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## Not the opium of the people: Income and secularization in a panel of Prussian counties

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January 2013

# **Not the Opium of the People: Income and Secularization in a Panel of Prussian Counties**

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## ABSTRACT

### **Not the Opium of the People: Income and Secularization in a Panel of Prussian Counties\***

The interplay between religion and the economy has occupied social scientists for long. We construct a unique panel of income and Protestant church attendance for six waves of up to 175 Prussian counties spanning 1886-1911. The data reveal a marked decline in church attendance coinciding with increasing income. The cross-section also shows a negative association between income and church attendance. But the association disappears in panel analyses, including first-differenced models of the 1886-1911 change, panel models with county and time fixed effects, and panel Granger-causality tests. The results cast doubt on causal interpretations of the religion-economy nexus in Prussian secularization.

JEL Classification: Z12, N33

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The interplay between religion and the economy has occupied social scientists for long. We construct a unique panel of income and Protestant church attendance for 175 Prussian counties in 1886-1911. The data reveal a marked decline in church attendance – secularization – coinciding with increasing income. The cross-section also shows a negative association between income and church attendance. But the association disappears when using the panel structure: In first-differenced models of the 1886-1911 change, counties with larger increases in income did not see significantly larger reductions in church attendance; in panel models with county and time fixed effects, counties with earlier increases in income than others did not see earlier reductions in church attendance; and in panel Granger-causality tests, initial income is not related to lower subsequent church attendance, or vice versa. These findings cast doubt on causal interpretations of the religion-economy nexus during this important phase of secularization in Prussia.

## **I. Concepts**

Religion and the economy may interact in both directions (Iannaccone (1998); McCleary and Barro (2006)). On the one hand, classic secularization hypotheses suggest that improved material conditions may reduce the demand for religious consolation. This point was perhaps most forcefully made by Karl Marx (1844), who referred to religion as “opium of the people” (p. 72) that is required only to alleviate the ailments of poor economic conditions. More generally, increased opportunity costs may restrain religious participation (e.g., Gruber and Hungerman (2008)).

On the other hand, religious beliefs may influence economic behavior and outcomes. E.g., Weber (1904/05) argued that a Protestant ethic furthered the spirit of capitalism. But religiously motivated refusal of materialism may also limit economic development. More

generally, religion may affect beliefs, behaviors, and network interactions that in turn affect economic outcomes.

Existing empirical evidence is far from conclusive. In cross-country analyses, McCleary and Barro (2006) find that per-capita GDP negatively predicts religious participation and beliefs and that economic growth relates negatively to church attendance, but positively to religious beliefs. At the micro level, e.g., Guiso, Sapienza, and Zingales (2003) find that religious beliefs are positively associated with economic attitudes, whereas Lipford and Tollison (2003) find a mildly negative two-way relationship between church membership and income. It is unclear, however, to what extent such cross-sectional identification can rule out that omitted factors – e.g., any beliefs, attitudes, and mentalities such as individualism or scientific rationality that relate to both income and religious participation – affect the observed associations.

In our analysis, we draw on county-level panel data. Such within-country analysis is less plagued by the substantial cultural and institutional differences that aggravate cross-country studies. What is more, the panel structure of our data allows us to condition on county and time fixed effects, thereby identifying from county-specific longitudinal variation. Such models hold constant any unobserved time-invariant county characteristics and any common country-wide trends.

Our application relates to Prussia, a core European state, during a period (1886-1911) when industrialization advanced rapidly and when secularization tendencies were a leading public concern in Europe (Hölscher (2001), pp. 16, 29-30). While in the United States, religious participation did not decline in a vivid religious market setting (Finke and Stark (1992)), Prussia remained dominated by two established churches, making official church membership hardly informative of actual religious involvement. Church membership barely changed over our period

of investigation: On average across all Prussian counties, 98.7 percent of inhabitants formally were members of the Protestant or Catholic Churches both in 1885 and in 1910.

But as our analysis below shows, Protestant church attendance – a direct measure of participation in church life – in fact declined significantly during the same period. Active church attendance reflects “demonstrations of churchly life ... that were considered already by contemporaries as indicators of churchliness” (Hölscher (2001), p. 4). Of course, reduced church attendance does not necessarily imply a reduction in “religiosity” in the sense of inner attitudes towards belief in God. But it does depict people’s active involvement with the institutionalized church and its rituals. It is in this way that we use the term “secularization” here.

## **II. Data**

Our unique database on historical church attendance stems from the practice of the Protestant Church in Germany to count the number of participations in Holy Communion every year, which Hölscher (2001) gathered at the church-district (*Kirchenkreis*) level from regional archives covering modern Germany. This exceptional database “unlocks source material that is internationally unique in its scope and historical depth: the statistical surveys of the Protestant Regional Churches of Germany on the Expressions of Churchly Life” (Hölscher (2001), p. 29).

The Sacrament Statistics (*Abendmahlsstatistik*) stem from a uniform annual survey organized by the Statistical Central Office at the Protestant Higher Church Council in Berlin from 1880 (with precursors) to World War II. Data collection was done by the parish priests on a preprinted form following uniform surveying directives. Regional Consistories combined these parish data into registers at the level of church districts, which usually comprised 10-20 adjacent parishes. To our knowledge, the data have not yet been used in microeconomic analyses.

Our main indicator of church attendance is the number of participations in Holy Communion divided by the number of Protestants in a district. The general Protestant norm at the time was to have Holy Communion only once a year (Hölscher (2001), p. 37), although there were regional differences. By the end of the 19<sup>th</sup> century, the Church also started to propagate the possibility of attending Holy Communion more than once a year, which will lead our indicator to underestimate any decline in church involvement over time. In addition, participants were counted in the parish where Communion was taken, not in their host parish, and children not yet confirmed and thus not allowed to participate in Holy Communion (on average roughly one third of parishioners) are counted among the Protestants in the denominator. Still, sacrament participation is a useful proxy for church attendance, already used by contemporaries, that “best allows to discover the long-term change in churchliness” (Hölscher (2001), p. 31).<sup>1</sup>

Our income data refer to the average annual income of male elementary-school teachers, available every five years from 1886 to 1911 for all Prussian counties (*Kreise*) from Education Censuses (Galloway (2007)). Following Galloway, Hammel, and Lee (1994), we use teacher income as a proxy for overall income, as teaching is a well-defined occupation that facilitates comparison and as teacher income was almost entirely financed from local contributions, thus likely reflecting overall income in the county. Teacher incomes are the only income data

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<sup>1</sup> Actual data on church attendance collected at specific Count Sundays, available only in few Regional Churches, indicate a largely parallel movement of church attendance and sacrament participation both in the cross-section and in the time-series (Hölscher (2001), pp. 37-38).



consistently available across counties and time in this period and are highly correlated with other measures of economic development in the cross-section (see Appendix A2).<sup>2</sup>

Our dataset covers an unbalanced panel of 175 territorial entities (“counties”) in 1886-1911. This sample of Prussian counties constitutes the intersection between end-of-19<sup>th</sup>-century Prussia (for which income data are available) and modern Germany (for which church attendance data are available) and is thus not necessarily representative of Prussia or of Germany. To this dataset, we merge cross-sectional data for Prussian counties used in Becker and Woessmann (2009). The Appendix provides details on data sources and construction.

### **III. Evidence on Secularization**

The Sacrament Statistics clearly suggest that a process of secularization was underway in the late 19<sup>th</sup> and early 20<sup>th</sup> centuries in the Protestant Church in Prussia (s.a. Hölscher (2001), pp. 15-16). In the 89 counties observed in both 1886 and 1911, church attendance (proxied by participations in Holy Communion over Protestants) decreased by 12.8 percent from 0.508 to 0.443. From 1862 to 1930 (59 counties), church attendance declined by more than half from 0.561 to 0.258.

Panel estimates with county fixed effects suggest an average annual decline in church attendance by 0.25 percentage points per year over the quarter century 1886-1911 (Table 1, col. 1).<sup>3</sup> Non-linear inspection shows that church attendance was largely flat from 1886 to 1896 and

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<sup>2</sup> Daily wages of urban male day laborers aged 16 and over, an alternative income measure available only in 1892 and 1901, show the same pattern of results (see Table A6 in the Appendix).

<sup>3</sup> Throughout, to reduce measurement error we measure church attendance as average of the actual (e.g., 1886), the preceding (1885), and the subsequent (1887) years; qualitative results are identical when using the actual year only. Table 1 is based on the five-yearly structure of the income data. When replicating col. 1 on the annual church-

then declined steadily from 1896 to 1911 (col. 2). Earlier data suggest significant decreases also in 1862-1876 (8.6 percentage points) and in 1876-1886 (3.2 percentage points).

At the same time, income (proxied by teacher income) increased on average by 1.65 percent per year from 1886 to 1911, with the strongest increases from 1891 to 1906 (cols. 3, 4).<sup>4</sup> Thus, over the period, a process of secularization coincided with increasing income in Prussia.

#### **IV. Income and Secularization: Empirical Models and Results**

We start our investigation of the relationship between income and secularization by looking separately at cross-sectional variation and at time-series variation, respectively.

In a model that uses only cross-sectional variation – pooled cross-sectional estimation with time fixed effects – there is a significant negative association between log income and church attendance; a 10 percentage-point (0.356 standard-deviation) increase in the church attendance measure is related to a 3.0 percent (0.145 standard-deviation) decline in income (Table 2, col. 1). (The model follows a standard log earnings equation; in bivariate models, direction and statistical precision of the estimates are identical in the inverse model with church attendance as dependent variable.) The pooled estimate reflects a consistent negative cross-sectional association that is relatively stable over time (e.g., -0.291 in 1886 and -0.309 in 1911, see Table A2 and Figure A1 in the Appendix). The cross-sectional association remains

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attendance data and without averaging, where we have 3,633 data points for our 175 counties in 1886-1911, we get almost exactly the same estimate (coef. -0.0026, std. err. 0.00008). When we extend the analysis to 1850-1931 (7,261 data points), the average annual decline in church attendance is even larger (coef. -0.0036, std. err. 0.00004).

<sup>4</sup> Given that a general price deflator is not available at the time and that the currency is pegged to gold throughout the period, the analysis is performed with nominal income. Using Desai (1968)'s cost-of-living index to deflate nominal income, the average increase in real income is 0.8 percent (statistically highly significant).

significantly negative when adding controls for age structure, gender distribution, urbanization, literacy, migration, Protestant share, and Province fixed effects (see Table A3 in the Appendix).<sup>5</sup>

In a model that uses only time-series variation – with fixed effects for counties but not for years – there is again a significant negative association between income and church attendance, now indicating an 18.5 percent decline in income for each 10 percentage-point increase in church attendance (col. 2).<sup>6</sup> This reflects the overall coincidence of increasing income and declining church attendance in Prussia during this period.

However, once we make direct use of the panel structure of our data, there is little evidence that these negative associations reflect any causal relationship between income and secularization.

First, in a simple long first-differenced model that regresses the change in log income between 1886 and 1911 on the change in church attendance over the same period (where both changes show substantial cross-county variation, see Figure A2 in the Appendix), the association becomes statistically insignificant (col. 3). The point estimate is small and significantly different from the first two columns. That is, counties with larger decreases in church attendance did not see significantly larger increases in income, or vice versa.

Second, the association also gets statistically and quantitatively insignificant (and significantly different from the first two columns) in a panel model with county and time fixed effects (col. 4). That is, counties that saw relatively strong decreases in church attendance from

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<sup>5</sup> Unfortunately, these cross-sectional control variables are not consistently available in the panel dimension.

<sup>6</sup> This is the only model of Table 2 affected by using the estimate of real (rather than nominal) income, which reduces the coefficient estimate to -0.548 (std. err. 0.131), more in line with the cross-sectional estimate of col. 1.

one period to the next did not contemporaneously see significantly different relative increases in income.

Finally, there are also no significant associations when adding lagged church attendance to the model (col. 5). The same is true when regressing church attendance on income and its lag (col. 6). That is, lagged church attendance does not predict income and lagged income does not predict church attendance. Hence in this panel, there is no causality in the spirit of Granger (in that cause happens before consequence) in either direction.<sup>7</sup>

The pattern of results is confirmed in a number of robustness checks, including restriction to mostly Protestant counties and to a balanced sample (see Appendix A5).

## **V. Conclusion**

Annual surveys of the Protestant Regional Churches of Germany on “Expressions of Churchly Life” uniquely document active religious involvement for a panel of Prussian counties in the late 19<sup>th</sup> and early 20<sup>th</sup> centuries. The church attendance data clearly show that – contrary to what church membership data suggest for the United States – a process of secularization was underway among Prussian Protestants between 1886 and 1911. Furthermore, using only variation across counties or using only variation within counties over time, church attendance is strongly negatively associated with income. However, this association disappears in first-differenced models of the 1886-1911 change, in panel models with county and time fixed effects, and in panel Granger-causality tests where secularization does not follow increased income, or vice

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<sup>7</sup> The same is true in specifications with just the lagged variable (without the contemporaneous one); when adding the twice-lagged variable; and when including the lag, the contemporaneous, and the lead of the variable (in which case the contemporaneous variable is significantly positive, whereas lead and lag are insignificant).

versa. It thus seems that unobserved factors correlated with both income and secularization – e.g., individualism or rationality – and common country-wide trends give rise to the observed associations. Our findings are not in line with an interpretation that income was a causal driver of secularization or that changing religious participation affected income.

While the panel analyses cast strong doubt on a causal interpretation of the simple associations, future research should aim to directly model exogenous variation in income and in church attendance that would allow for a causal identification of their mutual interdependence. An investigation of the omitted factors underlying the observed associations would also be revealing. Furthermore, a comparable analysis of Catholics would be welcome. Finally, different dimensions of development like income and education may have differing relevance for religious participation. In fact, in a companion project (Becker, Nagler, and Woessmann (2013)), we find panel evidence of a relation between increasing enrollment in advanced schools and decreasing church attendance in a panel of German cities before World War I.

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Table 1  
Trends in Church Attendance and in Income, 1886-1911

Dependent variable:	Church attendance		ln(teacher income)	
	(1)	(2)	(3)	(4)
Linear time trend	-0.0025 (0.0003)***		0.0165 (0.0003)***	
Year 1891		0.002 (0.003)		0.034 (0.005)***
Year 1896		-0.0006 (0.004)		0.106 (0.005)***
Year 1901		-0.011 (0.005)**		0.303 (0.007)***
Year 1906		-0.032 (0.005)***		0.347 (0.007)***
Year 1911		-0.062 (0.006)***		0.349 (0.007)***
County fixed effects	yes	yes	yes	yes
Const.	0.519 (0.005)***	0.490 (0.004)***	7.118 (0.006)***	7.232 (0.004)***
Obs.	898	898	1050	1050
Number of counties	175	175	175	175
R <sup>2</sup> (within)	0.299	0.378	0.821	0.902

Panel estimation with county fixed effects. Unbalanced panel of counties observed every five years in 1886-1911. Dependent variable in col. 1 and 2: participations in Holy Communion over Protestants; in col. 3 and 4: log income of male elementary-school teachers. Standard errors (clustered by county) in parentheses: significant at the \*\*\* 1, \*\* 5, \* 10 percent level.

*Data sources:* church attendance: Hölscher (2001) based on Sacrament Statistics; teacher income: Galloway (2007) based on Education Censuses.



Table 2  
Income and Church Attendance, 1886-1911

Dependent variable:	ln(teacher income)					Church attendance
	Cross-section (time fixed effects)	Time-series (county fixed effects)	First difference 1886-1911	Two-way fixed effects		
	(1)	(2)	(3)	(4)	(5)	(6)
Church attendance	-0.298 (0.031)***	-1.852 (0.228)***	-0.071 (0.129)	0.066 (0.079)	0.046 (0.076)	
Church attendance ( $t - 5$ )					0.018 (0.089)	
ln(teacher income)						0.009 (0.026)
ln(teacher income) ( $t - 5$ )						0.035 (0.029)
Time fixed effects	yes	no	no	yes	yes	yes
County fixed effects	no	yes	no	yes	yes	yes
Const.	7.368 (0.023)***	8.301 (0.108)***	0.355 (0.013)***	7.549 (0.034)***	7.218 (0.048)***	0.169 (0.312)
Obs.	898	898	101	898	705	775
Number of counties	175	175	101	175	167	175
$R^2$ (within)	0.691	0.203	0.003	0.899	0.900	0.430

Unbalanced panel of counties observed every five years in 1886-1911. Dependent variable in col. 1-5: log income of male elementary-school teachers; in col. 6: participations in Holy Communion over Protestants. In col. 3, dependent variable and independent variable refer to the change between 1886 and 1911. Standard errors (clustered by county) in parentheses: significant at the \*\*\* 1, \*\* 5, \* 10 percent level.

*Data sources:* church attendance: Hölscher (2001) based on Sacrament Statistics; teacher income: Galloway (2007) based on Education Censuses.

## Appendix

### A1. Church Attendance Data

The Protestant Regional Churches of Germany conducted annual surveys of “Expressions of Churchly Life” between 1880 (with precursors) and World War II (see main text for further information). Our main indicator of church attendance is the “sacrament participation” (Hölscher (2001)), measured as the number of participations in Holy Communion divided by the number of Protestants in a church district. Counting sacrament participations is deemed relatively reliable because the established practice was to count the number of issued wafers from the number of wafers before and after the sacrament. As indicated in the main text, the possibility of multiple individual attendances, the possibility of attending Holy Communion outside the home parish, and the counting of non-confirmed children among the number of Protestants in the denominator constitute reasons why the indicator does not directly measure the actual sacrament participation of parishioners.

While the data were contemporaneously regularly published in a comparative manner at the level of the Regional Churches, Hölscher (2001)’s “Data Atlas on the Religious Geography in Protestant Germany: From the Mid-19<sup>th</sup> Century to the Second World War” for the first time brings together the district-level data, gathered from regional archives, for the geographic coverage of modern Germany.<sup>8</sup> Hölscher kindly provided us with digital versions of the data as

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<sup>8</sup> For additional background on secularization in Germany around this time, see Nipperdey (1988) and Hölscher (2005), and Pollack (2003) for the post-WW II period. In post-WW II West Germany, the share of Protestants reporting to regularly attend church service declined from 13 percent in 1952 to 8 percent in 2005 (Pollack (2006), Table 1); among Catholics, the same measure declined from 51 percent to 23 percent over the same period.

published in the Data Atlas. After assigning IDs to every church district (*Kirchenkreis*) and cross-checking the data, we combined the data into one panel dataset. In a few cases, data were reported as double years, e.g., 1892/93. Attendance numbers for double years turned out to be in the same range as those in single calendar years, so we assigned attendance numbers to the first year of a double year.

In our analysis, in order to reduce potential measurement error, we take three-year averages of church attendance around our years of analysis. However, results are equivalent when using the original year-specific data.

The church attendance data have gaps for some church districts in some years. Our main analyses in Tables 1 and 2 use an unbalanced panel of observed church attendance (using three-year averaged data). Table A5 uses a balanced panel of counties where church attendance is observed in all six waves (as is the income data).

## **A2. Income Data**

Income data refer to income of male elementary-school teachers, the only income data we are aware of that are available as a panel at the county level over our period of investigation. Because teacher salaries were almost entirely financed from local contributions at the time, they should provide a reasonable proxy for average income in the county (cf. Schleunes (1989)). Becker and Woessmann (2009) show that across the 452 Prussian counties, log teacher income in 1886 is highly correlated with other measures of economic development such as the size of the non-agricultural sector in 1882 (correlation coefficient 0.74) and a proxy for average income constructed from data on income tax and wages of unskilled day laborers in 1900 (0.71).

The data were collected by the Prussian Statistical Office and reported at the level of administrative counties (*Kreise*). Teacher income data are available for all Prussian counties in

all the years 1886, 1891, 1896, 1901, 1906, and 1911. The data are drawn from the Galloway (2007) Prussia Database and are based on the following volumes of the *Preussische Statistik*: Volume 101, pp. 2-391 (for 1886); Volume 120, part II, pp. 2-313 (for 1891); Volume 151, part II, pp. 2-315 (for 1896); Volume 176, part III, pp. 2-485 (for 1901); Volume 209, part III, pp. 2-513 (for 1906); and Volume 231, part II, pp. 2-599 (for 1911).

In several cases, county reforms led to the split of counties into smaller units over time; typically, with increasing urbanization, counties were split into urban counties (*Stadtkreise*) and rural counties (*Landkreise*). In those cases, we aggregated data in later years up to the boundaries as of earlier years. Since teacher income data are complete for all years 1886, 1891, ..., 1911, this yields a balanced panel of teacher income data in constant county borders.

There are two changes in how teacher income is reported over time. First, in 1886 and 1891, teacher income covers only direct wage payments, but not extras such as housing allowances and any other allowances. From 1896 onwards, data include all components of income. To make data consistent over time, we pre-multiply direct wage payments in 1886 and 1891 by the county-specific ratio of total income over (only) wage payments observed in 1896.

Second, in 1911, income is only reported as total income of male and female elementary-school teachers combined, whereas for all other years both genders are reported separately. In 1911, we impute income of male elementary-school teachers by pre-multiplying total income of elementary-school teachers by the county-specific share of male teachers in total income observed in 1906.

As an alternative income measure available only in 1892 and 1901, Table A6 uses daily wages of urban male day laborers aged 16 and over, taken from the Social Security Statistics. The Prussian authorities used these day laborer wages as reference values to determine

contributions to the compulsory Health Insurance System (1.5 percent of the customary wage paid to day laborers), indicating that they were considered sufficiently representative of wages in low-income households and thus constitute a useful proxy for their local standard of living. The source of the variable is Georg Neuhaus, “Die ortsüblichen Tagelöhne gewöhnlicher Tagearbeiter in Preußen 1892 und 1901,” *Zeitschrift des Königlich Preussischen Statistischen Bureaus*, 44 (1904), 310-346. For additional information, see Becker and Woessmann (2009) and the ifo Prussian Economic History Database (iPEHD) described in Becker, Cinnirella, Hornung, and Woessmann (2012).

### **A3. Additional Data**

The control variables used in Table A3 are taken from the Prussian Population Census in 1871. First used in Becker and Woessmann (2009), who provide variable definitions and detailed documentation (see also iPEHD), they are based on Königliches Statistisches Bureau, *Die Gemeinden und Gutsbezirke des Preussischen Staates und ihre Bevölkerung: Nach den Urmaterialien der allgemeinen Volkszählung vom 1. December 1871* (Berlin: Verlag des Königlichen Statistischen Bureaus, 1874).

The Population Census provides data on several measures that are often used in the church attendance literature and in the income literature, such as the age structure (where, in addition to the share of the population below 10 years of age, we also use the share of the population aged 60 and older from Galloway (2007)), gender distribution, the share of the county population that lives in urban areas, literacy, migration, and the share of Protestants in the

population. Unfortunately, these cross-sectional control variables are not consistently available in the panel dimension.<sup>9</sup>

In the province of Hannover, county borders changed substantially between 1871 and 1886 in a fashion that prevents re-aggregation (for example, two old counties split and merged into three new counties). Counties in the province of Hannover are therefore dropped in the regression analyses in Table A3 that involve control variables from 1871.

#### **A4. Merging the Datasets**

We merge the church attendance and income data by assigning the income data, available at the level of the administrative county, to that church district (for which we have church attendance data) which contains the capital of the administrative county (same for the 1871 control variables available for administrative counties). In cases where several county capitals are located in the same district, we aggregated the county data up to the church district level (taking population-weighted averages of income data).

To make regional entities comparable over time in face of territorial changes during our period of observation, we aggregated church-district and county data up to the highest level at which consistency over time is given.

Our resulting dataset covers an unbalanced panel of 175 separate territorial entities (which we refer to as “counties”) spanning 1886-1911. These counties constitute the intersection between modern Germany (for which Hölcher (2001) collected church attendance data) and

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<sup>9</sup> Available data suggest that church membership barely changed over our period of investigation. On average across the 508 (593) Prussian counties in 1885 (1910), 65.9 (63.4) percent of inhabitants were Protestants, 32.8 (35.3) percent Catholics, 0.25 (0.43) percent other Christians, 0.99 (0.65) percent Jews, and only 0.01 (0.16) percent “adherents of other religions, with undetermined or without religious designation.”

Prussia at the end of the 19<sup>th</sup> century (for which Prussian census records provide income data). Due to the intersection requirement, our analysis does not cover the non-Prussian parts of modern Germany (esp. the Southern parts) and the parts of Prussia not located in modern Germany (esp. the Eastern Provinces located in modern Poland and Russia). Due to lack of church-district data, we also miss the Province of Brandenburg (except for Berlin) and Western Pomerania.

Table A1 provides descriptive statistics. Figure A1 shows a scatterplot of income and church attendance in 1911.

#### **A5. Robustness Checks**

The pattern of results of the basic models presented in the paper is confirmed in a number of robustness checks. First, results are robust in the subsample of 116 counties with more than 90 percent Protestant population (Table A4), which shows that results are not affected by the fact that income refers to all teachers while church attendance refers to Protestants. Second, results are robust in a balanced sample of 89 counties with full data in all six waves (Table A5). Finally, results are robust when dropping Berlin (which has the highest income level in most waves) and when dropping the two counties with participations in Holy Communion over Protestants larger than one in 1911 (see Figure A1).

Table A1  
Descriptive Statistics

	Obs. (1)	Mean (2)	Std. Dev. (3)	Min (4)	Max (5)
<b>Church attendance</b>					
Pooled	898	0.47	0.28	0.06	1.48
1886	123	0.53	0.28	0.07	1.48
1891	149	0.50	0.28	0.07	1.42
1896	156	0.49	0.28	0.07	1.43
1901	162	0.48	0.29	0.07	1.40
1906	160	0.46	0.28	0.06	1.35
1911	148	0.39	0.25	0.06	1.29
Change 1886-1911	101	-0.07	0.07	-0.20	0.15
<b>ln(teacher income)</b>					
Pooled	1,050	7.42	0.21	6.94	8.08
1886	175	7.23	0.16	6.95	7.78
1891	175	7.27	0.16	6.94	7.91
1896	175	7.34	0.15	7.08	8.06
1901	175	7.54	0.13	7.25	8.04
1906	175	7.58	0.15	7.29	8.08
1911	175	7.58	0.12	7.39	7.99
Change 1886-1911	101	0.36	0.09	0.19	0.59
<b>Control variables (1871)</b>					
Share of population < 10 years	100	0.24	0.02	0.19	0.28
Share of population > 60 years	100	0.08	0.01	0.04	0.10
Share female	100	0.51	0.02	0.44	0.54
Share of county pop. in urban areas	100	0.31	0.19	0.06	1.00
Share literate	100	0.95	0.02	0.87	0.99
Share born in municipality	100	0.66	0.10	0.40	0.85
Share of Protestants	100	0.81	0.28	0.03	1.00

Church attendance refers to participations in Holy Communion over Protestants. Ln(teacher income) refers to log income of male elementary-school teachers.

*Data sources:* church attendance: Hölischer (2001) based on Sacrament Statistics; teacher income: Galloway (2007) based on Education Censuses; control variables: Becker and Woessmann (2009) based on Population Census.



Table A2  
Income and Church Attendance: Year-by-Year Cross-Sections

	1886	1891	1896	1901	1906	1911
	(1)	(2)	(3)	(4)	(5)	(6)
Church attendance	-0.291 (0.042)***	-0.334 (0.033)***	-0.321 (0.034)***	-0.256 (0.031)***	-0.286 (0.038)***	-0.309 (0.037)***
Const.	7.365 (0.030)***	7.426 (0.022)***	7.497 (0.023)***	7.657 (0.020)***	7.705 (0.022)***	7.705 (0.020)***
Obs. = number of counties	123	149	156	162	160	148
$R^2$	0.308	0.384	0.381	0.314	0.321	0.376

Dependent variable: log income of male elementary-school teachers. Ordinary least squares (OLS) estimations in cross-sections of counties for respective year indicated in header. Church attendance refers to participations in Holy Communion over Protestants. Robust standard errors in parentheses: significant at the \*\*\* 1, \*\* 5, \* 10 percent level.

*Data sources:* church attendance: Hölscher (2001) based on Sacrament Statistics; teacher income: Galloway (2007) based on Education Censuses.

Table A3  
Income and Church Attendance, 1886

Dependent variable:	ln(teacher income)		Church attendance	
	(1)	(2)	(3)	(4)
Church attendance	-0.285 (0.052)***	-0.183 (0.049)***		
ln(teacher income)			-0.927 (0.126)***	-1.000 (0.186)***
Share of population < 10 years		-0.914 (0.602)		-2.229 (1.663)
Share of population > 60 years		-3.298 (1.160)***		-3.424 (2.927)
Share female		-0.242 (0.823)		1.591 (2.032)
Share of county pop. in urban areas		0.049 (0.085)		-0.461 (0.142)***
Share literate		-0.612 (0.573)		-0.326 (1.017)
Share born in municipality		-0.259 (0.126)**		-0.176 (0.293)
Share of Protestants		0.009 (0.036)		0.077 (0.090)
Fixed effects for six Provinces		yes		yes
Const.	7.377 (0.035)***	8.906 (0.700)***	7.209 (0.920)***	8.501 (2.301)***
Obs.	100	100	100	100
$R^2$	0.264	0.706	0.264	0.507

Ordinary least squares (OLS) estimation in cross-section of counties in 1886. Ln(teacher income) refers to log income of male elementary-school teachers. Church attendance refers to participations in Holy Communion over Protestants. Control variables refer to the year 1871. Robust standard errors in parentheses: significant at the \*\*\* 1, \*\* 5, \* 10 percent level.

*Data sources:* church attendance: Hölischer (2001) based on Sacrament Statistics; teacher income: Galloway (2007) based on Education Censuses; control variables: Becker and Woessmann (2009) based on Population Census.

Table A4  
Restriction to Counties with at least 90 Percent Protestants

Dependent variable:	ln(teacher income)					Church attendance
	Cross-section (time fixed effects)	Time-series (county fixed effects)	First difference 1886-1911	Two-way fixed effects		
	(1)	(2)	(3)	(4)	(5)	(6)
Church attendance	-0.224 (0.029)***	-1.610 (0.255)***	-0.003 (0.130)	0.109 (0.089)	0.104 (0.080)	
Church attendance ( $t - 5$ )					-0.010 (0.088)	
ln(teacher income)						0.025 (0.031)
ln(teacher income) ( $t - 5$ )						0.043 (0.040)
Time fixed effects	yes	no	no	yes	yes	yes
County fixed effects	no	yes	no	yes	yes	yes
Const.	7.294 (0.020)***	8.195 (0.127)***	0.364 (0.014)***	7.495 (0.041)***	7.165 (0.049)***	0.024 (0.404)
Obs.	620	620	71	620	495	536
Number of counties	116	116	71	116	113	116
$R^2$ (within)	0.755	0.160	0.000	0.901	0.907	0.386

Unbalanced panel of counties observed every five years in 1886-1911. Sample restricted to counties with a share of Protestants in the population of at least 90 percent in 1885. Dependent variable in col. 1-5: log income of male elementary-school teachers; in col. 6: participations in Holy Communion over Protestants. In col. 3, dependent variable and independent variable refer to the change between 1886 and 1911. Standard errors (clustered by county) in parentheses: significant at the \*\*\* 1, \*\* 5, \* 10 percent level.

*Data sources:* church attendance: Hölischer (2001) based on Sacrament Statistics; teacher income: Galloway (2007) based on Education Censuses.

Table A5  
Balanced Panel of Counties with Observed Data in All Waves

Dependent variable:	ln(teacher income)					Church attendance
	Cross-section (time fixed effects)	Time-series (county fixed effects)	First difference 1886-1911	Two-way fixed effects		
	(1)	(2)	(3)	(4)	(5)	(6)
Church attendance	-0.281 (0.043)***	-2.271 (0.294)***	-0.024 (0.131)	0.076 (0.099)	-0.081 (0.132)	
Church attendance ( $t - 5$ )					0.125 (0.140)	
ln(teacher income)						-0.002 (0.034)
ln(teacher income) ( $t - 5$ )						0.006 (0.039)
Time fixed effects	yes	no	no	yes	yes	yes
County fixed effects	no	yes	no	yes	yes	yes
Const.	7.373 (0.030)***	8.486 (0.141)***	0.355 (0.014)***	7.194 (0.050)***	7.542 (0.057)***	0.402 (0.416)
Obs.	534	534	89	534	445	445
Number of counties	89	89	89	89	89	89
$R^2$ (within)	0.689	0.298	0.0004	0.914	0.904	0.476

Balanced panel of counties observed every five years in 1886-1911. Dependent variable in col. 1-5: log income of male elementary-school teachers; in col. 6: participations in Holy Communion over Protestants. In col. 3, dependent variable and independent variable refer to the change between 1886 and 1911. Standard errors (clustered by county) in parentheses: significant at the \*\*\* 1, \*\* 5, \* 10 percent level.

*Data sources:* church attendance: Hölscher (2001) based on Sacrament Statistics; teacher income: Galloway (2007) based on Education Censuses.

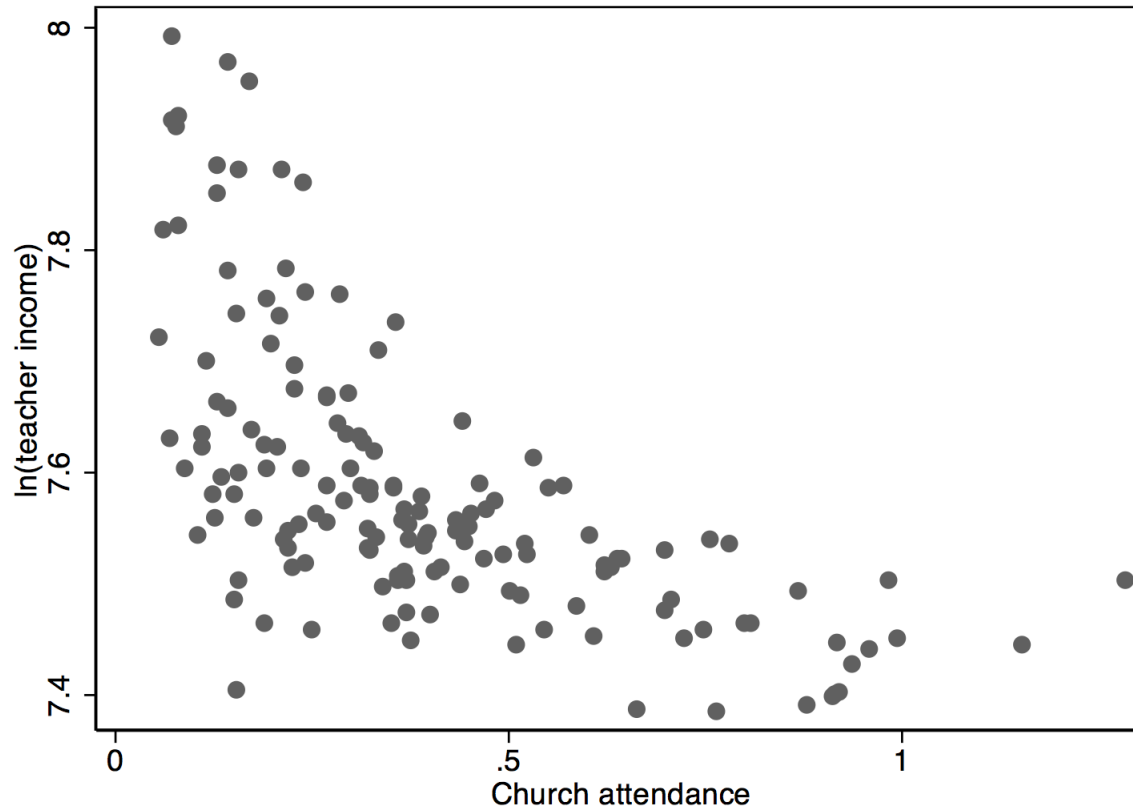
Table A6  
Alternative Income Measure: Wages of Day Laborers in 1892 and 1901

Dependent variable:	ln(day laborer wages)				
	Cross-section (time fixed effects)	Time-series (county fixed effects)	First difference 1892-1901	Two-way fixed effects	
	(1)	(2)	(3)	(4)	(5)
Church attendance	-0.309 (0.035)***	-1.547 (0.662)**	-0.131 (0.208)	-0.131 (0.208)	-0.164 (0.233)
Church attendance ( $t - 5$ )					0.224 (0.226)
Time fixed effects	yes	no	no	yes	yes
County fixed effects	no	yes	no	yes	yes
Const.	0.707 (0.024)***	1.363 (0.313)***	0.146 (0.009)***	0.619 (0.1)***	0.515 (0.101)***
Obs.	244	244	113	244	216
Number of counties	131	131	113	131	126
$R^2$	0.399	0.138	0.003	0.753	0.796

Unbalanced panel of counties observed in 1892 and 1901. Dependent variable: log daily wages of urban male day laborers aged 16 and over. Church attendance refers to participations in Holy Communion over Protestants. In col. 3, dependent variable and independent variable refer to the change between 1892 and 1901. Standard errors (clustered by county) in parentheses: significant at the \*\*\* 1, \*\* 5, \* 10 percent level.

*Data sources:* church attendance: Hölcher (2001) based on Sacrament Statistics; day laborer wages: Becker and Woessmann (2009) based on Social Security Statistics.

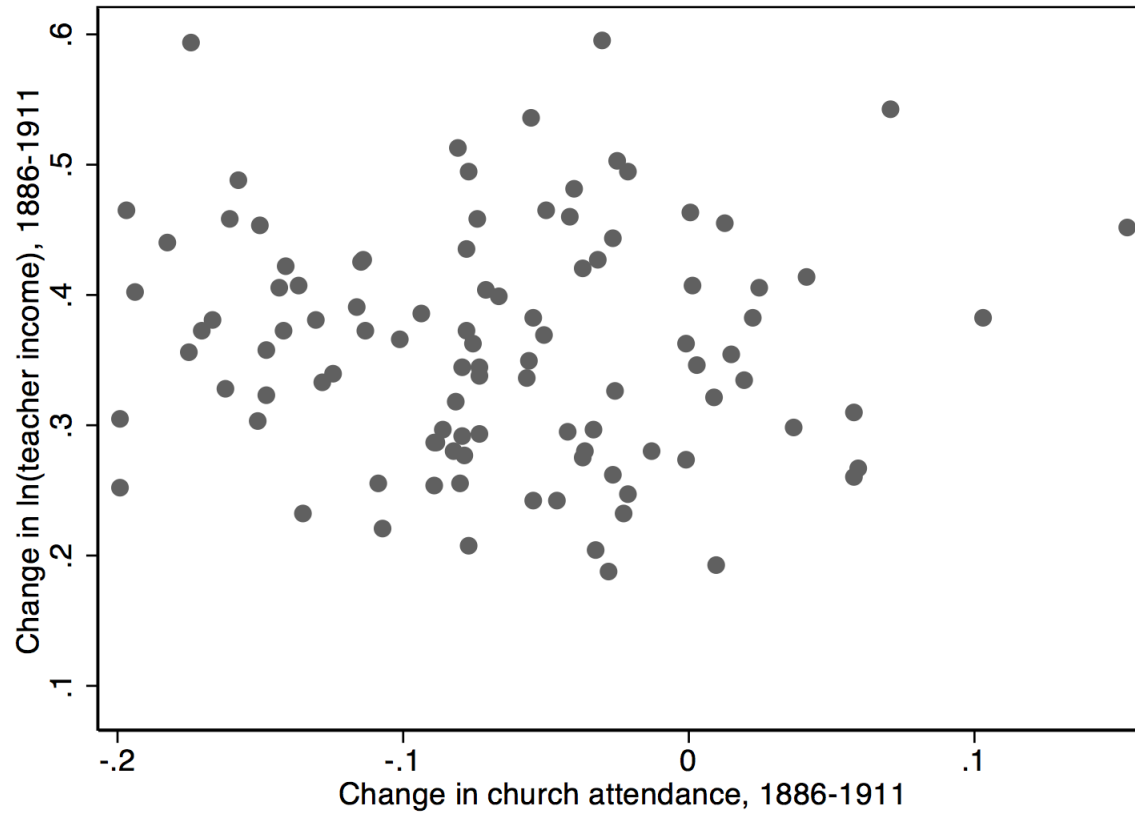
Figure A1  
Income and Church Attendance, 1911



Note:  $\ln(\text{teacher income})$  refers to log income of male elementary-school teachers. Church attendance refers to participations in Holy Communion over Protestants.

*Data sources:* church attendance: Hölscher (2001) based on Sacrament Statistics; teacher income: Galloway (2007) based on Education Census.

Figure A2  
Change in Income and in Church Attendance, 1886-1911



Note: Ln(teacher income) refers to log income of male elementary-school teachers. Church attendance refers to participations in Holy Communion over Protestants.

*Data sources:* church attendance: Hölscher (2001) based on Sacrament Statistics; teacher income: Galloway (2007) based on Education Census.