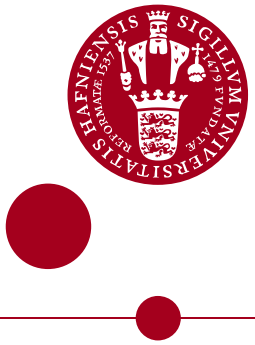
UNIVERSITY OF COPENHAGEN
FACULTY OF SOCIAL SCIENCES



Demography Term Paper

Bismarck's Lost Battle

Marriage, Fertility, and the Kulturkampf in Prussia, 1867-1890

Anton Meier Ebsen Jørgensen

Lecturer: Casper Worm Hansen

Submitted: May 29, 2026

Number of characters: Approximately 39,800

Abstract

Catholics in nineteenth-century Prussia had higher marital fertility than Protestants. Interestingly, this differential persisted for decades after the Prussian fertility decline began. To analyze if this differential was caused by Catholic institutions or Catholic cultural norms, I use Bismarck's *Kulturkampf* (1871-1878) using annual county-level vital registration from 392 Prussian *Kreise* over 1867-1890.

My findings suggests that the Kulturkampf did not affect marital fertility, which is what is expected of a pre-transition population as the intensive margin is non-existent. Decomposing religion and Polish ethnicity, my findings suggest that the negative associations in the CBR and general marriage outcomes are limited to the Polish regions. Moreover, the large ethnicity coefficient and the delayed timing reflects the *Germanisierungspolitik* rather than the Kulturkampf.

The persistence in the Catholic-Protestant differential was likely a result of different structural economic factors Galloway et al. (1994), especially those regarding human capital investment Galor (2010); Murtin (2013) and informational barriers between the two cultural groups Beach and Hanlon (2023).

Keywords: Kulturkampf, Catholic-Protestant fertility differential, religion and ethnicity, human capital and fertility transition, Prussia, difference-in-differences

JEL classification: N33, N43, J13, I25, Z12

Contents

1 Introduction 4

2 Historical background 5

3 The demographic setting 7

4 Description of data 8

5 Methodology 10

6 Empirical results 13

7 Discussion 20

8 Conclusion 24

Appendix A AI transparency 28

Appendix B Data appendix 28

Appendix C Methodology appendix 36

Appendix D Empirical results appendix 41

1 Introduction

In nineteenth-century Europe, Catholic populations had systematically higher fertility than their Protestant counterparts, especially within marriage. The institutional view explains the differential through Catholic doctrine, clerical authority, and Catholic schooling. The cultural view emphasize family structure, networks, and morality of the individuals. The two views are difficult to separate because institutions and culture are highly correlated in cross-sections. Anderson (1986) argues that cross-sectional analysis leads to a tautology: we observe that Catholics have higher fertility, we say it is because of culture, and we prove it by observing that Catholics have higher fertility.

To break this tautology, I use Bismarck's *Kulturkampf* (1871-1878). Bismarck assumed that Catholic institutions played a large role in defining and strengthening the Catholic culture. To weaken the institutions, the Kulturkampf legislation expelled the Jesuit order, placed Catholic schools under state inspection in the 1872 School Inspection Law, required training of priests through the 1873 May Laws, and removed legal recognition of religious marriages in the 1874 Prussian Civil Marriage Act. If institutions transmit to culture then I expect the differential to narrow under the shock and if strong Catholic norms are the reason then it should persist.

I analyze this using annual county-level vital registration from approximately 392 Prussian *Kreise* over 1867-1890 and the 1871 Catholic share Galloway (2007). I estimate a continuous difference-in-differences interacting the 1871 Catholic share with a post-1873 indicator, with county and year fixed effects and standard errors clustered at the county level. To identify a Catholic effect, I need to take another cultural variable into consideration: ethnicity. To distinguish between German and Polish regions, I use a triple-difference. Moreover, I

The result that survives every specification is that fertility within marriage does not respond to the shock. This is what a pre-transition population predicts. Following the margin decomposition of Aaronson et al. (2014), fertility responds on an extensive margin, whether and when reproduction occurs, here operating through marriage, and an intensive margin, the number of children within marriage. In a pre-transition population, the intensive margin is non-existent, since deliberate limitation within marriage is not

yet practiced (Coale and Watkins, 1986), so fertility is regulated primarily through the extensive margin. An institutional attack on the infrastructure of marriage thus has no channel through which to reach fertility within marriage, and it does not. The negative aggregate associations on the crude birth rate and the marriage rate are concentrated in the Polish regions and, once the ethnic channel is separated out, prove predominantly ethnic rather than religious, driven by the *Germanisierungspolitik* whose timing matches the data far better than the religious shock.

The Catholic fertility transition arrived later, likely through human capital as identified by Galor (2010) and supported by Murtin (2013). Embedded in a religious culture that encourages reading, Becker and Woessmann (2009) show that nineteenth-century Prussian Protestants had significantly higher literacy rates. However, the polarization between the Protestant and Catholic subculture, which the Kulturkampf worsened, may help explain why it arrived in Catholic counties with a delay, in the spirit of Beach and Hanlon (2023) on cultural barriers in the British fertility transition.

The paper proceeds as follows. section 3 provides the historical and demographic context. section 4 describes the data sources and construction of the sample. section 5 explains the empirical strategy. section 6 presents the main results. section 7 interprets the empirical findings. section 8 concludes.

2 Historical background

2.1 Mobilization of Prussian Catholics

The Kulturkampf was not an unprovoked legislation but a reaction to a Catholic mobilization in nineteenth Prussia. In the 1860s, Pope Pius IX responded to the secularization of Europe by making Catholic doctrine more rigid, and it culminated in 1870 with the Papal Infallibility dogma (Coale et al., 1986). The strategy mobilized Catholics, creating a strong subculture, which historians describe as the Catholic *milieu* Smith (1995). In December 1870, Prussian Catholics established the pro-Catholic *Zentrum* party, which protected the Catholic interests.

Bismarck and the National Liberals viewed this political mobilization as a threat to na-

tional sovereignty because of ultramontanism. They feared that the Catholics were ultramontane, being more loyal to the Pope rather than the unified German state. To limit the influence of the Pope on national policies, Bismarck and the National Liberals responded with policies that weakened the Catholic institutions with an intent to weaken the Catholic subculture and the political influence of the Church.

A second motivation was ethnic. Bismarck viewed the Catholic priests in the Polish-majority provinces Posen and Bromberg as "un-German" Smith (1995). Together with the Kulturkampf Bismarck also targeted the Polish minority by implementing the *Germanisierungspolitik*, for example by prohibiting Polish as the instruction language in Polish elementary schools in 1872 Clark (2006). This geographical division becomes relevant in subsection 6.3.

2.2 The legislative shock

The Kulturkampf legislation was de jure neutral between denominations but de facto targeted at Catholics. It began in 1871 with the *Kanzelparagraph* (Pulpit Paragraph) which criminalized priests from making political statements. In March 1872, the Prussian *Schulaufsichtgesetz* (School Inspection Act) transferred the inspection of religious schools to the Prussian state. Moreover, in July the *Jesuitengesetz* (Jesuit Law) exiled the Jesuit, Redemptorist, and Lazarist orders. Especially, many German intellectuals feared the Jesuit order because of their high education and influence on the Catholic communities Smith (1995).

The *Maigesetze* (May Laws) in 1873 were viewed by the Catholic community as the strictest laws. They removed the self-governance of the Catholic institutions: the Prussian state took control of who could become priests, required priests to be trained at secular state universities and to pass a cultural exam. The Prussian state arrested and exiled priests who refused to follow these laws. The *Brotkorbgesetz* (Breadbasket Law) in April 1875 cut all state subsidies to the parishes that resisted the May Laws. In May 1875, the *Klostergesetz* exiled the remaining religious orders.

The essential law in regards to family formation was the Prussian *Zivilehegesetz* (Civil Marriage Act) from March 1874, where couples had to register civilly for the marriage to

be legally valid. Instead of weakening the Catholic community, Bismarck strengthened it: Zentrum's vote share increased from 15 percent in 1871 to 22 percent in 1874 and to 26 percent in 1881 (Figure C.2).

Following the death of Pius IX in 1878, Bismarck started negotiations with the new Pope Leo XIII in 1880. The motivations for the negotiations were two-fold. First, Bismarck, being a pietist, dismissed the idea of a fully secular state, in contrast to the Liberals. Moreover, the left-leaning Liberals began to criticize the Kulturkampf, Clark (2006). The Kulturkampf officially ended with the *Milderungsgesetze* in the mid-1880s. Several of the Kulturkampf laws were excluded from the rollback: the school inspection and civil marriage acts remained effective in the end of my sample period.

3 The demographic setting

In this section, I introduce the demographic setting of Prussia to predict how the Catholic population might react to the Kulturkampf.

3.1 Catholic Prussia: a pre-transition population

The Prussian fertility decline began to decline from its plateu around 1880-1890 and it accelerated after 1900 Galloway et al. (1994). Therefore, my time sample 1867-1890 covers a period where some families in the population actively limits fertility within marriage, while still being s predominantly pre-transition population.

Such pre-transition populations are natural fertility populations, since differences in marital fertility are driven by the length between births (Coale et al., 1986). For example, short breastfeeding durations will shorten the birth intervals, increasing the marital fertility (Coale et al., 1986). Moreover, familial modes of production which Catholics retained for longer than Protestants often incentivize a higher quantity of children, as these were laborers who contributed to the production (Coale et al., 1886) (Chapter 7).

3.2 The extensive and intensive margins

When analyzing how the Kulturkampf might affect fertility, it makes sense to draw on the distinction, which Aaronson et al. (2014) make. They decompose fertility into an

extensive margin and an intensive margin. The extensive margin is the family formation: whether to have at least one child. The intensive margin is the number of children for those households who have decided to become parents.

In a pre-transition population, the intensive margin is driven by natural fertility, as households do not practice parity-dependent birth control to limit child quantity. On the other hand, the extensive margin is the only margin where a Kulturkampf shock can reduce fertility.

3.3 The prediction

The Kulturkampf legislation includes two laws which directly affected the extensive margin: the 1873 May Laws and 1874 Prussian Civil Marriage Act. These laws made it more difficult to form a marriage, as a lot of priests were exiled and it now required civil reregistration. Therefore, if the Kulturkampf should have an association with any of the fertility-related variables then it should be the marriage rate.

4 Description of data

In this section, I describe the data sources and sample construction, and define the variables used in the analysis. A more detailed description of data is included in Appendix B.

4.1 Data sources and sample

I construct an annual *Kreise*-level (county) panel that covers 1867-1890. This time sample begins 6 years before the 1873 May Laws so I can test parallel trends and the samples includes the rollback (1880-1887) and some post-rollback years (1888-1890). The panel is unbalanced and consists of 9,261 observations on the 392 counties. However, boundary reforms and holes in the vital registration data prevent 33 counties from being observed in every year.

The Galloway Prussia Database Galloway (2007) contains the (i) cross-county annual vital registration data, total-, legitimate-, and illegitimate births, and marriages (VIT-files), (ii) the number of Catholics in 1871, and (iii) the 1871 Reichstag election votes (ELE1871-file) for the Polish-nationalist party (Polenpartei) and Catholic Centre Party

(Zentrum). The panel in subsubsection 6.3.2 that uses the electoral results covers 339 counties, since I have to match electoral districts to counties.

4.2 County matching between datasets

To match the counties in the Galloway Prussia Database, I match based on the county names, since the county codes are following different numbering systems. To ensure correct matching, I validate the match by comparing the 1871 Catholic share in my effective sample with the iPHED denomination file. I allow for a maximum difference of 5 percentage points for the 1871 Catholic share. I match 352 out of 393 counties with a correlation between the 1871 Catholic share in the two samples of 0.9998.

4.3 Variable construction

The treatment variable is the 1871 Catholic share (CathShare_i) which is defined as the percentage of county i's 1871 population that was Roman Catholic. This variable is time-invariant, and I fix it at the pre-treatment value because it seems likely that the Kulturkampf led to emigration or conversion to some extent. In Figure 4.1, I plot the distribution of the 1871 Catholic share across the 392 counties. The 1871 Catholic share has a mean of 34 percent and a median of 13.3 percent.

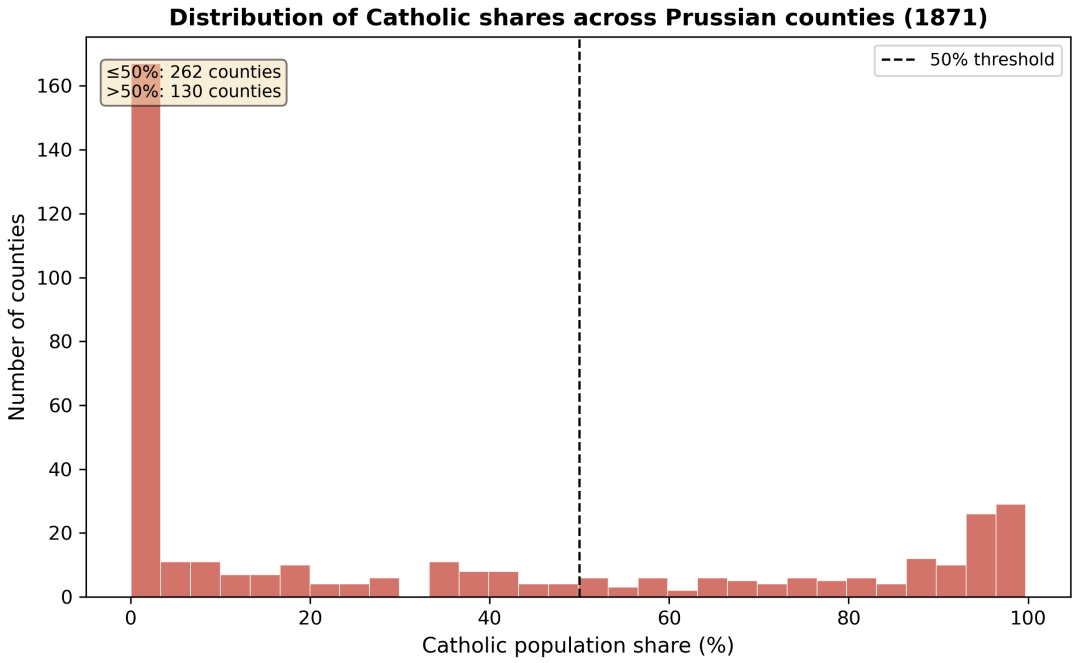


Figure 4.1: 1871 Catholic share distribution

The four dependent variables are:

- The crude birth rate (CBR): total births per 1000 mid-year population.
- General marital fertility rate (GMFR): legitimate births per 1000 mid-year married women aged 15-49. The marriage share is fixed at the 1871 share, because the Kulturkampf potentially affected the marriage share. A lower marriage share would ceteris paribus lead to an increase in GMFR but this cannot be interpreted as fertility within marriage.
- The illegitimate fertility rate: illegitimate births per 1000 mid-year non-married women aged 15-49.
- The general marriage rate: marriages per 1000 unmarried mid-year population aged 15+.

All the rates use mid-year population in the denominator, which I construct using linear interpolation between the December censuses and evaluated at July 1. If I had used end-of-year population then I would have a downward bias of 1-3 percent in population growth. There are limitations in regards to control variables, for example a measurement change in infant mortality which implies I cannot use it to control for the families wanting to maximize the number of surviving children Galor (2010).

5 Methodology

5.1 Treatment variable

I fix the Catholic share at 1871 because it is before the strictest Kulturkampf laws (the 1873 May Laws). This is also justifiable as the Catholic share is stable during this time period (Table C.1).

I use the Catholic share as a continuous treatment intensity rather than a binary Catholic indicator. This follows Figure 4.1, which shows that approximately 22 percent of the counties are in the 20-80 percentage range, though most counties are either predominantly Catholic or Protestant. Using a continuous treatment variable, I allow the treatment intensity to scale linearly with the density of the Catholic population. This is relevant

from a historical perspective: Smith (1995) documents that state enforcement of the Kulturkampf was more aggressive in more-Catholic counties and that local communities played a role for the Catholics to resist state intervention. However, I use a high-Catholic dummy when I analyze descriptive statistics of high- and low-Catholic counties.

5.2 Baseline specification

To estimate the Kulturkampf's effect on the fertility-related outcomes, I use a difference-in-differences:

$$\mathrm{Y}_{it} = \beta\left(\mathrm{CathShare}_i \times \mathrm{Post}_t\right) + X_{it}'\gamma + \alpha_i + \delta_t + \varepsilon_{it} \tag{5.1}$$

Where $Y_{i,t}$ is the fertility-related outcomes (CBR, GMFR^{1871}, illegitimate fertility rate^{1871}, and general marriage rate). The DiD coefficient β is the average marginal change in $Y_{i,t}$ that is associated with a one percentage-point increase in the Catholic share after 1873.

County fixed effects (α_i) absorb time-invariant factors that affect the outcome variables within each county, such as age structure, occupations, and urbanization. Year fixed effects absorb the common shocks that affect all Prussian counties simultaneously, for example, the Franco-Prussian War (1870-71) and the Gründerkrise (1873). I cluster the standard errors at the county level because there is strong autocorrelation in fertility and marriage data. This is because the female population in the fertile ages is persistent and slow-moving, and also because conceptions result in births across years t and $t+1$. I estimate an alternative specification that uses county and Year $\times$ *Regierungsbezirke* (region) fixed effects instead of county and year fixed effects, which motivates subsection 5.3.

The DiD identifies the causal effect of the Kulturkampf under the parallel-trends assumption: more or less Catholic counties would have continued on parallel trends after 183 without the Kulturkampf. In subsection C.1, I include the event study specification from which I conduct pre-trends tests and report in the estimation tables.

5.3 Sub-region heterogeneity estimation and timing analysis

The DiD in Equation 5.1 estimates an average β across the 372 Prussian counties. This raises a concern regarding ethnicity, as the 1871 Catholic share is collinear with Polish ethnicity in the Polish Catholic counties in the regions of Posen and Bromberg (Figure C.3 shows that $\text{corr}(\text{CathShare}, \text{PolenShare}_{1871} = 0.93)$). Therefore, β cannot distinguish between the religious Kulturkampf and the ethnic Polenpolitik. Moreover, the Kulturkampf is multiples laws that were implemented from 1871 to 1878, and it was rolled back in 1880-1887. This has implications for the timing, as the magnitudes should be at their peak during the Kulturkampf period and decrease thereafter. If it is in the opposite direction, it indicates associations stemming from the Polenpolitik rather than the Kulturkampf. To analyze the heterogeneity and the timing, I estimate two additional specifications.

5.3.1 Timing: Sub-region split

In the first specification, I estimate the baseline DiD on the three sub-regions: (i) Polish Catholic counties (visualized in Figure C.1), (ii) German Catholic counties, (iii) Protestant counties, where I decompose the post-1873 indicator into enforcement, rollback, and post-rollback periods. In each sub-region, the three β coefficients capture the association in each of the periods. The absolute value of the β coefficients should be largest in the enforcement period for it to be a Kulturkampf association.

5.3.2 Decomposition of religion and ethnicity

To decompose the religious Kulturkampf and the ethnic Polenpolitik, I interact the post-1873 indicator with CathShare_i and the 1871 *Polenpartei* Reichstag vote share:

$$\begin{aligned} \text{Y}_{it} = \beta_1 \left(\text{CathShare}_i \times \text{Post}_t\right) \\ +\beta_2 \left(\text{PolenShare}_i \times \text{Post}_t\right) \\ +\alpha_i + \delta_t + \varepsilon_{it}. \end{aligned} \tag{5.2}$$

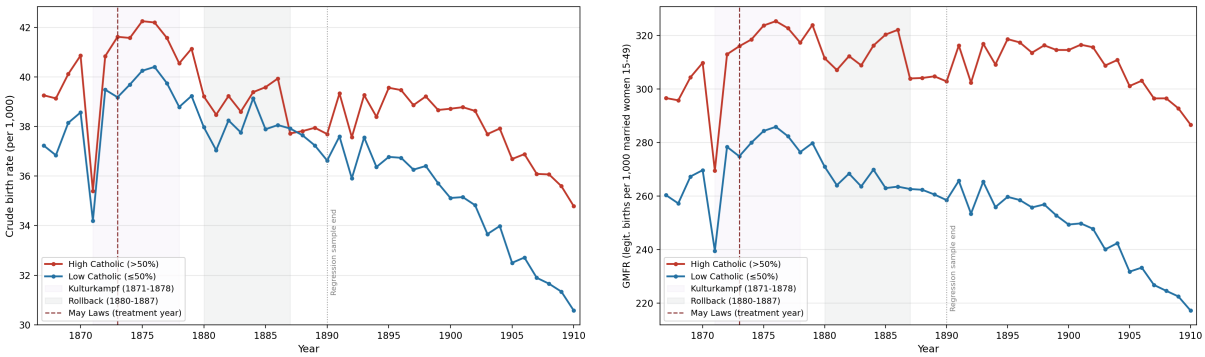
Where β_1 is the religion coefficient and β_2 is the additional ethnic-Polish coefficient.

6 Empirical results

6.1 Descriptive evidence

Before I analyze the impact of the Kulturkampf on fertility using difference-in-differences, I analyze the raw fertility data. **??** plots the crude birth rate and the general marital fertility rate separately for high-Catholic ($> 50\%$ Catholic in 1871) and low-Catholic counties over the sample period.

Figure 6.1: Plots for fertility trends across high- and low-Catholic counties, 1862-1910



(a) Crude Birth Rate

(b) General Marital Fertility Rate

Notes: Source: Galloway Prussia Database Galloway (2007) and author's calculations.

The level of Catholic-Protestant differential differs across the two fertility outcomes. The crude birth rate (**??**) is only a bit larger in high-Catholic counties. On the other hand, the general marital fertility rate (Figure 6.1b) is substantially larger in high-Catholic counties. This descriptive pattern is consistent with the Catholic-Protestant marital fertility differential in nineteenth-century Europe Galloway et al. (1994). High-Catholic counties have higher fertility within marriage but only slightly higher fertility measured in per capita. This pattern also suggests that Catholics on average had a lower marriage rate. Moreover, both fertility rates respond similar to the Franco-Prussian War of 1870-71 for high- and low-Catholic counties. The fertility rates fall sharply in 1871 and increase back to the baselines in 1872. This suggests that war shocks affect fertility in high- and low-Catholic counties similar. In the 1880s, the fertility transition began in Protestant counties, which is the reason behind the divergence in marital fertility. For Catholic counties, the fertility transition was at a slower rate Galloway et al. (1994). In 1886, both fertility rates decrease significantly for high-Catholic counties. I conduct a heterogeneity analysis across the re-

gions in subsection 6.3, which indicates that this decrease is found in the Polish-Catholic regions.

Interestingly, the Catholic-Protestant differential is constant during the enforcement period (1872-1878) and there is no change after 1873 specifically. Looking at the descriptive evidence it suggests that the Kulturkampf had no impact on this differential, which I formally analyze using difference-in-differences in subsection 6.2.

Lastly, it is possible to see an early fertility transition for low-Catholic counties in the 1880s, where it accelerates after 1900. Moreover, the fertility in Catholic counties plateaus in 1890-1900 and begins declining after 1900. The dotted vertical line at 1890 is the end of the regression sample. Therefore, my regression includes a period where some individuals in low-Catholic counties did limit their fertility within marriage, while high-Catholic counties still was a pre-transition population.

6.2 Baseline estimates

I report the baseline DiD results using Equation 5.1 in Table 6.1 for simple two-way fixed effects in Panel A and Year $\times$ *Regierungsbezirk* (region) fixed effects in Panel B.

Table 6.1: Baseline difference-in-differences: Kulturkampf and conventional demographic rates

	Crude birth rate	$GMFR^{1871}$ (static prev.)	Illeg. fert. rate	Gen. marriage rate
	(1)	(2)	(3)	(4)
Panel A: County + Year FE				
CathShare × Post	-0.011***	-0.023	-0.036***	-0.011***
	(0.003)	(0.026)	(0.006)	(0.003)
County FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Year × Rb FE	–	–	–	–
Observations	9,255	9,254	9,255	9,261
Within R^2	-0.013	-0.009	-0.036	0.036
Pre-trends χ^2 p	0.000	0.000	0.051	0.000
Panel B: County + (Year × Rb) FE				
CathShare × Post	0.001	0.043	-0.021***	-0.003
	(0.005)	(0.041)	(0.008)	(0.002)
County FE	Yes	Yes	Yes	Yes
Year FE	–	–	–	–
Year × Rb FE	Yes	Yes	Yes	Yes
Observations	9,255	9,254	9,255	9,261
Within R^2	0.000	0.014	-0.012	0.014
Pre-trends χ^2 p	0.001	0.002	0.712	0.842

Notes: Robust standard errors clustered at the county level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

In panel A, the coefficient for CathShare×Post are statistically significant and negative for the CBR, illegitimate fertility rate, and general marriage rate outcomes. These coefficients would suggest that the Kulturkampf reduced births, non-marital fertility, and marriage in more-Catholic counties while having no association with the marital fertility. However, as it can be seen from the pre-trends tests, the more- and less-Catholic counties followed different paths in the CBR, $GMFR^{1871}$, and the general marriage rate coefficients. Once I account for county and Year × Rb, then the coefficients for CBR and general marriage rate turn insignificant. This suggests that the associations on births and marriages are driven by the dynamics in the regional level. This finding motivates that I split the sample

up in sub-regions in subsection 6.3.

I use alternative rates (GFR and crude marriage rate) in a robustness check (Table D.1), and the baseline results are robust to the choice of rate.

6.3 The ethnic heterogeneity

6.3.1 Sub-region heterogeneity and timing

The aggregate coefficients in the baseline DiD specification (Table 6.1) does not account for heterogeneity, which is a concern as the sub-regions are different in a second cultural layer: ethnicity. During and after the Kulturkampf, Bismarck simultaneously implemented the Germanisierungspolitik, which targeted the Polish ethnicity specifically. Therefore, I re-estimate the baseline specification in the enforcement, rollback, and post-rollback periods on the three sub-regions: (i) Polish high-Catholic counties, (ii) German high-Catholic counties, and (iii) German low-Catholic counties. I report the results in Table 6.2.

Table 6.2: Heterogeneity: Kulturkampf by sub-region across enforcement and rollback periods

	Polish Catholic counties (1)	German Catholic counties (2)	Protestant counties (3)
Panel A: Crude birth rate			
CathShare × Enforcement (1873-78)	-0.038**	0.006	0.002
	(0.015)	(0.008)	(0.002)
CathShare × Rollback (1880–87)	-0.113***	0.028***	-0.014***
	(0.020)	(0.011)	(0.005)
CathShare × Post-rollback (1888+)	-0.192***	0.038***	-0.023***
	(0.056)	(0.012)	(0.007)
Pre-trends χ^2 p	0.669	0.332	0.061
Panel B: GMFR[1871]			
CathShare × Enforcement (1873-78)	-0.313**	0.076	0.033
	(0.131)	(0.071)	(0.025)

Continued on next page

[1]

Table 6.2: Heterogeneity: Kulturkampf by sub-region across enforcement and rollback periods – *Continued*

	Polish Catholic counties (1)	German Catholic counties (2)	Protestant counties (3)
CathShare × Rollback (1880-87)	-0.797***	0.316***	-0.032
	(0.153)	(0.102)	(0.037)
CathShare × Post-rollback (1888+)	-1.372***	0.363***	-0.153***
	(0.250)	(0.100)	(0.047)
Pre-trends χ^2 p	0.467	0.111	0.069
Panel C: Illeg. fert. rate			
CathShare × Enforcement (1873-78)	-0.107***	0.003	-0.024***
	(0.027)	(0.011)	(0.007)
CathShare × Rollback (1880-87)	-0.160***	-0.008	-0.053***
	(0.031)	(0.008)	(0.011)
CathShare × Post-rollback (1888+)	-0.143***	-0.004	-0.057***
	(0.040)	(0.007)	(0.011)
Pre-trends χ^2 p	0.000	0.291	0.014
Panel D: Gen. marriage rate			
CathShare × Enforcement (1873-78)	-0.041***	0.001	-0.005***
	(0.007)	(0.007)	(0.002)
CathShare × Rollback (1880-87)	-0.031***	-0.000	-0.012***
	(0.008)	(0.006)	(0.002)
CathShare × Post-rollback (1888+)	-0.042***	-0.005	-0.014***
	(0.016)	(0.007)	(0.002)
Pre-trends χ^2 p	0.000	0.001	0.003
County FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Counties	24	68	300

Notes: Each column estimates the same specification on a different sub-sample of regions: Polish (Posen, Bromberg), German Catholic (Cologne, Koblenz, Trier, Aachen, Oppeln, Münster), and the remaining (largely Protestant) provinces. Standard errors clustered at the county level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The results indicate that the Kulturkampf has no association with the four demographic outcomes in the German high-Catholic counties, as the coefficients for the CBR, $GMFR^{1871}$, illegitimate fertility rate, and general marriage rate are all statistically insignificant during the enforcement period. During the rollback and post-rollback periods, the coefficients for the CBR and $GMFR^{1871}$ outcomes become significant and positive. These coefficients are unlikely to reflect a Kulturkampf association, as they should be largest in magnitude for the enforcement period and become smaller when the May Laws were repealed in the post-rollback period.

In the Polish high-Catholic counties, the coefficients for the CBR, illegitimate fertility rate, and the general marriage rate outcomes are significant and negative. However, the coefficients for the CBR and $GMFR^{1871}$ outcomes become more negative in the rollback and post-rollback periods. This is again a wrong timing for the Kulturkampf and suggests that it is more likely Germanisierungspolitik associations. In the 1885–86 *Polenausweisungen*, the Prussian state expelled Poles without a Prussian citizenship and in 1886, the Settlement Commission, the Prussian state made it more difficult for Poles to acquire land Clark (2006).

For the Protestant counties the coefficients are overall small, likely reflecting that the Catholic share is small.

CathShare × Post cannot separate the religious Kulturkampf from the ethnic Germanisierungspolitik without an indicator of ethnicity. Therefore, I use the Polish-nationalist party share from 1871, which is collinear with the 1871 Catholic share in the Polish high-Catholic counties, but the full-panel correlation is only 0.26, since the German high-Catholic counties have zero vote share for this party.

6.3.2 A decomposition of religion and ethnicity

In order to decompose the religious policies of the Kulturkampf and the ethnic policies of the Germanisierungspolitik, I include an interaction term for the 1871 vote share on the Polenpartei. I report the decomposition of religion and ethnicity on the four outcomes in Table 6.3.

Table 6.3: Decomposition of religion and ethnicity

Dependent variable:	Crude birth rate	GMFR ^{1871}	Illeg. fert. rate	Gen. marriage rate
	(1)	(2)	(3)	(4)
CathShare × Post	-0.0060*	-0.0214	-0.0384***	-0.0077**
	(0.0032)	(0.0291)	(0.0057)	(0.0030)
PolenShare_{1871} × Post	-0.0250***	-0.0599	0.0248**	-0.0179***
	(0.0064)	(0.0478)	(0.0109)	(0.0039)
Observations	8,026	8,026	8,026	8,031
Pre-trends χ^2 p (CathShare)	0.000	0.000	0.074	0.036
Pre-trends χ^2 p (PolenShare_{1871})	0.000	0.005	0.000	0.000
County FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Notes: Robust standard errors clustered at the county level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The ethnic coefficient is larger for the CBR and general marriage rate outcomes than the religion coefficient. Moreover, the religion coefficient for the CBR is only significant at the 10 percent level. These results suggests that the negative associations I found in panel A (Table 6.1) are most likely ethnic rather than related to religion. Though the pre-trends rejects parallel trends, it is only associations and not causal effects. For the illegitimate fertility rate, this is where the religion coefficient is largest in absolute size and most credible as this is the only outcome where pre-trends is not rejected. This negative coefficient is not consistent with a large-scale Catholic boycott in the civil registration. The religion coefficient is significant and negative, whereas the ethnic coefficient is significant and positive.

6.3.3 Migration as a demographic mechanism

There is a demographic concern regarding the results for the Polish provinces in Table 6.2. The concern is that the negative coefficients in the estimations for fertility and marriage rate in the Polish provinces reflect a change in the population at risk of fertility rather than a change in fertility for those who stayed. There are two out-migration movements

in the Polish provinces. First, the *Ostflucht* where Germans and Poles emigrated to the industrializing western provinces Clark (2006). Second, the expulsion of Poles in the 1885-86 *Polenausweisungen*. In Figure 6.2, I plot the implied net-migration for Polish provinces and the rest of the sample.

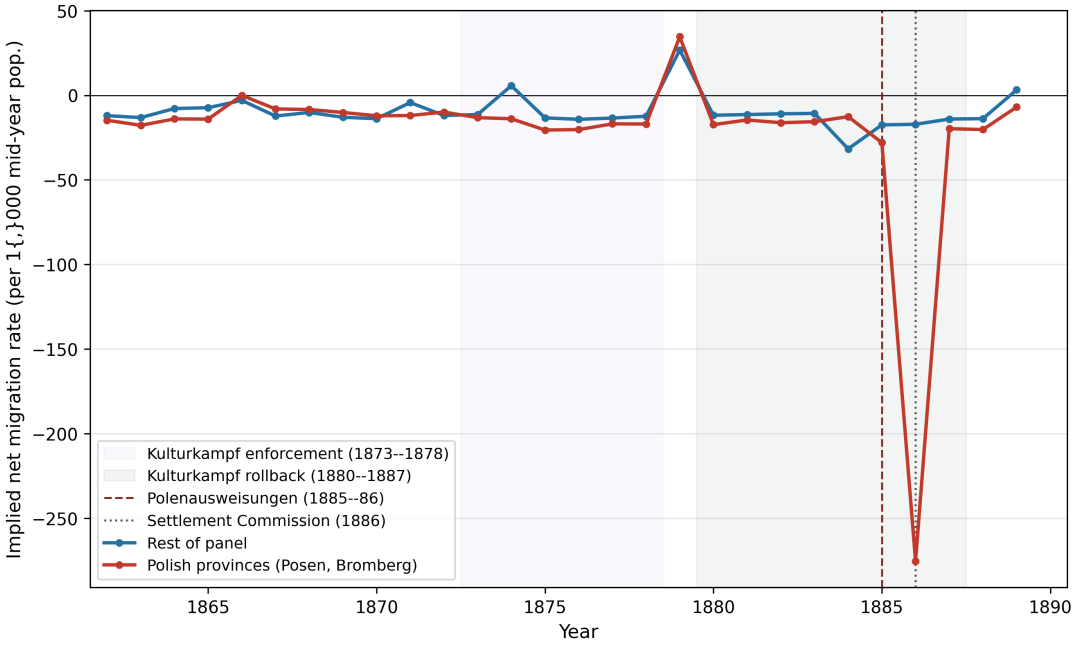


Figure 6.2: Implied net-migration plot, 1867-1890

The net implied rate shows that across the panel, the Ostflucht is not limited to only the Polish east but also the other eastern counties. Therefore, the Ostflucht can not explain the different fertility results for the Polish provinces. The migration flows are nearly constant during the Kulturkampf enforcement period for the Polish provinces. As expected, there is a large emigration flow in 1886. However, the magnitude of the implied migration rate in 1886 is too large to only reflect the expulsions, which is likely due to interpolation noise. The large population decline is likely what explains the absolute increase in the coefficients for Polish fertility and marriage in the rollback.

7 Discussion

7.1 The Kulturkampf and Catholic fertility

Bismarck's battle against the Catholic institutions did not affect Catholic fertility. For all specifications, marital fertility does not respond to the shock. I reject parallel trends for

most of the outcomes, and I therefore interpret the estimates as associations rather than causal effects. While most of my estimates are not robust, the results in the estimations for the marital fertility are robust.

These GMFR results follows the demographic setting with Catholic Prussia being a pre-transition population. Here, fertility is determined by the extensive margin rather than the intensive margin, since households do not yet limit their family size within marriage. At most, the Kulturkampf shock is associated with a fertility change via the extensive channel. My results suggests that the Catholic institutions Bismarck attacked were not a main driver of the Catholic-Protestant fertility differential. This is consistent with Galloway et al. (1994), who find that the Catholic share is the strongest predictor of marital fertility levels in nineteenth-century Prussia, but that changes in the Catholic share do not explain much of the fertility decline. Instead, their findings suggest that structural economic factors are what drove the fertility decline in nineteenth-century Prussia. I discuss these factors in subsection 7.3.

7.2 Polenpolitik, not Kulturkampf

The decomposition of religion and ethnicity suggests that the the negative birth rate and marriage coefficients are mostly ethnic. The Polish-ethnicity coefficients for both outcomes are larger and more significant than the religion coefficients. The religion and the ethnicity coefficient are both insignificant for the marital fertility outcome.

In the Polish regions, there is an emigration confound because of the large emigration outflow in 1886. I cannot distinguish between if the Polish results are due to the ones who were expelled were on average more fertile or the remaining Poles changed their fertility behavior. However, these results are not a Kulturkampf association.

7.3 What did explain the differential: human capital and informational barriers

Examples of the driving structural economic factors that led to the fertility decline, according to Galloway et al. (1994), include the growth of financial institutions, the development of transport, and improvements in education. The sub-region characteristics table (Ta-

ble D.3) shows that the three sub-regions differed in these structural economic factors. In 1886, German Catholic counties had a more under-resourced school system relative to Protestant counties, with 19 more pupils per teacher. Using the literacy rate, which is a better proxy of school quality, Becker and Woessmann (2009) find that Protestant counties had systematically higher literacy throughout nineteenth-century Prussia. They attribute this to Protestants being embedded in a religious culture, which encourages human capital in order to read the Bible. Moreover, Galloway et al. (1994) uses historical evidence from Golde (1975), who suggests that Catholics retained a more manual familial mode of production, whereas Protestants could mechanize their production because of a higher literacy. This implied that the labor value of children were higher for Catholic families which led to a higher incentive for fertility compared to Protestants.

The importance of human capital for the fertility transition is theorized by Galor (2010), who argue that rising returns to human-capital investment per child increase the shadow price of the quantity of children relative to the quality of children. The findings of Murtin (2013), who analyze a panel of 70 countries, support the importance of primary schooling, suggesting that it is the most robust determinant of the timing of the fertility transition. However, Murtin (2013)'s macroeconomic-level cross-country panels capture a robust correlation rather than an exogenous causality. In 1876, the German Catholic counties were on average wealthier than the Protestant counties: the income tax per capita was 1.43 Marks higher. Under the assumption that per capita income tax is a good proxy for per capita income, this aligns with the historical evidence Galor (2010) provides: there is often a positive relationship between income per capita and fertility when there are no rising returns to human capital.

The only Kulturkampf law that targeted human capital was the 1872 School Inspection law, which kept Catholic schools religious but transferred school inspection to the Prussian state. 14 years later, the difference in pupils per teacher between Catholic and Protestant counties remains large, indicating that school resourcing was not prioritized.

Returning to the role of culture on fertility, one possible explanation for the persistence and widening of the Catholic-Protestant fertility differential could reflect Beach and Hanlon (2023)'s findings. They analyze the 1877 Bradlaugh-Besant trial and its impact on the British fertility transition and suggest that informational barriers across cultures could

have hindered the transmission of fertility norms. Even in areas where the economic modernization incentivizes lower fertility, this implies that different cultural groups can maintain large differences in fertility, like in the case of nineteenth-century Prussia. The historical evidence suggests that the informational barriers between Prussian Protestants and Catholics were substantial before the Kulturkampf **?**. Moreover, Smith (1995) documents that the Kulturkampf strengthened the cultural *milieu* between these two religious groups, as the Catholic parishes boycotted the Liberal Prussian press.

Catholic Prussia, while on average being highly industrialized and prosperous, lagged behind in the fertility decline, likely because it lacked investments in human capital, and the cultural barriers between Protestants and Catholics made it difficult for fertility norms to be transmitted.

7.4 Limitations

Due to the population data being reported only at the December census dates, I had to construct mid-year (July 1st) population by linear interpolation between census anchors, and I interpolate the age shares (women aged 15-49 and 15+) between only three available age censuses. Linear interpolation introduces measurement error into these denominators and imposes a straight-line between anchors, smoothing within-interval variation. These denominators therefore add measurement error to the rate variables and bias my estimates.

Another limitation is that I cannot use the infant mortality rate as a control because of a measurement change in 1875. This is relevant for fertility because households target an optimal number of surviving children Galor (2010). However, the descriptive trends in Figure D.1 indicate that high-Catholic counties had a slightly lower infant mortality rate than low-Catholic counties.

Lastly, my fertility rates are measures of period fertility and not cohort fertility. As a result, the DiD coefficients are averages of the cohorts born between 1824-1875, that is 49 cohorts (Figure B.1). If I had analyzed cohort-level data then I could have analyzed if the Kulturkampf caused the Catholic couples couples to postpone their marriage or changes in the family size. However, since my DiD coefficient in the estimations for the marital fertility are all insignificant, it suggest that neither of the two were affected. Which is

again consistent with the intensive margin being non-existent.

8 Conclusion

This paper analyzed whether Bismarck's Kulturkampf in 1871-1878, which was a state-led attack on the institutions of the Catholic Church in Prussia, transmitted to Catholic culture and thereby narrowed the Catholic-Protestant fertility differential. Bismarck and the National Liberals viewed the Catholic institutions as being structural anchors of the Catholic culture. If that was the case then such a shock would have narrowed the Catholic-Protestant differential.

It is important to determine the margins at which such a shock could act. That the Catholic population was a pre-transition population predicts that the fertility within marriage should stay unaffected by a short-run shock that do not change the structural factors. In other words, the intensive margin is non-existent. My insignificant results for marital fertility suggests that Catholic Prussia indeed was a pre-transition population. The intensive margin being unaffected suggests that the extensive margin of whether to become a parent is the driving margin of fertility.

The negative association with marriage rate is located in the Polish regions, and when I decompose into religion and ethnicity then the associations are largely driven by the *Germanisierungspolitik* and not the Kulturkampf. Furthermore, the timing of these coefficients are wrong to be a Kulturkampf association. There is no convergence toward Protestant fertility in the German Catholic counties during the Kulturkampf. Instead, the differential diverged after the enforcement, likely reflecting that Prussia began the fertility transition. This fertility differential persisted for decades. I reject parallel trends for most outcomes, and therefore I interpret the estimates as associations rather than causal effects.

What did sustain the fertility differential are better explained by the structural economic factors that Galloway et al. (1994) identify as the drivers of the Prussian fertility decline. German Catholic Prussia was wealthy, but it was under-invested in human capital relative to Protestant Prussia. This is the channel where Galor (2010) locate the transition, which the findings of Murtin (2013) support. Another explanation is through the informational

channel suggested by Beach and Hanlon (2023), since the Kulturkampf led to increased informational barriers between Protestants and Catholics, the transmission of the new norms were delayed.

References

Aaronson, D., Lange, F., and Mazumder, B. (2014). Fertility transitions along the extensive and intensive margins. *American Economic Review*, 104(11):3701–3724.

Anderson, B. A. (1986). Regional and cultural factors in the decline of marital fertility in Europe. In Coale, A. J. and Watkins, S. C., editors, *The Decline of Fertility in Europe*, chapter 7, pages 293–313. Princeton University Press, Princeton, NJ.

Anthropic (2026). Claude opus 4.7. Large Language Model. Accessed: 03-05-2026.

Beach, B. and Hanlon, W. W. (2023). Culture and the historical fertility transition. *Review of Economic Studies*, 90(4):1669–1700.

Becker, S. O., Cinnirella, F., Hornung, E., and Wößmann, L. (2014). ipehd – the ifo prussian economic history database. *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, 47(2):57–66. Working paper version available as: CESifo Working Paper 3904.

Becker, S. O. and Woessmann, L. (2009). Was Weber wrong? A human capital theory of protestant economic history. *The Quarterly Journal of Economics*, 124(2):531–596.

Clark, C. (2006). *Iron Kingdom: The Rise and Downfall of Prussia, 1600–1947*. The Belknap Press of Harvard University Press, Cambridge, Massachusetts. Available via Internet Archive: https://archive.org/details/ironkingdomrised00chri.

Coale, A. J. and Watkins, S. C., editors (1986). *The Decline of Fertility in Europe*. Princeton University Press, Princeton, NJ.

Galloway, P. R. (2007). Galloway Prussia Database 1861 to 1914. Accessed: 20-04-2026.

Galloway, P. R., Hammel, E. A., and Lee, R. D. (1994). Fertility decline in Prussia, 1875-1910: A pooled cross-section time series analysis. *Population Studies*, 48(1):135–158.

Galor, O. (2010). The demographic transition: Causes and consequences. *Review of Economic Studies (Working Paper version)*. Brown University Working Paper.

Golde, G. R. (1975). *Catholics and Protestants: Agricultural Modernization in Two German Villages*. Studies in Anthropology. Academic Press, New York.

Google (2026). Gemini 3. Large Language Model. Accessed: 03-05-2026.

Hinde, A. (1998). *Demographic Methods*. Arnold, London.

Hubatsch, W. and Klein, T., editors (1975). *Grundriß der deutschen Verwaltungsgeschichte*. Johann-Gottfried-Herder-Institut, Marburg. Series published from 1815 to 1945.

Max Planck Institute for Demographic Research and Chair for Geodesy and Geoinformatics (2011). Mpidr population history gis collection. Partly based on Hubatsch and Klein (1975 ff.).

Murtin, F. (2013). Long-term determinants of the demographic transition, 1870-2000. *The Review of Economics and Statistics*, 95(2):617–631.

Smith, H. W. (1995). *German Nationalism and Religious Conflict: Culture, Ideology, Politics, 1870-1914*. Princeton University Press, Princeton, NJ.

Appendix A AI transparency

In this term paper, I have used AI to optimize my work. I used two Generative AI tools: (i) Claude Opus 4.7 Anthropic (2026) and (ii) Gemini Flash 3 Google (2026). I have used the GenAI tools in following ways:

- **Coding:** I got assistance writing Python code (Jupyter notebook and scripts) for data processing, estimations, and visualization.
- **LaTeX**: Generated code for tables and figures.
- **Sparring**: I used GenAI as a sparring partner to critique what I had written. Moreover, I had dialogues with GenAI about the course material and the papers I cite.

Every decision was taken by me, all interpretations, and the written product is my original work.

Appendix B Data appendix

In my empirical analysis, I use three different datasets. I use (i) the Galloway (2007) Prussia Database, (ii) iPEHD database Becker et al. (2014), and (iii) GIS data for German Empire (1871-1945) provided by the MPIDR and CGG Max Planck Institute for Demographic Research and Chair for Geodesy and Geoinformatics (2011), which is partly based on the administrative boundaries documented in Hubatsch and Klein (1975).

B.1 Variable definitions

I report the variable definitions in Table B.1.

Table B.1: Variable definitions and construction

Variable	Construction	Source
Headline outcomes		
CBR	Total live births per 1,000 mid-year population.	Galloway

Continued on next page

Table B.1, continued

Variable	Construction	Source
$GMFR^{1871}$	Legitimate births per 1,000 married women 15-49, with marriage share fixed at 1871 and applied to time-varying women population aged 15-49	Galloway, AGE
Illegitimate fertility rate	Illegitimate births per 1,000 unmarried women 15-49	Galloway, AGE
GMR	Marriages per 1,000 mid-year population aged 15+ (**?**).	Galloway, AGE
Appendix robustness outcomes		
GFR	Births per 1,000 women 15–49 (alternative denominator for CBR; Table D.1).	Galloway, AGE
CMR	Marriages per 1,000 mid-year pop. (alternative denominator for GMR; Table D.1).	Galloway
Total marriages, Births per marriage	Population-denominator-free outcomes (**??**).	Galloway
Treatment and time		
$CathShare_i$	1871 Catholic share of county population (continuous, time-invariant).	Galloway REL1871
$Post_t$	Indicator for $t \geq 1873$ (May Laws).	—
CathShare × Post	DiD interaction.	—
Auxiliary treatment intensities (heterogeneity and robustness)		
$PolenShare_{1871,i}$	1871 Polish-nationalist (Koło Polskie) vote share. Used in subsubsection 6.3.2.	Galloway ELE1871
$ZentrumShare_{1871,i}$	1871 Centre Party vote share. Used in subsection D.2.	Galloway ELE1871
$Polish_i$	Dummy for Posen (POS) and Bromberg (BRO).	Author's classification

Continued on next page

Table B.1, continued

Variable	Construction	Source
Sub-region balance variables (Table D.3, descriptive only)		
1871 demographic	`school1517` (literacy), `f_urban`, `f_pruss`, `f_jew`, `hhsize`; share born in current Kreis.	iPEHD, Galloway BIR1871
Economic and modernisation	Income tax per capita (1876, *Klassensteuer*); land Gini (1882); finance, transport, and health sector employment per 1,000 (1882); pupils per teacher (1886).	Galloway TAX1876, iPEHD
Migration variables (Figure 6.2)		
Implied net migration	$(P_{t+1} - P_t) - (B_t - D_t)$	Galloway
Fixed effects		
County FE (α_i)	392 *Kreis*-level fixed effects.	—
Year FE (δ_t)	Annual fixed effects, 1867–1890.	—
Year × Rb FE	Year by *Regierungsbezirk* fixed effects (Panel B of Table 6.1).	—
Descriptive only		
Infant mortality rate	Infant deaths per 1,000 live births. Measurement break in 1875; cross-religion comparison biased by baptismal-recording practices (**?**).	Galloway VIT

Notes: I approximate mid-year population by using linear interpolation between the end-of-year population data, where I evaluate at July 1st. The static 1871 fertility rates ($GMFR^{1871}$ and Illegitimate fertility $rate^{1871}$) use the marriage share $\mu_{i,1871}$ at its 1871 county-specific baseline to remove the endogeneity bias from fall in marriage rates. Galloway is the Galloway Prussia Database (Galloway, 2007), iPEHD is the Ifo Prussian Economic History Database (Becker et al., 2014), STA1871, AGE1882, and AGE1890 are the three age datafiles I use for the women aged 15-49 and population aged 15+.

B.2 Data sources

I report the data sources in Table B.2.

Table B.2: Summary of data sources

Category	Data Source	Description
Vital statistics	Galloway Prussia VIT	Annual county-level counts of total, legitimate, and illegitimate births, marriages, and deaths, 1862–1914 (Galloway, 2007).
Population census	Galloway Prussia POP	December population censuses, 1861/64/67/71/75/80/85/90, used for mid-year-population interpolation (Galloway, 2007).
Religious composition	Galloway Prussia REL1871	1871 cross-section of Catholic and Protestant population shares (headline treatment variable) (Galloway, 2007).
Reichstag elections	Galloway Prussia ELE1871	1871 Polish-nationalist (Koło Polskie) and Centre Party (Zentrum) vote shares, used in the religion-vs-ethnicity decomposition and Zentrum-only robustness.

B.3 Variable construction

In this section, I describe how I compute the demographic rate variables related to fertility that I use in the empirical analysis. The demographic rates mostly follow those in Hinde (1998). Throughout, I use two different subscripts: a county subscript (i) for the Prussian county and a time subscript (t).

B.3.1 Calculation of mid-year population

An important choice is the denominator of the demographic rate variables. This is because the Galloway Prussia Database Galloway (2007) only reports population at the end of the calendar (December), and not at mid-year (July), which has become the modern convention in Demography. It is important to use mid-year population, as population is a stock variable whereas births, deaths, and marriages are flow variables. As such, I need to use mid-year population which is the average population that is exposed to these flow variables over the calendar year. It is important to use mid-year population for Prussia in 1862-1890, as the population was growing, and hence using the population from Galloway Prussia Database Galloway (2007) will result in a downward bias, as the population will be too large. Furthermore, in counties where population might be declining in certain years due to emigration, the end-of-year population will be too small.

When I started estimating the regressions, I assumed the population was mid-year, which resulted in coefficients for the crude birth rate being statistically insignificant with p-values close to one and approximately equal to zero in magnitude.

To construct the mid-year population, I use linear interpolation between the observations and evaluate at July 1st for the census years (1861, 1864, 1867, and so on). I denote the the interpolated mid-year population as $\text{Poptot_midyear}_{i,t}$, and I will use this the mid-year in the denominator for all the demographic rates.

B.3.2 Calculation of age-specific population

For the general fertility rate (GFR), general marriage rate (GMR), and General Marital Fertility (GMFR), I use denominators that depend on age-specific populations of the county. For GFR, I use the count of women aged 15-49 and for GMR I use the total population aged 15 and above. Moreover, for GMFR, I fix the share of married women but keeping the number of women time-varying. I approximate the age structure by using linear interpolation for three census datasets with age and civil status: STA1871, AGE1882, and AGE1890.

GFR and GMFR use Women aged 15-49. AGE1882 does not report 15-49 but reports 0-19, 20-69, 70+ as bins. Hence, I get the 15-49 count by using the ratio between number of women in the age 15-49 and total female population from AGE1890 to the female population total from AGE1882. There is a small number of counties that is missing in the AGE1882 and AGE1890. For missing values in AGE1882, I interpolate between STA1871 and AGE1890, and for AGE1890, I use the age structure from STA1871.

The GMR uses population aged +15. The age intervals were different in STA1871, so I had to approximate by taking five-sixths of the 14-19 age intervals to approximate it to 15-19 which I do for all age intervals. I then linearly interpolate for the missing years. The cross-county mean in 1871 for age 15+ is 0.637, 0.637 in 1882, and 0.634 in 1890, so the marriage-eligible age is stable across the sample period. I sum across the civil status columns in AGE1882 to calculate the age bins. Then I extract the 15-19 year old population from 0-19 year old population by dividing the age interval ratios. At last, I use linear interpolation across the three datasets.

B.3.3 Catholic share (treatment variable)

I define the Catholic share variable as the fraction of a Prussian county's 1871 population that is Roman Catholic. I construct it using total male and female Roman Catholics (Relcathm and Relcathf) in a given county i, which I divide by the 1871 total population:

$$\text{CathShare}_i = \frac{\text{Relcathm}_{i,1871} + \text{Relcathf}_{i,1871}}{\text{Pop}_{i,1871}} \times 100 \tag{B.1}$$

CathShare_i is in the interval from 0 to 100 percent and it is time-invariant. This variable is important and it is used in these ways: (i) as a continuous treatment intensity variable in the DiD estimations, and (ii) to construct a dummy variable to divide the counties into high-Catholic and low-Catholic for the descriptive evidence in Figure 6.1.

B.3.4 Fertility variables

Aggregate fertility rates. The crude birth rate (CBR) is defined as the total births (Birtot) per thousand mid-year population (Poptot_midyear) Hinde (1998):

$$\text{CBR}_{i,t} = \frac{\text{Birtot}_{i,t}}{\text{Poptot_midyear}_{i,t}} \times 1000 \tag{B.2}$$

The CBR is not a fertility measure without its limitations. It would be preferred to use general fertility rate, as CBR does not control for the composition of age and sex, hence Prussian counties with younger populations or higher female-to-male ratios will have higher CBRs even though the fertility behavior is the same. However, these concerns will mostly be mitigated by the county and year fixed effects.

In a robustness check (Table D.1), I estimate Equation 5.1 but where I use the General Fertility Rate (GFR) instead of the CBR. GFR is defined as total births per thousand women aged 15-49 mid-year.

$$\text{GFR}_{i,t} = \frac{\text{Birtot}_{i,t}}{W_{i,t}^{15-49}} \times 1000 \tag{B.3}$$

The women aged 15-49 mid-year is calculated as I describe in subsubsection B.3.2. I do not use the GFR instead of CBR in my empirical analysis, as there is too much interpolation noise between the years.

This concern is less relevant for the general marriage rate, as the 15+ population is a larger age interval (around 80 percent of the population), and hence it covers more cohorts.

Marital and non-marital fertility. The Galloway Prussia Database Galloway (2007) separates total births into legitimate (Birletot) and illegitimate (Birbastot) births.

The General Marital Fertility Rate (GMFR) is my measure for marital fertility and it is the same as Galloway et al. (1994) use in their long-run analysis. However, in contrast to them, I fix the share of married women at 1871 and keep the number of women as time-varying. This is because the share of married women is likely endogenous to the Kulturkampf if the Kulturkampf did have an association with a fall in the marriage rates. Ignoring this, I would have gotten significant and positive coefficients, which could not be interpreted as a higher fertility within marriage but rather a lower average for share of the married women aged 15+. GMFR becomes:

$$\text{GMFR}_{i,t}^{1871} = \frac{\text{Birlegtot}_{i,t}}{\mu_{i,1871}^{15\text{-}49} \cdot W_{i,t}} \times 1000, \quad \mu_{i,1871}^{15\text{-}49} = \frac{\text{Marriedover15f}_i}{\text{Popover15f}_i}\bigg|_{1871} \tag{B.4}$$

For the non-marital fertility, I calculate an illegitimate fertility rate. Contrary to GMFR^{1871}, I keep the share of unmarried women time-varying. This is because I want analyze if Kulturkampf caused the Catholic couples to boycott the civil registration, as these births for these couples would be counted as illegitimate.

$$\text{IllegFR}_{i,t} = \frac{\text{Birbastot}_{i,t}}{\left(1 - \mu_{i,t}^{15\text{-}49}\right) \cdot W_{i,t}} \times 1000, \quad \mu_{i,t}^{15\text{-}49} = \frac{M_{i,t}}{W_{i,t}} \tag{B.5}$$

B.3.5 Marriage rates

The crude marriage rate (CMR) is the number of marriages (Martot) per thousand mid-year population:

$$\text{CMR}_{i,t} = \frac{\text{Martot}_{i,t}}{\text{Poptot_midyear}_{i,t}} \times 1000. \tag{B.6}$$

However, one limitation of the CMR is that it includes children, who are not allowed to get married. Therefore, I also calculate the general marriage rate (GMR) and estimate in a robustness check (Table D.1). GMR is the number of marriages per thousand mid-year population aged 15 and above:

$$\text{GMR}_{i,t} = \frac{\text{Martot}_{i,t}}{\text{Pop15_midyear+}_{i,t}} \times 1000. \tag{B.7}$$

I include the marriage as a secondary outcome, as it was important for Prussia at the time. Most births occurred inside of wedlock, especially for Catholic couples. Moreover, Catholic doctrine is more strict than Protestant in the way that marriage is a sacrament which is administered by the Catholic Church. One of the laws in the Kulturkampf legislation was the 1874 Prussian Civil Marriage Act, which made

religious marriages invalid and required civil registration. Hence, I expect the marriage rate to be the most robust variable, as it is the only variable that was directly affected by the Kulturkampf.

B.3.6 Migration variables

Migration is important to analyze because the Polenpolitik caused Poles to emigrate in 1886. However, the Galloway Prussia Database Galloway (2007) does not include migration data for late 1880s. Therefore, I approximate a net migration variable by using the basic demographic equation from Hinde (1998). I calculate it as the the residual of population change:

$$P_{t+1} = P_t + B_t - D_t + I_t - E_t M_t \equiv I_t - E_t = P_{t+1} - P_t - (B_t - D_t), \tag{B.8}$$

B.3.7 Infant mortality rate

The infant mortality rate is defined as deaths under age one per thousand live births:

$$\text{IMR}_{i,t} = \frac{\text{Dth_infant_leg}_{i,t} + \text{Dth_infant_bas}_{i,t}}{\text{Birlegtot}_{i,t} + \text{Birbastot}_{i,t}} \times 1000 \tag{B.9}$$

Where Dth_infant_leg are the legitimate infant deaths and $\text{Dth_infant_bas}_{i,t}$ are the illegitimate infant deaths.

I do not use the infant mortality rate in the regressions, as there is a measurement change in 1875. If I included it then I would get spurious results, as it does not reflect the actual changes in infant mortality. However, I do analyze it descriptively in subsection D.4.

B.4 Lexis chart

I report the Lexis diagram in Figure B.1 which shows which birth cohorts are exposed to the Kulturkampf and rollback periods. The fertile ages are illustrated by the dark area.

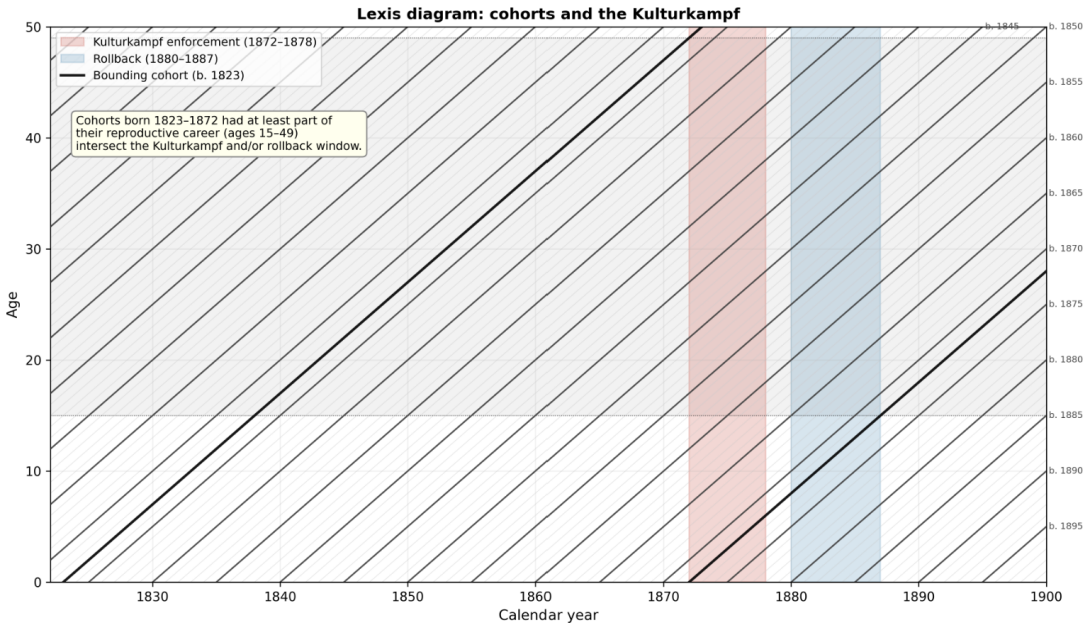


Figure B.1: Lexis diagram

The 1822 cohort becomes age 49 (highest fertile age) in 1871, while the 1872 cohort becomes age 15 in 1887. Every cohort which is born between these cohort years has at least some part of their fertile age in these windows. Some cohorts approximately 1824-1863 were exposed to different institutional and demographic outcomes. The oldest were at the end of their fertile years while the younger cohorts still had many fertile years left in their marriages. As a result, the post-1873 DiD coefficient reflects a period shock which averages over the cohorts. It would have been optimal to analyze the 1851-1865 cohorts as these were in their most fertile ages (25-39).

Appendix C Methodology appendix

C.1 Identification

It is a quasi-experimental design rather than a natural experiment. As a political shock, the Kulturkampf was not randomly assigned: Bismarck implemented it as a response to the establishment of the pro-Catholic *Zentrum* party. It could indicate that the enforcement was more aggressive in counties where the political mobilization of Catholics were high. Moreover, Prussian in the sample are not randomly assigned to a denomination: most of them are born into it. More- and less-Catholic counties also differ on many parameters that is not directly related to religion, such as urbanization, schooling, and ethnicity.

C.1.1 Event study specification

I estimate an event study to test the parallel-trends assumption:

$$Y_{it} = \sum_{j=1862, j\neq 1872}^{1890} \beta_j \left(\text{CathShare}_i \times \mathcal{I}(t=j)\right) + \alpha_i + \delta_t + \varepsilon_{it} \tag{C.1}$$

Where $\mathcal{I}(\text{Year} = j)$ is a dummy for year j and 1872 is the reference year. The β_j-coefficients are the association between the 1871 Catholic share and the outcome in year j relative to the reference year 1872. These coefficients should be statistically insignificant before 1873 for there to be parallel trends. I use the event study specifications to conduct pre-trends tests which I report in the estimation tables.

C.2 Stability of relevant demographics

In this appendix, I analyze the stability of relevant demographic variables across the sample period. It is the a check of the time-invariance of the treatment variable, the sex ratio and the population growth rates in high- and low-Catholic counties. I report it in Table C.1.

Table C.1: Stability of treatment groups, 1871-1890

	1871	1880	1885	1890
Panel A. Prussia-wide Catholic share (pop-weighted)				
Catholic share (%)	33.564	33.744	33.977	34.227
Counties observed (N)	514	503	547	585
Panel B. Within-county means, balanced 4-census sample ($N = 467$)				
Low-Catholic ($\leq 50\%$ in 1871, $N = 314$)	10.463	10.824	11.005	11.330
High-Catholic ($> 50\%$ in 1871, $N = 153$)	83.733	83.657	83.678	83.466
Panel C. Within-county persistence (balanced clean sample, $N = 467$)				
$\rho(cath_share_{1871}, cath_share_{1880})$		0.999		
$\rho(cath_share_{1871}, cath_share_{1890})$		0.998		
$\rho(cath_share_{1880}, cath_share_{1890})$		0.998		
Panel D. Sex ratio by treatment group (men per 100 women, pop-weighted)				
Low-Catholic ($\leq 50\%$ in 1871)	96.75	96.72	96.10	96.15
High-Catholic ($> 50\%$ in 1871)	97.36	97.25	96.69	96.76
High − Low (pp)	+0.61	+0.53	+0.59	+0.61

Panels A-C suggests that the Catholic share is stable across the period. The aggregate Prussian Catholic share increases by 0.66 percentage points. Moreover, the correlation within the counties for 1871 and 1890 is 0.998. The within-county changes happens in 1880-1890 and during the Kulturkampf.

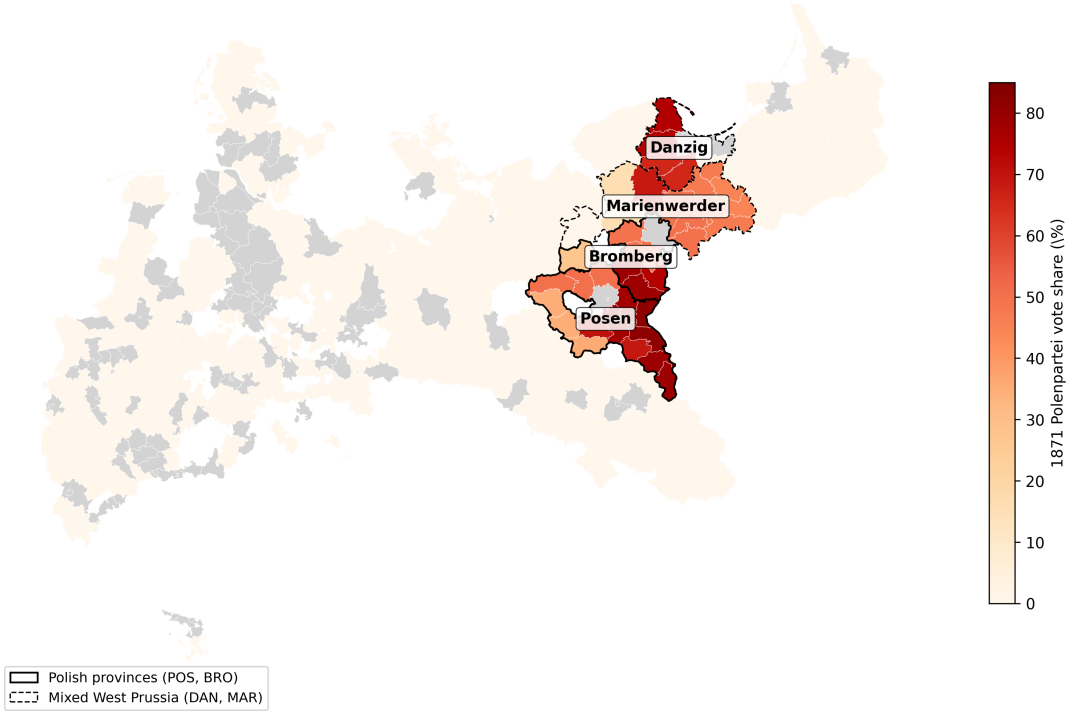
One concern is that the results for the decrease in marriage rate is due to high-Catholic counties having different sex ratios, where an imbalance of the sexes could lead to individuals not finding a partner. I calculate the sex ratio as: $\frac{\sum_i \text{Pop}_{i,t}^M}{\sum_i \text{Pop}_{i,t}^F}$. The sex ratios are stable across the four censuses and there are only slightly relative more men (0.6 more men per 100 women) relative to low-Catholic counties. However, this is not large enough to account for the approximately 4-5 percent lower marriage rates in high-Catholic counties.

High-Catholic counties grew a bit more slowly than low-Catholic counties. Splitting this into the ethnic provinces, it suggests that the Polish-Catholic provinces lost population, whereas the German-Catholic provinces grew a bit faster than the low-Catholic provinces.

C.3 The choice of the Polish provinces

In order to divide Prussia into the three sub-regions in the heterogeneity, I need to do so based on a Polish ethnicity proxy. In contrary to Galloway et al. (1994), I do not have data for Slavic mother tongue in Prussia. Instead, I divide Prussia up into German-majority and Polish-majority *Regierungsbezirke* (provinces) by using the 1871 Polenpartei vote share. A mother tongue proxy would be more accurate, as my proxy does not include (i) Poles who did not vote for Polenpartei, (ii) did not vote at all, and (iii) the Poles who could not vote. Therefore, I will be conservative in deciding the Polish provinces.

Figure C.1: 1871 Polenpartei Reichstag vote share by Prussian *Kreis*



Notes: Source: Galloway Prussia Database Galloway (2007) Reichstag 1871 election results (ELE1871) and the MPIDR Census Mosaic 1871 Prussian Kreis shapefile Max Planck Institute for Demographic Research and Chair for Geodesy and Geoinformatics (2011); Hubatsch and Klein (1975).

From Figure C.1, it can be seen that the 1871 Polenpartei vote share is distributed mostly in the eastern provinces of Posen, Bromberg, Danzig, and Marienwerder. In these provinces, the vote share is concentrated in Posen and Bromberg, with Danzig and Marienwerder being more ethnically mixed. I therefore exclude Danzig and Marienwerder from the Polish provinces in the sub-region heterogeneity analyses.

C.4 Zentrum vote share, 1871-1890

I receive Reichstag election results from seven cross-section datasets in Galloway (2007) to approximate the vote share for the Zentrum and Polen party. These parties were the two pro-Catholic parties in Prussia: Zentrum was German Catholic and Polen was Polish Catholic. I use these years:

- **1874 and 1878:** Kulturkampf enforcement (Post-May Laws)
- **1881 and 1884:** Kulturkampf rollback
- **1890:** Post-rollback

The election results data is organized in *Wahlkreis* (electoral district). I match these to the *Kreis* level.

I calculate the vote shares as (it is symmetric for Polen):

$$\text{zentrum_share}_{it} = \frac{\text{Zentrum votes}_{it}}{\text{valid votes}_{it}} \tag{C.2}$$

And then I aggregate to the Prussian average by taking the population-weighted mean across the Kreise. There are approximately 331-339 kreise per election, as I could not match all kreise. Therefore, these vote shares are not the official Prussian total, but the main purpose is to show that the Zentrum (and Polen) party gained popularity across the period and will not be part of the regressions.

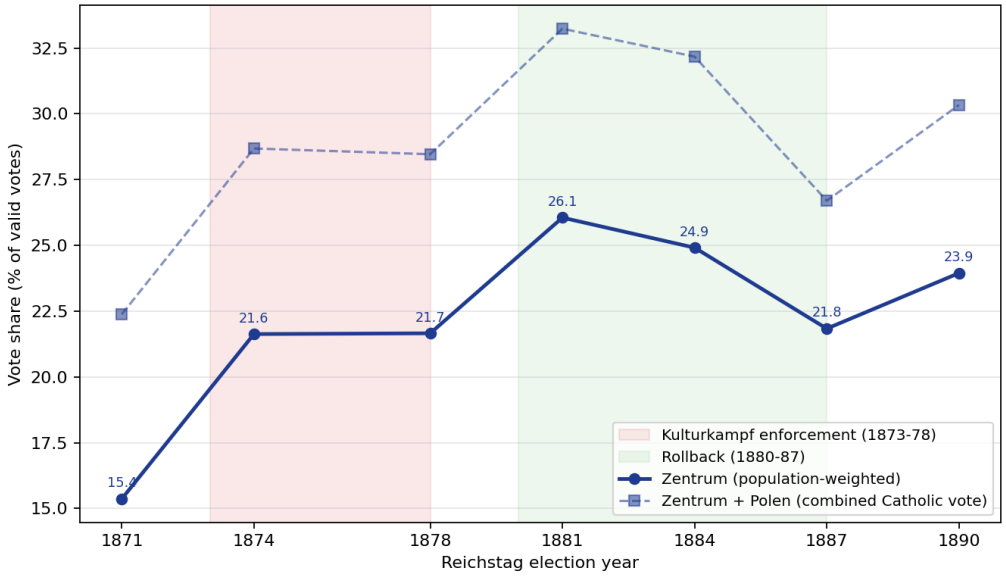


Figure C.2: Catholic Centre Party (Zentrum) vote share across Reichstag elections, 1871-1890.

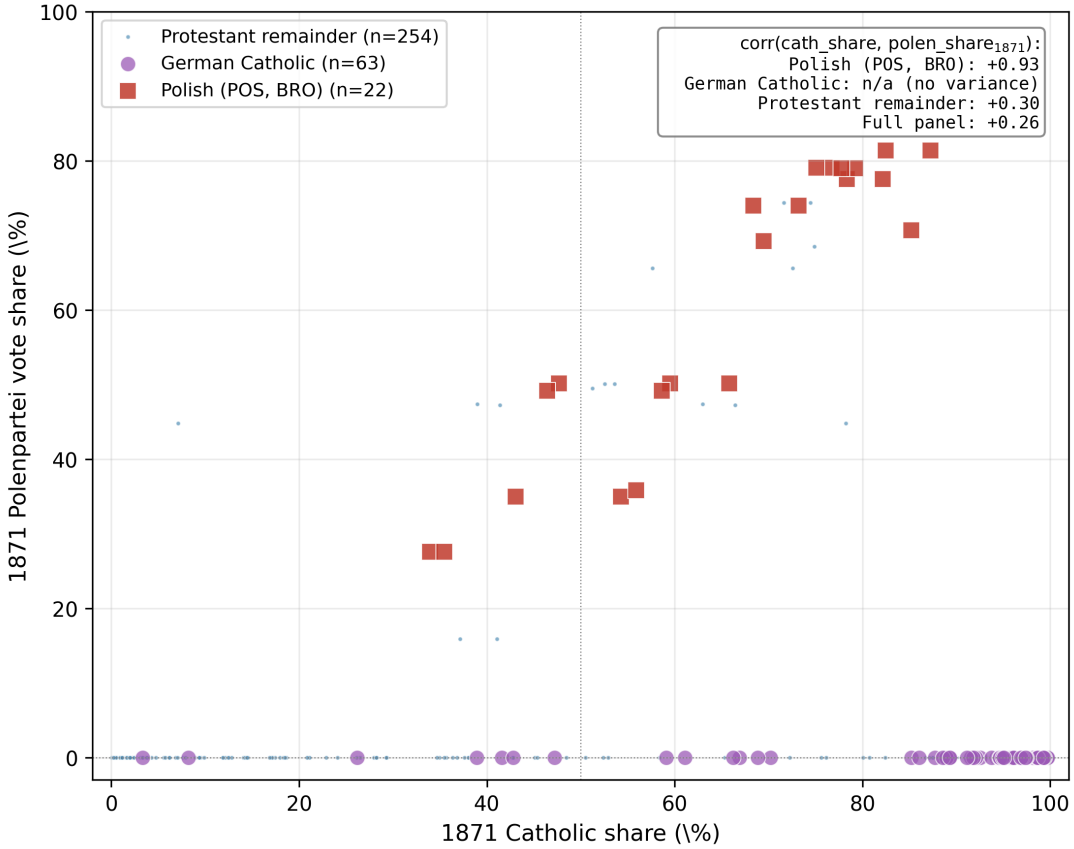
Notes: Population-weighted mean of Kreis-level vote shares across Galloway's seven election cross-sections. The shaded intervals mark the Kulturkampf enforcement period (1873-78) and the rollback period (1880-87).

Source: Galloway Prussia Database Galloway (2007) Reichstag election result files and own calculations.

C.5 Correlation between Roman Catholicism and Polish ethnicity

As a proxy for Polish ethnicity, I use the vote share for the Polish-Nationalist party (Polenpartei) in 1871. This should be useful as a proxy, as a vote for this party is a vote for more Polish interests, whereas the other Prussian parties are German. Moreover, the vote share for Polenpartei is near zero for the German Catholic counties, indicating that I can use this variable to separate Roman Catholicism and Polish ethnicity. I visualize the correlations in a scatter plot in Figure C.3.

Figure C.3: Cross-county distribution of the 1871 Catholic share and the 1871 Polenpartei vote share



Notes: Source: Galloway Prussia Database Galloway (2007): 1871 Reichstag election results file (ELE1871).

Appendix D Empirical results appendix

In this section, I include tables and figures related to the empirical results.

D.1 Robustness check: alternative denominators for demographic rates

The crude rates (CBR and marriage rate) in Table 6.1 use total mid-year population as the denominator. This implies that the denominator for CBR includes individuals not in the fertile age (children and the elderly). Moreover, the crude marriage rate includes the couples who are already married. I estimate the baseline DiD for the general fertility rate (GFR) and the crude marriage rate (CMR) in Table D.1.

Table D.1: Robustness check: Alternative denominator definitions for rate variables

	Panel A: County + Year FE		Panel B: County + (Year × Rb) FE	
	GFR	Crude marriage rate	GFR	Crude marriage rate
	(1)	(2)	(3)	(4)
CathShare × Post	-0.030**	-0.006***	0.009	-0.002
	(0.014)	(0.001)	(0.021)	(0.002)
County FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	–	–
Year × Rb FE	–	–	Yes	Yes
Observations	9,255	9,255	9,255	9,255
Within R^2	-0.021	0.035	0.005	0.013
Pre-trends χ^2 p	0.000	0.001	0.000	0.001

Notes: Robust standard errors clustered at the county level. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

The GFR coefficient is insignificant and negative (-0.007), which is consistent with the CBR result in Table 6.1. Moreover, the CMR is also consistent with the general marriage rate: it is significant and negative but a bit smaller in magnitude (-0.004).

D.2 Robustness check: Religiosity robustness

Table D.2: Religiosity estimation: Kulturkampf effect by Catholic-share vs. Zentrum-share treatment intensity

Dependent variable:	Crude birth rate	GMFR^{1871}	Illeg. fert. rate^{1871}	Gen. marriage rate
	(1)	(2)	(3)	(4)
Panel A: Treatment intensity = Catholic population share (1871)				
CathShare × Post	-0.0109***	-0.0234	-0.0220***	-0.0110***
	(0.0031)	(0.0262)	(0.0062)	(0.0027)
Observations	9,255	9,254	9,261	9,261
Pre-trends χ^2 p	0.000	0.000	0.150	0.000
Panel B: Treatment intensity = Catholic-party (Zentrum+Polen) vote share, 1871 Reichstag				
CombinedShare$_{1871}$ × Post	-0.0072	0.0009	-0.0213***	-0.0073***
	(0.0045)	(0.0357)	(0.0082)	(0.0028)
Observations	8,026	8,026	8,031	8,031
Pre-trends χ^2 p	0.000	0.000	0.003	0.000
Panel C: Treatment intensity = Zentrum-only vote share (excl. Polenpartei), non-Polish sub-sample (drops POS, BRO)				
ZentrumShare$_{1871}$ × Post	0.0015	0.0313	-0.0316***	-0.0013
	(0.0046)	(0.0423)	(0.0096)	(0.0026)
Observations	7,071	7,071	7,076	7,076
Pre-trends χ^2 p	0.014	0.033	0.041	0.029
County FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Notes: Robust standard errors clustered at the county level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D.3 Sub-region structural characteristics in 1871

In this appendix, I report the means for variables that are proxies for the structural characteristics for the sub-regions in 1871 (pre-treatment): Polish high-Catholic counties, German high-Catholic counties, and German low-Catholic counties. Moreover, I calculate the difference between the two high-Catholic

sub-regions and the low-Catholic sub-region mean and use a Welch two-sample t-tests. I report it in Table D.3 and use it to describe why my results suggests that the Kulturkampf had no association with fertility and give alternative explanations for the Catholic-Protestant fertility differential.

Table D.3: Kulturkampf county characteristics by sub-region

	Polish (POS, BRO)	German Catholic	Protestant remainder	Polish − Protestant	German Cath. − Protestant
Catholic share, 1871 (%)	65.3	82.7	20.5	44.80***	62.22***
Polenpartei vote share, 1871 (%)	60.5	0.0	3.2	57.33***	-3.18***
Elementary attendance rate, 1871 (%)	0.0	7.8	7.2	-7.22***	0.59
Pupils per teacher, 1886	98.7	102.2	83.3	15.41***	+18.86***
Income tax per capita, 1876 (Marks)	2.24	4.96	3.53	-1.29***	+1.43***
Urban share, 1871 (%)	24.0	15.9	24.0	-0.04	-8.07***
Total population, 1871 (in 1000s)	57.4	48.6	52.2	5.22	-3.64
Counties (N)	24	68	300		

Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Source: iPEHD database Becker et al. (2014).

D.4 Infant mortality

A valuable control in the regressions would be infant mortality, as historically it is positively associated with fertility. According to the theoretical framework of the replacement effect Galor (2010), increased infant mortality leads to an increase in fertility, because parents tries to reach a target number of surviving offspring Murtin (2013). However, due to a measurement change in 1875, I choose not to include it in my regressions but will instead rely on a descriptive analysis of infant mortality in high-Catholic and low-Catholic counties.

I report the infant mortality rates in Figure D.1.

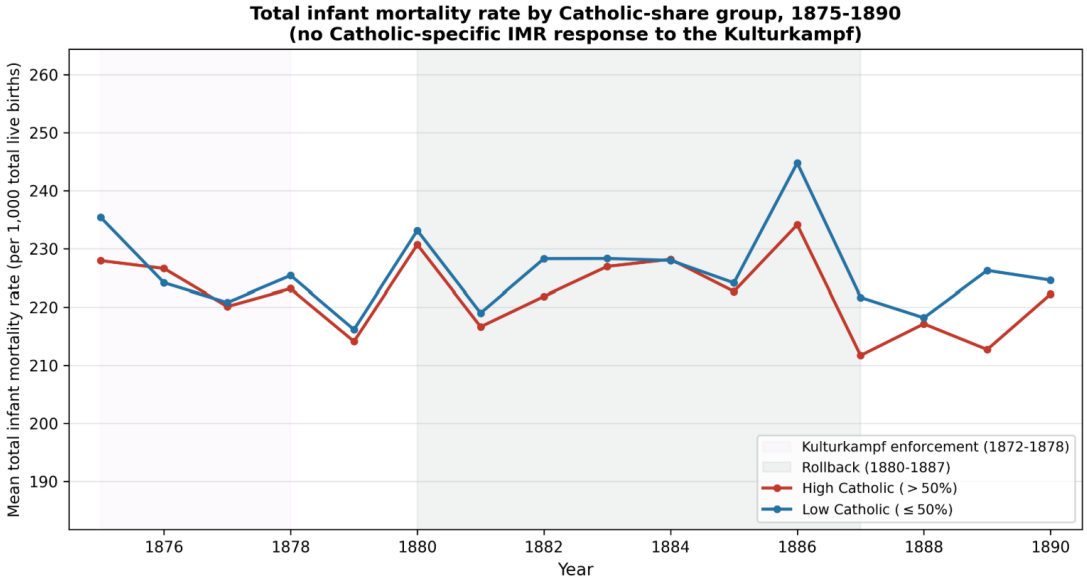


Figure D.1: Infant mortality

From Figure D.1, it can be seen that throughout 1875-1890, except for 1876, the infant mortality rate is slightly lower in high-Catholic counties compared to low-Catholic counties. When I analyzed the legitimate infant mortality rate, I saw that it was higher in high-Catholic counties, which could indicate that illegitimate infants had a higher mortality.