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Abstract

This paper analyzes the impact of direct legislation at the cantonal level on the quality of public education in Switzerland, using a cross-section of individual data on reading performance similar to that used in the OECD-PISA study. For this purpose, a structural and a reduced form of an educational production function is estimated. The OLS estimate of a composite index of direct democracy supports the findings previously obtained for U.S. states in which initiative-driven tax limits have had a deleterious effect on student performance in public schools. For a more complete picture, the impact of direct democracy on several portions of the conditional test score distribution is also investigated using a quantile regression method. The negative impact appears to be equal in size between the estimated quantiles and to occur exclusively through the budgetary channel. Moreover, the equipment of schools is found to matter for student performance. Finally, no redistributive influence on students attending the same class is found.

Zusammenfassung

In diesem Beitrag wird der Einfluss der direkten Demokratie auf der kantonalen Ebene auf die Qualität der öffentlichen Bildung in der Schweiz mit Hilfe eines Querschnitts an Individualdaten über die Lesekompetenz von Schülern, ähnlich den OECD-PISA Daten, untersucht. Zu diesem Zweck wird eine strukturelle und eine reduzierte Form einer Bildungsproduktionsfunktion geschätzt. Der OLS Schätzer eines zusammengesetzten Indexes für direkte Demokratie bestätigt ein früheres Resultat für solche US Staaten, in denen durch Volksinitiativen eingeführte Steuerbeschränkungen (tax limits) einen schlechten Einfluss auf die Schülerleistungen an öffentlichen Schulen gehabt hatten. Um ein vollständigeres Bild zu erhalten, wird auch der Einfluss der direkten Demokratie auf einzelne Bereiche der bedingten Leseleistungsverteilung mit Hilfe der Quantilsregressionsmethode analysiert. Der negative Effekt scheint für die geschätzten Quantile gleich gross zu sein, und ausschliesslich über den budgetären Einflusskanal zu laufen. Es konnte gezeigt werden, dass die Ausstattung der Schule für die Schülerleistungen relevant ist. Schliesslich konnte kein Umverteilungseffekt der direkten Demokratie auf Studenten innerhalb der selben Klasse gefunden werden.

Keywords

Direct Democracy, Public Finance, Economics of Education

JEL Classification

H41, I28, H10

I. INTRODUCTION

Direct democracy is conjectured to lead to lower educational spending and thus to lower academic achievement. In this paper, this assumption is examined for the case of Switzerland, a country with strong variation in the degree of direct democracy at the cantonal level. To provide supportive evidence for the hypothesized negative impact, the analysis focuses specifically on the impact of direct democracy on educational budgets and its effects on student achievement in reading.

The unexpectedly mediocre performance of Swiss students in the 2000 international PISA study has rekindled discussion about improving the Swiss educational system[1]. At the same time, because of the economic recession, cuts in federal, cantonal, and local budgets have become necessary that have also affected the funding available for public education. The ongoing debates about school reforms are further complicated by the fact that Swiss voters have an important influence on fiscal and budgetary issues through direct legislation. In general, direct legislative institutions restrict the financial means available to the government for the provision of schooling. Similarly, in the U.S., measures to cut property taxes have been enacted through popular initiatives at the state level. Because American school budgets rely primarily on this local tax as their revenue source, the question of how and whether these newly introduced tax caps affect student performance has arisen to create a new field of empirical research in the U.S. Hence, the underlying question is whether citizens' control over the school budget necessarily leads to a lower quality of this public good or not. Since Swiss cantons are heterogeneous with respect to the degree of direct democracy, and quite autonomous in their policies on public education, Switzerland seems especially suitable for such an analysis.

This paper aims at contributing to these recent discussions both in Switzerland and the U.S. by analyzing the impact of direct democracy on the quality of public education in Switzerland using national individual data on ninth graders acquired simultaneously with data collection for the 2000 OECD-PISA study. This paper is also the first to analyze (a) the ways that political institutions affect public schooling provision in Switzerland and (b) institutional impact on an entire conditional distribution of test scores.

In anticipation of the empirical results, direct democracy is first shown to considerably restrict the financial resources available for public education in Swiss cantons. Since the combined cantonal and local school expenses are the main source for public schooling in

[1] The average test score of 496 for Switzerland was below the international mean of 500 for the PISA study.

Switzerland, this limiting impact on the subfederal school budget can be considered crucial. Subsequently, it is observed that if an educational production function based on personal and class characteristics is estimated, direct democracy leads to a considerable decline in student performance. This result is very similar to that obtained by researchers for the U.S. Moreover, when a quantile regression method is used, an impact of comparable size is found for all students. However, following the inclusion of revenue-driven input variables, the link between direct democracy and academic achievement breaks down. Therefore, it can be concluded that the major (negative) impact of direct legislation must occur solely through the school budgetary channel. Beyond its financial impact, no further additional effect of direct democracy on student performance can be observed.

The rest of the paper is organized as follows. Section 2 provides a brief overview of the Swiss political and public educational system and presents related findings for the United States. Section 3 describes the data and model, and outlines the chosen estimation methods and the measure of direct democracy. Section 4 presents a discussion of the estimation results for both the composite index and the single institutions. Detailed regression outcomes are provided in the Appendix.

II. EDUCATION QUALITY AND DIRECT DEMOCRACY

2.1 Direct Democracy

In modern (semi-)direct democracies a representative democracy is complemented by direct democratic institutions. The most prominent cases are Switzerland and the United States, which are both also shaped by a very strong fiscal decentralization, with each level having its own sources of tax revenue. Therefore, there exists a direct institutional link between the power to tax and the direct legislative institutions that provide citizens with the political means to influence both sides of the budget equally. In Switzerland, popular rights can be exerted at all three levels of the state (federal, cantonal, and communal). Since cantons (and communes) differ with respect to the degree of direct democracy in their constitutions, it is possible to analyze the impact of a change in the degree of direct democracy on a particular policy outcome (Feld and Kirchgässner 2001), like the provision of schooling.

In Switzerland, cantons are not only responsible for public education but bear the financial burden for its provision. Concerning the overall costs of compulsory education, the federal government contributes only 0.2%, whereas the cantons bear 38.8% and the communes

61.1%[2]. With respect to the communes, they mostly finance primary schools. In general, in all 26 Swiss cantons, two types of advanced education can be distinguished: basic education and education to meet advanced requirements (e.g. university preparation). Usually, the second type can only be entered on a selective basis. Nowadays, Swiss cantons' school curricula in primary and secondary stages of education are harmonized to a great extent[3]. Also included in cantonal authority is the general responsibility for teacher education, particularly for primary schools, which takes place in specialized teacher seminaries. Compulsory education finishes with the ninth grade, usually at the age of about 15. The fundamental regulations of public education, particularly school organization and the financial contributions of each level, are laid down in various cantonal laws on education.

2.2 Theoretical Background

Institutions of direct legislation, argue their many supporters, serve as a means to discipline politicians and bureaucrats, who are assumed to behave in a Niskanen-like manner rather than as benevolent dictators. Specifically, these bureaucrats exercise monopoly power and aim at maximizing their budgets[4]. For example, there is evidence for the U.S. that people in favor of the introduction of property tax limits actually believed that these budget cuts would lead to efficiency gains (Temple 1996), hence an allocation of goods that is closer to the citizens', particularly the median voters', preferences (Pommerehne 1978)[5]. In practice, a reliance on user charges in more direct democratic cantons was observed that makes the quality of the public good more independent of the financial resources of the cantonal government (Feld and Matsusaka 1999)[6]. However, in the case of compulsory public schooling, this solution is (politically) not an option.

The limitation of the budget through direct legislation can give rise to bureaucratic adaptive behavior. Two different strategies have been suggested in the theoretical literature. The first, according to Niskanen's theory of bureaucracy (e.g. Inman 1979), is a substitution of budget maximization with a (relative) increase in administrative staff at the expense of the

[2] Appropriate information on this issue can be found at www.educa.ch, the Federal Statistical Office, www.bfs.admin.ch or in the annual issues of the *Statistisches Jahrbuch der Schweiz*, Bundesamt für Statistik (ed.), Neue Zürcher Zeitung.

[3] Such a curriculum includes the cantonal main language, a first foreign language, mathematics, writing, religion, history and civics, natural sciences, applied arts, needlework, music, and sports.

[4] See Romer and Rosenthal 1978, 1979, 1982, 1983, and ibid. with Munley, 1992.

[5] See Feld and Kirchgässner 2001 for a theoretical model that applies to fiscal referenda, Kirchgässner 2000, 2001, 2002 for a review of ample empirical evidence, Feld and Savioz 1997 for perspective on growth, and Hug 2004 for a corroborating meta-analysis.

[6] For the U.S., see Matsusaka 1995.

resources available for production of the public good (Williamson 1964). The rationale for this strategy is that a large personal staff gives the bureaucrat a feeling of importance and power (Downs 1967). When facing the decision to cut either administrative or instructional spending, a Leviathan-like administrator can be expected to choose the latter. For example, empirical U.S. studies have shown that a tax limit which imposes a limit on school budget growth leads to a spending shift from instruction to administration (Figlio 1997, 1998)[7].

Alternatively, Figlio and O'Sullivan (2001) proposed a manipulative bureaucratic behavior, in which the administrator deliberately allows student performances to decline by allocating fewer financial resources to instruction than to administration. The goal is persuade the electorate that budget reduction has a deleterious impact on the quality of education so that it overrules the previous tax limit vote. Figlio and O'Sullivan (2001), using expense data for police, fire protection, and general administration from 5,150 U.S. cities, were able to show that in those cities with a so-called override option, the deterioration in public service was larger than in cities without this option[8]. Moreover, they observed the same phenomenon with respect to teacher-administrator ratios in school districts with an override option.[9]

2.3 U.S. Empirical Evidence on Public Schooling

In the last two decades, so-called tax revolts like – for example, California's famous Proposition 13 in 1978 – have taken place in about 20 U.S. states[10], which have been pushed through by means of direct legislation, particularly by statutory initiatives at the state level[11]. These revolts mostly aimed at reducing the level and growth of property taxes[12] that creates important revenue at the local level (Card and Payne 2002, Downes et al. 1998, Dye and McGuire 1997). Therefore, such a change has a direct negative effect on school budgets (Bradbury et al. 2001, Shadbegian 2003), which does not necessarily translate into an equally large cut (in relative terms) in the teaching and administration components of school spending

[7] The same authors found this phenomenon in some cases to be mitigated by strong competition between jurisdictions.

[8] It is, however, questionable whether a change in the ratio of administration to production costs provides sufficient evidence for one of the two theories. If instruction costs are more variable than administrative costs, in the short term only a cut in instruction costs might be practical.

[9] A third, alternative explanation would be that if the school administration was already working efficiently prior the decision to cut its budget, a decline in the quality of the public service should be revealed even though a benevolent school administrator was in charge.

[10] The source ACIR (1995) provides a catalogue of existing tax limits.

[11] A brief overview of the theoretical background of this development can be found in Downes and Figlio (1997).

[12] See Figlio and Rueben 2001, Figlio 1997, Downes and Figlio 1997.

(e.g. Dye and McGuire 1997), particularly if, as in the U.S., the administrative body of a school has the power to allocate financial resources quite autonomously (Figlio 1997).

During the 1990s, empirical multivariate analyses of the impact of newly introduced tax limits on student performance were carried out testing an educational production function[13]. In a cross-state analysis using individual data, Figlio (1997) found a substantially lowering influence of tax limits on student performance, particularly on science, social studies, and reading examinations, but less robust on mathematics. Using individual data, Downes and Figlio (1997) again found a sizeable and significant decline in statewide mean student performance in states with a tax limit compared to states without such a limit in mathematics, but not in reading. A contrasting finding was reported by Downes et al. (1998), who analyzed the effect of a local property tax cap on student performance in elementary schools in the Chicago metropolitan area. The authors found only a weak and small negative impact on student performance in mathematics and no effect on reading test scores. One explanation for this contradictory finding may be that, because affected and unaffected school districts were in close proximity to each other, these neighborhood schools constituted a single supply of public schooling for their inhabitants, which created strong competition. This competition between schools is conjectured to have mitigated the otherwise detrimental impact of tax limits (Downes and Figlio 1999, Hoxby 2000) and to have restricted the rent-seeking behavior by bureaucrats (Dye and McGuire 1997, Figlio and O'Sullivan 2001).

To identify the channels through which the deleterious impact of these tax limits occurred, their influence on various revenue-driven input factors of the educational production function was also analyzed. Significant evidence was found that new tax limits brought about larger class sizes, higher student-teacher ratios (Shadbegian 2003, Figlio 1998), and lower wages for beginning instructors (Figlio 1997, Poterba and Rueben 1995)[14], thereby causing potentially well-qualified teachers to leave the profession (Figlio and Rueben 2001, Figlio 1997a). Moreover, in contrast to voter expectations (Temple 1996), administrator preferences remained unchanged (Downes 1996); that is, administrators still overstaffed their administrations (Downes 1996) and reduced instructional expenses relative to administrative expenses (Figlio 1998), or did not reduce administrative spending at all (Figlio 1997). Finally,

[13] Earlier contributions to this topic from the 1970s until the very early 1990s, some empirical but most informal, are described in Downes and Figlio 1999. These contributions, however, suffer from methodological shortcomings.

[14] Shadbegian (2003) found no significant effect of tax limits on teachers' average wages but provided no analysis of wages of starting teachers. In an older contribution, however, he showed that stringent tax limits had a decreasing effect on local government wages, which also comprised the wages of teachers (Shadbegian 2000).

the introduction of a property tax limit did not appear to have induced an increased service level of local public school provision (Figlio 1998). In sum, these findings provide evidence that the rent-seeking behavior of school bureaucrats is not limited by a cut in local school budget.

2.4 Direct Democracy and Educational Spending in Switzerland

As a first step, the impact of direct democracy on combined local and cantonal spending for public schools in Switzerland is determined. For this purpose, a model of government spending is estimated. This influence will then be taken into account in our structural form of the educational production function as the indirect effect of direct legislation on public education through endogenous variables (see section 3.1).

Various previous studies have investigated the effects that direct democratic institutions in Switzerland and in the U.S. have on the combined cantonal and communal budgets. For Switzerland, these studies have shown that direct democracy leads to both smaller revenue and smaller expenditure (Kirchgässner 2000, 2001, 2002). Regarding educational expenses, Schaltegger (2001) documented an expenditure-lowering impact of direct democracy on almost all components of cantonal and communal expenditure[15]. It is not surprising that this limiting impact is most noticeable in those policy areas in which Swiss cantons are granted political autonomy by the Swiss constitution (art.3 of Swiss constitution[16]), specifically, education, the health system, and culture (Germann 2002). The weak influence of the federal government is rooted in the very structure and division of power of the Swiss state, which developed in the nineteenth century. For the U.S., a restraining property tax revenue effect of (stringent) local tax limits on the local (school) budget and revenue was detected (Shadbegian 1999, 2003). Regarding the appropriation effort for the financing of higher education, Archibald and Feldman (2004) also found a considerable lowering impact at the US state level[17]. Based on these previous findings, it is hypothesized that direct democracy should have a spending restraint impact on the 'educational spending' component of the subfederal budget in Switzerland.

[15] Since Schaltegger (2001) employed a different model specification, this analysis could not be based solely on his results. Rather, this estimation might be viewed as an omitted variable test for his estimation.

[16] Available at http://www.admin.ch/ch/d/sr/c101.html (10. Nov 2004)

[17] This study used a broad definition of tax limits and included all existing types: both local and state property tax limits, formal restrictions of state expenditures and of state revenue, statutory and constitutional tax limits, moving base and fixed base versions. State spending for higher education appeared to be more sensitive to the introduction of tax limits than other components of the state budget.

In this model, government expenditure is regarded as a function of fiscal decentralization (defined as share of local expenses in total cantonal and local expenses), urbanization of the canton, average national income, cantonal population, tax competition, a fiscally effective constitutional 'break', the share of young and old people (< 20 years, > 60 years, respectively), and government ideology (with positive values indicating a conservative position). Most important, government spending is thought to be dependent on the degree of direct democracy and cantonal culture, measured by a dummy for French- and Italian-speaking cantons. A prediction of the impact of these controls and their theoretical foundation can be found in Feld and Kirchgässner (2001). The dependent variable is the combined cantonal and local budgetary expenses for schooling per capita, which have been logarithmized[18].

Insert Table 1 about here

All the budgetary, (macro)economic, and sociodemographic controls were obtained from the Federal Statistical Office (BFS). These aggregate data form a synthetic panel, with 26 cantons as observational units per year between 1980 and 1998. The estimation technique is a two-stage least squares (2SLS) approach: both ideology of government and fiscal federalism are treated as endogenous since higher educational spending might allow formerly disenfranchised groups go to the polls and induce a shift in government ideology. Further, the dependent variable, the combined local and cantonal expenditure for education, forms part of the denominator of the fiscal decentralization measure, which serves as a predictor. These variables have been instrumented with cantonal fixed effects. Newey-West standard errors correct for heteroscedasticity and serial autocorrelation. All monetary variables have been deflated to the year 2000.

The results indicate that direct democracy restricts the subfederal spending for education (see table 1): its coefficient is negative and significant at the 1% level. Fiscal decentralization also exhibits the expected dampening impact, whereas educational expenses rise with the degree of urbanization. In addition, the more retired persons reside in a canton, the fewer financial resources are available for compulsory schooling. Moreover, higher wealth in a

[18] A combination of cantonal and communal spending has to be employed, because in every single canton the financing of schooling is shared differently between the canton and its communes.

canton weakly induces more spending for public schooling. In this model, more conservatively oriented governments tend to have a lower level of educational expenses. The remaining controls are not significant at any conventional level. An adjusted R^2 of about 0.83 confirms the good explanatory power of the model. The normality of the distribution of the residuals can be rejected. An exclusion of statistical outliers leads to identical empirical results with respect to the impact of direct democracy on schooling expenses and for most of the remaining predictors (see table A.8 in the Appendix).

III. DATA AND MODEL

3.1 The Model: Structural and Reduced Form

This analysis of the impact of direct democracy on education assumes education in public schools to be an output of an educational production process in which several factors ('inputs') play a role[19]. These factors can be grouped according to the following criteria: school characteristics, classroom-related characteristics, peer characteristics, and, most important, student background information (individual and family). The selection of these determinants is based on empirical (econometric) analyses of the PISA results and hence reflects a typical model specification chosen by educational economists[20]. In addition, the model employs sociodemographic determinants at the cantonal level and is augmented by a cultural production factor that reflects the mentality of the citizens in the school's location to take into account the language gap which divides Switzerland. Finally, this model also contains an institutional variable that is the variable of interest. As dependent variable, the model uses the weighted likelihood estimate on reading provided in the dataset.

In this analysis, a *reduced* form and a *structural* form of the model will be distinguished. The structural form includes revenue-driven 'endogenous' input factors that are not part of the reduced form, which is composed of exogenous variables only by definition[21]. These endogenous input factors, which are determined by cantonal and communal school expenses and shown in section 2.4 to be negatively influenced by the level of direct democracy, are teacher qualification, teacher shortages, total hours of schooling, student-teacher ratio, availability and quality of instruction material, as well as state of school building or

[19] The most extensive set of such determinants originates from the work of Summers and Wolfe 1977.
[20] See Fuchs and Woessmann 2004, Fertig 2003, Fertig and Schmidt 2002, Fertig and Wright 2004. For specifications chosen by public economists, see Downes and Figlio 1997, and Figlio 1997.
[21] The second equation of this structural form was approximated in section 2.4 by the regression of educational expenditure on direct democracy.

availability of space. The reduced form includes the combined direct and indirect influence of political institutions, whereas the structural form includes only the direct influence because the indirect influence is filtered out. Whereas both forms have been estimated in the U.S. literature, the reduced form has been used more frequently. Nonetheless, the impact of tax limits has been found to significantly lower performance for both forms.

In the structural form, the relation between student performance and all its predictors outlined above can be expressed by the following function:

performance = f(*democracy, culture, individual, peers, school, canton, school inputs*),

where *democracy* denotes direct democratic institutions, and *culture* the main regional culture of the school location, which accounts for differences in people's mentality. *Individual* denotes the student's individual and family characteristics such as gender and parents' education. *Peers* stands for peer group characteristics that aim at measuring the external effects of the peer group on an individual's academic performance: i.e. individual academic performance might depend on the intellectual potential of peers[22]. *School* denotes school/class-related characteristics like the selectivity of the institution or problems with class discipline. C*anton* represents cantonal sociodemographics, which serve two purposes: first, they can be viewed as proxies for missing individual and peer group variables in class (e.g. religion); second, they account for the sociodemographic determinants of the demand for public goods[23]. Finally, *school inputs* denote revenue-driven school inputs as described above. A more detailed description of variables and the base categories can be found in the Appendix (table A.4).

For predicting the impact of the sociodemographic and peer controls, the reader is referred to the literature cited in the fields of educational economics and public finance (e.g. Winston and Zimmerman 2003, Figlio 1997). As regards the structural model, the influence of revenue-driven inputs on student performance is amply described in the educational economics literature. In general, empirical findings on the decisiveness of these budget-related input factors tend to disagree or suffer from confounding factors[24].

[22] In small classes, there might even exist a feedback relation and continuing interaction between the one and the other(s) (for empirical literature on peer effects, see Zimmer and Toma 2000, Summers and Wolfe 1977, Kerckhoff 1986, Epple et al. 2003, Hoxby 2000a, Rangvid 2004.

[23] See e.g. Feld, Fischer and Kirchgässner 2004 for a justification.

[24] For literature on the impact of financial resources in general available to schools on education, see Hanushek, 1996, Downes 1992, Hanushek and Somers 1999, Ludwig and Bassi 1998, Card and Payne 2002; for the impact of student-teacher-ratio on academic achievement, see Hanushek 1998, Krueger 2002, Buckingham

3.2 Direct Democracy

In the estimations a composite index of direct democracy is employed, which measures the degree of direct democracy at the cantonal level in Switzerland. It is an unweighted average of four subindices that evaluate the power of the constitutional initiative, the statutory initiative, the fiscal referendum, and the statutory referendum. This index takes on values between 1 and 6, with 6 indicating the highest degree of empowerment of the cantonal electorate. Nonetheless, this index measures the presence of these institutions rather than their actual use[25]. Its exact construction is demonstrated in Stutzer (1999) for the year 1992. The values for the year 2000 are displayed in the Appendix (table A.5).

Defining public schooling as a public good, this analysis first poses the question of whether and how direct democracy affects the provision of this public good at the cantonal level. Based on the U.S. experience, a performance-lowering impact in both forms of the model is anticipated.

3.3 The Data

The individual, family-, and school-related determinants are taken directly from the national PISA study. These data were collected jointly with the 2000 OECD-PISA study using identical questionnaires and subject tests, with a primary focus on reading performance. However, in contrast to the OECD-PISA study, the population of the national study includes all ninth graders[26]; hence, student ages range considerably. The procedure for data collection and treatment was roughly identical for both the Swiss national sample and the PISA sample. The primary sampling units are schools, not cantons (Fertig 2003), and the dataset provides a weighted likelihood estimate of a student's performance that is a weighted average of correctly answered responses, with the weights reflecting the level of difficulty of the question (Hambleton and Swaminathan 1985, Warm 1989). The matching of schools and students also makes it possible to construct classroom-based peer variables.

2003, and Figlio 1999; for the influence of teachers' wages, see Hanushek et al. 1999, Hanushek et al. 2001, Figlio 1999; and finally, for quality of teaching see Hanushek et al. 1998, Hanushek 2003, Buckingham 2003, 2003a.

[25] The existence of such an institution is already sufficient to induce a change in allocation of resources because it serves as a credible threat in a game theoretical context (Feld and Kirchgässner 2001).

[26] The OECD-PISA study focuses on pupils aged 15.

The national study sample is preferred over the original PISA sample for two reasons: first, it covers almost all cantons[27]; second, the administration of the questionnaires to complete classes instead of age groups allows the construction of peer group/class mate predictors. Moreover, even though there exists an extension ('the French sample') to the national study dataset that covers only French-speaking regions[28], the national study oversampled students from the German-speaking cantons of *Bern*, *Zürich*, and *St. Gallen*. Therefore, to prevent an overrepresentation, both datasets have been merged and all observations with missing values deleted. In a second step, to prevent endogeneity in the peer group variables, all students who attended test language classes with less than 20 peers have also been excluded. The mean of the reading test score was originally normalized at 500, with a standard deviation of 90 for the whole national dataset, but because of the deletion process, the new mean is about 530, with a standard deviation of approximately 80 based on a final sample of 3,411 observations. For more descriptive statistics, see tables A.6 and A.7 in the Appendix.

3.4 Methodology

Both the reduced and the structural model are estimated using two different econometric methods. The first approach uses ordinary least squares (OLS) and corrects the standard errors of the coefficients for heteroscedasticity. It also assumes that students who attend identical schools share common factors both at the school and cantonal level – for example, condition of the school building and political institutions in the canton – and it therefore employs clustering at the school level (Moulton 1990)[29].

The second approach applies a quantile regression method that, rather than estimating the conditional mean function of the dependent variable as in OLS, estimates various conditional functions for (predetermined) different portions of the test score distribution. Hence, this method provides a more complete picture of how the predictors influence the response

[27] No observations exist from the cantons *Appenzell Innerrhoden* and *Uri*. To the author's knowledge, there is no educational institute providing a ninth-grade education in the first canton.

[28] The extension dataset differs from the national sample solely in that entire classes were administered the questionnaires, whereas in the national sample, students were drawn randomly from selected classes. The original dataset includes 4,833 students in 105 schools who belong to both samples. For the data, the codebooks, and further information see SIDOS 2000 (2004). A more detailed description of data sources can be found in the Appendix (table A.4). The procedure of normalization follows that for the international PISA sample (Fertig 2003).

[29] This estimation method has also been applied by educational economists to the analysis of PISA results using an international sample containing several countries. However, no literature appears to exist using a multilevel analysis approach for such data.

variable over its distribution. It also becomes possible to uncover significant impacts on the tails that leave the mean unchanged, in contrast to an OLS regression that would render the determinant in question insignificant. The quantile regression method is also more efficient if the distribution of the dependent variable deviates from the normal distribution in its higher moments. The interpretation of a coefficient is the same as for an OLS estimate, but is only valid only for a particular quantile. As the specified quantile increases, the portion of sample observations included (sorted in an ascending order) rises. In this model, the 10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} quantiles of the test score distribution have been selected for analysis[30].

Some determinants employed are subject to potential simultaneity; e.g. besides the peer effects the discussion of performance at home or a higher age which could be proxies for a bad performance at school. Also the selection of pupils into different school types is not fully taken into account with these estimation methods. Both might induce a bias in the estimated coefficients. An instrumentation of endogenous variables or a correction of sample selection, however, cannot be carried out because the data do not provide the necessary exogenous instruments (for discussion see also Rangvid 2004).

IV. ESTIMATION RESULTS

4.1 Direct Democracy and OLS

Table A.1 in the Appendix displays the OLS estimation results for the reduced and the structural form of the model, i.e. the form that includes the educational input factors at the school and class level which are financed through cantonal sources. In the reduced form, the coefficient of direct democracy has a negative sign and is significant at the 5% level, meaning that it has a lowering effect on test scores. Moreover, the size of its impact appears to be considerable: since this index ranges from 1 to 6, the maximum reduction in the test score for an average student is about 46 difficulty adjusted test score points, which is quite substantial given the standard deviation of about 80 points. Nonetheless, compared to the remaining predictors, direct democracy does not appear to be a major determinant of an average student's performance. By far stronger, for example, are the effects of high parental income, age and gender, the personal situation and learning environment at home, and the school attended.

[30] For an introduction to the quantile regression method, see Koenker and Basset 1978, Koenker and Hallock 2001, Buchinsky 1998, Cade and Noon 2003.

In contrast, in the structural form of the model, the coefficient of the index of direct democracy is far from being significant at any conventional level. Of the endogenous revenue-driven input factors explicitly taken into account in this specification particularly the proportion of teachers with a tertiary education (from among the whole teaching staff and language teachers) appear to be decisive, as well as the equipment of the school with PCs. The coefficients of the remaining input variables are not significant at any conventional level. The insignificance of the composite index of direct democracy in the reduced form is a remarkable result which will be discussed below.

Interesting conclusions can be drawn from a comparison of results for the structural and reduced forms of the model. Since the reduced form reveals the combined direct and indirect influence of direct democracy but the structural model specification isolates only the direct effect, a comparison of the results for both forms reveals the disguised indirect influence. Based on these outcomes, it can be concluded that direct democracy must exert an indirect influence that lowers test scores and that, obviously, dominates the direct effect.

Given the observation that direct democracy dampens expenditure for compulsory education in Switzerland, a comparison of the estimation results leads to the further conclusion that the indirect institutional impact must be driven by this expenditure-limiting influence; this idea is supported by the fact that the endogenous variables reflect the financial equipment of the school district[31]. Hence, the disappearance of the significance of the institutional coefficient in the structural form provides strong evidence that these input factors may serve as budgetary transmission channels of direct legislation at the school and class level. Particularly, based on the estimation results for the structural form it can be conjectured that qualification of teachers and school organization constitute such channels. For this reason, it can be concluded that those institutions of direct legislation which are linked to cantonal school laws, i.e. which regulate school organization and determine the attractiveness of the teaching profession in the job market for university graduates, might be responsible for this result.

Viewed from an input perspective, the results for both forms also suggest that the quality (and quantity) of the endogenous input factors (jointly) is important for student academic performance; i.e. fewer available financial means for public schooling do indeed translate into a lower performance for all students equally. This finding constitutes a notable epiphenomenon of this analysis, because educational economists are still debating whether

[31] Educational expenditure per capita and educational expenditure per pupil are highly correlated.

resource endowment at the school and class level matters. These results strongly suggest that – at least in a Swiss context – they do.

Because the results of the OLS regression are only valid for an average student, closer investigation is called for into how direct legislation appears to influence the various portions of the conditional distribution of the reading test scores.

4.2 Quantile Regression Results

4.2.1 The Reduced Form of the Model

In the reduced model, quantile regression results (see table A.2 in the Appendix) indicate that direct democracy does have an achievement-lowering impact for all estimated quantiles of the conditional test score distribution. This empirical result corroborates the finding already observed for the average student. Moreover, the institutional influence on the median (0.5q) is very similar in size to that on its mean as measured by the OLS coefficient[32].

Nonetheless, some variation between the estimated quantiles appears to be present in both significance levels and sizes. The strongest institutional impact is for the 75th quantile, whose coefficient has an absolute value of about 8.9, significant at the 1% level. The coefficient for the 50th percentile is also significant at the 1% level, but its size is 1 point smaller. At the tails of the distribution, significances drop down to the 10% level. This decline in statistical significance at the tails, however, can be expected with a growing deviation from the median because the t-statistic is more likely to be confounded by single statistical outliers. However, a test of joint nonsignificance for all estimated coefficients reveals a significance at the 5% level. Quantile regressions provide not only the opportunity to look at the development of the size of the coefficient over the entire distribution, but also to test whether a seeming change in size holds true statistically or not.

Insert Figure 1 about here

[32] The difference in significance could have been caused by the fact that standard errors are not bootstrapped in the OLS regression.

A graphical representation of the development of the coefficient of direct democracy over the entire conditional test score distribution is presented in figure 1[33]. On the ordinate, the value of the coefficient is measured in test score points, while the abscissa depicts the percentiles of the distribution in 1% distances from 0% to 100%. The continuous line represents the coefficient of the institution, and the shaded area, its 95% confidence interval. The OLS estimate of direct democracy is depicted as a horizontal dashed line; in this case, intersecting the ordinate at -7.59.

An analysis of the graph (figure 1) reveals that the impact of direct democracy varies little between quantiles, particularly in the middle part of the test score distribution. The continuous line appears to be fluctuating around the dashed line and thus is not considerably different from the OLS estimate. A closer inspection also shows that for the very low and very high percentiles, the coefficient of direct democracy is no longer significant at the 5% level (the shaded area crosses the 0-line), which corresponds exactly to the observed 10% level of significance in the 10th and 90th quantiles[34]. A Wald test for equality between the estimated coefficients leads to no rejection of the H_0-hypothesis for the whole distribution. In sum, taking into account a student's personal, family, and peer characteristics, the impact of direct legislation on each individual appears to be considerable, negative and of equal extent.

4.2.2 The Structural Form of the Model

Table A.3 displays the quantile regression results for the structural form of the model, i.e. after the inclusion of input factors determined by the school budget and thus by the level of direct democracy. For the variable of interest, no significant influence of direct democracy is observed on the estimated quantiles of the conditional test score distribution, not even its middle portion. More important, the test of joint nonsignificance reveals no significance for all coefficients jointly. The latter result shows that the nonsignificance not only holds for a single estimated quantile but also jointly, i.e. for the entire distribution. Furthermore, the estimation results for the endogenous input variables suggest, again, that particularly the qualification of teachers serves as specific transmission channel of direct democracy. These findings again parallel the OLS regression results. An illustration (figure 2) of the development of the coefficient for the entire distribution confirms the regression result

[33] Plots have been created using the user-written command *grqreg*. According to the author Joao Pedro W. de Azevedo, coefficients for the entire distribution are estimated with confidence intervals based on the bootstrapped standard errors of the last regression results (personal communication, 8th of February, 2005).
[34] The significance level of 5.2% in the 25th quantile is also very well reflected in this plot.

reported above: the continuous line appears to be fluctuating around 0, and its shaded area always includes the 0-line. A Wald test for the equality of the political impact leads to no rejection of the H_0-hypothesis for any estimated percentiles. Hence, no redistributive impact of direct democracy between students attending the same class can be observed in reading.

Insert Figure 2 about here

Nonetheless, it might be asked whether a missing redistributive impact in the structural form implies no room for manipulation by the bureaucracy. The answer is, not necessarily. It should be noted that it is not really possible to distinguish between a decline in school resources for teaching induced directly by a budget cut and a deliberate additional cut made by a bureaucrat. Further, if a bureaucrat cannot limit the effect of an action to one particular student, then all students, including the median voter's child, must inherently suffer a decrease in performance, which in turn increases the chances of voter overrule. Such an overall deterioration of educational quality can most easily occur via the financial channel, in which case, the indirect effect filtered out in the structural model would also capture such a deliberate general bureaucratic strategy. Therefore, it can be surmised that any indirect effect through the budgetary channel would also capture deliberate manipulation by a bureaucrat.

Several robustness checks assess whether the observed influence of direct democratic institutions in both forms depends on the inclusion or exclusion of particular controls or is sensitive to a potentially unsolved endogeneity problem. In general, the results of the original model specification are insensitive to slight variations in the specification[35]. Also median imputation and the admission of class sizes of ten or more students, which lets the number of observations increase to roughly 9000, does not alter the main findings: In the reduced form, direct democracy again shows a performance-lowering effect, which disappears in the structural form, with the qualification of teachers as the most decisive budgetary channel of influence.

[35] The robustness of the linkage between direct democracy and public education was tested using different model specifications. E.g., the regional culture has been substituted with various measures of cantonal culture, four previously omitted input variables have been added, the model has been estimated solely for the national sample, and, finally, outliers at the tails of the unconditional test score distribution have been deleted. Furthermore, the exclusion of the peer group variables and inclusion of the remaining classes also did not affect the results considerably.

V. CONCLUSIONS

For the U.S., Figlio (1997) has shown that local tax limits on revenue and/or spending lead to larger class sizes, lower teacher wages, and worse teacher quality but not to any reduction in administrative personnel. Therefore, it was conjectured that instead of the expected efficiency gains in the provision of this public good of schooling, a decline in the quality of educational service must have occurred. This decline in academic achievement has indeed been reflected and corroborated by recent analyses of the impact of tax limits on student performances in the U.S. (e.g. Figlio and Rueben 2001). Such tax limits had been demanded by and implemented through citizen's initiatives, an institution of direct legislation, in various U.S. states. Based on these results for the U.S., a test score decreasing impact of direct democracy on student achievement would not be surprising for Switzerland, as its political institutions have been shown to restrain subfederal expenses for schooling.

The purpose of this study was to provide such evidence for similar or dissimilar effects of direct legislation on public education in Switzerland. Using a cross section of individual data on student performance in Switzerland obtained from a national study accompanying the OECD-PISA study, an educational production function augmented by institutional determinants of direct democracy was estimated. This model is similar to those employed both in public finance studies and in analyses by educational economists. Two major variations of the production function were estimated: first, a reduced form that excludes endogenous input factors at the school and class level (the reduced form) and second, a structural version that includes these factors (the structural form). This model specification made it possible to distinguish the direct institutional impact from an indirect impact. Two types of direct democracy measures were employed: first, a composite index of direct democracy that indicates the degree of overall empowerment of citizenry and second, measures of three different single institutions assumed to be of particular importance for decision making on schooling issues.

In the reduced form of the model, the findings from the OLS regression indicates that a higher degree of direct democracy leads to lower performance by students. Using a quantile regression technique, it was possible to show that direct democracy's performance-reducing effect was conspicuous across the entire conditional test score distribution, and equally strong in size for the estimated quantiles. However, after the inclusion of variables controlling for various revenue-driven input factors at the school and class level, the negative influence of direct democracy disappeared completely. This result leads to the conclusion that school and

class input factors whose quality is dependent on the school district's financial equipment are important for student academic achievement. Moreover, this finding also indicates that the test score lowering impact occurs through the subfederal budget, which is very similar to results obtained for the U.S. Finally, the estimation outcomes for the structural form also suggest that (a) there is no institutional influence on the distribution of given resources among students in the same class, and (b) there exists no deleterious effect which goes beyond the purely budgetary impact. This last outcome contradicts the U.S. results in which a performance-lowering impact also in the structural form of the model had been found. Based on the estimates of the revenue-driven input factors in the reduced form, it is conjectured that direct democracy exerts its influence through cantonal laws on public education which affects teacher qualification and the organization of school.

For future research, an evaluation of the impact of direct democracy at the school district level remains to be analyzed, because communal governments also have a substantial say in schooling issues and financing in Switzerland. In addition, selection into treatment at the school district level should be taken into account. Overall, going back to the main question of this paper, using a standard approach in the field of public finance direct democracy was found to have a substantial impact on public education, particularly on Swiss student performance in reading. Based on the empirical results presented in this paper, the Swiss electorate is advised to avoid further cuts in spending for public education and to increase the share of teachers with a tertiary education in their schools.

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VI. **Appendix**

Table A.1: OLS Regressions for Index of Direct Democracy

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	Coeff.	t	Coeff.	t
Direct democracy	-7.595*	-1.98	-0.695	-0.16
Latin region	1.073	0.09	8.579	0.69
hisei2	4.497	0.54	5.974	0.72
hisei3	18.009*	2.52	15.840*	2.12
hisei4	15.707*	2.13	13.714 (*)	1.86
hisei5	30.095*	3.25	31.338***	3.34
hisei6	26.767***	3.37	25.991**	3.22
hisei7	34.188***	3.54	31.298**	3.12
No income data	0.535	0.07	-2.335	-0.28
Number of siblings	-0.774**	-2.64	-0.815**	-2.61
Old student	-28.223***	-3.23	-27.748**	-2.69
Young student	11.081***	3.67	10.715***	3.43
Books at home	9.075***	10.58	8.574***	9.26
No late arrival	2.263	0.76	2.962	0.95
No PC at home	-15.107***	-3.30	-13.151**	-2.70
Female	17.610***	7.68	15.878***	6.65
Both parents work	0.096	0.04	-0.913	-0.37
Intact family	0.466	0.15	0.117	0.03
Native	2.198	0.41	0.211	0.04
Foreign parents	-6.019	-1.23	-5.468	-1.02
Second generation	2.575	0.79	3.234	0.88
Non-test language	-14.755**	-3.15	-17.529***	-3.44
Parents low education	-11.286*	-2.18	-8.318	-1.60
Parents medium education	-13.724***	-4.69	-11.770***	-3.87
Mother tertiary education	-11.794***	-3.70	-11.589***	-3.44
Father tertiary education	-2.997	-1.05	-1.147	-0.38
Discuss politics	8.129**	2.61	8.922**	2.70
Listen to music	-5.950	-0.99	-3.936	-0.64
Discuss performance	-8.861***	-3.49	-8.975***	-3.49
Main meal	1.763	0.32	1.832	0.31
Regular talking	5.752*	2.06	5.982*	2.02
Village school	-4.811	-0.46	-3.071	-0.29
Small town school	-3.694	-0.68	0.790	0.12
City school	12.025	1.29	2.897	0.26
Private school	1.876	0.24	-0.996	-0.09
Selective school	13.290**	2.84	5.960	1.18
Regular tests	5.652	0.99	4.813	0.80
Homework feedback	-13.482***	-4.56	-11.524***	-3.84
Discipline problem	-12.062***	-3.83	-12.061***	-3.93
Coefficient reading	7.391***	4.26	5.597**	2.90
Ratio of female	0.135	0.57	-0.043	-0.16
Ratio of foreign peers	-0.653	-1.50	-0.587	-1.23

Table A.1: OLS Regressions for Index of Direct Democracy (cont.)

	Reduced Form		Structural Form	
	Coeff.	t	Coeff.	t
High education	1.539	1.47	1.332	1.14
Old people	-0.284	-0.13	-2.324	-0.99
Unemployment rate	7.160	0.83	5.722	0.58
Protestant	0.560	1.49	0.742 (*)	1.74
Muslim	2.209	0.71	1.292	0.37
No religion	-0.943	-0.72	0.419	0.28
Poor people	-2.214***	-4.16	-1.668*	-2.39
Urbanization	-0.200	-0.62	-0.322	-0.78
Log (population)	-25.102**	-2.69	-15.487	-1.34
Poor conditions 1			0.287	0.03
Poor conditions 2			-9.700	-0.77
No PC at school			-7.158*	-2.32
Teacher shortage			-2.735	-0.24
Tertiary reading			20.146 (*)	1.97
Tertiary staff			25.380*	2.15
Total hours			0.030	0.89
Student-teacher ratio			-0.495	-0.79
Constant	746.308***	6.77	597.282***	4.38
F-Test	29.06		28.38	
Adjusted R^2	0.258		0.264	
Number of observations	3411		2969	

OLS regression with robust standard errors obtained through clustering of schools (176/149 schools). Observations with missing values and a class size of less than 20 have been deleted.

Table A.2: Quantile Regression Using the Index of Direct Democracy without Revenue-Driven Inputs (Reduced Form)

	q10		q25		q50		q75		q90	
	Coeff.	t	Coeff.	t	Coeff.	t	Coeff.	t	Coeff.	t
Direct democracy	-7.148 (*)	-1.87	-5.865 (*)	-1.96	-7.964**	-2.82	-8.903**	-3.01	-6.167 (*)	-1.70
Latin region	22.210	1.53	14.442	1.46	-8.798	-0.99	-9.811	-1.05	-8.472	-0.74
hisei2	-0.233	-0.02	-0.408	-0.03	5.007	0.51	6.468	0.50	4.014	0.28
hisei3	26.430*	2.11	26.441*	2.47	16.123 (*)	1.75	11.487	0.96	0.180	0.01
hisei4	22.723 (*)	1.83	20.393 (*)	1.86	13.657	1.47	12.236	1.04	-0.536	-0.04
hisei5	34.291*	2.30	24.236*	2.03	21.543 (*)	1.85	24.805 (*)	1.77	33.050 (*)	1.89
hisei6	37.234**	2.98	28.497**	2.60	17.563 (*)	1.80	20.244 (*)	1.67	24.844 (*)	1.75
hisei7	37.512*	2.10	43.201***	3.50	27.437*	2.36	24.965 (*)	1.82	17.616	1.10
No income data	2.338	0.17	6.363	0.53	0.403	0.04	0.191**	0.01	-3.395	-0.23
Number of siblings	-0.477	-0.96	-0.370	-0.80	-0.819 (*)	-1.92	-1.075***	-3.55	-1.581**	-3.13
Old student	-35.165**	-2.66	-37.738***	-3.19	-26.379*	-2.32	-18.025	-1.57	-24.077*	-2.13
Young student	14.250**	2.78	9.677*	2.31	11.292**	3.11	13.785***	3.43	12.441*	2.47
Books at home	8.409***	5.05	8.870***	6.86	9.005***	7.67	9.603***	8.28	10.063***	8.26
No late arrival	2.386	0.49	4.405	1.12	-0.815	-0.23	-3.279	-0.98	0.322	0.08
No PC at home	-11.906	-1.29	-12.282*	-2.04	-12.134 (*)	-1.85	-10.832 (*)	-1.72	-9.469	-1.43
Female	21.619***	4.65	17.007***	5.22	17.446***	5.56	12.901***	4.06	17.228***	4.58
Both parents work	-1.729	-0.39	4.949	1.43	1.935	0.62	1.464	0.43	0.523	0.13
Intact family	8.657	1.31	1.722	0.36	-0.235	-0.05	-4.204	-0.93	-2.206	-0.44
Native	7.340	0.78	0.210	0.03	-4.748	-0.81	2.005	0.31	8.614	1.06
Foreign parents	-5.619	-0.68	-9.580	-1.40	-9.848	-1.53	-5.638	-0.77	3.619	0.48
Second generation	13.700*	2.42	2.874	0.68	2.947	0.70	1.051	0.26	-5.988	-1.28
Non-test language	-16.348 (*)	-1.77	-12.174 (*)	-1.82	-11.120 (*)	-1.93	-14.362*	-2.49	-13.413 (*)	-1.88
Parents low education	-3.668	-0.43	-10.496	-1.59	-13.301*	-2.12	-10.272	-1.53	-13.848 (*)	-1.68
Parents medium education	-15.970**	-3.08	-15.484***	-4.04	-15.510***	-4.49	-12.511***	-3.43	-7.220 (*)	-1.65
Mother tertiary education	-13.246*	-2.15	-8.288 (*)	-1.83	-10.942**	-2.69	-11.590**	-2.93	-10.639 (*)	-1.93
Father tertiary education	-5.393	-1.05	-3.238	-0.76	-2.068	-0.56	-5.061	-1.35	-5.281	-1.06
Discuss politics	12.842*	2.02	5.758	1.25	7.709	1.56	9.862*	2.15	12.506*	2.04

Table A.2: Quantile Regression Using the Index of Direct Democracy without Revenue-Driven Inputs (Reduced Form) (cont.)

	q10		q25		q50		q75		q90	
	Coeff.	t	Coeff.	t	Coeff.	t	Coeff.	t	Coeff.	t
Listen to music	6.068	0.53	-7.995	-0.86	-9.145	-1.02	-8.141	-1.03	-10.694	-0.83
Discuss performance	-14.802**	-3.00	-6.992*	-2.04	-8.589**	-2.63	-7.321*	-2.12	-6.968 (*)	-1.79
Main meal	17.790 (*)	1.92	5.006	0.52	-2.303	-0.43	1.603	0.22	-6.203	-0.76
Regular talking	4.435	0.92	7.441*	1.98	3.367	0.95	4.456	1.27	3.228	0.78
Village school	-5.047	-0.46	-9.265	-1.18	-11.108	-1.44	8.274	0.95	4.132	0.51
Small town school	-0.026	0.00	-2.290	-0.54	-2.122	-0.57	-2.717	-0.66	-6.062	-1.23
City school	25.348*	2.13	19.234*	2.42	7.168	1.17	9.837	1.28	3.415	0.41
Private school	-0.244	-0.02	2.366	0.26	5.334	0.79	5.155	0.71	5.462	0.64
Selective school	15.652***	3.29	14.758***	4.20	10.898**	2.96	10.871**	2.83	11.743**	2.69
Regular tests	-2.801	-0.46	4.838	0.98	3.728	0.73	5.985	1.24	11.859 (*)	1.93
Homework feedback	-11.686*	-2.35	-6.567	-1.60	-11.062***	-3.51	-10.289**	-2.72	-12.762**	-3.15
Discipline problem	-13.087**	-2.93	-11.285**	-3.13	-9.638**	-2.94	-12.329***	-3.40	-18.062***	-4.33
Coefficient reading	7.367***	4.67	6.920***	6.07	8.121***	7.68	7.361***	6.59	5.955***	4.43
Ratio of female	0.264	0.57	-0.060	-0.31	0.130	0.72	0.419*	2.16	0.306	1.41
Ratio of foreign peers	-1.281***	-3.88	-0.986***	-3.50	-0.394	-1.59	-0.234	-0.77	-0.182	-0.54
High education	1.668	1.26	1.382	1.35	1.503	1.58	1.236	1.42	0.691	0.63
Old people	-0.207	-0.07	-2.435	-1.17	0.622	0.28	-0.025	-0.01	-0.781	-0.27
Unemployment	13.934	1.45	5.138	0.70	7.941	1.32	7.361	1.02	15.673 (*)	1.85
Protestant	0.827 (*)	1.94	0.597 (*)	1.86	0.368	1.23	0.833**	2.85	1.246***	3.95
Muslim	3.330	0.95	2.682	0.95	1.813	0.71	3.420	1.46	3.235	1.14
No religion	-0.112	-0.07	-1.467	-1.17	-1.252	-1.09	-1.483	-1.52	-1.204	-0.98
Poor	-3.756***	-5.01	-1.994***	-3.59	-1.822***	-3.45	-1.931**	-3.14	-2.504***	-3.86
Urbanization	-0.558	-1.12	0.140	0.41	-0.186	-0.61	-0.115	-0.41	-0.223	-0.60
Log(population)	-29.095**	-2.61	-27.056**	-2.70	-23.843**	-2.78	-30.616***	-3.97	-32.067***	-3.61
Constant	702.680***	5.37	736.512***	6.56	736.482***	7.73	847.780***	8.87	919.927***	8.08

Table A.2: Quantile Regression Using the Index of Direct Democracy without Revenue-Driven Inputs (Reduced Form) (cont.)

	q10		q25		q50		q75		q90	
	Coeff.	t	Coeff.	t	Coeff.	t	Coeff.	t	Coeff.	t
Pseudo R^2	0.1999		0.1635		0.1351		0.1333		0.1574	

Quantile regression for the 10th, the 25th, the 50th, the 75th, and the 90th quantiles. Standard errors are bootstrapped (1,000 replications). Observations with missing values and with a class size of less than 20 students have been deleted. 3,411 observations.

Table A.3: Quantile Regression Using the Index of Direct Democracy Including Revenue-Driven Inputs (Structural Form)

	q10		q25		q50		q75		q90	
	Coeff.	t	Coeff.	t	Coeff.	t	Coeff.	t	Coeff.	t
Direct democracy	4.168	0.83	-0.001	0.00	-1.759	-0.53	0.966	0.29	-4.620	-1.00
Latin region	27.427	1.55	6.609	0.63	6.735	0.62	4.869	0.43	-1.190	-0.09
hisei2	7.893	0.50	7.497	0.57	5.858	0.55	10.464	0.76	7.946	0.51
hisei3	28.115 (*)	1.89	23.921*	1.98	11.883	1.18	12.296	0.94	2.950	0.20
hisei4	25.477	1.63	17.758	1.41	9.892	0.98	14.638	1.14	4.918	0.34
hisei5	38.552*	2.12	29.371*	2.15	17.447	1.42	32.093*	2.17	42.113*	2.13
hisei6	37.487*	2.43	28.277*	2.25	17.409 (*)	1.65	24.104 (*)	1.85	31.643*	2.09
hisei7	32.207 (*)	1.65	35.223*	2.30	18.777	1.48	34.275*	2.24	30.750 (*)	1.68
No income data	-2.169	-0.13	0.168	0.01	-1.231	-0.11	5.511	0.38	-0.569	-0.04
Number of siblings	-0.889	-1.48	-0.628	-1.14	-0.428	-1.06	-1.315***	-3.98	-1.935***	-3.49
Old student	-42.0783	-2.33	-27.080 (*)	-1.91	-30.785*	-2.48	-26.527 (*)	-1.95	-25.361 (*)	-1.83
Young student	9.192 (*)	1.68	6.109	1.45	9.328*	2.34	10.870*	2.52	12.325*	2.19
Books at home	7.394***	4.01	8.119***	6.02	9.479***	7.38	9.534***	8.16	10.067***	6.90
No late arrival	9.956 (*)	1.93	5.926	1.29	-1.264	-0.31	-4.090	-1.06	-0.075	-0.02
No PC at home	-9.467	-0.93	-11.243	-1.58	-12.416 (*)	-1.75	-12.269 (*)	-1.81	-7.440	-0.93

Table A.3: Quantile Regression Using the Index of Direct Democracy Including Revenue-Driven Inputs (Structural Form) (cont.)

	q10		q25		q50		q75		q90	
	Coeff.	t	Coeff.	t	Coeff.	t	Coeff.	t	Coeff.	t
Female	17.176***	3.83	16.597***	4.59	14.939***	4.29	11.754***	3.27	17.776***	4.28
Both parents work	-2.909	-0.61	3.225	0.83	-0.431	-0.13	-0.581	-0.15	1.538	0.34
Intact family	9.881	1.45	2.868	0.53	-1.373	-0.28	-4.119	-0.79	-0.230	-0.04
Native	-0.156	-0.02	1.959	0.24	-2.173	-0.33	0.296	0.04	5.672	0.61
Foreign parents	-8.527	-0.88	-4.008	-0.52	-4.260	-0.56	-6.747	-0.82	1.124	0.12
Second generation	11.637*	1.98	5.297	1.03	5.650	1.26	2.239	0.46	-3.170	-0.58
Non-test language	-19.271*	-2.14	-14.434 (*)	-1.89	-13.200*	-2.10	-13.893*	-2.14	-14.858*	-2.03
Parents low education	-0.893	-0.09	-10.193	-1.46	-10.526	-1.56	-9.948	-1.39	-12.256	-1.40
Parents medium education	-13.458*	-2.44	-12.419**	-3.04	-9.051*	-2.27	-12.825**	-3.06	-4.227	-0.87
Mother tertiary education	-10.485 (*)	-1.69	-11.555*	-2.11	-10.494*	-2.42	-13.057**	-2.89	-12.876*	-2.22
Father tertiary education	-6.425	-1.18	-0.554	-0.12	2.173	0.53	-4.974	-1.19	-4.375	-0.82
Discuss politics	16.077**	2.56	8.338	1.54	9.177 (*)	1.68	11.014*	2.41	13.576*	1.96
Listen to music	6.285	0.55	-5.897	-0.61	-5.519	-0.65	-6.637	-0.82	-13.205	-0.95
Discuss performance	-14.163**	-3.01	-8.236*	-2.24	-7.066*	-2.00	-7.280 (*)	-1.90	-5.507	-1.23
Main meal	11.101	1.14	9.395	1.02	-8.204	-1.27	4.872	0.65	-0.658	-0.06
Regular talking	4.931	1.01	4.895	1.25	3.773	1.05	4.202	1.13	2.677	0.59
Village school	-2.491	-0.23	-14.228	-1.60	-9.416	-1.11	14.142	1.56	12.378	1.36
Small town school	5.228	0.81	2.581	0.52	0.053	0.01	7.015	1.26	-1.274	-0.20
City school	5.379	0.38	6.971	0.65	-2.643	-0.35	-2.568	-0.29	1.714	0.17
Private school	-4.807	-0.34	5.044	0.40	1.904	0.24	-11.225	-1.19	4.288	0.36
Selective school	9.208	1.64	7.531	1.63	2.560	0.58	-0.157	-0.03	7.725	1.27
Regular tests	-1.961	-0.27	3.118	0.62	5.072	0.91	4.426	0.78	8.797	1.14
Homework feedback	-11.331*	-2.34	-5.499	-1.29	-10.354**	-2.97	-5.626	-1.41	-13.749**	-2.96
Discipline problem	-16.128*	-3.56	-11.503**	-2.99	-12.732***	-3.60	-11.502**	-3.11	-19.205***	-4.38
Coefficient reading	5.875**	3.02	5.416***	3.90	5.975***	4.51	6.438***	4.63	5.918***	3.78
Ratio of female	-0.054	-0.18	0.051	0.22	-0.259	-1.24	0.129	0.56	0.122	0.46
Ratio of foreign peers	-0.789 (*)	-1.87	-0.876**	-2.72	-0.686*	-2.19	0.226	0.58	0.008	0.02

Table A.3: Quantile Regression Using the Index of Direct Democracy Including Revenue-Driven Inputs (Structural Form) (cont.)

	q10		q25		q50		q75		q90	
	Coeff.	t	Coeff.	t	Coeff.	t	Coeff.	t	Coeff.	t
High education	0.278	0.18	0.738	0.63	1.423	1.31	1.719	1.64	0.769	0.67
Old people	-1.393	-0.50	-4.136 (*)	-1.74	-1.470	-0.62	-1.303	-0.49	-2.146	-0.68
Unemployment	19.306 (*)	1.73	9.140	1.19	5.206	0.65	2.054	0.23	11.415	1.17
Protestant	0.879*	1.96	0.489	1.49	0.833*	2.29	1.063**	3.17	1.389***	3.52
Muslim	-0.088	-0.02	-1.883	-0.66	2.702	0.89	3.239	1.19	6.744 (*)	1.79
No religion	2.655	1.51	1.097	0.79	-0.272	-0.21	-1.651	-1.45	-1.347	-0.90
Poor	-3.160***	-3.58	-1.321*	-2.20	-1.445*	-2.12	-1.315 (*)	-1.85	-1.687 (*)	-1.93
Urbanization	-1.053 (*)	-1.89	-0.338	-0.83	-0.180	-0.54	0.119	0.34	-0.050	-0.12
Log(population)	-10.315	-0.79	-7.655	-0.77	-21.362*	-2.06	-25.664**	-2.99	-33.117**	-2.90
Poor conditions 1	9.562	0.89	0.736	0.08	8.175	0.94	-4.365	-0.53	-12.415	-1.31
Poor conditions 2	-13.062	-0.79	-6.122	-0.49	-9.447	-0.79	-9.785	-0.76	-13.771	-0.86
No PC at school	-9.800 (*)	-1.65	-8.881*	-1.99	-1.966	-0.47	-4.638	-1.06	-7.881	-1.43
Teacher shortage	-17.794	-1.53	-10.907	-1.23	5.125	0.71	8.580	1.07	7.948	0.71
Tertiary reading	23.746 (*)	1.92	26.727**	3.14	21.799**	2.56	13.595 (*)	1.73	11.069	1.05
Tertiary staff	29.565*	2.10	21.325 (*)	1.82	26.327**	2.58	31.932**	3.10	15.983	1.40
Total hours	0.030	0.70	0.058 (*)	1.86	0.028	1.03	-0.006	-0.17	0.004	0.12
Student-teacher ratio	-0.750	-0.94	-0.972	-1.40	-0.401	-0.69	-1.056	-1.46	0.904	0.98
Constant	433.718**	2.79	453.589***	3.76	673.089***	5.35	743.483***	6.70	880.562***	6.31
Pseudo R^2	0.2157		0.1735		0.1402		0.1390		0.1591	

Quantile regression for the 10th, the 25th, the 50th, the 75th, and the 90th quantiles Standard errors are bootstrapped (1,000 replications). Observations with missing values and with a class size of less than 20 students have been deleted. 2,969 observations.

Table A.4: Description of Variables

Variables	Description	Source
Dependent variable	WARM estimate (weighted likelihood estimate) in reading: difficulty adjusted test score in reading literacy test	National PISA study
Direct democracy	Index of direct democracy from 1 (min.) to 6 (max.) in 2000	Own calculation based on Stutzer (1999)
Latin region	1 if language community is either French- or Italian-speaking, 0 otherwise (cantreg)	National PISA study
Individual and family variables		
hisei2	PISA International Socio-Economic Index of Occupational Status of the parents as a proxy of income, 28 - 37 index points	National PISA study
hisei3	38 - 47 index points	National PISA study
hisei4	48 - 57 index points	National PISA study
hisei5	58 - 67 index points	National PISA study
hisei6	68 - 77 index points	National PISA study
hisei7	> 78 index points	National PISA study
No income data	1 if missing value in hisei-Index (hisei), 0 otherwise	National PISA study
Number of siblings	Number of siblings (nsib)	National PISA study
Old student	1 if student older than 204 months / 15 years (age), 0 otherwise	National PISA study
Young student	1 if student younger than 180 months / 17 years (age), 0 otherwise	National PISA study
Books at home	Number of books at home (st37q01)	National PISA study
No late arrival	1 if student claims never to have arrived late for school in the last two school weeks (st29q03), 0 otherwise	National PISA study
No PC at home	1 if student never has access to a PC at home (it01q01), 0 otherwise	National PISA study
Female	1 if student is female, 0 otherwise (st03q01)	National PISA study
Both parents work	1 if both parents work, either full time or part time (st07q01, st06q01), 0 otherwise	National PISA study
Intact family	1 if student usually lives with father and mother (st04q01, st04q03), 0 otherwise	National PISA study
Native	1 if country of birth is Switzerland (st16q01), 0 otherwise	National PISA study
Foreign parents	1 if country of birth of both father and mother is not Switzerland (st16q02, st16q03), 0 otherwise	National PISA study
Second generation	1 if only one parent is born abroad (st16q02, st16q03), 0 otherwise	National PISA study

Table A.4: Description of Variables (cont.)

Variables	Description	Source
Non-test language	1 if language spoken at home is not test-language (st17q01), 0 otherwise	National PISA study
Parents low education	Father and/or mother completed only primary education or did not go to school (fisced, misced)	National PISA study
Parents medium education	Father and/or mother completed lower secondary level (fisced, misced)	National PISA study
Mother tertiary education	Mother completed tertiary education (misced)	National PISA study
Father tertiary education	Father completed tertiary education (fisced)	National PISA study
Discuss politics	1 if student regularly discusses political or social issues with parents (st19q01), 0 otherwise	National PISA study
Listen to music	1 if student regularly listens to classical music together with parents (st19q03), 0 otherwise	National PISA study
Discuss performance	1 if student regularly discusses school performance with parents (st19q04), 0 otherwise	National PISA study
Main meal together	1 if several times a week parents eat main meal with student (st19q05), 0 otherwise	National PISA study
Regular talking	1 if several times a week parents spend time just talking to the student (st19q06), 0 otherwise	National PISA study
School and class variables		
Village school	1 if school is located in a village (< 3000 E) (sc01q01), 0 otherwise	National PISA study
Small town school	1 if school is located in a small town (3000 - 15 000) (sc01q01), 0 otherwise	National PISA study
City school	1 if school is located in a city (100 000 to 1 000000) (sc01q01), 0 otherwise	National PISA study
Private school	1 if school is private, 0 otherwise (sc03q01)	National PISA study
Selective school	1 if admission to school is always based on student's record of academic performance including placement tests; 0 otherwise	National PISA study
Regular tests	1 if students are assessed four or more times a year using standardized or teacher developed tests, 0 otherwise (sc16q01, sc16q02)	National PISA study
Homework feedback	1 if homework is counted as part of mark or teachers grade homework most of the time or always (st32q07, st32q03), 0 otherwise	National PISA study

Table A.4: Description of Variables (cont.)

Variables	Description	Source
Discipline problem	1 if in most lessons or in every lesson, students don't listen to what the teacher says, students don't start working for a long time after the lesson begins, there is noise and disorder, or at the start of class more than five minutes are spent doing nothing (st26q13, st16q14, st26q16, st26q17)	National PISA study
Peer variables		
Coefficient reading	Peers' mean performance divided by peers' standard deviation in reading scores	Calculation based on National PISA study
Ratio of females	Share of female students in student's peer group	Calculation based on National PISA study
Ratio of foreign students	Share of students born abroad in student's peer group	Calculation based on National PISA study
Cantonal variables		
High education	Share of cantonal residents with a tertiary education or a high school degree	Swiss Federal Statistical Office
Old people	Share of cantonal residents older than 65 years	Swiss Federal Statistical Office
Unemployment	Cantonal unemployment rate	Swiss Federal Statistical Office
Protestant	Share of Protestant residents in canton	Swiss Federal Statistical Office
Muslim	Share of Muslim residents in canton	Swiss Federal Statistical Office
No religion	Share of residents with no religious affiliation	Swiss Federal Statistical Office
Poor people	Share of persons who cannot afford savings of 100 CHF per month (SHP data)	Own calculation based on Swiss Household Panel, wave 2000
Urbanization	Share of residents living in agglomerations with at least 100,000 inhabitants	Swiss Federal Statistical Office
Log (population)	Natural logarithm of cantonal residential population	Swiss Federal Statistical Office
Revenue-driven inputs		
Poor conditions 1	1 if school suffers from poor building, poor heating and/or inadequate space (sc11q01 sc11q02 sc11q03), 0 otherwise	National PISA study
Poor conditions 2	1 if school suffers from a lack of instructional material and /or a poor library [a lot] (sc11q04 sc11q06), 0 otherwise	National PISA study
No PC at school	1 if student has no access to PC at school (it01q02), 0 otherwise	National PISA study

Table A.4: Description of Variables (cont.)

Variables	Description	Source
Teacher shortage	1 if a shortage of teachers in general and/or language teachers in particular [Some/a lot] (sc21q01, sc21q02), 0 otherwise	National PISA study
Tertiary reading	Proportion of language teachers with tertiary education at school (propread)	National PISA study
Tertiary staff	Proportion of teachers with a tertiary education of teaching staff at school (propqual)	National PISA study
Total hours	Total number of schooling hours per year (tothrs)	National PISA study
Student-teacher ratio	Student-teacher ratio as school size divided by number of teachers (stratio)	National PISA study

Notes: In parentheses are the names of the variables on which the determinants of student performance are based. These labels are identical to those used in the OECD-PISA study conducted by the OECD in 2000. The questionnaires used for the Swiss national study are also identical to those used for the PISA study with the exception of a few questions which are irrelevant to our model specification. These labels also provide information about which questionnaire contained the original question. The first two letters either indicate 'st' for student questionnaire, 'it' for the information technology questionnaire, or 'sc' for the school questionnaire. The first two digits then stand for the number of the general issue, and 'qXX' for the related single question. The following variables have already been derived and computed by the issuing institution: *wleread*, *hisei*, *nsib*, *miscedu*, *fiscedu*, *stratio*, *tothrs* and are already part of the dataset. More information on the construction of these variables can be obtained from the issuing institution at http://www.sidos.ch/data/projects/pisa/ (13.04.2004). Base categories are schools in small towns (15,000 to 100,000 inhabitants), a low parental income (*hisei1*: below 28 index points), a high but not tertiary education of parents (*misced* = 4 or 5, *fisced* = 4 or 5).

Table A.5: Indices of Direct Democracy for the Year 2000

	VIR	GIR	GRR	FRR	Direct Democracy
Zürich	3.333	3.333	3.333	4.000	3.500
Bern	2.667	2.667	3.000	3.750	3.021
Luzern	4.667	5.333	3.667	4.000	4.417
Uri	5.333	5.333	5.333	4.500	5.125
Schwyz	5.333	5.333	4.667	4.375	4.927
Obwalden	5.333	5.333	4.333	3.500	4.625
Nidwalden	4.000	4.333	4.667	4.750	4.438
Glarus	6.000	6.000	6.000	5.000	5.750
Zug	5.000	5.000	3.667	4.000	4.417
Freiburg	3.000	3.000	2.667	2.500	2.792
Solothurn	5.333	5.333	5.333	5.000	5.250
Basel-Stadt	4.667	4.667	4.000	4.250	4.396
Basel-Land	6.000	6.000	5..167	4.750	5.479
Schaffhausen	5.333	5.333	5.167	5.000	5.208
Appenzell Ausserrhoden	6.000	6.000	6.000	4.000	5.500
Appenzell Innerrhoden	6.000	6.000	6.000	3.750	5.438
St. Gallen	3.333	4.000	3.000	3.500	3.458
Graubünden	4.333	5.000	6.000	4.000	4.833
Aargau	5.667	5.667	6.000	4.500	5.458
Thurgau	4.000	4.000	4.333	5.000	4.333
Tessin	1.333	2.667	2.000	3.000	2.250
Waadt	2.333	2.667	2.000	3.000	2.500
Wallis	4.333	5.000	4.000	1.000	3.583
Neuenburg	2.667	2.667	1.667	1.750	2.188
Genf	2.000	2.000	2.000	1.000	1.750
Jura	4.667	4.667	3.000	2.500	3.708

VIR indicates index of constitutional initiative, GIR index of statutory initiative, GRR index of statutory referendum, and FRR index of fiscal referendum, respectively. Swiss cantons appear in so-called historical sequence and in German denomination.

Table A.6: Descriptive Statistics

Variable	Obs	Mean	SD	Min	Max
Full sample	11781	500.6531	89.52575	23.89	884.49
National sample	7979	498.2971	92.53197	27.60	884.49
Reduced form sample	3411	534.2979	77.08092	98.22	812.88
Structural form sample	2969	535.5002	76.71042	166.01	812.88

Table A.7: Distribution of Observations in Swiss Cantons

Canton	Reduced model	Structural model	Complete dataset (French & national sample)
Zürich	157	134	1102
Bern	364	332	1062
Luzern	63	54	256
Uri	-	-	-
Schwyz	25	25	109
Obwalden	18	18	120
Nidwalden	-	-	39
Glarus	8	8	20
Zug	11	11	78
Freiburg	567	510	998
Solothurn	18	18	113
Basel-Stadt	42	41	173
Basel-Land	50	26	200
Schaffhausen	-	-	46
Appenzell Ausserrhoden	-	-	27
Appenzell Innerrhoden	-	-	-
St. Gallen	370	240	1061
Graubünden	20	20	155
Aargau	210	167	470
Thurgau	62	50	207
Tessin	-	-	903
Waadt	220	204	1101
Wallis	350	346	1046
Neuenburg	362	362	869
Genf	319	228	919
Jura	175	175	722
Students in German-speaking cantons	1418	1144	5126
Students in French-speaking cantons	1993	1825	5655
Sum	3411	2969	11796

Table A.8: Determinants of Educational Spending in Swiss Cantons, Outliers Excluded, 1980 – 1998

Variable	Coefficient	t-value
Direct democracy	-0.056**	-2.75
Cantons with Italian or French main language	-0.087	-1.62
Fiscal decentralization	-0.420***	-5.11
Tax competition	-0.058	-1.35
Log of lumpsum transfers	0.025	0.69
Constitutional constraint (fiscal break)	0.005	0.54
Conservative ideology of government	-0.141*	-2.48
Log of national income	0.158 (*)	1.95
Urbanization	0.242***	3.40
Log of cantonal population	0.016	0.93
Share of young people	-0.013	-1.51
Share of old people	-0.024***	-3.39
Constant	6.863***	5.82
Adjusted R^2	0.83	
F-statistic	83.64	
Jarque-Bera test	4.52	
Observations	491	

2SLS estimation with Newey-West standard errors. ***indicates significance at the 0.1% level, **at the 1% level, *at the 5% level and (*)at the 10% level, respectively. Estimation with year dummies.

TABLES

Table 1: Determinants of Educational Spending in Swiss Cantons, 1980 – 1998

Variable	Coefficient	t-value
Direct democracy	-0.054**	-2.65
Cantons with Italian or French main language	-0.078	-1.43
Fiscal decentralization	-0.440***	-5.04
Tax competition	-0.052	-1.17
Log of lumpsum transfers	0.028	0.78
Constitutional constraint (fiscal break)	0.003	0.36
Conservative ideology of government	-0.138 *	-2.35
Log of national income	0.157 (*)	1.92
Urbanization	0.238***	3.31
Log of cantonal population	0.018	1.06
Share of young people	-0.012	-1.39
Share of old people	-0.024**	-3.26
Constant	6.802***	5.72
Adjusted R^2	0.83	
F-statistic	80.280	
Jarque-Bera test	7.161*	
Observations	494	

2SLS estimation with Newey-West standard errors. ***indicates significance at the 0.1% level, **at the 1% level, *at the 5% level and (*)at the 10% level, respectively. Estimation with year dummies.

FIGURES

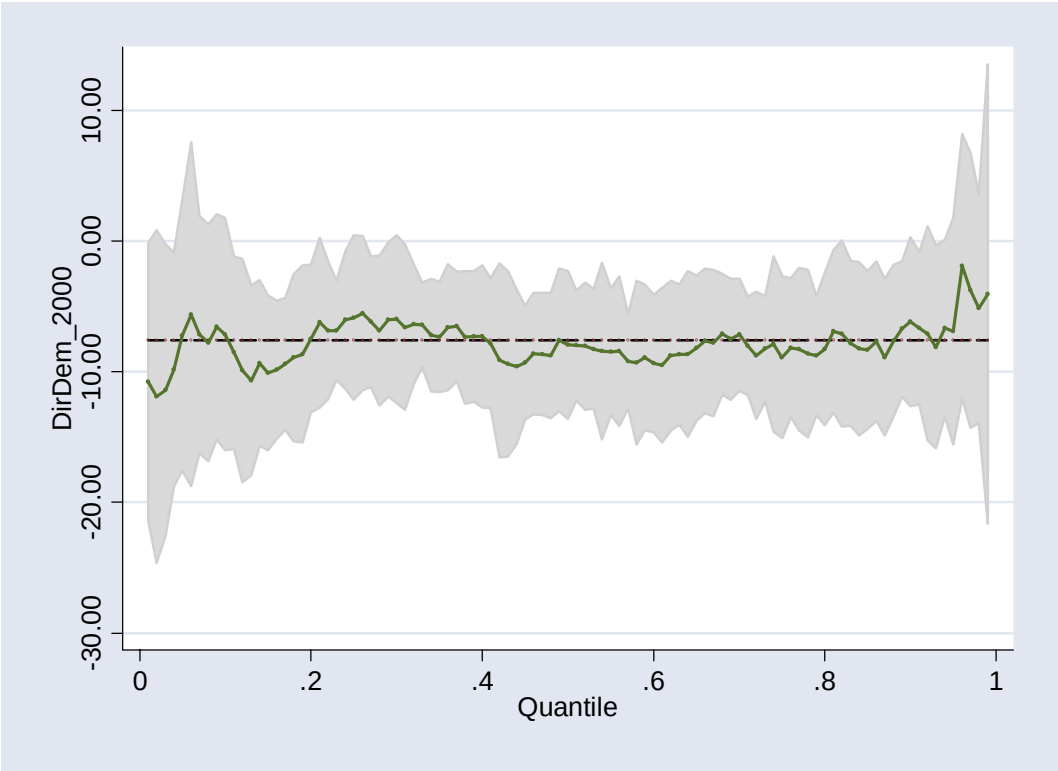

Figure 1: Index of Direct Democracy: Reduced Form

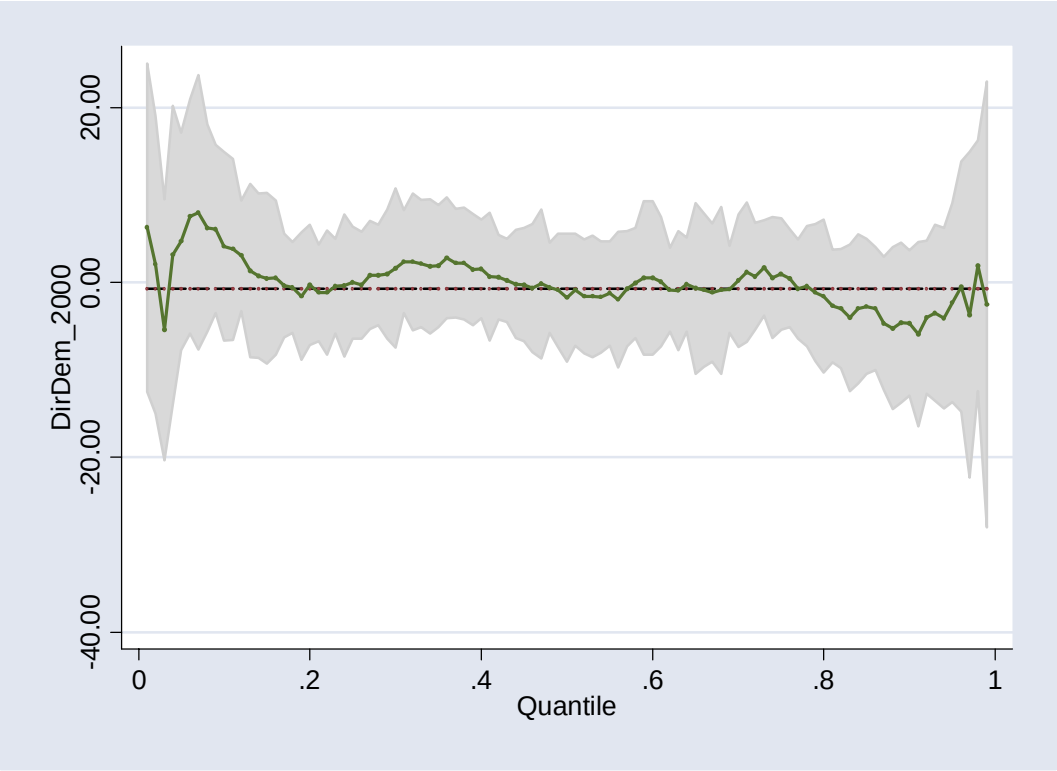

Figure 2: Index of Direct Democracy: Structural Form