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Qualifying Religion: The Role of Plural Identities for Educational Production

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ABSTRACT

Qualifying Religion: The Role of Plural Identities for Educational Production*

This paper examines the role of religious denomination for human capital formation. We employ a unique data set which covers, inter alia, information on numerous measures of 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 in addition to the cultural characteristics language and religion. Catholic districts show on average significantly lower educational performance than Protestant districts. However, accounting for other sociocultural characteristics qualifies the role of religion for educational production. The evidence suggests that 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.

JEL Classification: I20, H52, O10, N33

Keywords: culture, educational production, plural identity, religious denomination, school inputs

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1 Introduction

Economists have recently regained considerable interests in the role of religion and other cultural traits for the process of economic development (e.g. Barro and McCleary, 2003, 2006; Tabellini, 2005; Ashraf and Galor, 2007; Iyer, 2007; Doepke and Zilibotti, forthcoming). The literature has been initiated by Weber (1905), who argued that religious beliefs matter for professional attitudes and savings. More specifically, he suggested that Protestant regions have grown faster than Catholic regions due to Protestant work ethic and capital accumulation.[1]

This research examines a related but relatively neglected channel through which religious denomination and other sociocultural characteristics may affect economic development: human capital formation.[2] For instance, Becker and Woessmann (2007) find a significant positive effect of Protestantism on literacy in late 19-th century Prussia, while other economic outcomes are affected by religion only through literacy. The analysis presented in this paper looks at the interaction of religion with other sociocultural characteristics. We employ historical data from Swiss districts which provide us with a unique opportunity to examine this interaction during the second phase of industrialization. This opportunity stems from the recognition that, despite its smallness, Switzerland is extraordinarily diverse in many respects relevant for our study. Besides its sociocultural diversity (four official languages, large variation in religious denomination, occupational structure and political attitudes), there is a large disparity in school inputs across districts, thanks to the responsibility for primary school finance and tax authority on the municipal level. At the same time, Switzerland is characterized by a common institutional framework. In particular, our measures of educational performance are derived from the nationwide

[1] See Iannaccone (1998, p. 1474 ff.) for a critical review of this hypothesis. A new twist is brought in by Doepke and Zilibotti (forthcoming). They look at the evolution of Protestant values in interaction with occupational choice.

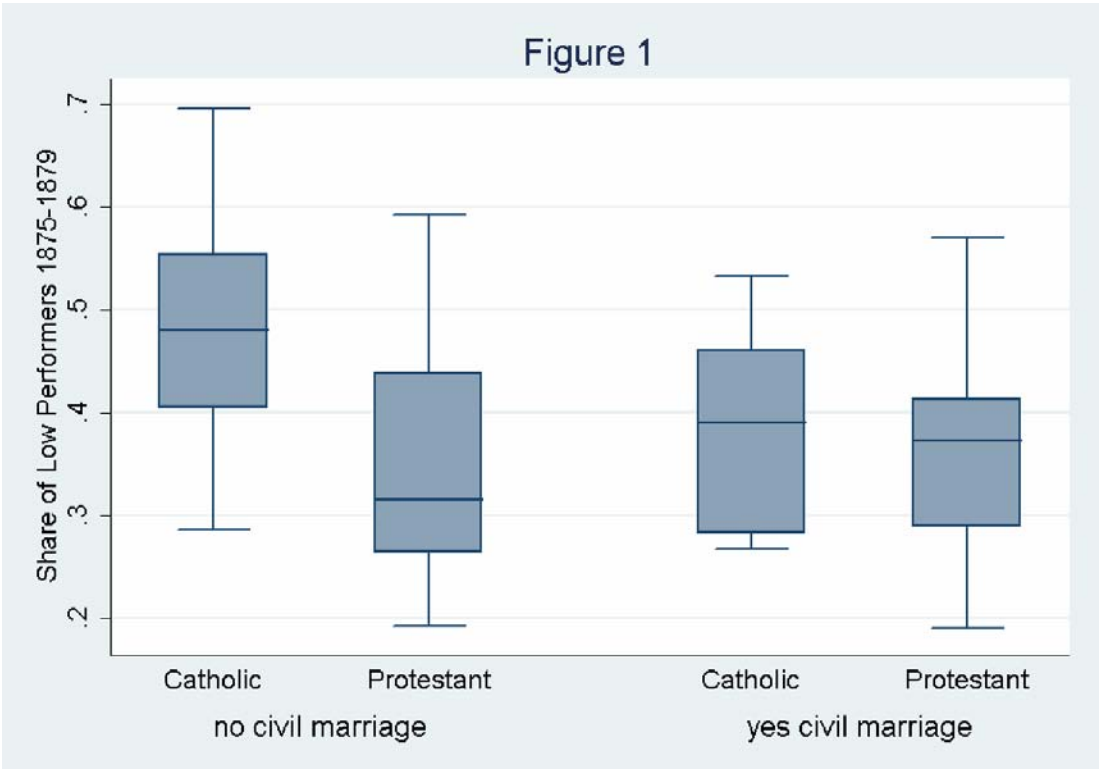
[2] Empirical evidence on the long-run effects of education attributes a fundamental role to human capital for the transition towards, and the development of a modern economy. The evidence suggests that human capital has a causal effect on potential growth factors such as property rights institutions (Glaeser et al., 2004), democratization (Glaeser, Ponzetto and Shleifer, 2007), social capital (Tabellini, 2005), and technological innovation (Mokyr, 2005). In a recent paper employing a new data series, Cohen and Soto (2007) also find a large positive impact of educational attainment on growth in standard cross-country growth regressions and in panel estimates for the 1960-2000 period.

examination of conscripts in standardized tests.

The long history of a direct-democratic political system in Switzerland provides us with the opportunity to go beyond characterizing the cultural environment by religion or language. We employ voting results of three historical federal referenda to capture political attitudes: 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.[3]

The main hypothesis we advance in this paper is as follows: Although Catholic districts show, on average, significantly lower educational performance than Protestant districts, the role of religious denomination for the educational production process is largely modified if one accounts for other cultural 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 performance when there was little support for the death penalty. Catholicism is particularly harmful if the agricultural labor share is high. This suggests that religious denomination ceases to matter for human capital formation if the economy is sufficiently advanced. Figure 1 illustrates the central message derived from our empirical analysis. The left boxes show that in the sample of districts where a majority rejected the referenda on easing civil marriage, the Catholic districts had a considerable higher share of low performers in the conscripts' pedagogical examinations than Protestants. In contrast to this, the results of the districts in which a majority approved the referendum on easing civil marriage (right boxes) reveal no such relation between religious denomination and educational outcome.

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



Our results suggest that reducing the sociocultural environment to religious denomination - and attributing to it the decisive role for education or long-run development - may be misleading. This is consistent with anecdotal historical evidence from the public debate on education and secularization which points to 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.[4] From a more general point of view, our results echo the recent warning of Sen (2007), who argues that individuals have plural identities and that characterizations of societies along

[4]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)

a singular dimension, such as religion, lead to inferior policy outcomes. This also implies that societies may not be doomed to economic failure due to their dominant religion. It is rather the plurality of identity reflected by political beliefs, language, occupation, place of residence, among other things, which, in addition to religious beliefs, should be taken seriously. Our data allows us to do exactly this.

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.[5] 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 conscripts (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. Our set of explanatory variables includes numerous measures of 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

[5]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/.

1894/95. As already stressed, we are interested in the effects of a rich set of sociocultural characteristics on educational outcomes, while controlling for school inputs. This particularly allows us to gain differentiated insights on whether and how religion plays a role for shaping human capital formation.

In addition, we are able to exploit information on pupils' absenteeism from school to analyze its effect on the results of pedagogical examinations. Our identification strategy is to instrument the number of days pupils are absent from school by the distance of family homes to schools in a district. 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. For instance, we find that the effect of religious denomination on conscripts' performance through absenteeism is the opposite of its effect for given absenteeism. Namely, catholic districts show significantly higher discipline in school attendance, which thereby positively affects educational outcome through this channel. However, the evidence on the interaction with other sociocultural attributes suggests that also with respect to absenteeism, Catholicism plays a negligible role in a culturally progressive and non-conservative milieu. Moreover, we find that a higher share of female teachers raises absenteeism, while a higher share of clerical teachers reduces it. But these teacher characteristics turn out to be insignificant for educational success when holding absenteeism constant. Not controlling for school attendance may thus lead to the deceptive conclusion that males or clerics are better teachers.

Finally, explicitly modelling school participation allows us to dig into the mechanics of the so-called "quality-quantity trade-off" which is prominently used in basically all theories of demographic transition and human capital formation (e.g. Galor and Weil, 2000; Galor and Moav, 2002; Doepke and de la Croix, 2003, amongst others).[6] We find that a higher number of children in a district lowers average educational performance. The effect appears to work by reducing school attendance and by decreasing school expenditure. This is consistent with the hypothesis that parents with more children find it more costly to send them to school. In contrast, the evidence does not suggest that a higher number of

[6] For a survey, see Galor (2005).

children per household implies less learning at home, for given school attendance.

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 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 development, specifically for human capital formation.

Barro and McCleary (2003, 2006) present instrumental variable estimates of the impact of religious beliefs on economic development by using a broad panel of countries. They find that belief in both heaven and hell positively affect GDP growth, while monthly church attendance has the opposite effect.[7] Grier (1997) focusses on ex-colonies, suggesting that Protestantism is positively associated with economic growth. Guiso, Sapienza and Zingales (2006) address more specifically the Weberian hypothesis that religious denomination determines preferences for thrift in cross-country evidence and find statistically significant but relatively small effects. Closer to our paper, Borooah and Iyer (2005) estimate how the probability of primary school enrollment in India depends on religion. Their evidence suggests that Muslim children had lower probability of enrollment than Hindus, where Muslim boys derive higher benefit than Hindu boys if the mother is laborer and Muslim girls derive less benefit than Hindu girls if household assets are high. By contrast, we examine − for Switzerland in the 19th century − the effect of religious (Christian) denomination on educational test results rather than school enrollment. Moreover, we allow for interactions of religion with political attitudes and sectoral structure to capture

[7] Related to this, Glaeser and Sacerdote (2001) show for the US that education is positively correlated with church attendance (as well as with other indicators of social activity, which are themselves related to church attendance) and negatively with religious beliefs. Barro and McCleary (2003) consider in addition how church attendance determines religious beliefs.

the cultural environment more comprehensively. Becker and Woessmann (2007) find a significant impact of Protestantism on literacy in late 19th-century Prussia. We complement their results in finding that religious denomination is correlated also with results of pedagogical examinations. However, we argue 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. Our findings therefore qualify the impact of religious denomination by emphasizing its interaction with other cultural traits in order to determine educational outcomes. Moreover, we are able to control for a large variety of school inputs and for absenteeism from school. This allows us to mitigate an omitted variable bias and to shed light on channels through which sociocultural factors and public education policy affect human capital formation.

We are not aware of any study in the vast literature on educational production which accounts for sociocultural characteristics or is able to use information on absenteeism of pupils from school. The literature on the effects of school resources on standardized test scores for the US 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.[8] 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 rich set of non-school variables which are likely to be correlated with

[8] There has recently emerged a literature on the effects of specific educational programs on test scores using randomized experiments in developing countries (a survey is provided by Kremer, 2003). For instance, Banerjee et al. (2005) find that in public schools in Indian slums the hiring of young women to help underperforming children on basic skills (literacy and numeracy) or the use of a computer-assisted learning program with educational games turned out to be quite effective.

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, and teacher quality in particular, matter. 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.[9] 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 educational 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

[9] 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.

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.[10]

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

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

[10] 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.

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,

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

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

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

$Q\,(\mathbf{z}) \equiv [q\,(\mathbf{z})\,/\theta(\mathbf{z})]^{\varkappa}$. 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 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.[11]

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

[11] 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).

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 $\varphi > 0$. Parameter $d \geq 0$ denotes the distance of a pupil to its school.[12] The economic preferences of the household are given by the utility function:[13]

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

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 $\mathbf{z}$.[14] As a result, education in a district is characterized by the following

[12] One straightforward interpretation is that e and $(1 + d)E$ is the time spent on home effort and attendance, respectively.

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

[14] 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, $Z = gQ(\mathbf{z}) =$

properties.

Proposition 1 *Assume that educational production is determined by economic motives according to (9). Then, i) absenteeism increases with distance to school, whereas home support is invariant with respect to distance. ii) Public expenditure g is increasing in 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 (i) therefore provides a theoretical foundation to use distance to school as an instrumental variable for absenteeism in our empirical analysis. Part (ii) predicts that school expenditure per pupil is higher in economically more advanced districts than in less developed districts.

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.[15] 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

$g\left[q(\mathbf{z})/\theta(\mathbf{z})\right]^{\varkappa} = g\left[q(\mathbf{z}_0)/\theta(\mathbf{z}_0)\right]^{\varkappa}$.

[15] 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.

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 milieus. 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 support 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 support 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 support, 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 more home support (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 support of school spending 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.[16] The pedagogical examinations of conscripts had been introduced in several cantons as early as the 1850s to check the efficiency of their school

[16] Data sources are provided in Appendix B.

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 (April 1875). 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).[17] In the first four years (1875 to 1879), the grades 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 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. Uniformity and comparability of results were major concerns throughout the years of testing (Lustenberger, 1996, p. 58-66).

[17]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 accordingly do not appear in the results at all.

4.2 School Statistics

The first of a series of four extensive collections of regional education statistics was published by Hermann Kinkelin (1875), initiated by the Federal Department of Home Affairs as a 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 Johann Kaspar Grob (1883). In 1894/1895, Albert 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 Bern 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.[18] 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 our data set. Several smaller cantons are not subdivided into districts,[19] 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.[20]

The statistics contain detailed information on the budget of the schools. From the budget information, we use total annual real school expenditure per pupil in logs ($Expenditure$ $[\log g]$)[21] and annual real capital stock per pupil in logs ($Capital$ $[\log k]$).[22] 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

[18] 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.

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

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

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

[22] The deflator is a consumer price index (1913=100) on the national level from Ritzmann-Blickenstorfer and Siegenthaler (1996, Table Q1a; *Konsumdeflator*).

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

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]),[23] as well as the share of Catholics (*Catholics*) and majority language (measured by dummy variables *German*, *French*, *Italian*, *Romanic*). As a measure of family structure, we calculated the ratio of children between 0 and 15 years to total population (*Children* [n]).

For measuring the prevalence of conservative or progressive attitudes, we use district data of yes-votes on three referenda:[24] The "Factory Law" (*Fabrikgesetz*) 1877, the

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

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

referendum on the introduction of the civil marriage 1875, and the referendum on the re-introduction of the death penalty in 1879.[25] The "Factory Law" ($YesFactory$) prohibited child labor for children younger than 14 years, and consequently enabled compulsory school attendance (Studer, 2005).[26] 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.[27] The compulsory referendum on the reintroduction of the death penalty, which had been banned by the 1874 constitution, was nearly as controversial.[28] 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.[29]

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

[25] 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.

[26] 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).

[27] 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.

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

[29] 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.

15.5.

<Table 1>

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 Bern) 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* on the other hand, is 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 and the share of low-performing conscripts.

5 Empirical Analysis

5.1 Identification Strategy

Let i be the index of a district and denote time by t. The endogenous variable in our empirical model is the share of low performing conscripts (educational outcome h). The aim of the empirical section is to examine the effects of culture, state of development and political attitudes on the three factors determining the outcome of educational production: Absenteeism, "home support" and education expenditure. The state of development is inversely measured by the employment share in agriculture, μ. Because we do not observe the home support of a pupil (e), we estimate the following model suggested by (5) and the theoretical result that home support depends on non-school district characteristics (use

$\gamma = \tilde{\gamma}(\mathbf{x}, A)$ in part (i) of Proposition 2):

$$\begin{aligned} h_{i,t} =& \alpha_0 + \alpha_1 \mu_{i,t-1} + \mathbf{x}'_{i,t-1}\boldsymbol{\alpha}_x + \mathbf{z}'_{i,t-1}\boldsymbol{\alpha}_z + \alpha_2 \log g_{i,t-1} + \\ & \alpha_3 \log a_{i,t-1} + \alpha_4 n_{i,t-1} + \boldsymbol{\nu}'_t \boldsymbol{\alpha}_\nu + u_{i,t}. \end{aligned} \tag{11}$$

That is, we study whether the cultural variables, $\mathbf{x}$, and the primary sector share, μ, affect the educational outcome for given expenditure per pupil, g, absenteeism, a, and school characteristics, $\mathbf{z}$.[30] The vector $\mathbf{z}$ 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, to assess the possibility of a "quality-quantity trade-off" as stressed by many authors, we control for the number of children, n. Finally, we control for time fixed effects, $\boldsymbol{\nu}$. 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. Since we control for school quality and its use (attendance), the coefficients of vector $\mathbf{x}$ must reflect effects on educational outcome via the channel of "home support".

Because *Absenteeism* is an endogenous variable, a sole estimate of (11) may lead to biased results.[31] To account for this difficulty, we instrument *Absenteeism* ($\log a$) by the distance to school, d. Arguably, the distance to school has no independent effect on educational performance other than through absenteeism. (This is confirmed by our theoretical analysis which showed that home support is independent of d.) Thus, at a first stage, we estimate the following model of absenteeism, suggested by part (i) of Proposition 2:

[30] The lag accounts for the fact that educational outcome is measured at recruitment and not during schooling. See description of time structure in Table 3.

[31] For instance there may be an endogeneity bias because low-performers lose motivation to attend school. At the same time, the instrumentation accounts for possible concerns regarding the quality of absenteeism data. For 1871/72, Kinkelin (1875, p. Xf.) himself cautions against a careless use of the numbers because of the lack of standards. By introducing cantonal regulations, the data quality in the later surveys was improved.

$$\begin{aligned}\log a_{i,t} =&\beta_0 + \beta_1\mu_{i,t} + \mathbf{x}'_{i,t}\boldsymbol{\beta}_x + \mathbf{z}'_{i,t}\boldsymbol{\beta}_z + \beta_2 \log g_{i,t} + \\ &\beta_3 d_{i,t} + \beta_4 n_{i,t} + \boldsymbol{\nu}'_t\boldsymbol{\beta}_\nu + \varepsilon_{i,t},\end{aligned} \tag{12}$$

and then use the instrumented *Absenteeism* to estimate (11).[32] An advantage of this two stage approach is that by computing the first stage, we get an answer to the question on how culture, $\mathbf{x}$, and the agricultural labor share, μ, affect attendance.

Our data set contains each variable at three points in time covering altogether about 30 years. Table 3 summarizes the time structure.

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		

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 ($t = 3$). The data on school resources and absenteeism are available for the years 1871/72 ($t = 0$), 1881/82 ($t = 1$), and 1894/95 ($t = 2$).[33] The Catholic share, the majority language, the number of children and the agricultural share come from the Census which was undertook in 1870 ($t = 0$), 1880 ($t = 1$) and 1888 ($t = 2$).

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 consider each district as a cluster group and systematically calculate robust Huber/White standard errors which are adjusted for intra-

[32] A Hausman test clearly rejects the null hypothesis that the endogenous variable (*Absenteeism*) has no deleterious effect on the estimates of (11).

[33] 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.

cluster correlation.[34] Under the assumption of uncorrelated between-cluster disturbances, these robust variance estimates are unbiased (Williams, 2000).

In the next subsections, we present the estimates of the two stages. We are especially interested in the effects of religious denomination and whether these effects are significantly modified by the voting behavior and the state of development (agricultural share). In subsection 5.4, we additionally examine whether school expenditure per pupil depends on the cultural milieu in a similar way as "home support" (suggested by Proposition 2).[35]

5.2 First Stage Results

Tab. 4 shows the results from the first stage regressions. It confirms that our instrument (*Distance*) is highly correlated with absenteeism from school.

<Table 4>

Column (1) suggests that in districts with a higher share of Catholics, as well as in those with a higher agricultural labor share, pupils attend school more often (coefficients on *Catholics* and *Primary* are negative and significant at the ten and one percent level, respectively). A (purely) Catholic district has on average a 13 percent lower absenteeism than a (purely) Protestant district. Evaluated at mean *Absenteeism* (= 14.4 days) this corresponds to a difference of two school days per year. (The mean number of school days was 188 days per year, according to Tab. 1.) For a one standard deviation increase in *Primary*, we estimate that absenteeism decreases by 12 ($= 0.088 \cdot 137.9$) percent. Thus, according to our theoretical considerations, we infer that either punishment of absenteeism must be harder or the sensitivity to punishment must be higher in a rural, Catholic district. Furthermore, we find that the majority language plays a significant role. Francophone districts have significantly more absenteeism. Moreover, absenteeism rises with the number of children. This suggests that parents with more children find it

[34] 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.

[35] Due to the lack of an appropriate instrument in our data we do not use instrumented expenditure per pupil in the estimation of (11). However, instrumenting g is not as crucial as instrumenting absenteeism, in particular as data quality is less of a concern.

more costly to send them to school. The result reflects a particular notion of a quality-quantity trade-off. 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. This shows that, without controlling for absenteeism in the second stage, the estimates could lead to the wrong conclusion that males and clerics are better teachers than females and non-clerics, respectively - although according to our results, the effect of these teacher characteristics on performance are entirely driven by the effects on school attendance.

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. These results may merely reflect, however, some measurement error in the absenteeism variable, as already discussed. In fact, the evidence suggests that teachers with better training and/or higher salary may have reported absenteeism more frequently.[36] 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. In addition to addressing potential reverse causality problems and omitted variable bias, this constitutes a further reason why we instrument absenteeism.

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, whereas the direct Catholic effect gets smaller and insignificant. Thus, we find a significant difference in absenteeism between Catholics and Protestants only in districts where the agricultural share of labor is above its mean.[37] In columns (3)-(5), we analyze whether the voting behavior qualifies the religion effect. We find that all interactions between the Catholic share and the yes-votes on the referenda

[36] 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.

[37] *Primary* measures the agricultural labor share minus the mean agricultural labor share. Thus, in an average rural district *Primary* is zero.

are significant at the 1 percent level. Catholic pupils are less absent only 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). 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. As you can see from Table 1, extreme voting behavior really occurred. 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 is 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 is fully approved.[38] 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 percent level. Furthermore, we find that the interaction between the Catholic share and the yes-votes on the "Factory Law" and civil marriage remains significant (at least at the five percent level).[39] 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, and an F-test over the joint significance of the three interactions is run, the null hypothesis is rejected at the one percent level (not reported in the Table). Hence the political attitude systematically qualifies the effect of religion.

We emphasize in this paper that the voting behavior reflects the prevalence of conservatism which is − in addition to religion − another aspect of the plural cultural identities of a society. In Table 2, we see that political attitudes and religion are correlated. Thus, it could be the case that the significance of the interaction terms are only driven by a

[38] $YesCivil$ 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 $YesCivil = 0.513$.

[39] 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.

non-linear Catholic effect. This is tested in column (9). We find that the coefficient of the squared Catholic share is not significant − indicating there is indeed a factor different from religion which drives our results.[40]

5.3 Second Stage Results

At the second stage, we estimate the effects of school resources, attendance of school and cultural variables on educational outcomes. Tab. 5 shows our findings.

<Table 5>

As expected, school resources matter. In column (1), we estimate that for given observable inputs, a 10 percent increase in expenditure reduces the share of low performing conscripts by 0.75 percentage points. Teachers with poor training increase the share of low performers, whereas experienced teachers reduce it. A 10 percent increase in absenteeism raises our measure of educational outcome by 1.38 percentage points (significant at the 1 percent level). Hence the identified cultural effects on absenteeism (first stage) will transform into educational outcome. Table 5 also reveals important culture effects at the second stage. Home support in a Romanic district is significantly lower, whereas it is higher when the majority language is French. The number of children, by contrast, does not have a significant effect on school performance, holding school attendance and expenditure constant. This suggests that a quality-quantity trade-off does not materialize through home support.

We find a very large religion effect. A purely Catholic district has on average a 9.1 percentage points higher share of low performers than a Protestant district (holding school resources and absenteeism constant). The magnitude of this effect is comparable with a 120 percent increase in expenditure (while holding expenditure structure constant). The impact of *Primary* is statistically and economically less significant. A one standard deviation increase in *Primary* raises the share of low performers by 1.4 ($= 15.7 \cdot 0.088$)

[40] Columns (3)-(5) also show 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 the educational production.

percentage points. Column (2) includes an interaction between *Primary* and *Catholics*. The estimated coefficient is positive but insignificant. Thus the state of development has more influence on absenteeism than on home support (and moderates the religion effect on absenteeism more than the religion effect on home support). Columns (3)-(5) further 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 significantly negative, whereas the interaction with the votes on the death penalty is significantly positive (at the five percent level). For instance, we estimate that in case of an increase of the Catholic share of one the share of low performers is 19 ($= 8.1 + 22.4 \cdot 0.487$) percentage points higher than in a district with 100 percent 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. In columns (6)-(8), we control simultaneously for $Catholics * Primary$ and the interaction between *Catholics* and the voting behavior. Again, we find that the interaction with the votes on the referenda have the expected sign and are statistically significant for the factory law (at the five percent level) and for the civil marriage (at the one percent level). Note that $Catholics * Primary$ remains insignificant (although having the expected sign). Thus the moderating effect of the state of development is less evident than those of the political attitude. In contrast to the first stage, the direct effect of *Catholics* remains significant if interaction effects are included. In a district with a mean approval of the referenda and with a mean agricultural labor share, there is a significant effect of religion on home support. But in highly progressive districts, the religion effect will cease to exist. An F-test over the joint significance of the three interaction coefficients is rejected at the 10 percent level (not reported in the Table) which again confirms our main hypothesis that Catholicism loses its importance for educational performance in a non-conservative milieu.

Comparing the results of the first and second stage, we see that the cultural effects, including their interactions, work in opposite directions. Pupils in Catholic and rural districts on average attend school more often, but receive less home support. These opposite directions are explained by 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. Overall, the effect of home support prevails. While, on average, the absenteeism channel *reduces* the share of low performers in a (purely) Catholic district by 1.8 ($= 0.138 \cdot 12.8$) percentage points, recall that the home support channel *raises* the share of low performers (on average) by 9.1 percentage points. Column (9) shows that, also at the second stage, a squared Catholic share is statistically not significant. This again suggests that the significant interactions between religious and other sociocultural factors do not merely reflect a non-linear Catholic effect.

5.4 Effect of religion on expenditure

So far, we have examined the effects of cultural variables on educational performance through school attendance and home support, and we found that the Catholic share has a strong influence in a conservative district, but has no (or even a reversed) impact when the district is progressive. The aim of this subsection is to analyze whether the political attitude also qualifies the effect of religion on expenditure. As suggested by part (ii) of Proposition 2, we run the following regression

$$\log g_{i,t} = \delta_0 + \delta_1 \mu_{i,t} + \mathbf{x}'_{i,t}\boldsymbol{\delta}_x + \mathbf{z}'_{i,t}\boldsymbol{\delta}_z + \delta_2 n_{i,t} + \boldsymbol{\nu}'_t\boldsymbol{\delta}_\nu + \tau_{i,t}. \tag{13}$$

Following our theoretical model, regression (13) 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

$$\log g_{i,t} = \epsilon_0 + \epsilon_1 \mu_{i,t} + \mathbf{x}'_{i,t}\boldsymbol{\epsilon}_x + \epsilon_2 n_{i,t} + \boldsymbol{\nu}'_t\boldsymbol{\epsilon}_\nu + \xi_{i,t}, \tag{14}$$

which assumes that voters are ignorant of the observed input structure. Table 6 and 7 show the results of these regressions.

<Table 6>

In column (1) of Table 6, we see that less economically advanced districts (*Primary* is high) have lower school expenditure per pupil. This is in line with the positive impact of an increase in productivity A on g derived in Proposition 2. A standard deviation increase in the agricultural share lowers school expenditure by 11 ($= 123.8 \cdot 0.088$) percent. The number of children matters, as well. School expenditure per child decreases in the number of children significantly. This supports the idea that a quality-quantity trade-off works through willingness to pay for schooling in addition to the channel through which a higher fraction of children in the population raises absenteeism from school. Cultural variables have an effect, too. Romanic and Italian districts have around 30 percent less school expenditure than German districts. And on average, we estimate that a purely Catholic district has 17.6 percent lower school expenditure than a purely Protestant district.[41] As suggested by our theoretical considerations, the effects on home support and expenditure go in the same direction, whereas absenteeism is driven by an additional force (sanctions). In column (2), we again 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. This suggests that religion does not affect human capital formation through the expenditure channel either if the economy is sufficiently developed (neither did it through absenteeism and home support). 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. Columns (3)-(5) consider interactions between the Catholic share and the political attitude. All interactions are significant (at least at the 10 percent level) and have the expected sign. In column (4) the direct Catholic effect gets 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

[41] Combined with the effect of expenditure on educational outcome (Tab. 5) this difference will (on average) increase the share of low performers in a Catholic district by 1.3 ($= 17.6 \cdot 0.075$) percentage points.

must be fully driven by "conservative" districts. 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. This would account for a 3.1 ($= 56 \cdot 0.056$) percentage points difference in the share of low performers (use column (4) in Tab. 5). 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 interactions with the voting behavior always have the expected sign and is in the case of the civil marriage, significant at the one percent level. Including all three political interactions simultaneously and running an F-test reveals that they are jointly significant at a one percent level (not reported). Column (9) shows that the squared Catholic share is not significant.

<Table 7>

Table 7 analyzes the cultural effects when voters are ignorant of the observed input structure. The results are similar to those of Table 6. Romanic, Italian, Catholic and less developed districts spend significantly less on schooling. 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. Unlike the other regressions, a squared Catholic share is significantly negative. This is the only case where we found that the significant interactions could be driven by a non-linear religion effect.

6 Conclusion

Our research sheds light on the conditions and mechanisms under which religion may be an important determinant of human capital formation, and therefore of economic development. 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 (school attendance, home support and school expenditure) through which culture can effect the educational outcome. The results show that religion works through all these three channels, but only when conservative political attitudes are prevalent. The evidence suggests that neglecting the interaction of religious denomination with these measures of political attitudes leads to misleading conclusions about the role of religion for human capital formation. Our results demonstrate that religious denomination ceases to have impact on educational performance if, at the same time, progressive movements are widely supported.

Our results also suggest that economic development, in the sense of structural change away from agricultural production, mitigates the overall harmful effect that Catholicism has, on average, on human capital formation. This potentially gives rise to a virtuous circle between structural change and education: Any economic policy conducive to structural change leads to better educational outcomes in Catholic regions and thereby fosters further development. Thus, rather than concluding that some economies are doomed to failure due to their cultural heritage, our evidence suggests that in economies with unfavorable cultural characteristics, policies designed to promote growth could be particularly helpful.

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

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

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

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

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

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

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.
- *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).

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Tab. 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, YesDeath, YesCivil are mean subtracted. The respective mean values are 0.217, 0.497, 0.533, 0.487. Definitions of other variables are provided in the main text.

Tab. 2: Correlation coefficients

(a): Cultural variables

	Catholics	YesFactory	YesCivil	YesDeath
Catholics	1.000			
YesFactory	-0.095**	1.000		
YesCivil	-0.6802***	0.3797***	1.000	
YesDeath	0.4897***	-0.1965***	-0.7861***	1.000
German	-0.0758*	0.5007***	0.2582***	0.124***

(b): Catholic share and non-cultural indicators

	Catholics	Primary [μ]	LowPerf	Expenditure [log$g$]	Absenteeism [log$a$]
Catholics	1.000				
Primary [μ]	0.3162***	1.000			
LowPerf	0.1862***	0.2264***	1.000		
Expenditure [log$g$]	-0.3913***	-0.5494***	-0.6041***	1.000	
Absenteeism [log$a$]	-0.3755***	-0.319***	0.0597	0.2945***	1.000
Children [n]	-0.2465***	0.0734	0.0167	-0.1638***	0.1904***

Notes: Data 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.

Tab. 4: First stage results

Dependent variable: *Absenteeism* [log(a)]

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.
Weeks	0.012 **	-0.001	0.008	0.005	0.009	0.005	0.009 *	0.005	0.011 **	0.005	0.006	0.005	0.008	0.005	0.008	0.005	0.009 *	0.005
Class Size	-0.070	0.287	-0.039	0.105	-0.078	0.111	-0.055	0.105	-0.064	0.108	-0.030	0.108	-0.039	0.104	-0.041	0.105	-0.031	0.105
Capital	-0.025	0.121	-0.028	0.047	-0.008	0.050	0.006	0.048	-0.006	0.049	-0.023	0.049	-0.006	0.048	-0.015	0.048	-0.042	0.048
Poor Training	-0.690 ***	1.008	-0.659 ***	0.154	-0.657 ***	0.158	-0.610 ***	0.154	-0.607 ***	0.160	-0.640 ***	0.154	-0.613 ***	0.152	-0.622 ***	0.155	-0.657 ***	0.154
Female Teachers	0.851 ***	-0.494	0.980 ***	0.174	0.872 ***	0.179	0.998 ***	0.174	0.949 ***	0.181	0.978 ***	0.174	1.040 ***	0.173	1.025 ***	0.177	1.044 ***	0.184
Clerics	-0.733 ***	1.176	-0.996 ***	0.219	-0.922 ***	0.229	-0.783 ***	0.218	-0.764 ***	0.225	-1.133 ***	0.225	-0.943 ***	0.220	-1.009 ***	0.224	-1.003 ***	0.219
Length of Service > 20 Years	0.016	0.813	-0.153	0.401	-0.096	0.414	-0.040	0.401	-0.029	0.411	-0.217	0.401	-0.137	0.397	-0.156	0.401	-0.140	0.402
Age > 40 Years	0.691 *	0.112	0.756 *	0.388	0.785 **	0.400	0.730 *	0.389	0.676 *	0.398	0.810 **	0.388	0.762 **	0.384	0.734 *	0.388	0.769 **	0.388
Expenditure	0.317 ***	-0.157	0.229 ***	0.079	0.287 ***	0.080	0.191 **	0.080	0.287 ***	0.080	0.208 ***	0.079	0.170 **	0.079	0.223 ***	0.079	0.222 ***	0.079
Romanic	0.035	0.314	-0.065	0.169	-0.007	0.175	-0.090	0.170	-0.011	0.174	-0.104	0.171	-0.119	0.168	-0.073	0.170	-0.097	0.172
Italian	0.009	0.247	0.030	0.124	0.056	0.135	-0.185	0.130	-0.188	0.146	0.088	0.131	-0.113	0.130	-0.049	0.145	0.013	0.125
French	0.387 ***	-0.232	0.375 ***	0.075	0.393 ***	0.088	0.283 ***	0.079	0.323 ***	0.079	0.404 ***	0.086	0.307 ***	0.078	0.344 ***	0.077	0.364 ***	0.076
Catholics	-0.128 *	0.261	-0.087	0.064	-0.101	0.067	-0.033	0.083	-0.094	0.072	-0.071	0.065	-0.033	0.082	-0.086	0.070	0.296	0.359
Catholics squared																	-0.392	0.362
Children	4.506 ***	0.811	3.593 ***	0.798	4.876 ***	0.830	4.523 ***	0.783	4.454 ***	0.804	3.821 ***	0.826	3.906 ***	0.792	3.654 ***	0.799	3.763 ***	0.813
Primary	-1.379 ***	0.336	0.220	0.421	-1.538 ***	0.342	-1.476 ***	0.353	-1.366 ***	0.346	0.061	0.438	-0.373	0.466	0.051	0.436	0.310	0.429
Catholic*Primary			-3.826 ***	0.644							-3.651 ***	0.652	-2.564 ***	0.718	-3.503 ***	0.684	-3.755 ***	0.647
Distance	2.482 ***	0.523	2.378 ***	0.505	2.504 ***	0.520	2.638 ***	0.507	2.791 ***	0.526	2.423 ***	0.505	2.522 ***	0.502	2.533 ***	0.515	2.365 ***	0.505
Constant	-0.054	0.640	0.538	0.626	-0.025	0.635	0.250	0.620	0.006	0.634	0.533	0.624	0.555	0.618	0.512	0.626	0.469	0.629
YesFactory					-0.411 **	0.203					-0.222	0.200						
Catholic*YesFactory					0.814 ***	0.268					0.593 **	0.263						
YesCivil							-0.796 ***	0.173					-0.552 ***	0.184				
Catholic*YesCivil							1.765 ***	0.302					1.231 ***	0.333				
YesDeath									0.499 ***	0.187					0.287	0.187		
Catholic*YesDeath									-1.034 ***	0.314					-0.479	0.324		
Number of Observations	493		493		493		493		493		493		493		493		493	
R2	0.51		0.55		0.52		0.55		0.52		0.55		0.56		0.55		0.55	

Notes: Standard errors adjusted for intragroup correlation. Time structure (see also Tab. 3): School inputs and absenteeism for 1871/72, 1881/82, 1894/95, corresponding to Catholic share, agricultural share and number of children for 1870, 1880, 1888, 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.

Tab. 5: Second stage results

Dependent variable: *LowPerf*

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.
Weeks	-0.003 ***	0.001	-0.003 **	0.001	-0.002 **	0.001	-0.003 **	0.001	-0.003 ***	0.001	-0.002 **	0.001	-0.003 **	0.001	-0.003 **	0.001	-0.003 **	0.001
Class Size	0.055 **	0.023	0.053 **	0.023	0.051 **	0.023	0.053 **	0.021	0.054 **	0.021	0.047 **	0.023	0.052 **	0.021	0.053 **	0.021	0.052 **	0.023
Capital	-0.012	0.012	-0.012	0.012	-0.013	0.011	-0.017	0.012	-0.016	0.012	-0.012	0.011	-0.017	0.012	-0.015	0.012	-0.011	0.012
Poor Training	0.128 ***	0.038	0.128 ***	0.038	0.121 ***	0.036	0.113 ***	0.032	0.106 ***	0.030	0.121 ***	0.036	0.114 ***	0.033	0.111 ***	0.032	0.128 ***	0.038
Female Teachers	-0.068	0.044	-0.083	0.050	-0.063	0.043	-0.081 *	0.046	-0.069 *	0.041	-0.075	0.049	-0.084 *	0.049	-0.080 *	0.046	-0.089	0.055
Clerics	-0.006	0.043	0.021	0.053	0.024	0.049	-0.003	0.042	-0.009	0.040	0.044	0.057	0.004	0.048	0.012	0.048	0.022	0.053
Length of Service > 20 Years	-0.216 **	0.098	-0.200 **	0.099	-0.201 **	0.096	-0.209 **	0.093	-0.211 **	0.092	-0.191 **	0.097	-0.206 **	0.094	-0.202 **	0.094	-0.201 **	0.100
Age > 40 Years	0.107	0.097	0.098	0.101	0.099	0.094	0.108	0.094	0.122	0.091	0.095	0.097	0.106	0.095	0.115	0.095	0.097	0.102
Expenditure	-0.075 ***	0.022	-0.068 ***	0.020	-0.067 ***	0.021	-0.056 ***	0.019	-0.066 ***	0.020	-0.062 ***	0.019	-0.056 ***	0.019	-0.063 ***	0.020	-0.067 ***	0.020
Romanic	0.044 ***	0.017	0.053 ***	0.019	0.055 ***	0.018	0.060 ***	0.020	0.049 ***	0.017	0.063 ***	0.019	0.061 ***	0.020	0.053 ***	0.018	0.056 ***	0.021
Italian	-0.012	0.021	-0.014	0.024	-0.028	0.022	0.012	0.024	0.009	0.026	-0.031	0.024	0.009	0.025	0.002	0.027	-0.013	0.024
French	-0.051 **	0.021	-0.052 **	0.022	-0.059 ***	0.022	-0.034 *	0.018	-0.036 **	0.018	-0.061 ***	0.023	-0.036 *	0.019	-0.040 **	0.020	-0.051 **	0.021
Catholics	0.091 ***	0.015	0.088 ***	0.015	0.087 ***	0.015	0.081 ***	0.018	0.088 ***	0.016	0.085 ***	0.015	0.081 ***	0.018	0.088 ***	0.016	0.053	0.091
Catholics squared																	0.036	0.092
Children	-0.151	0.278	-0.085	0.256	-0.161	0.273	-0.121	0.256	-0.074	0.239	-0.087	0.250	-0.105	0.248	-0.048	0.234	-0.103	0.265
Primary	0.157 *	0.090	0.016	0.095	0.165 *	0.091	0.166 *	0.088	0.143 *	0.078	0.037	0.098	0.126	0.100	0.059	0.090	0.007	0.097
Catholic*Primary			0.350	0.218							0.302	0.204	0.098	0.176	0.229	0.194	0.346	0.216
Absenteeism	0.138 ***	0.039	0.142 ***	0.041	0.133 ***	0.036	0.131 ***	0.034	0.122 ***	0.031	0.136 ***	0.037	0.133 ***	0.036	0.128 ***	0.036	0.143 ***	0.041
Constant	0.231 *	0.124	0.177	0.129	0.226 *	0.123	0.193	0.123	0.224 *	0.117	0.180	0.126	0.181	0.125	0.191	0.122	0.183	0.129
YesFactory					0.039	0.043					0.025	0.042						
Catholic*YesFactory					-0.129 **	0.054					-0.113 **	0.053						
YesCivil							0.108 ***	0.040					0.100 ***	0.038				
Catholic*YesCivil							-0.224 **	0.086					-0.207 ***	0.080				
YesDeath									-0.078 **	0.037					-0.067 *	0.038		
Catholic*YesDeath									0.132 **	0.064					0.102	0.063		
Number of Observations	493		493		493		493		493		493		493		493		493	
R2	0.75		0.74		0.76		0.77		0.78		0.76		0.77		0.77		0.74	

Notes: Standard errors adjusted for intragroup correlation. Time structure (see also Tab. 3): School inputs and absenteeism 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.

Tab. 6: Effects on expenditure, controlling for expenditure structure

Dependent variable: *Expenditure* [Log(g)]

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.
Weeks	0.019 ***	0.004	0.017 ***	0.004	0.017 ***	0.004	0.017 ***	0.004	0.019 ***	0.004	0.016 ***	0.004	0.016 ***	0.004	0.017 ***	0.004	0.018 ***	0.004
Class Size	-0.306 ***	0.093	-0.283 ***	0.087	-0.285 ***	0.095	-0.274 ***	0.085	-0.298 ***	0.092	-0.257 ***	0.088	-0.268 ***	0.084	-0.281 ***	0.087	-0.273 ***	0.087
Capital	0.233 ***	0.034	0.224 ***	0.035	0.228 ***	0.034	0.223 ***	0.035	0.233 ***	0.035	0.215 ***	0.035	0.219 ***	0.035	0.225 ***	0.035	0.209 ***	0.034
Poor Training	0.183 **	0.082	0.188 **	0.090	0.192 **	0.080	0.220 ***	0.082	0.215 **	0.083	0.192 **	0.088	0.218 **	0.086	0.202 **	0.089	0.188 **	0.089
Female Teachers	0.287 **	0.133	0.329 **	0.132	0.278 **	0.132	0.341 **	0.134	0.314 **	0.138	0.313 **	0.133	0.350 ***	0.133	0.338 **	0.134	0.390 ***	0.147
Clerics	-0.976 ***	0.136	-1.052 ***	0.133	-1.060 ***	0.141	-0.891 ***	0.129	-0.950 ***	0.138	-1.115 ***	0.137	-0.933 ***	0.132	-1.035 ***	0.138	-1.053 ***	0.134
Length of Service > 20 Years	0.385	0.273	0.305	0.286	0.333	0.264	0.305	0.263	0.353	0.268	0.275	0.272	0.278	0.272	0.297	0.283	0.317	0.285
Age > 40 Years	0.040	0.263	0.062	0.278	0.074	0.247	0.087	0.254	0.049	0.258	0.079	0.260	0.094	0.261	0.064	0.275	0.073	0.276
Romanic	-0.349 ***	0.093	-0.377 ***	0.099	-0.378 ***	0.097	-0.396 ***	0.101	-0.366 ***	0.094	-0.406 **	0.101	-0.402 ***	0.105	-0.382 ***	0.100	-0.406 ***	0.104
Italian	-0.294 ***	0.101	-0.275 ***	0.101	-0.237 **	0.101	-0.396 ***	0.094	-0.380 ***	0.105	-0.216 **	0.101	-0.374 ***	0.096	-0.314 ***	0.102	-0.289 ***	0.101
French	-0.169 ***	0.052	-0.169 ***	0.048	-0.134 **	0.062	-0.197 ***	0.052	-0.189 ***	0.051	-0.125 ***	0.059	-0.190 ***	0.051	-0.178 ***	0.049	-0.179 ***	0.049
Catholics	-0.176 ***	0.047	-0.154 ***	0.047	-0.162 ***	0.046	-0.073	0.060	-0.150 ***	0.052	-0.145 ***	0.046	-0.076	0.058	-0.145 ***	0.049	0.237	0.274
Catholics squared																	-0.388	0.272
Children	-2.366 ***	0.662	-2.666 ***	0.689	-2.232 ***	0.704	-2.163 ***	0.677	-2.329 ***	0.668	-2.600 ***	0.736	-2.329 ***	0.695	-2.624 ***	0.695	-2.483 ***	0.692
Primary	-1.238 ***	0.247	-0.545 *	0.324	-1.254 ***	0.263	-1.091 ***	0.268	-1.183 ***	0.262	-0.564	0.350	-0.783 **	0.348	-0.578 *	0.344	-0.453	0.330
Catholic*Primary			-1.557 ***	0.575							-1.487 **	0.597	-0.703	0.626	-1.429 **	0.609	-1.476 **	0.571
Constant	2.790 ***	0.507	2.932 ***	0.512	2.753 ***	0.506	2.770 ***	0.495	2.781 ***	0.507	2.893 ***	0.515	2.847 ***	0.506	2.916 ***	0.515	2.843 ***	0.517
YesFactory					-0.106	0.153					-0.024	0.151						
Catholic*YesFactory					0.395 **	0.182					0.293	0.182						
YesCivil							-0.334 ***	0.116					-0.265 **	0.120				
Catholic*YesCivil							0.992 ***	0.207					0.840 ***	0.224				
YesDeath									0.154	0.124					0.069	0.123		
Catholic*YesDeath									-0.406 *	0.220					-0.179	0.217		
Number of Observations	493		493		493		493		493		493		493		493		493	
R2	0.76		0.77		0.77		0.78		0.77		0.77		0.78		0.77		0.77	

Notes: Standard errors adjusted for intragroup correlation. Time structure (see also Tab. 3): School inputs and absenteeism 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.

Tab. 7: Effects on expenditure, not controlling for expenditure structure

Dependent variable: *Expenditure* [Log(g)]

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.
Romanic	-0.375 ***	0.063	-0.389 ***	0.085	-0.462 ***	0.081	-0.453 ***	0.105	-0.427 ***	0.085	-0.488 ***	0.102	-0.454 ***	0.116	-0.434 ***	0.104	-0.528 ***	0.104
Italian	-0.148 ***	0.078	-0.062	0.103	-0.063	0.078	-0.324 ***	0.083	-0.388 ***	0.120	0.001	0.102	-0.271 ***	0.101	-0.270 *	0.141	-0.048	0.098
French	0.014	0.045	0.032	0.043	0.085	0.052	0.024	0.050	-0.018	0.043	0.102 **	0.049	0.042	0.059	0.004	0.043	0.037	0.041
Catholics	-0.436 ***	0.062	-0.402 ***	0.066	-0.440 ***	0.063	-0.087	0.086	-0.295 ***	0.077	-0.409 ***	0.064	-0.091	0.083	-0.293 ***	0.070	0.703 **	0.297
Catholics squared																	-1.110 ***	0.314
Children	-4.866 ***	0.700	-4.957 ***	0.722	-4.958 ***	0.762	-3.780 ***	0.700	-4.519 ***	0.704	-5.215 ***	0.792	-3.945 ***	0.710	-4.718 ***	0.724	-3.970 ***	0.716
Primary	-2.056 ***	0.311	-0.957 **	0.390	-1.888 ***	0.343	-1.405 ***	0.353	-1.766 ***	0.356	-0.729 *	0.428	-0.900 **	0.431	-0.894 **	0.443	-0.761 *	0.396
Catholic*Primary			-2.329 ***	0.698							-2.408 ***	0.714	-1.085	0.751	-1.900 **	0.791	-1.991 ***	0.681
Constant	4.499 ***	0.237	4.525 ***	0.243	4.505 ***	0.253	4.112 ***	0.241	4.385 ***	0.238	4.586 ***	0.265	4.152 ***	0.243	4.439 ***	0.243	4.127 ***	0.244
YesFactory					0.248	0.201					0.376 *	0.192						
Catholic*YesFactory					0.132	0.280					-0.090	0.288						
YesCivil							-0.214	0.140					-0.099	0.142				
Catholic*YesCivil							1.619 ***	0.280					1.381 ***	0.327				
YesDeath									0.118	0.158					-0.014	0.163		
Catholic*YesDeath									-0.895 ***	0.333					-0.587	0.363		
Number of Observations	493		493		493		493		493		493		493		493		493	
R2	0.61		0.64		0.62		0.68		0.63		0.65		0.68		0.65		0.64	

Notes: Standard errors adjusted for intragroup correlation. Time structure (see also Tab. 3): Absenteeism 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.