Under Which Conditions Does Religion Affect Educational Outcomes?*

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December 16, 2010

Abstract

This paper examines under which conditions religious denomination affects public spending on schooling and educational performance. We employ a unique data set which covers, inter alia, information on numerous measures of public school inputs in 169 Swiss districts for the years 1871/72, 1881/82 and 1894/95, marks from pedagogical examinations of conscripts (1875-1903), and results from political referenda to capture conservative or progressive values. Although Catholic districts show on average significantly lower educational performance and spend less on primary schooling than Protestant districts, Catholicism is harmful only in a conservative milieu. We also exploit information on absenteeism of pupils from school to separate provision of schooling from use of schooling.

Key words: Catholicism; Human capital; Political attitudes; Public education; Religious denomination.

JEL classification: H52; I20; O10.

Acknowledgements: We are indebted to Abhijit Banerjee, Sascha Becker, Matthias Doepke, Michel Habib, Mathias Hoffmann, Ann Markussen, Patrick Puhani, Rainer Winkelmann, Ludger Wössmann, Fabrizio Zilibotti, Oliver Zimmer and seminar participants at the 7th conference of the European Historical Economics Society (EHES) in Lund, the European Economic Association (EEA) Meeting in Milan, the Max-Planck-Institute of Bonn, University of Hanover, University of Leipzig, University of Munich, University of St. Gallen, and University of Helsinki for illuminating discussions. We are also grateful to Christian Bollinger for providing us with the political data, and to Brigitte Gasser, Benedikt Hofer, Maximilian Hofer, Daniela Lang, David Nietlispach, and Christopher Young for reliable research assistance.

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1 Introduction

Recent evidence by Becker and Woessmann (2008, 2009, 2010) suggests that Protestant regions had higher literacy rates, higher density of schools, higher primary school enrolment, and a lower gender gap in education than Catholics in 19th century Prussia. Their findings refine the famous hypothesis of Weber (1905), who argued that Protestantism was conducive to economic development. Weber himself emphasized Protestant work ethic and Protestant motivation to accumulate capital.[1] By contrast, the evidence by Becker and Woessmann points to the role of religious denomination for economic development through its effect on education.

The analysis presented in this paper advances their hypothesis by shifting the focus away from average effects of religious denomination on education towards the interaction of religion with other sociocultural characteristics. We employ historical data from Swiss districts during the second phase of industrialization. Our purpose is to identify under which sociocultural conditions religious denomination does or does not matter for publicly financed education and educational performance.

The long history of a direct-democratic political system in Switzerland allows us to characterize the sociocultural environment by political attitudes, captured by employing voting results of three historical federal referenda: on easing restrictions for civil marriage held in 1875, on the "Factory Law" which imposed work regulations including the prohibition of child labor in 1877, and on the re-introduction of the death penalty in 1879. The issue at stake in these three referenda is that voting behavior reveals more or less conservative or progressive political views. Support of civil marriage reveals a political attitude in favor of secularization. The "Factory Law" introduced a progressive economic reform revealing a non-conservative political attitude in its supporters, whereas support of the death penalty is generally associated with conservatism.[2]

[1] See Iannaccone (1998, p. 1474 ff.) for a critical review of Weber's original hypothesis. Employing contemporaneos data, Arruñada (2010) finds no indication that individual working hours are related to religious denomination. However, Schaltegger and Torgler (2010) present evidence which suggests that Protestants give higher priority to work when they are more religious and better educated. A new twist is brought in by Doepke and Zilibotti (2008) who examine the evolution of Protestant values in interaction with occupational choice.

[2] All referenda were accepted by small margins. However, there was a very large variation of voting results across districts. (See section 4 for details.)

The main hypothesis we advance in this paper is as follows: Although Catholic districts show, on average, significantly lower public education spending per pupil and weaker educational performance than Protestant districts, the role of religious denomination for the educational production process is largely modified if one accounts for sociocultural characteristics interacting with religion. The evidence suggests that Catholicism loses its importance for educational production in a non-conservative milieu supporting secularization and work regulations. Moreover, we find that religious denomination played a minor role for educational outcomes when there was little support for the death penalty.

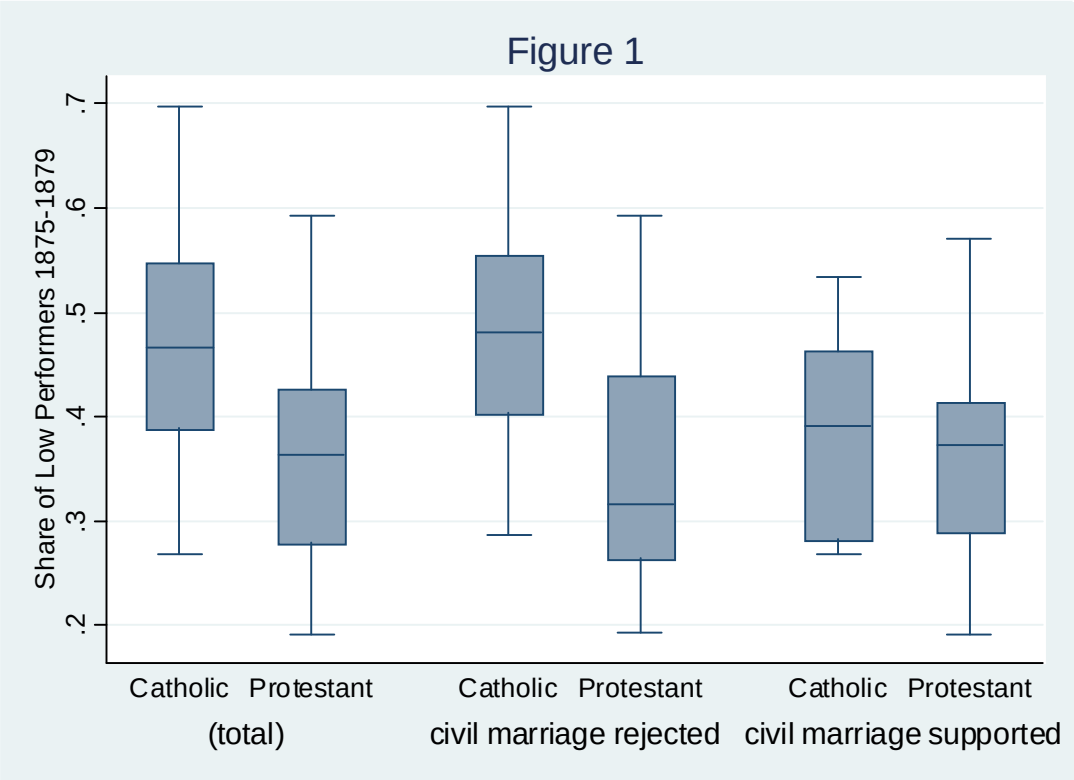

Figure 1 illustrates the central message derived from our empirical analysis. The left boxes show that the median share of low performers in the conscripts' pedagogical examinations is considerably higher in Catholic districts than in Protestant districts and even higher than the 75th percentile for Protestant districts. The difference between Catholics and Protestants widens when we focus on those districts where the majority of voters rejected the referendum on easing civil marriage (middle boxes). In contrast to this, however, in districts in which a majority approved the referendum on civil marriage (right

boxes) the relation between religious denomination and educational outcomes ceases to exist. An evaluation of the votes on the Factory Law or the death penalty gives analogous figures.

Consistent with our hypothesis that not religious denomination alone but its interaction with other sociocultural characterisitcs mattered for the public debate and policy action on education and secularization, anecdotal historical evidence suggests that there were prominent liberal and conservative voices from both religious groups. As documented in Späni (1999), conservative Protestant priests opposed liberal promoters of educational reforms, and liberal Catholics faced conservative forces against educational reform. In the public debate about secularization, the editors of a conservative Catholic periodical explicitly warn against liberal Catholics while speculating that conservative Protestants may be allies - though unreliable.[3]

Since the seminal work of Mincer (1958) and Becker (1964), there is a huge body of research which aims to identify the determinants of educational success. In view of the apparent importance of human capital formation for economic growth, it is not surprising that, for instance, the results of the OECD Programme for International Student Assessment (PISA) meets with considerable interest both from the research and the policy side.[4] In Switzerland, at the turn of the 19th Century, there was a similar wave of interest in education and performance, triggered by attempts to harmonize the cantonal education systems (Zimmer, 2003). In 1874, the constitutional reform placed the responsibility for primary education on the cantonal and municipal level, while nationwide quality control remained an issue. To overcome the problem, the Federal Council tried to implement an inspection system under federal authority. This attempt did not meet with general approval and, in 1882, was rejected in a referendum. But as an alternative to the inspection system, the government could use the pedagogical examinations of con-

[3]In a memorandum proposing the formation of a "catholic-conservative cantonal, district, and municipal committee" against the further secularization of the constitution, they emphasize: "We have so far referred to the conservative-catholic politicians only; from the liberal Catholics we actually do not expect anything [...] Conservative, honest thinking Protestants [...] are isolated and without influence on the public life and goings [...] unless it could be achieved to unify the conservative and truly acquiescent Protestants in order to prevent an irreligious direction of the revision of the federal constitution". (Schweizer Blätter, 1871, p. 353f., own translation)

[4]The PISA studies assess scientific, reading and mathematical literacy in a three-yearly survey (2000, 2003, 2006...) of 15-year-olds in the principal industrialised countries. See www.pisa.oecd.org/.

scripts (implemented in 1875) to effectively monitor differences in regional performance (Mattmüller, 1982). The examinations were based on standardized tests and covered the whole male population. The resulting marks were published in annual rankings, debated, and subjected to inter-regional comparison.

We measure educational success by conscripts' marks in the pedagogical examinations on reading, essay, numeracy and Swiss history. Uniformity and comparability of results were major priorities throughout the years of testing (Lustenberger, 1996). Our set of explanatory variables includes numerous measures of public school inputs which have been suggested by the literature on educational production, such as expenditure per pupil, school capital per pupil, school weeks, pupil/teacher-ratio, teachers' training, age, gender, and length of service. The data set covers information on schools in 169 Swiss districts for the years 1871/72, 1881/82, and 1894/95. Contemporaries emphasized the generally high quality of these school statistics (Huber, 1897, Bundesrat, 1897).[5]

Controling for school inputs allows us, to the best of our knowledge for the first time, to augment a standard educational production function with religion and other sociocultural characteristics. The approach is particularly suited to gain differentiated insights on whether and how religion plays a role for shaping publicly-financed human capital formation. We show that the interactions between religious denomination and political attitudes shape educational outcomes through their effects on public education expenditure per pupil but also for given levels of school inputs. Generally, the large disparity in public school inputs across districts makes Switzerland is an ideal testing ground for the purposes of our study, thanks to the responsibility for primary school finance and tax authority on the municipal level. In addition, we are able to exploit information on pupils' absenteeism from school to analyze its effect on the results of pedagogical examinations. This allows us to separate the effect of schooling from the "use of schooling" (school attendance). The analysis of absenteeism leads to further new insights on the potential determinants of educational outcomes. The evidence suggests that also with respect to school attendance Catholicism matters only in a conservative milieu (i.e., is negatively

[5]Switzerland even received an award for their compilation of school statistics at the World Exhibition 1873 in Vienna (Gonon, 1999).

related to absenteeism) while playing a negligible role in a culturally progressive environment.

The paper is organized as follows: Section 2 discusses the advancements of our paper with respect to the related literature. Section 3 provides the theoretical considerations from which we derive our estimation model. The data is described in section 4, where correlations between important variables are also discussed. Section 5 discusses the estimation strategy and provides the main results. The last section recapitulates the main conclusions.

2 Related Literature

Our research combines the literature on educational production with the literature on the role of religion and culture for economic outcomes. We complement the findings by Becker and Woessmann (2009, 2010) in several ways. First, we consider Switzerland instead of Prussia. Second, we examine the effect of religious (Christian) denomination on different outcome variables than literacy, school density and enrolment, namely public spending on primary schooling, absenteeism from school and educational test results. Third, and most importantly, we allow for interactions of religion with political attitudes and the sectoral structure to investigate under which conditions religion matters for human capital formation. Moreover, by controling for school inputs, we are able to separate several specific channels through which sociocultural factors have an impact on human capital formation: via public education expenditure, via school attendance, and through learning effort at home. The most distinctive result to the previous literature is our finding that the beneficial effects of Protestantism are significantly weakened or non-existent in a progressive and non-conservative milieu as reflected in results of federal referenda.

The rich dataset on public school inputs relates our study to the literature on the effects of school resources on educational production or, more precisely, on standardized test scores. For the US, the literature is reviewed, inter alia, by Hanushek (1986, 1996, 2002) and Greenwald, Hedges and Laine (1996). Woessmann (2005) provides a detailed account of evidence from Western European countries. The reviews provide mixed conclusions

about the effectiveness of school resources in raising test scores. For instance, many OLS estimates with school level-data suggest that raising school expenditure to lower the pupil-teacher ratio has little impact on test scores. As theoretically shown by Lazear (2001), class size effects on individual test scores are biased towards zero when behavior of students is not controlled for and low-performing pupils are put into smaller classes. In our paper, this problem is substantially reduced due to the aggregate nature of the data. Hanushek, Rivkin and Taylor (1996) argue that existing studies using state-level or district-level data show higher effects of school resources on test scores but may deliver biased estimates when not controlling for non-school district or state characteristics. Fortunately, our data set allows us to include a variety of non-school variables which are likely to be correlated with attitudes towards education and the learning environment, affecting both the educational production process for given school attendance and through a change in absenteeism. We find that school resources matter**,** although sociocultural characteristics seem relatively more important. We are careful to interpret the results by making use of theoretical considerations (in section 3) which take into account the public budget constraint for educational spending. Besides incorporating sociocultural factors, our main innovation for estimating educational production is to exploit information on absenteeism. This takes into account that school attendance is a choice variable which may depend on both sociocultural factors and school resources, in turn affecting educational outcomes.

3 Theoretical Considerations

We consider primary education. Even though primary education was compulsory in Switzerland during the time period under consideration, there was apparently significant discretion by pupils or parents in choosing school attendance, as revealed by our data.[6] We account for this by endogenously explaining absenteeism. Moreover, human capital acquisition in schools may be complemented by efforts at home (learning efforts of pupils and parents' support). In sum, households (of parents and pupils) can influence educa-

[6] Compulsory schooling was introduced on a national level in 1874. Thus, regarding the time period under consideration, compulsory schooling had not yet become a matter of course and enforcement was partially imperfect.

tional production by voting over the level of public expenditure, by school attendance and by home efforts. The following theoretical model of human capital formation accounts for these three channels. First, we characterize the outcome of the education system by analyzing economically optimal behavior of the representative household with respect to the three variables public school expenditure, school attendance and home effort. Then we extend the model to account for religion effects and other cultural attitudes.

3.1 Educational Production

Human capital, h, depends on school quality, Z, on home efforts, e, and on school attendance, $E \equiv 1 - a$, where a is the fraction of teaching time that a pupil is absent from school. While Z represents the supply of educational services by schools, attendance E reflects the use of school services by the household. Absenteeism reduces the effective use of school services one to one. Private effort e captures, for instance, the support of parents for the education of their children at home. We assume that home efforts complement the used school services, EZ, according to a Cobb-Douglas function

$$h = e^{1-\varkappa}[EZ]^{\varkappa},\ 0 < \varkappa < 1. \tag{1}$$

The quality of education provided by schools depends on school inputs. We do not distinguish between classes and school, and assume that school inputs are the same for each pupil within a district. In our data set, the observable school inputs are the number of school weeks per year, s, the number of pupils in a class, m, and capital costs (e.g. for school buildings) per pupil, k. We also observe a vector $\mathbf{T}$ of teacher characteristics including formal education, gender, age, and experience of a teacher. In addition, unobserved variations in school inputs may affect school quality. For instance, teacher efforts or the quality of school managements can vary across districts. In our data, we do not observe teacher remuneration aggregated at the district level to account for such effects. However, we have data on total public spending per pupil, g. This allows us to infer the proportions of spending on unobserved inputs from the public budget constraint. The

spending explained by observable inputs is given by the sum of capital and teacher costs.[7]

$$k + \frac{W(\mathbf{T}) \cdot s}{m} \equiv \theta(\mathbf{z}), \tag{2}$$

where $W(\mathbf{T})$ represents the wage component (for a teacher per school week) related to observable teacher characteristics. $\mathbf{z}$ is the vector of observable school inputs (including the observable teacher characteristics). We assume that the share of spending which is not explained by observable inputs works like a quality augmenting factor. For instance, additional spending on teacher wages induces more able individuals to choose the teacher occupation, or, reflecting standard efficiency wage arguments, may trigger higher effort provision and less turnover of teachers. Formally, let $q(\mathbf{z})$ be the technology relating observed school inputs to output of school services per pupil. Then,

$$Z = q(\mathbf{z})\left(1 + \omega\right), \tag{3}$$

where

$$\omega = \frac{g - \theta(\mathbf{z})}{\theta(\mathbf{z})} \tag{4}$$

is the ratio of unexplained to explained school expenditure. Using this in (1), we have

$$h = e^{1-\varkappa} E^{\varkappa} g^{\varkappa} Q\left(\mathbf{z}\right), \tag{5}$$

$Q\left(\mathbf{z}\right) \equiv \left[q\left(\mathbf{z}\right)/\theta(\mathbf{z})\right]^{\varkappa}$. In sum, the effect of school resources on human capital can be decomposed in two factors: The level of resources available to schools, given by public school spending g, and the expenditure structure according to which total expenditure is distributed over different inputs. The latter factor is captured by $\mathbf{z}$. Given the allocation on the observed inputs, $\mathbf{z}$, school expenditure g positively affects school quality and thus human capital h. For a given g, its allocation on inputs $\mathbf{z}$ potentially affect school quality and human capital in two opposing ways. For instance, higher capital spending per

[7] We implicitly assume that extending school weeks, s, is consequential for the public budget only through affecting wage costs for teachers. Also note that the inverse of class size, $1/m$, is the number of teachers per pupil.

pupil positively affects Z since it leads to a better learning infrastructure in school (this is reflected by $q(\mathbf{z})$). However, for a given per pupil expenditure g, it goes along with a reduction in other inputs, including the unobserved inputs, and thereby may impede school quality.[8]

3.2 The Economic Determinants of Educational Production

At first, we characterize the provision of education if household behavior is based on purely economic considerations. This means that the only motive for acquiring human capital is its potential to generate income. Assume that the gross income earned by an agent with human capital h equals Ah, where A reflects the state of development of the considered economy. (In the empirical analysis, we assume that A is negatively related to the agricultural labor share in a district.) Then, the representative household's net income is given by

$$c = Ah - g. \tag{6}$$

For acquiring h the household incurs, in addition to the cost of public school inputs, effort e at home and the effort required for school attendance, E. We assume that total effort costs are given by

$$\phi(e, E) = \varphi\left[e + (1 + d)E\right], \tag{7}$$

where $\varphi > 0$, $d \geq 0$. One straightforward interpretation is that e and $(1+d)E$ is the time spent on home effort and attendance, respectively. Parameter d captures the distance of a pupil to its school, where a larger d raises (time) costs to attend school. The economic preferences of the household are given by the utility function:[9]

$$U = \log(c) - \phi(e, E). \tag{8}$$

[8] Similarly, although a higher class size (m) leads to a deterioration of the learning environment (e.g. Lazear, 2001), it also allows to pay higher wage rates for teachers when holding the other school inputs constant, thereby possibly raising school quality by increasing teacher quality. Similar arguments apply to school weeks (s).

[9] We did the analysis for more general cost and utility functions. The essential results remain valid. More specifically, we considered the following specifications: $\phi\left(e, E\right) = \varphi\left[e^{\beta} + (1 + d)\, E^{\beta}\right]$, $\varphi > 0$, $1 \leq \beta$, and $U = u(c) - \phi\left(e, E\right)$, $u' > 0$, $u''(c) < 0$.

In sum, for a given public expenditure level g, the representative household of a district chooses home support e and attendance E by solving

$$\max U \text{ subject to (5)-(7).} \tag{9}$$

Moreover, as a voter, the representative household chooses g according to (9). While the level of public school expenditure is determined by the voters, the allocation of school budgets on the different school inputs is controlled by the school administration. The voter takes the structure of inputs given. To fix ideas, we assume that the voter observes input vector $\mathbf{z}$ before voting over the school budget g and can infer the expenditure structure from $\mathbf{z}$.[10] As a result, education in a district is characterized by the following properties.

Proposition 1 *Assume that educational production is determined by economic motives according to (9). Then, i) absenteeism (a) increases with distance to school (d), whereas home effort (e) is invariant with respect to distance. ii) Public expenditure per pupil (g) is positively related to the state of economic development (A).*

Proof: Appendix A.

Part (i) shows that effort allocation of households changes in favor of school attendance if the distance to school declines. The fact that home support doesn't depend on distance to school ensures that educational performance − given by (5) − is unrelated to d after controlling for absenteeism ($a = 1 - E$) and per pupil spending (g). Part (ii) predicts that school expenditure per pupil is higher in economically more advanced districts than in less developed districts.

[10] This is possible if expenditure shares and input prices are invariant with respect to the scale of educational production. Formally, let λ denote the scale of educational production and $\mathbf{z}_0$ be the vector of the weights of the different inputs. Then $q(\mathbf{z}) = \lambda q(\mathbf{z}_0)$ and $\theta(\mathbf{z}) = \lambda\theta(\mathbf{z}_0)$. Thus, $Z = gQ(\mathbf{z}) = g\left[q(\mathbf{z})/\theta(\mathbf{z})\right]^{\varkappa} = g\left[q(\mathbf{z}_0)/\theta(\mathbf{z}_0)\right]^{\varkappa}$.

3.3 Accounting for Cultural Attitudes

To account for the fact that cultural attitudes may play a role in the education system, we extend household preferences by two components and assume that utility is given by

$$V = U + \gamma \log(h) - \psi(1 - E),\ \gamma > 0,\ \psi > 0. \tag{10}$$

The term $\gamma \log(h)$ captures the (culturally rooted) value assigned to education. For instance, all other things equal, γ may be higher in a Protestant district than in a Catholic district, possibly reflecting a specific form of Weberian Protestant ethic which affects effort provision in education.[11] More generally, γ is a function of the sociocultural characteristics of a district. Besides religious denomination, the values captured by the results from the political referenda can affect education. In the empirical analysis, we are particularly interested in the question on how political attitudes revealing liberal or conservative values modify the role of religious denomination on absenteeism, home support and school expenditure. Conservative political views are reflected in the support of the death penalty whereas liberal views are reflected in the support of civil marriage (secularization) and progressive work regulations. Cultural differences between districts may also be related to language (German, French, Italian and Rhaeto-Romanic in the Swiss context) or, importantly, to interactions between religious denomination and political attitudes. In the empirical analysis, sociocultural district characteristics are represented by vector $\mathbf{x}$; formally, $\gamma = \tilde{\gamma}(\mathbf{x}, A)$.

The term $\psi(1 - E)$ captures heterogeneity in the attitude towards school attendance. One reason for variation in this attitude may be heterogeneity in internalized norm compliance. Other reasons are different "cultures" of sanctioning absence from school, or that people from different backgrounds react differently to sanctions. For instance, clerical teachers may be stricter than laypersons; pupils may fear male teachers more than females; punishments in Catholic districts or in rural environments may be harder than in Protestant or urban districts; or respect of authority and obedience differ across mi-

[11] In Switzerland, at the time we consider, almost everybody was either Catholic or Protestant, and the distribution of the share of Catholics across districts centered close the extreme values 0 and 1.

lieus. We account for such differences in the simplest possible way by assuming that the disutility of absence is proportional to absenteeism, $a = 1 - E$. Parameter $\psi \geq 0$ reflects both the strength of sanctions and the fear of sanctions. As the examples showed, ψ may vary with both school characteristics, in particular teacher characteristics, and non-school characteristics of a district. Formally, $\psi = \tilde{\psi}(\mathbf{x}, \mathbf{z}, A)$. Under the preferences represented by (10), private effort, attendance and educational performance are biased as follows - compared to the optimal program based exclusively on the economic values of human capital.

Proposition 2 *If educational production is determined by economic and cultural motives according to (10) we have in addition to part (i) and part (ii) of Proposition 1 the following effects: i) Home effort is increasing in γ and invariant with respect to ψ. Absenteeism is decreasing in both γ and ψ. ii) Spending per pupil is positively related to home support and school attendance and therefore also rises with γ and, if there is absenteeism, also with ψ. In addition, an increase in γ has a direct positive effect on g.*

Proof: Appendix A.

Part i) shows that heterogeneity in the cultural attitudes towards schooling leads to a bias in private effort allocation. Part ii) shows how cultural motives can affect school expenditures. A positive ψ means that absence from school has "cultural" costs - for instance, stricter sanctions of absenteeism by teachers or more respect of discipline. In contrast, a positive γ reflects cultural attitudes which attribute a positive value to human capital, in addition to its economic value. According to part (i), school attendance rises with both higher sanctions for absenteeism and a higher value assigned to education. Home effort is positively related to the latter but does not depend on the former. Religion, political values and other sociocultural characteristics can affect the outcome of the education system through home effort, school attendance and expenditure in different directions. For instance, in Protestant districts, the economic determinants of educational choices may be associated with a positive cultural valuation of human capital, whereas in districts with many clerical teachers respect of discipline may be high regardless of the value of human capital. According to Proposition 2, in the first type of district, we

should expect better educational performance through higher home effort (part i) as well as higher public spending (part ii) than in a Catholic district, especially if these Catholic inhabitants hold conservative political values (see introduction). In the later type of districts, we should expect high school attendance (part i). As this implies more use of school services, also the willingness to pay for school services (and therefore g) may rise, ceteris paribus (part ii).

4 Data

4.1 Pedagogical Examinations

As the output measure of primary school performance, we use the results of the pedagogical examinations of conscripts at the district level (five year averages) for the periods 1875-79, 1885-89. and 1899-1903.[12] The pedagogical examinations of conscripts had been introduced in several cantons as early as the 1850s to check the efficiency of their school systems. The idea of surveying the output of education definitely won recognition with the introduction of those early cantonal examinations (Lustenberger, 1996, p. 25-34; Lustenberger 1999, p. 364f). The new federal constitution of 1874 demanded "adequate" education, but provided no legal background for controls by the federation. The only means to check the cantonal education systems was to implement pedagogical examinations in the military service, which was compulsory for every male citizen. With the new constitution, the federal state had also received more competence in the military sector. It immediately installed a new military law providing standards for the different branches of service, including a paragraph with rules for the pedagogical examinations. With few exceptions, recruits had to undergo a standardized test in four subjects: reading, essay-writing, mathematics (written and oral) as well as knowledge of Swiss history and constitution (Zimmer, 2003, p. 181).[13] In the first four years (1875 to 1879), the grades

[12] Data sources are provided in Appendix B.

[13] Recruits with secondary education (i.e. at least one, or from 1880 onwards two years of higher education) were not required to take the test. If they were able to provide acceptable records, they were automatically assigned the best grade. However, only few of the higher educated conscripts seemed to make use of this possibility. In 1886, only 235 out of 24'059 tested recruits were evaluated according to their school reports. Blind, deaf or mentally disabled conscripts were freed from the tests, as well, and

ranged from 1 (very good) to 4 (poor), and thereafter from 1 to 5. Those recruits who did poorly in more than one subject (i.e. marks 4 to 5) were compelled to take repetition courses during military training.

During the next four decades, the pedagogical examinations were steadily improved according to new pedagogical and statistical requirements. The federal state enforced a variety of measures to ensure uniformity and comparability of results (Lustenberger, 1996, p. 58-66). For instance, the examiners themselves might have formed a certain risk of distorting the results, but precautions were taken: The experts were not allowed to take tests in the canton they came from; all the experts met once a year to set standards securing the uniformity of evaluation, and for the same reason, one of them had to attend all the tests in the different divisions; guidance papers were framed, and preparation courses for experts and their assistants introduced.

4.2 School Statistics

The first of a series of four extensive collections of regional education statistics was published by Kinkelin (1875), initiated by the Federal Department of Home Affairs as a prize-winning contribution to the World Exhibition in Vienna in 1873. On the occasion of the first National Exhibition 1883 in Zurich, a second collection was compiled by Grob (1883). In 1894/1895, Huber was assigned to renew the school statistics for the National Exhibition 1896 in Geneva (Huber, 1897), and again in 1911/12 for the National Exhibition in Berne 1914 (Huber and Bay, 1915). The exhibitions legitimated the collection of statistical material on education all over Switzerland, because federal intervention in the school system was out of the question after the negative vote on the secretary of education in 1882.

The data analyzed in our study cover the years 1871/72, 1881/82, and 1894/95.[14] They provide information on pupils, teachers, budget, and facilities on the level of the individual schools. The results are aggregated by districts, which constitute the base of

accordingly do not appear in the results at all.

[14]The data refers to a school year which begins/ends in spring. We cannot use the data from 1911/12, because the pedagogical examinations stopped in 1913.

our data set. Several smaller cantons are not subdivided into districts,[15] so either the available municipal data or the cantonal totals were taken. There are 156 observations for 1871/72, 168 observations for 1881/82 and 169 observations for 1894/95.[16]

The statistics contain detailed information on the budget of the schools. From the budget information, we use total annual real public school expenditure per pupil in logs (*Expenditure* $[\log g]$)[17] and the real capital stock per pupil in logs (*Capital* $[\log k]$).[18] Further information on the quality of the learning environment is provided by the pupil-teacher ratio (*ClassSize* $[\log m]$) and the school weeks (*Weeks* $[s]$).

Absenteeism is measured by the number of school days per year a pupil is absent from school in logs. The corresponding variable *Absenteeism* $[\log a]$ can be interpreted as a measure for the degree of utilization of the supply of school services. From 1881/82, the data set contains information about the number of pupils with a long distance from home to school. Grob (1883) started to collect these data as a potential reason for absenteeism. The variable *Distance* $[d]$ is the share of pupils with a distance of more than 3 km to school (1881/82) and more than 2.5 km (1894/95). Since we do not have data for 1871/72, we assume that the share is the same as in 1881/82.

Teachers are characterized by their training, status (cleric or layperson), gender, age and length of service. The clerical teachers (their share is denoted by *Clerics*) either belonged to a religious order or worked in a parish; vocational education could either be taken at university, teacher training seminars, grammar schools, in courses, or simply with finishing primary school and via "other" training such as self-study. We categorize primary school, courses and "other" as inadequate training; the fraction of teachers falling in this category is denoted by *PoorTr*. The variable $Age > 40$ represents the share of teachers older than 40 years, and $Experience > 20$ measures the share of teachers with

[15] Obwalden, Nidwalden, Glarus, Zug and Appenzell Innerrhoden in all school statistics; Lucerne in 1881/82, and Uri in 1894/95.

[16] For 1871/72, the data for the canton Valais on the district level are incomplete. For 1881/82 data for Saanen (canton Berne) is missing.

[17] Throughout, the variable name in squared parenthesis refers to the notation in section 3; we also indicate when we employ logs.

[18] The deflator is a consumer price index (1913=100) on the national level from Ritzmann-Blickenstorfer and Siegenthaler (1996, Table Q1a; *Konsumdeflator*). In the theoretical analysis of section 3, k denotes investment rather than the stock of school capital. We therefore implicitly assume that both variables are highly related.

more than 20 years of service. *Female* refers to the fraction of female teachers.

The quality of the school statistics data is generally high. Huber (1897, p. XVI) stressed that "the data eventually reached the maximum completeness and reliability" (own translation). Also the Swiss Federal Council recognized the compilation as "accurate and complete work" (Bundesrat, 1887, p.1089; own translation). Only with respect to the absenteeism variable, for 1871/72, Kinkelin (1875, p. Xf.) himself cautions against a careless use of the numbers because of the lack of standards (see also Grob, 1883, p.VII).[19] We address the problem by instrumenting *Absenteeism* [$\log a$] in our econometric analysis of the determinants of test scores with our measure of distance to school (*Distance* [d]).

4.3 Other Control Variables

The main source of the other control variables is the Swiss census. Since 1860, the census was reiterated every ten years, with the exception of 1888 (instead of 1890). Our census data cover the years 1870, 1880, and 1888. For every district, we have information on the proportion of population employed in the primary sector (*Primary* [μ]),[20] as well as the share of Catholics (*Catholics*) and majority language (measured by dummy variables *German*, *French*, *Italian*, *Romanic*). We also calculated the ratio of children between 0 and 15 years to total population (*Children* [n]), in order to control for the family structure in a district.[21]

For measuring the prevalence of conservative or progressive attitudes, we use district data of yes-votes on three referenda:[22] The "Factory Law" (*Fabrikgesetz*) 1877, the referendum on the introduction of the civil marriage 1875, and the referendum on the re-introduction of the death penalty in 1879.[23] The "Factory Law" (*YesFactory*) prohibited

[19] By introducing cantonal regulations, the quality of the data on absenteeism from school was improved in the later surveys.

[20] For interpretation reasons, the variable *Primary* [μ] measures the mean subtracted agricultural labor share.

[21] Thereby we control for the possibility that a higher fraction of children is associated with lower education spending per pupil, higher absenteeism, or lower home effort. For instance, parents with more children may find it more costly to send them to school or to support their studies at home.

[22] For interpretation reasons, variables on voting behavior measure the share of yes-votes minus the mean share of yes-votes.

[23] The data set is based on a collection by Rolf Nef and Peter Gilg, and will be published in the near future by SIDOS (www.sidos.ch). We are grateful to Christian Bollinger for allowing us access.

child labor for children younger than 14 years, and consequently enabled compulsory school attendance (Studer, 2005).[24] The fraction of voters supporting the introduction of civil marriage ($YesCivil$) captures attitude in favor of secularization, which in turn may be conducive to non-religious education. The optional referendum was only accepted due to the majority of the citizens, whereas the majority of the cantons dismissed it.[25] The compulsory referendum on the reintroduction of the death penalty, which had been banned by the 1874 constitution, was nearly as controversial.[26] Distinctions between the conservative and progressive regions could clearly be seen in the voting behavior. We interpret the fraction of voters supporting death penalty ($YesDeath$) as a measure of political conservatism and the fraction of voters supporting the factory law ($YesFactory$) and the introduction of civil marriage ($YesCivil$) as a measure of prevalence of progressive political attitudes.[27]

4.4 Summary Statistics and Correlations

Tab. 1 provides summary statistics of important variables employed in the panel data analysis of the coming section. The variation in the data is remarkable. For instance, the average of the fractions of conscripts who failed in the tests on reading, essay writing, math and history ($LowPerf$) ranges from 1.3 to 70 percent, with a standard deviation of 15.5.

<Table 1>

[24] The "Factory Law" was accepted by a very narrow majority. Citizens: 179'915 : 170'140; cantons 14 : 8 (Ritzmann-Blickenstorfer and Siegenthaler, 1996, Table X10).

[25] Citizens: 211'336 : 203'437; cantons: 9.5 : 12.5 (Ritzmann-Blickenstorfer and Siegenthaler, 1996, Table X10). The federal constitution of 1848 required a compulsory referendum on constitution issues, with both the majority of yes-votes by the cantons (*Ständemehr*) and the majority of yes-votes by the citizens (*Volksmehr*) for acceptance. In the revision of 1874, the optional referendum on laws and decisions was institutionalized (Gilg, 2005), requiring only a majority of yes-votes by the citizens.

[26] Citizens: 198'335 : 179'251; cantons: 14 : 8 (Ritzmann-Blickenstorfer and Siegenthaler, 1996, Table X10).

[27] To check robustness of our main results, we experimented with further control variables. To account for possible human capital spillover effects among households, we included the altitude of a district (as spillovers may be lower in the mountains where the population is detached from bigger cities) and population density in our regressions. The effects of changes in these variables almost always turn out to be insignificant and leave other coefficients basically unchanged. So we did not include the variables in the reported regressions.

The voting results from the three referenda also differed substantially across districts, which indicates considerable cultural divisions within Switzerland. For instance, in Goms (canton Valais) there were 1'201:1 votes against and in Biel (canton Berne) 1'909:49 votes in favor of civil marriage. Similarly, in Raron (canton Valais), we find 1'215:4 in favor and in La-Chaux-de-Fonds (canton Neuchâtel) 2'581:220 votes against the death penalty. Similar extreme differences can be found for the referendum about the "Factory Law". The standard deviations of the fraction of yes-votes in the three referenda all exceed 20 percentage points.

There were also large differences in school inputs. For instance, some districts had more than twice as many school weeks than others, and the standard deviation in the data is six weeks. Spending per pupil differed substantially, too. Moreover, some districts had a large fraction of poorly trained, experienced or older teachers while others had none of those teachers. Finally, in some districts, there were no female or clerical teachers whereas the large majority of teachers had these characteristics in others.

<Table 2>

Tab. 2 provides the correlation coefficients among cultural indicators on the one hand (panel (a)) and between the share of Catholics (*Catholics*) and other important (non-cultural) indicators on the other hand (panel (b)). Panel (a) shows that *Catholics* was positively correlated with the fraction of supporters of the death penalty and negatively with the support of civil marriage. Correlations were quite strong but not near-perfect, suggesting that share of Catholics and yes-votes on these issues don't measure the same cultural traits. Support of the "Factory Law" was barely related to the share of Catholics. There is a rather high correlation between support of the death penalty and opposition to civil marriage, which is consistent with the interpretation that these variables reflect "conservative" attitudes. All three referenda, particularly on the "Factory Law" had more support in districts with German as majority language. The dummy variable *German* is, on the other hand, rather uncorrelated to religious denomination.

Panel (b) of Tab. 2 suggests that Catholicism is related to a higher fraction of conscripts who failed the tests. However, Catholicism is also negatively related to school

expenditure per pupil (*Expenditure*), which itself is correlated with performance in the expected way. Catholicism is also more prevalent in districts where the agricultural labor share (*Primary*) is high and the primary sector share is itself somewhat related to educational performance. Thus, it is not clear if a higher share of Catholics depresses school performance when holding *Expenditure* and *Primary* (among other variables) constant.

There is a negative relationship between absenteeism from school and the share of Catholics as well as between absenteeism and the fraction of agricultural workers in the population. But absenteeism is seemingly unrelated to test performance. Finally, there is no significant correlation between the fraction of children (n) and the share of low-performing conscripts**,** whereas absenteeism from school is positively related to n and expenditure per pupil is negatively related to n.

5 Estimation Strategy and Empirical Results

Tab. 3: Time structure.

	Pedagogical Examinations ($h_{i,t}$)	School Statistics ($g_{i,t}, a_{i,t}, d_{i,t}, \mathbf{z}_{i,t}$)	Census ($n_{i,t}, \mu_{i,t}, \mathbf{x}_{i,t}$)
$t = 0$		1871/72	1870
$t = 1$	1875-1879	1881/82	1880
$t = 2$	1885-1889	1894/95	1888
$t = 3$	1899-1903		

The aim of the empirical section is to examine the effects of religion (and other cultural variables), political attitudes and state of development on the three key factors determining the outcome of educational production according to our theoretical model: education expenditure, absenteeism and "home effort". The state of development (parameter A in the theoretical model) is inversely measured by the employment share in agriculture, μ. Let i be the index of a district and denote time by t. Tab. 3 summarizes the time structure of our data set employed in the estimated equations given below.

One of the potential problems of explaining educational outcome with religion is the potential endogeneity of religion with respect to educational variables. It might be the case, for instance, that for some reason regions with low levels of human capital were more likely to adopt Catholicism during the time of the Reformation. Through intergenerational transmission of human capital, such regions may still have had relatively low levels of human capital about 350 years later. In this case, a correlation between educational outcome and religious denomination may reflect the initial adoption process of religion rather than the effect of religion on education. As discussed in more depth in Appendix C, however, the historical context for the time of Reformation in Switzerland suggests that such a possibility is very unlikely. Of course, cities such as Zurich as Zwingli's base played an important role at the beginning of the reformation. However, overall, human capital arguably concentrated in urban areas does not seem to be a decisive precondition for the spread of protestantism. The success in a community depended on the magistrates. When discussing the causes of the Reformation failing in some regions, Gordon (2002, pp. 119-122) stresses that magistrates had no incentive to adopt reformation in communities where they were already in control of religious life: Catholic communities in central Switzerland could elect their priest, who had a regulated income. This point is also made by Blickle (2004) as part of an explanation of why central Switzerland did not adopt the Reformation. It is difficult to see how these institutional characteristics can be linked to a lack of human capital formation in these regions.

Nevertheless, for the estimates of the average effect of Catholicism we employ an instrumentation strategy which is inspired by Becker and Woessmann (2009) who instrumented the share of Protestants in a Prussian jurisdiction by the distance to Luther's city of Wittenberg. The Protestant Reformation in Switzerland has first spread from the city of Zurich (which converted to Protestantism in 1523) to the rural areas of the canton of Zurich and then to other parts of the German-speaking part of the Confederation, before reaching Geneva in 1536. In Geneva, church leader and main Reformist John Calvin made Protestantism popular also in the Frankophone part of Switzerland. We therefore take the shorter (log) distance of the main town of a district to the two cities Zurich and Geneva as instrument for the fraction Catholics, using historical maps (see Appendix

B). Moreover, we add the (log) distance to the next big city Basel, Lucerne, St. Gallen, Geneva, Berne and Zurich to our control variables (*Log Next City*). Consequently, the identifying assumption of our IV stategy is that given the distance to the next big city, proximity to Zurich and Geneva is uncorrelated with unobserved characteristics which affect human capital (and school inputs). Since Zurich and Geneva were − appart from their key role in the proliferation of Protestantism − comparable to other big cities, we argue that this identifying assumption holds.[28] When studying the interaction effects of religion with political attitudes and the sectoral structure, however, we cannot follow such an IV-strategy since we lack a second instrument. We nevertheless hope to convince the reader on basis of our results on average effects of (instrumented) religion and the historical background on the Reformation process in Switzerland, that endogenity of religion is not a serious issue in our context.

5.1 Determinants of Expenditure Per Pupil

We start with evidence on the role of religious denomination for education spending per pupil (g), particularly focussing on the question whether political attitudes qualify the effect of religion on expenditure.

As suggested by part (ii) of Proposition 1, we expect g to negatively depend on the agricultural labor share (μ). Most importantly, part (ii) of Proposition 2 predicts that g is affected by the value assigned to education and the strength (and fear) of sanctions for being absent from school. Postulating that both may depend on sociocultural characteristics, we run the following regression:

$$\log g_{i,t} = \delta_0 + \delta_1 \mu_{i,t} + \mathbf{x}'_{i,t}\boldsymbol{\delta}_x + \mathbf{z}'_{i,t}\boldsymbol{\delta}_z + \delta_2 n_{i,t} + \boldsymbol{\nu}'_t\boldsymbol{\delta}_\nu + \tau_{i,t}. \tag{11}$$

The vector of cultural variables, $\mathbf{x}$, includes the language dummies, voting results from the three referenda, the share of Catholics and (depending on the model) interactions between the voting behavior / the agricultural labor share and the Catholic share. The vector $\mathbf{z}$

[28] For instance, the first University of Switzerland was founded in Basel in 1460 and the Swiss capital city is Berne. Hence, it is unlikely that human capital around Zurich and Geneva was more concentrated than around Lucerne, St. Gallen, Berne or Basel.

contains capital spending per pupil in logs ($\log k$), class size in logs ($\log m$), the number of school weeks (s) and teachers' characteristics ($\mathbf{T}$): gender ($Female$), status ($Clerics$), age ($Age > 40$), length of service ($Experience > 20$), and training ($PoorTr$). Furthermore, we control for the possibility that a higher fraction of children (n) is associated with lower willingness to pay for schooling. Finally, we control for time fixed effects, $\boldsymbol{\nu}$.

Following our theoretical model, regression (11) focuses on the question whether culture affects the voters' willingness to pay for schools, assuming that the school administration spends the provided money according to the structure observed in $\mathbf{z}$. As a robustness check, we also run the regression

$$\log g_{i,t} = \epsilon_0 + \epsilon_1 \mu_{i,t} + \mathbf{x}'_{i,t}\boldsymbol{\epsilon}_x + \epsilon_2 n_{i,t} + \boldsymbol{\nu}'_t \boldsymbol{\epsilon}_\nu + \xi_{i,t}, \tag{12}$$

which assumes that voters are ignorant of the observed input structure.

The conventional calculation of standard errors relies on the assumption that the error terms are independent and identically distributed. To tackle the problem that this assumption might be violated in our case, we throughout consider each district as a cluster group and systematically calculate robust Huber/White standard errors which are adjusted for intra-cluster correlation.[29] Under the assumption of uncorrelated between-cluster disturbances, these robust variance estimates are unbiased (Williams, 2000).

<Table 4>

Tab. 4 and 5 show the results of regressions (11) and (12), respectively. In column (1) of Tab. 4, we see that less economically advanced districts ($Primary$ is high) have lower school expenditure per pupil, consistent with part (i) of Proposition 2. A standard deviation increase in the agricultural share lowers school expenditure by 10.9 ($= 123.8 \cdot 0.088$) percent. School expenditure per child also decreases in the fraction of children in a district. Raising n by one percentage point lowers g by more than two percent. Concerning cultural variables, districts where Romanic is majority language have around 35 percent

[29] To account for possible spatial correlations, we furthermore calculated standard errors which are adjusted for intra-cantonal clustering. However, this modification does not affect the robustness of our main results.

lower and those with Italian around 29 percent lower school expenditure than German-speaking districts. Religious denomination plays a similarly important role. On average, we estimate that a purely Catholic district has 17.6 percent lower school expenditure than a purely Protestant district. In column (2), we introduce an interaction between *Catholics* and *Primary*. We find that $Catholics * Primary$ is negative and significant at the one percent level. Thus, the state of development substantially qualifies the effect of religion on expenditure. For a district whose agricultural share lies at the first decile ($Primary = -0.111$), we estimate no difference in expenditure levels between Catholic and Protestant districts.[30] This suggests that religion does not affect human capital formation through the expenditure channel if the economy is sufficiently developed. In contrast, if the agricultural share of the district lies at the ninth decile ($Primary = 0.114$), we predict a 33 percent difference in school expenditure between Catholics and Protestants.

In columns (3)-(5), we analyze whether the voting behavior qualifies the religion effect. All interactions are significant (at least at the 10 percent level) and have the expected sign. In column (4) the direct Catholic effect becomes insignificant. This suggests that given a mean support of the law on civil marriage, religious denomination does not affect school expenditure. Hence, the result of column (1) that a purely Catholic district has on average 17.6 percent less school spending must be fully driven by "conservative" districts. To get a sense of how large the qualifying effect of political attitudes can be, we consider the extreme cases of voting behavior on the referendum on civil marriage. If the introduction of civil marriage was fully rejected, we estimate a 56 ($= -7.3 - 0.487 \cdot 99.2$) percent difference in expenditure between a purely Catholic and a purely Protestant district.[31] In columns (6)-(8), we additionally control for $Catholics * Primary$. The coefficient of this interaction is again negative and, except for column (7), significant at the five percent level. The sign of the interactions with the voting behavior from columns (3)-(5) are maintained and is in the case of the civil marriage again significant at the one percent level. Including

[30] *Primary* measures the agricultural labor share minus the mean agricultural labor share. Thus, *Primary* is zero on average.

[31] $YesCivil$ is the difference between the share of yes-votes and its mean ($= 0.487$). Thus a full rejection implies $YesCivil = -0.487$ and a full approval corresponds to $YesCivil = 0.513$. According to Table 1, such extreme voting behavior really occurred.

all three political interactions simultaneously and running an F-test reveals that they are jointly significant at the one percent level (not reported).

In column (9), we show the impact of Catholicism instrumented with the shorter (log) distance to Zurich and Geneva – the centers of the Protestant Reformation in Switzerland. We find that the negative effect of Catholicism on public education expenditure is much higher than suggested by the OLS estimates: a purely Catholic district has 52.7 percent lower school expenditure than a purely Protestant district.

<Table 5>

Tab. 5 analyzes the cultural effects when voters are ignorant of the observed input structure. The results are similar to those of Tab. 4. Romanic, Italian, Catholic and less developed districts spend significantly less on schooling. When Catholicism is instrumented (column (9)), its effect again becomes larger compared to the OLS estimate in column (1). An interaction between *Primary* and *Catholics* highly qualifies the effect of religion (column (2)). Similarly, the interactions between *Catholics* and $YesCivil$ and between *Catholics* and $YesDeath$ are significant at the one percent level.

In sum, we have seen that conservatism is distinguishable from the state of development (agricultural share). Therefore we have four relevant identities (language, religion, conservatism and the state of development) which – in combination with their interactions – influence education expenditure. The Catholic share has a strong influence on education expenditure in conservative districts, but has no (or even a reversed) impact when districts are progressive. We will next show that similar results hold for absenteeism and educational performance (via home effort) as well.

5.2 Determinants of Absenteeism From School

In addition to the provision of schooling (education expenditure), the use of schooling as reflected by school attendance potentially plays an important role for human capital formation. As suggested by our theoretical considerations, we expect absenteeism from school to increase with distance to school, d (part (i) of Proposition 1) and to be affected by sociocultural variables, x (part (i) of Proposition 2). School inputs (z, g) may matter

because teacher characteristics may affect the strength (and fear) of sanctions for being absent from school. We again also include the fraction of children n in our regressions, since parents with more children may be less willing to send them to school. In sum, we estimate the following model of absenteeism:[32]

$$\begin{aligned}\log a_{i,t} =& \beta_0 + \beta_1 \mu_{i,t} + \mathbf{x}'_{i,t}\boldsymbol{\beta}_x + \mathbf{z}'_{i,t}\boldsymbol{\beta}_z + \beta_2 \log g_{i,t} + \\ & \beta_3 d_{i,t} + \beta_4 n_{i,t} + \boldsymbol{\nu}'_t \boldsymbol{\beta}_\nu + \varepsilon_{i,t}.\end{aligned} \tag{13}$$

<Table 6>

Tab. 6 confirms that distance to school (*Distance* [d]) is highly correlated with absenteeism from school. Column (1) suggests that in districts with a higher agricultural labor share pupils attend school more often (the coefficient on *Primary* is negative and significant at the one percent level). For a one standard deviation increase in *Primary*, we estimate that absenteeism decreases by 12.1 ($= 0.088 \cdot 137.9$) percent. Evaluated at mean *Absenteeism* ($= 14.4$ days) this corresponds to a difference of about two school days per year. (The mean number of school days was 188 days per year, according to Tab. 1.) Thus, according to our theoretical considerations, we infer that either punishment of absenteeism must be relatively strong or the sensitivity to punishment must be comparatively high in rural districts. Furthermore, we find that the majority language plays a significant role. Francophone districts have significantly higher absenteeism. Moreover, absenteeism rises with the number of children. This suggests that in districts with many children parents are more reluctant to let them attending school. With respect to school inputs, column (1) reveals that absenteeism increases in the number of mandatory school weeks. Moreover, absenteeism rises in the share of female teachers and falls in that of clerical teachers. These results could reflect that the punishment of a male teacher is harder and that clerics may possess a higher degree of authority.[33]

[32] The vector of time dummies is again denoted by $\boldsymbol{\nu}$.

[33] This shows that, without controlling for absenteeism in an analysis of the determinants of educational performance (like that of the next subsection), the estimates could lead to the deceptive conclusion that males and clerics are better teachers than females and non-clerics, respectively. In fact, as will become apparent, there is no discernable effect of these teacher characteristics on performance when holding school attendance constant.

Somewhat surprisingly at the first glance, a higher fraction of teachers with poor training is negatively associated with absenteeism, while the opposite applies if there is higher per pupil spending ($\log g$). These results may merely reflect, however, some measurement error in the absenteeism variable, as already discussed in section 4. In fact, the evidence suggests that teachers with better training and/or higher salary may have reported absenteeism more frequently.[34]

The share of Catholics does not, on average, affect school attendance significantly (see OLS estimate in column (1) and IV estimate in column (9)). However, religious denomination may play a role in specific environments. In column (2), we additionally control for an interaction term between *Catholics* and *Primary*. As we see, the estimated coefficient of this interaction is negative and significant at the one percent level. Thus, similar to our results for education expenditure per pupil, we find a significant difference in absenteeism between Catholics and Protestants in districts where the agricultural share of labor is above its mean. Columns (3)-(5) again consider interactions between the Catholic share and the political attitude. We find that all interactions between the Catholic share and the yes-votes on the referenda are significant at the one or five percent level. Catholic pupils are less absent if they live in a district where conservative political attitudes dominate (i.e. where the factory law and the law on civil marriage were highly rejected or the capital punishment was highly approved). In a progressive environment, by contrast, they attend school less often. We estimate that a purely Catholic district would have 89 ($= -3.3 - 176.5 \cdot 0.487$) percent lower absenteeism than a purely Protestant district if the law on civil marriage was fully rejected, whereas a purely Catholic district would have 87 ($= -3.3 + 176.5 \cdot 0.513$) percent higher absenteeism if the law on civil marriage were fully approved. As a robustness check, we analyze, in columns (6)-(8), whether there actually are two different variables (state of development and political attitude) that qualify the effect of religious denomination. After controlling for the voting behavior and its interaction with the Catholic share, $Catholics * Primary$ remains significantly negative at the one or five percent level. Furthermore, we find that the interaction between the Catholic

[34]Recall from section 3 that a higher g indicates better school quality (e.g. related to the salary of teachers) when holding the other school input variables in our data constant.

share and the yes-votes on the civil marriage remains significant at the five percent level.[35] Overall, our findings suggest that the sign of the religion effect on absenteeism depends on whether the district is rural or whether conservative political attitudes prevail. When all three voting results and their interactions with *Catholics* are included in the regression, an F-test reveals that they are jointly significant at the one percent level (not reported in Tab. 6). Hence, we also find that with respect to school attendance, the political attitude systematically interacts with religion.

5.3 Determinants of Educational Performance

We finally examine the determinants of results of the pedagogical examinations of conscripts. We measure educational outcome h by the share of low performing conscripts. This reduces potential bias which may arise from the fact that the best pupils attended secondary school and we are only able to control for inputs into primary school; even without secondary schooling these conscripts were unlikely to fail the test. Because we do not observe home effort of pupils or their parents supporting their children (e), we estimate the following model suggested by (5) and the theoretical result that home effort depends on non-school district characteristics (use $\gamma = \tilde{\gamma}(\mathbf{x}, A)$ in part (i) of Proposition 2), school characteristics ($\mathbf{z}$) and the fraction of children in a district (n), for given expenditure per pupil ($\log g$) and given absenteeism ($\log a$):

$$\begin{aligned} h_{i,t} =& \alpha_0 + \alpha_1 \mu_{i,t-1} + \mathbf{x}'_{i,t-1}\boldsymbol{\alpha}_x + \mathbf{z}'_{i,t-1}\boldsymbol{\alpha}_z + \alpha_2 \log g_{i,t-1} + \\ & \alpha_3 \log a_{i,t-1} + \alpha_4 n_{i,t-1} + \boldsymbol{\nu}'_t \boldsymbol{\alpha}_\nu + u_{i,t}. \end{aligned} \tag{14}$$

The lag accounts for the fact that educational outcome is measured at recruitment and not during schooling. As shown in the description of time structure in Tab. 3, for our measurement of educational performance, we consider five-years-averages of the performance of conscripts in the periods 1875-79 ($t = 1$), 1885-89 ($t = 2$), and 1899-1903 ($t = 3$). We study how h is affected by school resources and absenteeism in the years 1871/72

[35] For example we estimate that, given a mean agricultural share of labor, a purely Catholic district has 63 ($= -3.3 - 123.1 \cdot 0.487$) percent lower absenteeism than a purely Protestant district, if the law on civil marriage is fully rejected, whereas a purely Catholic district has 60 ($= -3.3 + 123.1 \cdot 0.513$) percent higher absenteeism if the law on civil marriage is fully approved.

($t = 0$), 1881/82 ($t = 1$), and 1894/95 ($t = 2$), respectively,[36] as well as by sociocultural characteristics, the fraction of children and the agricultural share in 1870 ($t = 0$), 1880 ($t = 1$) and 1888 ($t = 2$).

5.3.1 Results without Instrumenting Absenteeism

<Table 7>

According to Tab. 7, as expected from equ. (5), school resources enter significantly (at the one percent level). Effects are not particularly large, however. We estimate that for given observable inputs, a 10 percent increase in expenditure per pupil reduces the share of weakly performing conscripts by only about 0.33-0.38 percentage points. Teachers with poor training increase the share of low performers, whereas experienced teachers reduce it. Absenteeism enters significantly (at the one percent level) in the expected way, but quantitatively the effect is small. Cultural effects are much more important for educational performance than the provision or use of schooling. Districts where Romanic is the majority language have an about five percentage points higher fraction of low performers than if it were German. The religion effect is particularly large. A purely Catholic district has on average a 8.2 percentage points higher share of low performers than a Protestant district (holding school resources and absenteeism constant), according to column (1) of Tab. 7. When instrumenting the share of Catholics with the distance to Zurich/Geneva, the effect more than doubles (column (9)). The role of the agricultural labor share seems negligible, including the interaction between *Primary* and *Catholics*. This suggests that the state of development has more influence on education expenditure and absenteeism than on home effort. Columns (3)-(8) again examine the interactions between the Catholic share and the voting behavior. The interactions with the votes on the "Factory Law" and the easing of civil marriage are negative, whereas the interaction with the votes on the death penalty is positive. Although this is consistent with the view that religious denomination matters for educational performance through home effort only in conservative but not in progressive districts, interaction effects are often of little

[36] The only exception is distance to school, d, for which we have no data in 1871/72, so we assign $t = 0, 1$ to the year 1881/82 and $t = 2$ to 1894/95.

statistical significance, in contrast to the effects on education expenditure (Tab. 4, 5) and absenteeism (Tab. 6).

5.3.2 Results with Instrumenting Absenteeism

In order to check whether the results on interaction effects as well as the little importance of expenditure and absenteeism for outcomes of the pedagogical examinations of conscripts in the estimates presented in Tab. 7 are driven by the measurement error in the absenteeism variable discussed earlier, we include an instrumented value of *Absenteeism* to estimate (14).[37] We take distance to school (*Distance* [d]) as instrument and therefore use estimations of equ. (13) of the previous subsection (Tab. 6) as first stage to estimate equ. (14) at the second stage. In fact, we have already seen in Tab. 6 that *Distance* [d] is highly related to absenteeism from school. Moreover, a Hausman test clearly rejects the null hypothesis that the original absenteeism variable has no deleterious effect on the estimates of (14). Our theoretical considerations in section 3 delivers an additional argument for using distance d as instrument for absenteeism, as part (i) of Proposition 1 suggests that d has no direct effect on educational outcome h via home effort.[38]

<Table 8>

In sum, when using the instrumented absenteeism variable at the second stage, we more accurately account for the effect of absenteeism on human capital formation by partly correcting the potential measurement errors associated with different reporting behavior of teachers. Tab. 8 shows that doing so critically affects the results compared to the OLS estimates. First, and most importantly, in columns (3)-(7) the interaction effects of the Catholic share with voting results again become mostly statistically significant and have the expected sign. They are quantitatively important as well. For instance, in column (4) of Tab. 8 we estimate that in a purely Catholic district the share of low performers is 19 ($= 8.0 + 22.4 \cdot 0.487$) percentage points higher than in a district with

[37] We abstain from instrumenting Catholicism at the same time, as the first stage regressions become too imprecise.

[38] We have not found any indication for the considered historical time period that parents located their homes nearby schools. Our measure of distance to school is therefore assumed to reflect exogenous geographical conditions in a district.

only Protestants, if the law on civil marriage was fully rejected. But if 85 percent of the voters supported the civil marriage, religion has no effect. Thus, once again, the political attitude strongly qualifies the impact of religion. The direct effect of *Catholics* via home effort remains significant at the one percent level if interaction effects are included. In a district with a mean approval of the referenda and with a mean agricultural labor share, a purely Catholic district has an about 8-9 percentage points higher share of low performers than a Protestant district. But in highly progressive districts, the religion effect will cease to exist. An F-test indicates that the three interaction coefficients are jointly significant at the 10 percent level (not reported). This again suggests that Catholicism loses its importance for educational performance in a non-conservative milieu.

Second, the agricultural labor share now enters significantly in some regressions at the ten percent level. According to column (1), a one standard deviation increase in *Primary* raises the share of low performers by 1.4 ($= 15.7 \cdot 0.088$) percentage points. The interaction effect of $Catholics * Primary$ remains insignificant however (although having the expected sign). Thus the moderating effect of the state of development is less evident than those of political attitudes.

Third, provision and use of schooling matter more than in the OLS estimates. A 10 percent increase in (instrumented) absenteeism raises our measure of educational outcome by 1.38 percentage points (significant at the one percent level). Hence the identified cultural effects on absenteeism (first stage) will transform into educational outcome. Comparing the results of the first and second stage of the instrumental variable regression (Tab. 6 and 8, respectively), we see that the interaction effects of religious denomination with political attitudes work in opposite directions. This is consistent with our theory which explicitly accounts for strength of punishment as a separate cultural determinant of education, in addition to value assigned to education as such. Also school expenditure has a larger influence on educational performance than in the OLS regression (the coefficient roughly doubles), though still moderate. The difference of 17.6 percent in education spending per pupil between a Catholic and a Protestant district, shown in column (1) in Tab. 4, on average accounts for a 1.3 ($= 17.6 \cdot 0.075$) percentage points higher fraction

of low performers in a Catholic district.[39] Considering interaction effects of religion with political attitude suggests an enhanced role of the effect of higher education expenditure for test results. Recall that from column (4) of Tab. 4 we estimate a 56 percent difference in expenditure between a purely Catholic and a purely Protestant district if the introduction of civil marriage was fully rejected. Using column (4) in Tab. 8 suggests that this would account for a 3.1 ($= 56 \cdot 0.057$) percentage points difference in the share of low performers.[40]

6 Conclusion

Our research sheds light on the conditions and mechanisms under which religion may be an important determinant of public education finance and human capital formation. We have analyzed a unique and rich data set covering 169 Swiss districts in the last quarter of the 19th century (the phase of the second industrialization), which contains comparable measures of educational outcomes (results from pedagogical examinations of conscripts), sociocultural indicators, standard school inputs as commonly employed in the literature on educational production, and a measure of school attendance. Sociocultural indicators include voting results from political referenda which capture the extent of progressive movements and conservatism. We examine three channels (public school expenditure, school attendance and home effort) through which religious denomination can affect educational outcomes. Our results show that religion works through all these three channels. The evidence suggests that religion affects educational performance via home effort and education expenditure in the same direction, whereas absenteeism is driven by an additional force (strength of sanctions for non-attendance of school). Most importantly, our findings indicate that religious denomination determines public spend-

[39] This figure may be compared to the average effect of religious denomination. As we see from column (1) of Tab. 8, Catholic districts have a 9.1 percentage points larger fraction of low performers than Protestant districts. The magnitude of this religion effect is comparable with a 120 percent increase in expenditure.

[40] Regarding observable school inputs, particularly the fraction of teachers with poor training matters, whereas school capital has no discernible effect when education expenditure is controlled for. The number of children does not have a significant effect on school performance as well in the instrumental variable regressions when holding school attendance and expenditure constant. (This is different to the OLS estimates in Tab. 7.)

ing on schooling and educational performance only when conservative political attitudes are prevalent. Neglecting the interaction of religious denomination with these measures of political attitudes thus leads to misleading conclusions about the role of religion for economic outcomes. Our results demonstrate that religious denomination ceases to have impact on educational performance if, at the same time, progressive movements are widely supported. From this we may conclude that economies are not doomed to economic failure due to their religious heritage. Rather, the role of religion may change quickly over time along with changes in other sociocultural characteristics.

Appendix

A. Proof of Proposition 1 and 2

We first prove Proposition 2. Using (6)-(8) in (10), we get for the optimization problem

$$\max_{E,e,g} \log\left(Ah - g\right) + \gamma \log\left(h\right) - \varphi\left(e + \left(1 + d\right)E\right) - \psi\left(1 - E\right) \tag{15}$$

subject to (5) and $E \leq 1$. The first-order condition for E can be written in the form

$$\frac{Ah}{Ah - g} + \gamma \geq \frac{E}{\varkappa}\left(\varphi\left(1 + d\right) - \psi\right), \tag{16}$$

with equality if $E < 1$. The first-order conditions for e and g can be written as

$$\frac{Ah}{Ah - g} + \gamma = \frac{\varphi e}{1 - \varkappa}, \tag{17}$$

$$\frac{Ah}{Ah - g} + \gamma = \frac{g}{\varkappa\left(Ah - g\right)}, \tag{18}$$

respectively. (18) implies that

$$\frac{Ah}{g} = \frac{1 + \gamma\varkappa}{\varkappa\left(1 + \gamma\right)}. \tag{19}$$

The second-order conditions are straightforward. Note first that (17) and (18) imply

$$\left(\frac{Ah}{g}-1\right)\varphi e=\frac{1-\varkappa}{\varkappa}. \tag{20}$$

Solving (19) and (20) for e gives

$$e=\frac{1+\gamma}{\varphi}. \tag{21}$$

Substituting (5) for h into (19), we get

$$g=\left[A\frac{(1+\gamma)\,\varkappa}{(1+\gamma\varkappa)}e^{(1-\varkappa)}E^{\varkappa}Q(\mathbf{z})\right]^{\frac{1}{1-\varkappa}}. \tag{22}$$

For $E=1$, (21) and (22) gives us

$$g=\left[A\frac{(1+\gamma)^{2-\varkappa}\,\varkappa}{\varphi^{1-\varkappa}\,(1+\gamma\varkappa)}Q(\mathbf{z})\right]^{\frac{1}{1-\varkappa}}, \tag{23}$$

which increases in A and γ. For $E<1$, $\frac{Ah}{Ah-g}+\gamma=\frac{E}{\gamma}\varphi\,(1+d)-\psi$, according to (16). Combining this with (18), we get $\left(\frac{Ah}{g}-1\right)E\,(\varphi\,(1+d)-\psi)=1$. Thus, with (19) we get

$$E=\frac{(1+\gamma)\,\varkappa}{(1-\varkappa)\,(\varphi\,(1+d)-\psi)}. \tag{24}$$

With (21) and (24), the expression in (22) becomes

$$g=\left[A\frac{(1+\gamma)^{2}\,\varkappa^{1+\varkappa}}{\varphi^{1-\varkappa}\,(1+\gamma\varkappa)\,(1-\varkappa)^{\varkappa}}\left(\frac{1}{\varphi\,(1+d)-\psi}\right)^{\varkappa}Q(\mathbf{z})\right]^{\frac{1}{1-\varkappa}}. \tag{25}$$

Comparative-static results of Proposition 2 immediately follow from (21), (24) and (25), if there is absenteeism. If $E=1$, expressions (21) and (23) for e and g, respectively, are relevant.

For $\gamma=0$ and $\psi=0$, (21), (24) and (25) reduce to

$$E=\frac{\varkappa}{(1-\varkappa)\,\varphi\,(1+d)}, \tag{26}$$

$$e = \frac{1}{\varphi}, \tag{27}$$

$$g = \left[A \frac{\varkappa^{1+\varkappa}}{\varphi^{1-\varkappa} (1-\varkappa)^{\varkappa}} \left(\frac{1}{\varphi (1+d)} \right)^{\varkappa} Q(\mathbf{z}) \right]^{\frac{1}{1-\varkappa}}. \tag{28}$$

If $E = 1$, then $g = \frac{[A\varkappa Q(\mathbf{z})]^{\frac{1}{1-\varkappa}}}{\varphi}$, according to (23). The comparative-static results of Proposition 1 then follow from these equations. QED

B. Data sources

- *Pedagogical examinations:* Statistisches Bureau des eidgenössischen Departement des Innern, *Schweizerische Statistik*, Lieferungen 27 (1876), 34 (1877), 36 (1878), 38 (1879), 61 (1885), 64 (1886), 67 (1886), 71 (1888), 75 (1889), 120 (1899), 124 (1900), 129 (1901), 134 (1901), 138 (1903).
- *School inputs:* Kinkelin (1875), Grob (1883), Huber (1897).
- *Results from political referenda:* forthcoming at www.sidos.ch.
- *Distance to Zurich and Geneva:* Bundesamt für Landestopographie (2003): Topographische Karte der Schweiz (Dufour Map), CD Rom (first publication: 1845-1865); Bundesinventar der historischen Verkehrswege der Schweiz (http://www.ivs.admin.ch/).
- *Census information:* Statistisches Bureau des eidgenössischen Departement des Innern, *Schweizerische Statistik*.
  - Primary sector share: Lieferungen 28 (1876), 59 (1884), 97 (1894).
  - Catholic share, majority language: Lieferungen 15 (1872), 51 (1891), 84 (1892).
  - Ratio of children (aged 0-15): Lieferungen 20 (1874), 56 (1883), 88 (1892).

C. Reformation in Switzerland: Historical Background

At the time of the Reformation, the Swiss Confederation consisted of 13 semi-autonomous regions (after 1513: Uri, Schwyz, Unterwalden, Lucerne, Zurich, Glarus, Zug, Berne, Fribourg, Solothurn, Basle, Schaffhausen, Appenzell). In addition, there were the Mandated

Territories (Untertanengebiete) under joined administration, and the allied states (zugewandte Orte), such as St. Gall, the Raethian Leagues in Graubünden, and Geneva.

The two councils at Constance (1414-1418) and Basle (1431-1449) were important events putting Swiss scholars in touch with European Humanism. In connection with the Council of Basle, the university was founded in 1460, and became "[t]he most significant point of contact for the future reformers" (Gordon 2000, p. 86) and the intellectual center, hosting the eminent humanist Erasmus (Bietenholz, 2005). The Reformation in the German speaking part of the Confederation was initiated 1522-23 in Zurich by Huldrych Zwingli, who started to preach in 1519 against mendicants and the mercenary service, challenging Lenten fasting and clerical celibacy. As Gordon (2002, p. 49) states, Zurich as starting point of the reformation cannot be explained by economic and social preconditions, but the presence of Zwingli was central: "Nothing about Zurich, its urban or rural conditions made it more or less propitious for a reformation than any other middling city of the empire. [...] The decisive element was the personality and preaching of Zwingli." In 1525, important reforms took place which placed Zurich outside the Catholic church (poor relief, the Lord's Supper, baptism and marriage; see Gordon 2002, p. 68).

After 1524, the Reformation started to spread throughout the Confederation. The success in a community depended on convincing the magistrates, because they had the control over the religious life. Moreover, success also depended on the availability of an able and convincing preacher (Gordon, 2002, p. 86/88). The Five Inner States (Fünf Orte) remained catholic (Uri, Schwyz, Unterwalden) or rejected existing reform movements (Lucerne, Zug), St. Gall, Appenzell, Berne, Schaffhausen, and Basle adopted Reformation between 1524 and 1529. In order to preserve peace, many communities were allowed to follow the example of Appenzell to adopt or reject the Reformation by majority vote. The Kappel Wars 1529-1531, starting as a fight between Zurich and the catholic cantons mainly over the control of the Mandated Territories, stopped the spread of Reformation. The Second Territorial Peace ending the wars allowed converted communities to remain protestant, but catholic minorities had the right to practice their faith: "Crucially, Catholics in Reformed areas were protected, while no such protection was extended to the evangelicals" (Gordon, 2002, p. 134). In the french speaking part of the Confederation,

the Reformation started later, with Neuchâtel in 1530, and 1535-1536 under John Calvin and Guilaume Farel in Geneva. A territory late to become protestant was the Pays de Vaud in 1536 (occupied by Berne), and in Graubünden, it took until the 1550s.

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Table 1: Summary statistics

Variable	Mean	Std. Dev.	Min	Max
Weeks [s]	37.556	5.990	22.835	48.484
ClassSize [log m]	3.938	0.310	2.643	5.159
Capital [log k]	5.355	0.637	2.767	7.035
PoorTr	0.070	0.144	0.000	1.000
Female	0.273	0.225	0.000	0.857
Clerics	0.052	0.148	0.000	0.872
Experience>20	0.287	0.123	0.000	0.778
Age>40	0.301	0.125	0.000	0.778
Expenditure [log g]	3.068	0.507	1.548	4.711
Absenteeism [log a]	2.665	0.615	0.278	4.274
Catholics	0.436	0.412	0.001	1.000
Children [n]	0.324	0.031	0.224	0.425
Primary [μ]	0.000	0.088	−0.212	0.261
YesFactory	0.000	0.205	−0.427	0.373
YesCivil	0.000	0.249	−0.487	0.483
YesDeath	0.000	0.210	−0.453	0.467
Distance [d]	0.043	0.047	0.000	0.301
LowPerf	0.213	0.155	0.013	0.696

Notes: Pooled over periods (493 observations). LowPerf is the average share of conscripts who failed in Reading, Essay, Math and History. Primary, YesFactory, YesCivil, YesDeath are mean subtracted. The respective mean values are 0.217, 0.497, 0.487, 0.533. Definitions of other variables are provided in the main text.

Table 2: Correlation coefficients

(a) Cultural variables

	Catholics	YesFactory	YesCivil	YesDeath
Catholics	1.000			
YesFactory	−0.095 ∗∗	1.000		
YesCivil	−0.680∗∗∗	0.380∗∗∗	1.000	
YesDeath	0.490∗∗∗	−0.197∗∗∗	−0.786∗∗∗	1.000
German	−0.076∗	0.501∗∗∗	0.258∗∗∗	0.124∗∗∗

(b) Catholic share and non-cultural indicators

	Catholics	Primary [μ]	LowPerf	Expenditure [log g]	Absenteeism [log a]
Catholics	1.000				
Primary [μ]	0.316∗∗∗	1.000			
LowPerf	0.186∗∗∗	0.226∗∗∗	1.000		
Expenditure [log g]	−0.391∗∗∗	−0.549∗∗∗	−0.604∗∗∗	1.000	
Absenteeism [log a]	−0.376∗∗∗	−0.319∗∗∗	0.060	0.295∗∗∗	1.000
Children [n]	−0.247∗∗∗	0.073	0.017	−0.164∗∗∗	0.190∗∗∗

Notes: Pooled over periods. See notes to Tab. 1 for the definition of LowPerf; other variables are defined in the main text. *** significant at, or below, 1 percent, ** significant at, or below, 5 percent, * significant at, or below, 10 percent.

Table 4: Effects on expenditure (controlling for expenditure structure)

Log[g]	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Catholics	−0.176***	−0.154***	−0.162***	−0.073	−0.150***	−0.145***	−0.073	−0.145***	−0.527**
	(0.047)	(0.047)	(0.046)	(0.060)	(0.052)	(0.046)	(0.058)	(0.049)	(0.261)
Week	0.019***	0.017***	0.017***	0.017***	0.019***	0.016***	0.016***	0.017***	0.013***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Class Size	−0.306***	−0.283***	−0.285***	−0.274***	−0.298***	−0.257***	−0.268***	−0.281***	−0.310***
	(0.093)	(0.087)	(0.095)	(0.085)	(0.092)	(0.088)	(0.084)	(0.087)	(0.092)
Capital	0.233***	0.224***	0.228***	0.223***	0.233***	0.215***	0.219***	0.225***	0.199***
	(0.034)	(0.035)	(0.034)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.043)
Poor Training	0.183**	0.188**	0.192**	0.220***	0.215**	0.192**	0.218**	0.202**	0.251***
	(0.082)	(0.090)	(0.080)	(0.082)	(0.083)	(0.088)	(0.086)	(0.089)	(0.084)
Female Teachers	0.287**	0.329**	0.278**	0.341**	0.314**	0.313**	0.350***	0.338**	−0.037
	(0.133)	(0.132)	(0.132)	(0.134)	(0.138)	(0.133)	(0.133)	(0.134)	(0.193)
Clerics	−0.976***	−1.052***	−1.060***	−0.891***	−0.950***	−1.115***	−0.933***	−1.035***	−0.485
	(0.136)	(0.133)	(0.141)	(0.129)	(0.138)	(0.137)	(0.132)	(0.138)	(0.360)
Length of Service	0.385	0.305	0.333	0.305	0.353	0.275	0.278	0.297	−0.085
	(0.273)	(0.286)	(0.264)	(0.263)	(0.268)	(0.272)	(0.272)	(0.283)	(0.282)
Age	0.040	0.062	0.074	0.087	0.049	0.079	0.094	0.064	0.156
	(0.263)	(0.278)	(0.247)	(0.254)	(0.258)	(0.260)	(0.261)	(0.275)	(0.225)
Romanic	−0.349***	−0.377***	−0.378***	−0.396***	−0.366***	−0.406***	−0.402***	−0.382***	−0.296**
	(0.093)	(0.099)	(0.097)	(0.101)	(0.094)	(0.101)	(0.105)	(0.100)	(0.133)
Italian	−0.294***	−0.275***	−0.237**	−0.396***	−0.380***	−0.216**	−0.374***	−0.314***	0.113
	(0.101)	(0.101)	(0.101)	(0.094)	(0.105)	(0.101)	(0.096)	(0.102)	(0.166)
French	−0.169***	−0.169***	−0.134**	−0.197***	−0.189***	−0.125**	−0.190***	−0.178***	−0.005
	(0.052)	(0.048)	(0.062)	(0.052)	(0.051)	(0.059)	(0.051)	(0.049)	(0.060)
Children	−2.366***	−2.666***	−2.232***	−2.163***	−2.329***	−2.600***	−2.329***	−2.624***	−2.521**
	(0.662)	(0.689)	(0.704)	(0.677)	(0.668)	(0.736)	(0.695)	(0.695)	(1.006)
Primary	−1.238***	−0.545*	−1.254***	−1.091***	−1.183***	−0.564	−0.783**	−0.578*	−0.727**
	(0.247)	(0.324)	(0.263)	(0.268)	(0.262)	(0.350)	(0.348)	(0.344)	(0.320)
CatholicsPrimary		−1.557***				−1.487**	−0.703	−1.429**	
		(0.575)				(0.597)	(0.626)	(0.609)	
YesFactory			−0.106			−0.024			
			(0.153)			(0.151)			
CatholicsYesFactory			0.395**			0.293			
			(0.182)			(0.182)			
YesCivil				−0.334***			−0.265**		
				(0.116)			(0.120)		
CatholicsYesCivil				0.992***			0.840***		
				(0.207)			(0.224)		
YesDeath					0.154			0.069	
					(0.124)			(0.123)	
CatholicsYesDeath					−0.406*			−0.179	
					(0.220)			(0.217)	
Log Next City									−0.166***
									(0.033)
Obs.	493	493	493	493	493	493	493	493	475
R^2	0.763	0.771	0.767	0.779	0.765	0.775	0.781	0.772	0.734

Notes: Standard errors adjusted for intragroup correlation in parentheses. Time structure (see also Tab. 3): School inputs for 1871/72, 1881/82, 1894/95, corresponding to Catholic share, agricultural share and number of children for 1870, 1880, 1888 and dependent variable (see notes to Tab. 1) averaged for 1875-79, 1885-89, 1899-1903, respectively; language dummies: German is left-out category; Primary, YesFactory, YesCivil and YesDeath are mean subtracted. *** significant at, or below, 1 percent, ** significant at, or below, 5 percent, * significant at, or below, 10 percent. The regressions account for time fixed effects. In column (9) Catholics is instrumented by the distance to Zurich/Geneva.

Table 5: Effects on expenditure (not controlling for expenditure structure)

Log[g]	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Catholics	−0.436***	−0.402***	−0.440***	−0.088	−0.295***	−0.409***	−0.091	−0.293***	−0.730**
	(0.062)	(0.064)	(0.063)	(0.086)	(0.077)	(0.064)	(0.083)	(0.070)	(0.310)
Romanic	−0.375***	−0.389***	−0.462***	−0.453***	−0.427***	−0.488***	−0.454***	−0.434***	−0.193
	(0.063)	(0.085)	(0.081)	(0.105)	(0.085)	(0.102)	(0.116)	(0.104)	(0.123)
Italian	−0.148*	−0.062	−0.063	−0.324***	−0.388***	0.001	−0.271***	−0.270*	0.254**
	(0.078)	(0.103)	(0.078)	(0.083)	(0.120)	(0.102)	(0.101)	(0.141)	(0.127)
French	0.014	0.032	0.085	0.024	−0.018	0.102**	0.042	0.004	0.130**
	(0.045)	(0.043)	(0.052)	(0.050)	(0.043)	(0.049)	(0.050)	(0.043)	(0.057)
Children	−4.866***	−4.957***	−4.958***	−3.780***	−4.519***	−5.215***	−3.945***	−4.718***	−4.891***
	(0.700)	(0.722)	(0.762)	(0.700)	(0.704)	(0.792)	(0.710)	(0.724)	(1.203)
Primary	−2.056***	−0.957**	−1.888***	−1.405***	−1.766***	−0.729*	−0.900**	−0.894**	−0.644
	(0.311)	(0.390)	(0.343)	(0.353)	(0.356)	(0.428)	(0.431)	(0.443)	(0.394)
CatholicsPrimary		−2.329***				−2.408***	−1.085	−1.900**	−1.124
		(0.698)				(0.714)	(0.751)	(0.791)	(1.038)
YesFactory			0.248			0.376*			
			(0.201)			(0.192)			
CatholicsYesFactory			0.132			−0.090			
			(0.280)			(0.288)			
YesCivil				−0.214			−0.099		
				(0.140)			(0.142)		
CatholicsYesCivil				1.619***			1.381***		
				(0.280)			(0.327)		
YesDeath					0.118			−0.014	
					(0.158)			(0.163)	
CatholicsYesDeath					−0.895***			−0.587	
					(0.333)			(0.363)	
Log Next City									−0.175***
									(0.044)
Obs.	493	493	493	493	493	493	493	493	475
R^2	0.614	0.635	0.624	0.675	0.635	0.646	0.679	0.647	0.592

Notes: Standard errors adjusted for intragroup correlation in parentheses. Time structure (see also Tab. 3): School inputs for 1871/72, 1881/82, 1894/95, corresponding to Catholic share, agricultural share and number of children for 1870, 1880, 1888 and dependent variable (see notes to Tab. 1) averaged for 1875-79, 1885-89, 1899-1903, respectively; language dummies: German is left-out category; Primary, YesFactory, YesCivil and YesDeath are mean subtracted. *** significant at, or below, 1 percent, ** significant at, or below, 5 percent, * significant at, or below, 10 percent. The regressions account for time fixed effects. In column (9) Catholics is instrumented by the distance to Zurich/Geneva.

Table 6: Effects on absenteeism

Absenteeism	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Catholics	−0.128	−0.087	−0.101	−0.033	−0.094	−0.071	−0.034	−0.086	1.700
	(0.094)	(0.091)	(0.095)	(0.123)	(0.111)	(0.093)	(0.118)	(0.102)	(1.109)
Week	0.012*	0.008	0.009	0.009	0.011	0.006	0.008	0.008	0.016
	(0.006)	(0.007)	(0.006)	(0.006)	(0.007)	(0.007)	(0.006)	(0.007)	(0.013)
Class Size	−0.070	−0.039	−0.078	−0.055	−0.064	−0.030	−0.039	−0.041	0.010
	(0.117)	(0.114)	(0.120)	(0.111)	(0.115)	(0.117)	(0.112)	(0.114)	(0.274)
Capital	−0.025	−0.028	−0.008	0.006	−0.006	−0.023	−0.006	−0.015	−0.073
	(0.067)	(0.067)	(0.066)	(0.069)	(0.073)	(0.066)	(0.068)	(0.072)	(0.114)
Poor Training	−0.690***	−0.659***	−0.657***	−0.610***	−0.607***	−0.640***	−0.613***	−0.622***	−0.915***
	(0.165)	(0.155)	(0.170)	(0.158)	(0.156)	(0.161)	(0.154)	(0.152) >	(0.297)
Female Teachers	0.851***	0.980***	0.872***	0.998***	0.949***	0.978***	1.040***	1.025***	1.529**
	(0.184)	(0.173)	(0.182)	(0.179)	(0.191)	(0.174)	(0.176)	(0.177)	(0.717)
Clerics	−0.733***	−0.996***	−0.922***	−0.783***	−0.764***	−1.133***	−0.943***	−1.009***	−2.137**
	(0.226)	(0.213)	(0.246)	(0.238)	(0.240)	(0.231)	(0.243)	(0.235)	(0.919)
Length of Service	0.016	−0.153	−0.096	−0.040	−0.029	−0.217	−0.137	−0.156	0.733
	(0.453)	(0.428)	(0.459)	(0.427)	(0.440)	(0.430)	(0.422)	(0.424)	(0.857)
Age	0.691	0.756*	0.785*	0.730*	0.676	0.810**	0.762*	0.734*	0.612
	(0.440)	(0.407)	(0.445)	(0.419)	(0.430)	(0.407)	(0.405)	(0.404)	(0.629)
Expenditure	0.317***	0.229**	0.287***	0.191**	0.287***	0.208**	0.170*	0.223**	0.911**
	(0.096)	(0.092)	(0.098)	(0.093)	(0.100)	(0.093)	(0.093)	(0.095)	(0.445)
Distance	2.482***	2.378***	2.504***	2.638***	2.791***	2.423***	2.522***	2.533***	0.180
	(0.706)	(0.674)	(0.698)	(0.673)	(0.688)	(0.667)	(0.651)	(0.657)	(1.860)
Romanic	0.035	−0.065	−0.007	−0.090	−0.011	−0.104	−0.119	−0.073	0.622
	(0.143)	(0.149)	(0.159)	(0.141)	(0.151)	(0.148)	(0.150)	(0.153)	(0.507)
Italian	0.009	0.030	0.056	−0.185	−0.188	0.088	−0.113	−0.049	−0.720
	(0.134)	(0.139)	(0.133)	(0.149)	(0.200)	(0.138)	(0.158)	(0.197)	(0.652)
French	0.387***	0.375***	0.393***	0.283***	0.323***	0.404***	0.307***	0.344***	0.322
	(0.087)	(0.081)	(0.097)	(0.098)	(0.091)	(0.093)	(0.094)	(0.086)	(0.211)
Children	4.506***	3.593***	4.876***	4.523***	4.454***	3.821***	3.906***	3.654***	12.150***
	(0.963)	(0.892)	(1.014)	(0.886)	(0.930)	(0.937)	(0.885)	(0.908)	(4.536)
Primary	−1.379***	0.220	−1.538***	−1.476***	−1.366***	0.061	−0.373	0.051	−1.850**
	(0.397)	(0.507)	(0.420)	(0.420)	(0.396)	(0.546)	(0.564)	(0.506)	(0.810)
CatholicsPrimary		−3.826***				−3.651***	−2.564**	−3.503***	
		(0.901)				(0.924)	(1.052)	(0.992)	
YesFactory			−0.411			−0.222			
			(0.277)			(0.259)			
CatholicsYesFactory			0.814**			0.593			
			(0.359)			(0.362)			
YesCivil				−0.796***			−0.552***		
				(0.201)			(0.209)		
CatholicsYesCivil				1.765***			1.231**		
				(0.420)			(0.483)		
YesDeath					0.499**			0.287	
					(0.244)			(0.238)	
CatholicsYesDeath					−1.034**			−0.479	
					(0.476)			(0.478)	
Log Next City									0.068
									(0.159)
Obs.	493	493	493	493	493	493	493	493	475
R^2	0.512	0.546	0.521	0.547	0.523	0.551	0.559	0.548	.

Notes: Standard errors adjusted for intragroup correlation in parentheses. Time structure (see also Tab. 3): School inputs for 1871/72, 1881/82, 1894/95, corresponding to Catholic share, agricultural share and number of children for 1870, 1880, 1888 and dependent variable (see notes to Tab. 1) averaged for 1875-79, 1885-89, 1899-1903, respectively; language dummies: German is left-out category; Primary, YesFactory, YesCivil and YesDeath are mean subtracted. *** significant at, or below, 1 percent, ** significant at, or below, 5 percent, * significant at, or below, 10 percent. The regressions account for time fixed effects. In column (9) Catholics is instrumented by the distance to Zurich/Geneva.

Table 7: Effects on share of low performers (through "home support")

LowPerf	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Catholics	0.082***	0.084***	0.082***	0.080***	0.083***	0.083***	0.080***	0.083***	0.174***
	(0.012)	(0.012)	(0.012)	(0.015)	(0.013)	(0.012)	(0.015)	(0.013)	(0.065)
Absenteeism	0.022***	0.020**	0.023***	0.024***	0.023***	0.021***	0.022***	0.021**	0.030***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)
Week	−0.002**	−0.002**	−0.002**	−0.002**	−0.002**	−0.002**	−0.002**	−0.002**	−0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Class Size	0.050***	0.051***	0.044***	0.049***	0.050***	0.045***	0.051***	0.051***	0.057***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.021)
Capital	−0.020**	−0.020**	−0.018*	−0.021**	−0.022**	−0.018**	−0.022**	−0.022**	−0.022**
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Poor Training	0.054***	0.054***	0.054***	0.053***	0.049***	0.054***	0.051***	0.047**	0.032
	(0.018)	(0.018)	(0.019)	(0.019)	(0.018)	(0.019)	(0.018)	(0.018)	(0.025)
Female Teachers	0.030	0.036	0.032	0.024	0.021	0.038	0.030	0.027	0.088
	(0.033)	(0.033)	(0.035)	(0.033)	(0.033)	(0.035)	(0.033)	(0.033)	(0.057)
Clerics	−0.062	−0.072*	−0.048	−0.060	−0.056	−0.057	−0.075*	−0.072*	−0.150**
	(0.038)	(0.039)	(0.039)	(0.039)	(0.038)	(0.039)	(0.039)	(0.039)	(0.075)
Length of Service	−0.233***	−0.239***	−0.231***	−0.231***	−0.230***	−0.235***	−0.239***	−0.237***	−0.182*
	(0.081)	(0.080)	(0.080)	(0.080)	(0.081)	(0.079)	(0.079)	(0.079)	(0.094)
Age	0.207**	0.211**	0.206**	0.205**	0.208**	0.209***	0.209***	0.213***	0.196**
	(0.082)	(0.081)	(0.081)	(0.082)	(0.082)	(0.079)	(0.080)	(0.080)	(0.086)
Expenditure	−0.036***	−0.038***	−0.034**	−0.033**	−0.035**	−0.036***	−0.034**	−0.037***	−0.004
	(0.013)	(0.014)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)	(0.026)
Romanic	0.049***	0.045***	0.056***	0.052***	0.050***	0.053***	0.049***	0.047***	0.068**
	(0.017)	(0.016)	(0.017)	(0.018)	(0.016)	(0.016)	(0.017)	(0.016)	(0.032)
Italian	−0.016	−0.015	−0.029	−0.011	−0.008	−0.027	−0.005	−0.001	−0.077*
	(0.020)	(0.019)	(0.024)	(0.021)	(0.022)	(0.023)	(0.020)	(0.021)	(0.046)
French	−0.003	−0.002	−0.014	−0.001	0.001	−0.012	0.002	0.003	−0.023
	(0.012)	(0.012)	(0.015)	(0.013)	(0.012)	(0.015)	(0.013)	(0.012)	(0.019)
Children	0.459***	0.440***	0.468***	0.448***	0.449***	0.442***	0.407***	0.419***	0.585**
	(0.134)	(0.137)	(0.142)	(0.136)	(0.135)	(0.145)	(0.141)	(0.138)	(0.231)
Primary	0.014	0.064	0.010	0.018	0.023	0.061	0.104	0.092	−0.047
	(0.055)	(0.065)	(0.055)	(0.058)	(0.054)	(0.066)	(0.072)	(0.063)	(0.065)
CatholicsPrimary		−0.125				−0.125	−0.207*	−0.179*	
		(0.102)				(0.103)	(0.113)	(0.104)	
YesFactory			−0.012			−0.007			
			(0.027)			(0.028)			
CatholicsYesFactory			−0.041			−0.047			
			(0.036)			(0.037)			
YesCivil				0.021			0.039		
				(0.024)			(0.026)		
CatholicsYesCivil				−0.048			−0.087*		
				(0.045)			(0.049)		
YesDeath					−0.042*			−0.052**	
					(0.024)			(0.024)	
CatholicsYesDeath					0.060			0.085**	
					(0.041)			(0.041)	
Log Next City									0.017
									(0.011)
Obs.	493	493	493	493	493	493	493	493	475
R^2	0.853	0.853	0.854	0.853	0.854	0.855	0.854	0.855	0.853

Notes: Standard errors adjusted for intragroup correlation in parentheses. Time structure (see also Tab. 3): School inputs for 1871/72, 1881/82, 1894/95, corresponding to Catholic share, agricultural share and number of children for 1870, 1880, 1888 and dependent variable (see notes to Tab. 1) averaged for 1875-79, 1885-89, 1899-1903, respectively; language dummies: German is left-out category; Primary, YesFactory, YesCivil and YesDeath are mean subtracted. *** significant at, or below, 1 percent, ** significant at, or below, 5 percent, * significant at, or below, 10 percent. The regressions account for time fixed effects. In column (9) Catholics is instrumented by the distance to Zurich/Geneva.

Table 8: Second stage of IV regressions (effects through "home support")

LowPerf	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Absenteeism	0.138***	0.142***	0.133***	0.131***	0.122***	0.136***	0.132***	0.128***
	(0.038)	(0.041)	(0.035)	(0.034)	(0.031)	(0.037)	(0.036)	(0.036)
Week	−0.003***	−0.003**	−0.002**	−0.003**	−0.003***	−0.002**	−0.003**	−0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Class Size	0.055**	0.053**	0.051**	0.053**	0.054**	0.047**	0.052**	0.053**
	(0.023)	(0.023)	(0.023)	(0.021)	(0.021)	(0.023)	(0.021)	(0.021)
Capital	−0.012	−0.012	−0.013	−0.017	−0.016	−0.011	−0.017	−0.015
	(0.012)	(0.012)	(0.011)	(0.012)	(0.012)	(0.011)	(0.012)	(0.012)
Poor Training	0.128***	0.128***	0.120***	0.113***	0.106***	0.121***	0.114***	0.110***
	(0.038)	(0.038)	(0.036)	(0.032)	(0.030)	(0.036)	(0.033)	(0.032)
Female Teachers	−0.067	−0.083	−0.063	−0.080*	−0.069*	−0.074	−0.084*	−0.079*
	(0.043)	(0.050)	(0.043)	(0.045)	(0.041)	(0.049)	(0.049)	(0.046)
Clerics	−0.007	0.020	0.023	−0.004	−0.010	0.043	0.004	0.011
	(0.043)	(0.053)	(0.049)	(0.042)	(0.039)	(0.057)	(0.048)	(0.048)
Length of Service	−0.217**	−0.202**	−0.203**	−0.211**	−0.212**	−0.192**	−0.207**	−0.204**
	(0.098)	(0.099)	(0.096)	(0.093)	(0.092)	(0.097)	(0.094)	(0.094)
Age	0.108	0.099	0.100	0.109	0.123	0.096	0.107	0.116
	(0.097)	(0.101)	(0.094)	(0.094)	(0.091)	(0.097)	(0.095)	(0.095)
Expenditure	−0.075***	−0.068***	−0.068***	−0.057***	−0.066***	−0.062***	−0.056***	−0.064***
	(0.022)	(0.020)	(0.021)	(0.019)	(0.020)	(0.019)	(0.019)	(0.020)
Romanic	0.043**	0.053***	0.055***	0.059***	0.049***	0.063***	0.061***	0.053***
	(0.017)	(0.019)	(0.018)	(0.019)	(0.017)	(0.019)	(0.020)	(0.018)
Italian	−0.013	−0.015	−0.029	0.011	0.009	−0.031	0.009	0.001
	(0.021)	(0.024)	(0.021)	(0.024)	(0.025)	(0.024)	(0.025)	(0.027)
French	−0.052**	−0.052**	−0.059***	−0.035*	−0.037**	−0.061***	−0.036*	−0.040**
	(0.021)	(0.022)	(0.022)	(0.018)	(0.018)	(0.023)	(0.019)	(0.019)
Catholics	0.091***	0.088***	0.087***	0.080***	0.088***	0.085***	0.081***	0.088***
	(0.015)	(0.015)	(0.015)	(0.018)	(0.016)	(0.015)	(0.018)	(0.016)
Children	−0.152	−0.085	−0.161	−0.122	−0.073	−0.086	−0.105	−0.048
	(0.278)	(0.256)	(0.273)	(0.255)	(0.239)	(0.249)	(0.247)	(0.234)
Primary	0.157*	0.015	0.166*	0.167*	0.143*	0.036	0.125	0.058
	(0.090)	(0.094)	(0.091)	(0.088)	(0.078)	(0.098)	(0.100)	(0.090)
Catholics*Primary		0.353				0.304	0.102	0.231
		(0.218)				(0.203)	(0.176)	(0.194)
YesFactory			0.039			0.024		
			(0.043)			(0.042)		
Catholics*YesFactory			−0.129**			−0.113**		
			(0.054)			(0.053)		
YesCivil				0.108***			0.100**	
				(0.040)			(0.038)	
Catholics*YesCivil				−0.224***			−0.206**	
				(0.085)			(0.080)	
YesDeath					−0.078**			−0.067*
					(0.037)			(0.038)
Catholics*YesDeath					0.132**			0.102
					(0.064)			(0.063)
Obs.	493	493	493	493	493	493	493	493
R^2	0.746	0.743	0.759	0.768	0.777	0.757	0.765	0.769

Notes: Standard errors adjusted for intragroup correlation in parentheses. Absenteeism is instrumented by Distance. For first stage results see Tab. 6. Time structure (see also Tab. 3): School inputs for 1871/72, 1881/82, 1894/95, corresponding to Catholic share, agricultural share and number of children for 1870, 1880, 1888 and dependent variable (see notes to Tab. 1) averaged for 1875-79, 1885-89, 1899-1903, respectively; language dummies: German is left-out category; Primary, YesFactory, YesCivil and YesDeath are mean subtracted. *** significant at, or below, 1 percent, ** significant at, or below, 5 percent, * significant at, or below, 10 percent. The regressions account for time fixed effects.