The Review *of* Economics *and* Statistics

VOL. C JULY 2018 NUMBER 3

SOCIAL COHESION, RELIGIOUS BELIEFS, AND THE EFFECT OF PROTESTANTISM ON SUICIDE

Sascha O. Becker and Ludger Woessmann*

Abstract—In an economic theory of suicide, we model social cohesion of the religious community and religious beliefs about afterlife as two mechanisms by which Protestantism increases suicide propensity. We build a unique microregional data set of 452 Prussian counties for 1816 to 1821 and 1869 to 1871, when religiousness was still pervasive. Exploiting the concentric dispersion of Protestantism around Wittenberg, our instrumental variable model finds that Protestantism had a substantial positive effect on suicide. Results are corroborated in first-difference models. Tests relating to the two mechanisms based on historical church attendance data and modern suicide data suggest that the sociological channel plays the more important role.

I. Introduction

EVERY year, over 800,000 people commit suicide worldwide, making suicide a leading cause of death, in particular among young adults (World Health Organization, 2014). This creates far-reaching emotional, social, and economic ramifications and invokes major policy efforts to prevent suicides. In the scientific literature, religious denomination has long been observed as an important factor related to suicide. In *Le suicide*, a classic example of quantitative investigation of socially framed individual behavior, Émile Durkheim (1897) presented aggregate indicators suggesting that Protestantism was a leading correlate of suicide incidence. The proposition that Protestants have higher suicide rates than Catholics has been "accepted widely enough for nomination as sociology's *one law*" (Pope & Danigelis, 1981). Even today, Protestant countries tend to have substantially higher suicide rates, suggesting that the relation of religion and suicide remains a vital topic.[1] Several contributions have so far revealed the usefulness of investigating suicide from an economics point of view (Hamermesh & Soss, 1974; Becker & Posner, 2004; Chen et al., 2012).[2] But religious denomination, a leading established correlate of suicide in the sociological literature, has received surprisingly little attention in the economics literature, despite the recent burst of interest in issues of culture and religion.[3] While the economics literature on happiness and subjective well-being considers suicide as a revealed-preference outcome measure of utmost unhappiness (Oswald, 1997; Layard, 2005), these analyses so far have not been linked to religious denomination.

This paper makes three contributions to the economic analysis of religion and suicide. First, in section II, we model social cohesion and religious beliefs as two channels through which Protestantism may affect suicide in the framework of an economic theory of suicide. We show how a higher suicide rate of Protestants relative to Catholics can be understood as the outcome of denominational differences in community integration and in theological doctrine. Second, in section III, we provide new microregional evidence from Prussia in the nineteenth century that the effect of Protestantism on suicide may indeed be causal. Third, in section IV, we use this empirical setting to devise tests that discriminate between the sociological and the theological explanations. Our results suggest that Protestantism is a leading explanatory factor for suicide rates and that the sociological mechanism plays an important, if not dominant, role.

Our empirical setting is Prussia in the nineteenth century. Apart from mirroring the perspective of Durkheim's (1897) work, the nineteenth century has the advantage that virtually everybody was a member of a religious denomination

Received for publication March 25, 2015. Revision accepted for publication June 19, 2017. Editor: Asim I. Khwaja.

* Becker: University of Warwick, CEPR, CESifo, IZA, and ifo; Woessmann: University of Munich and ifo Institute, CESifo, IZA, and CAGE.

We thank the editor, three referees, Ran Abramitzky, Robert Barro, Gary Becker, Davide Cantoni, Francesco Cinnirella, Carl-Johan Dalgaard, Angus Deaton, Luca De Benedictis, Ray Fisman, Jon Gruber, Gordon Hanson, Dan Hungerman, Larry Iannaccone, Murat Iyigun, Andrew Oswald, Jared Rubin, John Sawkins, Fabian Waldinger, and participants at several seminars for helpful discussion and comments. We also profited from the exchange with Martin Hofmann, who wrote his master's thesis on an economic analysis of confession-specific suicide rates under our supervision. Capable research assistance by Martin Hofmann, Laurenz Detsch, and Martin Hoben; support by Urban Janisch with the remote access to the German Mortality Statistics; and support by the Pact for Research and Innovation of the Leibniz Association, the German Science Foundation through CRC TRR 190, and the ESRC Centre for Competitive Advantage in the Global Economy (ESRC grant ES/L011719/1) are gratefully acknowledged.

A supplemental appendix is available online at http://www.mitpressjournals.org/doi/suppl/10.1162/rest_a_00708.

[1] Among the ten OECD countries in which either Protestants or Catholics make up over 85% of the population in 2000, the average suicide rate among the four Protestant countries is 15.5 suicides per 100,000 inhabitants, whereas it is 8.9 among the six Catholic countries (suicide data from OECD, 2009; religion data from Barrett, Kurian, & Johnson, 2001). See also Huang (1996) and Helliwell (2007) for cross-country studies of religion and suicide.

[2] Cutler, Glaeser, and Norberg (2001), Daly and Wilson (2009), Daly et al. (2011), and Daly, Wilson, and Johnson (2013) are further examples.

[3] The economics literature on culture and religion (Iannaccone, 1998; Guiso, Sapienza, & Zingales, 2006; Iyer, 2016) does not emphasize suicide as a possible outcome.

The Review of Economics and Statistics, July 2018, 100(3): 377–391

doi:10.1162/rest_a_00708

and that religion pervaded all aspects of life. The Prussian perspective offers the opportunity to compare nonminority occurrences of the two religious denominations within a common setting of political governance, institutions, jurisdiction, language, and basic culture. Combining suicide data administered by local police departments from 1869 to 1871 with rich census data, we build a unique new microregional data set on suicide, religion, and relevant covariates for 452 Prussian counties. We also use data from 1816 to 1821.

A fundamental challenge for empirical identification is self-selection of more suicide-prone people into Protestantism, as hypothesized already in 1919 by the neurologist Kollarits (1919). However, the endogeneity bias may also go in the opposite direction; for example, during the Reformation, Protestantism may have spread more easily to regions where people were willing to take matters into their own hands and change their lives, which may be negatively related to suicide proneness. While manifold, existing studies do not address this fundamental endogeneity problem. To identify the causal effect of Protestantism, we use distance to Wittenberg as an instrumental variable tracing the initial spread of the Reformation from its epicenter (Becker & Woessmann, 2009). We vindicate the validity of the instrument with evidence that it is orthogonal to important correlates of suicide rates in 1517, before the start of the Reformation.

Our results show that Protestantism had a significant positive effect on suicides in Prussia in both the early and late nineteenth century. Protestantism increased the annual suicide rate per 100,000 inhabitants, which has a mean of thirteen suicides from 1869 to 1871, by about fifteen to twenty suicides. Channels such as economic modernization and literacy, which are also affected by Protestantism, seem to play only a minor role in this effect, suggesting that it is an effect of the Reformation per se rather than of its nonreligious outcomes. The empirical result proves very robust to a large set of robustness tests. In addition, exploiting differential changes in Protestant shares across counties between 1816 and 1871, a first-difference model corroborates a positive effect of Protestantism on suicide. Thus, Protestantism seems to bring positive effects for some people and negative effects for others: For the majority of the population, it raises economic prosperity through higher human capital (Becker & Woessmann, 2009), but for the select group of people in a suicidal state of mind, it may tip the balance toward ending their lives.

We devise several tests to tentatively discriminate between the two classes of theoretical models. All turn out to speak in favor of the empirical importance of sociological compared to theological channels. Among others, the effect of Protestantism on suicide is lower in counties where church attendance is high, implying closer community integration. By contrast, according to the theological channel, higher church attendance would indicate a more devout belief in Protestant doctrine, consistent with higher suicide rates. Modern individual-level data show that in 1992, suicides are higher among Protestants than among Catholics, but even higher among those without a religious affiliation. By 2009, the Protestant-Catholic difference is substantially reduced and only the religiously nonaffiliated have substantially higher suicide proneness. Again, this speaks against the theological channel because those who remain in the church are presumably the most devout believers in Protestant doctrine.

Our economic analysis of religion and suicide contributes to the major debate in sociology since Durkheim (1897). Several contributions have questioned the empirical regularity that Protestants have higher suicide rates than Catholics.[4] Durkheim's theoretical hypotheses have also been subjected to major criticism (see Pope & Danigelis, 1981). Stark, Doyle, and Rushing (1983) go as far as finding Durkheim's argument "inconsistent and unconvincing" and "amazingly uninformed and misleading about elementary features of religion in 19th century Europe" (p. 120). In contrast, both our evidence of a strong causal effect of Protestantism on suicide in nineteenth-century Prussia and the indications that social cohesion may have been a stronger mechanism in this than religious doctrine corroborate Durkheim's (1897) original contribution.

II. A Theory of Religion-Specific Suicide

We see two classes of theoretical reasoning—one related to social cohesion (sociological channel for short), the other to individual religious beliefs (theological channel, for short)—that have a bearing on the rationality of the act of suicide in Catholicism and in Protestantism. We model these denominational differences in the framework of an economic theory of suicide. We briefly sketch the mechanisms here; online appendix A presents the model in detail.

The scientific study of suicidal behavior and its prevention, or suicidology, is the topic of several disciplines (online appendix A.1). As stressed by the psychology of suicide, most suicides are committed in a depressed mental state that is transient and diverges from a person's usual state of preferences. But even in this state, suicidal persons may take the costs and benefits of their action into account. In this sense, an intertemporal utility-maximizing framework of standard economic theory may provide insight into an understanding of what might lead these people to carry out their suicide or not and exit the suicidal state.

Our model framework extends the economic theory of suicide developed by Hamermesh and Soss (1974) and Becker and Posner (2004). Suicide is modeled as forward-looking utility-maximizing behavior. We view this model as applying to the suicidal state of mind depicted in the psychological research, where preference parameters may differ from those

[4] See Pope and Danigelis (1981), Bankston, Allen, and Cunningham (1983), van Poppel and Day (1996), and Simpson (1998) for leading examples of the controversy.

during normal mental states. In a process of rational decision making, individuals in the suicidal state compare the expected utility from living with that from death. If the latter is greater than the former, committing suicide will maximize utility (see online appendix A.2 for a formal derivation).

To understand how religious differences may affect the propensity to commit suicide, we start by modeling a sociological aspect of denominational differences. Durkheim (1897) emphasized that Protestant doctrine encourages independent thought and religious individualism, decreasing social cohesion relative to a more unified Catholic community, which tends to protect people from committing suicide. If there is mutual interdependence in preferences, the fact that there are others who would suffer from a person's suicide will tend to discourage people from committing suicide. In terms of our simple economic model of suicide, the lower cohesion of the Protestant community leads to the prediction that suicide rates would be higher in Protestant communities than in Catholic communities (see online appendix A.3 for details).

To this sociological mechanism, we add a couple of theological explanations. When afterlife is added to the model, Protestant-Catholic differences rooted more deeply in religious doctrine affect suicidal behavior through the utility or disutility of afterlife (see online appendix A.4 for details). In particular, Protestantism tends to stress that human salvation is by God's grace alone, and not by any merit of a person's own work, whereas Catholicism allows human deeds and sins to affect God's judgment. Committing suicide thus entails the disutility of foregoing paradise for Catholics but not for Protestants. In addition, the confession of sins is a holy sacrament in Catholicism but not in Protestantism. Since suicide is the only sin that (by definition) can no longer be confessed, this additionally creates a substitution effect that diverts Catholics from committing suicide toward other forms of behavior considered in times of desperation.

III. Evidence on the Effect of Protestantism on Suicide in Nineteenth-Century Prussia

A. *Data and Descriptive Statistics*

Prussia provides uniquely rich census-based data to study the relation of suicide, religion, and covariates at the county level in the nineteenth century. The focus on the nineteenth century has the advantage that religiosity was pervasive at the time, in the sense that almost everybody had a religious affiliation and that religion affected virtually all dimensions of everyday life. The focus on Prussia allows us to exploit variation between counties with nonminority Protestant and Catholic populations within the setting of one country. In particular, the Prussian population was about two-thirds Protestants and one-third Catholics, and a majority of counties were close to having a uniformly Catholic or uniformly Protestant population, so that no denomination was an extreme minority. This may be important to exclude that religious factors are confounded with particular behavior in religious minorities. The religious division of Prussian territory goes back to Reformation times and was solidified by the exceptional individual religious freedom granted in Prussia at least since Frederick the Great in the mid-eighteenth century. In its nineteenth-century shape, Prussia had Wittenberg, the birthplace of the Reformation, at its center, where Protestantism originated and was conserved in its purest form. Prussia had uniform laws and institutional frameworks, and official suicide figures were collected as early as 1816. In contrast to cross-national analyses, this makes county-level data within Prussia directly comparable.

We have religion and suicide data for two points in time, one early (1816 to 1821) and one late (1869 to 1871) in the nineteenth century. Our analyses mainly focus on the latter period when suicide data are more reliable and background data richer. But the first time for which suicide statistics were collected for the whole of Prussia is the 1816–1821 period (Mützell, 1825).[5] The data average suicides over several years, reducing noise due to random jumps in suicide incidents. The data cover all 306 Prussian counties at the time. The 1816 Population Census provides data on religion and background controls (see online appendix C for details on the different data sources).

We also digitized suicide statistics for 1869 to 1871, again averaged over consecutive years. We combine these data with a rich set of variables that the literature considers as determinants of suicide rates. Most prominent, the 1871 Population Census contains shares of Protestants in the county population, demographic characteristics, and literacy rates (see Becker et al., 2014). It also provides shares of the population with different forms of physical and mental disabilities. The 1882 Occupation Census provides data on the occupational structure, used as indicators of the stage of industrial development. The data cover all 452 Prussian counties (*Kreise*) at the time, divided into 11 provinces (*Provinzen*) and 35 districts (*Regierungsbezirke*).

There is a difference in the way suicide data were collected at the beginning and end of the nineteenth century (Hilse, 1871). For 1816 to 1821, data on suicides were drawn from the local burial and death registers, which were often run by the church. In 1868, dedicated suicide statistics were introduced for which the local state administration (the city council or the local police) recorded every civilian suicide on a separate data sheet. Background information on the person committing suicide and the suicide circumstances were collected with the explicit aim of understanding the factors explaining suicides. The new data collection method was used as the basis of very detailed suicide statistics from 1869 onward. The Prussian Statistical Office exerted extensive effort to ensure high data quality and dedicated eighty pages

[5] Prussian statistics have published data on suicides as a death cause since 1777 (Wilke, 2004).

TABLE 1.—DESCRIPTIVE STATISTICS, PRUSSIA, 1871

	Mean (1)	SD (2)	Minimum (3)	Maximum (4)
Suicide rate (per 100,000 inhabitants)	13.00	8.33	.00	37.06
Suicide proportion (per 1,000 deaths)	4.78	3.17	.00	15.76
Share of Protestants	.64	.38	.003	1.00
Share of population < 15 years	.36	.03	.23	.43
Share of population > 60 years	.07	.02	.03	.11
Average household size	4.79	.34	3.83	5.86
Share of population living in towns	.28	.22	.00	1.00
Share of labor force in manufacturing and services (1882)	.34	.15	.08	.82
Share of literate adults	.88	.13	.37	.99
Distance to Wittenberg (in 1,000 km)	.33	.15	.00	.73
Share of females	.51	.02	.44	.55
Share of Jews	.01	.01	.00	.13
Share of population born in municipality	.59	.12	.32	.87
Share of population of Prussian origin	.99	.02	.74	1.00
Share blind (× 100)	.09	.03	.03	.24
Share deaf-mute (× 100)	.10	.05	.02	.42
Share insane (× 100)	.23	.17	.02	1.56
Fatal accident rate (per 100,000 inhabitants)	42.35	15.80	9.37	114.52
Fatal accident proportion (per 1,000 deaths)	15.17	5.00	3.77	37.48
Latitude (in rad)	.91	.03	.84	.97
Longitude (in rad)	.22	.08	.11	.39
Year when annexed by Prussia	1,751.69	111.05	1,525	1,866

Suicide rates are average annual rates in 1869 to 1871. Data for 452 Prussian counties from the 1869–1871 Suicide Statistics, the 1871 Population Census, and the 1882 Occupation census. See main text and online appendix C for details.

in its quarterly journal to providing background information and first results on the new suicide statistics (Hilse, 1871). The care given to data collection and the amount of detail given in the suicide tables are impressive and reassuring signs of data quality.[6]

Descriptive statistics for the 1869–1871 period in table 1 reveal that the average annual suicide rate across all Prussian counties was 13.0 per 100,000 inhabitants, ranging between 0 in only one county (Adenau) to 37.1 (Schönau). The upper panel of figure 1 shows substantial geographic variation in suicide rates across Prussia. Prussian suicide levels are somewhat higher than in Germany today, where the suicide rate was 10.3 per 100,000 inhabitants in 2004 (OECD, 2009). The comparison of our historic data with modern data provides no indication of a systematic underreporting in the late nineteenth century, unless one believes that suicide rates had a significant downward trend over the twentieth century.[7]

Another check on whether there is systematic underreporting of suicides in some counties is to cross-check the suicide data with other mortality data. Because, in particular in Catholic parishes, a religious funeral ceremony was sometimes not granted for proven suicides, there may in principle be an incentive to underreport suicides and classify them as fatal accidents (Kollarits, 1919). If this were the case, the incidence of reported suicides and fatal accidents should be negatively correlated. In our data set, suicide rates and fatal accident rates are in fact uncorrelated; their raw correlation is −0.004 (p-value 0.932) in the full sample and 0.110 (p-value 0.362) in the 71 counties with a Catholic share higher than 90%. This indicates that systematic underreporting of suicides is unlikely. According to Kollarits (1919), the standard way to get a religious funeral ceremony was to claim that the suicide was caused by aberration. In this case, even the Catholic Church approved a religious ceremony, and suicide rates and their denominational differences are not misreported.

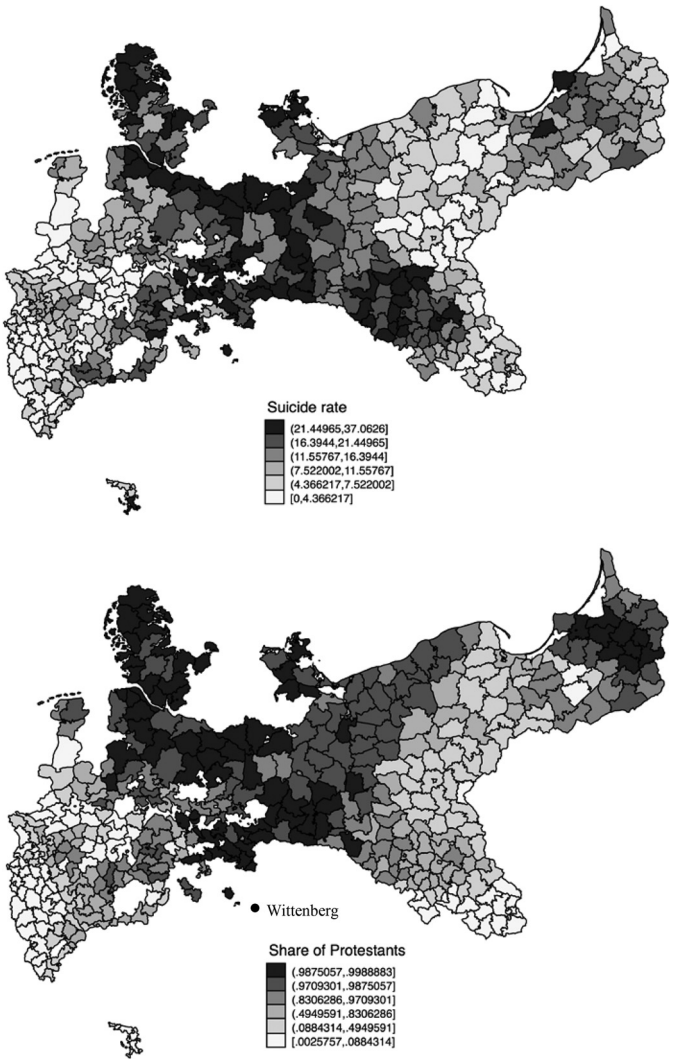
The average share of Protestants in a county was 64.2% in 1871, against 34.5% Catholics (the remainder being 1.1% Jews and 0.2% other Christian denominations). Thus, both Protestants and Catholics are not just a small minority but constitute a sizable fraction of the Prussian population. Furthermore, there is substantial variation across counties, ranging essentially from 0 to 100% Protestants or Catholics. More than 75% of the counties have a share of at least 80% of either Protestants or Catholics, and more than 60% have a share of at least 90% of one denominational group. In restricted analyses, we even focus on samples of countries where the share of Protestants is smaller than 2% or larger than 98% or even 0.1% and 99.9%.

The bottom panel of figure 1 depicts the geographic variation of Protestant shares across Prussia. The close mapping between the geographic distribution of Protestant shares and suicide rates is directly evident. In fact, the raw correlation between the two across the 452 counties is 0.66 (statistically significant at the 1% level). When plotting the two against each other (figure A.1 in the online appendix), there is a clear positive association between the share of Protestants in a county and the suicide rate, and the average suicide rate is notably higher in all-Protestant than in all-Catholic counties.

[6] For instance, eleven different means of suicide are provided, hanging and drowning being the two most widespread categories (see table A.1 in the online appendix).

[7] La Vecchia, Lucchini, and Levi (1994) do not find substantial trends in suicide rates in developed countries from 1955 to 1989, and Chen et al. (2012) refer to substantial increases.

FIGURE 1.—SUICIDES AND PROTESTANTISM IN PRUSSIA, 1871



Suicide rate (average annual suicides per 100,000 inhabitants), 1869–1871, and share of Protestants, 1871. County-level depiction based on 1869–1871 Suicide Statistics and 1871 Population Census, respectively. See online appendix C for data details.

B. Basic Evidence from 1869 to 1871

To probe the association between Protestantism and suicide in a multivariate setting, we estimate a simple least-squares model,[8]

$$SUIC_i = \alpha + \beta\, PROT_i + X_i\,\gamma' + \varepsilon_i, \qquad (1)$$

where $SUIC_i$ is the suicide rate in county i, $PROT$ is the share of Protestants in the county, and X is a set of control variables. Our most basic set of controls includes the shares of the county population below 15 years of age and above 60 years of age, respectively, and average household size. Such measures of age and family patterns are standard determinants considered in suicide equations. In richer models, we will also consider a host of additional possible correlates of suicide as control variables (see Helliwell, 2007, and Chen et al., 2012, for extensive overviews of factors considered in empirical suicide research).

The first column of table 2 shows the strong positive association between the Protestant share and the suicide rate. On average, all-Protestant counties have a suicide rate that is 14.5 suicides per 100,000 inhabitants higher than all-Catholic counties. Viewed against an average suicide rate of 13.0, this is a substantial difference across religious denominations. Column 2 adds the list of basic demographic control variables. The significant positive association between Protestantism and suicide remains largely unchanged in the multivariate specification. Suicide rates are significantly negatively related to larger shares of young (below 15 years) and old (over 60 years) population. The fact that suicide initially increases with age is a standard result in suicide research. The inversely U-shaped pattern of suicide rates declining again with larger shares of old people may indicate a declining suicide inclination after reaching a certain age. As an indicator of longevity, it may also capture an effect of the level of economic development, which may protect from suicide disposition. The negative relation of suicide rates with average household size mirrors the importance of the family generally found in the suicide literature.

Columns 3 to 5 add further control variables. Previous work has found urbanization, economic conditions, and education to be factors related to suicide (Helliwell, 2007; Chen et al., 2012). We add the share of population living in towns, the share of the labor force working in manufacturing and services (as a measure of economic development), and the share of literates to the basic model. None of these measures enters the model significantly, and the point estimate on the share of Protestants is barely affected. Column 6 adds a set of dummies for the 35 Prussian districts (*Regierungsbezirke*), the administrative layer between counties and provinces, to the model. This specification excludes all the variation that exists across districts and exploits only the within-district variation. To the extent that there is unobserved regional heterogeneity, district dummies should capture most of its substance. While the estimated association between Protestantism and suicide is somewhat reduced in magnitude, it remains highly robust.

Column 7 uses the suicide proportion—the number of suicides divided by the flow of deaths in the same period—as an alternative dependent variable. This measure takes into account that average mortality rates differ across counties. Again, there is a significant association of Protestantism with suicides. The lower point estimate is in line with the smaller value range of this variable (see table 1).

C. Identifying Exogenous Variation in Protestantism

A concern with the evidence so far is that religious affiliation may not be exogenous to the suicide model. Specifically,

[8] Our qualitative results are confirmed in Poisson and negative binomial regression models that use the number of suicides rather than suicide rates as the dependent variable (not shown). Similarly, the significance of our main results holds in models that cluster standard errors at the level of 35 districts (not shown).

TABLE 2.—PROTESTANTISM AND SUICIDE IN PRUSSIA, 1871

Dependent Variable	Suicide Rate (per 100,000 inhabitants)						Suicide Proportion (per 1,000 deaths)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Share of Protestants	14.496	12.328	12.306	12.411	12.528	9.812	4.928
	(.669)***	(.612)***	(.611)***	(.634)***	(.705)***	(.906)***	(.272)***
Share of population < 15 years		−70.781	−66.868	−66.580	−67.552	−57.218	−21.537
		(10.911)***	(15.498)***	(15.590)***	(15.811)***	(17.233)***	(6.394)***
Share of population > 60 years		−30.120	−23.869	−22.354	−15.241	13.799	9.570
		(18.102)*	(23.812)	(24.118)	(27.741)	(34.247)	(11.133)
Average household size		−7.575	−7.529	−7.364	−7.317	−1.727	−2.077
		(.758)***	(.755)***	(.771)***	(.761)***	(1.568)	(.285)***
Share of population living in towns			.754	.091	.089	.212	.548
			(1.838)	(1.862)	(1.867)	(1.826)	(.686)
Share of labor force in manufacturing and services (1882)				1.807	2.437	5.550	.118
				(1.683)	(2.089)	(2.646)**	(.790)
Share of literate adults					−1.614	3.900	.020
					(3.054)	(4.040)	(1.123)
35 district dummies						Yes	
Constant	3.691	68.928	66.655	65.148	65.868	23.571	18.352
	(.370)***	(5.626)***	(8.046)***	(8.464)***	(8.738)***	(13.034)*	(3.372)***
Observations	452	452	452	452	452	452	452
R^2	.433	.627	.627	.628	.628	.738	.611

Ordinary least squares (OLS) estimation. Heteroskedasticity-robust standard errors in parentheses: Significant at *10%, **5%, and ***1%. Data for Prussian counties from the 1869–1871 Suicide Statistics, the 1871 Population Census, and the 1882 Occupation Census. See main text and online appendix C for details.

whether a person adheres to a specific faith may to some extent be a choice variable that is correlated with the error term of equation (1). For example, in the early twentieth century, Kollarits (1919), a Hungarian publishing in a German journal of neurology and psychiatry, hypothesized that the higher incidence of suicide among Protestants may simply result from selection of suicide-prone people into the Protestant denomination. However, direct conversion was in fact minimal in the nineteenth century: only 0.01% of Catholics (or 766 out of more than 7 million Catholics) converted to Protestantism per year over the period 1859 to 1867, mostly in the course of marriage to a Protestant partner (Hilse, 1869).

But endogeneity may take another form of unobserved heterogeneity, in that three centuries earlier, during the Reformation, regional conversion to the new Protestant faith may not have been orthogonal to suicide proneness, which may exhibit strong intertemporal persistence. Most of the denominational variation across Prussia in the nineteenth century can be traced back to denominational choices of local rulers in the roughly 300 political entities that made up Germany during the Reformation in the sixteenth and early seventeenth centuries, mostly motivated by religious conviction and power politics vis-à-vis the pope and the German emperor. While it seems unlikely that the adoption of Protestantism was directly related to pre-Reformation patterns in suicide, it might have been indirectly related to correlates of suicide such as economic conditions, urbanity, education, and mental disposition. For example, regions where people are naturally inclined to try to change a bad status quo rather than giving up may have been more willing to adopt the new denomination that emerged from a protest movement ("Protestantism"), and such people may also be less prone to commit suicide when matters turn bad. Such issues of causality pose a fundamental challenge for empirical identification that has not been directly addressed in the (mostly sociological) literature so far.

To identify exogenous variation, we exploit the concentric spread of the Reformation from Wittenberg, where Luther initiated the new denomination. As is visible in the bottom panel of figure 1, the Reformation spread in the areas around Wittenberg but was less successful farther away from Wittenberg. The geographically concentric dispersion of the Reformation allows us to employ an instrumental variable (IV) strategy that uses a county's distance to Wittenberg as an instrument for the share of Protestants in the county. We thereby restrict the analysis to a specific part of the denominational variation that is arguably exogenous to variation in important drivers of suicide rates. Our identifying assumption, which we probe in greater detail below, is that the concentric pattern is unrelated to suicide apart from its effect through Protestantism.

Table 3 reports results of the IV estimation of the effect of Protestantism on suicide rates. Distance to Wittenberg is a strong instrument for the share of Protestants in a county, as is evident from an F-statistic of the instrument in the first stage of 23 to 47 (depending on the included controls). Each 100 km distance to Wittenberg is associated with a Protestant share that is 7 to 9 percentage points lower (columns 1 to 4). The second stage uses only that part of the variation in Protestant shares that is due to distance to Wittenberg to predict suicide rates.

The positive effect of Protestantism on suicide rates is highly robust in the IV specifications (columns 5 to 8). In fact, the IV point estimates are significantly higher than the OLS estimates. Depending on the model, a 10 percentage point increase in the share of Protestants in a county increases the suicide rate by 2.0 to 2.4 suicides per 100,000

TABLE 3.—INSTRUMENTAL VARIABLE ESTIMATES USING DISTANCE TO WITTENBERG

Dependent Variable	First Stage Share of Protestants				Second Stage Suicide Rate (per 100,000 inhabitants)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Share of Protestants					28.019	20.485	19.969	24.016
					(3.051)***	(2.672)***	(2.417)***	(3.836)***
Distance to Wittenberg (in 1,000 km)	−.936	−.863	−.909	−.693				
	(.137)***	(.145)***	(.136)***	(.145)***				
Share of population < 15 years		−.599	−.747	.093		−68.989	−67.873	−79.150
		(.739)	(.742)	(.738)		(17.176)***	(17.065)***	(18.385)***
Share of population > 60 years		−2.550	−3.177	−7.136		−23.759	−19.051	61.177
		(1.587)	(1.491)**	(1.620)***		(27.266)	(26.607)	(45.356)
Average household size		−.155	−.195	−.226		−5.467	−5.163	−3.845
		(.059)***	(.059)***	(.059)***		(1.159)***	(1.179)***	(1.590)**
Share of population living in towns		−.048	.149	.172		−.686	−2.604	−3.605
		(.101)	(.104)	(.099)*		(1.968)	(2.084)	(2.345)
Share of labor force in manufacturing and services (1882)			−.587	−.940			5.628	14.021
			(.122)***	(.130)***			(2.509)**	(4.855)***
Share of literate adults				1.053				−17.929
				(.200)***				(6.076)***
Constant	.947	2.084	2.535	1.797	−4.988	52.669	49.416	51.711
	(.038)***	(.454)***	(.443)***	(.451)***	(2.084)**	(11.255)***	(11.467)***	(13.031)***
Observations	452	452	452	452	452	452	452	452
R^2	.135	.152	.189	.235	.056	.498	.521	.406
F-statistic (instrument)					46.807	35.547	44.882	22.793

Instrumental variable (IV) estimation. Heteroskedasticity-robust standard errors in parentheses: Significant at *10%, **5%, and ***1%. Data for Prussian counties from the 1869–1871 Suicide Statistics, the 1871 Population Census, and the 1882 Occupation Census. See main text and online appendix C for details.

inhabitants. The pattern of IV and OLS results suggests that without the Reformation, suicide rates would have been lower in regions that turned Protestant due to their proximity to Wittenberg ("compliers") than in regions that remained Catholic. This negative bias in the OLS estimates is consistent with a Reformation pattern where regions with a less suicide-prone population tended to select into Protestantism.

D. Validity of the Instrumental Variable Strategy

The validity of the IV model rests on the assumption that the initial concentric spread of the Reformation led to exogenous variation in the Protestant share (see online appendix B.1 for details on the analyses summarized in this section). Factors that likely contributed to the historical diffusion process include costs of traveling and information diffusion, increasing dissimilarity of dialects, Electoral Saxony as an early role model, regional political alliances, and historical randomness. Consistent data on suicide rates before the Reformation are not available. But the lack of a significant association of the distance-to-Wittenberg instrument with several proxies of suicide proneness observed before the onset of the Reformation—including proxies for economic conditions, urbanity, education, and cultural predisposition—lends credibility to assuming exogeneity of the instrument. There is also ample anecdotal evidence that the initial spread of Protestantism was indeed associated with increases in suicide incidences.

Still, the fact that we have shown in Becker and Woessmann (2009) that Protestantism affected literacy and economic development raises a question of interpretation: Was it these other outcomes of the Reformation, rather than Protestantism per se, that led to the increase in suicides? As shown in table 3, the estimated effect of the Protestant share on suicide rates is largely unaffected by conditioning on the share of the workforce that moved out of agriculture, and it in fact increases (although not statistically significantly so) when conditioning on the share of literate adults, which is significantly negatively associated with suicides in this specification. This suggests that the estimated effect of Protestantism on suicides is barely affected by any effect of the Reformation on literacy and economic development. This conclusion is corroborated when adding controls for further dimensions of educational and economic development and for proxies for two additional potential nonreligious outcomes of the Reformation, income inequality and the number of social protests (see table A.2 in the online appendix). Neither measure enters significantly or affects the estimate on Protestantism. Overall, the results seem most consistent with a strong effect of Protestantism per se on suicides.

E. Robustness Analyses

As shown in online appendix B, the empirical results prove very robust to a large set of robustness tests. Among others, we control for additional demographic variables such as gender, the share of Jews, internal and external migration, and the share of married people (see table A.3 in the online appendix). To account for differences in suicides that stem from aspects of general mental illness that are not well depicted in a rational choice framework, we use information on the share of people classified as having physical or mental disabilities, including being "insane." This measure does not vary by denomination in our data, and holding the shares of people with different disabilities constant does not affect our results. In addition, we can add geographic controls, such as

latitude, longitude, and their interaction; altitude; and a set of dummies indicating the year in which the county became part of Prussia. We also control for local weather conditions such as rainfall and temperature (table A.4 in the online appendix).

To rule out bias from denomination-specific reporting bias, we analyze whether some suicides might be hidden as fatal accidents or other alternative death causes. Neither fatal accident rates nor total mortality rates are higher in Protestant areas, and controlling for the fatal accident rate does not alter our results (see table A.5 in the online appendix). To account for denominational sorting into occupations with different frequencies of fatal accidents, we also include an extensive set of controls for employment shares in 32 sectors. Results are also robust when using the suicide proportion (suicides per death incidents) rather than the suicide rate (suicides per inhabitants) as an alternative outcome measure.

We also look into effects of religious minorities and religious concentration (table A.6 in the online appendix). Cross-tabulated data confirm that the county-level results do not derive from ecological fallacy (table A.7 in the online appendix). They also allow us to probe into denomination-specific suicides by gender and effects of being a religious minority on suicide, rejecting the existence of important nonlinearities in the effect of Protestantism on suicide.

F. Evidence from 1816 to 1821

While the 1869–1871 data are in the first statistical investigation specifically devised to analyze suicides, official burial and death registers provide data on suicides as early as 1816 to 1821. These are the earliest data covering all of Prussia, again available at the county level. Suicide rates are reported separately by gender for each county. On average, male suicide rates are about four times higher than female suicide rates (see table A.8 in the online appendix). The set of control variables available in the 1816 Population Census is not as rich as in the later data. However, the same types of basic demographic control variables are available: the share of the population younger than 15 years and the share older than 60 years, as well as the share of the population living in towns. Furthermore, the number of public buildings per capita can serve as an indicator of economic development and the enrollment rate in primary schools as a measure of education, and we again have information on fatal accident rates.

At 6.5 suicides per 100,000 inhabitants, the average suicide rate in the 1816–1821 data is only half the average suicide rate reported in the 1869–1871 data. This raises the concern of possible underreporting of suicides in the official burial and death registers, where some of the suicides may be classified as fatal accidents. This may be particularly the case where priests denied a church burial ceremony for those who committed suicide (a practice prohibited by Prussian law only in 1845; see Hilse, 1871). However, while underreporting of suicides might affect the size of the estimated effects, it would affect the qualitative results only to the extent that the degree of underreporting varies by denomination. If we take the 1869–1871 data as a benchmark, we can assess the relative difference in reported suicides over time for Protestant and Catholic counties. Counties with a share of Protestants higher than 90% have an average suicide rate of 9.3 suicides per 100,000 inhabitants in 1816 to 1821, compared to 17.4 in 1869 to 1871. In Protestant counties, reported suicides from 1816 to 1821 are thus lower by a factor of 1.9. Counties with a share of Catholics higher than 90% have an average suicide rate of 2.8 from 1816 to 1821, compared to 4.7 for 1869 to 1871. In Catholic counties, reported suicides from 1816 to 1821 are thus lower by a factor of 1.7. This is an indication that, if anything, Protestants underreport slightly more in the 1816–1821 period compared to Catholics not only in absolute terms but even in relative terms, putting the stakes against finding an effect of Protestantism for 1816 to 1821. In addition, we can again control for fatal accident rates in our regressions to guard against bias from misclassification of suicides as fatal accidents.

Suicide rates in all-Protestant counties are 7.2 larger than in all-Catholic counties on average. This difference is reduced to 4.7 but remains highly significant in OLS regressions that control for the age structure of the population, urbanization, public buildings, and school enrollment (table A.9 in the online appendix). Both male and female suicide rates are significantly higher in Protestant areas. However, as a direct corollary of the substantially higher male suicide rates, the point estimate on Protestantism is substantially higher for men than for women. In fact, the male effect for 1816 to 1821 is quantitatively in the same range as the average effect for 1869 to 1871.

Table 4 reports the IV results that use distance to Wittenberg as an instrument for the share of Protestants. The IV estimates suggest that Protestantism raises male suicide rates by 23.4 suicides per 100,000 inhabitants, female suicide rates by 7.1, and average suicide rates by 15.0. To exclude possible bias from underreporting of suicides as accidents, columns 3 to 5 control for fatal accident rates. Fatal accident rates are not significantly related to suicide rates in the multivariate regressions, and the estimated effect of Protestantism on suicide is barely affected. Again, the positive effect of Protestantism is also evident when measuring suicides per deaths rather than per inhabitants (column 6). The 1816–1821 analyses thus confirm a strong positive effect of Protestantism on suicide also for the early nineteenth century and show it for both genders.

G. A First-Difference Model

With data from two points in time—1816 to 1821 and 1869 to 1871—it is also possible to estimate a first-difference model. By testing whether any change in the Protestant share over time is associated with a contemporaneous change in the suicide rate, such a model effectively removes county fixed effects, disregarding any differences in the levels of suicides and Protestantism across counties and focusing only

TABLE 4.—PROTESTANTISM AND SUICIDE IN PRUSSIA, 1816: IV ESTIMATES

Dependent Variable:	First Stage	Second Stage				
	Share of Protestants	Suicide Rate (per 100,000 inhabitants)				Suicide Proportion (per 1,000 deaths)
	All (1)	All (2)	All (3)	Males (4)	Females (5)	All (6)
Share of Protestants		14.989	14.971	23.439	7.066	5.240
		(3.020)***	(2.873)***	(4.701)***	(1.621)***	(1.059)***
Distance to Wittenberg (in 1,000 km)	−.869					
	(.195)***					
Share of population < 15 years	−4.251	15.253	15.117	19.218	11.345	4.804
	(.943)***	(21.538)	(20.667)	(33.926)	(11.620)	(7.797)
Share of population > 60 years	−8.089	1.281	.555	4.341	−.576	7.929
	(1.845)***	(39.500)	(36.464)	(59.446)	(21.749)	(13.593)
Share of population living in towns	−.078	6.570	6.566	11.932	1.922	1.809
	(.088)	(1.431)***	(1.428)***	(2.536)***	(.900)**	(.493)***
Public buildings per capita	.091	−.262	−.256	−1.900	1.278	.087
	(.056)	(1.165)	(1.129)	(1.706)	(1.033)	(.394)
School enrollment rate	.443	−2.074	−2.045	−2.941	−1.174	−.886
	(.104)***	(1.998)	(1.881)	(3.160)	(.963)	(.676)
Fatal accident rate (per 100,000 inhabitants)			−.001	.010	−.014	.0001
			(.021)	(.034)	(.011)	(.008)
Constant	2.647	−7.369	−7.225	−9.985	−4.881	−2.761
	(.421)***	(10.830)	(10.029)	(16.502)	(5.700)	(3.755)
Observations	306	306	306	306	306	306
R^2	.360	.024	.026	.023	.078	.092
F-statistic (instrument)		19.827	24.861	24.861	24.861	24.861

Instrumental variables (IV) estimation. Heteroskedasticity-robust standard errors in parentheses: Significant at *10%, **5%, and ***1%. Data for Prussian counties from the 1816 Census. See main text and online appendix C for details.

on changes over time. The identifying assumption of this first-difference model is quite different from our IV model (which assumes that the concentric spread of the Protestant Reformation from Wittenberg is not otherwise related to suicide proneness). It assumes that in the absence of any differential change in the Protestant share, there would have been no systematic difference in the change in suicide rates. Changes in denominational shares within counties during this time are likely to mostly reflect migration patterns such as movements of Polish Catholics to the coal mines of the Ruhr area, as well as differential fertility and mortality, so that the analysis cannot exclude selection bias. Still, the first-difference model provides an alternative test of our main hypothesis that Protestantism affected suicide rates.

We can perform the first-difference analysis for 272 counties (out of the 306 counties that existed in 1816) that can be linked over time because there were no or only negligible changes in their county boundaries between 1816 and 1871. The observed range of county-level changes in Protestant shares is in fact quite substantial, ranging from a 25 percentage point decrease to a 22 percentage point increase across counties. As is evident from the first column of table 5, both the initial share of Protestants and its change over time are significantly positively related to the change in the suicide rate over time.[9] The larger the increase in the Protestant share, the larger the increase in the suicide rate. To test for robustness to contemporaneous changes in other potentially confounding factors, column 2 includes controls for contemporaneous changes in urbanization and the age structure, as well as their initial levels. Column 3 additionally controls for the initial level of the dependent variable, the suicide rate in 1816. The effect of changes in Protestant shares on changes in suicide rates is highly robust in these specifications.

Despite the substantial range of observed changes in Protestant shares over time, the majority of counties experience relatively small changes in denominational shares. To ensure that these are not affecting the first-difference results, columns 4 and 5 restrict the analysis to those 114 (50) counties whose Protestant shares change by at least 2 (5) percentage points, respectively. Results are robust in these smaller samples. The first-difference analysis thus indicates a robust positive association between increased Protestant shares and increased suicide rates over time.

IV. Discriminating between Sociological and Theological Explanations

The evidence so far confirms a causal effect of Protestantism on suicide, but it does not discriminate between the sociological and the theological explanations for this effect. In this section, we devise a series of empirical tests that try to provide such discrimination.

A. *Church Attendance and the Relevance of Social Cohesion and Religious Beliefs*

A first test to discriminate between the two types of explanation builds on their differing predictions with respect to

[9] Mechanically, the change in the Protestant share is negatively correlated with its initial level.

TABLE 5.—FIRST-DIFFERENCE MODEL ON CHANGES BETWEEN 1816 AND 1871

Dependent Variable:	Change in Suicide Rate (per 100,000 inhabitants), 1816–1871				
				Excluding Counties Where	
	All Panel Counties			Δ *%Prot* < 2 p.p.	Δ *%Prot* < 5 p.p.
	(1)	(2)	(3)	(4)	(4)
Change in share of Protestants (1816–1871)	.099	.084	.078	.091	.117
	(.040)**	(.037)**	(.036)**	(.040)**	(.040)***
Share of Protestants (1816)	.081	.078	.099	.116	.143
	(.007)***	(.008)***	(.009)***	(.016)***	(.022)***
Change in share of population < 15 years (1816–1871)		−.048	−.144	−.187	−.329
		(.163)	(.164)	(.205)	(.239)
Change in share of population > 60 years (1816–1871)		.869	1.007	.761	1.014
		(.288)***	(.279)***	(.307)**	(.432)**
Change in share of population living in towns (1816–1871)		−.007	.004	−.018	−.013
		(.026)	(.026)	(.028)	(.029)
Share of population < 15 years (1816)		−.269	−.450	−.537	−.531
		(.191)	(.197)**	(.281)*	(.301)*
Share of population > 60 years (1816)		.864	.695	.167	.422
		(.327)***	(.336)**	(.491)	(.669)
Share of population living in towns (1816)		−.012	.005	−.005	−.018
		(.021)	(.020)	(.027)	(.033)
Suicide rate per 100,000 inhabitants (1816)			−.333	−.419	−.604
			(.078)***	(.117)***	(.163)***
Constant	1.028	4.938	13.039	20.580	18.748
	(.344)***	(9.150)	(9.476)	(13.606)	(15.085)
Observations	272	272	272	114	50
R^2	.284	.365	.404	.464	.653

Ordinary least squares (OLS) regression on long difference in suicide rates. Heteroskedasticity-robust standard errors in parentheses: Significant at *10%, **5%, and ***1%. Data for Prussian counties from the 1816 Census, the 1869–1871 Suicide Statistics, and the 1871 Population Census. See main text and online appendix C for details.

how the extent of church attendance in a community affects suicide rates and their dependence on Protestantism. From the sociological perspective, higher church attendance can be viewed as a sign of greater social cohesion. Thus, even if the integration into the Protestant community might be lower than in the Catholic community on average, in Protestant areas, Protestants should be relatively more closely embedded in their community when more people attend church. The sociological explanation would thus predict that higher church attendance should dampen the effect of Protestantism on suicide.

By contrast, from the theological perspective, higher church attendance can be viewed as a sign of more devout church members. Higher church attendance would thus signal stronger belief in Protestant doctrine, which should go along with an even stronger effect of Protestantism on suicide. There is ample evidence to support the assumption that theological beliefs are more strictly believed in areas with higher church attendance. For example, McCleary and Barro (2006) show that the correlations of monthly attendance at religious services with religious beliefs such as belief in afterlife, God, heaven, and hell, as well as with self-identification as a religious person, are as high as 0.86 to 0.91 across countries (see their table 9). For the United States, Glaeser and Sacerdote (2008) show a strong significant effect of religious beliefs (an index that combines belief in heaven, miracles, the devil, and the Bible as literal truth) on monthly attendance at both the individual and the metropolitan-area levels (see their tables 1, 2, and 9). For Great Britain, Sawkins, Seaman, and Williams (1997) show that attendance at religious services is significantly positively associated with the intensity of religious belief for both women and men (see their tables 1 and 2).

These opposite predictions of the two explanations on how suicide rates change with church attendance rates provide us with a way to test the two channels against each other. To do so, we make use of the unique database of church attendance provided by the statistical surveys of the Protestant regional churches of Germany on the expressions of churchly life (see Hölscher, 2001, and Becker & Woessmann, 2013, for additional detail). First in 1862 and then more regularly on an annual basis starting in 1881, parish priests were to count the number of participations in Holy Communion on a preprinted form following uniform surveying directives. The data are available from regional archives at the level of church districts (*Kirchenkreise*), usually comprising 10 to 20 adjacent parishes. Our measure of church attendance is the number of participations in Holy Communion divided by the number of Protestants in a church district. To match our 1869–1871 suicide statistics, we take a simple average of church attendance in 1862 and 1881, the closest years with available data for most church districts.[10] We map the church district data into our administrative county data by using

[10] Results based on just the 1862 data are very similar. To ensure that the averaging is not affected by overall trends in church attendance, before taking the average of the two years, we first regress the 1862 and 1881 data on each other and predict any missing value for a county in one year by the predicted value from these regressions.

TABLE 6.—DISCRIMINATING BETWEEN SOCIOLOGICAL AND THEOLOGICAL EXPLANATIONS, 1871

Dependent Variable:	Suicide Rate			
	Counties with More Than 98% Protestants	All Counties		
	(1)	(2)	(3)	(4)
Church attendance	−11.418			
	(3.542)***			
Share of Protestants		10.934	11.224	10.480
		(1.231)***	(1.241)***	(1.382)***
Bottom quartile of church attendance		−2.131		−1.948
		(1.409)		(1.411)
Share Protestants × Bottom quartile of church attendance		4.386		3.891
		(1.903)**		(1.915)**
Top quartile of urbanization			−.952	−.558
			(1.274)	(1.711)
Share Protestants × Top quartile of urbanization			3.269	2.691
			(1.838)*	(1.993)
Further controls (as in table 2)	Yes	Yes	Yes	Yes
Observations	90	396	396	396
Number of clusters	66	258	258	258
R^2	.442	.642	.641	.647

Ordinary least squares (OLS) estimation. Heteroskedasticity-robust standard errors, clustered at the level of church districts, in parentheses: Significant at *10%, **5%, and ***1%. Sample of counties with church attendance data (396 counties). Data for Prussian counties from the 1869–1871 Suicide Statistics, the 1871 Population Census, the 1882 Occupation Census, and the 1862–1881 Church Attendance Data. See main text and online appendix C for details.

GIS technology to compute the surface-weighted average of the available church district data for each county.[11] In cases where more than one county falls within the same church district, we cluster our regression analyses at the church district level.

We perform two types of analyses. First, we restrict the analyses to the ninety counties (with available church attendance data) that are virtually all Protestant (Protestant share larger than 98%) to test whether Protestant church attendance is significantly related to suicide rates. As is evident from the first column of table 6, suicide rates decline significantly with higher church attendance. If church attendance increases from the 10th to the 90th percentile in this sample (0.402 to 0.706), suicide rates are 3.5 suicides per 100,000 inhabitants lower, equivalent to a fifth of the sample mean. Declining suicides with increasing church attendance are in line with the sociological channel but not the theological channel.

Second, in the full sample, we test whether the effect of Protestantism on suicide differs with church attendance rates. To allow for functional flexibility, we interacted the Protestantism effect with indicator variables for four quartiles of Protestant church attendance. Given that effects for the upper three-quartiles do not significantly differ from one another, the specification in column 2 includes an interaction only with the bottom quartile of church attendance. As is evident, the effect of Protestantism on suicide is significantly larger in counties where Protestant church attendance is low. At 15.3 compared to 10.9 suicides per 100,000 inhabitants, the difference is again substantial. With higher church attendance dampening rather than heightening the effect of Protestantism on suicide, this finding again speaks in favor of the sociological channel and against the theological channel. Note that given the lack of evidence of a causal effect of income on church attendance in nineteenth-century Prussia (Becker & Woessmann, 2013), church attendance is unlikely to capture other factors like economic development.

An additional indication that church attendance is indeed related to higher social cohesion among Protestants comes from modern microdata from the German Socio-Economic Panel (SOEP), where we can observe frequency of church attendance and several measures of social cohesion at the individual level. The data show that Protestants who attend church regularly are more likely to regularly meet with family and relatives, meet with neighbors or friends, and volunteer in associations or social services than Protestants who do not attend church regularly.[12] This pattern is in line with the interpretation that higher church attendance indicates greater social cohesion.

B. Further Evidence on Channels from Historical Patterns

It can also be argued that the sociological aspect of a less tightly integrated Protestant community is particularly relevant in the anonymous environment of urban areas. By contrast, rural communities may exhibit more social cohesion irrespective of denomination, thereby dampening the

[11] We treat a county as missing data if church attendance information is missing for more than half of its surface, but results are robust in larger samples that include all counties with any church attendance information.

[12] For example, 83.1% of Protestants who attend church at least monthly mutually visit family members or relatives at least once per month, compared to 78.1% of Protestants who attend church less regularly. The equivalent comparisons are 83.2% versus 77.5% for mutual visits of neighbors, friends, or acquaintances and 36.7% versus 14.3% for volunteering in associations or social services. While the pattern is generally similar among Catholics, there is an interesting contrast in that churchgoing Catholics are less likely to meet friends on a weekly basis than non-churchgoing Catholics (42.6% versus 47.3%; Protestants: 49.8% versus 46.7%).

effect of Protestantism on suicide if the sociological channel is indeed at work. The theological channel does not predict the Protestantism effect to differ with urbanization.

Allowing for a flexible functional form, we interacted the Protestantism effect with indicator variables for four quartiles of the share of the county population living in towns. With the lower three quartiles not significantly differing from one another, column 3 of table 6 includes only the interaction with the top quartile of urbanization. The effect of Protestantism on suicide is indeed significantly larger in urban areas, supporting the relevance of the sociological channel. However, as is evident from column 4, the interaction of Protestantism with church attendance dominates its interaction with urbanity.

Another way to gauge the relevance of the sociological community channel is to look at the suicide rates of Catholics by whether they live in a predominantly Catholic or Protestant area. While the results reported in the bottom panel of table A.7 in the online appendix do not provide evidence for systematic minority effects, suicide rates of Catholics are in fact substantially larger in areas where Protestants have a majority. They are below 5% in districts with less than 40% Protestants but above 14% in districts with more than 60% Protestants. This pattern may again cast doubt on the importance of religious beliefs in generating the observed results and indicate instead the relevance of social structure, here in terms of social spillovers.

C. *Evidence from Modern Data*

A final piece of evidence to differentiate between relevant channels builds on modern data. In modern times even more than before, Protestant doctrine is more accommodating with suicides. Leading Protestant theologians have turned against condemning suicide, arguing that an individuals can commit suicide in a state of peace with God. At the same time, the Catechism of the Catholic Church continues to be very explicit against suicide, noting in point 2325, "Suicide is seriously contrary to justice, hope, and charity. It is forbidden by the fifth commandment." Based on the theological channel, one might thus expect the difference in suicide rates between true believers in Protestant and Catholic doctrine to sharpen in modern times, especially when large numbers have left both churches, presumably leaving behind members more committed to the doctrine of their church. In contrast, if the sociological channel dominates, a smaller flock of (firm) Protestant and Catholic believers should both find consolation in their congregations.

Data on suicides in modern Germany come from the mortality statistics accessible via controlled remote access (*Todesursachenstatistik*, EVAS 23211), covering all deaths at an individual level from 1992 to 2009. These statistics are based on the death certificate issued by the doctor declaring the death, in combination with the death registry certificate issued by the registrar of the municipality of residence. The death certificate contains information about diseases and significant other health issues that have contributed to death. The classification of causes of death follows the World Health Organization's International Classification of Diseases (ICD-9 until 1997 and ICD-10 since). In addition to the primary cause of death, the mortality statistics include demographic features such as gender, age, German citizenship, marital status, place of residence, date of death, and, importantly, religion.

We use the years 1992 and 2009, the earliest and latest years available. In 1992, the mortality statistics report 885,374 deaths, out of which 13,459, or 1.5%, are suicides. In 2009, the number of deaths is 854,544, out of which 9,622, or 1.1%, are suicides, indicating a considerable decline in the suicide proportion over the seventeen years.

Between 1992 and 2009, both the Catholic and Protestant churches lost many members due to secessions. But the share of Protestants leaving the church is nearly 50% higher. In 1991, Protestant churches had 29.2 million members and the Catholic Church 27.7 million (Eicken & Schmitz-Veltin, 2010). The number of members actively seceding from Protestant churches from 1992 to 2009 (not counting deaths or other movements) was 3.6 million: 12.2% of the initial stock left over the course of less than two decades. In the Catholic Church, the number of members seceding over the same period was 2.3 million, or 8.2%, of the initial stock.[13] Consequently, former Protestants make up a larger share of the nonaffiliated, an important factor when assessing suicide rates by denomination and nonaffiliation.[14]

Table 7 reports OLS regressions of a suicide indicator on religious affiliation, controlling for basic demographic characteristics: a quadratic in age, gender, German citizenship, and marital status.[15] In 1992, the regression reveals that suicide proportions are 0.18 percentage points higher for Protestants than for Catholics. This estimate is equivalent to 13.7% of the raw Catholic suicide proportion. The suicide proportion of citizens without religious affiliation is 0.44 percentage points higher than that of Catholics. It thus far exceeds that of any affiliated deceased, including Protestants. When county fixed effects are included in the analysis, the estimates increase to 0.252 percentage points for Protestants and 0.597 percentage points for the nonreligiously affiliated.[16] While the higher suicide proneness of Protestants

[13] Data source: http://www.kirchenaustritt.de/statistik (accessed July 25, 2014).

[14] The pattern of Protestant seceding from their church in higher numbers is consistent with the religious affiliation data in the mortality statistics. Among the people who died in 1992, 46.1% were Protestants, 33.9% were Catholics, and 16.0% were not religiously affiliated. By 2009, the Protestant share had decreased to 39.9%, the Catholic share had barely changed at 33.2%, and the nonreligiously affiliated had increased to 21.4%.

[15] As not only the choice to secede from the church, but also strong postwar migration waves and increased regional mobility probably undermine the instrument characteristics of the historical spread of the Reformation for Protestantism in our modern data, the contemporary analysis stays purely descriptive.

[16] Qualitative results are robust in probit and logit models, although the estimated marginal effects are somewhat smaller than the OLS estimates (e.g., 0.167 in the probit and 0.124 in the logit model rather than the 0.252 OLS estimate with county fixed effects, not shown).

TABLE 7.—PROTESTANTISM AND SUICIDE IN GERMANY, 1992 AND 2009

Dependent Variable:	Suicide[a]							
	1992		2009		West Germany, 1992			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Protestant	.180	.252	.027	.143	.215	.217		.213
	(.029)***	(.034)***	(.026)	(.030)***	(.037)***	(.034)***		(.037)***
Share Protestants in county							.244	.046
							(.120)**	(.130)
No religious affiliation	.443	.597	.161	.381	1.098	1.065	.927	1.062
	(.039)***	(.049)***	(.032)***	(.040)***	(.125)***	(.121)***	(.129)***	(.122)***
Other religious affiliations	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age	−.314	−.312	−.265	−.263	−.338	−.338	−.339	−.338
	(.005)***	(.005)***	(.004)***	(.004)***	(.014)***	(.014)***	(.014)***	(.014)***
Age squared	.140	.138	.113	.111	.155	.155	.156	.155
	(.004)***	(.004)***	(.003)***	(.003)***	(.009)***	(.009)***	(.009)***	(.009)***
Male	.720	.715	.738	.731	.702	.702	.703	.702
	(.029)***	(.029)***	(.025)***	(.025)***	(.036)***	(.036)***	(.036)***	(.036)***
German citizenship	.423	.417	.112	.163	.162	.155	.199	.155
	(.120)***	(.122)***	(.080)	(.081)**	(.206)	(.206)	(.205)	(.206)
Family status controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County fixed effects	No	Yes	No	Yes	Yes	No	No	No
County-level controls	No	No	No	No	No	Yes	Yes	Yes
Observations	885,374	885,374	854,544	854,544	666,261	666,261	666,261	666,261
R^2	.032	.033	.029	.030	.038	.037	.037	.037

Ordinary least squares (OLS) estimation. [a]Dependent variable multiplied by 100. Heteroskedasticity-robust standard errors in parentheses: Significant at *10%, **5%, and ***1%. Standard errors in specifications with county-level controls are clustered at the level of 327 counties. Other religious affiliations: Jewish; Muslim; other Christian; other religion; religion unknown (reference category: Catholic). Family status controls: single; widowed; divorced; unknown (reference category: married). County-level controls: log(county population); share of county population in twenty separate age groups; share of county population who are single, widowed, married, divorced; share of foreigners; share of workforce in four separate sectors; share of population receiving social benefits; share of population receiving financial support from relatives; share of population with five separate educational degrees. Data: Mortality Statistics (*Todesursachenstatistik*), 1992 and 2009; county-level variables: Population Census (*Volkszählung*), 1987. See main text and online appendix C for details.

compared to Catholics is still visible in 1992, the fact that suicide proneness of those not affiliated with a religion—which are disproportionately formerly Protestant—is even higher raises doubts that Protestant religious beliefs are the predominant factor in the denominational pattern of suicides.

In 2009, the estimate on Protestantism is reduced to an insignificant 0.03 percentage points, or just 2.8% of the raw Catholic suicide proportion. With county fixed effects, the estimate regains statistical significance, but at 0.14 percentage points, it is 43% lower than the respective estimate in 1992. The suicide proportion of those without religious affiliation remains 0.38 percentage points higher than that of Catholics. Under the assumption that the most devout believers in the respective religious doctrines are more likely to stay in their church, the declining difference in suicides between Protestants and Catholics again speaks against a paramount role for the theological explanation. The continuing fact that religiously nonaffiliated people, which disproportionately draw on people leaving Protestant churches, have the highest suicides also speaks for a dominant role of socialization rather than religious beliefs.

The individual-level modern data also allow us to probe some more into the issue of ecological fallacy. Religious affiliation at a regional level is available only in the most recent Population Census (*Volkszählung*) of 1987, available for West Germany only. As column 5 indicates, at 0.215, the point estimate on Protestantism in the 1992 specification with county fixed effects is slightly (although not statistically significantly) smaller in West Germany than the equivalent estimate of 0.252 for the whole of Germany. The estimate barely changes when we replace the county fixed effects by county-level controls from the 1987 Population Census (the shares of the county population in twenty separate age groups, in four family-status groups, in five education groups, receiving social benefits, receiving financial support from relatives, the share of foreigners, the share of the workforce in four sectors, and log county population). When we replace the indicator of individual Protestant affiliation with the share of Protestants among Protestants and Catholics in the county, the estimate is very similar at 0.244. But when we include individual and county-level Protestant affiliation together, only the individual Protestant affiliation remains significant, with a point estimate that is barely affected, while the point estimate on the Protestant share in the county is reduced to virtually 0. This pattern suggests that the actual effect stems from the individual affiliation, but that estimates based on the county share provide unbiased estimates of the individual effect. That is, county-level estimates do not seem to suffer from ecological fallacy, which is reassuring for our historical analyses.

Finally, modern data also allow us to test whether Protestantism indeed features a more individualistic and less community-oriented nature than Catholicism, as the basic hypothesis of the sociological channel suggests. For this, we use the individual-level data from the German SOEP in 2003. Catholics are in fact much more likely to go to church (see table A.10 in the online appendix). Among Catholics, 20.1% attend church at least weekly and 35.3% at least monthly, whereas these shares are only 4.9% and 16.3%, respectively, among Protestants. That is, Protestants are indeed substantially less likely to interact with their religious community on a regular basis than Catholics, which

may have detrimental consequences when they are in a suicidal state of mind. The lack of cohesion within the religious community is not compensated by higher social cohesion outside the religious community. Indeed, Catholics are 2.8 percentage points more likely to visit family or relatives on a weekly basis and only slightly (1.6 percentage points) less likely to visit neighbors and friends weekly.[17] As another indicator of social interaction beyond the religious community, Catholics are more than 3 percentage points more likely to go out in cafés or restaurants on a weekly or monthly basis than Protestants. Overall, these indicators suggest that the higher suicide proneness of Protestants is indeed related to a lower incidence of social cohesion, in particular within the religious community, as suggested by the sociological channel.[18]

Strikingly, religiously nonaffiliated individuals show a lower incidence of community orientation than either Catholics or Protestants. While they obviously rarely attend religious events, they are also substantially less likely to regularly visit family or visit friends than either Catholics or Protestants. Only with respect to going out for food or drink are they on a level roughly similar to Protestants. Again, this pattern is consistent with a sociological explanation for the greater incidence of suicides among those without a religious affiliation.

V. Conclusion

This paper studies the effect of Protestantism on suicide both theoretically and empirically. Theoretically, we model sociological and theological mechanisms through which Protestants are predicted to have higher suicide rates than Catholics. In the framework of an economic model of suicide, individuals who are in a suicidal mental state compare the expected utility from living with that from death. According to the sociological aspect of religion based on denominational differences in group structure, as Durkheim (1897) argued, Protestant doctrine emphasizes religious individualism, whereas Catholics have a more integrated religious community. As a consequence, Protestants will have a lower utility from keeping on living and a lower cost of committing suicide relative to Catholics. To this sociological channel, we add two mechanisms based on denominational differences in theological doctrine that derive from a consideration of afterlife in individuals' utility maximization. Protestant doctrine tends to stress that humans cannot affect God's decisions by their deeds but depend on God's grace (*sola gratia*), whereas Catholic doctrine grants that human access to heaven is affected by individual deeds. For Catholics, committing the deadly sin of suicide reduces the probability of reaching heaven, thereby lowering the optimality of the suicide threshold relative to Protestants. Furthermore, since Catholic doctrine views confession as a holy sacrament but Protestant doctrine does not, the impossibility of confessing the sin of suicide creates a substitution effect away from suicide to other possible actions considered by Catholics who are in a suicidal mental state, again reducing the optimality of suicide relative to Protestants in that state. Thus, both sociological and theological differences between Protestants and Catholics make suicide more likely among Protestants.

When testing the model prediction that Protestantism increases suicides, our empirical model places particular emphasis on excluding biases from self-selection of suicide-prone individuals into religious denominations and from other forms of endogeneity and unobserved heterogeneity. For this, we construct a unique database from suicide statistics and censuses that cover all Prussian counties in the early and late nineteenth century. In this setting, we exploit the concentric dispersion of Protestantism in Prussia in an IV model that instruments the share of Protestants in a county by its distance to Wittenberg. We find that Protestantism increases the average annual suicide rate over the 1869–1871 period by about fifteen to twenty suicides per 100,000 inhabitants, a large effect compared to the mean suicide rate of thirteen suicides per 100,000 inhabitants. The result is robust to a rich set of controls for demographic, economic, educational, and geographic background factors. Controls for the share of insane people in the population and for fatal accident rates address concerns of bias from denominational differences in nonrational suicide causes and in underreporting of suicides. Likewise, we exclude that the higher Protestant shares identified by our instrument are related to unpleasant weather conditions and that our results are driven by religious concentration or ecological fallacy. We find a positive effect of Protestantism on suicide also in the 1816–1821 period, where the effect is larger for men than for women. Results are further confirmed in a first-difference model of changes between 1816 and 1871.

Finally, we devise several tests to differentiate between the sociological and the theological channels. Most important, the effect of Protestantism on suicide tends to decrease rather than increase with church attendance, suggesting that the sociological role of a more integrated community dominates the theological aspect of a stronger devotion to religious beliefs. In addition, the difference in suicides between Protestants and Catholics recedes in modern data, whereas nonaffiliated people (predominantly former Protestants) have significantly more suicides, again suggesting a dominant role for socialization rather than theological belief. Of course, both sociological and theological mechanisms can be working at the same time, and confirmative evidence for one channel does not rule out that the other channel also plays a role.

The modern results also suggest that affiliation with a Christian church in general may hedge against suicide risk, possibly because of a higher degree of social integration in

[17] There is no noteworthy difference in volunteering in associations or social services between Protestants and Catholics in these data.

[18] Relatedly, using data from 32 countries in the International Social Survey Programme (ISSP) 1998–1999, Arrunada (2010) shows that Catholics have a more personalized and Protestants a more impersonal social ethic. For example, Catholics are significantly more likely to cover up for friends and to value the importance of family but less likely to trust strangers.

Christian communities in general compared to people not affiliated with any church (but possibly also because atheists do not belief in punishment with loss of afterlife utility, as depicted in our model). In this sense, our main results may also be interpreted as a positive effect of Catholicism on reduced suicide, both relative to Protestantism but in particular relative to individuals with no religious affiliation, who may suffer from particularly low levels of perceived social cohesion. This aspect of the modern data opens an interesting direction for future research.

In terms of the effect of Protestantism on overall well-being, our result that Protestantism increases suicide rates relative to Catholics contrasts with the finding that Protestantism furthers educational and economic development (Becker & Woessmann, 2009). Thus, the effect of Protestantism on well-being seems to be neither uniformly positive nor uniformly negative and may affect the average population differently from the very select subgroup of people who are in a suicidal state of mind. In fact, the two aspects may be related in a dark-contrasts paradox where suicide behavior is subject to a relative comparison of utility (Daly et al., 2011). Still, our results hold conditional on proxies for economic development and inequality, suggesting that religious denomination in the form of Protestantism is a main independent driver of regional differences in suicide rates.

REFERENCES

Arrunada, Benito, "Protestants and Catholics: Similar Work Ethic, Different Social Ethic," *Economic Journal* 120:547 (2010), 890–918.

Bankston, William B., H. David Allen, and Daniel S. Cunningham, "Religion and Suicide: A Research Note on Sociology's 'One Law,'" *Social Forces* 62:2 (1983), 521–528.

Barrett, David B., George T. Kurian, and Todd M. Johnson, *World Christian Encyclopedia*, 2nd ed. (Oxford: Oxford University Press, 2001).

Becker, Gary S., and Richard A. Posner, "Suicide: An Economic Approach," University of Chicago mimeograph (2004).

Becker, Sascha O., Francesco Cinnirella, Erik Hornung, and Ludger Woessmann, "iPEHD—the Ifo Prussian Economic History Database," *Historical Methods* 47:2 (2014), 57–66.

Becker, Sascha O., and Ludger Woessmann, "Was Weber Wrong? A Human Capital Theory of Protestant Economic History," *Quarterly Journal of Economics* 124:2 (2009), 531–596.

——— "Not the Opium of the People: Income and Secularization in a Panel of Prussian Counties," *American Economic Review, Papers and Proceedings* 103:3 (2013), 539–544.

Chen, Joe, Yun Jeong Choi, Kohta Mori, Yasuyuki Sawada, and Saki Sugano, "Socio-Economic Studies on Suicide: A Survey," *Journal of Economic Surveys* 26:2 (2012), 271–306.

Cutler, David M., Edward L. Glaeser, and Karen E. Norberg, "Explaining the Rise in Youth Suicide," in Jonathan Gruber, ed., *Risky Behavior among Youths* (Chicago: University of Chicago Press, 2001).

Daly, Mary C., Andrew J. Oswald, Daniel J. Wilson, and Stephen Wu, "Dark Contrasts: The Paradox of High Rates of Suicide in Happy Places," *Journal of Economic Behavior and Organization* 80:3 (2011), 435–442.

Daly, Mary C., and Daniel J. Wilson, "Happiness, Unhappiness, and Suicide: An Empirical Assessment," *Journal of the European Economic Association* 7:2–3 (2009), 539–549.

Daly, Mary C., Daniel J. Wilson, and Norman J. Johnson, "Relative Status and Well-Being: Evidence from U.S. Suicide Deaths," this REVIEW 95:5 (2013), 1480–1500.

Durkheim, Émile, *Le suicide: étude de sociologie* (Paris: Félix Alcan, 1897). (*Suicide: A Study in Sociology*, trans. John A. Spaulding and George Simpson. Glencoe, The Free Press, 1951.)

Eicken, Joachim, and Ansgar Schmitz-Veltin, "Die Entwicklung der Kirchenmitglieder in Deutschland: Statistische Anmerkungen zu Umfang und Ursachen des Mitgliederrückgangs in den beiden christlichen Volkskirchen," *Wirtschaft und Statistik* 6 (2010), 576–589.

Glaeser, Edward L., and Bruce I. Sacerdote, "Education and Religion," *Journal of Human Capital* 2:2 (2008), 188–215.

Guiso, Luigi, Paola Sapienza, and Luigi Zingales, "Does Culture Affect Economic Outcomes?" *Journal of Economic Perspectives* 20:2 (2006), 23–48.

Hamermesh, Daniel S., and Neal M. Soss, "An Economic Theory of Suicide," *Journal of Political Economy* 82:1 (1974), 83–98.

Helliwell, John F., "Well-Being and Social Capital: Does Suicide Pose a Puzzle?" *Social Indicators Research* 81:3 (2007), 455–496.

Hilse, Carl, "Beiträge zur Kenntnis der Bewegung der Bevölkerung innerhalb der evangelischen und der römisch-katholischen Landeskirche des preussischen Staats in den Jahren 1859 bis 1867," *Zeitschrift des Königlich Preussischen Statistischen Bureaus* 9 (1869), 305–318.

——— "Die Selbstmorde in Preussen im IV. Quartal 1868 und im Jahre 1869," *Zeitschrift des Königlich Preussischen Statistischen Bureaus* 11:1–2 (1871), 41–120.

Hölscher, Lucian, *Datenatlas zur religiösen Geographie im protestantischen Deutschland: Von der Mitte des 19. Jahrhunderts bis zum Zweiten Weltkrieg*, 4 vols. (Berlin: Walter de Gruyter, 2001).

Huang, Wei-Chiao, "Religion, Culture, Economic and Sociological Correlates of Suicide Rates: A Cross-National Analysis," *Applied Economics Letters* 3:12 (1996), 779–782.

Iannaccone, Laurence R., "Introduction to the Economics of Religion," *Journal of Economic Literature* 36:3 (1998), 1465–1496.

Iyer, Sriya, "The New Economics of Religion," *Journal of Economic Literature* 54:2 (2016), 395–441.

Kollarits, Jenö, "Ein Erklärungsversuch für die Selbstmordhäufigkeit der Protestanten," *Zeitschrift für die gesamte Neurologie und Psychiatrie* 49 (1919), 357–372.

La Vecchia, C., F. Lucchini, and F. Levi, "Worldwide Trends in Suicide Mortality, 1955–1989," *Acta Psychiatrica Scandinavica* 90:1 (1994), 53–64.

Layard, Richard, *Happiness: Lessons from a New Science* (New York: Penguin Press, 2005).

McCleary, Rachel M., and Robert J. Barro, "Religion and Political Economy in an International Panel," *Journal for the Scientific Study of Religion* 45:2 (2006), 149–175.

Mützell, Alexander A., *Neues Topographisch-statistisch-geographisches Wörterbuch des Preussischen Staats* (Halle: Karl August Kümmel, 1825).

OECD, *Society at a Glance 2009: OECD Social Indicators* (Paris: Organisation for Economic Co-operation and Development, 2009).

Oswald, Andrew J., "Happiness and Economic Performance," *Economic Journal* 107:445 (1997), 1815–1831.

Pope, Whitney, and Nick Danigelis, "Sociology's 'One Law,'" *Social Forces* 60:2 (1981), 495–516.

Sawkins, John W., Paul T. Seaman, and Hector C. S. Williams, "Church Attendance in Great Britain: An Ordered Logit Approach," *Applied Economics* 29:2 (1997), 125–134.

Simpson, Miles, "Suicide and Religion: Did Durkheim Commit the Ecological Fallacy, or Did Van Poppel and Day Combine Apples and Oranges?" *American Sociological Review* 63:6 (1998), 895–896.

Stark, Rodney, Daniel P. Doyle, and Jesse Lynn Rushing, "Beyond Durkheim: Religion and Suicide," *Journal for the Scientific Study of Religion* 22:2 (1983), 120–131.

van Poppel, Frans, and Lincoln H. Day, "A Test of Durkheim's Theory of Suicide—Without Committing the 'Ecological Fallacy,'" *American Sociological Review* 61:3 (1996), 500–507.

Wilke, Jürgen, "From Parish Register to the 'Historical Table': The Prussian Population Statistics in the 17th and 18th Centuries," *History of the Family* 9:1 (2004), 63–79.

World Health Organization, *Preventing Suicide: A Global Imperative* (Geneva: World Health Organization, 2014).