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KNOCKING ON HEAVEN'S DOOR? PROTESTANTISM AND SUICIDE

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ABSTRACT

Knocking on Heaven's Door? Protestantism and Suicide*

We model the effect of Protestant vs. Catholic denomination in an economic theory of suicide, accounting for differences in religious-community integration, views about man's impact on God's grace, and the possibility of confessing sins. We test the theory using a unique micro-regional dataset of 452 counties in 19th-century Prussia, when religiousness was still pervasive. Our instrumental-variable model exploits the concentric dispersion of Protestantism around Wittenberg to circumvent selectivity bias. Protestantism had a substantial positive effect on suicide in 1816-21 and 1869-71. We address issues of bias from mental illness, misreporting, weather conditions, within-county heterogeneity, religious concentration, and gender composition.

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I. Introduction

Each year, about one million people commit suicide worldwide, making suicide a leading cause of death in particular among young adults (World Health Organization (2008)). 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. Already 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 and 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 and Soss (1974); Becker and Posner (2004)).[2] But the leading established correlate of suicide in the sociological literature, religious denomination, 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 measure of utmost unhappiness with the particular advantage over subjective self-reports of being a revealed-preference outcome measure (e.g., Oswald (1997); Layard (2005)), these analyses have so far not been linked to religious denomination.

In this paper, we make two contributions to the economic analysis of the relation between religion and suicide. First, we model the effect of Protestantism on suicide in the spirit of recent advances in the economics of suicide. We show how a higher suicide rate of Protestants relative

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[1] This observation is based on the sample of ten OECD countries in which either Protestants or Catholics still make up more than 85 percent 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 Organisation for Economic Co-operation and Development (2009); religion data from Barrett, Kurian, and 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, Oswald, Wilson, and Wu (forthcoming), and Daly, Wilson, and Johnson (forthcoming) are further examples.

[3] The economics literature on culture and religion (see, e.g., Iannaccone (1998) and Guiso, Sapienza, and Zingales (2006) for surveys) does not emphasize suicide as a possible outcome. A noteworthy exception is the economics of suicide bombers (Benmelech and Berrebi (2007); Berman and Laitin (2008)), which addresses a special case where the prime motivation for suicide is not to end one's life. Evidence suggests that the typical profile of suicide bombers is very different from those who commit suicide in general (Krueger and Malečková (2003)).

to Catholics can be understood as a rational[4] outcome of several differences in religious doctrine between the two denominations. Second, we provide new micro-regional evidence from the 19th century – a time when religiousness was still pervasive – that the effect of Protestantism on suicide may indeed be causal. While many sociological studies have confirmed Durkheim's association since, causal interpretation is hampered by several forms of unobserved heterogeneity, such as the possibility that individuals with characteristics that make them prone to committing suicide may select themselves into different religious denominations. Existing studies do not address this fundamental endogeneity problem. We suggest an empirical identification strategy that exploits the fact that in Prussia, Protestantism initially tended to spread concentrically around Luther's city of Wittenberg (Becker and Woessmann (2009)). Using a unique dataset of 452 Prussian counties at the beginning and end of the 19th century, our results suggest that Protestantism is a leading explanatory factor for suicide rates.

Durkheim (1897)'s hypotheses on religion and suicide have created substantial controversies in the sociological literature to these days, and the regularity of the empirical pattern has not gone without question.[5] Theoretically, Durkheim (1897) stressed the point that Protestantism encourages independent thought and religious individualism, decreasing the integration of the community relative to the unified Catholic community. He argued that this role of religion as a society tends to protect man from committing suicide. We put this argument in the framework of a simple economic theory.

However, there are additional differences between Protestantism and Catholicism, rooted more fundamentally in religious doctrine, that have consequences for the utility or disutility of afterlife. By adding religion and the consideration of afterlife to the Becker and Posner (2004) version of the economic theory of suicide, we show that such doctrinal differences between the Protestant and Catholic denominations are relevant to suicidal behavior. In particular, Protestantism tends to stress that man's salvation is by God's grace alone and not by any merit of man's own work, whereas Catholicism allows for God's judgment to be affected by man's deeds and sins. As a consequence, committing suicide entails the disutility of forgoing paradise for Catholics but not for Protestants. A further doctrinal difference is that the confession of sins is a

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[4] Of course, many suicides are not rational acts but derive from affective emotions or mental illness. In the empirical part, we can control for physical and mental disabilities.

[5] See Bankston, Allen, and Cunningham (1983) and Simpson (1998) for two examples over the years.

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 towards other forms of behavior considered in times of desperation. Consequently, within the framework of a rational theory of suicide, we show that the effect on suicide of the integration of the religious community, of views about the impact of man on God's grace, and of the impossibility of confessing the sin of suicide all give rise to a higher propensity to commit suicide among Protestants than among Catholics.

To test this prediction empirically, we turn to the setting of Prussia in the 19th century. Apart from mirroring the perspective of Durkheim (1897)'s work, the 19th century has the advantage that virtually everybody was member of a religious denomination and that religion pervaded all aspects of life. The Prussian perspective offers the opportunity to compare non-minority occurrences of the two religious denominations within an otherwise common setting of political governance, institutions, jurisdiction, language, and basic culture.

In addition, 19th-century Prussia proves to be the source of uniquely rich micro-regional data for an empirical application. In order to understand better how the incidence of suicide might be curtailed, in 1869-71 the Prussian statistical office embarked on a detailed survey of suicides, to be administered by all local police departments. These data are available at the level of the 452 Prussian counties. Combining them with rich census data on relevant background information, we build a unique new county-level dataset on suicide, religion, and relevant covariates. We also use much older data on suicide incidence, from 1816-21, where questions about the neutrality of data recording necessitate additional robustness analyses.

A fundamental challenge for an empirical identification of the effect of Protestant denomination on suicide is that people with different characteristics may self-select into religious denominations. This may be less of an issue in the 19th century compared to today. Still, as early as 1919 the Hungarian neurologist and psychiatrist Kollarits (1919) advanced the hypothesis that the higher incidence of suicide among the Protestant population may be the result of selection into denominational groups, in that suicide-prone people may be more likely to convert to Protestantism. However, the endogeneity bias may also assume the opposite direction: for example, during the time of the Reformation Protestantism may have spread more easily to regions where people are willing to take matters into their own hands and change their lives, which may be negatively related to suicide proneness. To identify the causal effect of

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Protestantism in the face of such endogeneity issues, we exploit arguably exogenous variation in Protestant affiliation that stems from the initial geographic dispersion of the Reformation within Prussia. As shown in Becker and Woessmann (2009), Protestantism had a tendency to spread in concentric circles around Luther's city of Wittenberg during the first century after the onset of the Reformation. This allows us to use distance to Wittenberg as an instrument for Protestantism in Prussia. To vindicate the validity of this instrument, we draw on evidence showing that it is orthogonal to several correlates of suicide rates in 1517, before Luther started the Reformation.

Our results show that Protestantism had a significant positive effect on suicide rates in Prussia both in the early and late 19th century. This is true in simple correlations as well as after controlling for rich background factors, and when employing the variation emanating from our instrument. According to our estimates, Protestantism increased the annual suicide rate per 100,000 inhabitants, which has a mean of 13 suicides in 1869-71, by about 15-20 suicides. Channels such as economic modernization and literacy, which are also affected by Protestantism, seem to play only a minor role in this effect.

The result proves very robust to a large set of robustness tests. To rule out that our geography-based identification is affected by effects of bad weather on suicide, we show that the variation identified by our instrument does not capture a tendency for Protestants to live in regions with unpleasant weather conditions. If anything, the opposite is the case, and controlling for rainfall and temperature does not affect our results. We also show that our results capture a genuine effect of Protestant denomination, rather than specific behavior of religious minorities or other forms of religious concentration. Furthermore, cross-tabulated data confirms that the higher suicide rate in Protestant counties does not derive from ecological fallacy. In order to rule out that the effect stems from denomination-specific reporting bias (potentially relevant in the 1816-21 data), we analyze whether some suicides might be hidden in the death reporting category of fatal accidents. If anything, the correlation between reported suicides and reported fatal accidents is positive, and controlling for the fatal accident rate does not alter our results.

Not all suicides are rational acts, despite our emphasis that a relevant part can be understood within a rational framework. Psychiatrists often link suicide to mental illness, and part of the ensuing behavior may defy rational thinking.[6] Patients in mental hospitals, especially those with

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[6] See Becker and Posner (2004) for a discussion of the extent to which suicides by depressed and mentally disturbed persons may reflect utility maximizing behavior.

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depressive disorders, tend to have high suicide rates (e.g., Dublin (1963)). To exclude that such sources of suicide drive our results, we use information in our rich dataset on the share of people classified as having physical or mental disabilities, including being "insane." The data show that the occurrence of mental illness does not vary by religious denomination (see also Guttstadt (1874)). Holding the shares of mentally disabled people and of people with other disabilities constant in our regression analyses does not affect our results.

In what follows, Section II develops the economic theory of religion-specific suicide rates and Section III presents the evidence from 19th-century Prussia. Section IV concludes.

II. An Economic Theory of Religion-Specific Suicide

Based on the 5th Commandment ("Thou shalt not kill"), suicide was forbidden and viewed as sin both in Catholicism and in Protestantism. As Durkheim (1897) emphasized, "The Protestant believes in God and the immortality of the soul no less than the Catholic." (p. 170) However, we see three main differences in doctrine between the two denominations that have bearing on the rationality of the act of suicide – the integration of the religious community, views about the impact of man on God's grace, and the possibility of confessing sins – which we will model in the framework of an economic theory of suicide.[7]

A. The Economic Theory of Suicide

To do so, we extend the economic theory of suicide developed by Becker and Posner (2004). In line with the pioneering work by Hamermesh and Soss (1974), suicide is modeled as forward-looking utility-maximizing behavior. In a process of rational decision-making, individuals compare the expected utility from living with that from death. If the latter is greater than the former, committing suicide will maximize utility.

Let $u(t)$ denote the utility of living at age t. Then, the necessary and sufficient condition for suicide to be rational at age t is that the discounted value of present and future utilities is not greater than the cost of committing suicide c, neither at age t nor at any segment starting at t and ending before or at the length of life without suicide T:

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[7] When describing Protestant doctrine, we mostly focus on the Lutheran type, which is the first variant of the Protestant Reformation and will also be the subject of our empirical application further below. In Prussia, the two Protestant factions, Lutherans and Reformists, were merged into the single Protestant Church in Prussia (Evangelische Kirche in Preußen) in 1817, and the official statistics dropped the distinction between them. However, statistics from just before the merge show that 94 percent of Protestants in Prussia were Lutherans (Mützell (1825)).

$$\sum_{i=t}^{A} \beta^{i-t} u(i) \le -c_d, \;\; for \;\; all \;\; A = t, t+1, \dots, T \tag{1}$$

where β is the discount factor. The left-hand side of the condition depicts the utility derived from carrying on living, whereas the right-hand side depicts the utility from dying by suicide. In this case, the latter is comprised only of the disutility stemming from the cost of committing suicide c, which may vary by religious denomination d (Protestant or Catholic in our case). Note that the relation has to hold for all segments of life into the future that start in t, because otherwise it would be worth living a little longer to reap some positive utility before large negative utilities set in. In the Becker and Posner (2004) specification, c is normalized to zero by choice of the utility function, but given our aim to explicitly model inter-group differences in the cost of committing suicide, we add c_d as a variable that may differ across individuals and is expressed in units commensurate with the utility function. This is similar in spirit to the "distaste for suicide" variable in the Hamermesh and Soss (1974) specification, although the latter is only subject to random variation, whereas we model systematic differences by denomination.

For simplicity, our setup assumes certainty about all future lifetime utilities. Thereby, we abstract from aspects introduced by uncertainty into the suicide decision, such as the option value of waiting (Cutler, Glaeser, and Norberg (2001); Becker and Posner (2004)) and implications for risk-taking behavior (Becker and Posner (2004)), as well as from further possible refinements of the model setup.[8] While these refinements raise important aspects of the suicide decision in general, we do not view them as pivotal for understanding denominational differences in suicide, so that their modeling would distract from the core mechanisms at work.

B. *Modeling the Durkheim Point: Integration of the Religious Community*

In order to understand how religious differences may affect the propensity to commit suicide, we model three denominational differences between Protestantism and Catholicism in the framework of this simple economic model of suicide. The first denominational aspect, emphasized by Durkheim (1897), is that Protestant doctrine encourages independent thought and religious individualism, which decreases the integration of the community. By contrast,

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[8] In particular, our setup abstracts from differences in the probability of success between different methods of committing suicide (Becker and Posner (2004)), imative aspects of suicide through contagion (Cutler, Glaeser, and Norberg (2001)), and signaling motives for (intentionally unsuccessful) suicide attempts (Rosenthal (1993); Cutler, Glaeser, and Norberg (2001); Marcotte (2003); Becker and Posner (2004)).

Durkheim argued, Catholicism is generally more oriented towards the group, providing social support, and the specific Catholic credos, norms, and codices unify the Catholic community. As Becker and Posner (2004) point out, 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 the economic model, the greater integration of the Catholic community has two effects.

First, assuming that that individual utility u depends on the extent to which other people care about oneself (otherwise keeping the same form of the utility function u for both denominations), the fact that Protestants are mostly surrounded by individualists means that, ceteris paribus, their utility derived from living at any point in time is lower than that of Catholics. The greater cohesion and social support in an integrated community means that Catholics' utility from living is higher, thereby reducing the probability that their discounted stream of utilities falls below the suicide threshold. This aspect models the core of Durkheim (1897)'s argument, who observes an "indivisible unity of the Catholic Church" (p. 158) because its common beliefs and practices create an integrated religious community and are "capable of supporting a sufficiently intense collective life" (p. 170).

Second, the cost of committing suicide c_d will be higher if the denomination d is Catholic rather than Protestant, both because it entails breaking from a community with stronger common codices and because of the negative effect on other people for whom a person more strongly integrated in the community is concerned about more strongly. Together, these effects make it more unlikely that relation (1) holds. Thus, based on this aspect, suicide rates would be predicted to be higher in Protestant communities than in Catholic communities.

C. *Differences in Doctrine about the Impact of Man on God's Grace*

In our view, to fully understand denominational differences in suicide, we have to go beyond the sociological aspect stressed by Durkheim (1897) and take the theological aspect of the possibility of afterlife into account. Views about afterlife seem obviously crucial for considerations about ending one's life on earth. Christians – both Catholics and Protestants – believe in life after death. We assume that from this afterlife a, they derive an expected utility $u(a)$ per unit of time (given uncertainty about whether one actually reaches afterlife, this expectation may be smaller than full afterlife utility). However, depending on denominational

doctrine, the act of committing suicide may affect the probability of accomplishing these benefits of afterlife. We express this by the parameter p ($0 \le p \le 1$), which depicts the punishment in terms of expected loss of afterlife utility for the act of committing suicide. Considering the possibility of such punishment, there are two ways in which afterlife enters the optimality condition for committing suicide:

$$\sum_{i=t}^{A} \beta^{i-t} u(i) \le (1 - p_d) \sum_{i=t}^{A} \beta^{i-t} u(a) - \left(c_d + p_d \sum_{i=T+1}^{\infty} \beta^{i-t} u(a) \right), \quad for \ \ all \ \ A = t, t+1, \ldots, T \quad (2)$$

The first term on the right-hand side depicts the utility of dying before year T. Because death now means that one may enter afterlife, there is a positive utility component to immediate death. For each period, the individual has to weigh the utility $u(t)$ from living on earth against the utility $u(a)$ from afterlife. In principle, the latter should be large, although given uncertainty about afterlife, the expected utility may be lower than actual afterlife utility. Still, in itself this aspect raises the suicide inclination of believers relative to non-religious people – "heaven can't wait." However, to the extent that the act of committing suicide lowers the probability of reaching afterlife (p), this effect is reduced. In addition, this punishment will not only affect the possible years in afterlife until T, but afterlife into eternity. As a consequence, the expected loss of afterlife utility after T will add to the cost of committing suicide, as expressed by the additional term at the end of the right-hand side.

In total, then, the question whether suicide inclination is higher or lower for believers than for atheists depends on the relative size of the punishment and expected afterlife utility. In particular, suicide incidence will, ceteris paribus, be smaller among religious than non-religious people if the punishment p is larger than the "short-run" gain of the additional time in afterlife until T (expressed relative to all afterlife utility until eternity).[9] This could explain why the literature tends to find a negative association between suicide and belief in God (Helliwell (2007); Layard (2005)).

More to the point of our topic of investigation, difference in denominational doctrines mean that punishment p will vary with denomination d. In Catholic doctrine, man can affect his entry into heaven by doing good deeds, while committing a deadly sin leads to a loss of God's grace.

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[9] For $A = T$, the condition is: $p > \sum_{i=t}^{T} \beta^{i-t} u(a) \Big/ \sum_{i=t}^{\infty} \beta^{i-t} u(a)$.

By contrast, Protestant doctrine does not provide for an impact of man on God's grace. Given that traditional Catholic doctrine views suicide as a deadly sin which forfeits God's grace and bars man from entering heaven, $p_C > p_P$. Thus, the utility from committing suicide – the right-hand side of inequality (2) – will be larger for Protestants than for Catholics. In the extreme, we can expect that the Catholic $p_C = 1$ – paradise is lost due to the act of committing suicide. In fact, if Catholics view suicide as a deadly sin which turns a possible afterlife of heaven into hell (or at least prolongs purgatory), the act of committing suicide may turn the very utility of afterlife $u(a)$ from positive to negative (respectively reduce it).

By contrast, following the Protestant "sola gratia" doctrine, suicide (or any other act of man) and the probability of going to heaven are orthogonal, as the latter depends only on God's grace, which is unaffected by any human deed. According to the predestination doctrine, salvation is by God's grace alone, not by any act of man.[10] As a consequence, in the extreme the Protestant $p_P = 0$. This reasoning is consistent with the fact that, at least in modern Protestant doctrine, the predestination aspect leads to a more lenient assessment of suicide. For example, the influential Protestant theologian Karl Barth (1951) argued that there may be cases where God commands the suicide, and man can commit suicide in a state of peace with God.

As a consequence, the denominational differences in the view of the extent to (and manner in) which the deeds of man can impact God's grace will lead to a higher propensity to commit suicide of Protestants relative to Catholics.

D. *Modeling the Impossibility of Confessing the Sin of Suicide*

While Catholic doctrine has confession as a holy sacrament, Protestant doctrine (generally) does not. The confession of sins is one of the seven holy sacraments of Catholicism, of which Lutheranism accepts only two (baptism and communion). However, due to the irreversibility of the act of successfully committing suicide, by definition it is impossible to confess a successful suicide. As Becker and Posner (2004) put it, "The dominant characteristic of suicide is its finality – there is no second chance." (p. 5) This fact reinforces the mechanism just discussed, because Catholics cannot use confession to evade the loss of afterlife utility due to the act of suicide.

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[10] The Lutheran version of the predestination doctrine may not be as strict as the Calvinist version, but the two Protestant factions did accept the joint predestination doctrine of the 1973 Leuenberg Agreement. In Protestantism, success in life was sometimes viewed as a *sign* of God's contentment and election, but not as its *cause*.

But the finality of suicide gives rise to an additional mechanism by which confession affects the optimality of the suicide decision. When considering the possibility or impossibility of confession, the finality of the specific sin of suicide creates a substitution effect between committing suicide and other possible options considered by very unhappy people: The possibility of confessing sins raises the relative "price" of suicide relative to other sinful options, compared to a situation where confession is not a possibility at all.

When contemplating different possible actions as a response to extreme unhappiness, a miserable person may thus view the cost of the specific sinful action of suicide (which cannot be confessed because the person will not be there to do so) as higher relative to the cost of other sinful actions such as heavy drinking, blindfold marriage, or committing crimes. This effect will be lower, the lower a doctrine views the influence of the act of confession; and it does not arise at all in a denomination whose doctrine does not allow for the possibility of confession anyways. In light of the denominational differences in doctrine discussed above, this creates an additional mechanism by which Catholics are predicted to be less prone to suicide than Protestants.

III. Evidence from 19th-Century Prussia

To validate the hypothesis that Catholics are less prone to commit suicide than Protestants and that this is a causal relationship, this section provides evidence from 19th-century Prussia.

A. *Data and Descriptive Statistics*

Prussia provides uniquely rich census-based data to study the relation between suicide, religion, and covariates at the county level in the 19th century. The focus on the 19th century has the advantage that religiosity was still 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 the exploitation of variation between counties with non-minority Protestant and Catholic denominations 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. The even division and regional concentration means that no denomination was an extreme minority. This may be crucial in the context of suicide 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-18th century. Also, in its 19th-century shape, Prussia had Wittenberg, the birthplace of the Reformation, at its center, where Protestantism originated and was conserved in its purest form. At the same time as there was substantial denominational variation, 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 during the 19th century, one early (1816-21) and one late (1869-71) in the century. Our analyses mainly focus on the latter period, as suicide data are more reliable and background data richer then.

The first time for which suicide statistics were collected for the whole of Prussia is the years 1816-1821 (see Mützell (1825)).[11] A favorable feature of the data is that they average suicides over several years, which reduces noise due to random jumps in suicide incidents. The data cover all 306 Prussian counties at the time. The 1816 Population Census provides respective data on population shares of religious denominations, as well as data on demographics, education, and development (see Appendix for details on the different data sources).

We also digitized suicide statistics for the years 1869-1871, 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 prominently, the 1871 Population Census contains shares of Protestants in the county population, demographic characteristics, and education information in the form of adult literacy rates. The census also provides information on shares of the population with different forms of physical and mental disabilities – blind, deaf-mute, and insane. Furthermore, data from the 1882 Occupation Census provides information on the occupational structure that we use as indicators of the stage of industrial development. We further geocoded the county capitals to obtain geographic information on latitude and longitude. These 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 19th century (Hilse (1871)). In 1816-21, data on suicides were drawn from the local burial and

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[11] Official Prussian statistics published data on suicides as a cause of death from 1777 onwards (Wilke (2004)).

death registers, which were often run by the church. This changed when, in 1868, dedicated suicide statistics were introduced. Every civilian suicide was now counted by the local state administration (the city council or the local police). For that purpose, each suicide was measured on a separate data sheet. Background information on the person committing suicide and on the suicide circumstances were collected with the explicit aim of understanding the factors explaining suicides. After a test period in the last quarter of 1868, the new data collection method was used as the basis of very detailed suicide statistics from 1869 onwards. The Prussian Statistical Office exerted extensive efforts to insure high data quality and dedicated 80 pages to providing background information and first results on the new suicide statistics in its quarterly journal (see Hilse (1871)). The care given to data collection and the amount of detail given in the suicide tables is an impressive and reassuring sign of data quality.[12]

The descriptive statistics for the 1869-71 period, reported in Table 1, reveal that the average annual suicide rate over the three years across all Prussian counties was 13.0 per 100,000 inhabitants, ranging between 0 in only one county (Adenau) to 37.1 (Schönau). Figure 1 shows that there is substantial geographic variation in suicide rates across Prussia. To account for differences in mortality rates across counties, in alternative specifications we also use the number of suicides over a period divided by the flow of deaths in the same period, which we call the suicide proportion. The Prussian suicide levels are somewhat higher than in modern-day Germany, where the suicide rate is 10.3 per 100,000 inhabitants in 2004 (Organisation for Economic Co-operation and Development (2009)). The comparison of our historic data with modern data provides no indication of a systematic underreporting in the late 19th century, unless one believes that suicide rates had a significant downward trend over the 20th century.[13]

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

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[12] For instance, eleven different means of suicide are provided, hanging and drowning being the two most popular categories (see Table A.1 in the appendix). Three cases of "otherwise unclassified" means of suicide are described in quite some detail, e.g., the case of a woman who had filled a cooking pot with eight buckets of water which she put on the fireplace and sat down in the boiling water; she died of her wounds five minutes after she was removed from the pot (Hilse (1871)). Unfortunately, the detailed background information on the suicides is available only at the aggregate level, so that we cannot use it in our county-level analyses.

[13] Over the period 1955-1989, La Vecchia, Lucchini, and Levi (1994) do not find substantial trends in suicide rates in developed countries.

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. Our dataset contains information on fatal accidents. Suicide rates and fatal accident rates are in fact uncorrelated; their raw correlation is -0.004 (p-value 0.932). This indicates that systematic underreporting of suicides is unlikely. The pattern is in line with the assessment of Kollarits (1919) that the standard way to ensure a religious funeral ceremony was to invoke aberration as the suicide cause, in which case even the Catholic church approved a religious ceremony, so that suicide rates and their denominational differences are not misreported. Still, in robustness specifications, we use fatal accident rates as a control variable.[14]

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

Figure 2 depicts the geographic variation of Protestant shares across Prussia. The close mapping between the geographic distribution of Protestant shares and suicide rates (Figure 1) is directly evident. In fact, the raw correlation between the two across the 452 counties is as high as 0.66 (statistically significant at the 1 percent level). Figure 3 plots the two against each other. 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" counties than in "all-Catholic" counties.

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[14] The fact that, in contrast to 1869-71, in 1816-21 the church was partly responsible for the suicide statistics may mean that the 1816-21 suicide data might suffer from some overall degree of underreporting. However, in the 1816-21 data, suicide rates and fatal accident rates are actually slightly *positively* correlated (raw correlation of 0.223, statistically significant at the 1 percent level), suggesting that there was no systematic hiding of suicides as fatal accidents even in these earlier and less reliable suicide data. For 1869, Hilse (1871) reports suicide numbers from the church registers alongside data from the police registers; in most districts, the count on the church register is actually higher than the one on the police register. We will return to this issue below.

B. *Basic Evidence from 1869-71*

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

$$SUIC = \alpha + \beta\, PROT + X\, \gamma + \varepsilon \tag{3}$$

where *SUIC* is the suicide rate (or the suicide proportion) in a county, *PROT* is the share of Protestants in the county, and *X* is a set of control variables. Our most basic control model 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) for an extensive overview of factors considered in empirical suicide research).

The first column of Table 2 replicates the strong positive bivariate association between the share of Protestants and the suicide rate depicted in Figure 3 above. 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 fact that, in an inversely U-shaped pattern, suicide rates decline 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 result that suicide rates are negatively related to 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 (see Helliwell (2007)). To account for these factors, 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

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share of literate adults to the basic model. None of the three measures enters the model significantly once Protestantism and the basic demographic measures are controlled for, and the point estimate on the share of Protestants is hardly affected.

Column (6) adds a whole 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.

Finally, column (7) uses the suicide proportion – the number of suicides relative to the number of deaths – as an alternative dependent variable. This measure takes into account that average mortality rates differ across counties. Again, there is a statistically 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 remaining concern with the evidence so far is that religious affiliation may not be exogenous to the suicide model. Specifically, whether a person adheres to the Catholic or Protestant faith may to some extent be a choice variable that is correlated with the error term of equation (3). For example, already in the early 20th 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 19th century: Only 0.01 percent of Catholics – or 766 out of more than 7 million Catholics – converted to Protestantism per year over the period 1859-67, mostly in the course of marriage to a Protestant partner (Hilse (1869)).

But endogeneity may rather take another form of unobserved heterogeneity, in that some three centuries earlier during the Reformation, regional conversion to the new Protestant faith may not have been orthogonal to suicide proneness, which may have strong intertemporal persistence. Most of the denominational variation across Prussia in the 19th 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 16th and early 17th century, 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 situation, urbanity, education, and mental disposition. For example, regions with people who are inclined to try to change a bad situation rather than turning away from it 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 in Protestantism, we exploit the specific aspect that there was an initial tendency of the Reformation in the German Empire to spread out in a concentric fashion from Wittenberg, where Luther initiated the new denomination. As is visible in Figure 2, the Reformation spread in the areas around Wittenberg but had a diminishing impact, the further away from Wittenberg one gets. Reasons for the roughly circular dispersion include costs of traveling and of information diffusion through space, increasing dissimilarity of German dialects, and the role of Electoral Saxony as an early leader and role model for the implementation of the new denomination that allowed observing Reformation ideals put in practice and forming regional Protestant alliances (see Becker and Woessmann (2009) for details).

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. Thereby, we restrict the analysis to a specific part of the denominational variation in Prussia that is arguably exogenous to variation in important drivers of suicide rates. Our identifying assumption is that the concentric pattern is unrelated to suicide apart from its possible indirect effect through Protestantism. The validity of the instrument is corroborated by evidence that the spread of the Reformation from Wittenberg did not just follow pre-existing differences in economic situations, urbanity, education, and cultural disposition – factors that the suicide literature has shown to be correlates of suicide (see Helliwell (2007)). Thus, Becker and Woessmann (2009) provide detailed evidence that distance to Wittenberg is orthogonal to the following set of factors observed before the Reformation set on in 1517: the probability of being a free imperial city (measured in pre-Reformation status),

considered to be centers of economic activity before the Reformation; the probability of being a free Hanseatic city, which constituted major trading hubs in pre-Lutheran times; the urban population density and city sizes in 1500, a proxy often also used for economic progressiveness before industrialization; the existence and year of foundation of schools and of universities before 1517; and the density of monasteries in 1517 as a proxy for religiosity.

Table 3 reports the 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 the F-statistic of the instrument in the first stage. Each 100 km distance to Wittenberg is associated with a Protestant share that is 7-9 percentage points lower (see columns (1)-(4)). The second stage uses only that part of the Protestant share 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 (see columns (5)-(8)). In fact, the IV point estimates are significantly higher than the OLS estimates. Depending on the variables included in the control 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 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 than in regions that remained Catholic. This negative bias in the OLS estimates is consistent with a Reformation pattern where regions with less suicide-prone population tended to select into Protestantism. In the IV model, the estimates on the economic and educational controls get statistically significant: Suicide rates increase with the level of industrialization and decrease with the level of literacy.[15]

D. *Robustness to Mental Disabilities, Misreporting, Bad Weather, and Other Factors*

We proceed with a number of tests for robustness of the IV specification. Table 4 adds several further control variables. In the first column, we start with a set of additional demographic controls. As suicide rates are generally found to differ substantially by gender, we add the share of females (see below for more extensive analyses of gender patterns). The share of Jews accounts for the only other sizable religious group in Prussia (at 1.1 percent of the

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[15] Similar to the share of population living in towns, population density measured as inhabitants per square kilometer does not enter the model significantly.

population on average) apart from Protestants and Catholics. Furthermore, we add the share of the population born in the municipality and the share of the population of Prussian origin to the model, since suicide research has shown that migrants tend to take suicide propensities with them. Of the three additional control variables, only the share of the population of Prussian origin enters statistically significantly, indicating higher suicide rates in counties with a stronger presence of foreigners. The estimated effect of Protestantism, however, is hardly affected.

Psychiatric research tends to link suicide to mental disorders. Thus, Dublin (1963) reports that patients in mental hospitals have particularly high suicide rates, especially those with depressive disorders. To account for variation in mental and physical disabilities across counties, we use information on the share of the population classified as blind, deaf-mute, and insane, respectively, in the county. As the results in column (2) show, controlling for these shares does not change the results.

As discussed in the data section above, some observers have worried that there might have been attempts to hide suicides and classify them under different death causes in order to ensure a religious funeral ceremony. If such misreporting varied by denomination, this would bias our estimate on the effect of Protestantism. The most obvious other category of death causes where suicides might be hidden is the category of "fatal accidents." The specification in column (3) therefore adds the fatal accident rate in the county to account for potential underreporting of suicide rates. However, there is no statistically significant conditional association between reported suicide rates and reported fatal accident rates, and controlling for the latter leaves the effect of Protestantism on suicides unaffected. Further categories of death causes that might be possible places to hide suicides are "sudden incidents of illness" and "undetermined illnesses" (see van Poppel and Day (1996)). Again, both death categories do not enter our suicide model significantly and do not affect the estimated Protestantism effect.[16]

As our IV identification builds on geographic variation, we next add geographic controls. Using latitude, longitude, and their interaction, the specification in column (4) controls for potentially systematic variation in suicide rates across geographical space, for instance due to different climatic conditions. Column (5) adds a set of dummies indicating the year in which the county became part of Prussia. Depending on the duration of affiliation with Prussia, common

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[16] Detailed results are available from the authors on request.

norms may have settled in to a different degree. Our results indicate, however, that neither set of geographic controls affects the qualitative result on the effect of Protestantism on suicide.

Apart from general geographic patterns, suicide propensity may be affected by gloomy weather. If our instrument, distance to Wittenberg, were correlated with better weather conditions, this could introduce bias in the IV model so that the Protestantism effect is overestimated. To account for possible effects of unpleasant weather conditions on suicide, we make use of the high-resolution interpolated climate surfaces by Hijmans et al. (2005), whose climate model provides data on monthly precipitation and mean temperature based on rich input data from weather station records from a variety of sources for the 1950-2000 period (interpolated geographically using data on latitude, longitude, and elevation).[17] Assuming that the general pattern of climatic variation across the Prussian counties did not change substantially since the late 19th century, we can control for the weather situation in our suicide analysis using geo-coordinates of a county's main town to map the climate data into our dataset of Prussian counties.[18]

As the first two columns of Table 5 show, distance to Wittenberg is in fact *negatively* correlated with rainfall und *positively* correlated with temperature: The further away from Wittenberg, the more pleasant is the weather. Thus, if unpleasant weather were predictive of higher suicide, our IV model would tend to underestimate the effect of Protestantism. However, when entering rainfall and temperature as control variables in our IV specification, neither of the two enters statistically significantly to predict suicide rates. The strong effect of Protestantism on suicide is robust in this specification, although with a somewhat (though not statistically significantly) smaller point estimate.

E.   *Effects of Religious Concentration and Ecological Composition*

As our analyses are performed at the county level, we further probe robustness of our results to issues of religious concentration and minority behavior. Counties that have a larger degree of heterogeneity in religious denominations may differ in their suicide rates from counties that do not. Also, people of the same denomination might behave differently when constituting a small

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[17] Worldwide, the climate model draws on data from 47,554 weather stations for precipitation and 24,542 weather stations for temperature.

[18] Using instead the centroid of the county or the mean of all climate data points (on a 1 km grid) in the county to map the climate data into our Prussian county data leads to virtually identical results.

minority in the region than when their denomination is in the majority. As a first test of concentration effects, we compute the Herfindahl index of religious concentration in a county (computed over the shares of Protestants, Catholics, and Jews). Adding the Herfindahl index to our suicide model in the first column of Table 6 leaves the estimate of the Protestantism effect virtually unaffected. The Herfindahl index enters the IV model significantly negative, indicating a tendency of lower suicide rates in areas with higher religious concentration.

We can provide additional evidence on the relevance of religious heterogeneity in a county for our results by restricting our sample to counties with very high concentrations of one denomination. Thus, column (2) restricts the estimation sample to those 142 counties that have either more than 98 percent Protestants or less than 2 percent Protestants. In this smaller sample, the IV estimates get somewhat smaller, closer to the original OLS estimates. We can even restrict the sample to those 33 counties where Protestants make up more than 99.9 percent or less than 0.1 percent of the population. The effect of Protestantism on suicide rates is robust.

This subsample evidence also addresses the potential concern of ecological inferences of individual associations from aggregate data (see Robinson (1950)).[19] Given the near universal denominational affiliation in these counties, the higher suicide rates in Protestant counties are unlikely to be driven by the Catholic minority living in those counties.

We can probe the issue of ecological composition in further detail by making use of special tables reported in Hilse (1871) that show simple cross-tabulations of suicide numbers by religious denomination within districts. These data refer to suicides in the year 1869 only (rather than averaging over three years, as in our county-level analyses).[20] While the available county-level data do not allow us to distinguish between suicides by Protestants and by Catholics within a county, for 25 districts the cross-tabulated data present information on suicides by the denomination of the individual person committing suicide.[21] As shown in the first row of Table 7, the suicide rate in the Protestant population is indeed much higher than the suicide rate of the Catholic population. Protestants have a suicide rate of 18.4, compared to the Catholic suicide rate

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[19] Note that Robinson (1950) showed that the difference between ecological and individual inference will usually be lower the more the variables are clustered within regions, and religious affiliation is very highly clustered in Prussian counties (see Figure 2).

[20] The data on districts' population by denomination that allow us to compute the suicide rates are available in the population census for the year 1871.

[21] For the other 10 Prussian districts, cross-tabulations of suicides by denomination are not available.

of 6.5. The difference of 11.9 between the two denominations closely resembles our OLS estimates reported in Table 2 above, indicating that the latter are not driven by ecological fallacy.

The cross-tabulated data also allow us to distinguish the denomination-specific suicides by gender. Again, while the data are based on information for the individuals committing suicide, they are available only at the aggregate level.[22] The descriptive pattern clearly shows that suicides are substantially higher among males than among females, a pattern consistently found also in modern suicide research (see Helliwell (2007)). Still, within both gender groups, suicide rates are substantially higher among Protestants than among Catholics. Specifically, average suicide rates of Protestant males are as high as 30.3 suicides per 100,000 inhabitants, compared to 11.3 for Catholic males. In the female population, suicide rates of Protestant females are at 6.9 suicides per 100,000 inhabitants, compared to only 2.0 for Catholic females.

The cross-tabulated district data also allow us to probe the issue of effects of being a religious minority on suicide rates in greater detail. For this, we subdivide the districts by increasing shares of Protestants and analyze denomination-specific suicide rates in the different groups of districts (see the bottom panel of Table 7). Within each group of districts defined by brackets of the share of Protestants in them, the suicide rate of Protestants is higher than the suicide rate of Catholics. The suicide rate of Protestants does not vary systematically with the size of the Protestant population in the district, indicating that there is neither a substantial effect of being a religious minority nor of an increasing share of the Protestant community in the district. For Catholics, there is a slight tendency for the suicide rate to be higher in districts where the Protestant share exceeds 60 percent. But the relationship is not monotonic, decreasing again in districts where Catholics are less than 2 percent of the population, thus again rejecting a systematic minority effect.

This result is also confirmed in regression analyses estimated for the 50 district-by-denomination observations (25 districts with one observation each for the Protestant and the Catholic population): When regressing the suicide rate on a denomination dummy, the share of the own denomination in the district population, and the share of Protestants in the district population, only the own denomination enters strongly and significantly as a predictor of the denomination-specific suicide rate, whereas neither the size of the own denomination in the

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[22] For county-level analysis of gender-specific suicide rates see our analysis of the 1816-21 data below, where the gender decomposition is available at the county level.

district nor the size of the Protestant community in the district enter significantly, once the own denomination of the group is controlled for.[23]

The presented evidence rejects the existence of important non-linearities in the Protestantism effect on suicide. We have also probed this in further detail in our county-level regression analyses. While non-linear specifications become imprecise in IV models, OLS models are quite precise and reject the existence of noteworthy non-linearities: A quadratic term in the share of Protestants is statistically insignificant, and a specification with a set of indicators for the Protestant share being larger than a quarter, half, and three quarters indicates that the Protestantism effect is linear along the value range of the share of Protestants.

As a final robustness test, we again find a sizeable and statistically significant effect of Protestantism on suicide also when using the suicide proportion (suicides per 1,000 death incidents) rather than the suicide rate (suicides per 100,000 inhabitants) as an alternative outcome measure (reported in column (4) of Table 6).

F. *Evidence from 1816-21*

While the 1869-71 data are the first statistical investigation specifically devised to analyze suicides, official burial and death registers provide us with data on suicides as early as 1816-21. These are the earliest data covering all of Prussia, and they are again available at the county level. A particular feature of the 1816-21 data is that suicide rates are reported separately by gender for each county. As is evident from the descriptive statistics reported in Table 8, on average male suicide rates are about four times higher than female suicide rates. The set of control variables available in the 1816 Population Census is not as rich as in the later data. However, the same type 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 enrolment rate in primary schools as a measure of education. Furthermore, we again have information on fatal accident rates.

At 6.5 suicides per 100,000 inhabitants, the average suicide rate in the 1816-21 data is only half the average suicide rate reported in the 1869-71 data. This raises the concern of possible underreporting of suicides in the official burial and death registers, where part of the suicides

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[23] Detailed results are available from the authors on request.

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 1869-71 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 percent have an average suicide rate of 9.3 suicides per 100,000 inhabitants in 1816-21, compared to 17.4 in 1869-21. In Protestant counties, reported suicides in 1816-21 are thus lower by a factor of 1.9. Counties with a share of Catholics higher than 90 percent have an average suicide rate of 2.8 in 1816-21, compared to 4.7 in 1869-21. In Catholic counties, reported suicides in 1816-21 are thus lower by a factor of 1.70. This is an indication that, if anything, Protestants underreport slightly more in 1816-21 compared to Catholics not only in absolute terms, but even in relative terms, putting the stakes against finding an effect of Protestantism in 1816-21. In addition, we can again control for fatal accident rates in our regressions to guard against bias from misclassification of suicides as fatal accidents.

Table 9 reports results of OLS regressions. On average, all-Protestant counties have a suicide rate that is 7.2 higher than all-Catholic counties (column (1)). This difference is reduced to 4.7 but remains highly significant when, in column (4), we control for the age structure of the population, urbanization, public buildings, and school enrollment. As the remaining columns reveal, 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 males than for females. In fact, the male effect in 1816-21 is quantitatively in the same range as the average effect in 1869-71.

Table 10 reports the respective IV results where, as before, we use distance to Wittenberg as an instrument for the share of Protestants in a county. The IV estimates suggest that Protestantism raises male suicide rates by 23.4 suicides per 100,000 inhabitants, female suicides 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 suicides rates in the multivariate regressions, and the estimated effect of Protestantism on suicide is hardly affected. Again, the positive effect of Protestantism is also evident when measuring suicides per deaths rather than per inhabitants (column (6)). The 1816-

21 analyses thus confirm a strong positive effect of Protestantism on suicide also for the early 19th century and show it for both genders.

IV. Conclusion

In this paper, we have studied the effect of Protestantism on suicide both theoretically and empirically. Theoretically, we model three mechanisms through which Protestants are predicted to have higher suicide rates than Catholics. In the framework of an economic model of suicide, individuals compare the expected utility from living with that from death. First, if Protestant doctrine emphasizes religious individualism whereas Catholics have a more integrated religious community, as argued by Durkheim (1897), Protestants will have a lower utility from keeping on living and a lower cost of committing suicide relative to Catholics. To this sociological aspect of religion based on denominational differences in group structure, we add two individual mechanisms based on denominational differences in theological doctrine that derive from a consideration of afterlife in individuals' utility maximization. Thus, second, Protestant doctrine tends to stress that man cannot affect God's decisions by his deeds but fully depends on God's grace ("sola gratia"), whereas Catholic doctrine has it that man's access to heaven is affected by his deeds. For Catholics, committing the deadly sin of suicide reduces the probability of reaching heavens, thereby lowering the optimality of the suicide threshold relative to Protestants. Third, 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 very unhappy Catholics, again reducing the optimality of suicide relative to Protestants. Thus, both sociological and theological differences between Protestants and Catholics make suicide more likely among the former group.

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 specific 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 19th century. In this setting, we exploit the concentric dispersion of Protestantism in Prussia in an instrumental-variable 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 in 1869-71 by about 15-20 suicides per

100,000 inhabitants, a large effect compared to the mean suicide rate of 13 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 non-rational 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 1816-21, where the effect is larger for males than for females.

A possible direction for future research is to empirically disentangle the sociological from the theological channels of our theoretical model. It seems unlikely that the large Protestantism effect on suicides can be assigned to differences in the connectedness of the religious community alone, which on first impression would not seem to differ substantially between Protestant and Catholic communities in Prussia. However, testing the importance of social integration and the character of religious beliefs empirically is a daunting task in general, and it may ultimately be in vain for historical data.[24] Still, any progress in this direction could further deepen our understanding of how religious aspects affect suicide proneness.

In terms of the effect of Protestantism on overall well-being, our result that Protestantism increases suicide rates contrasts with the finding that Protestantism furthers educational and economic development (Becker and 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 than the very select subgroup of highly unhappy people. 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, Oswald, Wilson, and Wu (forthcoming)). Still, our results hold conditional on proxies for economic development, suggesting that religious denomination in the form of Protestantism is a main independent driver of regional differences in suicide rates.

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[24] We experimented with ratios of health workers and of priests to the total population as proxies for the integration of the community. Adding them as controls does not affect the Protestantism estimate; but they enter the model positively, questioning their validity as proxies for a suicide-reducing effect of community integration. We also experimented with the idea that rural communities may be highly integrated irrespective of denomination, whereas the anonymous environment of urban areas may bring the sociological aspects of a less tightly integrated Protestant community to the fore. In OLS specifications, an interaction between urbanization and Protestantism is indeed positive, but the Protestantism effect is still very strong in purely rural areas. This may be viewed as suggestive evidence that both sociological and theological channels are relevant, but the latter take precedence. However, interacted results are very imprecise in IV models, and the interpretation is admittedly highly speculative.

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Appendix: Data Sources on Suicide and Religion in 19th-Century Prussia

The county-level data available for Prussia in the 19th century is generally viewed as a unique source of highest-quality data for micro-regional analyses (see Galloway, Hammel, and Lee (1994)). We have compiled the county-level data used in this paper from several archives.

1816 Population Census and 1816-21 Suicide Statistics

The Prussian Statistical Office, founded in 1805, collected detailed data at the county level for the first time in 1816. This is the earliest year that lends itself to a micro-regional analysis of religion and suicide. Suicide rates are reported for the years 1816-21 combined and are drawn from the local burial and death registers. The share of Protestants in the county population refers to the year 1816. In addition, the 1816 Population Census provides data on demographics, schooling, the number of public buildings per capita, and other death causes. The data refer to 306 counties in Prussia in its borders at the time. The source of the 1816 Population Census data and the 1816-21 Suicide Statistics is Mützell (1825).

1869-71 Suicide Statistics

The second period for which we have county-level suicide data is 1869-71. In dedicated suicide statistics, introduced in the last quarter of 1868, the local state administration – the city council or the local police – had to count every suicide on a separate data sheet. The survey also collected background information on the suicide with the explicit aim of understanding the factors affecting suicides. The data refer to the 452 counties existing at the time.[25] The source of the 1869-71 Suicide Statistics is Preussische Statistik (1874). The data are further described in a paper by Hilse (1871) which also contains interesting cross-tabulations of suicides by characteristics of the person committing suicide and of the suicide incident, although only at the district level.

1871 Population Census

The 1871 Population Census provides information on the share of different religious denominations – in particular, Protestants, Catholics, and Jews – in a county. In addition, the

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[25] Prussia annexed several territories between 1816 and 1871, namely Hohenzollern-Sigmaringen, Schleswig-Holstein, the Kingdom of Hannover, Hessen-Kassel, Nassau, and the free city of Frankfurt.

majority of our control variables is drawn from the 1871 Population Census, including a host of demographic characteristics, adult literacy rates (measured as the ability to read and write among the population aged 10 years or older), and shares of the population with physical or mental disabilities (blind, deaf-mute, and insane). The source of the 1871 Population Census data is Preussische Statistik (1875).

1882 Occupation Census

The 1882 Occupation Census collected information on employment and self-employment across two-digit sectors. We calculate the share of the labor force working in the manufacturing sector and in the service sector, using the classification provided by the Prussian Statistical Office to classify the two sectors. The manufacturing sector (sector B in the 1882 classification) includes mining, construction, and manufacture of metals, machinery, equipment, chemicals, textiles, paper, leather, food products, and wood. The service sector (sector C in the 1882 classification) includes trade business, insurance, transport, lodging, and restaurants. The source of the 1882 Occupation Census data is Preussische Statistik (1884/85).
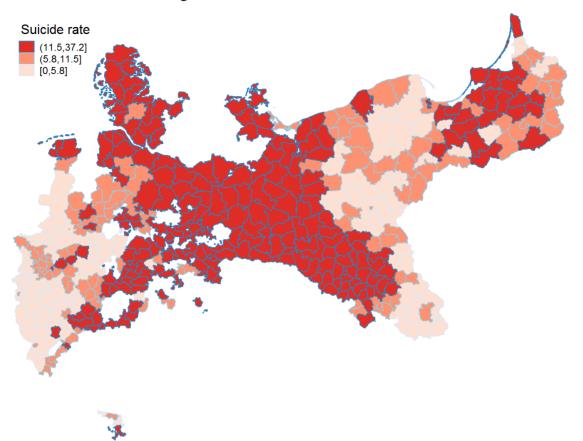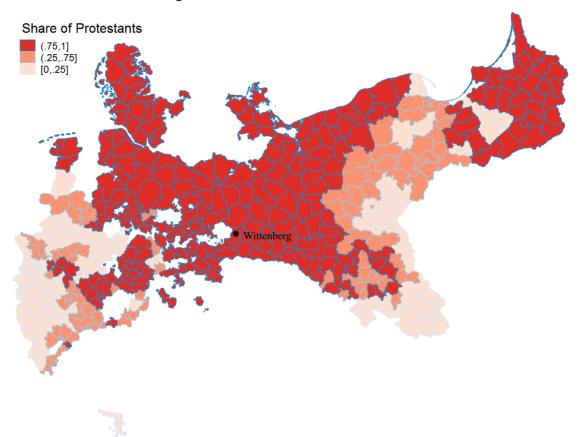
Figure 1: Suicides in Prussia, 1869-71

Suicide rate (average annual suicides per 100,000 inhabitants), 1869-71. County-level depiction based on 1869-71 Suicide Statistics. See Appendix for data details.

Figure 2: Protestantism in Prussia, 1871

Share of Protestants, 1871. County-level depiction based on 1871 Population Census. See Appendix for data details.

Figure 3: Protestantism and Suicide in Prussia, 1871
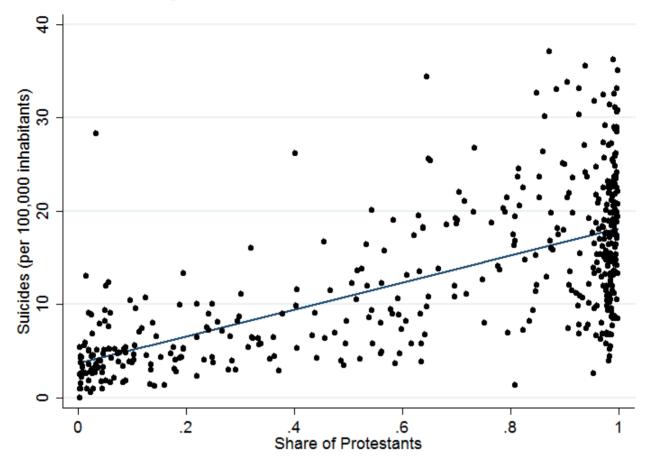
Share of Protestants 1871 and suicide rate 1869-71. County-level depiction based on 1871 Population Census and 1869-71 Suicide Statistics. See Appendix for details.

Table 1: Descriptive Statistics, Prussia 1871

	Mean (1)	StdDev (2)	Min (3)	Max (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 manu. and serv. (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 (x 100)	.09	.03	.03	.24
Share deaf-mute (x 100)	.10	.05	.02	.42
Share insane (x 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	1751.69	111.05	1525	1866

Suicide rates are average annual rates in 1869-71. Data for 452 Prussian counties from the 1869-71 Suicide Statistics, the 1871 Population Census, and the 1882 Occupation census; see main text and Appendix for details.

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 (.782)***	12.328 (.655)***	12.306 (.657)***	12.411 (.667)***	12.528 (.705)***	9.812 (1.124)***	4.928 (.275)***
Share of population < 15 years		-70.781 (8.653)***	-66.868 (12.050)***	-66.580 (12.056)***	-67.552 (12.212)***	-57.218 (14.122)***	-21.537 (4.760)***
Share of population > 60 years		-30.120 (18.060)*	-23.869 (22.491)	-22.354 (22.556)	-15.241 (26.429)	13.799 (34.418)	9.570 (10.301)
Average household size		-7.575 (.824)***	-7.529 (.831)***	-7.364 (.850)***	-7.317 (.856)***	-1.727 (1.357)	-2.077 (.333)***
Share of population living in towns			.754 (1.615)	.091 (1.770)	.089 (1.772)	.212 (1.872)	.548 (.691)
Share of labor force in manu. and serv.				1.807 (1.970)	2.437 (2.318)	5.550 (2.746)**	.118 (.903)
Share of literate adults					-1.614 (3.118)	3.900 (4.503)	.020 (1.215)
35 district dummies						yes	
Constant	3.691 (.582)***	68.928 (5.536)***	66.655 (7.375)***	65.148 (7.557)***	65.868 (7.690)***	23.571 (13.000)*	18.352 (2.997)***
Observations	452	452	452	452	452	452	452
R^2	.433	.627	.627	.628	.628	.738	.611

Ordinary least squares (OLS) estimation.

Standard errors in parentheses: * significance at ten, ** five, *** one percent.

Data for Prussian counties from the 1869-71 Suicide Statistics, the 1871 Population Census, and the 1882 Occupation Census; see main text and Appendix for details.

Table 3: Instrumental-Variable Estimates using Distance to Wittenberg

Dependent variable:	1st stage Share of Protestants				2nd stage Suicide rate (per 100,000 inhabitants)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Share of Protestants					28.019 (2.736)***	20.485 (2.445)***	19.969 (2.275)***	24.016 (3.520)***
Distance to Wittenberg (in 1,000 km)	-.936 (.111)***	-.863 (.125)***	-.909 (.123)***	-.693 (.127)***				
Share of population < 15 years		-.599 (.835)	-.747 (.818)	.093 (.812)		-68.989 (13.906)***	-67.873 (13.582)***	-79.150 (15.679)***
Share of population > 60 years		-2.550 (1.584)	-3.177 (1.557)**	-7.136 (1.696)***		-23.759 (25.930)	-19.051 (25.419)	61.177 (40.122)
Average household size		-.155 (.057)***	-.195 (.057)***	-.226 (.056)***		-5.467 (1.123)***	-5.163 (1.144)***	-3.845 (1.486)***
Share of population living in towns		-.048 (.115)	.149 (.121)	.172 (.118)		-.686 (1.907)	-2.604 (2.136)	-3.605 (2.475)
Share of labor force in manu. and serv. (1882)			-.587 (.131)***	-.940 (.144)***			5.628 (2.470)**	14.021 (4.498)***
Share of literate adults				1.053 (.204)***				-17.929 (6.218)***
Constant	.947 (.040)***	2.084 (.502)***	2.535 (.502)***	1.797 (.508)***	-4.988 (1.797)***	52.669 (9.386)***	49.416 (9.613)***	51.711 (10.509)***
Observations	452	452	452	452	452	452	452	452
R^2	.135	.152	.189	.235	.056	.498	.521	.406
F-statistic (instrument)					70.46	47.39	54.49	29.86

Instrumental-variable (IV) estimation.
Standard errors in parentheses: * significance at ten, ** five, *** one percent.
Data for Prussian counties from the 1869-71 Suicide Statistics, the 1871 Population Census, and the 1882 Occupation Census; see main text and Appendix for details.

Table 4: Robustness to Additional Factors, Prussia 1871

Dependent variable:	Suicide rate (per 100,000 inhabitants)				
	(1)	(2)	(3)	(4)	(5)
Share of Protestants	25.617 (4.033)***	24.759 (3.683)***	23.919 (3.275)***	17.094 (2.263)***	26.076 (3.641)***
Share of females	-21.400 (30.956)	-5.420 (29.963)	-5.976 (29.189)		
Share of Jews	46.201 (33.099)	52.915 (32.658)	52.957 (31.779)*		
Share of population born in municipality	11.725 (7.837)	10.671 (7.309)	7.340 (6.220)		
Share of population of Prussian origin	-66.155 (17.643)***	-62.765 (17.114)***	-61.172 (16.723)***		
Share blind (x 100)		7.160 (11.274)	9.121 (11.172)		
Share deaf-mute (x 100)		-23.586 (9.056)***	-21.633 (8.468)**		
Share insane (x 100)		.758 (1.957)	.603 (1.890)		
Fatal accident rate (per 100,000 inhabitants)			-.038 (.026)		
Latitude, longitude and their interaction (in rad)				yes	
36 dummies for years when annexed by Prussia					yes
Standard controls	yes	yes	yes	yes	yes
Observations	452	452	452	452	452
R^2	.389	.432	.463	.633	.547

Instrumental-variable (IV) estimation, where share of Protestants is instrumented by distance to Wittenberg.
Standard errors in parentheses: * significance at ten, ** five, *** one percent.
Standard controls: share of population < 15 years, share of population > 60 years, average household size, share of population living in towns, share of labor force in manufacturing and services, share of literate adults, and a constant.
Data for Prussian counties from the 1869-71 Suicide Statistics, the 1871 Population Census, and the 1882 Occupation Census; see main text and Appendix for details.

Table 5: Accounting for Unpleasant Weather Conditions

	OLS		IV 1st stage	IV 2nd stage
Dependent variable:	Rainfall	Temperature	Share Protestants	Suicide rate (per 100,000 inhabitants)
	(1)	(2)	(3)	(4)
Share of Protestants				18.479 (5.137)***
Distance to Wittenberg (in 1,000 km)	329.781 (33.323)***	-1.949 (.249)***	-.538 (.153)***	
Rainfall			-.0008 (.0002)***	-.006 (.007)
Temperature			-.222 (.022)***	.819 (1.172)
Standard controls			yes	yes
Observations	452	452	452	452
R^2	.179	.120	.387	.579

Instrumental-variable (IV) estimation, where share of Protestants is instrumented by distance to Wittenberg.

Standard errors in parentheses: * significance at ten, ** five, *** one percent.

Standard controls: share of population < 15 years, share of population > 60 years, average household size, share of population living in towns, share of labor force in manufacturing and services, share of literate adults, and a constant.

Data for Prussian counties from the 1869-71 Suicide Statistics, the 1871 Population Census, and the 1882 Occupation Census; see main text and Appendix for details.

Table 6: Religious Concentration and Further Robustness Specifications

Dependent variable:	Suicide rate (per 100,000 inhabitants)			Suicide proportion (per 1,000 deaths)
	All counties	Counties with share of Protestants		All counties
		<2% or >98%	<.1% or >99.9%	
	(1)	(2)	(3)	(4)
Share of Protestants	24.739 (3.758)***	15.443 (3.800)***	17.574 (7.109)**	9.265 (1.356)***
Share of population < 15 years	-83.074 (16.095)***	-54.081 (31.183)*	-117.200 (72.056)	-25.914 (6.040)***
Share of population > 60 years	69.192 (41.817)*	80.997 (66.548)	81.524 (199.936)	38.417 (15.456)**
Average household size	-3.350 (1.608)**	-4.717 (2.613)*	-3.911 (3.617)	-.766 (.573)
Share of population living in towns	-4.611 (2.651)*	-1.672 (6.189)	-34.468 (22.622)	-.846 (.953)
Share of labor force in manu. and serv.	13.129 (4.319)***	16.598 (6.905)**	52.275 (10.805)***	4.491 (1.733)***
Share of literate adults	-15.216 (5.660)***	4.628 (8.790)	-39.946 (25.164)	-6.139 (2.395)**
Herfindahl index of religious distribution	-7.577 (2.982)**			
Constanst	54.062 (10.308)***	29.687 (21.914)	85.792 (43.484)**	13.008 (4.048)***
Observations	452	142	33	452
R^2	.400	.623	.838	.393

Instrumental-variable (IV) estimation, where share of Protestants is instrumented by distance to Wittenberg.

Standard errors in parentheses: * significance at ten, ** five, *** one percent.

Data for Prussian counties from the 1869-71 Suicide Statistics, the 1871 Population Census, and the 1882 Occupation Census; see main text and Appendix for details.

Table 7: Suicide Rates by Individual-Level Religion and Gender

	Suicide rate (per 100,000)		
	Protestant (1)	Catholic (2)	Total (3)
Prussian total	18.4	6.5	14.1
By gender			
Male	30.3	11.3	23.4
Female	6.9	2.0	5.4
By share of Protestants in the district			
0% - 5%	21.1	3.8	4.4
5% - 15%	16.9	4.1	5.5
15% - 40%	17.5	4.7	7.7
40% - 60%	16.4	7.9	12.4
60% - 85%	19.6	14.3	18.4
85% - 98%	17.5	14.6	17.4
98% - 100%	24.9	10.8	24.8

Suicide rates (per 100,000 people in the sub-group) in the year 1869. Based on a total count of 2,560 suicides in the 25 (out of 35) Prussian districts with cross-tabulated data. Source: Hilse (1871).

Table 8: Descriptive Statistics, Prussia 1816

	Mean	StdDev	Min	Max
	(1)	(2)	(3)	(4)
Suicide rate (per 100,000 inhabitants)	6.50	5.06	.00	26.06
Suicide rate males (per 100,000 inhabitants)	10.52	8.28	.00	47.50
Suicide rate females (per 100,000 inhabitants)	2.69	2.88	.00	22.42
Suicide proportion (per 1,000 deaths)	2.30	1.90	.00	8.82
Share of Protestants	.59	.41	.00	1.00
Distance to Wittenberg (in 1,000 km)	.32	.15	.00	.73
Share of population < 15 years	.36	.03	.26	.46
Share of population > 60 years	.07	.01	.04	.11
Share of population living in towns	.12	.21	.00	1.00
Public buildings (per 100 inhabitants)	.33	.38	.00	2.09
School enrollment rate	.59	.20	.02	1.10
Fatal accident rate (per 100,000 inhabitants)	42.96	16.73	14.01	123.54
Fatal accident proportion (per 1,000 deaths)	15.39	6.77	4.23	54.90

Suicide rates are average annual rates in 1816-21. Data for 306 Prussian counties from the 1816-21 Suicide Statistics and the 1816 Population Census; see main text and Appendix for details.

Table 9: Protestantism and Suicide in Prussia 1816: OLS Estimates

Dependent variable:	Suicide rate (per 100,000 inhabitants)					
	All	Males	Females	All	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Share of Protestants	7.221 (.574)***	11.065 (.970)***	3.605 (.346)***	4.735 (.596)***	7.341 (1.017)***	2.232 (.374)***
Share of population < 15 years				-36.224 (10.361)***	-61.949 (17.661)***	-12.448 (6.493)*
Share of population > 60 years				-84.322 (20.097)***	-134.666 (34.257)***	-34.774 (12.595)***
Share of population living in towns				5.978 (1.056)***	10.974 (1.801)***	1.680 (.662)**
Public buildings (per 100 inhabitants)				2.529 (.643)***	2.488 (1.096)**	2.584 (.403)***
School enrollment rate				3.135 (1.250)**	5.396 (2.131)**	1.070 (.783)
Constant	2.262 (.411)***	4.023 (.694)***	.573 (.247)**	18.961 (4.937)***	32.135 (8.415)***	6.485 (3.094)**
Observations	306	306	306	306	306	306
R^2	.342	.300	.263	.509	.468	.405

Ordinary least squares (OLS) estimation.
Standard errors in parentheses: * significance at ten, ** five, *** one percent.
Data for Prussian counties from the 1816 Census; see main text and Appendix for details.

Table 10: Protestantism and Suicide in Prussia 1816: IV Estimates

Dependent variable:	1st stage Share of Protestants	2nd stage Suicide rate (per 100,000 inhabitants)				Suicide proportion (per 1,000 deaths)
	All	All	All	Males	Females	All
	(1)	(2)	(3)	(4)	(5)	(6)
Share of Protestants		14.989 (2.771)***	14.971 (2.628)***	23.439 (4.310)***	7.066 (1.455)***	5.240 (.953)***
Distance to Wittenberg (in 1,000 km)	-.869 (.160)***					
Share of population < 15 years	-4.251 (.928)***	15.253 (19.613)	15.117 (18.901)	19.218 (31.001)	11.345 (10.467)	4.804 (6.853)
Share of population > 60 years	-8.089 (1.801)***	1.281 (35.661)	.555 (33.516)	4.341 (54.973)	-.576 (18.560)	7.929 (12.152)
Share of population living in towns	-.078 (.098)	6.570 (1.481)***	6.566 (1.477)***	11.932 (2.422)***	1.922 (.818)**	1.809 (.535)***
Public buildings (per 100 inhabitants)	.091 (.066)	-.262 (1.149)	-.256 (1.120)	-1.900 (1.836)	1.278 (.620)**	.087 (.406)
School enrollment rate	.443 (.113)***	-2.074 (2.200)	-2.045 (2.089)	-2.941 (3.427)	-1.174 (1.157)	-.886 (.758)
Fatal accident rate (per 100,000 inhabitants)			-.001 (.020)	.010 (.033)	-.014 (.011)	.0001 (.007)
Constant	2.647 (.434)***	-7.369 (9.666)	-7.225 (9.026)	-9.985 (14.803)	-4.881 (4.998)	-2.761 (3.272)
Observations	306	306	306	306	306	306
R^2	.360	.024	.026	.023	.078	.092

Instrumental variables (IV) estimation.
Standard errors in parentheses: * significance at ten, ** five, *** one percent.
Data for Prussian counties from the 1816 Census; see main text and Appendix for details.

Table A.1: Suicide Methods

	Male (1)	Female (2)	Total (3)
Hanging	63.5	43.2	59.6
Drowning	16.5	42.7	21.6
Shooting	12.4	0.2	10.1
Poisoning	2.3	7.3	3.3
Cutting throat	2.8	2.8	2.8
Plunging	0.7	1.1	0.8
Have oneself ridden over	0.6	0.3	0.6
Cutting artery	0.3	0.7	0.4
Stabbing	0.3	0.2	0.3
Inhaling gases	0.1	1.1	0.3
Strangling	0.3	0.2	0.3
Other means	0.0	0.3	0.1
Undisclosed means	0.1	0.0	0.1
Total	100.0	100.0	100.0

Suicides in the year 1869, in percent. Based on a total number of 3,187 classified suicides (2,573 male and 614 female). Source: Hilse (1871).