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# Was Weber Wrong? A Human Capital Theory of Protestant Economic History\*

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Max Weber attributed the higher economic prosperity of Protestant regions to a Protestant work ethic. We provide an alternative theory, where Protestant economies prospered because instruction in reading the Bible generated the human capital crucial to economic prosperity. County-level data from late 19<sup>th</sup>-century Prussia reveal that Protestantism was indeed associated not only with higher economic prosperity, but also with better education. We find that Protestants' higher literacy can account for the whole gap in economic prosperity. Results hold when we exploit the initial concentric dispersion of the Reformation to use distance to Wittenberg as an instrument for Protestantism.

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\* The idea that the rise of Protestantism may have fostered human capital accumulation in Europe stems from our discussions with Paul E. Peterson, who again traces the idea back to a late-1960s University of Chicago seminar by C. Arnold Anderson and Mary Jean Bowman. We have received substantive comments in discussions in seminar presentations at Ifo Institute Munich, Aarhus Business School, ZEW Mannheim, the theological and economics faculties of the University of Munich, the University of Zurich, the Third Christmas Conference of German Expatriate Economists, WZB Berlin, and the Max Planck Institute for Research in Collective Goods in Bonn. Support has come from the Program on Education Policy and Governance of Harvard University. Erik Hornung and Martin Hofmann provided capable research assistance. We are grateful to all of them.

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## I. Introduction

In his seminal work that is considered a key founding stone of sociology, *The Protestant Ethic and the Spirit of Capitalism*, Max Weber [1904/05] (2001) suggested that it is a “Protestant ethic” that can account for the greater economic affluence of Protestants relative to Catholics. To this sociological theory, we offer a simple alternative economic theory based on the standard human capital model. We suggest that Luther’s demand that all Christians should be able to read the Gospel by themselves led to increased literacy among Protestants that, incidentally, could then also be used in economic activities.

We go on to present county-level evidence from the very perspective that Weber had, namely Weber’s native Prussia in late 19<sup>th</sup> century, to show that there is indeed a significant positive association between Protestantism and economic success. We then show that there is also a significant positive association between Protestantism and literacy. Intriguingly, after controlling for the positive effect of literacy on economic success, there remains no significant difference in economic success between Protestant and Catholic counties. Human capital can account for the whole denominational difference in economic affluence, leaving little scope for any denomination-based work ethic to explain. Furthermore, we argue that the near concentric diffusion of Protestantism around Luther’s city of Wittenberg in Lutheran times allows us to identify exogenous variation in Protestantism in late 19<sup>th</sup> century. We find that even when instrumented by distance to Wittenberg, a county’s share of Protestants increases literacy, which in turn yields higher economic progressiveness. The results suggest that while religious affiliation may indeed have had economic consequences, this may have been for reasons unrelated to any ethical disposition.

It is well known that Luther opposed the Roman Catholic practice of reading out the Gospel in the scholarly language of Latin, and that he was the first to translate the Bible into his native German, for everybody to read. What is less well known today is that he also explicitly favored the advancement of universal schooling, for the simple reason that people had to be literate in order to be able to read God’s Word, the Bible. In light of human capital theory, the ensuing literacy has the unintended side effect in the economic realm to increase people’s productivity and thus economic prosperity.<sup>1</sup> In this view, religion in the form of Protestant denomination may well be associated with economic affluence, but not because of any difference in work ethic, but rather incidentally because it furthered the creation of human capital. In the next section, we introduce this effect into a simple model of human capital.

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<sup>1</sup> In a closely related argument, Botticini and Eckstein (2005, 2006) suggest a human capital interpretation of Jewish history, where the ultimate root of Jewish economic prosperity as merchants lies in a centuries-old Judaic rule that required male Jews to be able to read the Torah in the synagogue, and to teach the reading of the Torah to their sons.

To study the relationship between Protestantism, education, and economic prosperity empirically, 19<sup>th</sup> century Prussia is the natural place to look at. First, the Prussian territory is the birthplace of Martin Luther, where the Reformation was initiated and where his doctrine diffused in its purest form. Second, Prussia is also Max Weber's birthplace, and the situation in late 19<sup>th</sup> century is the one he had in mind when formulating his thesis. Third, Prussia is a well-defined region with rather uniform laws and institutional settings, so that empirical investigation is not hampered by institutional heterogeneity. Fourth, Prussia is reasonably well divided between Protestants and Catholics, at roughly two thirds to one third of the population in 1871, so that no denomination constitutes just a small minority, and Prussia had a long tradition of freedom of religion. Fifth, the Prussian Statistical Office collected an impressive amount of data, available at the level of 452 counties. It is generally accepted that Prussian orderliness and thoroughness yielded high-quality data even in the 19<sup>th</sup> century, which are available in archives to these days. Important for our purposes, the 1871 Prussian Census is the first instance surveying literacy of the whole population. We thus do not have to rely on data from selective samples like military recruits, which provide only a limited picture of the population at large.

The use of Prussian county data allows us to go beyond the existing empirical literature on the Weber thesis, which mostly uses cross-country variation. Iannaccone (1998) concludes that the empirical literature on the relationship between Protestantism and economic outcomes largely rejects the empirical validity of Weber's argument. In fact, studies based on cross-country data seem to show no relationship at all between Protestantism and the rise of industrial capitalism. Delacroix and Nielsen (2001) conclude that there is no clear-cut pattern in the adoption of capitalism across European countries in 19<sup>th</sup> century with respect to the dominant religion.<sup>2</sup>

A broader context of papers studies the association between religion and economic outcomes. Quite generally, religion is an important expression of culture (Guiso, Sapienza, and Zingales 2006), and as such is viewed as a possible fundamental cause of economic growth. Thus, Barro and McCleary (2003; 2005) study the association between different religions and economic growth. In a study concerned with the proper controlling for effects of economic institutions, Acemoglu, Johnson, and Robinson (2001, p. 1388; 2005, p. 419) find no effect of religion on growth in a cross-country setting.

Any cross-country study is plagued by the difficulty of disentangling the effect of religion from other possible fundamental causes of economic prosperity that vary across countries, such as institutions and geography. By looking at regional data within Prussia, all our observations are exposed

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<sup>2</sup> In a growth model calibrated to England, Cavalcanti, Parente, and Zhao (2006) suggest that Protestantism could at best account for only slight delays in the start of industrialization.

to the same institutional and legal setting. Similarly, problems of geographical variation are substantially smaller within Prussia than on a global scale, and we control for a rich set of geographical features. We can even include district fixed effects, using only variation across counties within each district. In effect, we hold institutions and geography constant and ask whether there is a role for religion in economic outcomes.<sup>3</sup>

In contrast to the cross-country findings, we do find a significant association between Protestantism and economic prosperity when using county-level variation in late 19<sup>th</sup>-century Prussia, confirming Weber's descriptive observation. But we also show that there is a strong association between Protestantism and literacy, confirming the basic tenet of our suggestion that Luther's preaching advanced education. When Protestantism and literacy are entered jointly in a "horse race" to explain economic prosperity, the association between Protestantism and economic outcomes vanishes, and the whole effect is absorbed by a significant association between literacy and economic outcomes.<sup>4</sup> Thus, Protestantism does have no independent association with economic prosperity once differences in literacy are accounted for. The interpretation of these findings that would be most favorable to Weber's thesis would be that the work ethic works exclusively via human capital accumulation, a thought not explicitly contained in Weber's work.

However, we argue below that for several reasons, the higher literacy of Protestant counties is exogenous to ethics, as well as to economic outcomes. Not only was literacy an unintended side effect of Luther's Gospel-reading aims, unrelated to a work ethic or any other economic thought. Also, most of the denominational variation found in 19<sup>th</sup> century can be traced back to denominational choices of local rulers during Reformation in 16<sup>th</sup> and early 17<sup>th</sup> century, mostly motivated by religious conviction and power politics vis-à-vis the Pope and the German Emperor. Furthermore, Protestantism spread out across Prussia roughly in circles around Luther's city of Wittenberg, whose role as the birthplace of Protestantism was strongly favored by a particularly vicious example of indulgence practices.

We use this concentric diffusion of Protestantism to obtain exogenous variation in counties' shares of Protestants in a "double-IV" estimation. Using distance to Wittenberg as an instrument, we can identify an effect of Protestantism on literacy, which is then found to advance economic outcomes. In

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<sup>3</sup> In the discussion of "fundamental" causes of economic growth, the cross-country finding by Glaeser, La Porta, Lopez-de-Silanes, and Shleifer (2004) that human capital may be a more basic source of growth than institutions carries particular interest for our study.

<sup>4</sup> The finding of an important role of education is consistent with a long literature stressing the importance of human capital for historical economic development in general; cf., e.g., Easterlin (1981), Goldin (2001), Lindert (2003), and Galor (2005). Landes (1969) stresses that education was a key ingredient for the transfer of industrial leadership from Britain to Germany at the end of the 19<sup>th</sup> century. For a recent review of the vast literature on the role of human capital in modern economic growth, cf. Hanushek and Wößmann (2007).

this model, identification comes from the assumption that Luther's Reformation was an exogenous event, generating a random shock that spread concentrically around Wittenberg. We provide several pieces of evidence showing that the adoption of the Reformation was indeed unrelated to the economic or educational reality of the time.

Combining the facts about the historical origin of the geographical variation in Protestantism with the results of our county-level estimations, we argue that the variation in literacy used in this paper is exogenous both to any work ethic and to economic outcomes. We also show that literacy had the same effect on economic outcomes in Protestant and Catholic regions, which does not allow for a role of schools in economic advancement solely through their potential transmission of a differential work ethic. As a consequence, the higher economic prosperity of Protestant counties has to be viewed as a consequence of higher human capital (unintended during its adoption), but not of work ethic.

Thus, the evidence favors a human capital theory of Protestant economic prosperity over Weber's theory. The driving force of the higher economic prosperity of Protestants in late 19<sup>th</sup> century Prussia was education. Religion in the sense of an *ethical* disposition towards economic issues did *not* have a significant effect on economic outcomes. Of course, without the Reformation, Protestants would not have acquired more human capital relative to Catholics. In this sense, religion *was* important for economic success, because without intention it involved an uneven accumulation of human capital.

As a final addition, we use individual-level data from contemporary Germany to show that the same pattern between religious denomination, education, and income holds in Germany to these days. The use of contemporary data allows us to go from county-level to individual-level data and to use labor income as an individual-level measure of economic success. Protestants earn more than Catholics even in the late 1990s, but again, this can be fully traced back to their higher level of education.

On a cautionary note, we stress that there is considerable controversy about what Weber's main hypothesis about Protestantism and the development of capitalism actually is. However, it goes undisputed that the core of his argument is that there is a difference in ethical disposition between Protestants and Catholics that has a significant bearing on economic outcomes. Furthermore, a "common interpretation" (Delacroix and Nielsen 2001) has developed which – rightly or wrongly – interprets Weber's thesis as the view that the rise of industrial capitalism was facilitated in Protestant regions. This is the basic relationship that we test in this paper. In this sense, the paper does not necessarily test Weber's theory of a Protestant work ethic proper, but rather its common interpretation, namely that there is a relationship between Protestantism and economic success.

The structure of the paper is straightforward. Section II provides the theoretical foundation. Section III presents our data and empirical results. Section IV concludes.

## II. Theory of Protestant Economic History

This section presents two alternative theoretical approaches for understanding the history of Protestants' relative economic progressiveness. We first discuss Weber's thesis based on a Protestant work ethic. We then derive our alternative explanation, a simple human capital theory of Protestant economic history based on Luther's request for literacy as a prerequisite to reading the Bible.

### A. *Weber's Thesis and Its Criticism*

In his *The Protestant Ethic and the Spirit of Capitalism*, Max Weber [1904/05] (2001) proposed the "most famous link between culture and economic development" (Acemoglu, Johnson, and Robinson 2005, p. 401), namely that the Protestant Reformation was instrumental in facilitating industrial capitalism in Western Europe. Weber [1904/05] (2001, p. 3) provides the object of his investigation in his very first sentence:

"A glance at the occupational statistics of any country of mixed religious composition brings to light with remarkable frequency a situation which has several times provoked discussion in the Catholic press and literature, and in Catholic congresses in Germany, namely, the fact that business leaders and owners of capital, as well as the higher grades of skilled labor, and even more the higher technically and commercially trained personnel of modern enterprises, are overwhelmingly Protestant."

Actually, the descriptive observation of greater economic prosperity of Protestants seems to have been the subject of a long-running discussion, traceable at least as far back as to *Menschenfreund* (1773).

But the particular feature of Weber's main thesis is that it is the specific *ethic* of Protestantism which affected economic outcomes. Weber argued that the Reformation introduced the crucial notion of the "calling" ("Beruf"), with the current use of the word originating in Luther's translation of the Bible. The notion of the calling carries the suggestion of a religious conception, the sanctification of labor to a task set by God. This notion, according to Weber, created a particular Protestant work ethic, which – in contrast to the Catholic ideal of surpassing worldly morality in monastic asceticism – valued the fulfillment of worldly duties as the highest moral achievement. According to Weber [1904/05] (2001, p. 40), "The only way of living acceptably to God was ... solely through the fulfillment of the obligations imposed upon the individual by his position in the world. That was his calling." Weber explicitly traces this central notion back to Luther, while later it was most rigorously developed in certain Protestant communities, such as Calvinism, Puritanism, Methodism, and Baptism.<sup>5</sup>

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<sup>5</sup> In Germany, there were only two major Protestant fractions, Lutherans and Reformists. In Prussia, those were merged in 1817 into the "Protestant Church in Prussia" (*Evangelische Kirche in Preußen*).

The Protestant work ethic approved the accumulation of wealth and thus, according to Weber's argument, provided the moral foundation for capitalist industrialization. Although success in a calling was not seen as a means to please God – which, according to Luther's *Doctrine of Justification*,<sup>6</sup> was beyond human capability and solely depended on God's grace – it became regarded as a sign of being among the select group that God will save from damnation (cf. Giddens' introduction to Weber 2001). Thus, Weber provides an ethics-based theory for economic development.

The exact interpretation and precise mechanisms of the Weber thesis remain hotly debated. There are literally libraries full of books interpreting and discussing his work. One mechanism traced back to Weber's work is that the work ethic drives Protestants to simply work harder. Another mechanism is that their belief system compels them to save more in order to defer gratification, which transforms into investments and thus higher productivity in the longer run. There is also a lot of controversy whether Weber was trying to explain economic disparities existent at his time, or whether he was just trying to explain the initial origin of capitalism. Because more than a hundred years of exegesis have proven futile in settling these issues, we resort to aiming our analysis at what has been called the "Common Interpretation" (Delacroix and Nielsen 2001) of the *Protestant Ethic* which has taken a life of its own, namely the simple emphasis of a "connection between Protestantism and economic progress" (Coleman's 1959 introduction to Samuelson [1957] 1993) in general.

Given its fundamental importance, Weber's thesis has witnessed a stream of criticism that has not stopped for a century. Among others, he was criticized as misinterpreting Protestant doctrine, Catholic doctrine, and the development of specific forms of "capitalism" (see Giddens' introduction to Weber 2001 for a summary). Many casual observers also felt unconvinced by the idea that denominational differences indeed materialize in substantially different work ethics, at least in within-German comparisons where denominational affiliations hardly reflect deliberate personal choices but rather follow regional patterns. Yet, by surviving for more than a hundred years, the Weber thesis has shown remarkable resilience against its numerous critics.

Whatever the exegetic merits and shortcomings of Weber's thesis, our interest is a purely empirical one, investigating the real-world validity of the argument. And it is worth noting that this empirical interest does not distinguish us from Weber [1904/05] (2001, p. xl)<sup>7</sup> himself, who explicitly viewed his

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<sup>6</sup> This central doctrine of Luther's theological considerations, which declared that man himself could do nothing and that everything is bestowed by God's grace, in itself creates some uneasiness towards the Weber thesis that it should be particularly the Protestants whose ethic drives them to higher worldly objectives than Catholics.

<sup>7</sup> Authors' own translation from the German original, since the existing English translation ("these thoroughly serious studies") misses Weber's main statement in this case.



work as “thoroughly matter-of-fact analyses of studies which are strictly empirical in their intention”. However, to date we are not aware of a thorough empirical analysis of the Weber thesis at the sub-national level.<sup>8</sup>

Although – as Weber’s introductory sentence quoted above already shows – Weber based his thesis explicitly on within-country comparisons, the most influential empirical evidence to date is cross-country. The previous cross-country research seems to refute even “Weber’s stylized account of European economic history, demonstrating that ... economic progress was uncorrelated with religion” (Iannaccone 1998, p. 1475). In a thorough study of the historical cross-country pattern in 19<sup>th</sup>-century Europe, Delacroix and Nielsen (2001, p. 509) conclude that Weber’s purported link between Protestantism and economic outcome is a “myth”, “derived largely from selected anecdotal evidence”.<sup>9</sup> However – as even Delacroix and Nielsen (2001, pp. 544-545) duly concede – there are substantial limitations to the use of cross-national data because of substantial regional heterogeneity in religious denomination and economic development, and even more because cross-country comparisons are notoriously plagued by the difficulty of netting out the effects of other fundamental causes of economic development, such as institutions and geography (cf. Acemoglu, Johnson, and Robinson 2005).

At least, regular common perceptions of systematic denominational differences in economic and educational backwardness within Germany stand in contrast to the cross-country pattern. Weber [1904/05] (2001) himself refers to regular public discussions at the “Katholikentag”, regular official meetings of Catholic laymen in Germany (the “Catholic congresses in Germany” cited above), on the general public feeling that Catholics were economically disadvantaged relative to Protestants at his time. The very same discussions of Catholic backwardness actually reemerged at the “Katholikentag” meetings and in the Catholic press in the 1950s and 1960s (see, e.g., Herder-Korrespondenz 1954; Erlinghagen 1965), suggesting that the Weber observation was indeed viewed as an important stylized fact in Germany both in the late 19<sup>th</sup> century and in the mid 20<sup>th</sup> century. But a thorough empirical analysis of the respective patterns that Weber had in sight when making his argument, from Germany – the heartland of the Reformation – is still missing. Still, the historical data are available, and modern computational facilities allow a thorough sub-national empirical analysis.

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<sup>8</sup> The only explicit evidence that Weber put forward is Offenbacher’s (1900) descriptive exposition for the region of Baden, but even this piece of evidence has been shown to have substantial flaws (cf. Becker 1997).

<sup>9</sup> Early critics of the Weber thesis had already pointed out historical inconsistencies in the argument, arguing that most capitalist institutions preceded the Reformation (Tawney 1926), that early leaders of the Reformation were very much uninterested in or even hostile to economic issues and ignorant of the working of capitalist institutions (Samuelson [1957] 1993), and that several selective regional examples of economic development went counter to the Weber thesis (cf. also Iannaccone 1998 and the additional references cited therein).

## ***B. Luther's Educational Postulations***

It is a highly acclaimed fact that Martin Luther was the first to translate the Bible into his native German. To spread God's Word, he urged for a move away from the scholarly language of Latin towards German, which could be understood by everyone. What is less well known is that Luther also very explicitly urged for an expansion of education (cf. especially Rupp 1996a, 1996b, 1998). Quite obviously, if one wants to read the Bible, one must be able to read. Very early on, in what is generally viewed his first major pamphlet that signified the breakthrough of the Reformation among the general public, *To the Christian Nobility of the German Nation Concerning the Reform of the Christian Estate*, Luther (1520, pp. 461-462) explicitly demanded that every town should have both a boys' and a girls' school where every child should learn to read the Holy Scriptures, in particular the Gospel.

Luther's call to teach everyone in order for them to be able to read God's Word by themselves is the key feature for our alternative theory of the relative economic affluence of Protestants, because – as a mere coincidence – the literacy that was created also had a significant use in the economic sphere. It should be stressed, though, that Luther never had an economic use in mind. The increased education of Protestants was purely religiously motivated in its instrumental function for the dissemination of the Gospel among the population; instruction, learning, education, and scientific engagement did not carry a value of their own for Luther (Rupp 1998, p. 173). Thus, Rupp (1996b, p. 618) states quite clearly that “Luther's prime concern in this area was the creation of elementary schools for the people as a means of providing all Christians with access to the word of God, as contained in the Bible”.

This relates both to the authority of a book, the Bible, for Protestantism and to Luther's general theological tenet of the universal priesthood of all believers. As Pelikan (2005, p. 171) put it:

“The teaching of the New Testament, Luther insisted, was meant to be read and to be obeyed not only by the religious professional but by the artisan at his job and the mother at her household duties. That is part of what he meant by ‘the universal priesthood of believers’ and was one reason that he devoted himself to producing a translation of the Bible which spoke to the people in their own language.”

Rather than relying on injunctions by specifically ordained priests, ceremonial exercises, and sacerdotal imagery, each Christian was urged to read the sacred text for himself or herself. This required breaching the clerics' privilege of education in favor of universal basic education – a demand truly revolutionary for the time (Rupp 1996b). Rupp (1998, p. 172) summarizes the basic line of reasoning:

“because the divine revelation had quasi materialized itself in the Holy Scripture, each Christian, each Protestant believer was indispensably referred to getting to know and reading this scripture. But this, in turn, made it necessary that everybody could indeed read this scripture – and this, of course, had corresponding efforts of education in schools, which had still to be established, as its precondition...”

The next step in our argument is that such educational expansion was useful beyond religion, in our case for economic productivity. As Rupp (1996b, p. 613) points out,

“Such a call for the launching of educational efforts, motivated at first by religious considerations, naturally released other potentialities beyond the strictly religious sphere: because of its inherent formal structures, the work of education, once begun, was no longer tied exclusively to religion but could also develop naturally in other areas. This was a fact of exceptional importance to the history of Protestantism. In this way, Protestantism became an educational factor of the first order. Since Luther’s day and right up to the present, it has produced countless poets and thinkers, scientists and philosophers who have left their mark upon the life of the intellect, and not only in Germany.”

The linguistic and methodical skills created by the teaching of God’s Word – reading, understanding, and knowing the Word, including its exegetical comprehension – are disposable in relation to other tasks that go beyond the religious realm (Rupp 1996a, p. 38). But these alternative uses of the acquired education are purely unintentional and of no value to Luther and his Reformist circles. Economic or even capitalist aspects were not a key issue in the Reformation, a fact that Weber [1904/05] (2001, pp. 48-49) was also well aware of: “We have continuously to deal with aspects of the Reformation which must appear to the truly religious consciousness as incidental and even superficial.”

It is well accepted in the study of German educational history that the Reformation was of exceptional importance to the development of the German school system. Thus, Flitner [1941] (1954, pp. 33-43) names Luther and the Reformation as one of four “sources” of elementary schooling, and Spranger (1949, pp. 15-17) counts the Reformation’s religious teaching of children as one of the three “roots” of the German elementary school (see also Reble 2002, pp. 81-94).<sup>10</sup> It is thus no surprise that Luther’s closest collaborator in the Reformation, Philipp Melanchthon, quite early on in his career was bestowed the honorary title of *Praeceptor Germaniae*, teacher of the Germans (cf. Rupp 1996b).<sup>11</sup>

Luther addressed his educational demands at two different addressees. First, as is most evident in a 1524 pamphlet, he pressured the Protestant rulers to build and maintain schools. Second, most evident in a 1530 sermon, he demanded from each individual, especially the parents, to put emphasis on education and to send children to school.

In his pamphlet *To the Councilmen of All Cities in Germany That They Establish and Maintain Christian Schools*, Luther (1524) assigned the duty of operating schools to the rulers and territorial

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<sup>10</sup> In the post-Luther era of the Counter-Reformation, it was particularly the Jesuits who tried to advance education also among the Catholic population. However, as our evidence below shows, this was far less encompassing than the Protestant urge for education.

<sup>11</sup> However, whereas Luther’s main concern was with the literacy taught in elementary schooling, Melanchthon was most concerned with advanced schools and universities (Rupp 1996b).

authorities. If parents did not take care of schools, Luther argued, it would be the duty of the rulers to incur the effort and cost of running schools. He explicitly puts the blame for the lack of educated people on the authorities. In his practical implementation of educational reforms, Melancthon also made the authorities responsible for organizing the new education system (cf. Rupp 1996b).

But in his *Sermon on Keeping Children in School*, Luther (1530, p. 526) also extended his educational postulations to every individual Christian:

“I see that the common people are dismissive to maintaining the schools and that they withdraw their children from instruction altogether and turn solely to the care for food and bellies, and besides they either will not or cannot consider what a horrible and un-Christian thing they are doing and what great and murderous harm they are doing everywhere in so serving the devil.”

Thus, in line with the universal priesthood of all believers, all Christians are called to ensure that their children receive a decent education.

### ***C. A Human Capital Theory of Protestant Economic History***

The supreme importance of education for economic prosperity receives particular emphasis in the economics profession since the emergence of the theory of human capital in the early 1960s. The key idea of this theory is that education is an investment which yields higher labor-market earnings because it increases productivity. Given Luther’s educational postulations discussed in the previous section, this reasoning provides a simple alternative theory for the historical economic success of Protestant regions: Protestants acquired more schooling than Catholics for religious reasons, and as a side effect, this higher schooling then transformed into higher economic prosperity.

We can depict the central features of this argument in a very simple model. Consider a utility function that adds non-monetary religious benefits  $r$ , differentiated by denomination  $d$ , to a standard human capital model, e.g. Card’s (1995) simplified version of the Becker (1967) model:

$$U(y, S) = \log(y(S)) + r_d(S) - h(S) \quad (1)$$

where  $y(S)$  denotes average annual earnings with  $S$  years of schooling measuring the benefits of schooling in terms of (labor) earnings, and  $h$  is an increasing convex function measuring the monetary and non-monetary costs of schooling.  $r_d(S)$  captures the non-monetary benefit associated with literacy stressed above, namely the ability to read the Bible.

Assume that individuals choose schooling  $S$  to maximize utility  $U$ . Using the same  $y$  and  $h$  functions across denominations, maximization yields a first-order condition that equates marginal benefits to marginal costs:

$$\frac{y'(S)}{y(S)} + r'_d(S) = h'(S) \quad (2)$$

We follow Card (1995) in making the model operational through linearity assumptions:

$$\frac{y'(S)}{y(S)} = a_i - k_1 S \quad (3a)$$

$$h'(S) = b_i + k_2 S - m_d \quad (3b)$$

$$r'_d(S) = l_d \quad (3c)$$

where  $k_1, k_2 \geq 0$  and subscripts  $i$  denote person-specific intercepts.

Equations (3b) and (3c) contain the two main points of our model extension. The first one is the reduction in costs of schooling  $m_d$  to the individual, which we add to the standard formulation of equation (3b). The idea is that because of the demands to build and maintain schools that Luther addressed at the regional rulers (see Luther's 1524 pamphlet, discussed above), the costs of schooling may be lower for individuals in Protestant regions than in Catholic regions. Therefore, the marginal costs of schooling will show heterogeneity across denominations  $d$ , just like the monetary costs and benefits show heterogeneity across individuals  $i$  in the Card model.

There are three aspects to this reduction in individual marginal costs of schooling. First, due to the higher prevalence of public schools in Protestant regions, the commuting costs to schools will be lower. Second, depending on the incidence on the ruler's financing of the costs of schools, part or all of the financial burden may not have to be carried by the individual in terms of taxes, but may come, e.g., from reduced spending on amenities for the ruler and his protégées. Third, independent of the behavior of the regional ruler, one may also think of Luther's educational postulations as inducing Protestants to view learning as less of a strain and more of an enjoyment. In sum, the marginal costs of schooling will be lower for individuals living in Protestant relative to Catholic regions:

$$m_{prot} > m_{cath} \quad (4a)$$

The second main point of our model extension is that the non-monetary religious benefits  $r$ , which we add to the model, also show heterogeneity across denominations  $d$ , as depicted in equation (3c).<sup>12</sup> Following the discussion of Luther's 1530 sermon above, we can assume that the individual marginal religious benefit of schooling will be higher for Protestants than for Catholics:

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<sup>12</sup> Adding individual heterogeneity in the religious benefits on top of the denominational heterogeneity would not change or add to the main point of our model.

$$r'_{prot}(S) > r'_{cath}(S) \quad \Leftrightarrow \quad l_{prot} > l_{cath} \quad (4b)$$

Presumably,  $l_{cath}=0$ , because Catholic doctrine had it that individuals should rely on their priests to teach them the Word of God, which is anyways to be read in Latin only. By contrast, Luther's postulations mean that Protestants receive a positive religious (non-monetary) benefit from being literate,  $l_{prot}>0$ , because this allows them to read the Word of God themselves, in particular after Luther had provided the German translation of the Bible. In essence, this structure means that even though the marginal monetary benefits to education may be the same across denominations, marginal total benefits to human capital investment are higher for Protestants.

With equations (2)-(4), the optimal level of schooling is given by

$$S^* = \frac{l_d + m_d + a_i - b_i}{k_1 + k_2} \quad (5)$$

It follows directly from (4) and (5) that in optimum, average education will be higher for Protestants than for Catholics:

$$S^*_{prot} > S^*_{cath} \quad (6a)$$

and, with the basic human capital idea of a positive marginal returns to education  $y'(S)>0$ , that average income will be higher for Protestants than for Catholics:

$$y^*_{prot} > y^*_{cath} \quad (6b)$$

The latter is a simple side effect emanating from the fact that due to their lower costs and higher non-monetary benefits of literacy, Protestants will choose a higher level of education, which then also translates into higher productivity and earnings in the market.

This equilibrium is illustrated in Figure 1. First, religion shifts the marginal benefit curve. The religious benefits to education shift the Protestant total marginal benefits to schooling upwards, so that they reach a higher optimal level of schooling. Second, religion also shifts the marginal cost curve. Marginal costs of schooling are lower for individuals living in Protestant regions, further increasing the equilibrium level of schooling chosen in Protestant regions. As depicted in Figure 1, these shifts may mean that optimal years of schooling jump beyond the level necessary to reach literacy (say, 4 or 5 years) for the average Protestant relative to the average Catholic.

### III. Evidence on Protestantism, Education, and Economic Outcomes

This section provides an empirical analysis of the associations between Protestantism, literacy, and economic progressiveness in late 19<sup>th</sup>-century Prussia, using variation across the 453 Prussian counties. To our knowledge, this is the first thorough empirical analysis of the Weber thesis at the sub-national level, in particular in Weber's native Prussia. After a brief presentation of the data, the section presents the basic results and tests for robustness to geographical controls. We then discuss several historical facts that suggest that the historical origin of denominational differences in literacy in Prussia can be viewed as an exogenous shock. The concentric dispersion of Protestantism around Luther's city of Wittenberg allows us to use distance to Wittenberg as an instrument to yield exogenous variation in Protestantism, which we exploit in a three-stage least-squares estimation. In additional analyses, we test for robustness to the exclusion of Prussian annexations and to migration, exploit data on students' distance to school to evaluate the role of the supply of schools, and estimate to what extent the role of schools may have been one of transmitters of denominational ethics. The section closes with a brief look at the patterns of Protestantism, education, and earnings in contemporary German micro data.

#### A. *Data and Descriptive Statistics from 19<sup>th</sup> Century Prussia*

Prussia in the late 19<sup>th</sup> century is the obvious place to analyze the relationships of interest, using sub-national data. First, it is the birthplace of the Reformation. Luther proclaimed his 95 Theses in Wittenberg, and the Prussian territory conserved Protestantism in its purest form. Second, Prussia is Max Weber's birthplace, and his views were shaped by what he observed there. Third, Prussia had rather uniform laws and institutional frameworks. Fourth, Prussia was well divided between Protestants and Catholics, with Protestants constituting roughly two thirds and Catholics roughly one third of the total population, so that no denomination was an extreme minority. This differs from the more lopsided denominational distributions of most other countries. What is more, Prussia was exceptional in granting freedom of religion to each individual as early as in the mid-18<sup>th</sup> century. Frederick the Great, the enlightened monarch of Prussia, had famously declared in 1740 that in his country, everybody may find his salvation in his own way.<sup>13</sup> Fifth, with a population of about 40 million in 1871, Prussia was the largest European country except Russia. Sixth, Prussian proverbial orderliness and thoroughness yielded high-quality data at the county level in the second half of the 19<sup>th</sup> century.

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<sup>13</sup> "... hier mus ein jeder nach Seiner Façon Selich werden." Elsewhere, Frederick wrote that "all religions are equal and good..." A unique feature in 18<sup>th</sup> century, a Protestant and a Catholic church stood next to each other in the *Forum Fridericianum* at the origin of the central boulevard "Unter den Linden" in Berlin.

We thus build our database on Protestantism, literacy, and economic outcomes in 19<sup>th</sup>-century Prussia from census material collected by the Prussian Statistical Office in the 1870s and 1880s, available at the county level. Our data cover all 453 Prussian counties (*Kreise*) at the time, divided into 35 districts (*Regierungsbezirke*) and 11 provinces (*Provinzen*). We use data from the 1871 Population Census, the 1882 Occupation Census, and the 1886 Education Census; see Appendix A for details.

The 1871 Population Census provides data on religious affiliation and literacy, as well as a set of standard demographic variables such as gender and age. The descriptive statistics, reported in Table 1, reveal that the average share of Protestants in a county was 64.3 percent, against 34.4 percent Catholics (the remaining shares being Jews at 1.1 percent and other Christian denominations at 0.2 percent). There are two things to note. First, both Protestants and Catholics are not just a small minority, but constitute a sizeable fraction of the Prussian population. Second, there is substantial variation across counties, essentially ranging from zero to 100 percent Protestants/Catholics, which provides the variation for our empirical analysis. In fact, more than three quarters of the counties have a share of at least 80 percent of either Protestants or Catholics, and more than 60 percent of counties have a share of at least 90 percent of one of the two religious denominations.

The 1871 census is explicitly the very first census ever to survey literacy in Prussia. Literacy is measured as the ability to read and write among the population aged 10 years or older. As a measure of educational outcome, literacy may be a more informative measure of accumulated human capital than standard enrollment data, which may partly capture years in school that did not lead to effective educational outcomes. Average literacy across the counties was as high as 87.5 percent (Table 1).<sup>14</sup> This mirrors the fact that Prussia was well-known and much-admired for its primary education system in the second half of the 19<sup>th</sup> century, which is often viewed as a key feature responsible for the fact that Germany took over industrial leadership from Britain (cf. Landes 1969, pp. 339-348). Still, there is substantial cross-county variation in the share of literate population, ranging from 37.4 to 99.3 percent, and 16 percent of the counties had more than one quarter of their population illiterate.

Our main indicators of economic progressiveness are measures of the sectoral structure, derived from the 1882 Occupation Census. The average share of the labor force in non-agriculture is 33.9 percent (27.7 percent in manufacturing and 6.3 percent in the service sector). The shares are somewhat higher when restricting the analysis to the male labor force (Table 1). As alternative measure of economic development, we also use an income proxy derived from the 1886 Education Census. This measure refers to the average annual income of male elementary school teachers, which has been used

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<sup>14</sup> This made West German regions those with the highest literacy of Western Europe at the time (Tabellini 2005).



as a proxy for income in general (e.g., Lee, Galloway, and Hammel 1994). In 19<sup>th</sup>-century Prussia, teacher salaries were almost entirely financed from local taxes and therefore reflect the overall income in the county (cf. Schleunes 1989). The downsides of this measure for our purposes are that teacher salaries may be affected by how much education is valued in a county and that there may be reverse causality from teacher income to literacy, giving rise to problems of endogeneity. Thus, we use the income measure only as a robustness check for results based on the sectoral measures; our main qualitative results turn out to be perfectly robust across the different measures.

The demographic control variables from the 1871 Population Census include age structure, gender, native population, household and county size, and recent population growth (Table 1). We routinely include population growth between 1867 and 1871 as a control variable to capture possible effects of the Franco-Prussian war of 1870/71. While the impact of the war on Prussian territory was very low in general, the death toll of the Prussian army was relatively low (40,000 soldiers), and there was nearly a year between the end of the war in January and the census in December, the control variable for recent population growth may capture any remaining differential migration or death toll across counties.

Figures 2-4 provide a rough impression of the geographical distribution of the main variables of interest. While our subsequent analyses will be performed at the level of 453 counties, the graphs are depicted at the level of 35 districts to convey broad geographical patterns.<sup>15</sup> Figure 2 reveals a mostly concentric pattern of the diffusion of Protestantism with Wittenberg, situated at the northern edge of the district of Merseburg, at the center. Protestant diffusion came to a halt in the western districts (the Ruhr area) and in the eastern districts which were predominantly Polish speaking.<sup>16</sup> As a general tendency, the predominantly Protestant districts in the center of Prussia are also economically more successful (Figures 3a and 3b). Another center of economic progressiveness is the western Ruhr area with its mineral resources. In line with the diffusion of Protestantism, literacy rates are highest in the Protestant heartland in the center of Prussia and lowest in the western and eastern districts (Figure 4).

### ***B. Protestantism, Education, and Economic Outcomes in 19<sup>th</sup> Century Prussia: Basic Results***

This section estimates the central associations of interest in this paper. First, we test the main prediction of the Weber thesis, namely whether Protestant counties were indeed economically more

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<sup>15</sup> Note that this depiction is for descriptive purposes only: In some of our econometric analyses, we will include district dummies, washing away all the variation depicted in the graphs.

<sup>16</sup> Note that the diffusion of Protestantism was intimately related to Luther's German language Bible translation and of his German language texts. It is thus no surprise that the Reformation was less successful in the Polish speaking districts. The German-speaking districts of Königsberg and Gumbinnen in the far east of Prussia, however, have been an integral part of the Prussian mainland for centuries and are again predominantly Protestant.

advanced. Second, we estimate the validity of our alternative explanation, namely whether Protestant counties showed higher literacy. Third, we calculate to what extent denominational differences in literacy can account for denominational differences in economic progressiveness and run a “horse race” between Protestantism and literacy in accounting for economic outcomes.

In this section, we keep the assumption that the spread of Protestantism was exogenous to prior economic progressiveness, and – given our argument above that the additional literacy of Protestants was an unintended by-product of Luther’s urge to read the Bible – we take denominational differences in literacy as exogenous to both work ethic and economic outcomes. Given these assumption, we can estimate the mentioned associations by ordinary least squares. In the sections below, we will probe these assumptions in instrumental variable specifications and other robustness specifications.

We start by establishing the link between Protestantism and economic outcomes, in order to provide empirical support for the common interpretation of the Weber thesis. Thus, we regress economic outcomes  $Y$  of the 453 Prussian counties on the share of Protestants  $PROT$  in the county, as well as a set of control variables  $X$ :

$$Y = \alpha_1 + \beta_1 PROT + X\gamma_1 + \varepsilon_1 \quad (7)$$

The vector of mostly demographic control variables includes the share of Jews and females in the county, the share of the county population below 10 years of age, born in the specific municipality, and of Prussian origin, shares of the population with physical or mental disabilities (blind, death-mute, and insane), average household size, size of the county, and population growth over the four preceding years (to control for potential effects of the Franco-Prussian war).

As the results in Table 2 show, counties with larger shares of Protestants exhibit an advanced degree of economic progressiveness, consistently across the different measures. The estimates suggest that on average, an all-Protestant county has a non-agricultural share of its total labor force that is 3.5 percentage points larger than an all-Catholic county. The estimate for the male labor force is higher, at 4.9 percentage points, combining a manufacturing sector that is 2.9 percentage points larger and a service sector that is 2.0 percentage points larger. Viewed against the average share of the non-agricultural sector in male employment of 40.0 percent, the average conditional difference in economic progressiveness between Protestants and Catholics appear modest, but economically non-negligible and statistically significant. Similarly, the income proxy increases significantly with the share of Protestants in a county, with an all-Protestant county having 6.4 percent higher income than an all-Catholic county.

In sum, the significant positive association between Protestantism and the different measures of economic progressiveness validates the empirical content of the common interpretation of the Weber

thesis. In contrast to the existing cross-county work (cf. Delacroix and Nielsen 2001), which may be hampered by the effects of institutional differences across countries, our sub-national analysis from Prussia confirms the basic underlying association purported by the Weber thesis.

Next, we test the basic prediction of our main argument raised above, namely that Protestants have higher literacy than Catholics. That is, we test equation (6a) of our extended human capital model by regressing the share of literates *LIT* in a county's population aged 10 and older on the share of Protestants *PROT* in the county:

$$LIT = \alpha_2 + \beta_2 PROT + X\gamma_2 + \varepsilon_2 \quad (8)$$

where the vector of control variables *X* now additionally includes the share of the population with missing information on literacy (which is the case for only 1.7 percent on average, cf. Table 1).<sup>17</sup>

As the results in Table 3 reveal, there is indeed a significant association between Protestantism and literacy. On average, an all-Protestant county has a literacy rate 10 percentage points higher than an all-Catholic county. Viewed against the average literacy rate of 87.5 percent, this is a substantial difference across religious denominations. As the data from the Population Census are available separately for urban municipalities and for rural areas in each county (see Appendix A for details), we can estimate this association separately for rural and urban areas. While the association is statistically significant in both sub-populations, it is more pronounced in rural areas, as might be expected with average literacy rates in urban municipalities as high as 91.0 percent (cf. Table A2 in the appendix).

Finally, we assess to what extent the higher literacy of Protestant counties can account for their advanced economic outcomes. The main tenet of our human capital theory of Protestant economic history is that Protestantism affected economic outcomes via human capital accumulation. We proceed in two steps. First, we estimate the association between literacy and economic outcomes and calculate to what extent this can account for the denominational difference in economic outcomes. Second, we run a "horse race" between Protestantism and literacy in regressions explaining economic outcomes.

As the first four columns of Table 4 reveal, there is a substantial association between a county's share of literate people and the different measures of economic progressiveness, without conditioning on the share of Protestants.<sup>18</sup> For every 10-percentage-point increase in the literacy rate, the size of the

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<sup>17</sup> Given that the dependent variable in this model is clustered near the right-censored value of 100 percent, the linear model might be inadequate and suffer from heteroscedasticity. We therefore also estimated the model on a logit-transformed dependent variable and with heteroscedasticity-consistent weighted least squares, yielding the same qualitative results. Detailed results are available from the authors.

<sup>18</sup> Note that the coefficient on the indicator of missing information on literacy is never statistically significant in these specifications, diluting worries that missing literacy information may have first-order effects on the presented results.

non-agricultural sector of a county is 4.6 percentage points larger, the manufacturing share is 3.6 percentage points larger, the service sector is 1.1 percentage points larger, and the income proxy is 6.2 percent larger. Combining these estimates with the observation that the average literacy rate in all-Protestant counties is exactly 10.0 percentage points larger than in all-Catholic counties (cf. Table 3), it turns out that Protestants' higher literacy can account for roughly the whole gap in economic outcomes between the two religious denominations. Remember from Table 2 that the non-agricultural sector of an all-Protestant county is 3.5 percentage points larger than that of an all-Catholic county, the manufacturing share is 2.1 percentage points larger, the service sector is 1.4 percentage points larger, and the income proxy is 6.4 percent larger. In fact, the extent of economic progressiveness of Protestant counties that could be attributed to their higher literacy is slightly larger than their actual progressiveness, at least in terms of the size of the manufacturing sector, which may be due to the fact that the basic specification does not yet include controls for economic geography (see below).

To provide a more thorough analysis of the relative importance of literacy and of other traits of Protestantism in determining the superior economic outcomes of Protestant counties, we perform a "horse race" between the share of Protestants and the share of literates in a county in explaining the different economic outcome measures:

$$Y = \alpha_3 + \beta_3 PROT + \chi_3 LIT + X\gamma_3 + \varepsilon_3 \quad (9)$$

As the results reported in the last four columns of Table 4 reveal, the coefficient on literacy is virtually unaffected by the inclusion of the share of Protestants in the county, retaining its large and significant effect.<sup>19</sup> By contrast, the coefficient on the share of Protestants drops to virtually zero. By including the share of literates in the county, the share of Protestants loses all the quantitative or statistical significance in accounting for economic progressiveness that it had without conditioning for literacy (cf. Table 2). This is true for all four measures of economic outcomes, as well as for the three sectoral shares measured for the male labor force (not reported). Note that the size of the standard errors of the coefficient on Protestantism stays the same after including literacy. That is, the coefficient is as precisely estimated as before; only its size changes to about zero in each specification.

The results reveal that after conditioning on the effect of literacy, there is no difference whatsoever in economic outcomes between Protestant and Catholic counties. Protestantism has no independent

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<sup>19</sup> One may worry about the fact that the literacy measure is significantly clustered near 100 percent, so that the estimates may be strongly driven by variation among observations that are all close to universal literacy. However, our results are robust to restricting the analysis to the sub-sample of 315 counties with literacy rates below 95 percent, to the 158 counties with literacy rates below 90 percent, and even to the 73 counties with literacy rates below 75 percent.

effect on economic outcomes beyond literacy. This leaves little room for substantive economic differences stemming solely from differences in work ethic, in that Protestants provided more effort, strived more for economic success, were thriftier, or had a more efficient approach to working life. The *whole* economic lead of Protestant counties can be attributed to their higher human capital.

### ***C. Robustness to Geographical Influences***

The fact that we exploit regional variation within a country means that we condition on a uniform framework of common laws and institutional settings. However, a potential threat to our specification so far comes from another possible “fundamental” cause of economic growth, namely geography. While geographical differences may not be as dramatic within Prussia as across countries, they may still exert effects on the variation of economic outcomes across Prussian counties. We therefore test the robustness of our results against including several geographical control variables (see Table 1 above for descriptive statistics). Since our results were not sensitive to the particular measure of economic outcome, we concentrate the remaining analyses on the share of the total work force in non-agriculture as economic outcome.

We first add a set of geographic variables to capture several dimensions of county location. To account for periphery, we include distance of the county capital to the Prussian capital of Berlin (measured as the greater circle distance). Longitude (measured in rad) is a measure of the North-South location of a county, included as a proxy for distance to the North and Baltic Seas at the northern boundary of Prussia. Latitude measures the East-West location and traces out the westward expansion of Prussia over the centuries. We also include the interaction of latitude and longitude. Finally, we include a dummy for counties located in Poland today, serving as a proxy for Slavic languages.

All our substantive previous results presented in Table 2-4 – the association between Protestantism and economic outcomes, the association between Protestantism and literacy, and the association between literacy and economic outcomes without and with conditioning on Protestantism – are robust to the inclusion of the geographic controls (Tables 5-7). In the regressions with the economic outcome as dependent variable, only latitude, longitude, and their interaction enter statistically significantly, while distance to Berlin and the Poland dummy are insignificant.

Next, we add the fraction of the work force employed in mining to control for the effects of the availability of natural resources. Several authors (e.g., Delacroix and Nielsen 2001) have argued that the Ruhr area in the west of Prussia was economically thriving because of the mining industry, and despite the Catholic dominance. While the mining variable enters significantly positive in all models, our main associations again remain robust, at a slightly reduced magnitude.

Another worry about geographical robustness is the variation between rural and urban areas, as economic development might have gained ground mostly in urban areas. From the Population Census, we know the share of Protestants separately for urban and rural areas in each county (where a population size of 2,000 is used to classify municipalities into urban and rural). As reported in Table A2 in the appendix, on average the share of Protestants is virtually identical in municipalities and in rural areas (64.57 percent and 64.69 percent, respectively). There is no tendency for Protestants or Catholics to live predominantly in urban (or rural) areas. Consequently, it does not come as a surprise that our results are robust to the inclusion of the fraction of the county population living in urban municipalities. While the share of urban population enters significantly positive in all models, the point estimates on our coefficients of interest are again slightly reduced, but remain highly significant.<sup>20</sup>

Our final and most demanding geographic robustness check consists in including a whole set of 35 district dummies. Thereby, we exclude all the variation that exists across districts and exploit only the within-district variation. To the extent that there is unobserved regional heterogeneity, district dummies should be able to capture most of its substance. While the point estimates of the coefficients on Protestantism are again reduced by inclusion of the district dummies in Tables 5 and 6, they remain statistically significant (at the 5.1 percent level in the case of Table 5). Results of our key specification in Table 7 are virtually unaffected by the inclusion of district dummies.

We conclude that all our qualitative results are robust to controlling for a variety of geographical influences: Economic outcomes and literacy are both significantly higher in Protestant counties, but Protestantism has no significant association with economic outcomes beyond the one due to literacy.

#### ***D. The Historical Origin of Denominational Differences in Literacy as Exogenous Shock***

The evidence presented thus far shows that Protestant regions were economically more advanced than Catholic regions only insofar as they had higher literacy rates. Religious denomination had no association with economic outcomes independent of the association that can be traced back to differences in literacy. In itself, this is an intriguing descriptive finding: The fact that Protestant regions were economically more successful in late 19<sup>th</sup>-century Prussia – purported by Weber and shown by our data – can be fully accounted for by a positive association between literacy and economic success, so that there is no room for additional explanations of economic success based on Protestantism, in particular based on a specific Protestant work ethic.

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<sup>20</sup> We estimated two additional specifications to control for urbanity. First, we used a binary indicator of urbanity that was equal to one when more than 50% of the county population lived in urban municipalities. Second, we dropped urban counties from the regression sample. Both exercises yielded very similar results.

Considering only the results so far without further discussion, the possible interpretation most favorable to Weber's thesis would be that the work ethic stressed by Weber works exclusively through the accumulation of human capital. One might argue that a Protestant ethic led Protestants to invest more in their human capital in order to be economically more successful. Such an interpretation would be consistent in particular with the interpretation of the Weber thesis which argues that the Protestant ethic led to higher thrift, which translated into investments and thus higher long-run economic prosperity. Of course, this is definitely *not* the specific kind of interpretation that Weber had in mind; there is no mention of any argument close to the human capital idea in his work. But at least, such an interpretation would be related in spirit to Weber's ethical interpretation.

However, we argue that such an interpretation is not consistent with several historical facts. As discussed in detail above, Luther's call for literacy was in no way intended to further economic goals. Quite to the contrary, Luther was at least as far from pursuing economic goals as his Catholic opponents. Instead, we argued that the economic effects of increased literacy were an unintended by-product of his call for everyone to be able to read the Gospel. Thus, the increased literacy among Protestants was unrelated to any work ethic or other thought from the ethical or economic sphere.

There are several further reasons to consider literacy as exogenous to the relationship considered by Weber, i.e. both to ethical considerations and to economic outcomes. First, the main features of denominational orientation across German regions were already determined at the time of Reformation in the 16<sup>th</sup> and early 17<sup>th</sup> century. In related work (Becker and Wößmann, in progress), we provide evidence for a strong intertemporal stability of regional denominational affiliations in Germany over more than 400 years. Thus, the overwhelming part of the denominational variation of the late 19<sup>th</sup> century which is studied in this paper had nothing to do with decisions made at the time, but had been given for at least 200 years. In Germany, religion is not only an individual cultural aspect that can be viewed as mostly invariant over an individual's lifetime as in any other country (Guiso, Sapienza, and Zingales 2006), but even more, it is a regional aspect that hardly changed for several centuries.

Second, what is more, even at the time of denominational choice in the 16<sup>th</sup> and early 17<sup>th</sup> century, it was not the personal ancestors of the citizens in our data who made the choices, but rather the local and regional princes, dukes, and rulers of the many small princedoms, fiefdoms, and imperial cities that constituted the fragmented German empire at the time of Reformation. The Imperial Diet held 1555 in Augsburg had adopted the principle "Cuius regio, eius religio" ("Whose rule, his religion"). Thus, even at the time of Reformation, it was not individual citizens who could make deliberate denominational choices, but they were forced to accept their respective sovereign's denomination.

Third, it is generally accepted that the princes' choices at the time were mostly driven by reasons of power politics, following or seceding from the Pope as a worldly leader. Several princes and dukes saw the Reformation as an opportunity to cut down on Roman influence and united in the so-called Schmalkaldischer Bund, the political union of Protestant rulers. Even if some Protestant princes at the time may also have had religious motives and personal convictions, Reformation historians agree that the adoption of the Reformation in different German regions was largely exogenous to the stage of regional economic development. There is no evidence from German Reformation history that economically more advanced regions were more likely to adopt the Reformation.

Fourth, it might be argued that regions that were educationally advanced already in Lutheran times might have been more conducive to Luther's preaching and its methods of distribution.<sup>21</sup> However, as is well documented (cf. Scribner 1994), Luther's theses were mostly distributed to the general public in the form of caricatures which denounce the unethical behavior of the Pope and his allies, so that they were equally accessible for the illiterate as for the literate. Furthermore, the available evidence suggests that around 1500, literacy in Germany was as low as about 1 percent of the population, exclusively restricted to the nobility and some townsmen (cf. Engelsing 1973, p. 19). So if there was any systematic aspect about the spread of Protestantism, it might have been centered in cities. However, as discussed above, the share of Protestants in rural and urban areas was in fact identical in late 19<sup>th</sup> century, and controlling for urbanity does not change our results.

A specific feature that might be a possible exception to the general rule that the spread of Protestantism was unrelated to the pre-existing economic and educational state might be the free imperial cities (*Reichsstädte*). Free cities were virtually self-ruling enclaves independent from the rule of regional princes. Many of them had accumulated substantial wealth through trade, and they were well-known for their liberal thinking, which might have been conducive to adopting the Reformation. Therefore, as a further robustness check, we exclude all Prussian counties from our sample that contain former free imperial cities. As the first column of Table 8 shows, our qualitative result is unaffected. The same is true when all free Hanseatic cities are excluded (not reported).

Fifth, the regional origination of Protestantism has to be viewed against the background of a very specific event, namely a specifically vicious example of indulgence practice to which many of Luther's penitents in Wittenberg succumbed. In 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

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<sup>21</sup> See Sander (2002) for a discussion (and rejection) of possible effects of education on religious behavior in US data.



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. Thus, the geographic spread of Protestantism originating from Wittenberg was initiated by a specific event that can be viewed as a random shock, unrelated to the economic or educational reality of the time.

### ***E. The Concentric Dispersion of Protestantism: Distance to Wittenberg as Instrument***

While the historical origin of the denominational differences in literacy rules out the most obvious forms of potential endogeneity, some possible sources of endogeneity might remain. For example, Ekelund, Hébert, and Tollison (2002) hypothesize that the diffusion of the Reformation might have been facilitated in societies characterized by the decline of feudalism and relatively unstable distribution of wealth. This hypothesis is explicitly aimed at the diffusion across countries, though, and may be less relevant for the diffusion within Prussia. Similarly, while the idea that choice of denomination may be endogenous to education (Sacerdote and Glaeser 2001) in principle provides an additional source of endogeneity, this source also seems less of an issue in our case, because there was hardly any effective individual denominational choice in the 19<sup>th</sup> century.

Still, to rule out potential remaining worries of endogeneity, we suggest using a particular aspect of the historical diffusion of Protestantism within Prussia in order to restrict the variation in Protestantism used in the estimation to a part that is credibly exogenous. Reformation historians refer to the diffusion of Protestantism as resembling the propagation of a wave caused by a stone thrown into water.<sup>22</sup> 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 dissipate with distance to Wittenberg. In effect, Protestantism dispersed around Wittenberg in a concentric pattern. As evidenced in Figure 2 above, it seems that the Reformation spread out from Wittenberg in all directions, but then came to a halt after some distance.

The main reasons for a circular dispersion around Wittenberg may have been transportation and transaction costs of all sorts, which played a crucial role at the time. Among others, 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

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<sup>22</sup> Luther himself likened the spreading of the sermon to "throwing a stone into the water which makes waves, circles, and streaks around it, and the waves push each other further and further; one pushes the other..." (Luther 1522, p. 140). He also stressed that the preaching "will be disseminated further and further and that from the Church which is located in a certain place many others will be drawn to the Word" (Luther 1528, p. 224). In the latter source, Luther explicitly refers to Wittenberg as the place from which a creek irrigates the neighboring regions.

likely declined with distance to Wittenberg. The fact that the German regions spoke ever more different dialects the further distant the regions may also have contributed to a concentric pattern of the dispersion of Protestantism, both in oral and written means of dissemination.

It is generally accepted that Wittenberg was an “unimportant place” (Holborn 1942, p. 133) until 1517. Therefore, distance to Wittenberg should be unrelated to a county’s economic and educational state before it adopted Protestantism. However, it is hard to ascertain this rigorously across our 453 Prussian counties because there is hardly any data on the economic or educational situation for the time of Reformation, and the 1871 Population Census is explicitly the first occasion where consistent data on literacy were surveyed.<sup>23</sup>

But several pieces of evidence support the idea that distance to Wittenberg is unrelated to the economic and educational state before 1517. First, in our sample of 453 Prussian counties, distance to Wittenberg is completely insignificant in predicting the probability of being a free imperial city, measured in pre-Reformation status. Second, distance to Wittenberg is similarly uncorrelated with the probability of being a free Hanseatic city. Third, we use data on the location of German universities founded before 1517 provided in Eulenburg (1904) to estimate whether distance to Wittenberg predicts whether a county in our sample had a university before 1517. We also regress the year of foundation of universities in existence before 1517 on distance to Wittenberg. In both exercises, we find that distance to Wittenberg is completely unrelated to the spread of universities before Lutheran times.<sup>24</sup>

As a consequence, the geographically concentric pattern of the dispersion of Reformation provides a means to obtain a specific variation in Protestantism that is credibly exogenous to economic, educational, and ethical considerations: the variation due to distance to Wittenberg. We thus use distance to Wittenberg as an instrument for the share of Protestants in a county in 19<sup>th</sup>-century Prussia.

The first two columns of Table 9 report the instrumental-variable (IV) estimate of Protestantism on literacy, where Protestantism is instrumented by distance to Wittenberg. As is evident from the first stage, distance to Wittenberg is indeed a strong instrument for the share of Protestants in a county. The F-statistic of the instrument in the first stage is 73.5. Each 100 km distance to Wittenberg goes hand in hand with a Protestant share that is 9.4 percentage points lower. The second stage uses only that part of the Protestant share that is due to distance to Wittenberg to predict the literacy rate. The positive effect of Protestantism on literacy is highly robust in the IV specification. In fact, the point estimate is

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<sup>23</sup> There is only scattered historical evidence on the spread of literacy and schooling in Prussia between 1500 and 1871, discussed in Appendix B, which suggests that Luther’s educational postulations did have a long-lasting effect.

<sup>24</sup> Detailed results on these estimates are available from the authors.

substantially higher, with a difference in literacy rates of 18.6 percentage points between an all-Protestant and an all-Catholic county.

How do the results for economic outcomes hold in the IV specification? As a first step, we can use the reduced form of the model just presented, regressing literacy on distance to Wittenberg, and use this as a first stage in a model that estimates the effect of literacy on economic progressiveness. This model is presented in columns (3) and (4) of Table 9. In the first stage, distance to Wittenberg is a strong instrument of the literacy share in a county. In the second stage, the variation in literacy that is due to distance to Wittenberg has a significant positive effect on economic progressiveness. The results suggest that a 10 percentage point increase in the literacy rate results in a 4.4 percentage point increase in the share of non-agriculture – a point estimate very close to the OLS estimate of Table 4. Given the exogeneity of the instrument, we can interpret this as a causal effect of literacy on economic outcomes. Furthermore, given that a Hausman test can in no way reject the null hypothesis that the difference in coefficients between the IV and the OLS model is not systematic ( $\chi^2 = 0.02$ ;  $\text{probability} > \chi^2 = 1.00$ ), we should actually prefer the estimates of Table 4 as being the efficient estimates.

We can go one step further if we are willing to assume that Protestantism does not have an impact on economic outcomes independent of its effect on literacy, as suggested by our previous results. With this assumption, we can estimate the following system of three equations:

$$\begin{aligned}
 Y &= \alpha_4 + \beta_4 \widehat{LIT} && + X\gamma_4 + \varepsilon_4 \\
 LIT &= \alpha_5 && + \beta_5 \widehat{PROT} && + X\gamma_5 + \varepsilon_5 \\
 PROT &= \alpha_6 && + \beta_6 \widehat{WITT} && + X\gamma_6 + \varepsilon_6
 \end{aligned} \tag{10}$$

In this system, the first stage predicts the share of Protestants in a county by its distance to Wittenberg. The part of the variation in Protestantism which is due to distance to Wittenberg is then used in the second stage to predict the literacy rate of the county. Finally, in the third stage, the part of the variation in literacy which is due to that part of the variation in Protestantism which is due to distance to Wittenberg is used to predict economic progressiveness. In effect, this system of three equations specifies a “double-IV” estimation, which can be estimated via three-stage least-squares (3SLS).

The 3SLS results, reported in columns (5) - (7) of Table 9, support our previous findings. Distance to Wittenberg is negatively associated with Protestantism; that part of Protestantism which is due to distance to Wittenberg has a positive effect on literacy; and that part of literacy which is due to that part of Protestantism which is due to distance to Wittenberg has a positive effect on the share of non-agriculture in the economy. Viewing distance to Wittenberg as yielding exogenous variation in the spread of Protestantism, we get the same qualitative results as before.

Given these results, and for all the reasons discussed in the previous sections, the denominational variance in literacy used in this paper can be viewed as exogenous to ethical and economic considerations. We therefore argue that the only interpretation of the presented results which lives up to the historical facts is that the higher literacy among Protestants across Prussia is a mere side effect of Luther's postulations, a "shock" exogenous to the ethical and economic system. Therefore, the higher economic prosperity of Protestant regions can be interpreted as the consequence of higher education.

***F. Additional Aspects of Identification and Interpretation: Prussian Annexations, Migration, Distance to School, and Teaching of Ethics***

This section addresses a set of additional issues of identification and interpretation. First, Prussia grew substantially over the centuries. At least for the areas annexed into Prussia shortly before the 1870s, the assumption of an effectively uniform institutional setting might thus be questioned. Second, there might have been non-random migration, in particular for different religious affiliations. Third, we use data on the supply of schools, both as an alternative measure of education and to provide evidence on the importance of the two channels proposed by our theoretical model, namely reduced cost due to rulers' building of schools and increased non-monetary benefits. Fourth, we test for the importance of Protestant ethics in the sense that one might hypothesize that the crucial aspect of schools in Protestant counties might have been to transmit the Protestant work ethic, rather than teaching literacy.

The first issue, that several territories had been annexed by Prussia in the course of the 19<sup>th</sup> century, might undermine a key strength of our within-country approach, namely that all counties are effectively exposed to the same set of laws and institutional settings. To the extent that there is path dependency in the effective working of institutions, the territories more recently annexed into Prussia may be subject to unobserved heterogeneity in effective institutions. We perform two empirical tests to deal with this issue. First, we control for the year in which a county came to Prussia, either as a linear variable or as 36 dummies for all the rounds of annexations after 1525. As is evident from columns (2) and (3) of Table 8, our qualitative results are unaffected by these controls. The first specification also shows that there is no significant linear effect of the year of annexation on economic outcomes, suggesting that more recent annexations do not perform systematically different from earlier Prussian territory. Second, we restrict the analysis in an increasingly restricted manner to sub-samples of counties that had been with Prussia for a long time. We start with the 361 counties that had been part of Prussia for more than 50 years in 1871, and then go on to restrict to the 235 counties that had been part of Prussia before 1800, 179 counties before 1750, and 89 before 1650 (see columns (4) to (7) of Table 8). Again, our main qualitative results are perfectly robust in these sub-samples.

The second issue is that migration might not have been independent of religion, literacy, and economic outcomes. Such migration might render the share of Protestants in a county endogenous to its economic state. First, note that our basic model already includes the share of the population born in the respective municipality and the share of the population that is of Prussian origin. Therefore, patterns of migration over the lifespan of the 1871 population are already controlled for. Second, we can restrict our analysis to the sub-sample of counties that are hardly intertwined in terms of denomination, i.e. only to counties that are either mostly-Protestant or mostly-Catholic (defined as having either less than 20 percent or more than 80 percent Protestants). The idea is to exclude all counties where migration might be a substantive issue. Given the very limited pattern of migration, the dominant denomination in the counties with very low and very high fractions of Protestants will derive from the historical choices of local princes, but not from migration. As the first column of Table 10 shows, our results are unaffected by restricting the analysis to this sample of 343 counties.

While in this specification, the main variation in the share of Protestants comes from the variation between the two extreme types of counties, the variation in the share of Protestants within the two types might still be affected by migration. Therefore, we transform the Protestantism measure into a dummy variable equaling one for the counties with more than 80 percent Protestants and zero for the counties with less than 20 percent Protestants. Such a specification uses only the variation that stems from historical regional choices and is unaffected by any type of migration. As column (2) of Table 10 reveals, our substantive results are again robust.

The third issue enters the black box of higher literacy, looking at whether Protestantism had indeed an effect on the supply of schools. The 1886 Education Census provides county-level information on the share of students who had a distance to school of more than three kilometers. While the information is limited to those who were students in 1886 (rather than the adult population), the measure may still provide a useful proxy for the supply of schools. Note also that the measure applies only to those children who actually attended school; it may underestimate the true average distance to school if there are children who did not attend school because the distance was too far. To begin with, in column (3) of Table 10 we ascertain that the share of Protestants in a county is indeed negatively related to the share of students who had a long distance to their school, indicating that there was a denser supply of schools in Protestant counties. This pattern is robust to the inclusion of our geographic controls, including urbanity. When the share of literate adults in the county is added to the estimation, both literacy and Protestantism have a significant negative association with distance to school.

Next, we use distance to school as an alternative measure of human capital in explaining economic outcomes, substituting for our previous literacy measure. As column (4) of Table 10 reveals, distance to

school has the very same effect as the literacy measure in a horse race against Protestantism: Distance to school is significantly negatively related to economic progressiveness, and it renders the share of Protestants in the county insignificant.

Finally, we enter distance to school and literacy jointly in the economic-outcome equation. When jointly entered (column (5) of Table 10), both distance to school and the share of literates in the county enter significantly in explaining economic progressiveness, while the share of Protestants again does not. Against a specification without distance to school, the coefficient on literacy is reduced from 0.49 to 0.40. These results allow us to draw some tentative conclusions about the two alternative aspects depicted by our human capital model. Remember that we suggested that Protestants may have higher education both because Luther urged regional rulers to build schools (Luther's 1524 pamphlet), thereby reducing marginal costs of schooling, and because Luther suggested that there are individual religious benefits of schooling to every Protestant citizen (Luther's 1530 sermon). Now, the results just reported suggest that part of the higher education of Protestants (and its effect on economic progressiveness) is due to the increased supply of schools, and thus reduced marginal costs of schooling ("Luther 1524"). But there also remains an additional part of higher education of Protestants (and its effect on economic progressiveness) that cannot be attributed to the better supply of schools, and in terms of our theoretical model may be best attributed to the higher individual marginal benefits of literacy ("Luther 1530").

The fourth issue concerns the extent to which the higher literacy of Protestants, and its effect on economic outcomes, may still be an outflow of a distinct Protestant work ethic, rather than a mere unintended by-product of Luther's educational postulations. We have already discussed above that the historical origin of the denominational differences in literacy make it unlikely that they are endogenous to any individual consideration of work ethic. However, while the origins may have been exogenous to work ethic, over the centuries Protestants might indeed have developed a specific work ethic. Our previous results show that any higher economic prosperity of Protestant counties can be attributed to differential literacy, but a remaining concern is that the schools that taught the literacy might at the same time also have taught a specific work ethic. Thus, schools might have functioned as transmitters of denominational ethics, and our measure of literacy may just serve as a proxy for the fact that Protestant schools convey Protestant ethics.

However, if this were the case, Protestant schooling should have had a larger effect on economic outcomes than Catholic schooling, because Protestant schools transmitted the Protestant work ethic while Catholic schools did not. Therefore, we can test for the quantitative substance of the ethic-transmission channel in determining economic outcomes by adding an interaction term between Protestantism and literacy to our economic-outcome model. As the results reported in the final column

of Table 10 reveal, this interaction term is statistically and quantitatively insignificant. The same is true when distance to school is used instead of literacy as an alternative measure of human capital. That is, Catholic schooling has the same effect on economic progressiveness as Protestant schooling. It is human capital as such that matters for economic outcomes, not any possible differential work ethic of the two denominations.

### ***G. An Addendum: Protestantism, Education, and Economic Outcomes in Contemporary Germany***

As a sequel to the historical analysis, we briefly analyze the association between Protestantism, education, and economic outcomes in contemporary Germany. The German Socio-Economic Panel (GSOEP) provides data on individual incomes for a representative sample of Germans in 1997. On a descriptive basis, Protestants have both higher incomes and higher education even today (Table 11).

As long as we do not condition on education in a regression analysis of a simple earnings equation (Table 12), Protestants earn significantly more than Catholics.<sup>25</sup> But as soon as we condition on the significant positive association between education and income, the income difference between Protestants and Catholics vanishes. Thus, just as in the historical analysis, Protestants do perform better economically even in contemporary Germany, but again, the whole gap can be accounted for by differential human capital.<sup>26</sup>

This observation goes largely unnoticed in present-day Germany because few data sets collect information on religious denomination, education, and income. Still, the current Catholic education gap is not completely surprising, considering the fact that family background plays an important role in human capital accumulation, which perpetuates the education gap over time. Even after more than a hundred years of a public school system that gives equal access to schooling independent of religious affiliation, Protestants are still better educated. The results suggest that Luther's educational postulations may have had very long-term repercussions. The precise nature of the contemporary associations is a matter for future research, however.

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<sup>25</sup> See Tomes (1985) for an early summary on earnings differentials between religious groups, reporting inconclusive results for Catholic-Protestant differentials in the United States and Canada.

<sup>26</sup> The three most recent GSOEP waves that collected data on religious affiliation are 1990, 1997, and 2003. We find the same reported (1997) pattern in 1990, but not in 2003. Whether this is due to data problems (e.g., a refreshment sample with relatively young households and thus more volatile income information) or a true change in economic associations is left for future investigation.

## IV. Conclusion

This paper advances an alternative to the Weber thesis: an explanation for the historically higher economic prosperity of Protestant regions based on a standard human capital argument. As an unintended side effect of Luther's postulations to enable everyone to read the Gospel, Protestants acquired the literacy that serves as human capital in the economic sphere. This human capital theory of Protestant economic history is consistent both with Luther's preaching and with county-level evidence from late 19<sup>th</sup>-century Prussia. The higher literacy in Protestant regions can account for their whole economic progressiveness relative to Catholic regions. We argue that the roughly concentric dispersion of Protestantism around Luther's city of Wittenberg yielded exogenous variation in Protestantism, allowing us to use distance to Wittenberg as an instrument in a "double-IV" specification estimated by 3SLS. In this system of three equations, we find that distance to Wittenberg predicts Protestantism, which predicts literacy, which predicts economic prosperity.

So, was Weber wrong? Or, more precisely, is what has come to be known as the Weber thesis, as commonly interpreted, wrong? Given the complexity and multifaceted character of the thesis, there can of course be no simple answer to this question. Within the scope of this paper, there are at least three aspects to the question, with three different answers. The separate aspects are the descriptive validity of the fundamental relationship of the Weber thesis, the main channel through which it arises, and the relevance of ethical aspects in it.

First, is the Weber thesis wrong in the main descriptive pattern of its argument? In contrast to the conclusion reached by the existing cross-country evidence (Delacroix and Nielsen 2001), we show that Weber was *right* in his observation that Protestant regions were economically more affluent than Catholic regions, at least in Prussia in the second half of the 19<sup>th</sup> century.

Second, is the Weber thesis wrong with respect to the main channel through which this pattern arises? Our evidence suggests that in this aspect, the Weber thesis has to be viewed as *wrong*. We find that the key channel is the acquisition of literacy (which is not among the key channels generally associated with the Weber thesis), which can account for the whole association between Protestantism and economic prosperity in late 19<sup>th</sup>-century Prussia. This leaves little room for substantial effects of the main channels advanced by the Weber thesis, namely working harder and being thriftier.

Third, is the Weber thesis wrong with respect to the importance of ethical considerations in the association between religious denomination and economic success? This aspect is hard to answer (as always when dealing with topics of ethics), given the virtual impossibility of observing ethical considerations, particularly over a century after the fact. However, we present several pieces of



evidence that suggest that the Weber thesis seems likely wrong also in this regard. Several historical facts indicate that the spread of Protestantism, and with it the spread of literacy, can be traced back to incidents occurring centuries before our time of observation and lying beyond the influence of individual citizens driven by differential work ethics. We even reject the possibility that the important role of schools in progressing economic outcomes was to transmit differential denominational work ethics, rather than literacy, because schooling has the same effect in Protestant and Catholic regions.

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## Appendix A: Census Data for Prussia in the 1870s/1880s

Three major censuses in Prussia provide the data for our analysis: the 1871 Population Census, the 1882 Occupation Census, and the 1886 Education Census. By the second half of the 19<sup>th</sup> century, the Prussian Statistical Office collected huge amounts of demographic and socio-economic data, and the quality of the census material is generally viewed as outstanding. Knodel (1974, p. 28) concludes that the quality of Prussian demographic data was of a very high standard by the 1860s. Similarly, Wojtun (1968) reports that population counts were virtually complete by 1864. Demographers have found county-level data for Prussia at the end of the 19<sup>th</sup> century to be a unique source of highest-quality data for analyses at a disaggregate level (cf. Galloway, Hammel, and Lee 1994, 1998; Lee, Galloway, and Hammel 1994). We have compiled the county-level data from respective archives.

In 1871, Prussia consisted of 453 counties, structured in 35 districts and 11 provinces. Table A1 lists the names of the Prussian districts and provinces.

Table A1: PRUSSIAN PROVINCES AND DISTRICTS

Map code	District (Regierungsbezirk)	Province (Provinz)	Map code	District (Regierungsbezirk)	Province (Provinz)
1	Aurich	Hannover	19	Münster	Westphalen
2	Stade	Hannover	20	Minden	Westphalen
3	Schleswig	Schleswig-Holstein	21	Hildesheim	Hannover
4	Stralsund	Pommern	22	Erfurt	Sachsen
5	Stettin	Pommern	23	Merseburg	Sachsen
6	Köslin	Pommern	24	Liegnitz	Schlesien
7	Danzig	Preussen	25	Breslau	Schlesien
8	Königsberg	Preussen	26	Oppeln	Schlesien
9	Gumbinnen	Preussen	27	Düsseldorf	Rheinprovinz
10	Osnabrück	Hannover	28	Arnsberg	Westphalen
11	Hannover	Hannover	29	Kassel	Hessen
12	Lüneburg	Hannover	30	Aachen	Rheinprovinz
13	Magdeburg	Sachsen	31	Köln	Rheinprovinz
14	Potsdam	Brandenburg	32	Trier	Rheinprovinz
15	Frankfurt / Oder	Brandenburg	33	Koblenz	Rheinprovinz
16	Marienwerder	Preussen	34	Wiesbaden	Hessen
17	Bromberg	Posen	35	Hohenzollern	Hohenzollern
18	Posen	Posen			

### 1871 Population Census

The 1871 Population Census took place on December 1<sup>st</sup> 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.

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.

In contrast to the 1882 Occupation Census and the 1886 Education Census, the data from the 1871 Population Census allow a separate analysis of urban and rural areas in each county, where a population size of 2,000 was used to classify municipalities into urban and rural. Table A2 reports descriptive statistics of our Population Census data separately by urban and rural municipalities in the counties.

The source of the Population Census data is: Königliches Statistisches Bureau (1874), *Die Gemeinden und Gutsbezirke des Preussischen Staates und ihre Bevölkerung: Nach den Urmaterialien der allgemeinen Volkszählung vom 1. December 1871*, Berlin: Verlag des Königlichen Statistischen Bureaus.

Table A2: RURAL-URBAN BREAKDOWN OF POPULATION CENSUS DATA

	Total	Rural	Urban
	(1)	(2)	(3)
% Protestants	64.62 (38.09)	64.57 (39.32)	64.69 (35.33)
% Literate	87.33 (12.56)	86.27 (13.78)	91.00 (8.13)
% Missing education info	1.71 (1.11)	1.87 (1.30)	1.18 (.98)
% Age below 10	24.91 (2.18)	25.56 (2.25)	22.82 (2.48)
% Jews	1.08 (1.18)	.43 (.63)	3.44 (4.18)
% Females	51.09 (1.42)	51.16 (1.44)	51.13 (2.32)
% Born in municipality	59.65 (11.93)	61.03 (13.16)	55.34 (10.23)
% Of Prussian origin	99.16 (1.85)	99.35 (1.46)	98.69 (2.31)
% Blind	.09 (.03)	.09 (.03)	.11 (.06)
% Deaf-mute	.10 (.05)	.10 (.05)	.12 (.16)
% Insane	.23 (.18)	.22 (.15)	.27 (.52)
Average household size	4.79 (.34)	4.89 (.40)	4.51 (.36)
Total population size	51963.55 (19125.07)	38734.44 (14258.55)	13229.11 (10659.00)
Popul. growth 1867-1871 (in %)	1.03 (4.08)	1.79 (25.98)	2.26 (6.16)
Number of observations	453	428	437

All columns show means. Standard deviations in parentheses. *Source*: Data for Prussian counties from the 1871 Population Census.

Column 1 displays county totals. Column 2 display values for rural municipalities ( $\leq 2,000$  inhabitants) in these counties. Column 3 is for urban municipalities ( $> 2,000$  inhabitants) in these counties.

### ***1882 Occupation Census***

The 1882 Occupation Census collected information on employment and self-employment across two-digit sectors.<sup>27</sup> We calculate the share of the total labor force, as well as the share of the male labor force, working in the manufacturing sector and in the service sector. We use 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.

<sup>27</sup> The Occupation Census contains only 452 observations; information is missing for one county, Communionharz.

The service sector (sector C in the 1882 classification) includes trade business, insurance, transport, lodging, and restaurants. Note that the service sector C does not include servants and housemaids, nor does it include those working in the public administration and the military.

Our results are robust with respect to dropping or including certain sub-sectors in the analysis, e.g. the mining industry, which in modern sector classifications would not be included in the manufacturing sector.

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

### ***1886 Education Census***

The 1886 Education Census collected information on both primary schools and secondary schools.

From the Education Census, we derive the average annual income of full-time male elementary school teachers in a county. Given that teacher incomes were almost entirely financed from local taxes, they should provide a reasonable proxy for the average income of the county (cf. Schleunes 1989).

The Education Census also provides county-level information on the share of students who had a distance to school of more than three kilometers. While the information applies to students (rather than the adult population) in 1886 and does not include school-aged children who did not attend school, the measure may still provide a useful proxy for the supply of schools in the different counties in our analysis.

The source of the Education Census data is: *Preussische Statistik*, Volume 101, pp. 2-391.



## **Appendix B: The Spread of Literacy from Lutheran Times to 1871**

This paper argues and shows that Luther's educational postulations, expressed in the early 1500s, ultimately transmitted into higher literacy of Protestants in the late 1800s. Unfortunately, as a consequence of limited data availability, the time in-between is mostly regarded as a black box. However, at least some cursory discussion and analysis of what happened between Luther and 1871 Prussia is possible. This appendix gives a brief description of what is known about how the educational pattern emerged from Luther to the 1870s.

While there is no consistent data on the development of literacy in Prussia before 1871, there is some scattered evidence on the spread of literacy and schooling between 1500 and 1871. As discussed above, Engelsing (1973) suggests that not more than 1 percent of the German population was literate at the time of Reformation. It is well known and well documented in many German cities that the new Protestant church had regular visitations in the parishes to make sure that a decent system of basic schooling is introduced, particularly in the tradition of Luther's closest collaborator Melanchthon (e.g., Rupp 1996b, 1998). Lanzinner (2001, pp. 114, 119) observes a boom in the education system in the second half of the 16<sup>th</sup> century and puts the share of literates in the German population in 1600 at at least 10 percent. However, the Thirty Years' War (1618-1648), with its tremendously devastating consequences of military and civilian casualties, lootings by the mercenary soldiers, dislocations, famines, and diseases across the whole German empire, put a hold on many of the structured attempts to build a functioning school system. Still, even in the midst of the war, there are examples such as Duke Ernst II the Pious of Saxe-Gotha-Altenburg who introduced a form of compulsory schooling in his area in 1642.

The Treaties of Westphalia (1648), which terminated the Thirty Years' War, reaffirmed the supreme authority of the church in matters of schooling, describing the school as an "annexum ecclesia" (ecclesiastical annex; cf. Schleunes 1989, p. 12). And in line with the preaching of Luther and Melanchthon, it was the Protestant churches which tried to advance matters of schooling, to a much larger extent than the limited attempts within the Catholic church. Schleunes (1989) points out that quite generally, when comparing the politics of Protestant-led Prussia and Catholic Bavaria over 1750-1900, it has always been Prussia that led school reforms and Bavaria that followed.

A common interpretation of the history of the German schooling system is that it experienced a manifest surge after the Reformation, but subsequently did not make noteworthy advancements until far into the 18<sup>th</sup> century. For example, the first academy for teachers in Prussia was not established

before 1749. Only slowly recovering from the devastations after the Thirty Years' War, the German regions managed to accomplish slow advances in literacy. While any concrete figures seem mostly approximate guesses, and there is no tangible evidence for the relative literacy of Protestants and Catholics, Müller (1986) puts the 18<sup>th</sup>-century average of adult Germans who were literate at 10 percent, with an increasing tendency, so that the figure was around 15 percent in 1770, 25 percent in 1800, and 40 percent in 1830 (cf. also Blanning 2002, p. 113).

A hallmark in the development of the Prussian schooling system is the General Elementary School Regulation (“Generallandschulreglement”) of Frederick the Great (notably worked out by a Protestant theologian), which in 1763 contained an explicit invitation to attend school – although not, as often purported, consequent compulsory universal schooling. Still, the regulation constitutes an important pre-stage for a vigorous development over the following decades. Starting with the early 1800s, there is some official data on school enrollment in Prussia, which may serve as a reasonable proxy for later literacy. According to official Prussian statistical publications, school enrollment (the proportion of children aged 6 to 14 attending a public school) in Prussia was 60.3 percent in 1816 and 82.4 percent in 1846 (Dieterici 1849, p. 47). By the 1860s, most of Prussia had achieved nearly universal enrollment in basic education.

In view of the human capital theory of Protestant economic history, these descriptive historical patterns suggest that Luther's educational postulations did have a long-lasting effect. While there is no data to provide a consistent picture of the relative literacy of Protestants and Catholics before 1871, the pattern of slowly increasing literacy from Lutheran times to 1871 and the evidence of this paper that, everything else equal, Protestant regions had significantly higher literacy in 1871, combine with the narrative patterns to suggest that Protestants took a strong lead in the advancement of literacy. With ever so slowly advancing means, Protestants did manage to get and keep ahead of Catholics in terms of schooling and literacy.

Figure 1: MARGINAL BENEFIT AND MARGINAL COST SCHEDULES FOR DIFFERENT DENOMINATIONS

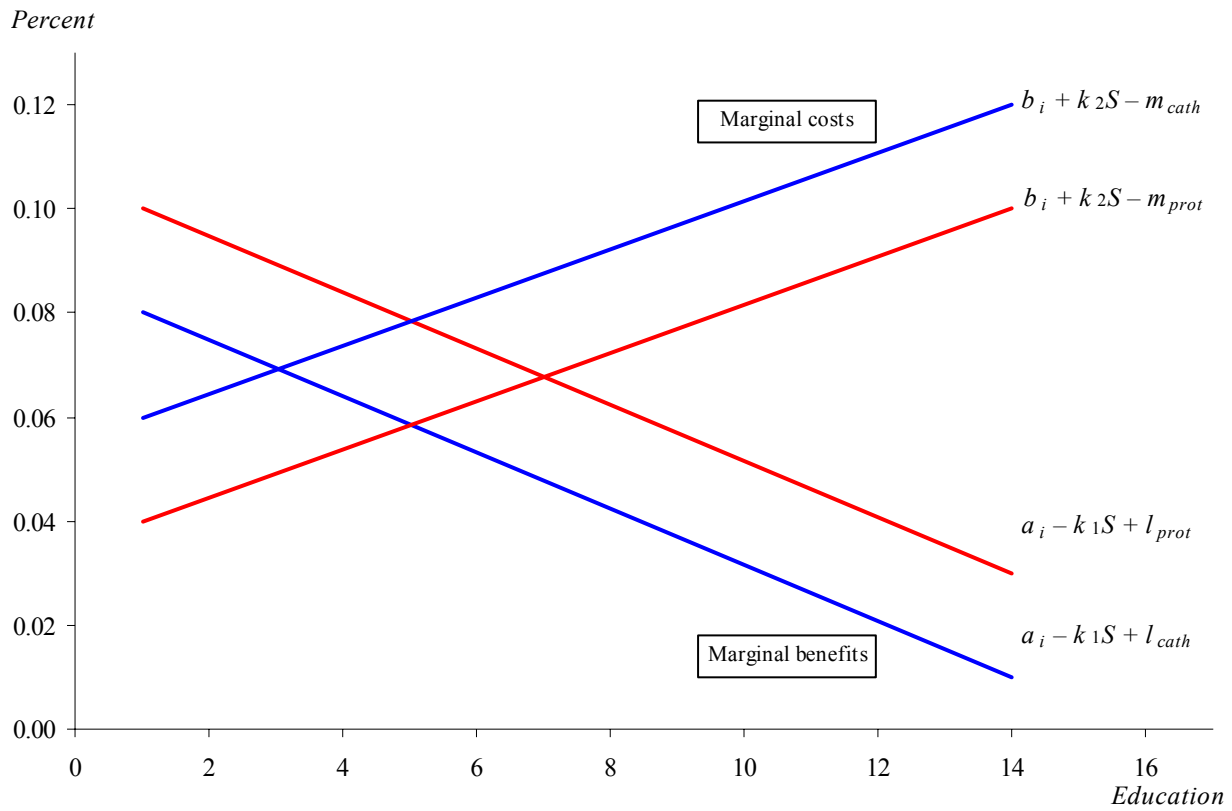
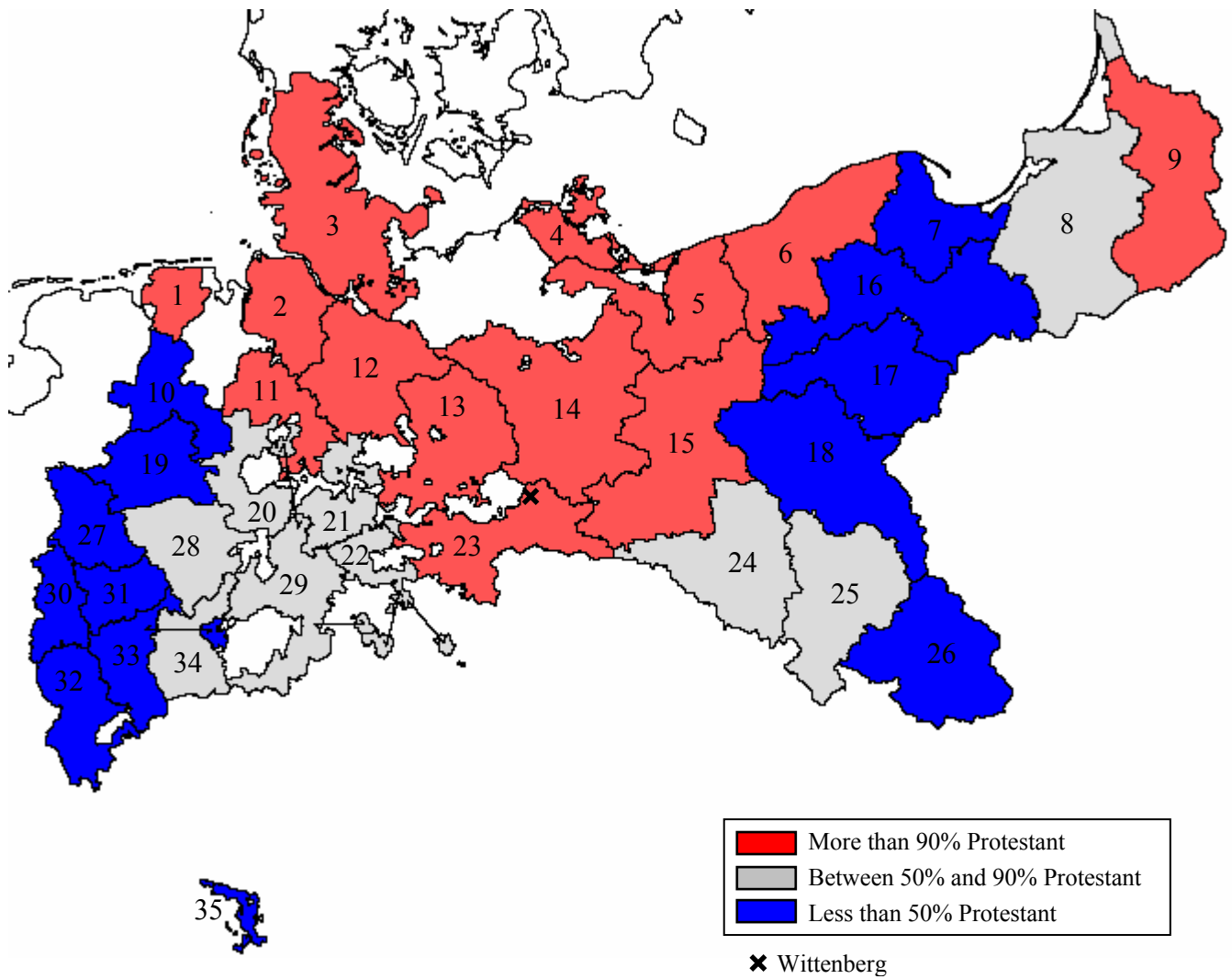


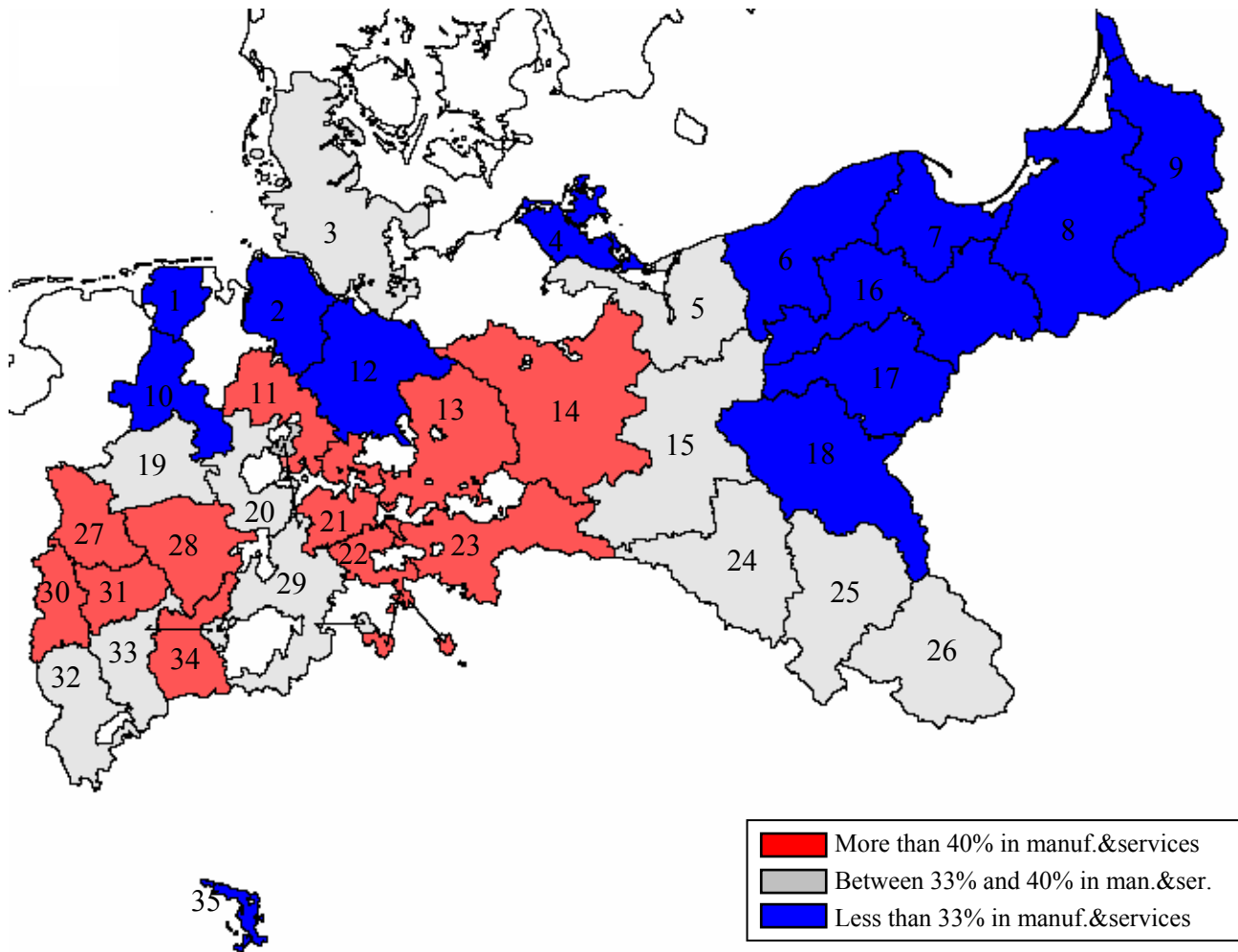
Figure 2: PROTESTANTISM IN 19TH CENTURY PRUSSIA



District-level depiction, 1871. District names are provided in Table A1.

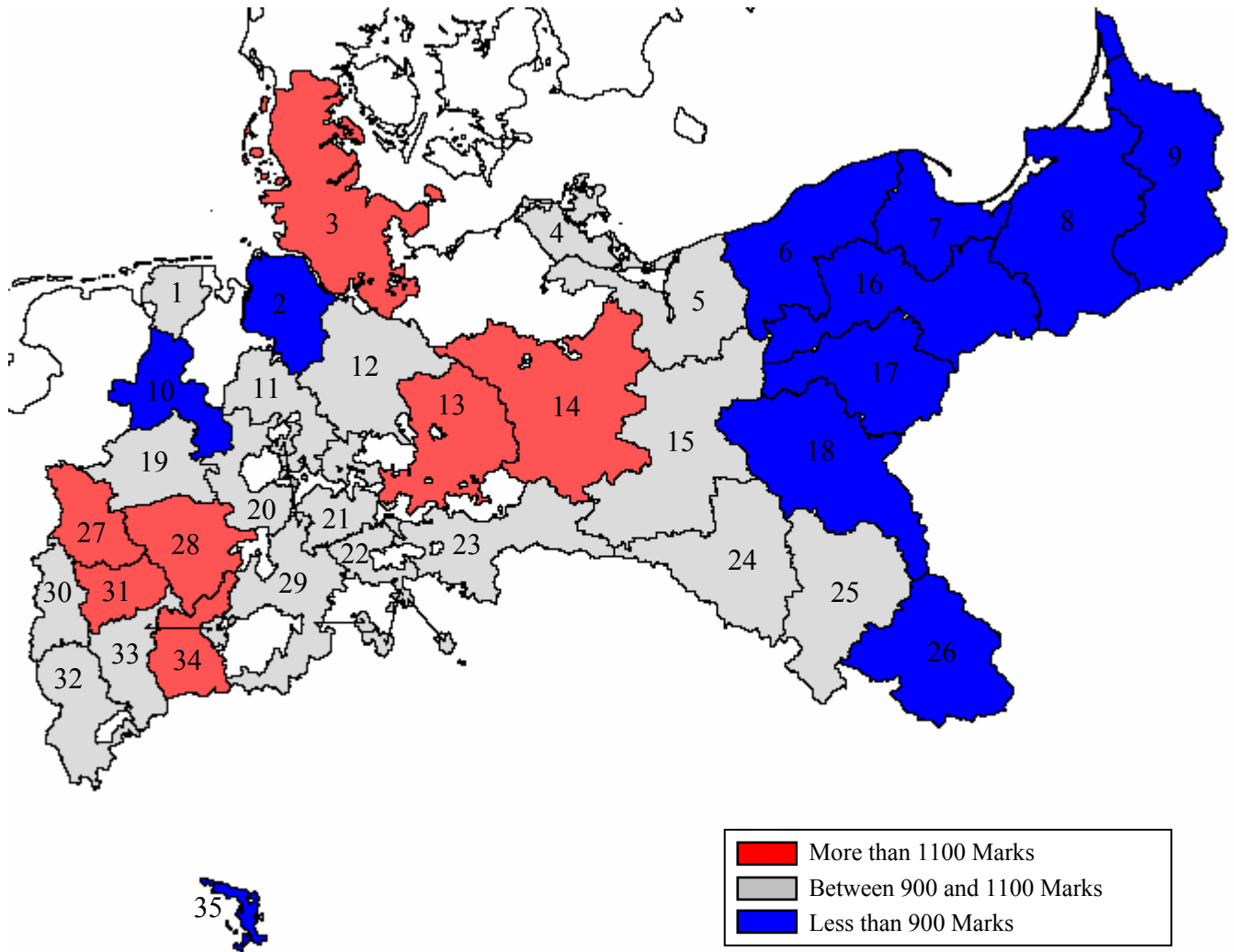
Figure 3: ECONOMIC OUTCOMES IN 19TH CENTURY PRUSSIA

(a) Share of Employment in Manufacturing and Services



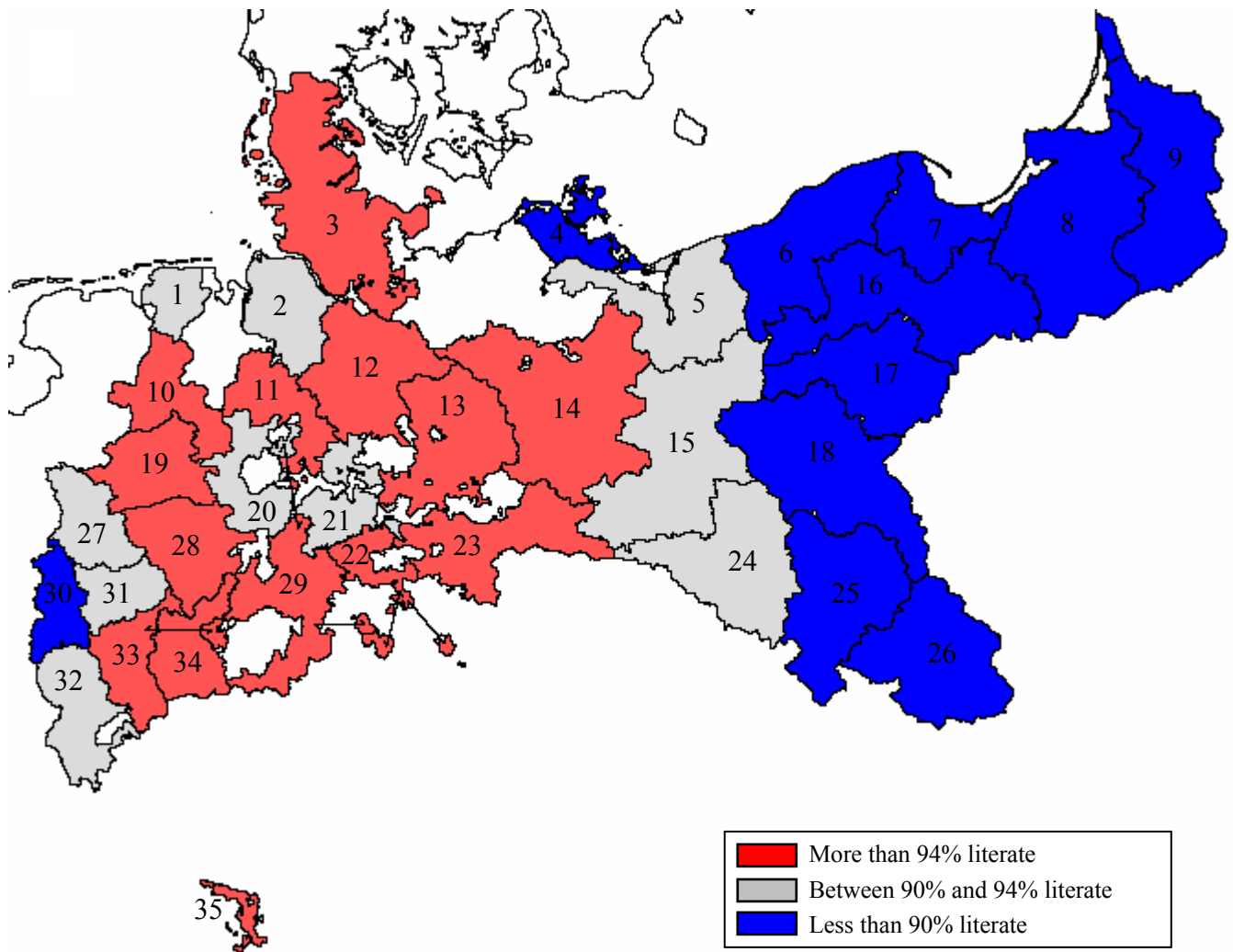
District-level depiction, 1871. District names are provided in Table A1.

(b) Income



District-level depiction, 1871. District names are provided in Table A1.

Figure 4: LITERACY IN 19TH CENTURY PRUSSIA



District-level depiction, 1871. District names are provided in Table A1.

Table 1: DESCRIPTIVE STATISTICS IN 19TH CENTURY PRUSSIA

	Mean (1)	Std. Dev. (2)	Min (3)	Max (4)
% Protestants	64.26	37.82	.26	99.89
% Catholics	34.40	37.53	.04	99.73
% Literate	87.52	12.66	37.40	99.33
% of labor force in manufacturing	27.65	13.41	6.12	71.76
% of labor force in services	6.26	3.55	1.80	24.46
% of labor force in manu and serv	33.91	15.31	7.93	81.53
% of male workers in manufacturing	32.74	14.83	7.20	80.89
% of male workers in services	7.31	4.39	2.04	33.24
% of male workers in manu and serv	40.05	16.96	9.24	90.74
Income of male elementary school teachers (in Marks)	983.24	200.57	711.96	1954.19
% Missing education info	1.69	1.11	.00	6.72
% Age below 10	24.70	2.48	15.33	29.87
% Jews	1.14	1.33	.00	12.87
% Females	51.01	1.51	43.97	54.63
% Born in municipality	58.97	12.37	32.01	87.23
% Of Prussian origin	99.02	2.25	74.22	100.00
% Blind	.09	.03	.00	.24
% Deaf-mute	.10	.05	.00	.42
% Insane	.23	.17	.00	1.56
Average household size	4.79	.35	3.83	5.86
Total population size	54306.02	42108.01	690	826341
Popul. growth 1867-1871 (in %)	1.60	4.93	-7.76	33.83
Distance to Berlin (in km)	332.63	146.56	.00	650.04
Latitude (in rad)	90.87	2.52	83.93	97.24
Longitude (in rad)	22.07	8.16	10.52	39.40
Poland dummy	.38	.49	.00	1.00
% of labor force in mining	2.54	7.57	.00	54.19
% of county population in urban areas	27.48	21.92	.00	100.00
Distance to Wittenberg in km	325.80	148.83	.00	731.46
Year in which annexed by Prussia	1751.94	111.06	1525	1866
% Pupils with distance to school over 3 km	2.99	3.41	.00	19.79

Source: Data for Prussian counties from the 1871 Population Census (453 observations), 1882 Occupation Census (452 observations), and 1886 Education Census (453 observations); see main text and appendix for details.



Table 2: PROTESTANTISM AND ECONOMIC OUTCOMES IN 19TH CENTURY PRUSSIA

Dependent variable:	Total labor force			Male labor force			
	Share	Share	Share	Share	Share	Share	
	Manuf & serv (1)	Manufacturing (2)	Services (3)	Manuf & serv (4)	Manufacturing (5)	Services (6)	
% Protestants	.035 (.015)**	.021 (.013)	.014 (.004)***	.049 (.016)***	.029 (.015)**	.020 (.005)***	.064 (.019)***
% Age below 10	-.441 (.232)*	-.021 (.211)	-.420 (.060)***	-.450 (.256)*	.118 (.232)	-.568 (.074)***	-1.801 (.300)***
% Jews	-.003 (.413)	-.708 (.375)*	.705 (.106)***	.323 (.457)	-.612 (.412)	.936 (.132)***	1.215 (.539)**
% Females	-2.859 (.439)***	-2.374 (.399)***	-.485 (.113)***	-2.847 (.485)***	-2.522 (.438)***	-.325 (.140)**	-4.287 (.573)***
% Born in municipality	.361 (.049)***	.355 (.044)***	.006 (.013)	.408 (.054)***	.407 (.049)***	.0005 (.016)	.264 (.063)***
% Of Prussian origin	-.368 (.265)	-.076 (.241)	-.292 (.068)***	-.454 (.293)	-.060 (.265)	-.394 (.084)***	-.236 (.314)
Average household size	-10.824 (1.840)***	-9.045 (1.673)***	-1.779 (.473)***	-12.743 (2.035)***	-11.103 (1.838)***	-1.639 (.586)***	-7.184 (2.395)***
ln(Population size)	5.211 (1.276)***	3.258 (1.160)***	1.953 (.328)***	5.721 (1.412)***	3.174 (1.275)**	2.547 (.407)***	5.552 (1.536)***
Popul. growth 1867-1871 (in %)	1.642 (.137)***	1.513 (.125)***	.129 (.035)***	1.873 (.152)***	1.717 (.137)***	.157 (.044)***	1.018 (.179)***
Obs.	452	452	452	452	452	452	453
R <sup>2</sup>	.611	.581	.521	.612	.586	.519	.533
F statistic	57.412	50.648	39.739	57.788	51.847	39.536	41.770

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

Source: Data for Prussian counties from the 1871 Population Census, 1882 Occupation Census, and 1886 Education Census; see main text and appendix for details.

<sup>a</sup> Coefficients multiplied by 100.

Further controls: % Blind, % Deaf-mute, % Insane.

Table 3: PROTESTANTISM AND LITERACY IN 19TH CENTURY PRUSSIA

	Total (1)	Rural (2)	Urban (3)
% Protestants	.100 (.010)***	.113 (.010)***	.027 (.008)***
% Missing education info	-.292 (.322)	-.348 (.310)	-.622 (.229)***
% Age below 10	-1.986 (.158)***	-1.717 (.196)***	-.840 (.113)***
% Jews	-.941 (.285)***	.471 (.666)	-1.049 (.063)***
% Females	-1.283 (.302)***	-.905 (.314)***	-.663 (.131)***
% Born in municipality	.494 (.033)***	.475 (.035)***	.274 (.030)***
% Of Prussian origin	-1.152 (.166)	.066 (.218)	-.667 (.098)***
Average household size	-1.603 (1.276)	-.218 (1.201)	-1.493 (.844)*
ln(Population size)	-.393 (.809)	-1.267 (.971)	-.680 (.295)***
Popul. growth 1867-1871 (in %)	.185 (.094)**	.022 (.014)	.118 (.047)**
Obs.	453	428	437
R <sup>2</sup>	.734	.741	.691
F statistic	93.073	91.052	72.658

Dependent variable: % Literate among those aged  $\geq 10$ .

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

Source: Data for Prussian counties from the 1871 Population Census; see main text and appendix for details. Column 1 is for county totals, column 2 for urban municipalities, and column 3 for rural areas inside these counties.

Further controls: % Blind, % Deaf-mute, % Insane.

Table 4: PROTESTANTISM, LITERACY, AND ECONOMIC OUTCOMES IN 19TH CENTURY PRUSSIA

Dependent variable:	Share		Share		Share		Share		Share		Share		ln(Income) <sup>a</sup>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)					
% Literate	.465 (.060)***	.357 (.055)***	.107 (.016)***	.623 (.078)***	.489 (.066)***	.390 (.061)***	.100 (.017)***	.615 (.086)***					
% Protestants													
% Missing education info	.163 (.443)	.224 (.409)	-.060 (.116)	-.250 (.580)	.195 (.445)	.265 (.410)	-.070 (.117)	-.260 (.582)					
% Age below 10	.455 (.248)*	.663 (.229)***	-.208 (.065)***	-.550 (.323)*	.505 (.254)**	.729 (.235)***	-.223 (.067)***	-.565 (.332)*					
% Jews	.505 (.396)	-.296 (.366)	.801 (.104)**	1.835 (.518)**	.464 (.399)	-.349 (.368)	.813 (.105)***	1.847 (.522)***					
% Females	-.2.243 (.424)***	-.1.895 (.392)***	-.348 (.112)***	-.3.462 (.555)***	-.2.236 (.425)***	-.1.886 (.392)***	-.350 (.112)***	-.3.463 (.556)***					
% Born in municipality	.151 (.047)***	.201 (.043)***	-.050 (.012)***	-.046 (.061)	.124 (.056)**	.166 (.052)***	-.042 (.015)***	-.038 (.073)					
% Of Prussian origin	-.201 (.252)	.057 (.233)	-.258 (.066)***	-.123 (.299)	-.210 (.252)	.045 (.233)	-.255 (.066)***	-.120 (.299)					
Average household size	-.9.684 (1.739)***	-.8.067 (1.605)***	-.1.617 (.457)***	-.5.978 (2.268)***	-.9.969 (1.770)***	-.8.439 (1.632)***	-.1.530 (.465)***	-.5.894 (2.310)**					
ln(Population size)	5.753 (1.212)***	3.693 (1.119)***	2.060 (.319)***	5.708 (1.459)***	5.799 (1.213)***	3.753 (1.119)***	2.046 (.319)***	5.697 (1.462)***					
Popul. growth 1867-1871 (in %)	1.583 (.125)***	1.481 (.115)***	.102 (.033)***	.898 (.163)***	1.551 (.130)***	1.440 (.120)***	.111 (.034)***	.908 (.170)***					
Obs.	452	452	452	453	452	452	452	453					
R <sup>2</sup>	.653	.615	.554	.582	.654	.616	.555	.582					
F statistic	63.519	53.842	41.817	46.959	59.005	50.167	38.908	43.512					

Standard errors in parentheses: \* significance at ten, \*\* five, \*\*\* one percent. Sectoral shares refer to total labor force.

Source: Data for Prussian counties from the 1871 Population Census, 1882 Occupation Census, and 1886 Education Census; see main text and appendix for details.

<sup>a</sup> Coefficients multiplied by 100.

Further controls: % Blind, % Deaf-mute, % Insane.

Table 5: PROTESTANTISM AND ECONOMIC OUTCOMES: GEOGRAPHICAL ROBUSTNESS

	(1)	(2)	(3)	(4)
% Protestants	.062 (.017)***	.053 (.016)***	.031 (.014)**	.032 (.017)**
ln(Distance to Berlin in km)	.328 (.963)	-.469 (.935)	.542 (.794)	1.137 (1.341)
Latitude in rad * 100	-2.317 (.605)***	-2.102 (.583)***	-1.545 (.495)***	-4.259 (1.439)***
Longitude in rad * 100	-6.027 (2.206)***	-6.134 (2.121)***	-4.287 (1.799)**	-10.333 (5.267)**
Latit. * Longit. in rad * 100	5.767 (2.382)**	5.806 (2.290)**	3.915 (1.942)**	11.226 (5.726)**
Poland dummy	1.020 (2.356)	1.298 (2.265)	2.349 (1.917)	-1.420 (2.266)
% of labor force in mining		.458 (.076)***	.636 (.065)***	.608 (.064)***
% of county pop. in urban areas			.305 (.023)***	.220 (.025)***
District dummies				yes
Obs.	452	452	452	452
R <sup>2</sup>	.663	.689	.778	.839
F statistic	50.216	53.365	79.820	39.127

Dependent variable: Share of total labor force in manufacturing and services.

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

Source: Data for Prussian counties from the 1871 Population Census, 1882 Occupation Census, and 1886 Education Census; see main text and appendix for details.

Further controls: % Age below 10, % Jews, % Females, % Born in municipality, % Of Prussian origin, Average household size, ln(Population size), Population growth 1867-1871 (in %), % Blind, % Deaf-mute, % Insane.

Table 6: PROTESTANTISM AND LITERACY: GEOGRAPHICAL ROBUSTNESS

	(1)	(2)	(3)	(4)
% Protestants	.125 (.011)***	.122 (.011)***	.118 (.011)***	.070 (.012)***
ln(Distance to Berlin in km)	-.704 (.603)	-1.031 (.618)*	-.843 (.615)	-1.994 (.935)**
Latitude in rad * 100	-.740 (.385)*	-.669 (.384)*	-.566 (.382)	-.762 (1.005)
Longitude in rad * 100	.658 (1.409)	.555 (1.403)	.900 (1.393)	-1.259 (3.683)
Latit. * Longit. in rad * 100	-1.556 (1.521)	-1.467 (1.515)	-1.821 (1.503)	.336 (4.005)
Poland dummy	2.614 (1.492)*	2.873 (1.496)*	3.062 (1.482)**	2.832 (1.582)*
% of labor force in mining		.118 (.050)**	.151 (.050)**	.073 (.045)
% of county pop. in urban areas			.056 (.018)***	.033 (.017)*
District dummies				yes
Obs.	453	452	452	452
R <sup>2</sup>	.801	.804	.808	.886
F statistic	97.001	93.135	90.785	57.181

Dependent variable: % Literate among those aged  $\geq 10$ .

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

Source: Data for Prussian counties from the 1871 Population Census; see main text and appendix for details.

Further controls: % Missing education info, % Age below 10, % Jews, % Females, % Born in municipality, % Of Prussian origin, Average household size, ln(Population size), Population growth 1867-1871 (in %), % Blind, % Deaf-mute, % Insane.

Table 7: PROTESTANTISM, LITERACY, AND ECONOMIC OUTCOMES: GEOGRAPHICAL ROBUSTNESS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
% Literate	.378 (.065)***	.328 (.063)***	.196 (.055)***	.200 (.069)***	.341 (.074)***	.295 (.072)***	.177 (.062)***	.176 (.072)**
% Protestants					.019 (.019)	.018 (.018)	.010 (.016)	.020 (.017)
ln(Distance to Berlin in km)	.402 (.926)	-.373 (.905)	.580 (.776)	1.431 (1.342)	.606 (.947)	-.185 (.925)	.684 (.793)	1.478 (1.342)
Latitude in rad * 100	-1.973 (.588)***	-1.822 (.568)***	-1.396 (.486)***	-3.984 (1.433)***	-2.072 (.595)***	-1.913 (.576)***	-1.448 (.493)***	-4.084 (1.435)***
Longitude in rad * 100	-6.385 (2.164)***	-6.482 (2.090)***	-4.537 (1.790)**	-9.921 (5.257)*	-6.235 (2.168)***	-6.345 (2.095)***	-4.464 (1.795)**	-9.912 (5.254)*
Latit. * Longit. in rad * 100	6.488 (2.335)***	6.477 (2.255)***	4.358 (1.931)**	10.994 (5.715)*	6.281 (2.343)***	6.288 (2.263)***	4.256 (1.939)**	10.941 (5.713)*
Poland dummy	-.415 (2.272)	.049 (2.196)	1.576 (1.878)	-2.139 (2.263)	.073 (2.321)	.491 (2.243)	1.821 (1.918)	-1.976 (2.266)
% of labor force in mining		.425 (.075)***	.610 (.066)***	.597 (.064)***		.424 (.075)***	.609 (.066)***	.594 (.064)***
% of county pop. in urban areas			.296 (.023)***	.218 (.024)***			.295 (.023)***	.214 (.025)***
District dummies				yes				yes
Obs.	452	452	452	452	452	452	452	452
R <sup>2</sup>	.678	.700	.782	.841	.679	.701	.782	.841
F statistic	50.650	53.145	77.407	38.870	48.047	50.528	73.639	38.226

Dependent variable: Share of total labor force in manufacturing and services.

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

Source: Data for Prussian counties from the 1871 Population Census, 1882 Occupation Census, and 1886 Education Census; see main text and appendix for details.

Further controls: % Missing education info, % Age below 10, % Jews, % Females, % Born in municipality, % Of Prussian origin, Average household size, ln(Population size), Population growth 1867-1871 (in %), % Blind, % Deaf-mute, % Insane.

Table 8: EXCLUDING IMPERIAL CITIES AND PRUSSIAN ANNEXATIONS

	Prussian Annexations						
	Excluding Imperial Cities	Linear Trend	Set of dummies	Subsample of counties annexed before			
	(1)	(2)	(3)	1820	1800	1750	1650
% Literate	.496 (.068)***	.491 (.066)***	.310 (.074)***	.485 (.069)***	.529 (.074)***	.532 (.094)***	.583 (.127)***
% Protestants	-.008 (.016)	-.015 (.016)	.010 (.019)	-.005 (.017)	-.013 (.022)	.015 (.026)	-.120 (.078)
Year when annexed by Prussia		-.003 (.005)					
Dummies for years when annexed by Prussia			yes				
Obs.	428	452	452	361	235	179	89
R <sup>2</sup>	.640	.654	.738	.721	.733	.747	.816
F statistic	52.386	55.021	23.070	63.718	43.120	34.596	23.441

Dependent variable: Share of total labor force in manufacturing and services.

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

Source: Data for Prussian counties from the 1871 Population Census, 1882 Occupation Census, and 1886 Education Census; see main text and appendix for details.

Further controls: % Missing education info, % Age below 10, % Jews, % Females, % Born in municipality, % Of Prussian origin, Average household size, ln(Population size), Population growth 1867-1871 (in %), % Blind, % Deaf-mute, % Insane.

Table 9: IV AND 3SLS RESULTS BASED ON DISTANCE TO WITTENBERG

Dependent variable:	2SLS		2SLS		3SLS		
	1st stage Protestant (1)	2nd stage Literate (2)	1st stage Literate (3)	2nd stage Manuf & serv (4)	1st stage Protestant (5)	2nd stage Literate (6)	3rd stage Manuf & serv (7)
Distance to Wittenberg in km	-.094 (.011)***		-.018 (.003)***		-.095 (.011)***		
% Protestants		.186 (.029)***				.188 (.028)***	
% Literate				.437 (.193)**			.437 (.190)**
Obs.	453	453	453	452	452	452	452
R <sup>2</sup>	.419	.689	.703	.653	.419	.689	.653

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

Source: Data for Prussian counties from the 1871 Population Census, 1882 Occupation Census, and 1886 Education Census; see main text and appendix for details.

Further controls: % Missing education info, % Age below 10, % Jews, % Females, % Born in municipality, % Of Prussian origin, Average household size, ln(Population size), Population growth 1867-1871 (in %), % Blind, % Deaf-mute, % Insane.



Table 10: MIGRATION, DISTANCE TO SCHOOL, AND INTERACTION OF LITERACY AND PROTESTANTISM

	Counties with % Protestants < 20% or > 80%		Distance to school		Interaction b/w Prot. and Lit.	
	Share (1)	Share Manuf & serv (2)	Distance to school (3)	Share Manuf & serv (4)	Share Manuf & serv (5)	Share Manuf & serv (6)
% Literate	.499 (.081)***	.492 (.081)***			.401 (.072)***	.505 (.080)***
% Pupils with distance to school over 3 km						
% Protestants	-.015 (.016)		-.026 (.004)***	-.901 (.161)***	-.514 (.171)***	.024 (.104)
Dummy: % Protestants > 80 %		-1.013 (1.443)				
Interaction between % Literate and % Protestants						-.0004 (.001)
Obs.	343	343	453	452	452	452
R <sup>2</sup>	.611	.610	.357	.637	.661	.654
F statistic	36.750	36.686	20.321	59.080	56.691	54.971

Dependent variable in Column (3): % Pupils with distance to school over 3 km.

Dependent variable in all other Columns: Share of total labor force in manufacturing and services.

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

Source: Data for Prussian counties from the 1871 Population Census, 1882 Occupation Census, and 1886 Education Census; see main text and appendix for details.

Further controls: % Missing education info, % Age below 10, % Jews, % Females, % Born in municipality, % Of Prussian origin, Average household size, ln(Population size), Population growth 1867-1871 (in %), % Blind, % Deaf-mute, % Insane.

Table 11: DESCRIPTIVE STATISTICS IN CONTEMPORARY GERMANY

	Catholic (1)	Protestant (2)	Other Christian denomination (3)	Non-Christian religious affiliation (4)	No religious affiliation (5)
Years of schooling	11.56 (2.62)	12.36 (2.77)	10.97 (2.78)	9.72 (1.94)	12.35 (2.70)
Gross monthly income	4801.58 (2072.95)	5060.70 (2241.22)	4607.21 (1882.66)	3918.76 (1242.18)	5734.37 (3414.99)
Sample share	.40	.29	.05	.08	.18

All columns show means. Standard deviations in parentheses.  
 Source: GSOEP 1997. Sample: full-time employed workers, ages 20-55.

Table 12: RELIGION, EDUCATION, AND EARNINGS IN CONTEMPORARY GERMANY

	(1)	(2)	(3)	(4)
Years of schooling			.058 (.003)***	.066 (.003)***
Protestant	.048 (.020)**	.051 (.018)***	.002 (.018)	.004 (.016)
Other Christian denomination	-.033 (.034)	-.004 (.032)	.0005 (.032)	.016 (.029)
Non-Christian religious affiliation	-.169 (.025)***	-.171 (.021)***	-.064 (.024)***	-.050 (.021)**
No religious affiliation	.154 (.024)***	.156 (.022)***	.108 (.022)***	.097 (.020)***
Female		-.268 (.016)***		-.241 (.015)***
Potential experience in years		.021 (.004)***		.035 (.004)***
Square of Potential experience in years		-.054 (.009)***		-.066 (.009)***
Firm tenure		.012 (.003)***		.011 (.003)***
Square of Firm tenure		-.016 (.009)*		-.017 (.008)**
Obs.	2566	2566	2566	2566
$R^2$	.040	.183	.178	.339
$F$ statistic	32.398	69.606	92.089	128.808

Dependent variable:  $\ln(\text{gross monthly earnings})$ .  
Standard errors in parentheses: \* significance at ten, \*\* five, \*\*\* one percent.  
Left-out category of religious affiliation is "Catholic".  
Source: GSOEP 1997. Sample: full-time employed workers, ages 20-55.