Fertility Decline and Social Democracy in Prussia 1875 to 1910

Patrick R. Galloway

November 2009

Introduction

The idea of fertility control was probably more acceptable to persons with preferences for innovative and non-traditional behavior. Voting for the Social Democratic Party in Prussia in the last quarter of the 19th century is a useful proxy for such preferences. In addition, many of the policies of the Social Democratic Party in Germany were such that their implementation would likely lead to fertility decline. These factors in combination with declining infant mortality and changes in structural variables theoretically linked to fertility change greatly increased the probability of fertility decline in Prussia in the last quarter of the 19th century.

I will examine the relationship between the growth of the Social Democratic Party, Social Democratic voting behavior and marital fertility decline within the context of other theoretically important socioeconomic variables in 407 Kreise (areas similar to small counties) in Prussia and in 54 cities in Prussia between 1875 and 1910. The method is panel analysis using ordinary least squares and two stage least squares.

Marital Fertility and the Social Democratic Party in Prussia 1871 to 1912

Political parties in Prussia in the last quarter of the nineteenth century can generally be classified as Conservative, Center (mainly Catholic), Liberal, and Social Democratic (Vogel et al. 1971). Elections were held every three to five years between 1871 and 1912. The Social Democratic Party, which represented the economic interests of workers, became the dominant force in German politics (Sheehan 1978:231). It increased its share of the total vote from 5.3 percent in 1874 to 32.2 percent in 1912 (see Table 1 and Figure 1).

Observers at the time noticed a relationship between lower fertility in areas with a

high percentage of votes for the Social Democratic Party, but were unable to posit a direct causal mechanism.

Wolf, in a 1912 study of fertility and social democracy in Germany, suggested that party affiliation does not directly influence fertility behavior, but rather that each may be influenced by similar factors. He suggests one factor might be an emancipated world view related to aesthetic, economic, and egotistical considerations (1912:293-294).

Borntraeger, also in 1912, noted that "the fertility decline seems to manifest itself especially in politically liberal and social democratic areas" (1912:27). He does not attempt to explain the connection.

An outline of the political platform of the German Social Democratic Party at the time is conveniently provided by Ogg (1917:355-356):

> "The more specific demands of the German Social Democrats comprise the following:
>
> 1. Universal, equal, and direct suffrage by ballot in all elections for all subjects of the Empire over twenty years of age, without distinction of sex; proportional representation; biennial elections to the Reichstag.
>
> 2. Direct legislation by the people through the use of the right of initiative and of veto; self-government by the people in Empire, state, province, and commune; an annual vote of taxes.
>
> 3. Universal military education; substitution of a militia for a standing army; decision of questions of peace and war by the Reichstag; decision of all international disputes by arbitration.
>
> 4. Abolition of all laws that restrict freedom of speech and the right of public assembly.
>
> 5. Abolition of all laws that put women, whether in a private or public capacity, at a disadvantage in comparison with men.
>
> 6. Declaration that religion is a private matter; abolition of all expenditure of public funds for ecclesiastical purposes.

> 7. Secularization of education; compulsory attendance at public schools; free education, free supply of educational apparatus, and free maintenance of children in schools and of such students in higher institutions as prove themselves fitted for higher education.
>
> 8. Free administration of the law by judges elected by the people; compensation to persons unjustly accused, imprisoned, or condemned; abolition of capital punishment.
>
> 9. Income, property, and inheritance taxes to meet all public expenses that are to be met by taxation; abolition of all indirect taxation, customs duties, and other measures which sacrifice the interests of the people at large to those of a small minority.
>
> 10. A national system of protection of labor on the basis of a working day of not more than eight hours, the prohibition of the employment of children under fourteen years of age, and the prohibition of night work, except where absolutely necessary; supervision of all industrial establishments and regulation of the conditions of labor by government departments and bureaus; confirmation of the rights of laboring men to form organizations."

Items 1, 4 and especially 5 suggest the emancipation of women, perhaps indicating a greater openness to new ideas, such as fertility control. Item 4 indicates a freer flow of information. Item 5 promotes gender equality in the workplace, and would thus increase the opportunity costs of childbearing to women. Items 7 and 10, compulsory education and abolition of child labor, would reduce the economic value of children to the family. Thus one could make a case that persons voting Social Democratic would tend to have some preferences that would be associated with lower fertility, *ceteris paribus*. Social Democratic Party influence on fertility can be seen as both a reflection of left-liberal thought and, perhaps, as a factor in the dissemination of left-liberal thought.

Perhaps more importantly, effective implementation of certain components of the

Social Democratic agenda (Items 5, 7, and 10) would tend to directly reduce fertility. In Germany, of which Prussia was part, legislation was enacted beginning in the last quarter of the 19th century to initiate programs for government-backed universal insurance against sickness and accidents, together with an invalidity, old age and survivor pension system (Dawson 1912). Compulsory childhood education and abolition of child labor in factories and mines began earlier. Unfortunately, even today, the efficacy of government-enacted programs is difficult to assess. Thus it is not possible to measure with certainty how effective government-enacted Social Democratic programs were in Prussia in the 19th century. Nonetheless, those areas where Social Democratic voting was strongest are likely to be those areas where Social Democratic principles and policies were most accepted and most effective.

Previous empirical research on voting behavior and fertility

Voting for liberal political parties has been used occasionally by researchers in studies of marital fertility level and change. The theoretical link in these articles was the idea that fertility control was probably more acceptable to persons with preferences for innovative and non-traditional behavior. In an analysis of six European countries using only two independent variables (Lesthaege and Wilson 1986:277-292) found a strong positive relationship between marital fertility decline, ca. 1880-1910, and percentage of votes for secularized social-reformist parties, ca. 1920. For Germany the specific variables were the pace of marital fertility decline 1869-1912 and percent of votes for Social Democratic and Communist parties in 1920-1922 in 63 large regions of Germany. The effect was somewhat stronger in Protestant areas compared to Catholic areas. Using data for the United States, Lesthaege and Neidert found a strong correlation between total

fertility rate and percent voting for George W. Bush in 2004 (2006:22).

Brown and Guinnane (2002:45) found that an increase in percent voting Social Democratic in Bavaria was associated with marital fertility decline by 1900 using a fixed effects model.

Dribe (2006) found that progressive party affiliation was associated with lower marital fertility levels in Sweden. However, the Swedish data (1910-1930) could only be used to generate level effects.

Units of Analysis, Periods, and Data

Germany was united in 1871, but the Prussian statistical office continued to publish detailed statistical data for small units of analysis until around World War I. The detail is generally greater than that published by the German statistical office. The Prussian data set is particularly useful for longitudinal analysis, with data being available quinquennially from 1875 to 1910 (see Galloway 1988 updated 2007, 1992 updated 2007; Galloway et al.1994, 1998a).

A map of Prussia within the context of Germany and northern Europe is shown in Appendix Figure 1. The population of Prussia in 1910 was some 40 million, about 12.5 percent of all of Europe less Russia. Appendix Table 1 shows that the population of Prussia in 1910 was larger than the populations of Great Britain, France, or Italy. The period under consideration, 1875 to 1910, saw the transformation of Prussia from a largely agrarian economy to the industrial powerhouse of Europe (Trebilcock 1981:41,45).

The units of analysis, as mentioned above, are 407 Kreis units in Prussia. Each Kreis unit has been constructed so that it has a constant area from 1875 to 1910. The

combination and recombination of Kreise to form a unit of constant area over time was a time-consuming and tedious process (Galloway et al. 1994:140-141). The Kreis units were on average about 70 percent rural.

A separate analysis of the 54 largest cities in Prussia (Galloway et al. 1998b:214) will be undertaken. Such a study by definition removes the urbanization variable, which is often difficult to interpret.

The periods that will be analyzed are 1875, 1880, 1885, 1890, 1895, 1900, 1905, and 1910.

The Social Democrat variable is defined as Social Democratic Party votes as a percent of total votes. There were 231 Wahlkreise (election districts) in Prussia and 407 Kreise. The Kreise election data were allocated based on the election data from the Wahlkreis in which the Kreis was a part. The same was done for the 54 cities. The Kreis and city data were interpolated where necessary between elections. Table 1 and Figure 1 show the percent of voters voting Social Democratic over time in Prussia.

Anti-socialist laws were enacted in 1878 and dropped in early 1890. The efficacy of these laws has been questioned (see Ogg 1917:352-353). Figure 1 shows some deviation from trend during the anti-socialist period.

Table 2 shows the definitions of all the variables, along with references to the articles which discuss each variable in detail. The theoretical implications in relation to marital fertility decline of the other independent variables have been discussed at length in Galloway et al. 1994 (for Kreise) and Galloway et al. 1998b (for cities). I refer the reader to these articles which can be downloaded from www.patrickgalloway.com. Appendix Figures 2 to 4 show the general marital fertility rate, the dependent variable, in

the Kreise in Prussia from 1875 to 1910, along with its change. Appendix Figures 6 to 8 show the same for the 54 cities.

Method

I will analyze two sets of data separately, the Kreis data consisting of 407 Kreise, and the city data consisting of 54 cities. The two data sets were compiled separately. Kreise often contain both urban and rural data. The city data set is obviously completely urban. The method used is panel analysis, which generates estimates for level effects, also called between-group effects, and pace effects, also called fixed effects.

LEVEL EFFECTS (BETWEEN-GROUP EFFECTS)

The between-group effects is a regression of the means of all the independent variables on the dependent variable (see Galloway et al. 1998a:230-231). This is a test of level effects. The mean is simply the average over all eight time *T* periods. *N* is 407 Kreise in the Kreis analysis. *N* is 54 cities in the city analysis. *Y* is the dependent variable, *X* is an independent variable, *k* is the number of independent variables, *C* is a constant, *a* is a regression coefficient, and *e* is the error term.

Eq 1. $\bar{Y}_i = C + a_1 \bar{X}_{1i} + a_2 \bar{X}_{2i} + a_3 \bar{X}_{3i} + \ldots + a_k \bar{X}_{ki} + e_i$

for $i = 1,2, \ldots, N$.

Eq 1, level effects, and between-group effects are interchangeable terms in this paper.

PACE EFFECTS (FIXED EFFECTS)

While most earlier work focused on level effects,an analysis of marital fertility decline, by definition, involves changes in the dependent variable. The fixed effects

model produces results that show the impact of changes in the independent variables on changes in the dependent variable. In fact, in a two period model, the fixed effects model generates the same estimates as simple OLS regression on first differences of all variables. The fixed effects model is appropriate when one wishes to study those factors involved with marital fertility decline.

The fixed effects model estimates the "within" component of variance, *i.e.*, the pace effects (see Galloway et al. 1998a:231-232). *N* is 407 Kreise in the Kreis analysis. *N* is 54 cities in the city analysis. In the Kreis model we allow each Kreis to have its own intercept term by introducing 407 Kreis dummies, *W*, with coefficients *d*. Similarly, in the city model we allow each city to have its own intercept term by introducing 54 city dummies, *W*, with coefficients *d*. Time is represented by *t*.

Eq 2. $$Y_{it} = a_1 X_{1it} + a_2 X_{2it} + a_3 X_{3it} + \ldots + a_k X_{kit} + d_1 W_{1t} + d_2 W_{2t} + d_3 W_{3t} + \ldots + d_N W_{Nt} + e_{it}$$

for $t = 1,2, \ldots, T$

for $i = 1,2, \ldots, N$

where $W_{it} = 1$ for the ith unit of analysis $i = 1, \ldots, N$ and 0 otherwise.

Eq 2, pace, and fixed effects are interchangeable terms in this paper.

The sample size in the Kreis fixed effects analysis is 3256 (407 Kreise times 8 periods). The sample size in the city fixed effects analysis is 432 (54 cities times 8 periods).

I am primarily interested in the pace model (the fixed effects model) because it tells us something about marital fertility change. The between-group model is about levels, which is not very informative when examining marital fertility decline. Mixing

the two models, levels and pace, can lead to difficulties when interpreting the estimates and is generally not recommended.

ESTIMATES OVER TIME

I will also examine the possibility that estimates might change over time in some systematic way by interacting each independent variable with a time dummy. I include in the equation all these interactions, each time dummy, and leave out the constant. This one large OLS regression generates exactly the same estimates as running eight separate OLS regressions, one for each time period, although the t-statistics will be slightly different. When looking at pace effects, first differences interacted with time dummies will be used.

INSTRUMENTAL VARIABLES

Because marital fertility and legitimate infant mortality both impact each other simultaneously, instrumental variables method might be appropriate. The difficulty is finding appropriate instruments for legitimate infant mortality. As in Galloway et al. (1998b:190-193) I will use the age specific death rate of males 30-34, ASDR, as an instrument for the legitimate infant mortality rate in two stage least squares (TSLS) in the Kreis analysis. This measure is likely correlated with legitimate infant mortality, but should have little relationship to marital fertility. Unfortunately, it is only available at the Regierungsbezirk level, a kind of large county. There were 36 Regierungsbezirke in Prussia, so with 407 Kreise, there were on average about 11 Kreise in each Regirungsbezirke. The Regierungsbezirk death rate of males 30-34 is used for each Kreis in the Regierungsbezirk.

The same instrument is available for the city analysis. However, there is an additional instrument that can be used for cities, the cumulative municipal sanitation bond debt per capita, SANITATION, a useful indicator of the development of sanitation infrastructure (Galloway et al. 1998b:193). This should be highly correlated with legitimate infant mortality, but should have little impact on marital fertility, other than some improvement in the health of females of reproductive age which might lead to fewer stillbirths.

The value of TSLS estimates is largely a function of the quality of the instruments chosen, and this is often difficult to assess. There are a few diagnostic procedures that can be helpful. Table 3 lists the various possible models, along with some tests for the appropriate instruments. As I mentioned, I am not too concerned with level effects, because they give little information about marital fertility change. ASDR will be used as an instrument for legitimate infant mortality in the Kreis analysis. In the city analysis, the instruments ASDR and SANITATION together lead to an over-identified model, according to the Sargan test shown in Table 3. So one should be dropped. The first stage F-statistic with the SANITATION instrument is over ten, while the first stage F-statistic with the ASDR instrument is about four. So SANITATION is chosen as the instrument for legitimate infant mortality in the city analysis.

Results for both OLS and TSLS will be shown.

Results for level effects in Kreise and cities

The regression results for the level effects are found at the top of Table 4 (for Kreise) and the top of Table 5 (for cities). The most important indicator of marital fertility level, as was found in most earlier studies, was percent Catholic. This is seen

most clearly in the incremental contribution to R^2 in Figure 2. The Social Democracy variable is negative and significant as expected. Its estimates become more important over time.

Results for pace effects in Kreise

The fixed effects results are shown at the bottom of Table 4. All of the signs of the significant estimates are in the expected direction except the sign on change in percent Catholic, which is negative. This may have something to do with migration of Catholics into areas of rapid marital fertility decline, probably cities. However, as will be shown, the Catholic variable is relatively unimportant. None of the estimates show any particular systematic change over time.

The incremental contribution to R^2 is shown in Figure 3. However, a more useful indicator of the importance of a variable is its contribution to the change in predicted GMFR from 1875 to 1910. This is shown in Figure 4, for both OLS and TSLS, along with a graph of the actual and predicted GMFR over time. The actual decline in the average GMFR in the Kreise of Prussia from 1875 to 1910 was -54.5. The OLS model predicts -44.8, and TSLS model predicts -46.2, a small improvement. The five most important indicators of marital fertility decline in both OLS and TSLS are an increase in the female labor force participation rate in non-traditional sectors, a rise in the concentration of insurance workers, an increase in the concentration of post, railway, and telegraph workers, a decrease in the legitimate infant mortality rate, and an increase in percent voting Social Democratic. Note in the TSLS model, increasing legitimate infant mortality almost doubles its contribution to predicted marital fertility decline when compared to the OLS model.

Figure 4 shows the model is a very good predictor of marital fertility change on average. To see its ability to predict marital fertility change in extreme cases, Figure 7 graphs actual and predicted marital fertility decline in Kreise having the fastest decline in marital fertility in Prussia from 1875 to 1910. Figure 8 shows actual and predicted marital fertility in Kreise in which marital fertility increased the fastest from 1875 to 1910. The model predicts well in all cases.

Results for pace effects in cities

The results for the cities are shown in Table 5 and summarized graphically in Figure 5. Table 5 shows that all the signs of the significant estimates are in the expected direction. Figure 5 also shows that the average decline in GMFR from 1875 to 1910 in the cities is 116.9, more than twice that of the average decline in the Kreise. Predicted decline from the OLS model is -103.1, from the TSLS model -105.4. The two most important contributors to predicted GMFR decline in the cities are increases in the female labor force participation rate and decreases in the legitimate infant mortality rate. A increase in percent voting Social Democratic is one of the most important predictors, but numerically not as important in the cities as in the Kreise.

Curiously, in TSLS the concentration of health care workers estimate is borderline significant (p-value is .12), yet it is an important component as a predictor of marital fertility change in the cities in TSLS, and the sign is unexpectedly positive. Perhaps this suggests that health care workers in the cities worked more toward preventing maternal diseases that affected fetal survival, thus increasing the birth rate.

As in the Kreise, legitimate infant mortality's contribution to predicted GMFR is higher in TSLS compared with OLS, but in the cities the increase is a striking threefold.

Actual and predicted marital fertility in the cities where marital fertility declined fastest from 1875 to 1910 is shown in Figure 9. Actual and predicted marital fertility in the cities where marital fertility declined slowest from 1875 to 1910 is shown in Figure 10.

Summary of results for pace effects

A simple way to summarize all this information is provided in Figure 6, which shows the percent share (based on absolute values) of each variable's contribution to predicted marital fertility change from 1875 to 1910. Recall that the Kreise in the Kreis data set are on average about 70 percent rural, while the cities in the city data set are obviously 100 percent urban.

The religion and language variables are never important in either Kreise or cities.

The financial and communications structural variables are very important in the Kreise, but quite a bit less so in the cities. The education variable, teachers per school-age children, is likewise important in the Kreise, but not so much so in the cities. Percent voting Social Democratic is important in both Kreise and cities, but more important in the Kreise than in the cities, perhaps because in cities the liberal attitudes associated with marital fertility decline had begun to spread across other parts of the political spectrum..

Female labor force participation in non-traditional sectors is important in both Kreise and cities, but more so in the cities. Legitimate infant mortality is much more important in the cities than in the Kreise. Income is only important in the cities.

The average decline in marital fertility was over twice as fast in the cities as in the Kreise (Figures 4 and 5). Thus we can see the Kreise data set as representing a slower and more rural fertility transition, when compared to the cities. Very broadly

speaking, those variables involved with the dissemination of information (education, communications, perhaps Social Democracy) along with those variables which can be seen as substitutes for children (banking and insurance services) are more important in the Kreise than in the cities. Variables that are more associated with increasing costs of children (female labor force participation and income), along with infant mortality, are more important in the cities than in the Kreise.

Conclusions

OLS and TSLS generate about the same general results, with the remarkable exception of the legitimate infant mortality rate. The importance of the legitimate infant mortality rate increases substantially in TSLS.

Analysis within the context of theoretically important socioeconomic variables indicates that the percent voting Social Democrat variable is a significant and important indicator of marital fertility level and change in both Kreise and cities of Prussia. An increase in percent voting Social Democrat is significantly associated with a decrease in marital fertility.

Other important variables associated with marital fertility decline were decreasing legitimate infant mortality rate, increasing female labor force participation rate in non-traditional sectors, and increasing concentrations of insurance workers, in both the Kreise and cities of Prussia. Increasing concentrations of teachers, post, telegraph, and railway workers were more important in Kreise, while rising income was more important in the cities.

Because the growth of Social Democracy in Prussia was importantly associated with fertility decline, implications for other areas are worth considering. The modern

welfare state and the communist state both evolved, though each with its own variations, from 19th century Social Democratic principles. Indeed, those states whose governments play a significant role in the lives of their citizens and which have their political roots in Social Democratic policy (see earlier quote by Ogg) have seen fertility decline to the lowest levels on the planet, even in the face of occasional pro-natalist policies and markedly different levels of economic development. These are the welfare states of Europe, Canada, Australia, Japan, and most existing and former communist states. The critical factors would appear to be the assumption by the state of traditionally important family functions (government programs like social security and workman's compensation), state-mandated gender equality in the labor force, compulsory child education, and abolition of child labor. These lead to decreased economic value of children and increased opportunity costs of child-bearing to the mother, which result in lower fertility.

Bibliography

(All Galloway references can be downloaded at www.patrickgalloway.com.)

Official Sources:

Germany. Statistisches Reichsamt, 1884-1891, *Monatshefte zur Statistik des Deutschen Reichs*.

Germany. Statistisches Reichsamt, 1873-1944, *Statistik des Deutschen Reichs*, Series 1 Volumes I-LXIII; Series 2 Volumes 1-601.

Germany. Statistisches Reichsamt, 1892-1943, *Viertelsjahreshefte zur Statistik des Deutschen Reichs*.

Prussia. Statistisches Landesamt, 1861-1934, *Preussische Statistik*, Berlin, Volumes 1-305.

Prussia. Statistisches Landesamt, 1864-1919, *Ergänzungshefte zur Zeitschrift des Königlich Preussischen Statistischen Bureaus*, Berlin, Volumes 1-46.

Other Sources:

Borntraeger, J., 1912, *Der Geburtenrückgang in Deutschland, seine Bewertung und Bekämpfung.* Berlin: Schoetz.

Brown, J, C. and Guinnane, T. W., 2002, "Fertility Transition in a Rural, Catholic Population: Bavaria 1880-1910", *Population Studies*, vol. 56, no. 1, pp. 35-49.

Cohen, B. and Montgomery, M., eds., 1998, *From Death to Births: Mortality Decline and Reproductive Change*, Washington D.C.: National Academy of Sciences.

Coale, A.J. and Watkins, S.C., eds., 1986, *The Decline of Fertility in Europe*. Princeton: Princeton University Press.

Dawson, W.H. 1912. *Social Insurance in Germany 1883-1911. Its History, Operation, Results.* London: Unwin.

Dribe, M., 2006, "Demand and Supply Factors in the Fertility Transition: A Disaggregated Analysis of Sweden 1880-1930", Social Science History Association.

Galloway, P.R., 1988 updated 2007, *Prussia vital registration and census data description tables 1849 to 1914 using Kreise and cities >20,000 as units of analysis*.

Galloway, P.R., 1992 updated 2007, *Prussia Code Book 1861-1914*.

Galloway, P.R., Lee, R.D., and Hammel, E.A., 1994, "Fertility decline in Prussia 1875 to 1910: a pooled cross-section time series analysis," *Population Studies*, vol. 48, no. 1, pp. 135-158.

Galloway, P.R., Lee, R.D., and Hammel, E.A., 1998a, "Urban versus rural: fertility decline in the cities and rural districts of Prussia, 1875 to 1910," *European Journal of Population*, vol. 14, pp. 209-264.

Galloway, P.R., Lee, R.D., and Hammel, E.A., 1998b, "Infant mortality and the fertility transition: macro evidence from Europe and new findings for Prussia," in Cohen, B. and Montgomery, M., eds., Chapter 6, pp. 182-226.

Guinnane T.W., and Ogilvie, S., 2008, "Institutions and Demographic Responses to Shocks: Württemberg, 1634-1870", Yale University Economics Department Working Paper No. 44.

Kintner, H.J., 1987, "The impact of breastfeeding patterns on regional differences in infant mortality in Germany, 1910", *European Journal of Population*, 3, pp. 233-261.

Knodel, J., 1974, *The Decline of Fertility in Germany, 1871-1939*, Princeton: Princeton University Press.

Knodel, J. and van de Walle, E., 1986, "Lessons from the past: policy implications of historical fertility studies", in Coale, A.J. and Watkins, S.C., eds. pp. 390-419.

Lesthaeghe, R., 1977, The *Decline of Belgian Fertility, 1800-1970*. Princeton: Princeton University Press.

Lesthaeghe, R. and Wilson, C., 1986, "Modes of production, secularization, and the pace of fertility decline in western Europe, 1870-1930", in Coale, A.J. and Watkins, S.C., eds. pp. 261-292.

Lesthaeghe, R. and Neidert, L., 2006, "The Second Demographic Transition in the US: Spatial Patterns and Correlates", Population Studies Center, Universityof Michigan.

Mitchell, B.R., 1981, *European Historical Statistics 1750-1975*, New York: Facts on File.

Notestein, F., 1953, "Economic problems of population change", Proceedings of the Eighth International Conference of Agricultural Economists, pp. 13-31.

Ogg, F.A., 1917, *Social Progress in Contemporary Europe*, New York: Macmillan.

Sheehan, J.J., 1978, *German Liberalism in the 19th Century,* Chicago: University of Chicago Press.

Shepherd, W.R., 1932, *Atlas of Medieval and Modern History*, New York: Holt, printed in Germany.

Trebilcock, C., 1981, *The Industrialization of the Continental Powers 1780-1914*, London: Longman.

Vogel, B., Nohlen, D. and Schultze, R., 1971, *Wahlen in Deutschland. Theorie, Geschichte, Dokumente, 1848-1970*, Berlin.

Wolf, J., 1912, *Der Geburtenrückgang: die Rationalisierung des Sexuallebens in unserer Zeit*, Jena: Fischer. NA

Galloway Prussia Series
(These are works about Prussia authored or co-authored by Galloway. They are available for download at www.patrickgalloway.com).

Galloway, P.R., 1988 updated 2007, *Prussia vital registration and census data description tables 1849 to 1914 using Kreise and cities >20,000 as units of analysis*.

Galloway, P.R., 1992 updated 2007, *Prussia Code Book 1861-1914*.

Galloway, P.R., Lee, R.D., and Hammel, E.A., 1994, "Fertility decline in Prussia 1875 to 1910: a pooled cross-section time series analysis," *Population Studies*, vol. 48, no. 1, pp. 135-158.

Lee, R.D., Galloway, P.R., and Hammel, E. A., "Fertility decline in Prussia: estimating influences on supply, demand and degree of control," *Demography*, 1994, vol. 31, no. 2, pp. 347-373.

Galloway, P.R., Lee, R.D., and Hammel, E.A., 1998, "Urban versus rural: fertility decline in the cities and rural districts of Prussia, 1875 to 1910," *European Journal of Population*, vol. 14, pp. 209-264.

Galloway, P.R., Lee, R.D., and Hammel, E.A., 1998, "Infant mortality and the fertility transition: macro evidence from Europe and new findings for Prussia," in Cohen, B. and Montgomery, M., eds., *From Death to Births: Mortality Decline and Reproductive Change*, Washington D.C.: National Academy of Sciences, Chapter 6, pp. 182-226.

Galloway, P.R., 2007, *Galloway Prussia Database 1861 to 1914*.

Galloway, P.R., 2009, “Fertility decline and Social Democracy in Prussia 1875 to 1910”.

Forthcoming:

Galloway, P.R., forthcoming, “Infant mortality decline in Prussia 1875 to 1910”.

Galloway, P.R., forthcoming, “Nonmarital fertility decline in Prussia 1875 to 1910”.

Galloway, P.R., forthcoming, “Mortality of infants born to unmarried women in Prussia 1875 to 1910”.

Galloway, P.R., forthcoming, “Short-run fluctuations in fertility, nuptiality, and mortality in Prussia 1875 to 1910”.

Galloway, P.R., forthcoming, “A population reconstruction of regions and cities of Prussia from 1688 to 1910 using annual inverse projection”.

Galloway, P.R., forthcoming, “Regional variations in fertility decline in Prussia 1875 to 1910”.

Table 1. Votes for Social Democratic Party in Prussia 1871 to 1912.

Year	Total votes	Social Democratic Party votes	Social Democratic votes as percent of all votes
1871	2,280,775	69,733	3.06%
1874	2,889,353	154,279	5.34%
1878	3,489,909	200,452	5.74%
1881	3,155,375	131,746	4.18%
1884	3,447,751	259,577	7.53%
1887	4,530,500	393,635	8.69%
1890	4,352,610	757,412	17.40%
1893	4,656,404	963,307	20.69%
1898	4,723,546	1,141,958	24.18%
1903	5,749,492	1,649,998	28.70%
1907	6,881,586	1,816,959	26.40%
1912	7,486,999	2,407,318	32.15%

Note: The anti-socialist laws were in effect from 1878 to early 1890.

Sources:
Monatshefte zur Statistik des Deutschen Reichs 1885, 1887, 1890.
Statistik des Deutschen Reichs 14, 37, 53, 250.
Viertelsjahreshefte zur Statistik des Deutschen Reichs 1893, 1903.

Table 2. Variables used in the analysis.

Name	Definition	Expected Sign Kreise	Cities	Detailed discussion
GMFR	General marital fertility rate, the dependent variable = (legitimate births*1000/married females 15-49)			Galloway et al. 1994:142, 1998a:213
CATH	Catholic population * 100 / total population	+	+	Galloway et al. 1994:144, 1998a:215
SLAV	Slavic speaking population * 100 / total population	+	+	Galloway et al. 1994:144, 1998a:222
CHURCH	Religious employees * 100 / population over age 20	+	+	Galloway et al. 1994:144, 1998a:222
TEACH	Teaching employees * 100 / population aged 6-13	-	-	Galloway et al. 1994:145, 1998a:222
HEALTH	Health employees * 100 / total population	-	-	Galloway et al. 1994:145, 1998a:223
FLFPR	Female labor force participation rate excluding agriculture and service = (employed females excluding agriculture and service * 100 / female population aged 20-69)	-	-	Galloway et al. 1994:145, 1998a:223
INCOME	Average real income of male elementary school teachers (in 1900 Marks)	-	-	Galloway et al. 1994:146, 1998a:224
MINING	Mining employees * 100 / all employed persons	+	+	Galloway et al. 1994:147, 1998a:224
MANU	Manufacturing employees * 100 / all employed persons		+	Galloway et al. 1998a:225
URBAN	Urban population * 100 / total population	-		Galloway et al. 1994:147
BANK	Banking employees * 100 / population over age 20	-	-	Galloway et al. 1994:148, 1998a:226
INSUR	Insurance employees * 100 / population over age 20	-	-	Galloway et al. 1994:148, 1998a:227
POST	Post, telegraph, railway employees * 100 / population over age 20	-	-	Galloway et al. 1994:148, 1998a:227
POPC	Population (in thousands)		-	Galloway et al. 1998a:227
IMRL	Legitimate infant mortality rate = (legitimate deaths under age 1*1000 / legitimate births)	+	+	Galloway et al. 1994:149, 1998a:228
MARRIED	Married males / married females	+	+	Galloway et al. 1994:149, 1998a:228
SOCDEM	Social Democratic Party votes * 100 / total votes	-	-	See text.
Instruments for IMRL:				
ASDR	Age specific death rate of males 30-34			Galloway et al. 1998b:192. See text.
SANITATION	Cumulative municipal sanitation bond debt per capita			Galloway et al. 1998b:193. See text.

Notes: URBAN is used only in the analysis of Kreise. MANU, POPC, and SANITATION are used only in the analysis of cities.
In the figures which follow, the short names for the variables are truncated to four characters to save space, e.g., INCOME becomes INCO.
Sources: *Preussische Statistik* and *Statistik des Deutschen Reichs*. See also Galloway et al. (1994:139, 1998a:216-218).
SOCDEM sources are in Table 1.

Table 3. Two stage least squares diagnostic tests.

Model	Importance for understanding fertility change	Instruments for IMRL	Hausman test p-value: Null hypothesis is OLS estimates are consistent (low p-value rejects consistency of OLS estimates, providing support for TSLS)	Sargan over-identification test p-value: Null hypothesis is all instruments are valid (low p-value rejects the validity of all instruments)	First-stage F-statistic: (a value less than 10 may indicate weak instruments)	Preferred for understanding fertility change
Eq 1K Kreis level	Little	ASDR	.0238	Not applicable	8.9274	
Eq 2K Kreis pace	Much	ASDR	.2799	Not applicable	21.9699	This one. Results are in Table 4.
Eq 1C City level	Little	ASDR and SANITATION	.5953	.0700	.9590	
Eq 1C City level	Little	ASDR	.9340	Not applicable	1.8687	
Eq 1C City level	Little	SANITATION	.0408	Not applicable	.1341	
Eq 2C City pace	Much	ASDR and SANITATION	.0000	.0028	6.8906	
Eq 2C City pace	Much	ASDR	.0000	Not applicable	4.2676	
Eq 2C City pace	Much	SANITATION	.0239	Not applicable	10.6639	This one. Results are in Table 5.

Note: ASDR is available for Kreise and cities. SANITATION is available only for cities.

Table 4. Regression results for all Kreise in Prussia 1875 to 1910. The dependent variable is GMFR.

Eq 1K-OLS. Kreis level effects OLS
Between groups estimates using 407 observations.
Uses data for 407 Kreise. Data for each Kreis is the average of 1875, 1880, 1885, 1890, 1895, 1900, 1905, 1910.

Variable	*Expected Sign*	*Coefficient*	*t-statistic*	*p-value*	
constant		174.6140	3.7621	0.00019	***
CATH	+	0.6207	12.6428	<0.00001	***
SLAV	+	0.3408	5.0627	<0.00001	***
CHURCH	+	-3.2463	-0.2783	0.78092	
TEACH	-	-6.2497	-2.1448	0.03259	**
HEALTH	-	-33.8392	-2.2114	0.02758	**
FLFPR	-	-0.2752	-0.9734	0.33095	
INCOME	-	-0.0044	-0.4024	0.68759	
MINING	+	0.9956	3.5226	0.00048	***
URBAN	-	0.0561	0.5250	0.59985	
BANK	-	-30.1941	-1.3820	0.16778	
INSUR	-	44.3383	1.8117	0.07080	*
POST	-	-1.3006	-0.5303	0.59622	
IMRL	+	-0.0495	-1.7594	0.07929	*
MARRIED	+	104.0570	2.1710	0.03053	**
SOCDEM	-	-0.5529	-3.7524	0.00020	***

R-squared = 0.69228
Adjusted R-squared = 0.68048

Eq 1K-TSLS. Kreis level effects TSLS
Between groups estimates using 407 observations.
Uses data for 407 Kreise. Data for each Kreis is the average of 1875, 1880, 1885, 1890, 1895, 1900, 1905, 1910.

Variable	*Expected Sign*	*Coefficient*	*t-statistic*	*p-value*	
constant		226.3090	3.5025	0.00046	***
CATH	+	0.6322	10.3070	<0.00001	***
SLAV	+	0.1773	1.4245	0.15429	
CHURCH	+	3.7578	0.2502	0.80244	
TEACH	-	-6.5735	-1.8136	0.06974	*
HEALTH	-	-41.9382	-2.1451	0.03194	**
FLFPR	-	-1.6170	-1.9379	0.05264	*
INCOME	-	0.0324	1.3053	0.19180	
MINING	+	1.1616	3.1967	0.00139	***
URBAN	-	-0.0367	-0.2573	0.79696	
BANK	-	-0.3815	-0.0119	0.99047	
INSUR	-	-14.6470	-0.3250	0.74520	
POST	-	3.3824	0.8387	0.40161	
IMRL	+	0.3607	1.5413	0.12325	
MARRIED	+	-49.1303	-0.4682	0.63966	
SOCDEM	-	-0.6042	-3.2605	0.00111	***

R-squared = 0.55149
Adjusted R-squared= 0.53429

Eq 2K-OLS. Kreis pace effects OLS
Fixed effects estimates using 3256 observations.
Uses data for 407 Kreise for each of the periods 1875, 1880, 1885, 1890, 1895, 1900, 1905, 1910.
Estimates Kreis dummies are not shown.

Variable	*Expected Sign*	*Coefficient*	*t-statistic*	*p-value*	
CATH	+	-1.7887	-9.0756	<0.00001	***
SLAV	+	-0.2418	-1.1495	0.25043	
CHURCH	+	15.0996	4.1872	0.00003	***
TEACH	-	-6.7488	-5.1955	<0.00001	***
HEALTH	-	-6.9474	-1.4036	0.16055	
FLFPR	-	-0.8014	-4.8743	<0.00001	***
INCOME	-	0.0010	0.3725	0.70955	
MINING	+	0.8522	3.7649	0.00017	***
URBAN	-	0.1393	1.5444	0.12261	
BANK	-	-52.7958	-5.8080	<0.00001	***
INSUR	-	-120.5210	-12.4543	<0.00001	***
POST	-	-6.5485	-7.3148	<0.00001	***
IMRL	+	0.2470	14.3193	<0.00001	***
MARRIED	+	48.6623	2.5928	0.00957	***
SOCDEM	-	-0.4322	-10.7090	<0.00001	***

R-squared = 0.92277
Adjusted R-squared = 0.91129

Eq 2K-TSLS. Kreis pace effects TSLS
Fixed effects estimates using 3256 observations.
Uses data for 407 Kreise for each of the eight periods 1875, 1880, 1885, 1890, 1895, 1900, 1905, 1910.
Estimates Kreis dummies are not shown.

Variable	*Expected Sign*	*Coefficient*	*t-statistic*	*p-value*	
CATH	+	-1.6569	-6.8475	<0.00001	***
SLAV	+	-0.4609	-1.4896	0.13632	
CHURCH	+	18.7488	3.5869	0.00033	***
TEACH	-	-6.2006	-4.3047	0.00002	***
HEALTH	-	0.8299	0.0885	0.92948	
FLFPR	-	-0.7680	-4.4763	<0.00001	***
INCOME	-	0.0026	0.8038	0.42152	
MINING	+	0.7730	3.1542	0.00161	***
URBAN	-	0.0169	0.1090	0.91319	
BANK	-	-45.5876	-3.8533	0.00012	***
INSUR	-	-103.2380	-5.1259	<0.00001	***
POST	-	-5.1365	-3.0203	0.00252	***
IMRL	+	0.4444	2.2094	0.02715	**
MARRIED	+	24.1474	0.7684	0.44224	
SOCDEM	-	-0.4449	-10.2877	<0.00001	***

R-squared = 0.91927
Adjusted R-squared = 0.90727

Note: In both TSLS models, the instrument for the legitimate infant mortality rate is the death rate of males aged 30-34. See Table 3 and text for details.

Table 5. Regression results for 54 cities in Prussia 1875 to 1910. The dependent variable is GMFR.

Eq 1C-OLS. City level effects OLS
Between groups estimates using 54 observations.
Uses data for 54 cities. Data for each city is the average of 1875, 1880, 1885, 1890, 1895, 1900, 1905, 1910.

Variable	*Expected Sign*	*Coefficient*	*t-statistic*	*p-value*	
constant		403.2690	2.1629	0.03708	**
CATH	+	0.5357	4.0135	0.00028	***
SLAV	+	0.2497	0.9147	0.36627	
CHURCH	+	23.4423	1.1997	0.23788	
TEACH	-	-4.1902	-1.4168	0.16492	
HEALTH	-	-1.4460	-0.0788	0.93765	
FLFPR	-	-1.2165	-2.4068	0.02120	**
INCOME	-	0.0067	0.5929	0.55686	
MINING	+	1.7906	3.4288	0.00150	***
MANU	+	0.7697	2.3318	0.02527	**
BANK	-	-42.8295	-2.3336	0.02516	**
INSUR	-	22.2412	1.7155	0.09462	*
POST	-	-5.4160	-2.0348	0.04908	**
POPC	-	-0.0055	-0.4550	0.65180	
IMRL	+	-0.0474	-0.7264	0.47215	
MARRIED	+	-172.1960	-0.9574	0.34458	
SOCDEM	-	-0.1997	-0.8682	0.39090	

R-squared = 0.89057
Adjusted R-squared = 0.84325

Eq 1C-TSLS. City level effects TSLS
Between groups estimates using 54 observations.
Uses data for 54 cities. Data for each city is the average of 1875, 1880, 1885, 1890, 1895, 1900, 1905, 1910.

Variable	*Expected Sign*	*Coefficient*	*t-statistic*	*p-value*	
constant		421.5650	2.1060	0.03520	**
CATH	+	0.5664	3.5863	0.00034	***
SLAV	+	0.1964	0.6272	0.53052	
CHURCH	+	16.1803	0.6029	0.54655	
TEACH	-	-4.6623	-1.4139	0.15739	
HEALTH	-	-1.7323	-0.0900	0.92828	
FLFPR	-	-0.9619	-1.1929	0.23289	
INCOME	-	-0.0005	-0.0218	0.98262	
MINING	+	1.6025	2.2631	0.02363	**
MANU	+	0.5223	0.7628	0.44559	
BANK	-	-50.2202	-1.9237	0.05439	*
INSUR	-	27.9970	1.4486	0.14746	
POST	-	-6.1648	-1.8608	0.06277	*
POPC	-	0.0022	0.0969	0.92279	
IMRL	+	-0.1715	-0.5638	0.57291	
MARRIED	+	-142.4710	-0.7076	0.47921	
SOCDEM	-	-0.2392	-0.9242	0.35536	

R-squared = 0.88014
Adjusted R-squared = 0.82831

Eq 2C-OLS. City pace effects OLS
Fixed effects estimates using 432 observations.
Uses data for 54 cities for each of the eight periods 1875, 1880, 1885, 1890, 1895, 1900, 1905, 1910.
Estimates for city dummies are not shown.

Variable	*Expected Sign*	*Coefficient*	*t-statistic*	*p-value*	
CATH	+	0.1891	0.2808	0.77904	
SLAV	+	1.3896	1.6204	0.10602	
CHURCH	+	-5.6565	-0.5963	0.55137	
TEACH	-	-3.4583	-1.9564	0.05119	*
HEALTH	-	3.9771	0.2742	0.78409	
FLFPR	-	-3.3338	-6.5754	<0.00001	***
INCOME	-	-0.0189	-3.7442	0.00021	***
MINING	+	0.3012	0.5039	0.61462	
MANU	+	0.8254	2.0218	0.04394	**
BANK	-	-11.6006	-0.8889	0.37464	
INSUR	-	-38.8842	-2.5304	0.01182	**
POST	-	-5.3164	-1.9927	0.04705	**
POPC	-	-0.0283	-1.7291	0.08464	*
IMRL	+	0.3329	5.8055	<0.00001	***
MARRIED	+	335.4530	4.1526	0.00004	***
SOCDEM	-	-0.4568	-3.1743	0.00163	***

R-squared = 0.89890
Adjusted R-squared = 0.87963

Eq 2C-TSLS. City pace effects TSLS
Fixed effects estimates using 432 observations.
Uses data for 54 cities for each of the eight periods 1875, 1880, 1885, 1890, 1895, 1900, 1905, 1910.
Estimates for city dummies are not shown.

Variable	*Expected Sign*	*Coefficient*	*t-statistic*	*p-value*	
CATH	+	1.2659	1.2558	0.20918	
SLAV	+	-0.3854	-0.2680	0.78870	
CHURCH	+	7.0994	0.5300	0.59610	
TEACH	-	-3.6659	-1.7521	0.07976	*
HEALTH	-	45.1527	1.5453	0.12228	
FLFPR	-	-2.1410	-2.3515	0.01870	**
INCOME	-	-0.0231	-3.5887	0.00033	***
MINING	+	-0.3448	-0.4321	0.66566	
MANU	+	0.5166	1.0051	0.31487	
BANK	-	18.6799	0.8033	0.42178	
INSUR	-	-14.0833	-0.6101	0.54182	
POST	-	-2.6670	-0.7617	0.44622	
POPC	-	0.0146	0.4658	0.64136	
IMRL	+	1.0198	2.5459	0.01090	**
MARRIED	+	264.0150	2.5407	0.01106	**
SOCDEM	-	-0.4143	-2.4110	0.01591	**

R-squared = 0.86244
Adjusted R-squared = 0.83622

Note: In Eq 1C-TSLS, city level effects, the instruments for the legitimate infant mortality rate are the death rate of males 30-34 and a sanitation infrastructure variable. In Eq 2C-TSLS, city pace effects, the instrument for the legitimate infant mortality rate is a sanitation infrastructure variable.
See Table 3 and text for details.

Figure 1. Social Democratic Party votes as a percent of all votes in Prussia 1871 to 1912. Source : Table 1.

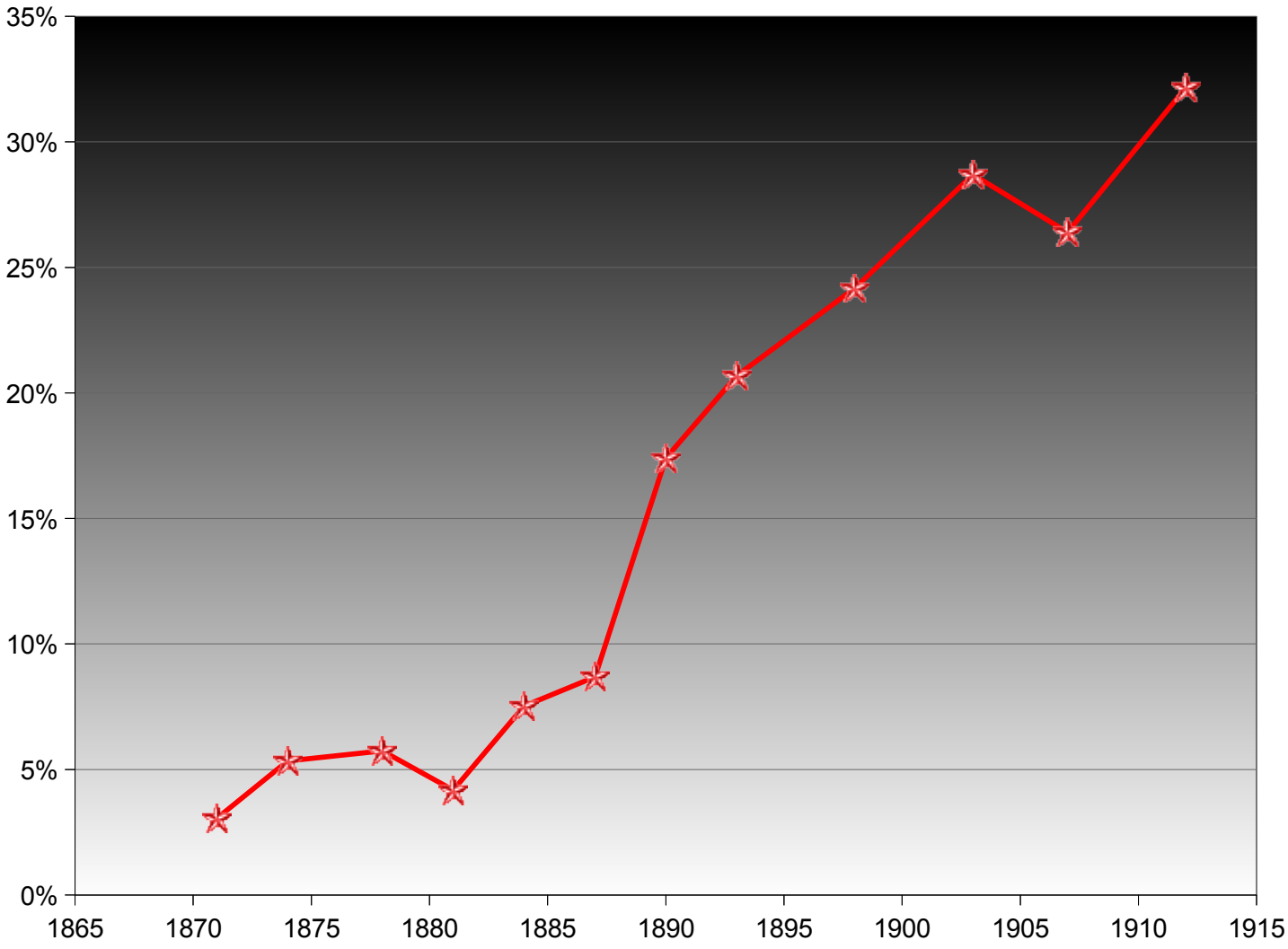
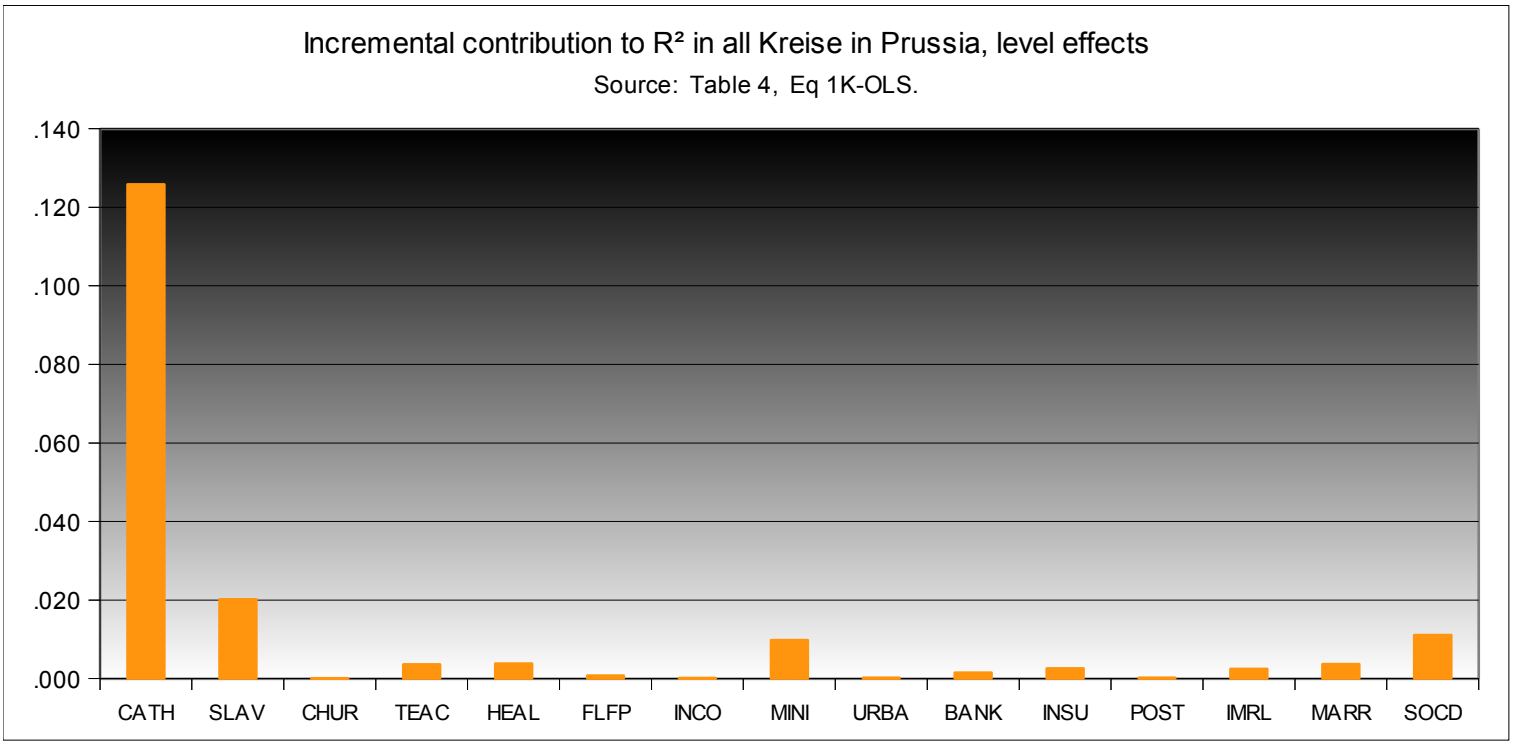


Figure 2. Incremental contribution to R^2 in all Kreise and 54 cities in Prussia, level effects



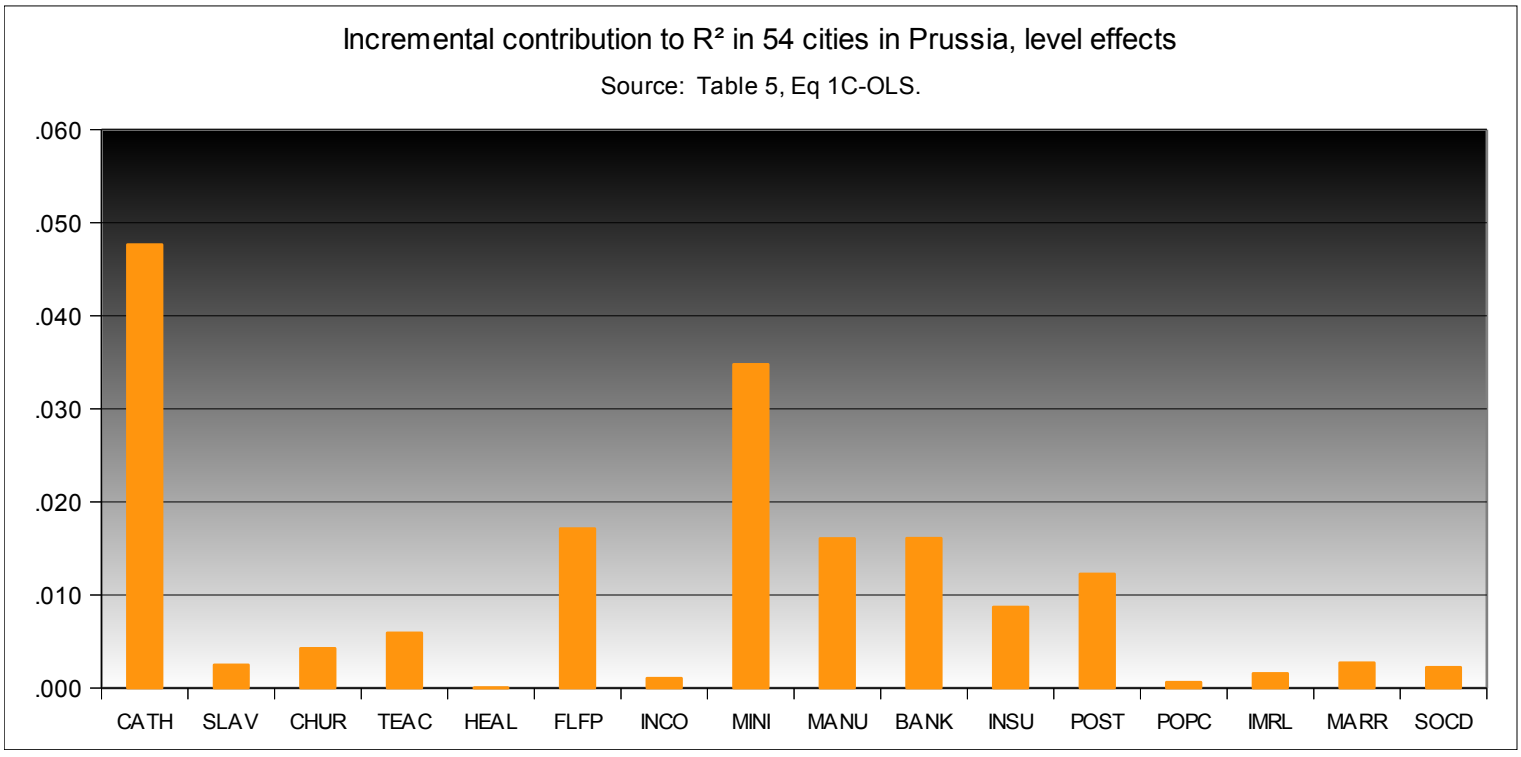
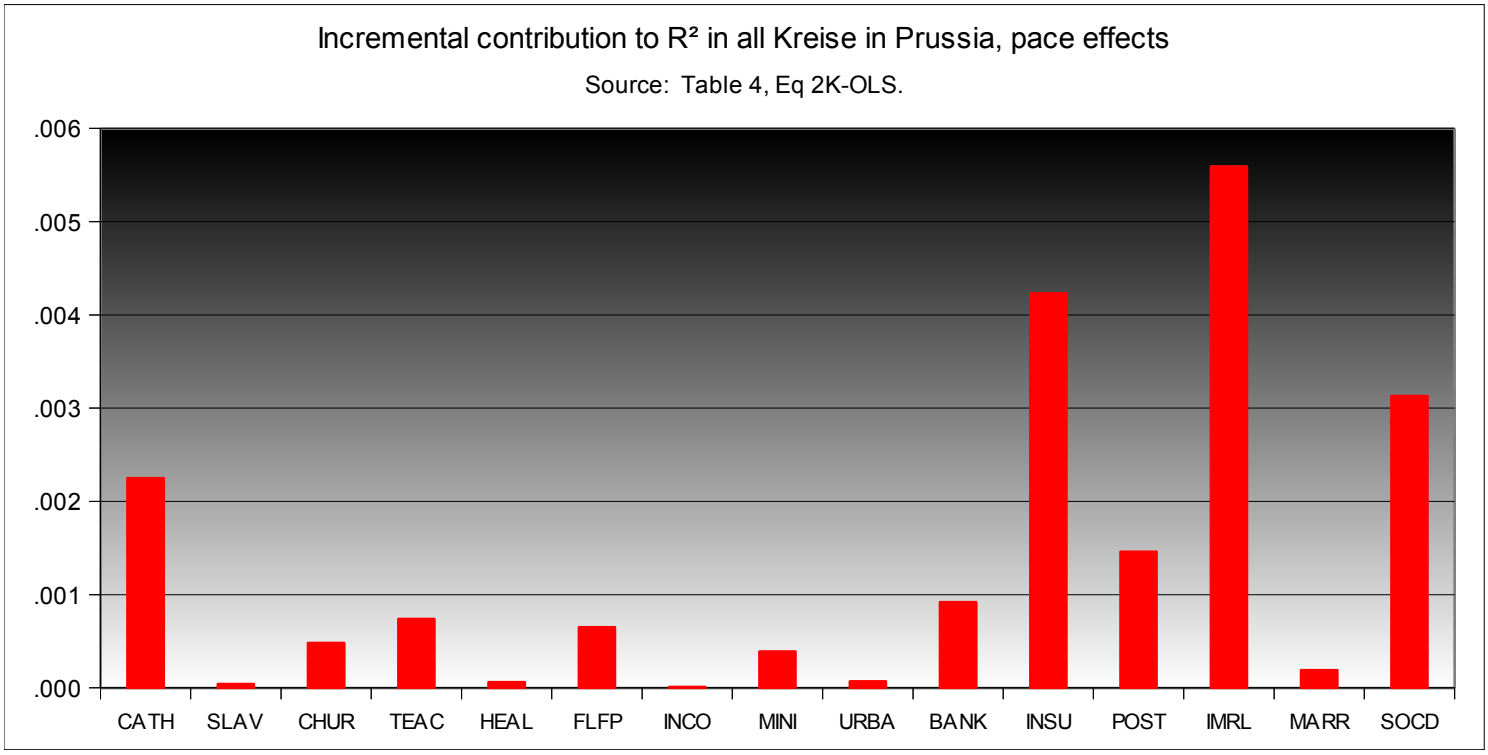


Figure 3. Incremental contribution to R^2 in all Kreise and 54 cities in Prussia, pace effects



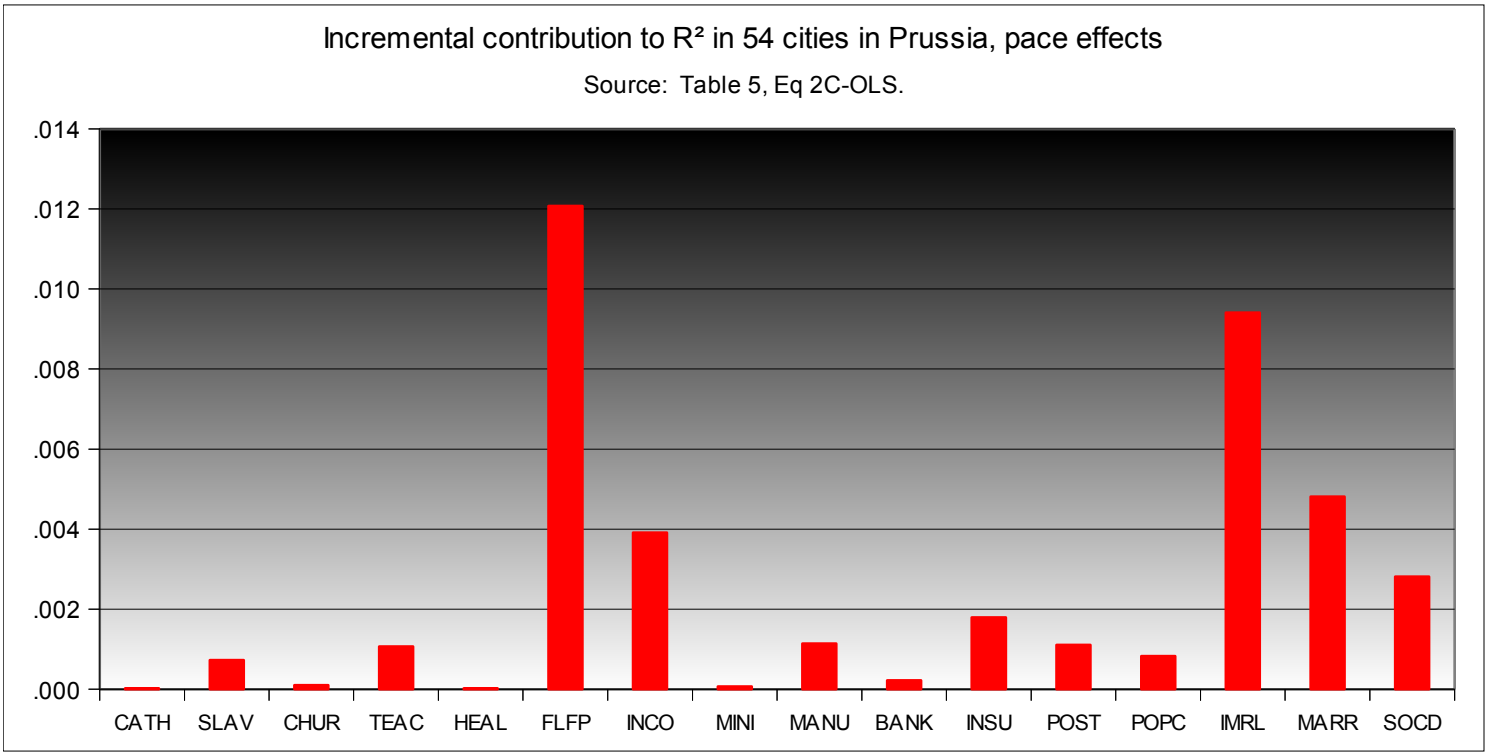
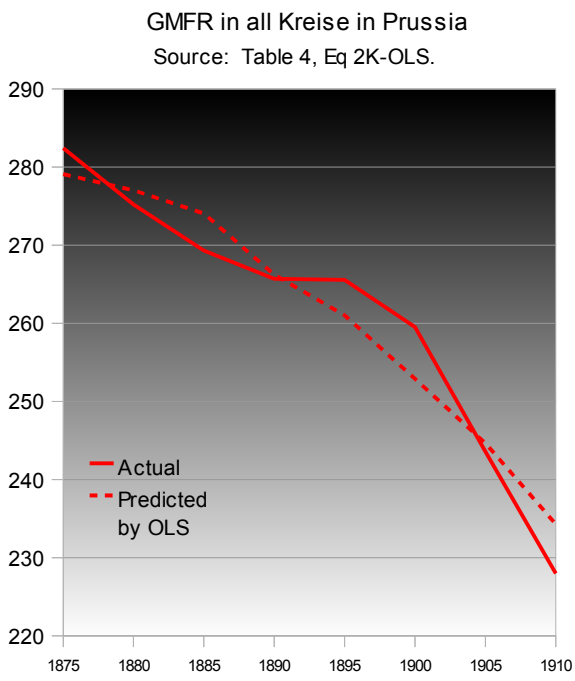
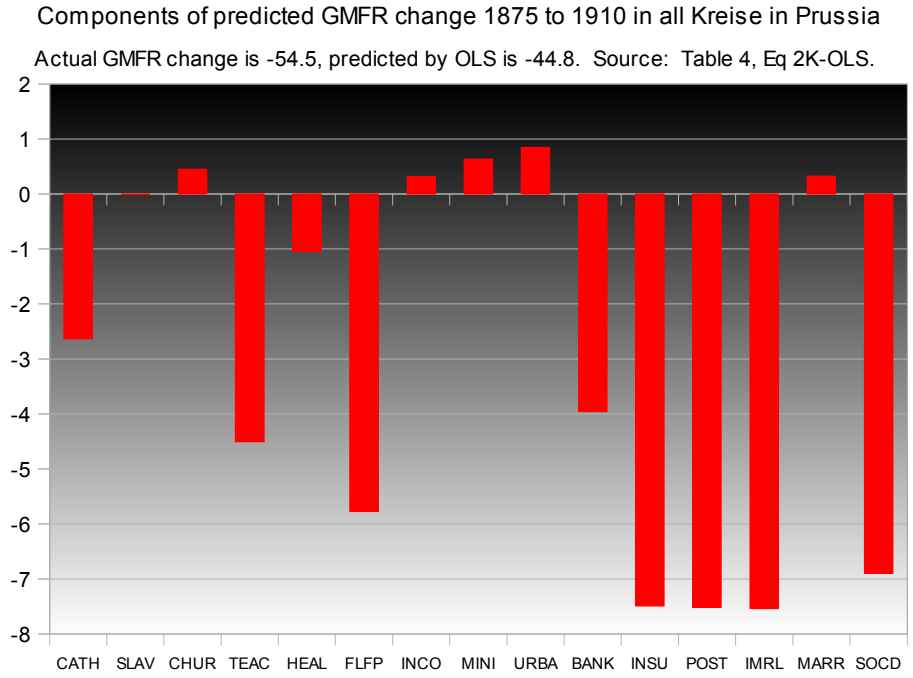
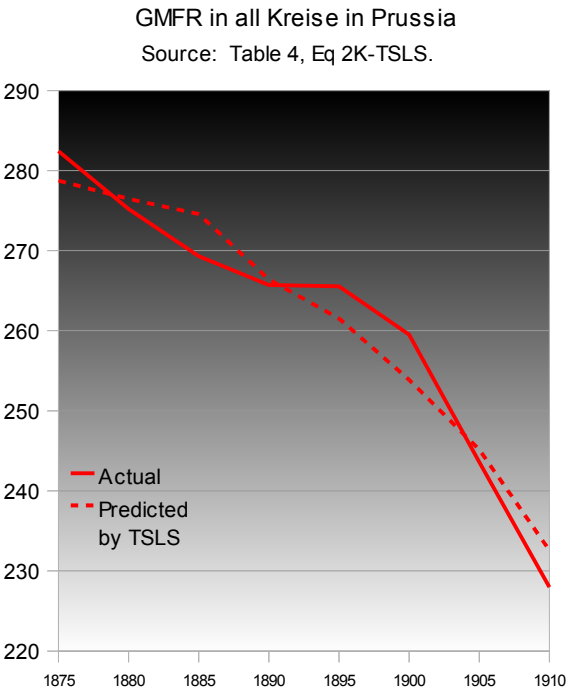


Figure 4. Actual GMFR, predicted GMFR, and components of predicted GMFR change 1875 to 1910 in all Kreise in Prussia.







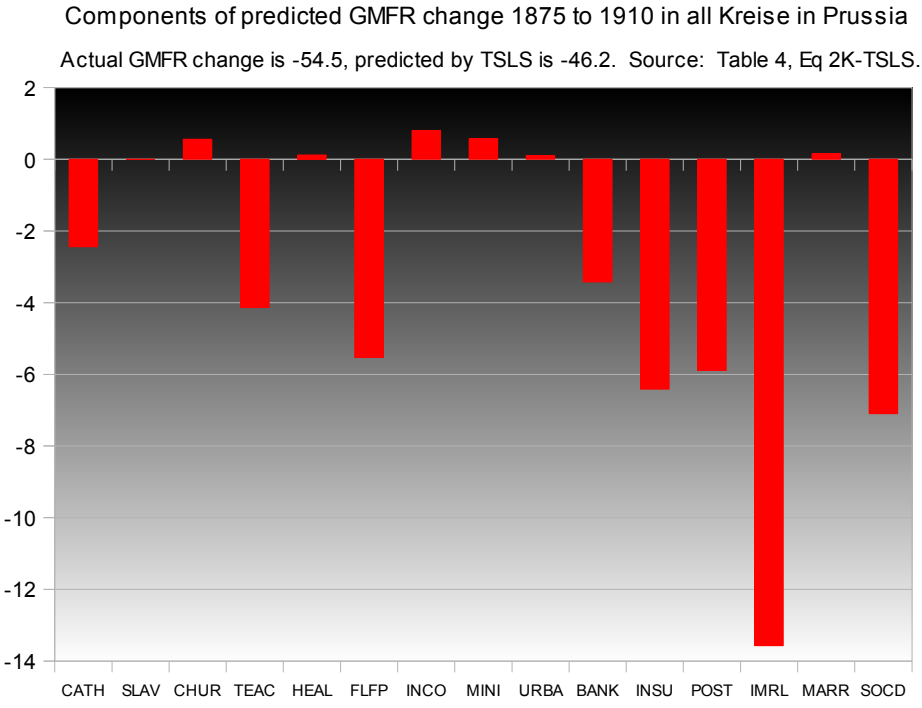
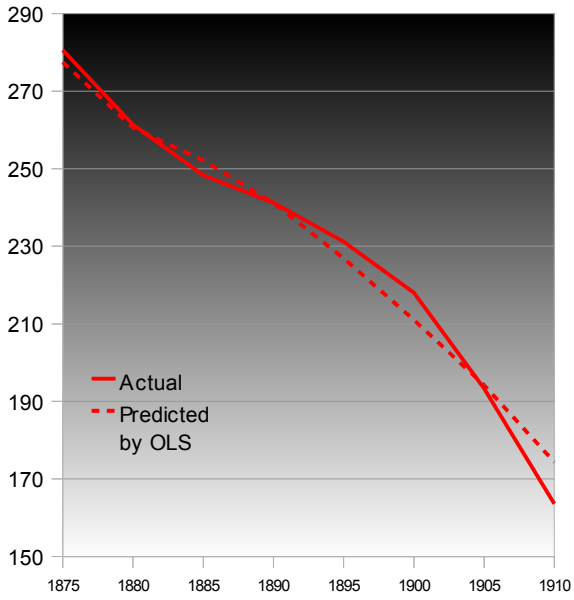


Figure 5. Actual GMFR, predicted GMFR, and components of predicted GMFR change 1875 to 1910 in 54 cities in Prussia.

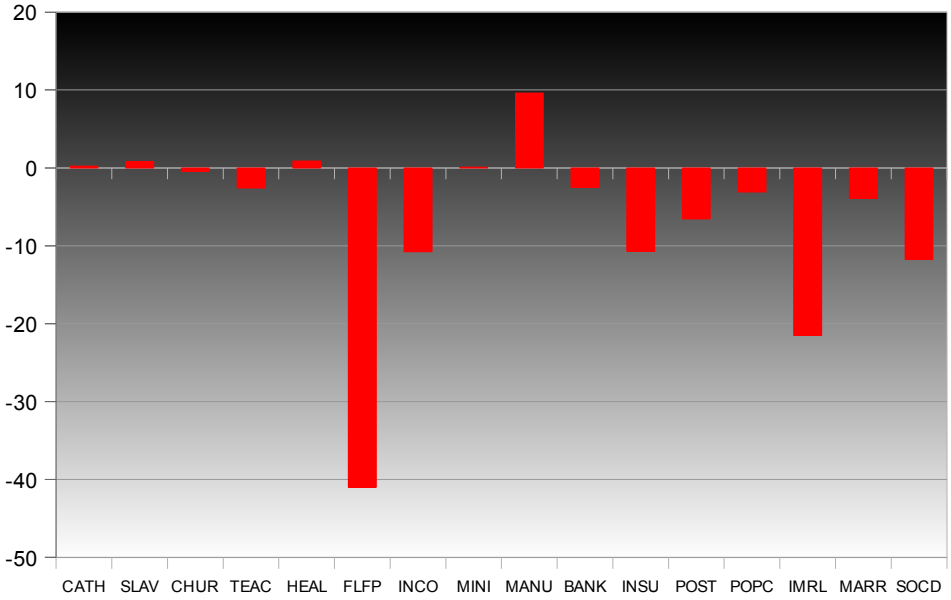
GMFR in 54 cities in Prussia

Source: Table 5, Eq 2C-OLS.



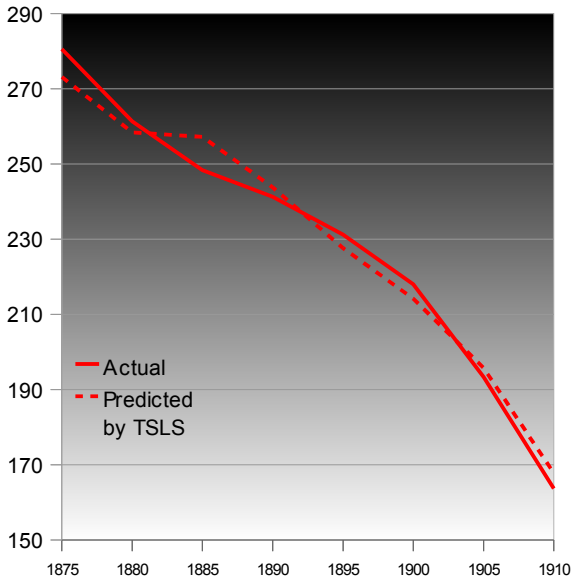
Components of predicted GMFR change 1875 to 1910 in 54 cities in Prussia

Actual GMFR change is -116.9, predicted by OLS is -103.1. Source: Table 5, Eq 2C-OLS.



GMFR in 54 cities in Prussia

Source: Table 5, Eq 2C-TSLS.



Components of predicted GMFR change 1875 to 1910 in 54 cities in Prussia

Actual GMFR change is -116.9, predicted by TSLS is -105.4. Source: Table 5, Eq 2C-TSLS.

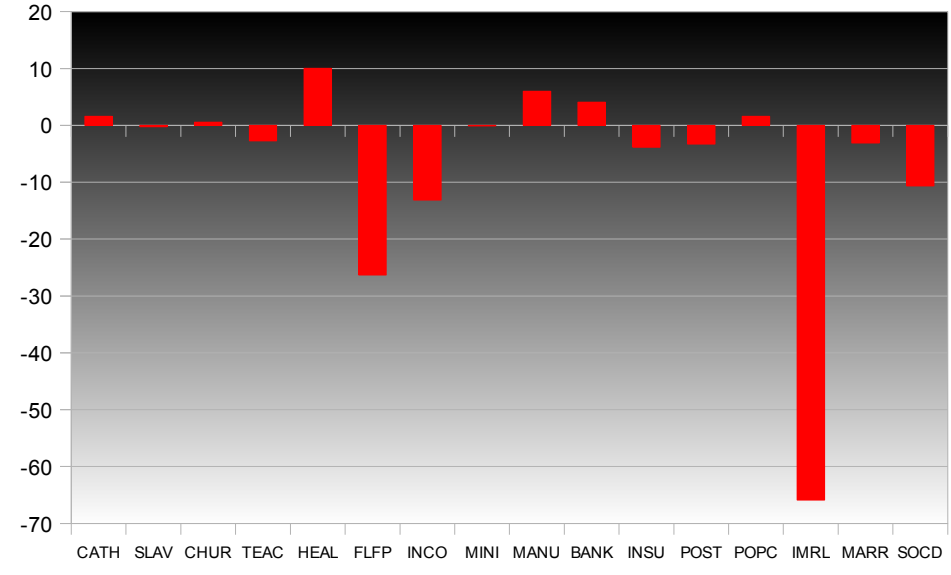
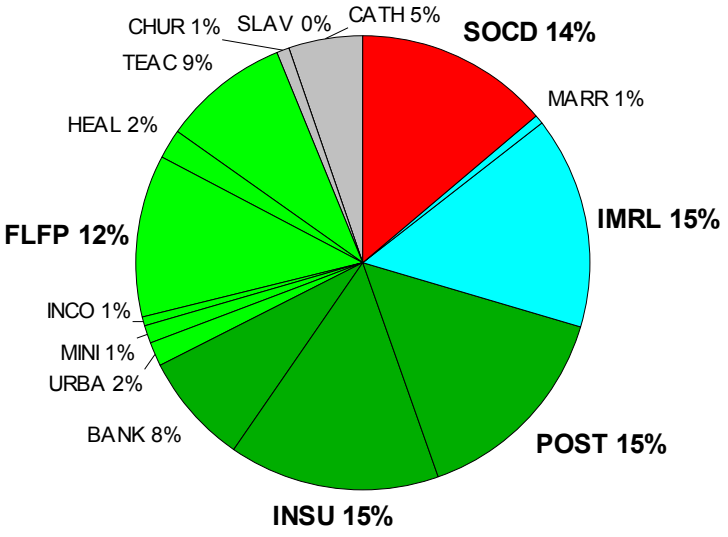


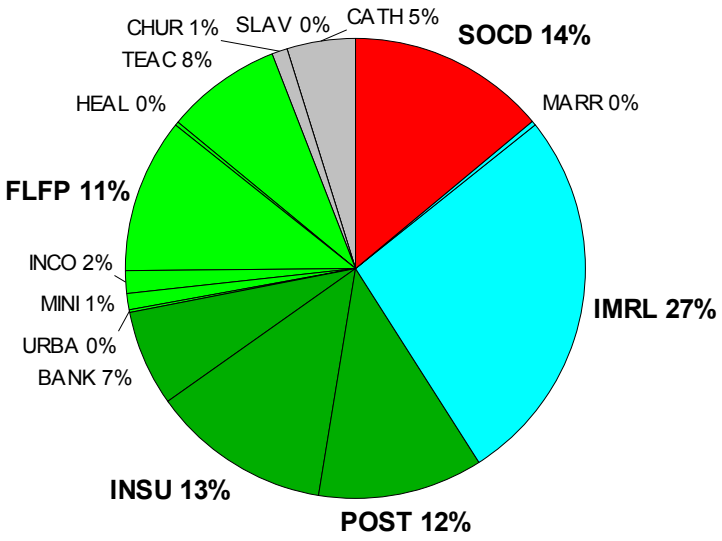
Figure 6. Components of predicted GMFR change 1875 to 1910 in all Kreise and in 54 cities in Prussia, percent share.

Percent share is based on absolute values. Highest five are in bold.
Gray is religion and language, light green is standard structural, dark green is financial and communications structural, blue is demographic, red is political/government.

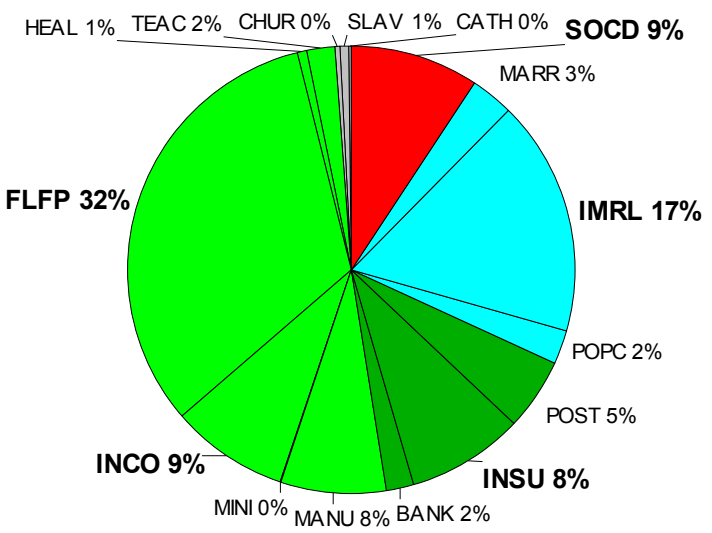
All Kreise in Prussia
Source: Table 4, Eq 2K-OLS.



All Kreise in Prussia
Source: Table 4, Eq 2K-TSLS.



54 cities in Prussia
Source: Table 5, Eq 2C-OLS.



54 cities in Prussia
Source: Table 5, Eq 2C-TSLS

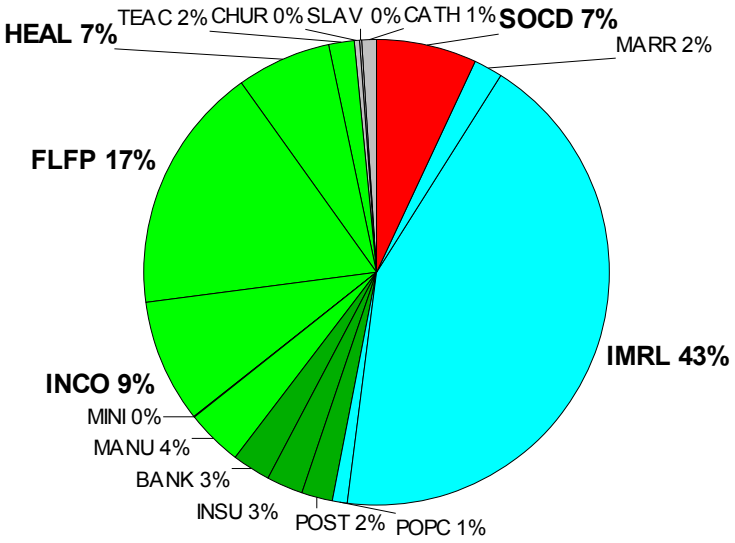
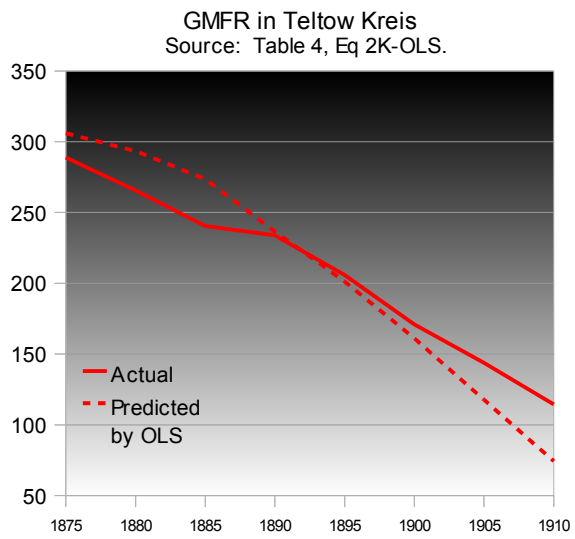
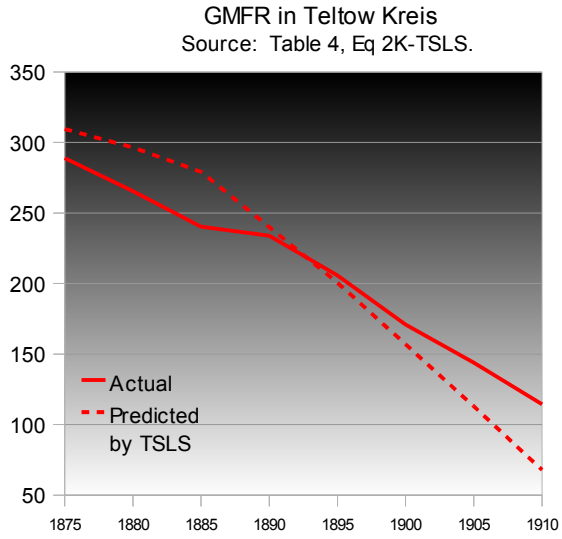
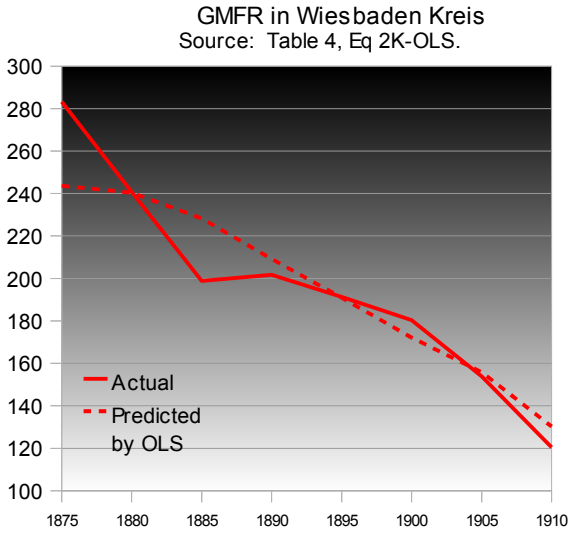
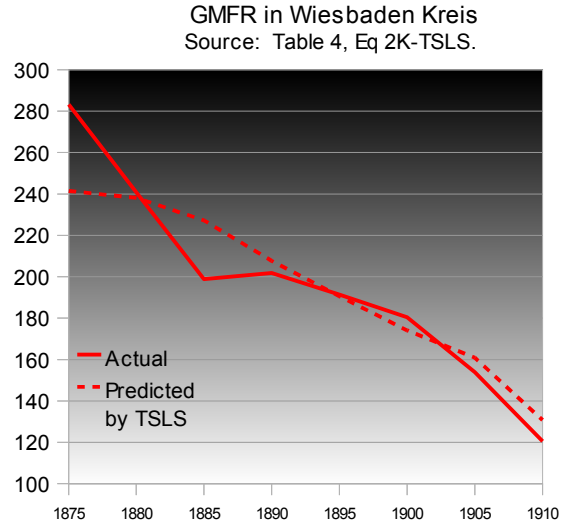


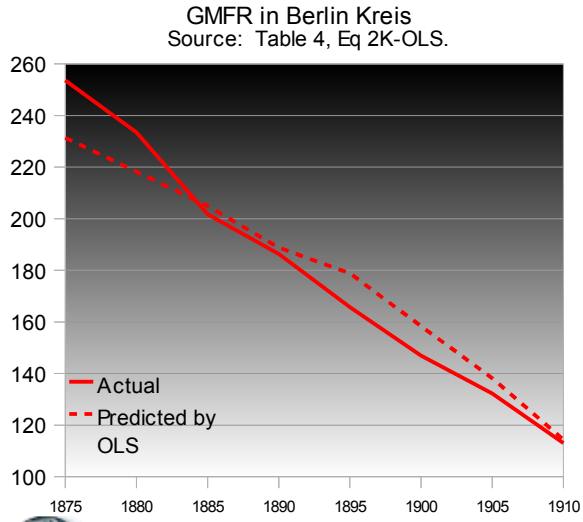
Figure 7. Actual and predicted GMFR in Kreise in Prussia with the greatest percent decline in GMFR from 1875 to 1910.











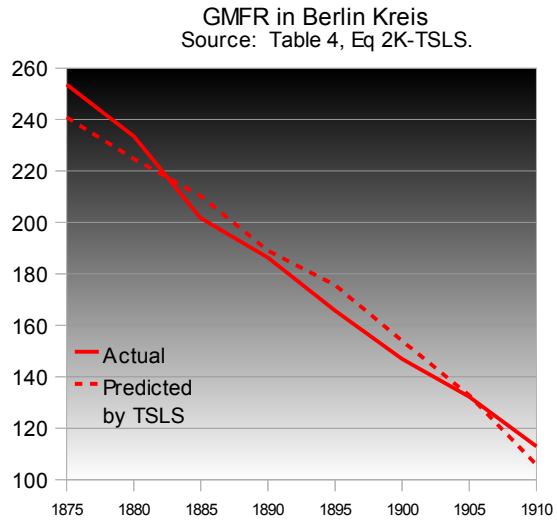
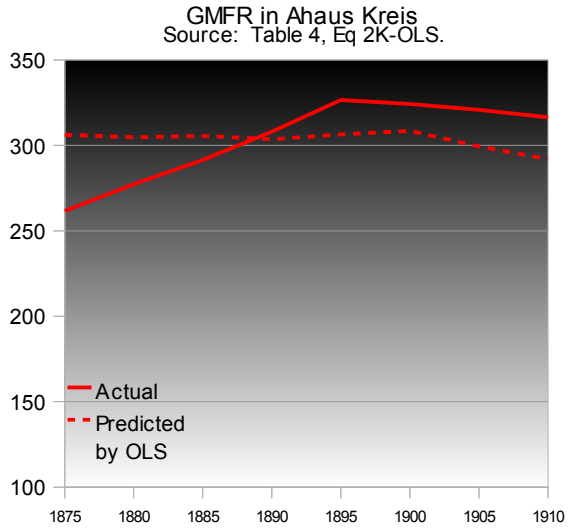
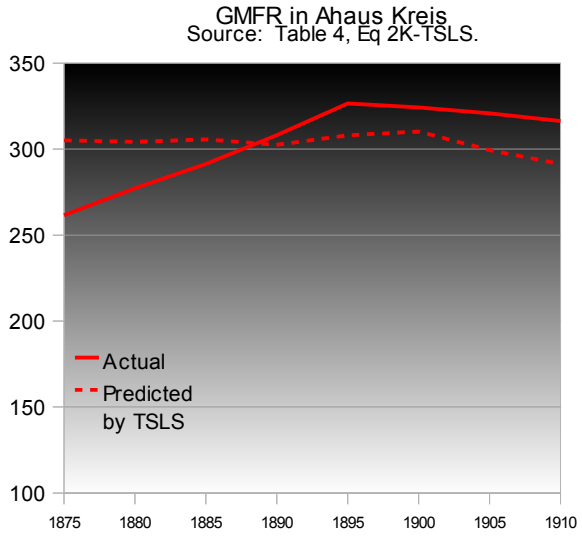
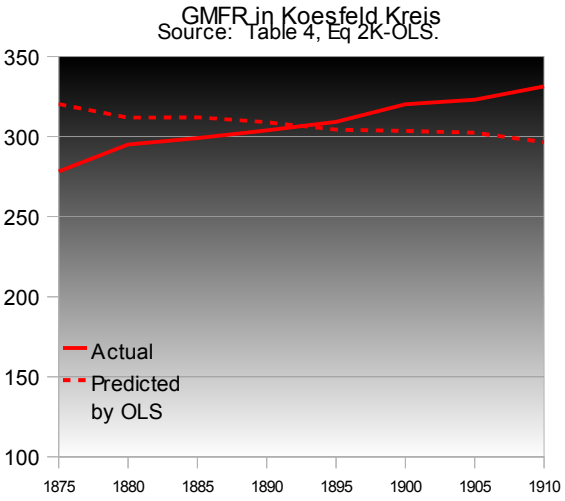
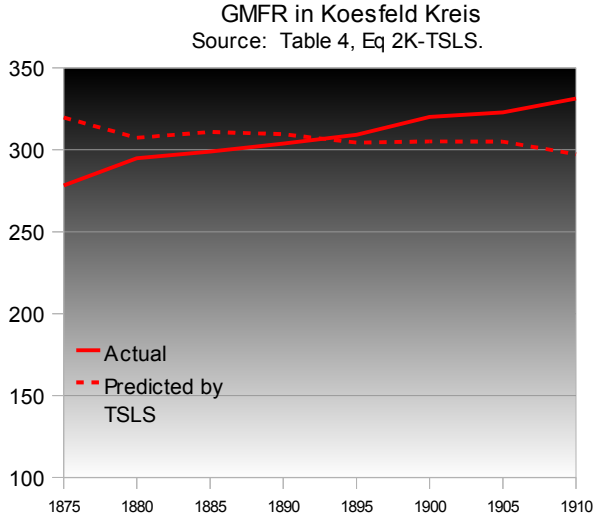


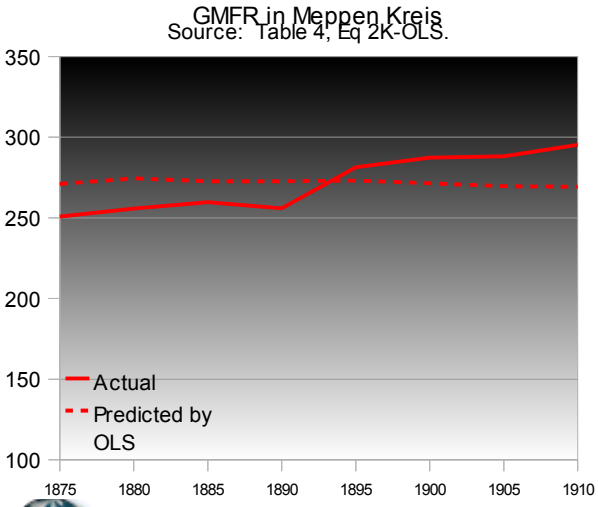
Figure 8. Actual and predicted GMFR in Kreise in Prussia with the greatest percent increase in GMFR from 1875 to 1910.











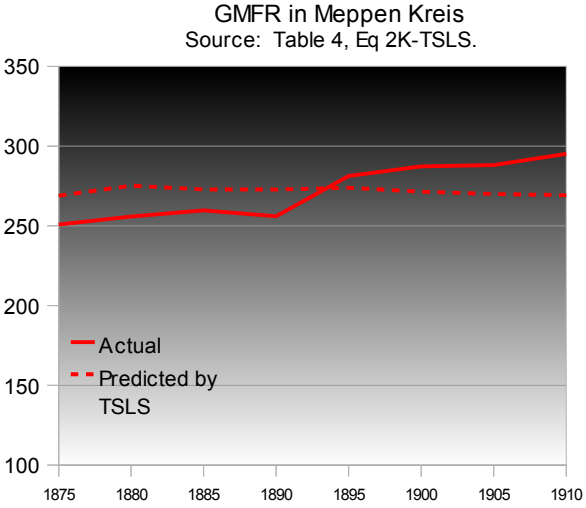
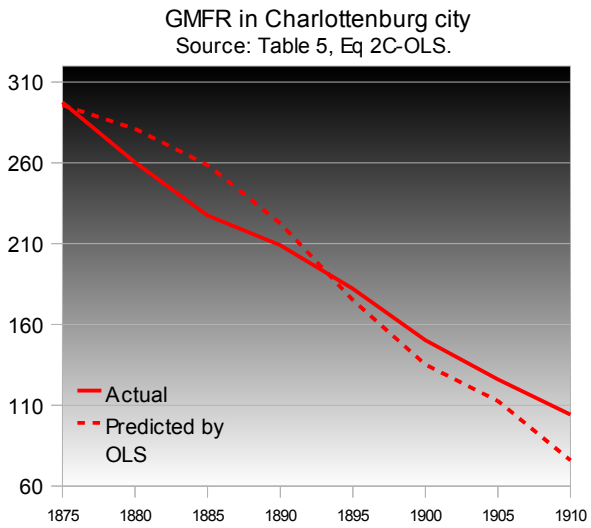
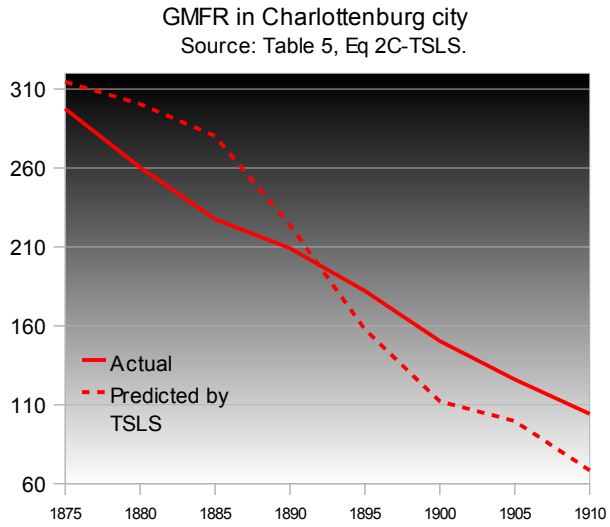
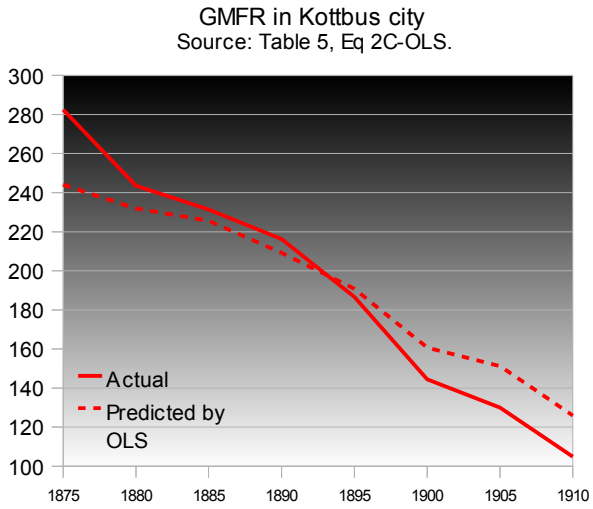
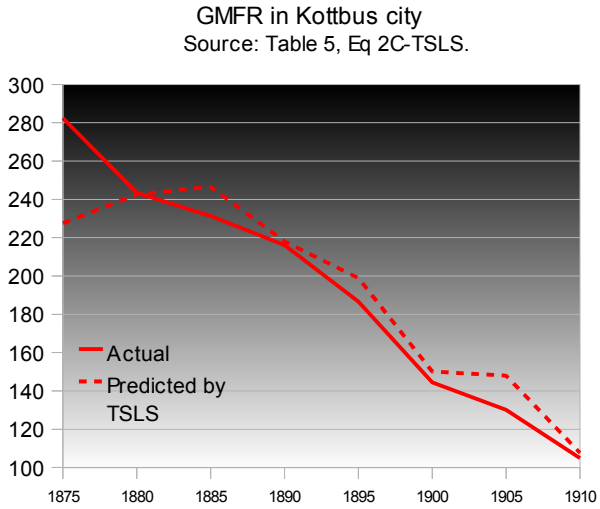


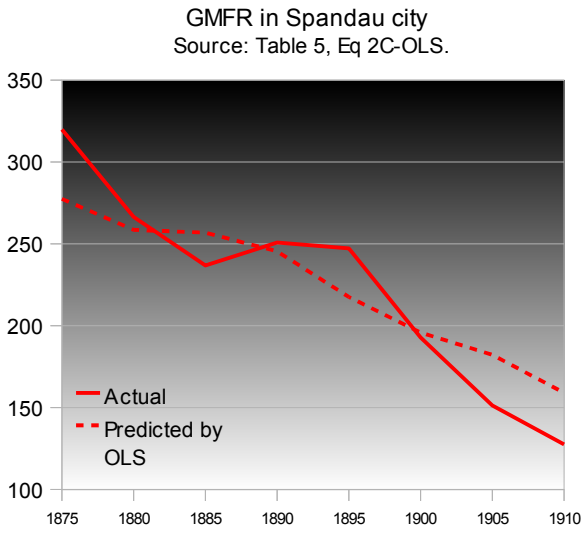
Figure 9. Actual and predicted GMFR in cities in Prussia with the greatest percent decline in GMFR from 1875 to 1910.











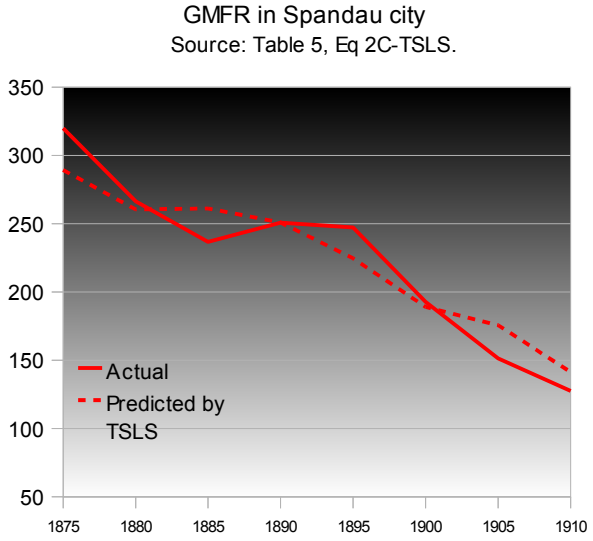
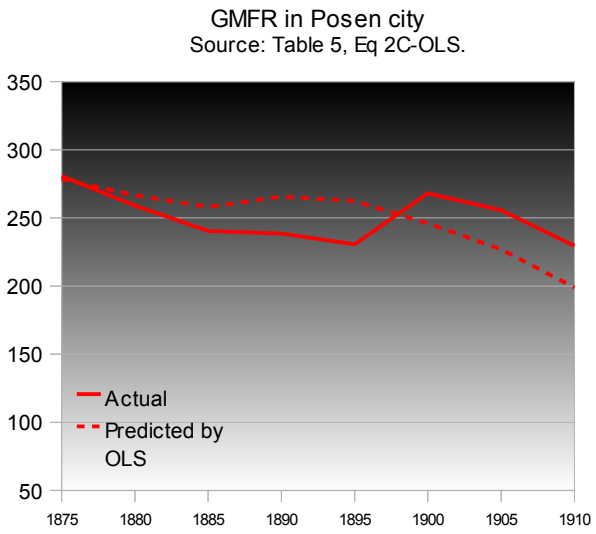
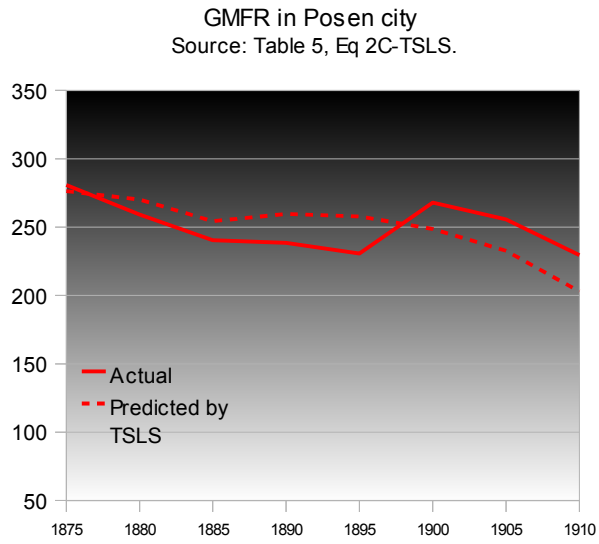
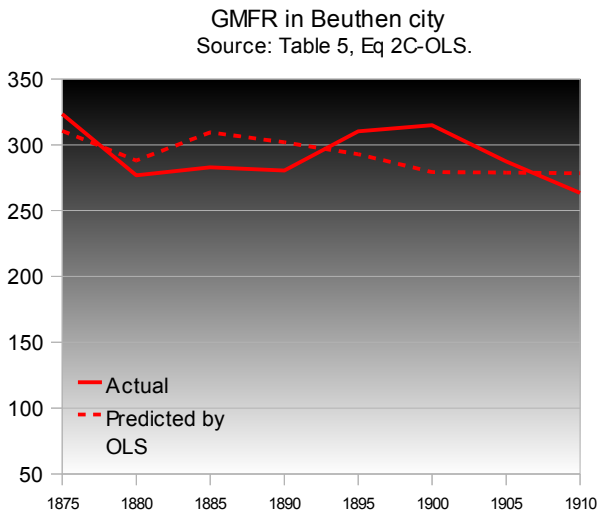
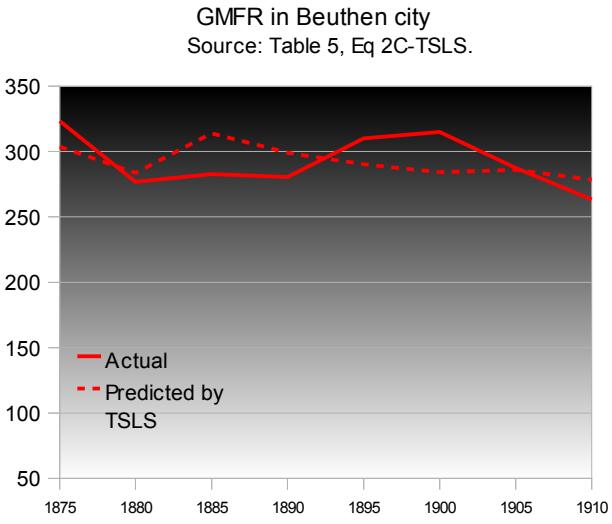


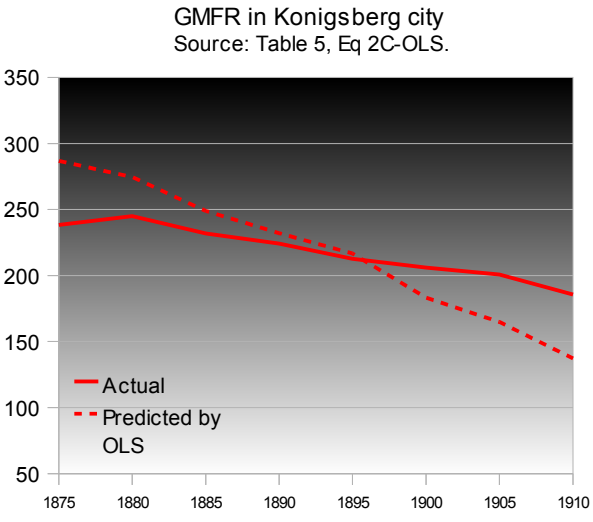
Figure 10. Actual and predicted GMFR in cities in Prussia with the smallest percent decline in GMFR from 1875 to 1910.

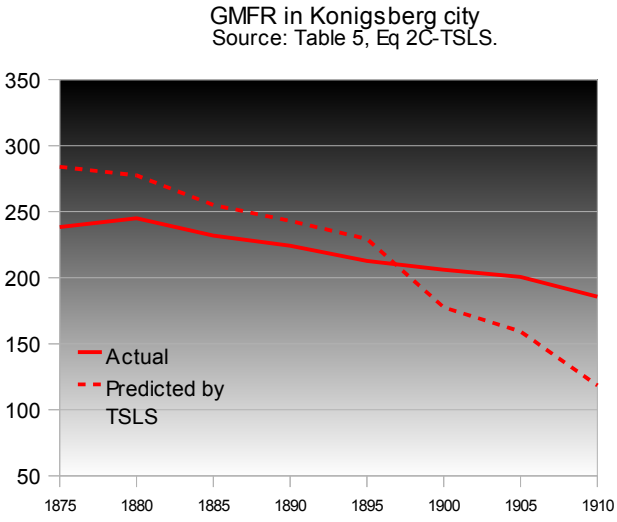




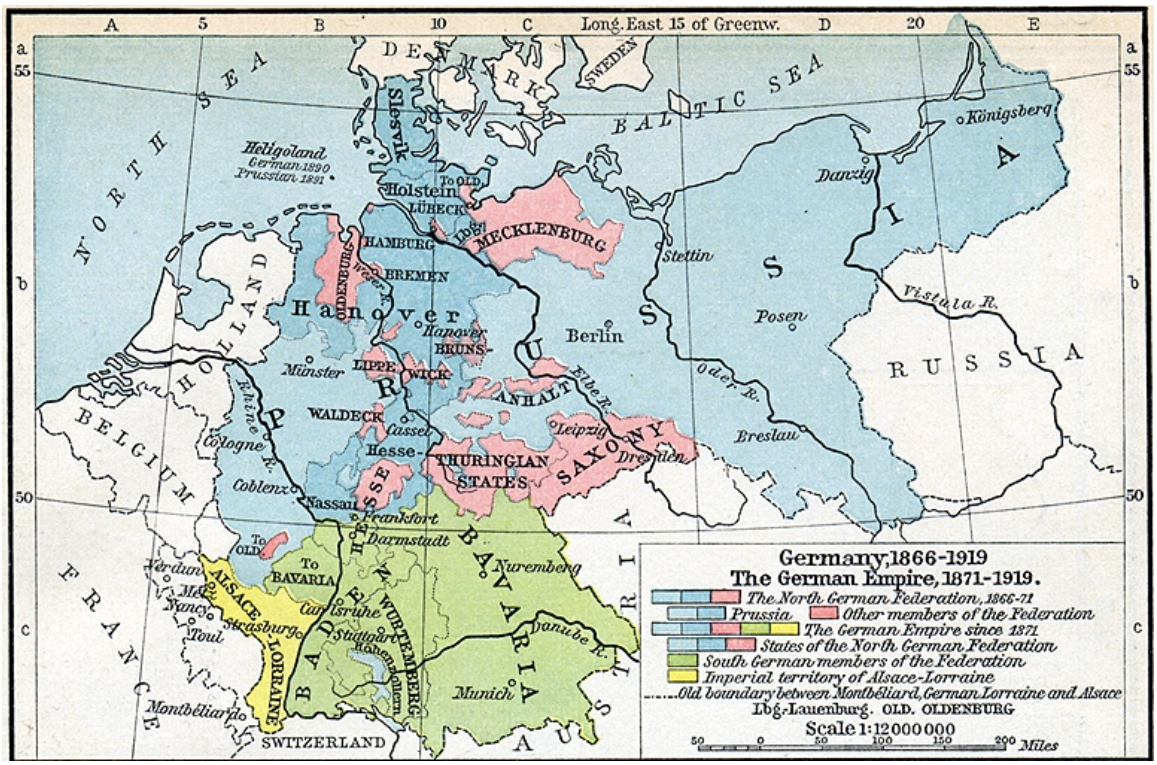








Appendix Figure 1. Map of Prussia and northern Europe.
(Prussia is the land area in light blue and dark blue)



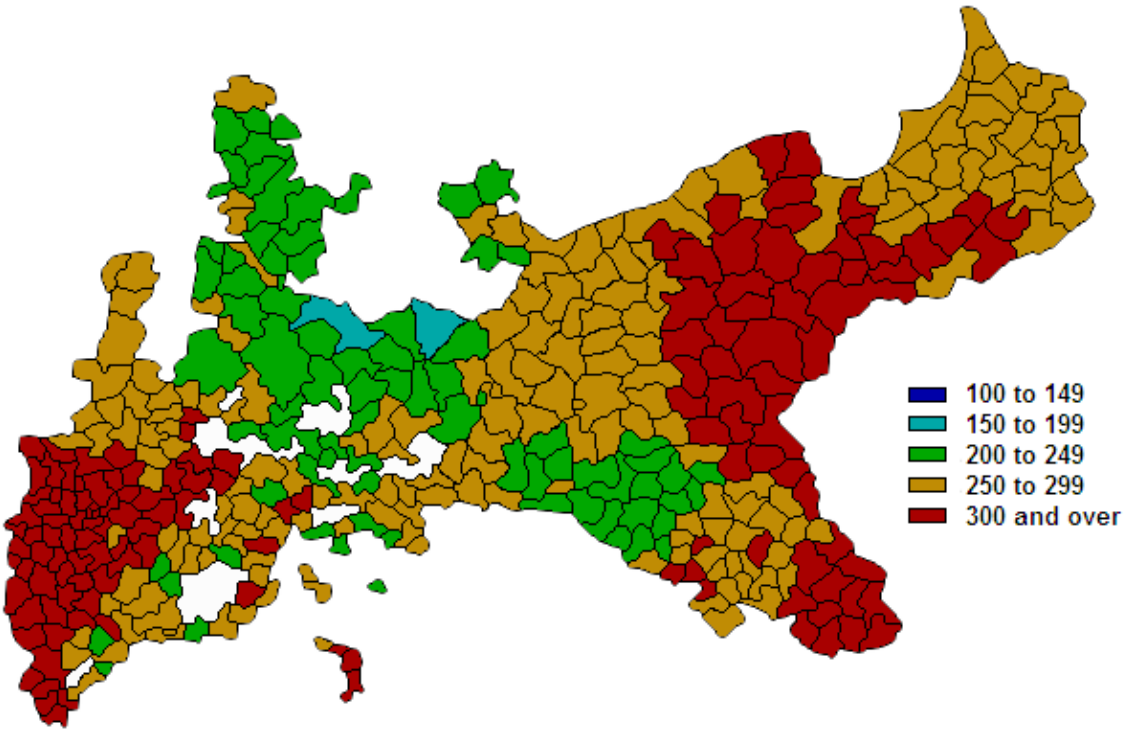
Source: Shepherd 1932:61.

Appendix Table 1. Population of Prussia and other major states in Europe in 1910.

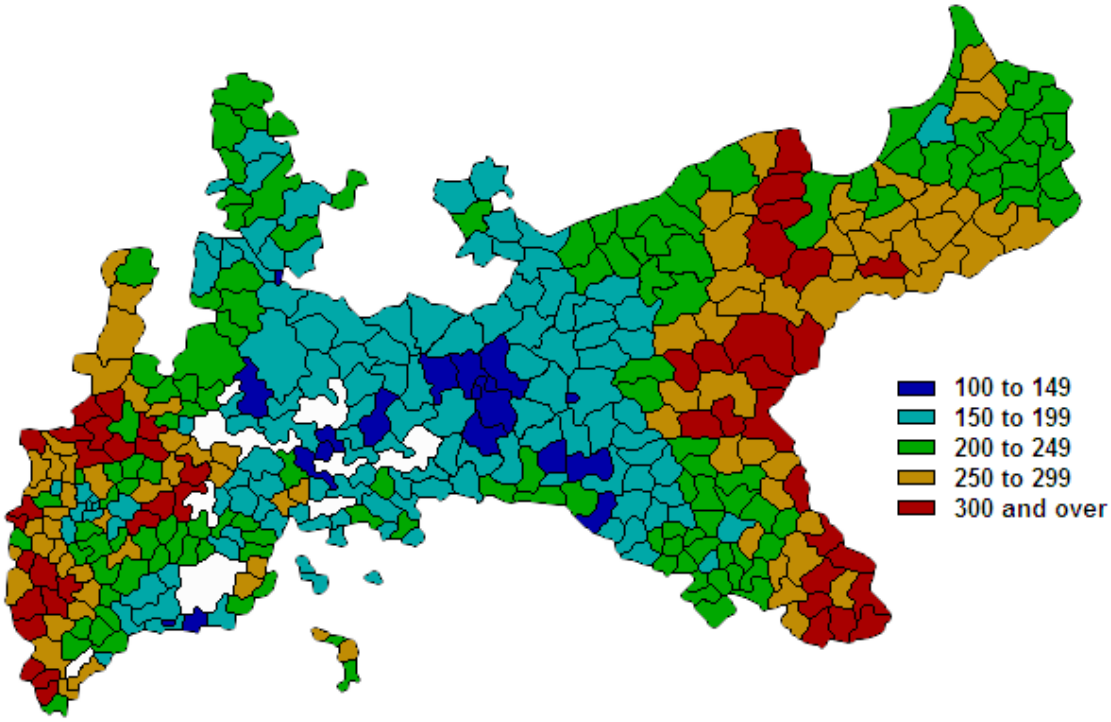
State	Population (thousands)
Prussia	40,165
France	39,192
United Kingdom	36,070
Italy	34,671
Austria Cisleithania	28,572
Germany less Prussia	24,761
Spain	19,927

Source: *Preussische Statistik*, Mitchell 1981:29-37.

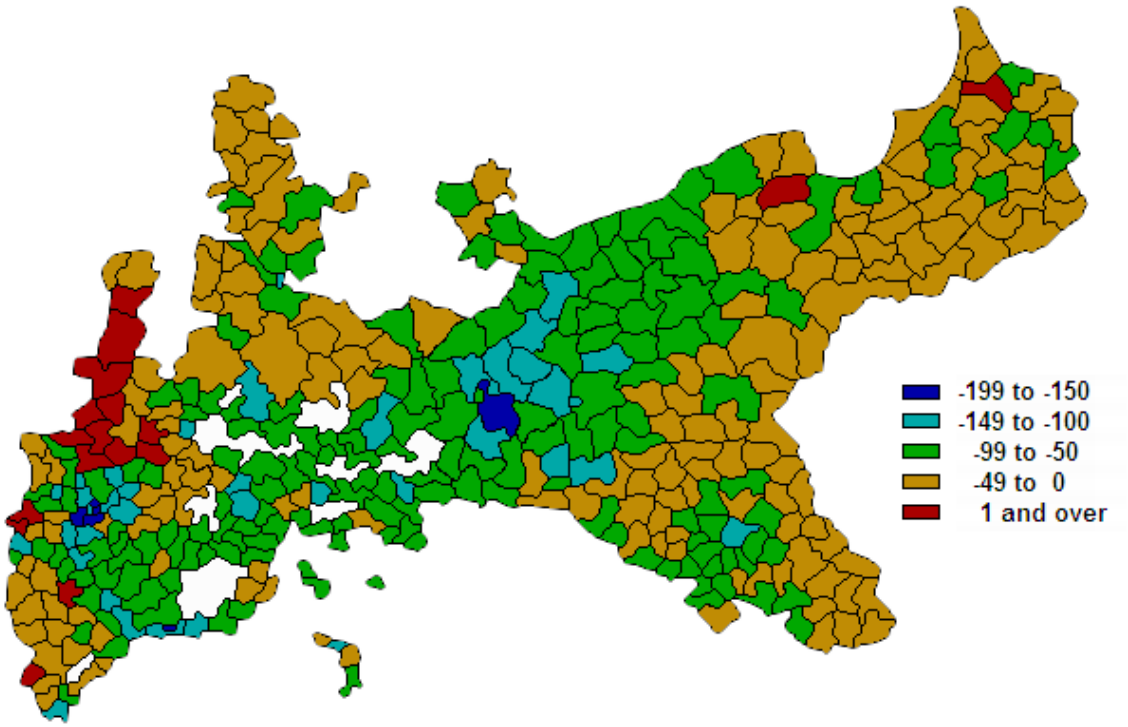
Appendix Figure 2. General marital fertility rate in Kreise in Prussia in 1875.



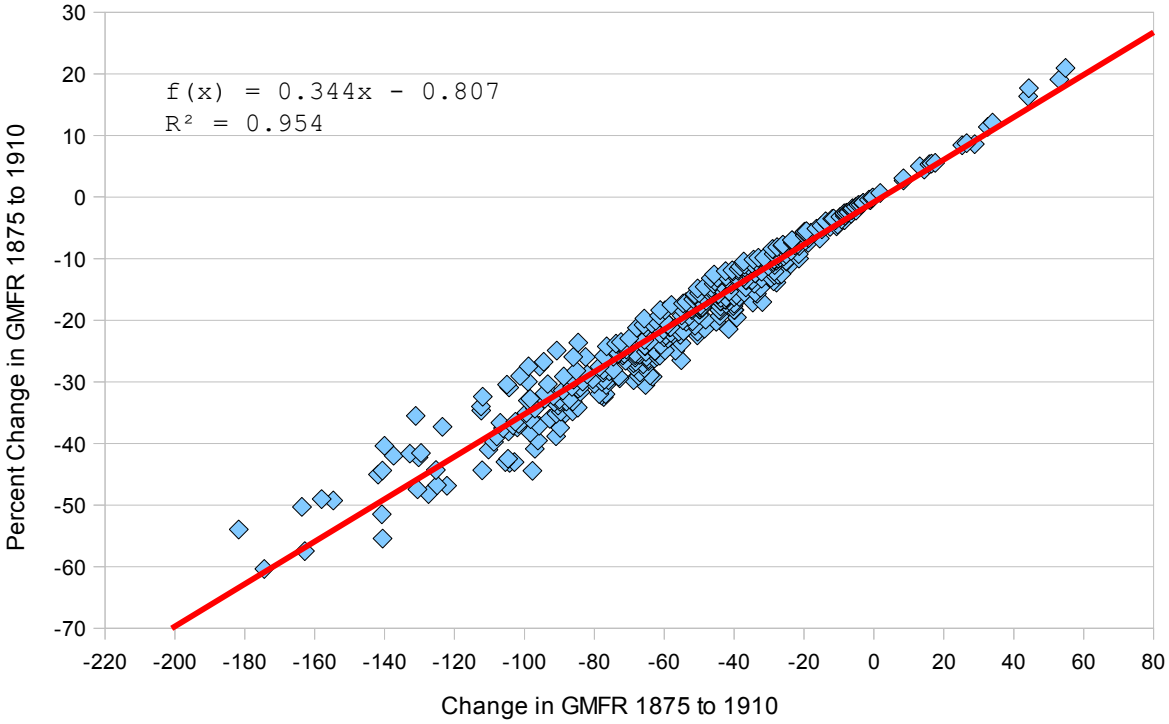
Appendix Figure 3. General marital fertility rate in Kreise in Prussia in 1910.



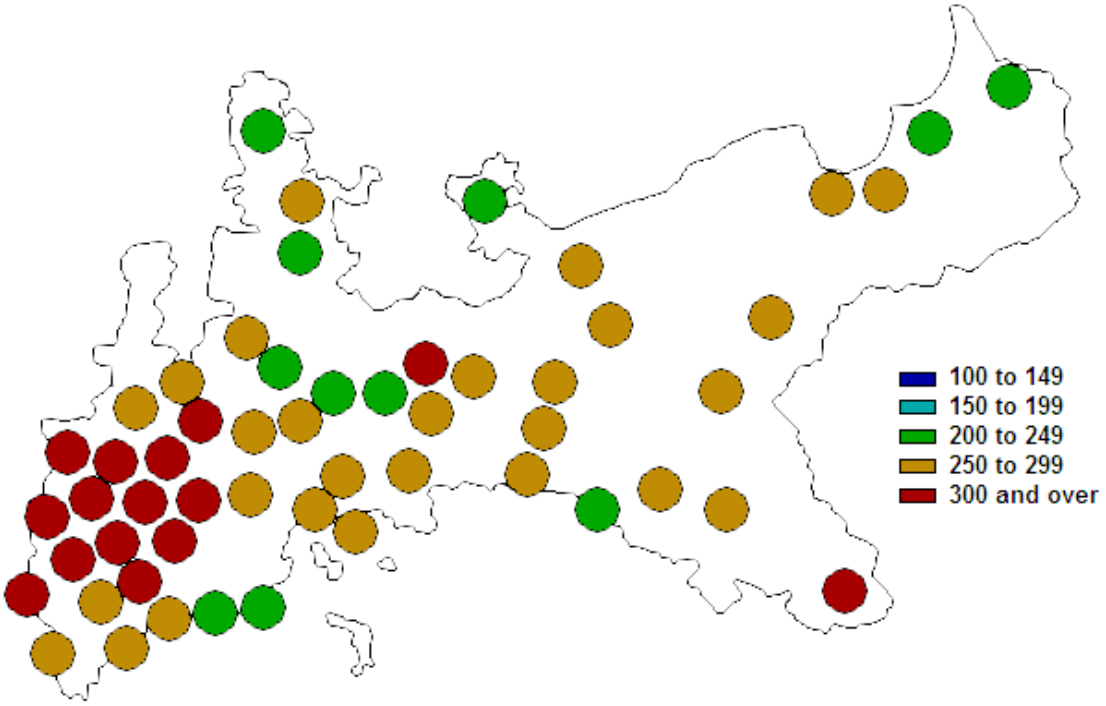
Appendix Figure 4. Change in general marital fertility rate in Kreise in Prussia from 1875 to 1910.



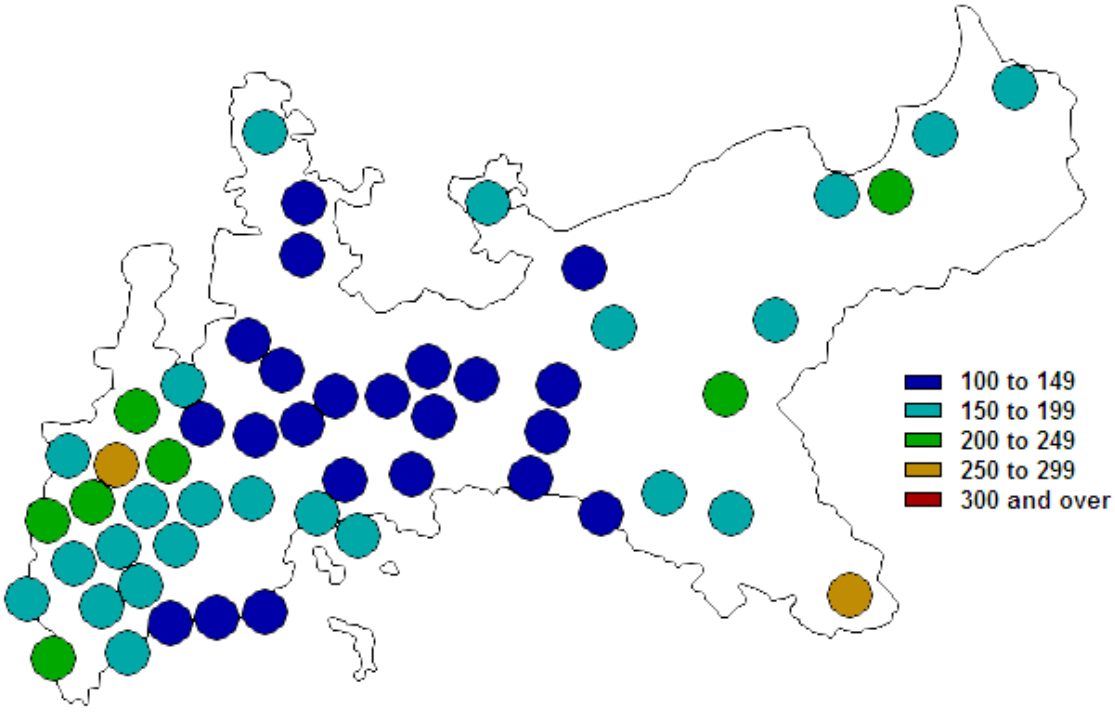
Appendix Figure 5. Percent change versus change in general marital fertility rate in Kreise in Prussia from 1875 to 1910.



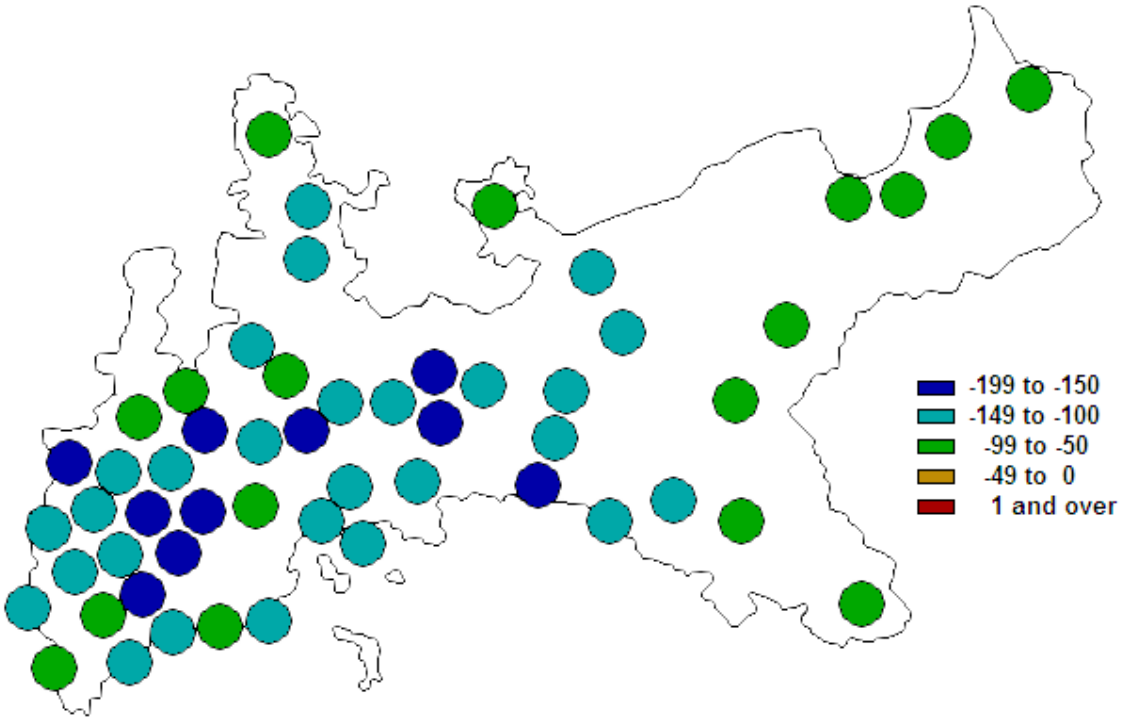
Appendix Figure 6. General marital fertility rate in 54 cities in Prussia in 1875.
(Note that the locations are only approximate.)



Appendix Figure 7. General marital fertility rate in 54 cities in Prussia in 1910.
(Note that the locations are only approximate.)



Appendix Figure 8. Change in general marital fertility rate in 54 cities in Prussia in from 1875 to 1910.
(Note that the locations are only approximate.)



Appendix Figure 9. Percent change versus change in general marital fertility rate in 54 cities in Prussia from 1875 to 1910.