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Education Policy and Educational Inequality—Evidence from the Swiss Laboratory

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Abstract: This article examines how the different education policies in the subnational units of Switzerland—the cantons—affect educational inequality. The article builds on previous research arguing that in order to properly evaluate education policy and its outcomes in decentralized countries, regional disparities must been taken into account. Switzerland has one of the most decentralized education systems in the world and is thus an exemplary case for a subnational analysis. Applying multilevel models the article illustrates that small class size, public investments in education as well as the mobility between ability groups are related to a lower degree of educational inequality. In contrast, longer schooldays strengthen inequality in education, implying that school instruction in the Swiss cantons does not provide equal opportunities to pupils irrespective of social class.

Introduction

The publication of the Program for International Student Assessment (PISA) has ushered in lively scientific and public debates on the effectiveness and performance of education policy. Central to these discussions are the ongoing search for the 'best' education policies and the question of whether the education systems of the most successful countries, such as Finland, can be used as role models to improve educational outcomes in other countries. Typical indicators of success include general school performance or the degree to which a system provides equal opportunities to pupils from different social backgrounds.

It is here that this article finds its starting point, asking how the different education policies in the subnational units of Switzerland—the cantons—moderate educational inequality. A systematic analysis of the Swiss cantons contributes to the ongoing debate for at least two reasons: first, comparative research with regard to macro-foundations of educational inequality remains rather scarce (exceptions include Schütz *et al.*, 2008; Freitag and Schlicht, 2009; Schlicht *et al.*, 2010). Moreover, the few existing studies reveal that the nation-state is not always the most appropriate level of analysis given the decentralized education policies in countries like Austria, Belgium, Germany, Hungary, or Switzerland (Schlicht *et al.*, 2010). In order to appropriately evaluate education policy and its outcomes in these countries, it is therefore important to take regional disparities into account. Switzerland has in fact one of the most decentralized education systems in the world (Heidenheimer, 1997; Hega, 2000, p. 1), with the cantons and their communes retaining almost full jurisdiction over education policy. This high degree of decentralization has led to extensive variation in educational structures among the Swiss cantons, particularly regarding primary, lower secondary, and general academic schools (Hega, 2000, p. 2, 7). Switzerland therefore provides an unparalleled example of a country suited to subnational analysis.

Second, the current state of research remains inconclusive regarding the actual relationship between education policy and education inequality. This is not only due to the possible ambiguous effects of some education policies (Scheerens and Bosker, 1997) but also to the fact that educational policies seem to produce different results in different environments (Schlicht *et al.*, 2010). Taking this heterogeneity into account, the case of Switzerland provides an excellent opportunity to investigate how educational structures are associated with educational outcomes. While the Swiss cantons are entities within a single national political system and have many characteristics in common that may be treated as constants, they are host to a multitude of political, societal, and economic structures which allow testing education policy outcomes in different contexts.

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This study adopts a multilevel approach. Data from the PISA study form the empirical basis of the contribution. The PISA data for Switzerland have been expanded by a Swiss national sample which makes it possible to conduct canton-specific analyses for 14 of the 26 Swiss subnational units. The individual level data are complemented by education policy data for these 14 cantons.

The remainder of this article is structured as follows: the following section is devoted to the discussion of the theoretical background and the hypotheses. Next, I describe the model, variables, and their operationalization, followed by a brief overview of educational inequality in the Swiss cantons. The empirical results will be presented in the fifth section; the article closes with a summary of the most important findings and some conclusions.

Theoretical Background

The Conceptualization of Educational Inequality

Jacobs (1996) identifies three concepts of educational inequality—social inequality in educational access, in educational outcome, and in the education process. The focus of this article lies on the latter concept, in particular on social inequality in the *school* education process. This approach is most widely used in international studies on social inequality in education and is suited for comparisons of units with varying education policies. Moreover, these early inequalities in education are not only relatively easy to investigate due to a common database (PISA), but they can also be perceived of as the foundation of later inequalities, i.e. unequal occupational opportunities.

Educational inequality in this study is conceptualized as the dependence of pupils' math capabilities on individual social background, that is, the parents' highest level of education. This operationalization generally corresponds to the cultural capital approach. Following Bourdieu (1983, p. 186), the transmission of cultural capital within the family is seen as the most effective educational investment. Parental education is used in various studies as a measure of cultural capital at home, as it represents the capacity for knowledge to be transferred from parents to children (Blossfeld and Shavit, 1993; Barone, 2006). It is important to note that parental education is also related to other dimensions of the home environment, in particular to financial and social resources (Gesthuizen *et al.*, 2005) that may influence a student's chances of educational success. Most importantly, better educated parents tend to be financially better off, thereby enabling them to finance extracurricular activities, private lessons, or tutors, etc., in order to enhance school performance (Tieben *et al.*, 2010, p. 79). Moreover, parents' involvement and networks—which are themselves important social resources—are also highly correlated with parents' educational background (McNeal, 1999). Parental education can thus be considered as the most general indicator of pupils' social background and has moreover proved to be a crucial and stable predictor of educational reproduction (Tieben *et al.*, 2010, p. 81).

Education Policy and Educational Inequality

I follow a policy-centred approach to investigate how different education policies in the Swiss cantons moderate educational inequality. The analyses are based on two crucial assumptions:

First, the central hypothesis of the article suggests that persistent differences in education policy in the subnational units of Switzerland are related to varying degrees of educational inequalities. This corresponds to a neo-institutionalist approach which posits that institutional rules, procedures, and conventions have the ability to mould individual preferences, thereby encouraging or limiting behavioural options by means of certain incentive mechanisms (Hall and Taylor 1996; Immergut 1998). Applied to the context of education policy, pupils are deeply embedded in the educational environment in which they live (Ostrom, 1999). Education policies, therefore, structure pupils' educational opportunities and act as filters for individual educational success.

Second, it is assumed that the educational context does not influence all pupils in the same way; instead, the effect of education policy—as an element of a broader welfare state concept—can be expected to vary depending on individual resources, values, and behaviour patterns (Schmid, 1984, p. 281). While some education policies are presumed to improve the chances of lower class individuals to participate equally in the educational process, other educational contexts are expected to hinder equal educational opportunities (Esping-Andersen, 2008). If this is the case, the educational context may impact the social stratification of educational outcomes. Hypotheses integrating such group-specific relationships between education policy and educational outcomes should therefore be formulated (Elster, 1998). In other words, I aim to understand the micro-mechanisms behind the macro-relationships observed (Hedström and Swedberg, 1996, p. 131), i.e. how the relationship between social background and educational performance is moderated by education policy variables.

In the Swiss context, education policy primarily lies within the cantonal jurisdictions. I draw on previous research and focus on five dimensions of education policy that are relevant in the Swiss subnational context:

1. Following Esping-Andersen (2008), a *widely available preschool education* is a necessary condition for reducing the degree of educational inequality. Compared with children from higher social classes, children from the lower social strata have fewer academic skills when they enter school (Magnuson *et al.*, 2006, p. 117). It can be expected that early childhood education, by providing enriching early experiences to these children, may act as a surrogate for insufficient capital resources at home and thus increase school readiness of children from the lower social classes (Magnuson *et al.*, 2006; McClelland *et al.*, 2006; Schechter and Bye, 2006; Esping-Andersen, 2008; Schlicht *et al.*, 2010). The equalizing effect of preschool education should, however, only occur if preschool facilities are provided on a broad and encompassing basis as a limited availability of preschool education may result in the exclusion of the lower social classes from early childhood education (Gamoran *et al.*, 1999; Schütz *et al.*, 2008). *In conclusion, it can be hypothesized that a broad and encompassing preschool enrolment of the relevant age cohort reduces the effect of parental educational status on pupils' mathematical performance.*
2. One of the highly discussed characteristics of education policy is whether or not *institutional tracking* of pupils into hierarchically ordered educational programs with varying academic reputations takes place. While in theory, such a policy could increase educational equality by optimizing educational development of children independent of their social background, in practice, it is commonly claimed that an early selection of pupils into different ability-based school types increases social inequality in education (Coleman, 1966; Saporito and Sohoni, 2007). Children are tracked into different schools not only on the basis of their capabilities but also based on their parents' attitudes and values towards education (Becker, 2000; Schlicht *et al.*, 2010). It can, however, be argued that educational inequality is not primarily a question of whether there is tracking or not, but on how strict and penetrable the selection process is (Lucas, 2001; Breen *et al.*, 2009, p. 1497). The negative impact of tracking should be particularly strong if an early division into ability-related groups is permanent and irrevocable (Hallinan, 1996, p. 984). Conversely, so-called track mobility may contribute to an efficient selection based on ability, since there is a higher probability that pupils—by changing school levels in secondary school—are selected into the school level that best fits their abilities (Mijs and van de Werfhorst, 2008). *In sum, it can be hypothesized that tracking into different ability levels increases educational inequality, while track mobility dampens the degree of social inequality in education.*
3. Small *class size*—that is where there is a small pupil to teacher ratio—is expected to decrease the effect of social background on educational success. Such an environment enables the teacher to pay more attention to individual needs and capabilities, while in large school classes the teachers' attention is spread across a greater number of pupils (Graddy and Stevens, 2005). While school performance of children from the lower social classes will be particularly sensitive to individual attention received, socially privileged children are more likely to be able to thrive in larger classes since their parents are better able to compensate by providing additional support at home (Mosteller, 1995). *It can therefore be assumed that small average class size weakens the relationship between individual social background and school performance.*
4. Similarly, the *number of hours taught at school* may impact social inequality in education (Schlicht *et al.*, 2010). On the one hand, it can be argued that the more hours pupils stay at school, the longer are they—independently of their social background—socialized under the same learning environment (Schütz *et al.*, 2008). Various studies have, however, shown that students in lower academic tracks tend to be less attentive on average than pupils assigned to a higher track (e.g. Felmlee and Eder, 1983, p. 85). Given that the assignment to the hierarchical school types largely depends on social background,[1] this could eventually mean that students from higher social classes profit more from long school days than lower class students, as they are more likely to possess the cognitive attention span needed to remain attentive throughout the school day. Against this background we can formulate two competing hypotheses. Following the first argumentation, *we can assume that the relation between pupils'*

social background and educational success is weaker when children spend more time at school. Assuming that the ability to concentrate over the course of a long school day varies among pupils' ability level, it can, by contrast, *also be hypothesized that the relationship between pupils' social background and educational success will be stronger when children spend more time at school.*

5. From the discussion above one has to conclude that educational inequality is influenced by *public investments in education*. Characteristics of the educational system that are expected to decrease social inequality in education, such as small class size or high preschool availability, involve costs. Low public expenditures in these areas will possibly be substituted by higher private expenditures, e.g. private lessons or privately purchased textbooks, and therefore be associated with higher inequality (Schmidt, 2002). High public investments in education, moreover, emphasize the importance and value of education (Schmidt, 2002). This symbolic policy message (see Jones and Cullis, 2003) will be transmitted to society and eventually be incorporated into individual educational behaviour. *In conclusion, I hypothesize that high public expenditures for school education decrease the degree of social inequality in education.*

Research Design, Methodological Procedures, and Operationalization

In the remainder of the article the hypotheses presented above will be empirically tested. The analyses are based on Swiss data from the 2006 PISA study, which contains individual student as well as school level data. Representative cantonal data are available for 14 of the 26 Swiss cantons. Unfortunately, PISA Switzerland does not provide a cantonal identifier for pupils in the other 12 cantons, meaning that in these cases students cannot be assigned to their home cantons. The following analyses will therefore be based on the 14 cantons for which a representative cantonal sample exists. The sample also allows one to distinguish between the French- and German-speaking parts of the bilingual cantons of Berne and Valais. The final sample consists of 17,200 15-year-old pupils in 394 schools in 14 cantons, whereby two representative samples of the French- and the German-speaking parts of Berne and Valais are distinguished (Table 1). The effective number of units at level 3 is therefore 16.

The dependent variable in the statistical model is *individual educational performance*, measured using the mathematical test score (mean plausible value) in PISA following Levels and Dronkers (2008). While the mathematical test score is of course only one aspect of students' school performance, I argue that mathematics is the most appropriate subject to compare. Mathematics is the most 'universal' subject and is largely independent from canton-specific—mainly linguistic-cultural—characteristics. Linguistic skills, by contrast, would be conceptually problematic due to the fact that the Swiss cantons belong to different language regions, meaning that the tests for language skills are per definition not identical.

The main focus of the analysis, however, is not on the dependent variable as such. The parameter of interest, educational inequality, constitutes a relationship between two individual-level concepts, namely between social background and educational performance. The relationship of interest is a canton-specific indicator which is expected to be influenced by contextual factors both at the school and cantonal levels.

The central independent variable at the individual level, a *pupil's social background*, is measured by parents' highest level of education on a scale from 0 (no school education whatsoever) to 6 (completion of a second stage of tertiary education, or at least higher secondary education, which provides access to advanced research programs).[2]

For the measurement of the contextual variables, I chose a point in time prior to 2006 that is relevant for the cohort of PISA 2006. In so doing, one can be assured that the potential cause precedes the effect. *Preschool facilities* are measured by the number of preschool facilities per canton per 1,000 children under the age of 7. The 14 cantons in the sample vary considerably regarding this indicator. For example, while there are almost no childcare institutions in the conservative cantons of central and eastern Switzerland (e.g. 0.2 institutions per 1,000 children under the age of 7 in Thurgovia), childcare availability is at its highest in the urban cantons Zurich and Geneva (e.g. Geneva: 4.4). *Tracking into different school levels* is accounted for at the school level, as it is typically the communes' choice of whether and how to provide classes with different ability levels. The PISA data allow for a distinction between schools that do not stream pupils according to their ability level (0), on the one hand, and schools that apply some degree of streaming between classes (1). In the present sample, 70 per cent of schools engage in streaming of some type; 30 per cent of schools do not

track pupils between classes at all. *The degree of mobility* between school levels is operationalized by means of the percentage of pupils that repeat a school year in order to move on to a higher school level. While in the canton of Jura these mobility repetitions are basically inexistent (0.0), in Schaffhausen roughly 5 per cent of pupils repeat a school year in order to reach a higher school level. Regarding *class size*, the maximum class size allowed in a canton is integrated into the analysis. The cantons of Neuchâtel, Vaud, and Valais allow only a maximum of 22 pupils per class, while school classes can be considerably larger (up to 30 pupils) in Schaffhausen.[3] The *hours taught at school* is measured by the number of hours pupils attend school in a given canton.[4] A weighted average accounts for the different number of hours taught as well as for the various durations of primary and secondary school. The mean standardized indicator illustrates that the differences between the 14 cantons in the sample amount to more than 150 school hours per year. Finally, a *canton's public expenditures* per student for primary school measures public investments in education in the first period of the school education process, which should be most decisive for pupils' school career and thus educational inequality. While the canton of Zurich spends almost 14,000 CHF per student and year, in Jura public investments in education are roughly 40 per cent below this amount.

Other potentially influential factors from the individual, school, and cantonal levels should be considered as controlling variables. At the *individual level*, I control for gender, language spoken at home (whether it is different from the PISA test language), and migration status (first generation foreigners), which have shown to be crucial predictors of individual school success in previous studies. I also consider the type of national program a pupil's class belongs to. A student may be in a homogeneous class with higher, intermediate, or basic requirements or in a heterogeneous class, which is supposed to influence his or her school performance. This indicator is related to the tracking variable but further indicates the actual ability level to which a student is assigned. I control for the following *school level variables*: whether a school is a public or private school[5] and the proportion of foreigners in a school. Finally, the level of cantonal urbanization is used as a control variable at the *cantonal level*, as it has been demonstrated to be an important indicator of canton's socio-economic and socio-structural conditions in previous studies (Steffen, 2005).

More detailed information on the variables, their operationalization, as well as the summary statistics can be found in Appendix 1.

I apply random intercept and random slope models, implying that individual behaviour and its determinants can vary between schools and cantons (Steenbergen and Jones, 2002; Kedar and Shively, 2005). Additionally, cross-level interactions are calculated in order to model the aforementioned parameters of interest: how the effect of parental education is moderated by contextual factors. I use a Bayesian estimation approach, as it has been shown to perform better than maximum likelihood, particularly in the case of multilevel models with a rather small number of cases at the higher level(s) (Browne and Draper, 2006). For an easy interpretation of the Bayesian estimation results, the mean and the standard deviation of the posterior distribution are presented, which can be interpreted like in a standard regression situation: The mean is the average effect of an independent variable on the outcome variable and the standard deviation gives a sense of the statistical reliability of this estimate. Moreover, the 90 per cent credible intervals are provided, which are the Bayesian equivalent to confidence intervals in a standard regression context.

The effect of parental education is estimated to vary across different levels of a given policy indicator. More precisely, the hypotheses would be confirmed if one (or both) of the following condition(s) is (are) fulfilled (see Brambor *et al.*, 2005):

1. The marginal effect of parental education *substantially decreases* as the value of a given policy variable increases. (For the variables 'class size', 'streaming' and possibly 'hours taught at school' inequality-fostering effects are expected. Accordingly, the marginal effects of parental education should *substantially increase* with higher values of the policy variable.) In Bayesian terms we have to look at the proportion of iterations that produced smaller (higher) marginal effects at a low level of the policy variables compared with high values of the respective policy indicator.
2. The marginal effect of parental education *loses its systematic influence* for higher levels of a given policy variable (in the case of 'class size', 'streaming' and possibly for 'hours taught at school', the marginal effect should *gain systematic influence*).

Social Inequality and Education Policy in the Swiss Cantons

The PISA study has revealed that social inequality in education not only persists in modern societies but also varies substantially among them. Table 1 illustrates that

Table 1 Educational inequality in the Swiss cantons

Swiss cantons	Educational inequality	EU-15 countries	Educational inequality
Schaffhausen (SH)	11.0	Greece	11.5
Thurgovia (TG)	10.3	France	10.3
Argovia (AG)	10.0	Germany	9.4
Basle-Country (BL)	9.5	Portugal	8.9
Ticino (TI)	7.1	Luxembourg	8.8
Vaud (VD)	6.7	Belgium	7.6
St. Gall (SG)	6.6	Ireland	7.2
Neuchâtel (NE)	6.4	Spain	7.1
Geneva (GE)	6.3	Denmark	4.8
Berne—German-speaking part (BE-g)	5.6	Netherlands	4.7
Zurich (ZH)	5.3	United Kingdom	4.2
Valais—German-speaking part (VS-g)	4.9	Italy	3.8
Fribourg (FR)[a]	3.9	Finland	3.7
Valais—French-speaking part (VS-f)	2.6	Austria	3.5
Berne—French-speaking part (BE-f)	2.3	Sweden	3.1
Jura (JU)[a]	2.1		

Note: Proportion of explained variance by the variable 'parental education' in individual bivariate regressions for each canton.
Source: PISA 2006.
[a]*Only the French-speaking part of the canton.*

these findings can easily be applied to Switzerland and its subnational units. The comparison with the EU-15 countries moreover and impressively illustrates that the inter-cantonal variance is even slightly larger than the international variance. Note that the inequality indicators for both the subnational units and the countries stem from literally the same dataset, thereby allowing for direct comparison of the international and inter-cantonal differences.

Educational Policy and Inequality in Education—Empirical Findings

I present a two-stage procedure to examine how educational policy moderates the relationship between social background and school success. In the first analytical step, I set out a basic model that includes individual and contextual variables based on previous research (Table 2). While the model largely confirms these earlier studies, I will only mention the most important findings in the context of this article: social background is clearly related to school success; higher parental education is associated with greater mathematical success. The effect of parents' educational achievements on pupils' educational performance thereby varies between the cantons, which can be seen from the random slope for this variable. This result thus confirms the finding above, whereby educational inequality systematically differs among the Swiss cantons. At this point it is important to note that even in a highly egalitarian education process, social background cannot be expected to completely lose its influence on pupils' school performance. In fact, there is an ongoing debate on how much pupils' capabilities are the result of genetic predispositions or of educational and socialization processes—or an interaction of both (Duyme, 1988). The marked variance of educational inequality between political entities implies, however, that social inequality in education is, to a considerable extent, the result of societal macro-processes (von Carnap and Edding, 1962). To put it bluntly, we cannot expect educational inequality to vary among the Swiss cantons so substantially simply 'by nature'.

In the second step, I now proceed by individually adding the six education policy variables to expand the basic model and to estimate cross-level interactions with parents' education level.[6] Figure 1 presents the results of these estimations. Each graph illustrates the marginal posterior distributions of parental education as the respective policy variables changes.[7]

Five of the six policy variables (somewhat) moderate educational inequality. First and according to the expectations, the effect social background has on individual school success tends to be stronger in cantons with high maximum class size. While at a very low

Table 2 Model 1—basic model

	Posterior mean (SD)	Percentiles 5%	95%
Constant	557.98 (15.92)	535.10	588.77
Individual level variables			
Sex (ref.cat. female)	26.50 (0.87)	25.06	27.93
Parental education	3.40 (0.92)	1.88	4.94
First-generation foreigner (ref.cat. born in Switzerland)	−28.92 (1.51)	−31.41	−26.43
Language spoken at home (ref.cat.: same as test language)	−13.73 (0.99)	−15.34	−12.10
National program (ref.cat.: intermediate requirements)			
Higher requirements	61.83 (1.52)	59.33	64.35
Basic requirements	−69.81 (1.38)	−72.10	−67.51
Heterogeneous class	−23.59 (2.91)	−28.40	−18.83
School-level variables			
Private school (ref.cat. public school)	−49.05 (13.03)	−71.22	−27.72
Share of foreign students	−79.80 (13.89)	−102.00	−57.16
Cantonal-level variable			
Urbanization	−0.46 (0.23)	−0.93	−0.12
Random effects			
Parental education			
Variance	13.05 (8.13)	5.14	27.18
Covariance	−15.77 (30.99)	−68.92	25.42
Variance individual level	3190.46 (35.26)	3248.10	3247.59
Variance school level	355.41 (34.14)	302.40	416.40
Variance cantonal level	439.21 (253.30)	175.32	955.25
N individual level		17,200	
N School level		394	
N cantonal level		16	
DIC		187,904	

Notes: Posterior means (standard deviations in brackets) as well as 90% credible intervals (last 10,000 iterations). Estimates from Bayesian estimation (100,000 iterations, thinning: 1; burn-in: 50,000, uniform priors, no signs of non-convergence).

maximum class size the credible interval includes zero, this is not the case if we move to cantons with higher maximum class size (i.e. condition 2 applies). With a probability of 87.5 per cent, educational inequality is higher when classes are large (condition 1). Even though one could conclude from the figure that an equalizing class size is only a 'borderline phenomenon', four contextual units, namely Neuchâtel, Vaud as well as the French- and the German-speaking Valais, demand classes to be kept so small.

Similarly, the cantonal number of hours taught at school increases rather than decreases the effect of pupils' social background (with a probability of 94.9 per cent). As discussed in the theoretical section of this article, both an inequality-diminishing as well as a fostering effect of this variable can be expected. The findings for Switzerland lend support to the latter: school instruction cannot fulfil an equalizing function, but rather tends to reinforce inequalities due to social background. Moreover, with the exception of four contextual units (both parts of Valais, Geneva, and Argovia), all cantons can be found in the area of the graph where educational inequality is present and increases with a greater number of school hours.

In contrast, high educational expenditures in a canton decrease the effect of parental education. Social background systematically increases individual school success at low levels of the policy variable, while the credible interval includes zero if public education expenditures are larger. Only the canton of Zurich has expenditures at this high level; Berne, spending slightly more than 11,000 CHF per student, comes close to this threshold. Examining the proportion of iterations that produced higher marginal effects for low educational expenditures compared with high educational expenditures, public investments in education decrease educational inequality with a probability of 78.6 per cent.

The same tendency can be found regarding the availability of childcare. Parental education is systematically related to individual school success if childcare is

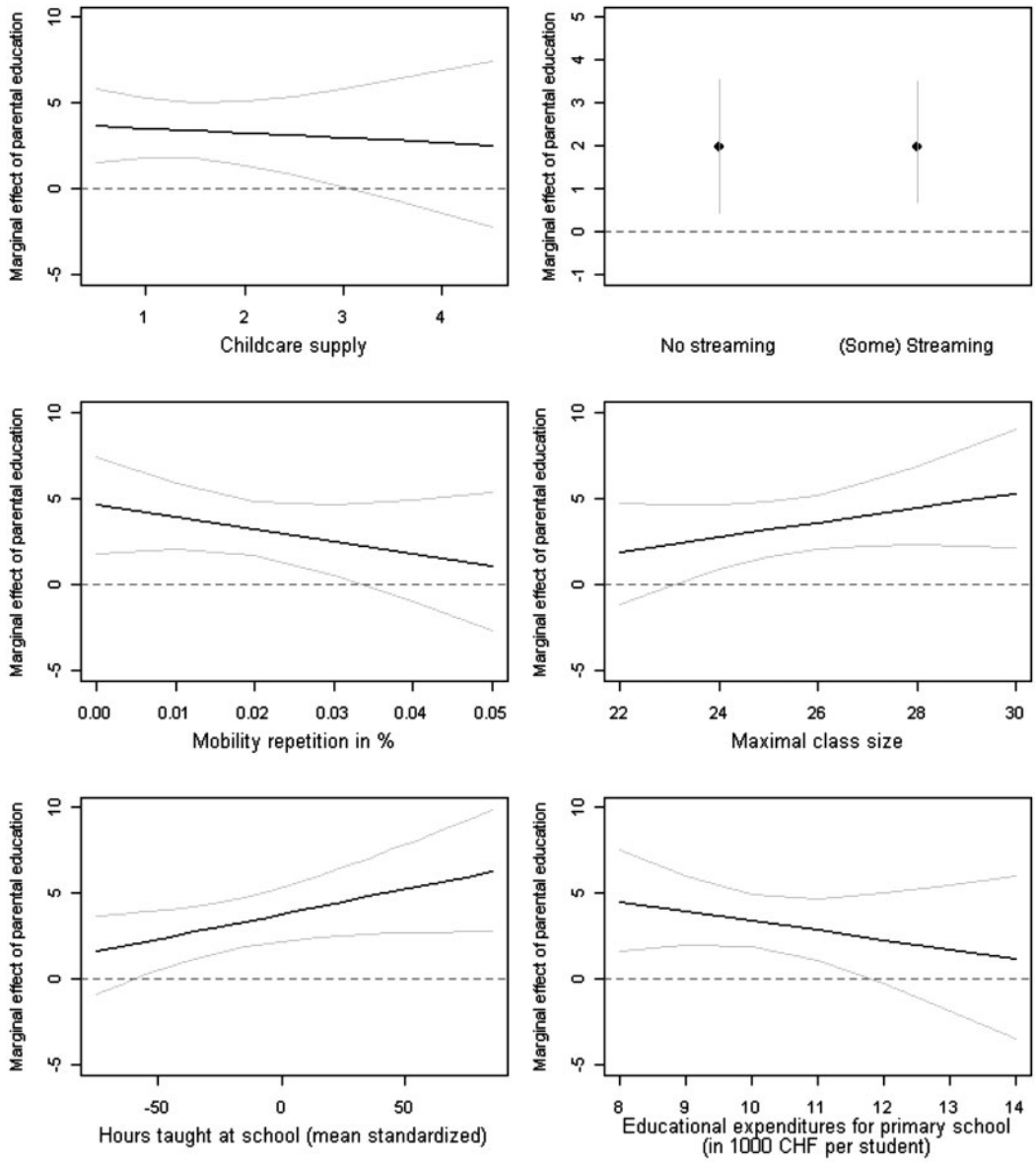

Figure 1 Marginal effect of parental education as a given policy context changes.
Marginal posterior distributions (last 10,000 iterations); black line: median, grey lines: 90% credible interval (5% and 95% percentiles). All models control for individual, school, and cantonal variables as shown in Table 2. Bayesian estimation: 100,000 iterations, thinning: 1; burn-in: 50,000, uniform priors, no signs of non-convergence.

less available, while the credible interval includes zero at high levels of this policy indicator. The marginal effect curve is, however, almost flat, meaning that the relationship between social background and school success does not change much in different policy contexts. With a probability of only 63.1 per cent, we see that the marginal effect is systematically higher at low levels of childcare supply than it is in a context of relatively easy access to preschool education.

Finally, the possibility to move from one school level to another decreases the effect of parental education, which ultimately is no longer systematically related to school

success. Three cantons—Schaffhausen, St Gall, and Argovia—can be found in this latter area. The probability that frequent mobility repetitions systematically decrease educational inequality amounts to 84.7 per cent. Conversely, streaming is not related to social inequality in education. This finding supports earlier studies (Lucas, 2001; Breen *et al.*, 2009, p. 1497) claiming that it is not the question of whether pupils are tracked or not that impacts social inequality in education, but rather how final these decisions are.[8]

In further analyses not presented, extensive robustness tests have been conducted mainly regarding potential outlier problems and omitted variable bias due to the separate modelling of the policy variables. These additional estimations clearly underscore the robustness of the findings presented and are available from the author upon request.

Conclusions

Does the school educational process affect social inequality in education, i.e. moderate the relationship between individual social background and school performance? Based on data from the PISA study for 14 Swiss cantons, the preceding analyses sought to clarify this matter. The following conclusions can be drawn:

Initially, the analyses in this article demonstrate that the degree of educational inequality considerably varies among the Swiss cantons. While social background, measured by the parent's highest level of education, is positively related to individual mathematical performance in all cantons, the strength of this relationship varies greatly. This supports the often-heard claim (Freitag and Schlicht, 2009; Schlicht *et al.*, 2010) that international comparisons neglect the substantial variance in the degree of educational inequality within highly decentralized countries.

The analyses moreover reveal that differences in educational policy moderate the relationship between social background and school success. In accordance with earlier findings, high educational expenditures as well as small class sizes tend to reduce social inequality in education. While tracking is often seen as an inequality fostering instrument—with Finland being the prime example of a successful, non-tracking country—this article demonstrates that a more differentiated perspective is necessary: it is not tracking as such, but rather the possibility to revise initial tracking decisions that moderates educational inequality. In cantons where mobility repetition is a frequent occurrence, the relationship between social background and school success is weaker. This Swiss finding also supports the notion that educational policies may produce different results in different environments.

Overall, however, the evaluation of cantonal education policy does not result in a very optimistic conclusion for two main reasons. First, although school is generally conceptualized as a place where all students are socialized within the same environment, which serves as a social equalizer, the reality in Switzerland is clearly quite different. The more hours pupils spend at school in a canton, the higher educational inequality is. Swiss school instruction therefore seems to reinforce inequalities based on social background rather than providing equal opportunities of education for all pupils. Second, this latter conclusion is further supported by the fact that even when considering the above mentioned policies aimed at providing equal opportunities to all students, the majority of cantons are unable to uniformly provide such opportunities. In fact, only in a few 'forerunner' cantons are mobility repetition and public expenditures high enough to actually provide equal opportunities to students from different social strata and only few subnational units demand classes to be so small that educational inequality is not reinforced. In terms of policy implications, this article not only points to policy areas that could be improved for increased equality in education but also reveals that much work remains to be done in most cantons.

Notes

1. Fifty per cent of the students from the highest social class in the PISA data set attend a homogeneous school type with higher requirements. This applies to less than 10 per cent of children from the lowest social group.
2. I forgo controlling for other social background indicators such as cultural and affluent home possessions. As discussed, parental education encompasses various dimensions of pupils' home environment. Variables that more narrowly account for financial or social resources can moreover be seen as a consequence of parents' educational background and are therefore not really controlling, but rather intermediating variables. The introduction of other social background variables runs the risk of over-controlling the model, meaning that we cannot tell which part of the variance is actually due to parental education as the crucial social background indicator. Further analyses not presented also show that the integration of these variables only marginally

influences the estimations and lead to the exact same conclusions as presented in the following.

3. The cantons define the minimum and maximum class size. School variance that exists in this respect is therefore a result of the specific school environment (e.g., dominant national program at school, rural vs. urban area) which is also accounted for in the models, and is not a result of school educational policy.
4. The number of hours taught at school is defined by cantonal regulation and must therefore be seen as a cantonal and not a school characteristic.
5. In the PISA sample for Switzerland, only 6 per cent of all schools are private schools. In reality less than 4 per cent of pupils are enrolled in private schools (Source: BfS, Statistisches Lexikon der Schweiz), which are generally required to enrol a proportional number of pupils from all social strata in order to receive public funding. For the following analyses, this distinction is therefore seen as a school characteristic rather than an education policy indicator.
6. Six models, each containing one of the education policy variables, are calculated. It is not reasonable to *simultaneously* include the educational context variables into one model: First, due to the small number of units at the cantonal level, it is not possible to integrate six contextual variables plus cross-level interactions into one model. Second, the policy variables are related to each other to some extent. Substantial correlations can, however, only be found between the maximal class size and mobility repetition (Pearson's $r = 0.45$) and between educational expenditure and preschool availability (0.40, though not significant at a conventional level of statistical significance). All other correlation coefficients are lower and far from being significant (Appendix 2), indicating that the Swiss cantons combine the education policy variables differently.
7. The last 10,000 iterations of the posterior distributions are used in order to represent the possible marginal effects for different values of the policy variables (Gelman and Hill 2007: 137). The models and estimated coefficients on which the figure is based can be found in Appendix 3. All models control for the school and cantonal context as well for individual level variables as shown in Table 2. In contrast, other controlling variables, namely the size of the third sector, a canton's foreign population share as well as the language region, did not prove to be systematically related to school success in further analyses not presented here nor did they influence the estimation results.
8. Further models have been estimated including an interaction between between-class streaming and mobility repetition. These results demonstrate that the marginal effect of parental education given a certain degree of mobility repetition does not significantly vary between schools with and without tracking.

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Appendix 1

Variable, operationalization, sources, and summary statistics

Variable	Summary statistics	Operationalization/source[a]
Dependent variable		
Pupils' educational Performance (dependent variable)	Mean: 5.37.9 SD: 79.8 Min.: 253.1 Max.: 785.9	Competence scores in mathematics, mean of plausible values
Covariates individual level		
Parental education	Mean: 4.2 SD: 1.5 Min.: 0 Max.: 6	ISCED, 7 levels of education, high values indicate high levels of parental education
Sex	Shares: Male: 49.2 Female: 50.8	Dummy: 1 = male; 0 = female
Cultural possession	Mean: −0.2 SD: 1.0 Min.: −1.6 Max.: 1.2	Index of cultural possession at home (e.g. books)
Home possessions	Mean: 0.1 SD: 0.8 Min.: −6.0 Max.: 3.2	Index of material possession at home (e.g. cars, technical devices)
Language spoken at home	Shares: Test language spoken at home: 66.5 per cent Other language spoken at home: 33.5 per cent	Dummy: Does the family speak another language as test language at home? 1 = yes; 0 = no
Migration status	Shares: First generation immigrant: 10.2 per cent Swiss/other immigrants: 89.8 per cent	Dummy: first generation foreigner? 1 = yes; 0 = no

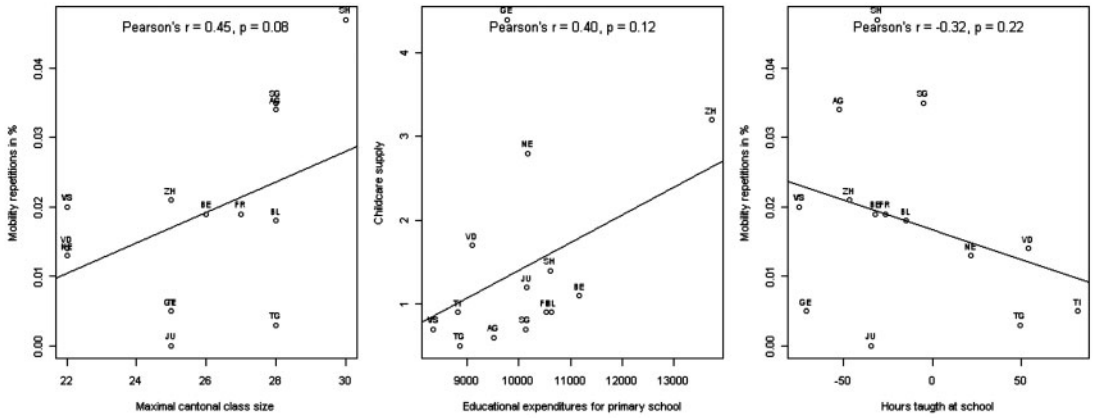
(continued)

Appendix 1 Continued

Variable	Summary statistics	Operationalization/source[a]
National program	Shares: Higher requirements: 40.5 per cent Intermediate requirements: 26.4 per cent Basic requirements 19.9 per cent Heterogeneous classes: 23.3 per cent	National program of a pupil's school class: four categories: Homogeneous calls with higher requirements; homogeneous class with intermediate requirements; homogeneous class with basic requirements; heterogeneous class.
Covariates school level		
Proportion of foreigners	Mean: 0.1 SD: 0.1 Min.: 0 Max.: 0.6	Proportion of first-generation foreigner in a school. Source: Own calculation based on the 2006 PISA survey.
Private schools	Shares: Public school: 96.9 per cent Private school: 6.1 per cent	Dummy variable: 0 = public school, 1 = private school. Source: PISA 2006, school questionnaire data.
Streaming	Shares: No streaming: 30.0 per cent (Some) streaming: 70.0 per cent	Dummy variable: 0 = No streaming at all in grade 9; 1 = (Some) streaming between classes in grade 9. Source: PISA 2006, school questionnaire data.
Covariates cantonal level		
Urbanization	Mean: 54.6 SD: 30.8 Min.: 0 Max.: 100	Proportion of cantonal population living in agglomerations or isolated cities (more than 10,000 inhabitants), 2001. Source: BfS, Statistisches Lexikon, retrieved from www.badac.ch (15.11.2009).
Preschool availability	Mean: 1.1 SD: 1.1 Min.: 0.2 Max.: 4.4	Number of preschool facilities per 1,000 children under the age of 7, mean 1995, 1998. Source: Own calculation based on BfS (2008).
Mobility repetition	Mean: 0.019 SD: 0.012 Min.: 0.000 Max.: 0.047	Share of mobility repetition in secondary school, 2005. Source: BfS (2009).
Class size	Mean: 26.1 SD: 2.2 Min.: 22 Max.: 30	Maximal class size in primary school, 2000. Source: EDK 2000.
Hours taught at school	Mean: −0.0 SD: 47.7 Min.: −75.0 Max.: 81.7	Average number of hours taught at school per year. Weighted average of number of hours taught at school in primary and secondary school, Mean centred. Source: Own calculation based on EDK 2000.
Educational expenditures	Mean: 10.4 SD: 1.2 Min.: 8.3 Max.: 13.7	Cantonal educational expenditures per student in primary school, in 1,000 CHF, mean 2000, 2002. Source: EFV 2002, 2004.

[a]*All individual and school level variables are taken from the Swiss data set of the 2006 PISA survey.*

Appendix 2



Education policy in the 14 Swiss cantons. *Notes*: Scatter plot of the five cantonal education policy indicators. The two variables exhibiting the highest correlation are shown together

Appendix 3

Models and estimates shown in Figure 1

	Childcare supply	Streaming	Mobility repetition	Maximal class size	Hours taught at school	Educational expenditure
Constant	559.86 (17.56)	566.67 (13.83)	552.597 (15.31)	505.59 (71.54)	566.73 (18.06)	500.96 (39.99)
Individual level variables						
Parental education	3.79 (1.60)	3.32 (1.21)	4.59 (1.71)	−7.93 (10.93)	3.79 (0.96)	8.79 (7.49)
Other individual level variables are controlled for						
School level variables						
Private school (ref.cat. public school)	−48.91 (13.12)	−49.01 (13.02)	−48.74 (13.11)	−49.37 (13.10)	−49.44 (13.09)	−50.35 (13.10)
Share of foreign students	−78.25 (14.35)	−78.37 (13.68)	−78.58 (14.30)	−78.47 (14.35)	−78.58 (14.31)	−78.32 (14.32)
Cantonal level variables						
Urbanization	−0.37 (0.33)	−0.55 (0.21)	−0.67 (0.22)	−0.60 (0.25)	−0.64 (0.27)	−0.74 (0.24)
Childcare supply	−5.56 (6.49)					
Streaming		−3.98 (4.09)				
Mobility repetition in per cent			977.51 (378.09)			
Maximal cantonal class size				2.40 (2.70)		
Hours taught at school					−0.04 (0.12)	
Educational expenditure						7.39 (3.97)
Parental education × policy indicator	−0.26 (0.90)	0.08 (0.78)	−68.69 (76.61)	0.44 (0.43)	0.03 (0.02)	−0.54 (0.73)
Random effects						
Parental education						
Variance	14.56 (9.13)	13.11 (8.58)	12.92 (8.13)	13.67 (8.55)	11.26 (7.00)	13.33 (8.35)
Covariance	−24.25 (39.47)	−8.60 (32.71)	1.52 (25.30)	−22.47 (38.06)	−13.56 (33.03)	−2.52 (30.06)
Variance individual level	3190.29 (34.80)	3173.58 (35.05)	3190.26 (34.81)	3190.32 (34.80)	3190.24 (34.80)	3190.23 (34.81)
Variance school level	355.00 (34.64)	348.32 (35.42)	354.80 (34.64)	354.99 (34.59)	355.40 (34.69)	355.80 (34.60)
Variance cantonal level	487.80 (308.97)	431.82 (268.20)	299.18 (199.92)	521.90 (347.76)	524.48 (325.22)	377.55 (243.04)

Notes: Posterior means (standard deviations in brackets) (last 10,000 iterations), models as shown in Figure 1. Estimates from Bayesian estimation (100,000 iterations, thinning: 1; burn-in: 50,000, uniform priors, no signs of non-convergence). Estimates of individual level variables are highly consistent with estimates as shown in Table 2 and are not shown here for reasons of space (except for parental education).