases in death rates from some of the degenerative diseases (for example, cancer and heart disease) might have appeared less if diagnosis had been better at an earlier date.

The mortality decline, hence the rise in RNI after 1860, thus appears to have been associated with better nutrition, sanitation, and environment. The reduction in mortality peaks from crop failures, the improved survival chances of children and teenagers relative to infants and adults, and the disappearance of certain diseases whose impact can be lessened by better food, hygiene, and health condi-

<sup>24</sup> The declines were 7 percent and 2 percent respectively. The results for the two regions were broadly similar and are therefore not presented.



tions, all point to economic factors. Such factors, as suggested by McKeown, Brown and Record, and by Abdel Omran,<sup>25</sup> include increased agricultural productivity, more governmental expenditure on public health (improved water supplies, sewage systems, etc.), higher real incomes allowing purchases of better food, clothing, and shelter, and better education in matters of hygiene. Data are lacking on many of these things for Oppeln; but, as suggested below, rising real wages and improved agricultural productivity characterized a part of the period.

### III

Natural population increase must be "absorbed" by three means: net out-migration, increase in urban population, or increase in rural population. The industrial region of Oppeln uniformly experienced "absorption" of population through urban growth. The course of absorption for the agricultural region is presented in Table 6. Prior to about 1860, natural increase was lower (about one percent per annum), and this was absorbed largely by rural population growth. After the 1860's, however, natural increase rose to over 1.5 percent per annum (because of the mortality decline discussed previously) and remained high right up to the decade 1901-1910. Rural population growth declined (and eventually became negative) as Oppeln's rural population responded to higher RNI with increased movement out of rural areas to local urban places and to places out of the region altogether.<sup>26</sup> In Kingsley Davis' terminology, the rural and agrarian population of Oppeln chose a particular (and not unusual) type of "multiphasic response."<sup>27</sup> Why did natural increase remain so

<sup>25</sup> Thomas McKeown, R. G. Brown and R. G. Record, "An Interpretation of the Modern Rise of Population in Europe," *Population Studies*, 26 (Nov. 1972), 345-382; Abdel R. Omran, "The Epidemiological Transition: A Study of the Epidemiology of Population Change," *Milbank Memorial Fund Quarterly*, 49 (Oct. 1971), 509-538.

<sup>26</sup> The decline in rural population growth in fact understated the fall in agricultural population growth. Agricultural population actually *declined* at an annual rate of 0.6 percent per annum between 1882 and 1895 and 0.5 percent per annum between 1895 and 1907. Earlier data on agricultural labor force are, unfortunately, not available. In 1882, the agricultural population was 75 percent of the rural population; and agriculture was the dominant rural economic activity, especially after the disappearance of the handicraft linen industry in the German-speaking areas in the 1840's and after the decline of rural charcoal iron smelting in the Polish-speaking areas after 1860. By 1880, charcoal smelting accounted for only 0.3 percent of all iron produced in Oppeln.

<sup>27</sup> Kingsley Davis, "The Theory of Change and Response in Modern Demographic History," *Population Index*, 29 (Oct. 1963), 345-366.

TABLE 6  
COMPONENTS OF POPULATION ABSORPTION IN THE AGRICULTURAL  
REGION OF OPPELN: 1841-1910  
(10 Year Averages)

| <i>Period</i>   | <i>RNI</i> <sup>a</sup><br>(per 1000 pop. p.a.) | <i>RRNM</i> <sup>a</sup> | $\Delta$ <i>Rural Pop.</i> <sup>b</sup><br>(percent)<br>(per decade) | $\Delta$ <i>Urban Pop.</i> <sup>b</sup><br>(percent)<br>(per decade) |
|-----------------|---|--------------------------|--|--|
| 1841/50         | 9.12  | -3.46                    | 3.99   | 1.85   |
| 1851/60         | 11.08   | -2.75                    | 6.35   | 1.81   |
| 1861/70         | 16.56   | -7.20                    | 2.05   | 7.09   |
| 1871/80         | 13.62   | -7.62                    | 1.75   | 4.40   |
| 1881/90         | 13.00   | -9.46                    | -1.34  | 4.51   |
| 1891/1900       | 16.70   | -9.60                    | -0.09  | 7.26   |
| 1901/10         | 16.38   | -7.77                    | 1.55   | 7.15   |
| 1841/50—1851/60 | 10.10   | -3.10                    | 5.17   | 1.83   |
| 1861/70—1901/10 | 15.25   | -8.33                    | 0.78   | 6.08   |

<sup>a</sup> RNI = rate of natural increase. RRNM = residual rate of net migration. For RRNM, + = net in-migration and - = net out-migration.

<sup>b</sup> Urban population is population in incorporated areas over 2,000 population after 1871/80. These data are regularly available only after 1867; but figures on chartered towns are available before this date. In the agricultural regions, the approximation of urban population using chartered towns is good after 1867. It is thus likely to be good before 1867 since towns grew only slowly then. Rural population is simply the difference between total population and urban population. The periods of measurement do not correspond exactly to the decades before the 1880's and have been adjusted to decade rates. The identity  $RNI = RRNM + \Delta \text{ Rural Pop.} + \Delta \text{ Urban Pop.}$  therefore holds only approximately for all decades since the data come from different data collection sources. (The sign on RRNM must be reversed to account for the fact that out-migration is absorption). The base for the percentage change in rural and urban population is total population, i.e.,

$$\frac{\text{Natural Increase}}{\text{Total Population}} = \frac{\text{Net Migration}}{\text{Total Population}} + \frac{\text{Change in Rural Population}}{\text{Total Population}} + \frac{\text{Change in Urban Population}}{\text{Total Population}}$$

Sources: Prussia, Statistisches Landesamt, *Preussische Statistik. Vierteljahreshefte zur Statistik des deutschen Reichs. Tabellen und amtlichen Nachrichten für das Jahr 1849, . . . 1852, . . . 1855, . . . 1858*, passim.

K. F. W. Dieterici, *Statistische Tabellen des preussischen Staates nach der amtlichen Aufnahme des Jahres 1843* (Berlin, 1845).

high for so long? Dov Friedlander has advanced the hypothesis that the availability of internal migration opportunities may lead to a delay in birthrate decline during the demographic transition because of the relative ease with which extra children may be sent from rural areas with high natural increase to employment elsewhere.<sup>28</sup> He contrasts the cases of England, with a delayed birth rate decline but large out-migration from rural areas to urban, industrial locations,

<sup>28</sup> Dov Friedlander, "Demographic Responses and Population Change," *Demography*, 6 (Nov. 1969), 354-381.

and Sweden, with a birth rate decline earlier in its demographic transition and relatively low internal migration rates because of a later industrialization. The data suggest that Oppeln fits the English model in this respect.

Some available evidence supports the view that availability of employment opportunities outside agriculture made possible a delayed birth rate decline. First, it can be established that migrants from the rural areas of Oppeln moved largely to non-agricultural regions elsewhere. One study of the industrial labor force in late nineteenth century Upper Silesia concludes from non-quantitative evidence that "not only was the work force in the Upper Silesian industrial region recruited in Silesia province, but for the most part was recruited within the territory of the tiny bunch of counties constituting the industrial area."<sup>29</sup> This indicates that migrants to the industrial region were overwhelmingly attracted from the agricultural region of Oppeln. (The definition of the "tiny bunch of counties constituting the industrial region" included a number of *Kreise* here classified in the agrarian region.) This is weakly supported by census data which show that in 1871 97 percent of the population resident in the industrial region had been born in Silesia. By 1905 this was still 96 percent.<sup>30</sup> Of the migrants leaving Upper Silesia for other places in Germany (and more persons left the rural areas after 1860 then entered the industrial region), most left for the urban areas of Lower Silesia (especially Breslau and Görlitz), the growing industrial areas in the Brandenburg/Berlin region, or in industrial provinces of Westphalia, Rhineland and Saxony.<sup>31</sup>

<sup>29</sup> Lawrence Schofer, "The Formation of a Modern Industrial Working Force: The Case of Upper Silesia, 1870-1914" (Ph.D. Dissertation, University of California at Berkeley, 1970), p. 69.

<sup>30</sup> *Preussische Statistik*, Bd. 30, p. 32; Bd. 206, Teil I, p. 297.

<sup>31</sup> The Prussian census of 1900 indicates that of the 208,439 persons born in Oppeln but living elsewhere in Germany, 50 percent were living in adjacent Lower Silesia (*Regierungsbezirke* Breslau and Liegnitz); Statistisches Landesamt, *Preussische Statistik*, Bd. 177, Teil II (1902/03), p. 26. This might be expected, since there was considerable industrial and commercial growth in some areas of Lower Silesia (e.g., the cities of Breslau and Görlitz), and also since most internal migration tends to be for short distances. See Everett Lee, "A Theory of Migration," *Demography*, 3 [1966], 48). Of the remaining 50 percent of the migrants, 80 percent went to industrializing areas around Berlin/Brandenburg and in Westphalia, Rhineland, and Saxony. Furthermore, agricultural employment declined absolutely in these destinations during the late nineteenth century, indicating that agricultural employment was not attracting migrants. (The agricultural population, including farmers, dependents, servants, and laborers, declined 17.2 percent between 1882 and 1907 in Lower Silesia and by 12.5 percent in Brandenburg in the same period.)

Second, there is evidence that rising real wages and employment in these other areas produced a migration "pull." Considering supply and demand for labor in the area of destination, a monotonically increasing series of real wage and employment observations over time can be generated *only* by demand for labor which expands (that is, shifts outward) faster than the supply of labor (assuming demand curves remain downward-sloping and supply curves upward-sloping). Hence a series of increasing price-quantity (that is, wage-employment) observations in the destination's labor market should identify a "pull" or, as Everett Lee describes it, "positive factors in the area of destination."<sup>32</sup> There exist data which give just such a picture for the destinations of migrants from the agrarian regions of Upper Silesia. In the industrial region of Oppeln, employment in mining and metallurgy expanded steadily from the 1850's and overall non-agricultural employment did the same after 1861 (the date of the first comprehensive Prussian census of manufactures). Similar data show consistent increases in non-agricultural employment after 1861 for Lower Silesia, Brandenburg/Berlin, and the Ruhr area (that is, the major areas of destination).<sup>33</sup> On the side of wages, Table 7 (upper panel) presents some real non-agricultural wages for Berlin and Silesia for the period 1873-1912 (in marks of 1895). The results show a general upward trend, which, combined with rising employment trends, do confirm the existence of a migration "pull."<sup>34</sup> Out-migration alternatives thus apparently existed for Oppeln's rural and agrarian population, and these alternatives could well have delayed a fertility response.

Data on real wages for Silesian agricultural workers are also presented in Table 7 (upper panel, col. 2). From these it appears that, although there was an absolute decline in agricultural population after 1882 (0.6 percent per annum between 1882 and 1895 and 0.5 percent per annum between 1895 and 1907), real agricultural wages were rising up to 1899. Even the decline between 1899 and 1912 left

<sup>32</sup> Lee, "A Theory of Migration," pp. 49-52.

<sup>33</sup> The data come mostly from the *Zeitschrift für das Bergbau-Hütten- und Salinenwesen im preussischen Staat* and the various censuses of manufactures (*Gewerbezahlungen* in 1861, 1875, 1882, 1895, and 1907) and of occupations (*Berufszählungen* in 1882, 1895, and 1907).

<sup>34</sup> Real wages are given only at distinct dates, rather than in quinquennia, because agricultural wages were available only at those dates. Non-agricultural wages were available annually after 1871, and an examination of five year averages in real wages from these annual data confirms a consistent upward trend. Some stagnation during the 1870's and after 1901/05 is also indicated.

TABLE 7  
RELATION OF REAL WAGES IN SILESIAN AGRICULTURE TO REAL WAGES IN SELECTED OCCUPATIONS  
IN THREE AREAS IN GERMANY 1873-1912  
(1895 Marks per Day)<sup>b</sup>

| (1)  | (2)  | (3)                     | (4)                                 | (5)                  | (6)                 | (7)                   | (8)               | (9)                                | (10)                        | (11)                         | (12)                           |
|------|--|-------------------------|-------------------------------------|----------------------|---------------------|-----------------------|-------------------|------------------------------------|-----------------------------|------------------------------|--------------------------------|
| Year | Male Ag.<br>Wage<br>(Silesia) <sup>a</sup> | (Real Wage<br>Deflator) | Coal<br>Miner<br>(Upper<br>Silesia) | Printer<br>(Breslau) | Printer<br>(Berlin) | Carpenter<br>(Berlin) | Mason<br>(Berlin) | Construction<br>Helper<br>(Berlin) | Wagon<br>Driver<br>(Berlin) | Cabinet<br>Maker<br>(Berlin) | Machine<br>Builder<br>(Berlin) |
| 1873 | .747                                       | 120.5                   | 1.80                                | —                    | 3.60                | 3.96                  | 3.73              | 2.54                               | —                           | —                            | —                              |
| 1892 | .859                                       | 104.8                   | 2.66                                | 3.75                 | 4.08                | 5.10                  | 5.23              | 3.23                               | 3.18                        | 3.79                         | 4.20                           |
| 1899 | 1.473                                      | 101.8                   | 3.21                                | 3.95                 | 4.30                | 5.37                  | 5.33              | 3.55                               | 3.52                        | 5.19                         | 4.79                           |
| 1912 | .952                                       | 131.3                   | 3.03                                | 3.65                 | 3.97                | 5.35                  | 5.35              | 3.63                               | —                           | —                            | —                              |

| RATIO OF AGRICULTURAL TO NON-AGRICULTURAL DAILY WAGES |                         |                      |                     |                       |                   |                                    |                             |                              |                                |  |  |
|---|-------------------------|----------------------|---------------------|-----------------------|-------------------|------------------------------------|-----------------------------|------------------------------|--------------------------------|--|--|
| Year  | Coal Miner<br>(Breslau) | Printer<br>(Breslau) | Printer<br>(Berlin) | Carpenter<br>(Berlin) | Mason<br>(Berlin) | Construction<br>Helper<br>(Berlin) | Wagon<br>Driver<br>(Berlin) | Cabinet<br>Maker<br>(Berlin) | Machine<br>Builder<br>(Berlin) |  |  |
| 1873  | .415                    | —                    | .208                | .189                  | .200              | .294                               | —                           | —                            | —                              |  |  |
| 1892  | .323                    | .229                 | .210                | .168                  | .164              | .266                               | .270                        | .226                         | .204                           |  |  |
| 1899  | .459                    | .373                 | .343                | .274                  | .276              | .415                               | .418                        | .284                         | .308                           |  |  |
| 1912  | .314                    | .261                 | .240                | .178                  | .178              | .262                               | —                           | —                            | —                              |  |  |

<sup>a</sup> Average.

<sup>b</sup> For some occupations, weekly wages were reduced to daily wages on the basis of a 6-day week.

Sources: UPPER PANEL. (1) Money Wages: Col. (2); Wilhelm Asmus, "Zur Entwicklung der Landarbeiterlöhne in Preussen," *Landwirtschaftliche Jahrbücher*, Bd. 52, Heft 4 (Berlin, 1919), p. 535. Col. (4); *Zeitschrift für das Bergbau-, Hütten- und Salinenwesen im preussischen Staat, passim*. Cols. (5), (7), (10)-(12): Jürgen Kucynski, *Die Geschichte der Lage der Arbeiter unter dem Kapitalismus*, Bd. 2-4 (Berlin, 1961-69), Cols. (6), (8), (9); Gerhard Bry, *Wages in Germany, 1871-1945* (Princeton, 1960). (II) Real Wage Deflator: Col. (3); Ashok V. Desai, *Real Wages in Germany, 1871-1913* (Oxford, 1968). LOWER PANEL. Col. (2) of Upper Panel divided by Cols. (4)-(12) of Upper Panel successively.

agricultural laborers better off than they had been in 1892. Now *if* (and this is by no means certain) the trend in agricultural incomes in general was the same as that for agricultural wage workers,<sup>35</sup> then the situation in agriculture did not appreciably deteriorate in an absolute sense. In a relative sense, however, agricultural wages first showed an improvement to 1899 and then a deterioration. This may be seen in the lower panel of Table 7, which gives real wages in Silesian agriculture relative to those in "competing" non-agricultural occupations. Although agricultural wages are considerably below those of non-agricultural occupations, it should be remembered that almost all the non-agricultural occupations cited here were skilled. Also, the cost of living index (that of Desai<sup>36</sup>) used to deflate money wages would overstate rural living costs since it was based on urban prices which are higher for such items as food and rent. Thus not too much should be made of the differentials. On the other hand, between 1873 and 1899 the relative agricultural wage generally rose. Even after 1899, when the relative wage deteriorated, agricultural workers were not much worse off than they had been in 1873. Therefore, during a period of exceptional out-migration from agriculture with a declining agricultural population, real agricultural wages (and probably income) were rising. This suggests that out-migration so reduced labor supply in agriculture that even a stagnant (or at most slowly growing) demand for labor could not prevent improvement. The factor which allowed birth rates to remain high (that is, availability of out-migration alternatives) apparently allowed agricultural wages and incomes to rise also. Indeed, the mechanism may well have been out-migration leading to improved economic conditions for those remaining which, in turn, allowed them to continue a high fertility pattern. It is much more likely that the birth rate in the agrarian region would have been adjusted earlier (as in the Swedish case) had the external "pull" factors not allowed so much occupa-

<sup>35</sup> There is considerable evidence of improved agricultural incomes after about 1890, but the period 1860-1890 was definitely one of flux. Arable land virtually ceased growing after the early 1860's and yields did not begin to rise sharply until after about 1890. In addition, there was a slump in grain prices from the early 1870's up to the mid 1900's, caused by international competitive pressures and technical change in ocean and land transport. Agricultural population was declining, at least after 1882, and so it is not clear whether the reduction in numbers of farmers and farm laborers more than compensated for the reduction in income caused by reduced prices and stagnant yields. See Haines, "Economic-Demographic Interrelations," ch. 5.

<sup>36</sup> Ashok V. Desai, *Real Wages in Germany, 1871-1913* (Oxford, 1968), pp. 19-33, 117.

tional and geographic mobility. It is also likely that the birth rate adjustment would have come rather quickly after about 1860, since a combination of circumstances (inelastic supply of good land, slowed productivity growth, and, after the 1870's, rapidly falling grain prices) created very poor conditions in agriculture during the decades 1860-1890, while thereafter productivity and eventually grain prices began to rise once again.

#### IV

From this study it can be concluded that Prussian Upper Silesia was originally in a situation where rural, agricultural conditions determined natural increase. The situation was similar to that of many preindustrial populations, with fluctuations in fertility, mortality, and natural increase caused by subsistence crises and heavy incidence of infectious disease. A "demographic transition" occurred after about 1860 as mortality peaks were reduced and the average level of mortality began to decline, especially among young children and teenagers but not among infants. Much of the mortality reduction concerned specific infectious diseases. Fertility did eventually decline but it showed fluctuations. In general, death rates and birth rates declined together in the long run with natural increase initially rising to a higher level and then showing no marked trend. The industrial region showed higher levels of fertility, mortality, natural increase, and total increase relative to the surrounding agrarian areas.

In the agricultural region before 1860, most of the natural population growth occurred within the rural areas. After 1860 this pattern changed as higher levels of natural population growth led to greater net out-migration and increased urban population growth. Natural increase was allowed to remain high in the post-1860 period because of non-agricultural opportunities both within and outside the region. Because of the possibility of migration, pressure to reduce birth rates was weaker. This accords with the views of Davis and Friedlander that internal migration and fertility control may be alternative responses to population pressure. In Oppeln in the late nineteenth century, as in England in the middle of the century, the migration response was chosen and maintained for a considerable period before birth rates fell sufficiently to reduce natural increase.

The existence of rising real wages and employment for non-agricultural occupations in the areas to which rural Upper Silesians were

migrating points to the operation of a "pull." This pull was apparently of sufficient strength to induce rising real wages in agriculture up to about 1900, despite evidence of deteriorating production conditions between 1860 and 1890. Economic conditions seem to have influenced (1) the decline in mortality and the resultant rise in natural increase after the 1850's, and (2) the choice of internal migration as a response to rising natural increase by providing (a) non-agricultural job opportunities and (b) incentives to leave agriculture, especially during the period 1860-1890.

In addition to the preceding analysis, an attempt was made to identify some of the specific socio-economic correlates of the eventual fertility decline. Regressions were run for three time periods, 1873/82, 1893/97, and 1907/12, using Oppeln's *Kreise* as the units of observation. The time periods were chosen because of proximity to the three occupational censuses prior to 1913 (1882, 1895, and 1907). Ordinary least squares (OLS) equations and, for 1873/82 and 1907/12, simultaneous systems using two stage least squares were estimated. The detailed results are not presented because of limitations of space,<sup>37</sup> but the analysis reinforces the view that economic factors were important in influencing the course of fertility. Among the independent variables considered were percentage of the population Roman Catholic, percentage non-German speaking, infant mortality rate, percentage urban, level of adult female labor force participation outside the home, and the sex ratio (males per 100 females) for the age group 15-49. The dependent variables were the general fertility ratio, the general marital fertility ratio (legitimate live-births per 1000 married women aged 15-45) for 1907/12, the general nuptiality ratio (marriages per 1000 non-married women aged 15 and over), and, for 1873/82, Coale's Index of Overall Fertility.<sup>38</sup> The simultaneous equation system was specified and estimates were made to overcome biases due to simultaneous causality between fertility and extra household female labor force participation and also between fertility and infant mortality. By examining the movements in mean values of the independent variables over time, as well as looking at the signs and significance of the regression

<sup>37</sup> A more detailed version of the present paper, containing the full results, may be obtained from the author on request.

<sup>38</sup> See Ansley J. Coale, "Factors Associated with the Development of Low Fertility: An Historic Summary," in United Nations, *World Population Conference: 1965*, II (New York, 1967), 205-209.



coefficients determined in the successive cross-sections, some idea of the direction, importance, and secular influence of the independent variables on fertility and marriage can be seen.

Overall, there was general agreement between the simple OLS equations and the TSLS equations. Both gave roughly similar signs and, in a qualified sense, significance levels for the estimated parameters.<sup>39</sup> Both explained a large proportion of variation (usually more than half) in fertility and marriage in the three cross-sections. Samples which included all *Kreise* and also only the agrarian *Kreise* were tried and gave similar results. The results showed that the eventual fertility decline was probably strongly influenced by increasing levels of extra-household female employment and by rising levels of urbanization, which provided greater opportunity for such work. This may be inferred from (a) the strong and significant positive association of urbanization with female work in 1873/82 and 1907/12, (b) the negative and usually significant association between female work and fertility (especially marital fertility in 1907/12), and (c) the rising mean levels of urbanization (32.1 percent in 1875 and 57.5 percent in 1910), and extra-household female labor force participation (7.9 percent of females age 14 and over in 1882 and 14.0 percent in 1907). Percent non-German speaking (ethnic composition) and percent Roman Catholic (religious composition) were both positively related to fertility and nuptiality, but the estimated coefficient for percent Roman Catholic was generally statistically insignificant. Both variables, however, showed virtually no change over time and thus probably had little influence on reducing fertility. Infant mortality, which usually declines during the demographic transition and is therefore often a major cause of the fertility decline, remained rather stable over the period considered, with only a small decline near the end. Further, its estimated relation with fertility in all three cross sections was uniformly statistically insignificant. Imbalances in the sex ratio for ages 15-49, originating in sex selective migration patterns, which themselves had economic causes, had a significant and positive effect on fertility and marriage in the cross-section. This variable also increased over time (from 86.4 in 1875 to 89.1 in 1910), but its positive effect was evidently overwhelmed by other negative factors. It must be stressed that these results are only inferences

<sup>39</sup> The small sample properties of adjusted R-square values as well as for F- and t-ratios are not known for two stage least squares estimates.

based on estimated coefficients from cross-sectional data (which provide a direction and significance to relationships) along with secular movements in the independent variables. The results are suggestive, but certainly not conclusive.

Finally, it should be noted that if economic conditions influenced and altered demographic trends, then demographic conditions were, in turn, important to the regional economic development of the Upper Silesian coal basin. The rising high natural increase of the population after about 1860 provided, after a lag, a flexible and rapidly growing labor supply which came both from the industrial population itself and via migration from the nearby agrarian regions.

MICHAEL R. HAINES, *Cornell University*