

Protestantism and Entrepreneurship: Evidence from the Pre-Industrial and from the Industrial Era

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Abstract

Max Weber (1905) observed a Protestant lead in entrepreneurship, using evidence from the South-West German region of Baden. Prussian data from the pre-industrialization period as well as the industrialization era show that, in fact, Protestants were more likely to be business owners or directors. We hypothesize that this effect is largely driven by denominational differences in human capital. These came about as unintended side effects of Luther's postulations to enable everyone to read the Gospel. Indeed, denominational differences in entrepreneurship are empirically largely explained by denominational differences in literacy rates.

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1 Introduction

Say (1803) characterized entrepreneurs as risk-takers that combine inputs of land, capital, and labor. According to Schumpeter (1912), entrepreneurs are the prime movers in economic development. In many modern economies, business founders receive substantial government subsidies to alleviate credit constraints.¹ Entrepreneurship receives particular attention because new businesses tend to grow faster than mature firms (see e.g. Evans 1987): Entrepreneurs not only employ themselves but also create jobs for others. Entrepreneurship is thus a key ingredient in market economies.

Whereas a strict definition of entrepreneurship typically refers to individuals who found a business (Lazear 2005), a broader definition includes the self-employed in general, independent of whether they founded the business or bought or inherited it (Evans and Leighton 1989, Blanchflower and Oswald 1998), as well as directors/managers of businesses. Lazear (2005) points out that many modern-time CEOs are considered entrepreneurs. The business economics literature uses the terms *corporate entrepreneurship* (Stopford and Baden-Fuller 1994) and *intrapreneurship* (Kuratko, Montagno and Hornsby 1990) to characterize entrepreneurship of managers inside the firm.

For a long time, the study of entrepreneurship was the poor cousin of economics because it was argued that by its very nature entrepreneurial activity could not be predicted using deterministic models. Empirically, however, certain regularities were observed early on. In his Protestant Ethic, Weber (1905) distinguishes between two kinds of entrepreneurs: first, “old-time” entrepreneurs: adventurers whose chances to succeed were irrational-speculative; second, in “modern times”, in the West, a rational-capitalistic breed. Weber associated the latter type of entrepreneur with Protestant traits. Weber’s observation that

¹In Germany, for instance, in the year 2004, the Federal Employment Agency funded more than 350,000 business start-ups by formerly unemployed individuals (see Baumgartner and Caliendo 2007).

Protestants were more likely to be entrepreneurs than Catholics was mainly based on data from the region of Baden collected by Offenbacher (1900). Some of Offenbacher's evidence has, however, been shown to have substantial flaws (cf. Becker 1997).

In this paper, we look at the hierarchical structure *within* sectors in 19th century Prussia, the largest state in the German empire. Using census data from the beginning and end of the 19th century, we show that, indeed, Protestants were more likely to take leadership positions. Our hypothesis is that human capital is a key factor explaining denominational differences in entrepreneurship.²

Human capital plays a role not only for taking hierarchical positions inside the firm (Lazear and Oyer 2007), but has been found to be a relevant factor in entrepreneurial success in many studies using data from the end of the 20th century (see Bates 1990 and Cooper, Gimeno-Gascon, and Woo 1994).

Using unique Prussian town-level data from the earliest Prussian Census in 1816/19 and county-level census data from 1882, we show that human capital differences largely explain the higher share of Protestants in leadership positions.

The beginning and end of the 19th century are interesting periods to look at because they surround the Industrial Revolution in Germany (Landes 1998). First, since large scale manufacturers appeared only during the industrialization, data from 1816/19 allow a look at the role of sole proprietors before the industrialization started. The 1816/19 data provide information about two particular types of entrepreneurs: artists and craftsmen, that stand out by the extended period of human capital acquisition (to obtain mastership) that their profession requires. We contrast this with servants, an occupation at the other end of the

²Differences in literacy rates between Protestants and Catholics in 19th century Prussia were documented in Becker and Wößmann (2007). In that work, we showed that Martin Luther's urge for every Christian to read the Bible was taken up by Protestant rulers (building schools) and Protestant parents (sending their kids to school) alike, leading to a Protestant lead in education.

hierarchy that arguable requires very little human capital investment, if any.

Second, we use data from 1882, covering the period after the first industrialization phase (up to around 1870). These data allow insights into denominational differences in self-employment and managerial positions across Prussian counties in the industrial era, the period Weber's (1905) own evidence for Baden is drawn from. Considering the flaws in Offenbacher's data for Baden, we fill an important empirical gap, using census data for the largest German state.

This paper proceeds as follows. Section 2 looks at entrepreneurship in the pre-industrial era, Section 3 at entrepreneurship in the industrial era, and Section 4 concludes.

2 Entrepreneurship in the Pre-Industrial Era

Industrialization in Prussia started considerably later than in Britain. Landes (1998, ch. 17) associates part of that delay with twenty-five years of revolution and war from 1789 to 1815 on the Continent. The beginning of the industrial revolution in Germany is typically dated around the 1830s to 1850s (see Borchardt 1972). Census data from 1816/19,³ which we will analyze below, can be therefore be considered as characterizing the endpoint of the pre-industrial era in Germany.

Doepke and Zilibotti (2007) describe artisans and craftsmen as the typical professions of the pre-industrial middle class. Artisans and craftsmen that persevere until mastership can be considered to be entrepreneurs of the pre-industrial era. Doepke and Zilibotti (2007) argue that, to become masters in their professions, artisans and craftsmen were required to make large human capital investments. After their apprenticeship, which could take 5-6 years, but in some professions even up to 12 years (Epstein 1991), artisans would go through a period of journeymanhip in European cities. According to Friedrichs (1995),

³See the Data Appendix for details on the data sets used in this paper.

this wandering period would last for a minimum of 3–4 years. Finally, the artisan could apply for admission to mastership and become a new guild member.⁴

To the extent that Protestants put more emphasis on education, we would expect a higher fraction of masters in Protestant areas as compared to Catholic areas.

The duration of the human capital investment associated with acquiring mastership (between 6 and 12 years) exceeds the one associated with achieving literacy (at most 5 or 6 years). Two mechanisms are likely to be at work in facilitating human capital acquisition beyond literacy. First, Heckman (2000) describes education as a dynamic process with synergetic components, i.e. education breeds education. Successful early investment in education facilitates later investment and is a prerequisite for the latter. Protestants, who took a lead in elementary education (see Becker and Wößmann 2007), may thus have laid the foundation for further human capital investments, e.g. in the form of acquiring mastership. Second, Doepke and Zilibotti (2007) consider patience (a lower discount rate) a key attribute of those acquiring mastership in the pre-industrialized world and those becoming entrepreneurs during industrialization. Both the larger (elementary) human capital stock and patience typically associated with Protestantism (Weber 1905) may interact such as to make Protestants more likely to obtain mastership.

Exogeneity of Protestantism?

Before proceeding to our empirical analysis, where we use regional data, we have to briefly discuss whether we can consider (the degree of) Protestantism as exogenous. Figure 1 shows the distribution of Protestantism across Prussia in both 1816/19 and 1871. The maps attest to a roughly circular diffusion of Protestantism around Wittenberg, the birthplace of

⁴Interestingly, until the onset of the Industrial Revolution in Germany, the number of masters grew faster than the population (Borchardt 1972, p. 51). So, whereas admission to guilds was subject to examination, there was no general upper bound on membership.

the Protestant Reformation.⁵ Reformation historians refer to the diffusion of Protestantism around Wittenberg as resembling the propagation of a wave caused by a stone thrown into water. Luther's preaching had its most imminent effect in the area surrounding his city of Wittenberg, and there is a tendency for the impact to diminish with distance to Wittenberg.⁶

Becker and Wößmann (2007) provide historic and econometric evidence that county-level shares of Protestants can be considered as exogenous to the economic sphere. The reasons for this are as follows: first, Wittenberg itself was considered to be an "unimportant place" (Holborn 1942). Its role as the origin of Protestantism was triggered by a particularly vicious example of indulgence practices.⁷

Second, the German political landscape at the time of the Reformation consisted of more than 300 political entities ranging from imperial cities to dukedoms and kingdoms. The rulers of these entities, at their annual meeting (Imperial Diet) in Augsburg in 1555

⁵The area south of Wittenberg that was not part of Prussia, Thuringia, was also predominantly Protestant. This is also true for most of the white areas landlocked by Prussia that were independent states within the German Empire, e.g. Mecklenburg, at the Baltic Sea, surrounded by Schleswig-Holstein, Hannover, Brandenburg and Pommern.

⁶The main reasons for a circular dispersion around Wittenberg may have been the costs of traveling and of information diffusion through space, and these transportation and transaction costs played a crucial role at the time. Among other things, rulers who wanted to convert their church system to Protestantism had to send priests to study the new denomination in Wittenberg. Thus, thousands of students came to Wittenberg to hear Luther's sermons and speeches, and they spread the word as preachers back in their home regions (cf. Peters 1969; Bunkowske 1985). Given the arduousness of travel in the early 1500s, the propensity to come to Wittenberg to listen to Luther and his successors likely declined with distance to Wittenberg.

⁷In 1517, the Dominican mendicant Johannes Tetzel started to sell indulgences in the province of Magdeburg to support the construction of St. Peter in Rome, by order of Bishop Albrecht of Brandenburg. In reality, half of the revenues were used to pay off Albrecht's debts with the Fugger family, the most influential economic dynasty at the time. Martin Luther, who taught in Wittenberg, proclaimed his 95 Theses in reaction to his specific experience with this selling of indulgences and in protest over the abuse of the money for Albrecht's private affairs.

agreed on the principal “Cuius regio, eius religio” (“Whose rule, his religion”). From an individual perspective, the adoption of the reformation was thus exogenous. Rulers decided and the population had to follow.⁸

But how did the rulers themselves decide? Reformation historians argue that the adoption of the Reformation within Germany was largely driven by theological convictions and not endogenous to the economic situation before Luther’s time. Church beliefs and practices under attack by Protestant reformers included purgatory, particular judgment, devotion to Mary, the intercession of the saints, most of the sacraments, and the authority of the Pope. Becker and Wößmann (2007) provide evidence that the higher likelihood of an adoption of the Reformation in closer proximity to Wittenberg was indeed exogenous to the economic and educational landscape before the Reformation. Wittenberg was a “random place on the map” in the sense that the economic centers of Germany (imperial cities and hanseatic cities) were distributed evenly across Germany in distance to Wittenberg. Furthermore, centers of education (universities) were distributed evenly across Germany and again unrelated to distance to Wittenberg.

In the following regression analysis, we thus consider the fraction of Protestants in a town or county as exogenous.

Regression Results

We can now analyze the empirical content of our conjecture that, in Protestant areas, more artists and craftsmen incur the substantial human capital investment and obtain mastership.

Indeed, regression results using the 1816/19 data from Prussian towns seem to confirm this conjecture. Table 1, column 1, shows that the number of masters per capita (or number of masters per male adult, measured as ages 19-60) is clearly positively related to the frac-

⁸Ordinary people could only escape the regional ruler’s choice by migrating to an area with a different denomination, a venture which only few people would take on.

tion of Protestants in town. Interestingly, this is not the case for the bivariate regressions of the number of assistants and apprentices (in the artisan and craftsman professions) per capita (see column 2). Thus, whereas in Catholic areas, there are not systematically fewer artisans and craftsmen in general, there are fewer of them who persevere and make the necessary human capital investments to achieve mastership.

The positive association between the degree of Protestantism and mastership is robust when adding control variables. In column 3, we add geographic controls to capture potentially systematic East-West and North-South differences, and in column 4, we add other indicators measuring the stage of economic development of the towns: the fraction of houses that have massive walls (as opposed to timbered or wooden walls), the number of looms per capita and the number of retailers per capita.

We briefly contrast this with the number of servants per inhabitant and find a negative association, consistent with the idea that occupations with a very low degree of human capital investment are less common in Protestant towns.⁹

Overall, the results from pre-industrial Prussia, are in line with the prediction that Protestants are more likely to be entrepreneurs, measured by mastership in the professions of artists and/or craftsmen. One potential reason behind these denominational differences in mastership is the intensity of human capital investments required to obtain mastership. Unfortunately, lacking data on educational outcomes for 1816/19, we cannot directly measure whether human capital differences between Protestant and Catholic towns account for the differences in mastership rates. We will, however, be able to do so when looking at entrepreneurship at the end of the 19th century, for which we have denomination-specific

⁹An alternative or complementary explanation is given by Borchardt (1972, p.78) who argues that a high number of servants is a clear sign of underdevelopment, well consistent with the evidence in Becker and Wößmann (2007) showing that Catholic areas lag behind Protestant areas in their economic development at the end of the 19th century.

literacy rates.

3 Entrepreneurship in the Industrial Era

The empirical evidence on entrepreneurship in Germany brought forward by Weber (1905) draws on Offenbacher (1900), his student. Weber argues that the Protestant ownership share of the capital stock (calculated from tax data) clearly exceeded the Protestant population share. All numbers in Offenbacher (1900) stem from the relatively small region of Baden, limiting the generalizability to Germany at large. Furthermore, some of Offenbacher's evidence has been shown to have substantial flaws (cf. Becker 1997). It is therefore interesting to look at evidence from Prussia, which was considerably larger than Baden, and may give a better indication for denominational differences in economic leadership in Germany at large.

3.1 Entrepreneurship across Counties

The 1882 Occupation Census classifies occupations along 25 main sectoral groups, some of them sub-divided in finer sub-sectors. An interesting feature of this census is that, within each occupation, two groups of workers are distinguished: first, self-employed and business directors (Selbständige und Geschäftsleiter) and second, dependent employees doing administrative or manual work (Verwaltungs- und Arbeiterpersonal). The data on the self-employed and directors are a promising proxy of entrepreneurship. The measure is likely to be broader than a strict definition of an entrepreneur as a person who undertakes and operates a new enterprise or venture and assumes some accountability for the inherent risks. Still, it is the best measure available for the Prussian population at large, and is available at

the county-level, thus allowing us to control for regional heterogeneity.¹⁰

In the sequel, we will look at the manufacturing industry, which made 30% of total employment in 1882 (remember that agriculture was still dominating the scene). The manufacturing industry is sub-divided into 15 sectors (14 proper manufacturing sectors and a residual category). Note that, different from modern sector classifications, in the 1882 Occupation Census, mining is classified as part of the manufacturing industry.

Table 4, column 1, gives the fraction of workers in total manufacturing employment that are employed in the respective 15 manufacturing sectors. The largest manufacturing sector by employment is the clothing and cleaning industry with 21.29 percent of total manufacturing employment, followed by construction (14.62 percent), textiles (10.57 percent) and mining (10.08 percent). Together these 4 sectors make up more than half of total manufacturing employment. All remaining sectors have employment shares of less than 10 percent of manufacturing employment.

Column 2 of table 2 shows that plant scale (average plant size) varies considerably across sectors. Interestingly, the largest sector, clothing and cleaning, has the smallest average firm size, 1.55 persons/firm. Leaving aside the residual category, the largest firm sizes in manufacturing are to be found in mining (128.22) and quarrying of stones (10.22). All other sectors have pretty small scale businesses. This is not surprising, considering that also nowadays, firm sizes are pretty small in some of these industries, e.g. in cleaning or in artistic production.

¹⁰As usual, there is a trade-off. Given data availability in the 19th century, concentrating on a stricter, and thus sharper, definition of entrepreneurship as business founders only, limits the analysis to the study of outstanding individual entrepreneurs, because data on business foundations as such is not available at large. In contrast, using a broader definition of entrepreneurship that includes business owners and business directors in general allows us to draw on Census data at town- and county-level data, thus covering the universe of economic activity in Prussia. See Kocka (1978) for a discussion of different approaches to the study of 19th century entrepreneurship.

Mining stands out as a particular sector, being one of the largest manufacturing sectors and having the largest average plant size. In addition, the preponderance of mining as such is driven by the availability of natural resources. In the county-level regressions, we will therefore always control for the fraction of mining in total employment. Furthermore, regressions will be weighted by total manufacturing employment in the county, to account for differences in county-level employment patterns.

3.2 Plant size vs. fraction of entrepreneurs

Regressing the fraction of entrepreneurs in county on the fraction of Protestants (and controlling for the share of mining in total employment), we find there to be fewer entrepreneurs in Protestant areas (see Table 3), which, at first glance, seems to go against the hypothesis that Protestants are more likely to be entrepreneurs. However, the mirror image of the lower fraction of entrepreneurs in Protestant areas is the larger average plant size in Protestant areas. Denoting the number of entrepreneurs by E , and the number of dependent employees by D , the share of entrepreneurs in total employment is $E/(E + D)$. To the extent that every entrepreneur corresponds to one plant, the inverse ratio $(E + D)/E$ represents plant scale, i.e. average plant size.

To explain the size distribution of firms, Lucas (1978) and Oi (1983) assumed that entrepreneurial quality varies across firms and that consequently more able entrepreneurs assemble larger firms. Our finding that firm sizes are larger in Protestant areas could thus indicate that entrepreneurial skills are better. At the same time, it has long been recognized that worker wages are higher in large firms (see Oi and Idson 1999). Idson and Oi (1999) provide evidence that workers are more productive in large firms. Larger firm size might thus also reflect higher labor productivity and labor quality in Protestant areas, well in line with the findings of Becker and Wößmann (2007) that labor income is higher in Protestant areas.

Adam Smith (1776) argued that if a worker needs to acquire task-specific human capital, there is a “set-up” cost incurred every time the worker is assigned to a new task. Workers perform specialized tasks and a firm needs to hire more workers when its production process becomes more specialized. In that sense, the production process might have achieved a higher degree of specialization in Protestant areas.¹¹

Also Kremer (1993) suggests human capital to be a positive correlate of firm size. He models human capital as the probability that a worker will successfully complete a task. Each task is performed by one worker, so the output of the firm (a sequence of tasks) depends on the product of the skill levels of *all* workers. Firms using technologies that need several tasks will employ highly skilled workers because mistakes are more costly to such firms. Kremer then assumes that the number of tasks and number of workers are likely to be positively correlated, and finds his model consistent with the stylized fact that richer (higher human capital) countries specialize in complicated products and have larger firms. Becker and Wößmann (2007) showed that human capital endowment (as measured by literacy rates) is indeed higher in Protestant areas in 1871, allowing for larger firm sizes on average.

3.3 Entrepreneurship within Counties

In order to get a grip on Protestant vs Catholic entrepreneurship, we need to look at the denominational distribution of entrepreneurship *within* counties.

Fortunately, the volumes of the 1882 Occupation Census contain special tables containing the denominational distribution of occupation types within counties. This allows us to

¹¹In Becker and Wößmann (2007), we argued that Protestants are more likely to work outside agriculture, i.e. in manufacturing and services, an indication of the division of labor (instead of autarky) that was more developed in Protestant areas at the end of the 19th century. The finding related to firm size reinforces this point.

condition out the differences in scale of operation.

For descriptive purposes, we use the county-level cross-tabulations by denomination to compute some indicators of interest.

As Table 4 shows, across Prussia, Protestants are more likely to be self-employed or direct a business compared to Catholics (column 4). Note also that Jews stand out as being much more likely than both Protestants and Catholics to run a business. They make up only about one percent of the population, however (see column 1). Here, we will concentrate on the comparison between Protestants and Catholics, the two biggest population groups. Jewish economic history has been dealt with in much detail in Botticini and Eckstein (2005, 2007).

So, on the one hand, as evidenced in Section 3.1, *across* counties, in Protestant areas, the scale of operation is higher indicating higher degree of entrepreneurial skills, human capital levels and/or more sophisticated division of labor. On the other hand, *within* county, Protestants hold relatively more (of the fewer) leadership positions.

Table 4 contains further indicators of denominational differences in manufacturing employment patterns. It shows the share of Protestants among entrepreneurs in manufacturing (column 3) compared to the share of Protestants among all those working in manufacturing (column 2) which, in turn, can be compared to the fraction of Protestants in county (column 1). The following points stand out: Protestants account for a higher share of the manufacturing workforce than their population share (one of the key findings in Becker and Wößmann 2007), but the share of Protestants among manufacturing entrepreneurs even goes beyond their share in the manufacturing workforce. Protestants are thus not only more likely to work in manufacturing, but, in addition, to make up a higher share of entrepreneurs in the manufacturing sector.

At the same time, the literacy rate of Protestants exceeds that of Catholics, as can be seen from the denomination-specific literacy rates in column 5 of Table 4. Our hypothesis

is therefore that, similar to the findings in Becker and Wößmann (2007), education differences are a driving force behind the Protestant lead in entrepreneurship over Catholics. We address this hypothesis in a regression analysis.

Our dependent variable is the share of Protestants in the total number of entrepreneurs in county. Naturally, since Protestants make up roughly two thirds of the Prussian population, we need to control for the Protestant share in manufacturing employment. Not surprisingly, the higher the share of Protestants employed in manufacturing in county, the higher their share among manufacturing entrepreneurs (see Table 5, column 1). As before, in all regressions we control for the fraction of the workforce employed in mining.

In column 2, we include our main variables of interest: literacy rates of Protestants, respectively Catholics. The denomination-specific literacy rates come from special tabulations in the 1871 Population Census data. In line with our hypothesis that literacy is a driving force behind denominational differences in entrepreneurship, we find the Protestant share among entrepreneurs to increase with the county-level literacy rate of Protestants and to decrease with the county-level literacy rate of Catholics.

To probe the robustness of the results, we run several specifications adding further control variables: first, to control for the scale of operation in the county at large (see Section 3.1), we control for the denomination-neutral fraction of entrepreneurs in the county at large (see column 3). Then, we add demographic control variables (see column 4). Finally, in column 5, we add geographic control variables. Across all specifications, we find a significantly positive effect of Protestant literacy and a significantly negative effect of Catholic literacy on the Protestant lead in entrepreneurship.

Are the denominational differences in literacy able to explain numerically the denominational differences in entrepreneurship? The gap in literacy rates between Protestants and Catholics is 6 percentage points on average (see Table 4). To close the gap, either the Protestant literacy rate would have to fall, or the Catholic literacy rate would have to rise.

The estimated coefficients have opposite signs but essentially the same size of about 0.075. An increase in the Catholic literacy rate by six percentage points (or, symmetrically, a fall of the Protestant literacy rate by the same amount) would thus reduce the Protestant share among manufacturing entrepreneurs by .45 percentage points. This is nearly identical to the difference of .43 percentage points between the Protestant share in total manufacturing employment (64.70%) and the Protestant share among manufacturing entrepreneurs (65.13 %).

This back-of-the-envelope calculation suggests that differences in literacy rates between Protestants and Catholics do have the potential to explain (most of) the denominational difference in entrepreneurship.

Given our argument above that the additional literacy of Protestants was an unintended by-product of Luther's urge to read the Bible, we can consider the different propensity to entrepreneurship of Protestants and Catholics in 19th century Prussia as a long-run impact of the Protestant Reformation, transmitted via denominational differences in human capital.

4 Conclusion

Max Weber hypothesized that Protestants are more likely to be entrepreneurs because they have the character traits conducive to rational-capitalistic behavior. We show that, indeed, Protestants were more likely to be entrepreneurs and that human capital differences across denominations are a key factor in explaining these differences in entrepreneurship.

Our results thus complement and extend Weber's study of entrepreneurship. Weber based his analysis mainly on Offenbacher's (1900) data from the region of Baden that seem to have substantial flaws (Becker 1997). Furthermore, he drew on casual observations on entrepreneurship in other countries.

We provide evidence on Prussia, the biggest German state, from the beginning and end

of the 19th century, employing data at the town- and county level.

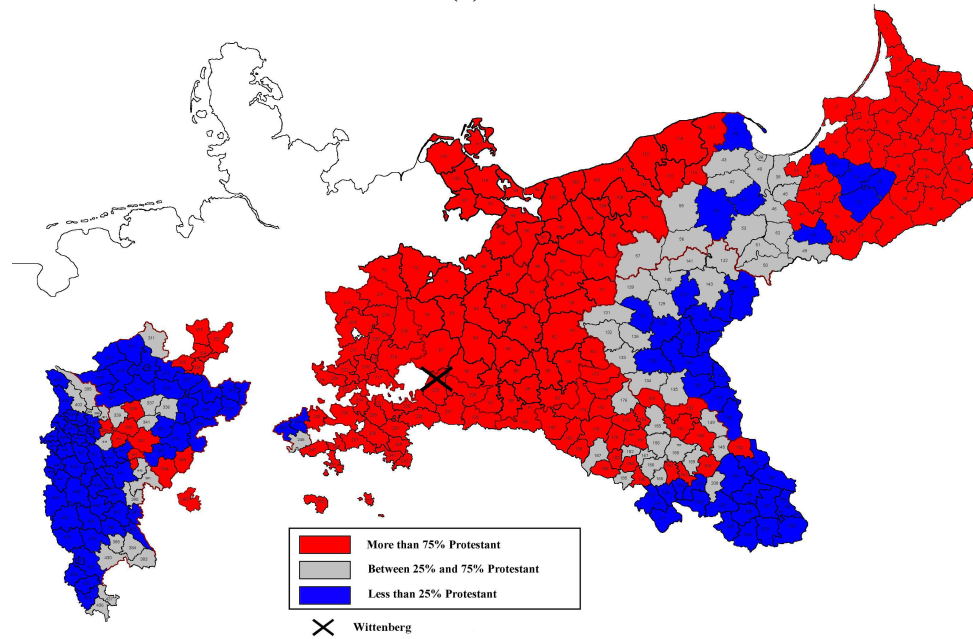
Using data from the pre-industrial era, we focus on a particular group of entrepreneurs. Artisans and craftsmen obtain mastership only after up to 12 years of apprenticeship and journeymanhood. Becoming a master thus entailed a huge human capital investment for this special group of entrepreneurs (Doepke and Zilibotti 2007). Since Protestants took a lead over Catholics in human capital acquisition (Becker and Wößmann 2007), we conjectured to find higher rates of mastership in Protestant areas. This is exactly what we find, using Prussian town-level census data from 1816/19. At the same time, the number of servants per capita is lower in Protestant areas, consistent with the idea that occupations with a very low degree of human capital investment are less common among Protestants.

Using data from the era of industrialization, we present two important findings. First, firm sizes are larger in Protestant areas, likely reflecting higher quality entrepreneurs (Lucas 1978, Oi 1983), a higher degree of specialization (Smith 1776), and/or higher levels of human capital of the workforce (Kremer 1993). Second, exploiting special cross tabulations of rates of entrepreneurship by religious denomination *within* counties, we show that Protestants are more likely to be entrepreneurs conditional on average firm size. Regressions analysis shows that denominational differences in rates of entrepreneurship are largely explained by denominational differences in literacy rates within county.

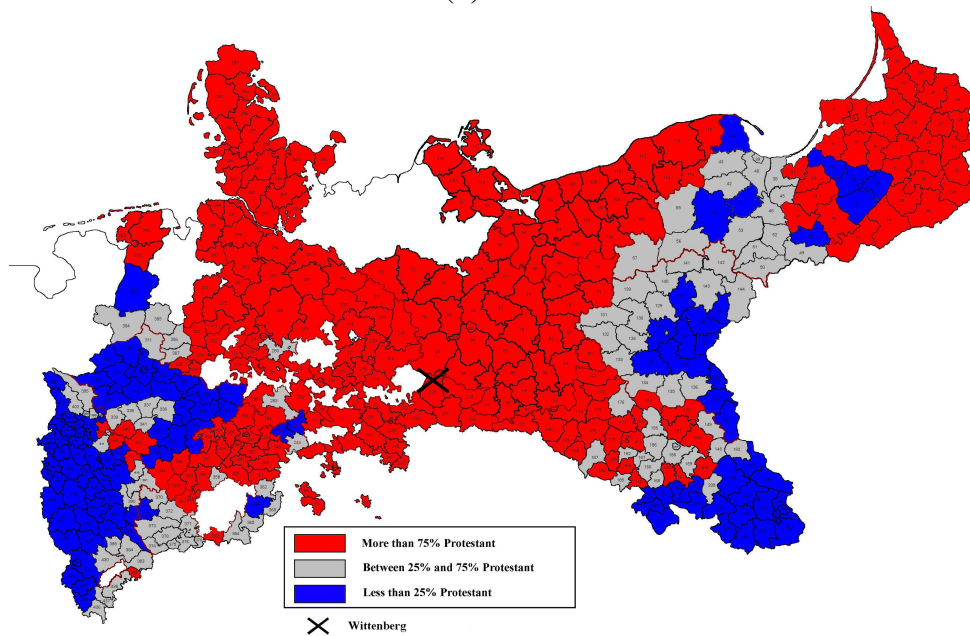
The results of this analysis thus adds to the evidence that denominational differences in economic outcomes do exist. The denominational differences in entrepreneurship reflect differences in human capital acquisition by Protestants vs Catholics that came about as unintended side effects of Luther's postulations to enable everyone to read the Gospel.

Figure 1: Protestantism in 19th Century Prussia

(a) 1816



(b) 1871



1871 map does not display Hohenzollern-Sigmaringen (Prussian exclave in the South of Germany).

Table 1: PROTESTANTISM AND ENTREPRENEURSHIP: PRUSSIAN TOWNS, 1819

Dependent variable:	Masters per capita (1)	Apprentices per capita (2)	Masters per capita (3)	Masters per capita (4)	Servants per capita (5)
% Protestants	.007 (.003)**	.004 (.004)	.010 (.003)***	.008 (.003)***	-.018 (.010)*
Geographic controls			yes	yes	yes
% Buildings w/ massive walls				-.013 (.004)***	-.001 (.012)
Looms per capita				-.023 (.010)**	.060 (.033)*
Retailers per capita				.132 (.093)	-.029 (.297)
Obs.	156	156	156	156	156
R ²	.040	.007	.085	.192	.088

Coefficients and standard errors from ordinary least squares (OLS) estimation. Standard errors in parentheses: * significance at ten, ** five, *** one percent. Data for 156 Prussian towns from the 1816 Population Census and the 1819 Occupation Census; see main text and appendix for details.

Table 2: MANUFACTURING EMPLOYMENT AND PLANT SIZE: PRUSSIAN COUNTIES, 1882

Sector	Share of employment in sector (in %) (1)	Average plant size in sector (2)	Rank of employment in sector (3)	Rank of plant size in sector (4)
Mining, steel mills, extraction of salt and peat	10.08	128.22	4	2
Quarrying of stone, sand and clay	4.91	10.21	8	3
Metal processing	8.76	3.38	6	10
Manufacture of machinery and equipment	4.02	3.49	9	9
Chemical industry	0.79	5.89	13	6
Industry of luminescent substances, fats, and resin	0.47	5.74	14	7
Textiles	10.57	2.47	3	13
Paper and leather industry	3.08	3.51	10	8
Wood and carving industry	7.68	2.37	7	14
Food, beverages and tobacco	9.96	2.97	5	11
Clothing and cleaning industry	21.29	1.55	1	15
Construction	14.62	6.80	2	5
Book and art print	0.97	7.16	12	4
Artistic production	0.34	2.75	15	12
Undefined businesses	2.46	134.40	11	1
Total manufacturing	100.00	3.08		

Data for 452 Prussian counties from the 1882 Occupation Census; see main text and appendix for details.

Table 3: PROTESTANTISM AND ENTREPRENEURSHIP: PRUSSIAN COUNTIES, 1882

	(1)	(2)	(3)
% Protestants	-0.054 (.011)***	-0.039 (.012)***	-0.077 (.014)***
% of labor force in mining	-0.690 (.031)***	-0.469 (.049)***	-0.440 (.049)***
% Age below 10		-0.285 (.181)	-0.273 (.177)
% Jews		.036 (.313)	.149 (.306)
% Females		.564 (.321)*	.651 (.370)*
% Born in municipality		-0.053 (.041)	.047 (.056)
% Of Prussian origin		.001 (.154)	-0.090 (.158)
Average household size		2.443 (1.543)	-0.332 (1.598)
ln(Population size)		-1.186 (.722)	-1.781 (.714)**
Popul. growth 1867-1871 (in %)		-0.422 (.099)***	-0.288 (.100)***
Geographic controls			yes
Obs.	452	452	452
R ²	.520	.607	.632

Dependent variable: % entrepreneurs in manufacturing workforce.
Coefficients and standard errors from ordinary least squares (OLS) estimation.
Standard errors in parentheses: * significance at ten, ** five, *** one percent.
Data for 452 Prussian counties from the 1871 Population Census and the 1882 Occupation Census; see main text and appendix for details.

Table 4: MANUFACTURING EMPLOYMENT AND DENOMINATION: PRUSSIAN COUNTIES, 1882

Denomination	Population share (1)	Share in manufacturing employment (2)	Share among manufacturing entrepreneurs (3)	Rate of entrepreneurship (4)	Literacy rate (5)
Protestant	64.18	64.70	65.13	37.71	90.80
Catholic	34.48	34.23	33.11	33.14	84.61
Jew	1.14	0.90	1.55	64.54	92.47

Column 1 refers to the total population. Columns 2-4 refer to the working population. Column 5 refers to the population aged 10 years or older. Data for 452 Prussian counties from the 1871 Population Census and the 1882 Occupation Census; see main text and appendix for details.

Table 5: THE PROTESTANT LEAD IN ENTREPRENEURSHIP: PRUSSIAN COUNTIES, 1882

	(1)	(2)	(3)	(4)	(5)
% Protestants in total manuf. employment	1.007 (.004)***	1.014 (.004)***	1.009 (.004)***	1.000 (.005)***	1.013 (.006)***
% of labor force in mining	.085 (.012)***	.084 (.011)***	.025 (.016)	.023 (.020)	.024 (.020)
<i>Literacy rate of Protestant adults</i>		.129 (.042)***	.089 (.041)**	.094 (.045)**	.074 (.045)
<i>Literacy rate of Catholic adults</i>		-.081 (.021)***	-.075 (.020)***	-.077 (.020)***	-.084 (.021)***
% Entrepreneurs in total manufacturing employment			-.085 (.017)***	-.096 (.018)***	-.082 (.018)***
% Age below 10				.223 (.076)***	.185 (.077)**
% Jews				.184 (.116)	.133 (.115)
% Females				-.190 (.122)	-.227 (.140)
% Born in municipality				-.037 (.018)**	-.057 (.021)***
% Of Prussian origin				-.210 (.057)***	-.186 (.059)***
Average household size				-1.810 (.577)***	-1.158 (.605)*
ln(Population size)				.100 (.266)	.282 (.269)
Popul. growth 1867-1871 (in %)				-.147 (.037)***	-.173 (.038)***
Geographic controls					yes
Obs.	452	452	452	452	452
R ²	.993	.993	.994	.994	.995

Dependent variable: % Protestants among entrepreneurs in manufacturing workforce.
Coefficients and standard errors from ordinary least squares (OLS) estimation.
Standard errors in parentheses: * significance at ten, ** five, *** one percent.
Data for 452 Prussian counties from the 1871 Population Census and the 1882 Occupation Census; see main text and appendix for details.

Appendix

A Data Appendix

The Prussian Statistical Bureau was founded in 1805 under King Friedrich Wilhelm III. As early as 1816, the Prussian Statistical Bureau collected data covering all Prussian counties. Prussia was among the first states worldwide to collect census data. For comparison, the first census in the United States took place in 1790, but covered only the Eastern territories of America.

Demographers have found county-level data for 19th century Prussia to be a unique source of highest-quality data for analyses at a disaggregate level (cf. Galloway, Hammel, and Lee 1994).

In the sequel, we will describe in more detail the following data sources: first, the 1816/19 Population/Occupation Census that we use to study entrepreneurship in the pre-industrial era. Second, the 1871 Population Census and the 1882 Occupation Census that we use to study entrepreneurship in the industrial era.¹²

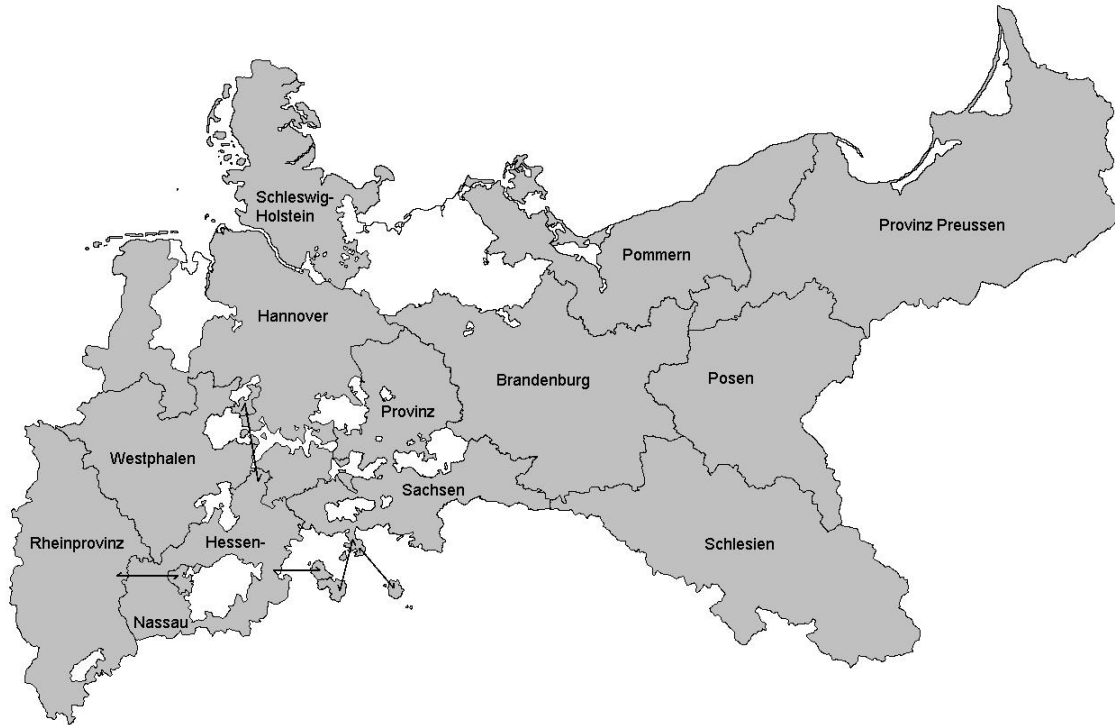
Before discussing the different data sources in more detail, we will briefly give an overview of Prussia as of 1871. In 1871, Prussia consisted of 452 counties,¹³ structured in 35 districts and 11 provinces. Table 6 lists the names of the Prussian provinces and districts, together with a count of counties in each district.

¹²After 1871, some bigger counties were split in two separate counties; we aggregated the Occupation Census data up to the 452 counties existing in 1871.

¹³We combined Communionharz, a tiny county of 690 inhabitants, with neighboring county Zellerfeld, as the Occupation Census does.

Figure 2: 19th Century Prussia

(a) Prussian provinces in 1871



(b) Prussian districts in 1871

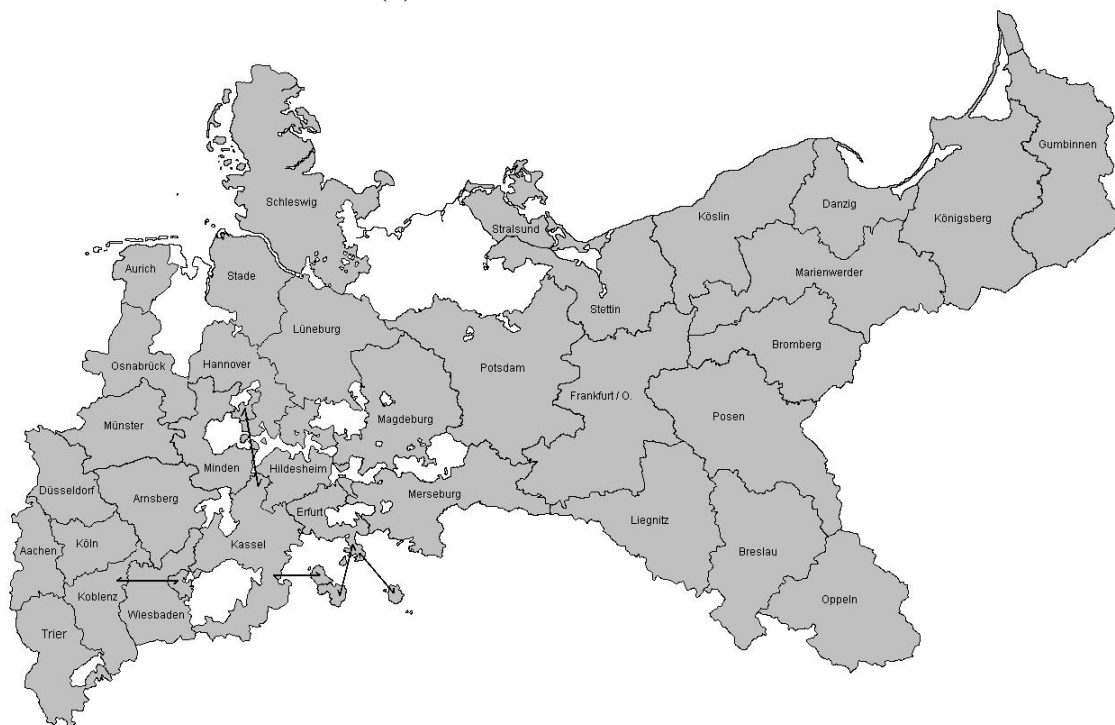


Table 6: PRUSSIAN PROVINCES AND DISTRICTS, 1871

Province (Provinz)	District (Regierungsbezirk)	Counties (Kreise)
Brandenburg	Frankfurt/Oder	18
	Potsdam	16
Hannover	Aurich	3
	Hannover	7
	Hildesheim	7
	Lüneburg	7
	Osnabrück	5
	Stade	8
Hessen	Kassel	23
	Wiesbaden	12
Hohenzollern	Hohenzollern	4
Pommern	Köslin	12
	Stettin	13
	Stralsund	4
Posen	Bromberg	9
	Posen	18
Provinz Preussen	Danzig	8
	Gumbinnen	16
	Königsberg	20
	Marienwerder	13
Rheinprovinz	Aachen	11
	Düsseldorf	21
	Koblenz	13
	Köln	11
	Trier	13
Provinz Sachsen	Erfurt	10
	Magdeburg	15
	Merseburg	17
Schlesien	Breslau	24
	Liegnitz	20
	Oppeln	19
Schleswig-Holstein	Schleswig	20
Westphalen	Arnsberg	14
	Minden	10
	Münster	11

Figure 2 shows the Prussian provinces and districts as of 1871. Note that the white-colored areas “inside” Prussia are independent states of the German Empire, e.g. Mecklenburg in the North of Germany, at the Baltic Sea, surrounded by Schleswig-Holstein, Hannover, Brandenburg and Pommern. Prussia as of 1816 was smaller. Figure 1 in the main text shows Prussia in the 1816 boundaries.

1816/19 Population/Occupation Census

1816 is the earliest year for which the Prussian Statistical Office, founded in 1805, collected detailed data at the county and municipality level (the data are published in Mützell 1825). It is thus the earliest year which lends itself to a micro-econometric analysis of entrepreneurship and religion. To our knowledge, these data have not been used for econometric analyses before. The 1816 data refer to 172 large and medium-sized towns.¹⁴

The data contain population counts, separately by religion (Protestant, Catholic, Jewish) that allow us to compute the share of Protestants. Note that the fraction of Jews was very small at about 1 percent of the Prussian population.

Different from the 1882 Occupation Census, the list of occupations is not exhaustive. For this reason, in defining indicators of occupational structure, we normalize occupation counts by the total population (or, alternatively, the total adult population) and not by the active labor force.

¹⁴The Prussian statistical office does not explicitly state what the threshold is for being classified as a medium-sized town, but the smallest town (Jülich) had 2,470 inhabitants in 1816. Some counties have missing information on variables of interest. Our estimation sample consists of 156 towns. The Census also contains information on the 357 Prussian counties, but those do not contain detailed occupation information.

1871 Population Census

The 1871 Population Census took place on December 1, 1871. Questionnaires were to be filled out by household heads after personal instruction through an agent of the Prussian Statistical Office. The agent assisted in filling out the questionnaire, where requested, and made sure the information provided was correct. The Census surveyed standard demographic variables such as gender and age, but also religion and literacy.

Religious affiliation was surveyed in four categories: Catholic, Protestant, other Christian denominations, and Jews, which we can use to compute the share of Protestants in county.

Literacy was surveyed for the first time ever in Prussia in 1871. It is measured as the ability to read and write of those who are aged 10 years or older. In the volume detailing the results of the Census, the Prussian Statistical Office attested to the unexpectedly high quality of the literacy question. Only slightly more than one percent of respondents did not respond to the question (captured by our variable "% Missing education info"). The Statistical Office expressed surprise about the fact that more than 10 percent of all males are illiterate, given the authorities' official long-standing educational objectives.

Special cross-tabulations of literacy by denomination allow us to use denomination-specific literacy rates in our regression analysis.

The source of the Population Census data is: Königliches Statistisches Bureau (1874).

1882 Occupation Census

The 1882 Occupation Census collected information on employment and self-employment across two-digit sectors. In analyzing the hierarchical structure (business owners and directors vs. regular dependent employees), we concentrate on the manufacturing sector.

The manufacturing sector (sector B in the 1882 classification) includes mining, con-

struction, and manufacture of metals, machinery, equipment, chemicals, textiles, paper, leather, food products, and wood.

We make use of special cross-tabulations at the county-level containing information on hierarchical positions within occupations, separately by denomination.

The source of the Occupation Census data is: Preussische Statistik, Volume 76b, pp. 232-695 and Vol. 76c, p. 239.

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