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Abstract

Demographic change in industrial countries will influence educational spending in potentially two ways. On the one hand, the decline in the number of school-age children should alleviate the financial pressure. On the other hand, the theoretical/empirical literature has established that the concomitantly increasing proportion of elderly in the population can influence the propensity of politicians to spend on education. Using a panel of the Swiss Cantons for the period from 1990 to 2002, we find that the education system has exhibited little elasticity in adjusting to changes in the school-age population, and that the share of the elderly population has a significantly negative influence on the willingness to spend on public education.

JEL Code: H72, I22, J18.

Keywords: public finance, education finance, demographics, panel estimates, Switzerland.

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Introduction

Like most other industrialized countries, Switzerland is in the midst of profound demographic change. Its stagnating and soon shrinking residential population will also lead to a declining number of school-age children. The effects of the decline in the number of pupils on education finance are therefore of interest. Two known effects from the theoretical and empirical literature will be specifically analyzed. First, the response of the education system to a decline in the student population is analyzed, i.e. as to whether a proportional decline in education spending can be expected given a decline in the school-age population. The hope has been expressed in educational policy-making circles that this (expected) relief on education budgets might be utilized to finance greater spending on other areas of the education system. Secondly, we analyze whether the trend of an increasing elderly population (almost parallel to the shrinking school-age population) does not have a negative influence on the willingness of the general public to spend money on public education. The preferences and needs of the older population differ in comparison with the younger population so the existence of such an effect could certainly be conjectured.

Empirically, this study makes use of the fact that Switzerland consists of 26 Cantons empowered with the political authority to organize and operate their particular system of education and that the Cantons also provide most of the financing for their Cantonal education systems. Similar to US studies, this set of data is suitable for conducting empirical analyses over a relatively short period of time because panel estimates permit a sufficiently high number of observations to be made.

The paper is organized as follows: Section 1 gives some basic information on the demographic situation in Switzerland. Section 2 provides a brief overview of the current theoretical and empirical literature from economic and political science literature that can be referred to for comparative purposes. The third section deduces the hypotheses and issues that merit further analysis. The data used is presented in the next section and section 5 shows the empirical evaluations of the data. The sixth section presents the estimated effects of the results on education finance during the next ten years. The conclusions drawn in regards to education policy are given in the final section.

Demographic change in Switzerland and its consequences for the education system

The ongoing demographic change is primarily distinguished by two aspects that are relevant to the present paper. First, the growth rate of the Swiss population, which more than doubled between 1900 and 2000, has slowed substantially in recent years, notwithstanding a sustained inflow of immigrants. According to demographic projections, Switzerland's population will shrink during the coming decades.

This slowdown in population growth is mainly attributable to significantly lower birth rates. In 1960 women in Switzerland had an average of 2.44 children; in 2002 this had declined to 1.39.

Secondly, the demographic pyramid has been deprived of its base owing to the lower birth rates, i.e. the number of young people is shrinking more quickly than the general population. At the top of the pyramid, however, the population is growing, not least due to the steady increase in life expectancy. The average life expectancy of Swiss men and women has risen to 77.9 and 83 years, respectively, over the past 50 years. At the beginning of the last century more than 40% of the population was younger than 20 and only about 6% was older than the current retirement age, whereas today these two segments of the population have shifted to such an extent that the under 20 year-olds now account for 22% of the total population and approximately one-sixth of the population is older than 65.

In summary, demographic change in Switzerland is leading to a declining absolute number of young people and a consequential shift in the age structure of the residential population, in which the share of the population that has reached or passed retirement age has the most rapid growth.

In view of the ongoing demographic development, the declining number of young people obviously has a direct effect on the education system. The compulsory primary and secondary levels of education (the first nine years of school) is already affected by these changes and the decline in the number of school-age children will accelerate in the coming years. The next level to be affected will be the non-compulsory upper secondary level of education (*Sekundarstufe II*). At these two levels, the decline in the number of students cannot realistically be compensated for by increasing the schooling rate. Even at the non-compulsory upper secondary level of education, the schooling rate of the current cohorts is almost 90%. At the tertiary level, predictions are somewhat more difficult to make because there is still some potential for increasing participation due to the still relatively low percentage of academics in the population compared to other countries. This may serve to compensate for some of the decline in the number of young people.¹

This paper examines only the compulsory education level because, on the one hand, this level is already affected by a declining number of pupils and, on the other hand, because it will experience the greatest decline in pupils during the coming ten years. Another reason is the data on education finance pertaining to the basic primary and secondary levels is the relatively best qualitative data on the Swiss education system and therefore a limitation to the period of compulsory education is appropriate.

¹ The EU (EU Economic Policy Committee 2003, pp. 15-16) projects that the demographic savings in the basic primary and secondary school levels will be offset by increasing participation at the upper secondary and tertiary levels of education.

Overview of the literature

The literature on the issue of the effects of demographic change on education finance can be divided into two groups. The first group analyzes how educational spending varies in response to a change in the number of pupils, while the second group specifically examines the potential competition between the elderly and younger segments of the population for public financial resources. Demographic change gives rise to such competition because the relative weightings of these age groups will undergo a fundamental shift in favor of the elderly age group as the demographic transition runs its course.

Reactions in terms of educational production

The educational system is slow to adapt cyclical fluctuations in school-going population, as has been observed time and again.² A typical indicator of this phenomenon in the educational system can be seen with regard to fluctuations in class sizes. In response to fluctuating numbers of pupils, the existing input factors (in this case, the number of teachers) are initially held constant as long as possible while the number of pupils per teacher increases or decreases. To a certain extent, this delay in adapting to changes in pupil numbers makes sound economic sense. The key input factors in the educational system, i.e., teachers and school buildings, cannot adapt quickly to short-term fluctuations without major expense. Buildings that meet the specific needs of pupils cannot be sold or purchased overnight. As far as the teacher component is concerned, teachers are specialist employees who have completed a long period of training and cannot easily be integrated into other sectors and professions in the broader economy. This means that a short-term increase in demand for teachers can only be accommodated in the medium-term by training new people or headhunting on the job market. Nor is firing teachers a useful reaction in response to a decline in the number of pupils; it would be difficult to re-recruit the dismissed teachers at short notice when demand for educators rises again. The associated inelastic adaptation processes with regard to the input factors was shown for instance by Baum & Seitz (2003) in their analysis of educational spending by western German federal states. These investigations showed that human resource spending in the educational system (most of which goes to pay teachers' salaries) shows little response to demographic changes. This inelasticity (corroborated by Kemkes & Seitz 2005) may be fiscally welcome when school-age populations are growing but, by the same token, the potential to reduce spending is lost when schoolgoer numbers decline for structural reasons.

In addition to these inelasticities pertaining to the input factors in educational production, there is empirical evidence indicating that there is indeed a tendency (see for example Falch & Rattso 1996) to re-channel the resources freed up by a declining school-age population for consumption elsewhere in the educational system. This automatically increases the overall cost of education per pupil, which – if looking at the scant literature demonstrating a positive correlation

² Hanushek & Rifkin (1997)'s calculations for the USA show for instance that the number of school-age children in that country declined by five million in the period from 1970 to 1990, while educational spending did not decline despite a shortage of public funds, automatically resulting in a steady increase in spending per student.

between school resources and student performance³ – generally serves to promote further inefficiencies in the educational system.

Competition for public funds

Compulsory schooling in Switzerland is funded almost entirely from the public purse, so spending is subject to a democratic decision-making process. The amount of funding allocated to the public sector is not the only decision of relevance. A perhaps more interesting issue is the distribution process determining the percentage of public funding allocated for particular purposes. Unlike the situation in other countries, Switzerland's tradition of direct democracy allows enfranchised citizens to vote on specific items of the public budget.

More than a decade's worth of theoretical and empirical literature has been published on the potential conflict between older and younger sectors of the population with regard to the allocation of public funds (see South 1991 or Hoyt & Toma 1993 in the early 90s). Poterba (1996, 1997 & 1998) pointed out very early however that this relationship is so complex that theoretical models are not a reliable basis for accurate outcome prediction (see also Gradstein & Kaganovich 2003).

Based on the assumption that a voter in a democratic decision-making process is likely to try and push his or her own interests, it would seem logical to guess that a continuous increase in the age of the median voter would tend to have a negative impact on education finance. This model of course assumes that the various generations involved in the decision-making process will each act based on total self-interest and differ in their preferences. The higher number of voters that stand to gain no direct (and short-term) benefit from educating the younger generation would, therefore, prefer to use public funds for purposes other than education.

The fact that the median voter is getting older and is very likely to have preferences differing from those of young parents, for instance, does not necessarily mean however that spending on education will suffer. The literature provides four main reasons why an aging population does not necessarily result in a reduction in the average spending per pupil:

- (1) The existence of positive intergenerational externalities might produce an effect whereby the older population has a stake in a well-educated population whose higher productivity is essential in financing transfer benefits (old age pension, healthcare system, etc.), the greatest beneficiaries of which are the elderly.⁴ This primary argument is based on the rationale that even a purely

³ A large empirical database in economics of education exists, from Hanushek (1986), Card & Krueger (1996) to Wössmann (2003).

⁴ Social returns from individual educational investments are not even absolutely necessary. It is sufficient to have a generation contract in the pension system whereby pensions received by the retired population from the employed population are consciously or implicitly co-determined by the economic performance of the employed population.

egoistical voter will not tend to lower spending on education because that would undermine his or her own interests. This line of argument assumes that the median voter both understands this relationship and that his actions are not solely based on thoughts of short-term gain.⁵ However, the latter is a strong argument against this view considering that older voters are more likely to be interested in the short-term rather than the long-term consequences of their behavior, given their shorter life expectancy.

- (2) If there is a kind of intergenerational altruism that more or less ensures that older people feel bound by a generational contract, the elderly would enable the young generation to enjoy the same funding that was afforded to themselves during their own youth. The only question here is the particular variable to which this solidarity would apply: per capita educational spending or educational spending per pupil (see also Argument 4)?
- (3) US studies in particular indicate a positive correlation between the quality of schooling and housing prices.⁶ On the basis of this frequently observed relationship, it might be assumed that older citizens (many of whom are property owners) would try to maintain the value of their property by supporting spending on education. This argument is based on the circumstance that the today's property market is dominated by newcomers to an area, who are likely to have school-age children and therefore be prepared to pay higher property prices in order to secure a higher-quality education for their offspring. It is uncertain whether this argument will continue to apply in future, when, due to demographic aging, more and more potential homebuyers will not have school-age children and will therefore not take the quality of the local schools into consideration when deciding where to buy a new home.
- (4) Finally, there is also a line of reasoning based on the argument that the elderly population is not usually interested in how much is spent per pupil, being more interested in how much is spent on the educational system in general. It is possible that the elderly population would accept a rise in the amount spent per pupil. In this context it is conceivable that there would still be sufficient financial resources available to satisfy the interests of the elderly population because the sums spent on education would be on the decline in any case due to the decline in the numbers of pupils. However, the sharp increase in public interest in the economic efficiency of education over the past few years and the increased criticism levied at the high level of spending (per pupil) would tend to go against this argument.

⁵ Konrad (1995) and Kemnitz (1999 & 2000) put forward this argument, for example.

⁶ Harris et al. (2001) use this argument to explain their empirical results, which identified a negative impact of the number of senior citizens on educational spending at State-level but no negative impact on local (County) educational spending. Declining spending at local level would have more of a negative impact on property prices than spending at State-level. Harris et al. (2001) uses this argument to try and reconcile the different results of Poterba (1998) and Ladd & Murray (2001). The same distinction between local and State-level spending is used also by Baldson & Brunner (2003).

Another potential area of rivalry exists between various interest groups whose differences are not necessarily based on age. Baum and Seitz (2003), for instance, investigated the hypothesis that increased social welfare spending competes with spending on education. The assumption is that, when public finances are strained, a sharp increase in public spending in one area (due to unemployment or disability insurance payments, for example) automatically reduces the funds available for other areas of spending.

The empirical part of this paper evaluates also rivalries between various ethnic groups and the resulting impact on educational spending, which is an area of research that has been dealt with extensively in the US literature. Our analysis in this paper is based on the ratio of nationals to non-nationals among the residential population.

The following general conclusions can be derived from the available theoretical/empirical literature. Firstly, virtually all studies indicate that educational systems are slow to react to changes in the student population. This produces certain cost-containing benefits during periods of expansion, but no proportional reduction in educational spending in response to a structural decline in the numbers of incoming pupils. However, savings should still be possible even in the absence of a proportional decline in spending per individual schoolgoer. Nevertheless, some studies do show that some players in the educational system manage to retain these savings by spending the freed-up amounts elsewhere in the educational system. There need not necessarily be an increase in educational spending per head of the population, but the spending per pupil increases significantly as a result. It is uncertain therefore whether the potential savings on educational spending arising out of declining numbers of pupils will actually be realized.

The impact the increasing percentage of seniors in a demographically aging society has on educational spending is unclear both in theory and based on observation. Authors basing their analyses on rational behavior of an (aging) median voter conclude from their assumptions that an aging society would not have a negative impact on educational spending. However, two assumptions are of essential importance in this line of argument. The first is that the median voter interprets the correlation between educational spending and his or her own personal benefit as meaning that a reduction in educational spending would also reduce his or her personal benefit. This means that it is assumed that the median voter sees a relationship between educational spending and the human capital stock available to an economy. However, the very existence of any such relationship is in fact controversial, even in economics of education. Secondly, it is also important to remember that, given the constant flow of public funds, the resources that are used for education will basically not be available for other government areas. In other words, the median voter will not say yes to educational spending unless the personal marginal benefit of spending on education is deemed to be greater than the marginal benefits derived from other government activities.

Previous Swiss studies

Related studies conducted in Switzerland to date dealt primarily with the disposition of total public spending, i.e. spending on education was not always the main focus of the respective analyses. Most of the exogenous variables studied were variables associated with the political process. Vatter & Freitag (2002), Freitag & Bühlemann (2003) and Schaltegger & Feld (2004) mainly studied the impact of federalism, concordance and direct democracy on public spending. Demographic influences received very little attention in these analyses. The authors also based the framework of their analysis of factors determining educational spending on the factors determining society's willingness to pay for education. Hence, per capita public spending on education was defined as a dependent variable. This analysis almost entirely neglects the fact that educational production develops its own dynamics to a certain extent. This means that educational spending is determined not only by political decision-making processes concerning the quantity and use of public funds, but is also affected by the characteristics of the school children and the educational production environment (e.g., also through the impact of teachers' unions, etc.). For this reason (cf. next section), both total spending on the educational system and average spending per pupil are construed as dependent variables in this paper.

Hypotheses, objectives and methods

The previous section showed that many of the issues pertaining to the determination of educational spending cannot be answered in theory but only on the basis of empirical observation, if indeed at all. It is therefore impossible to formulate definite, clear-cut hypotheses on the relationships and interactions between individual variables and educational spending.

Objectives

There are two key issues in this paper, as already mentioned. The first issue of interest is to establish how educational spending is going to respond to declining numbers of school-age children in the wake of demographic change. The second issue of interest is whether the concomitant increase in the percentage of retired people will affect society's willingness to spend money on education. As a basis for empirical investigation of these two issues, four groups of variables will be used in the models to be estimated. The purpose of these four groups of variables is to enable an analysis of the effect of pupil numbers and percentage of the elderly population on educational spending controlling for variables that also have an effect on educational spending. The four groups of exogenous variables are as follows:

The first assumption is that the composition of the population in a Canton has an impact on educational spending. Both composition in terms of age, and composition in terms of country of origin of the residents are taken into account. As already mentioned, the effect of the percentage of seniors on educational spending is unclear and may go either way. Nor is it easy to determine the effect of the percentage of non-nationals on educational spending. The US studies in the literature often argue (and confirmatory data is provided in some cases; see for

example Alesina et al. 1999) that a high percentage of non-whites in the population has a negative impact on educational spending because the white population is less keen to spend in this situation. On the other hand, we know that in Switzerland a high percentage of non-national pupils (most of whom have other mother tongues) leads to an increase in educational spending because these young people have a greater need for supplementary educational offerings. On the one hand, therefore, it is possible that the national population may be unwilling to allocate the same public resources to the non-national (non-voting, non-electable) population; on the other hand, we know that non-national pupils trigger higher investment in education from an educational production viewpoint. We would therefore tend to assume (in contrast to the US data) that a high percentage of non-nationals in the residential population would tend to increase educational spending.

Based on this hypothesis, we used an additional variable inspired by Poterba (1996). This variable subtracts the over-65 (retired) non-national population from the under-17 (school-age) percentage of the non-national population. The principle behind this variable is that, the higher it is, then the greater the concentration of school-age young people in the non-national population. As such, one would expect to see a decline in the trend toward high educational spending among the domestic population (or, with reference to the US, the white population). However, it is important to take into account the fact that this “heterogeneity” variable correlates closely with the variable regarding the percentage of non-nationals in the residential population (0.74). Nevertheless, the model is useful for investigating whether the percentage of non-nationals is the sole relevant factor or whether the age mix is also of relevance.

Second, our estimations control for differences in the parliamentary structures in the various Cantons. Our choice of variables is based on political science literature. As with the other variables, the direction of the effect of these variables on educational spending is definite in very few cases.

The government structure variables on the Cantonal level are the number of ruling political parties and their strength (based on the percentage of votes received in recent elections). There is virtually no correlation between the two variables, i.e., the cumulative percent of the vote obtained by the ruling parties is not affected by the number of parties participating in the government. It is assumed that governments comprising multiple parties must accommodate diverse interests (consensus decisions) and therefore are more likely to have large state budgets (see Freitag & Bühlmann 2003). It is unclear however whether the trend toward high public spending must automatically result in more being spent on education. It is by all means possible that accommodating multiple interests might lead to a situation where the item traditionally accorded the greatest importance (education) is used more frequently as a compensating variable in Cantonal budgets, with the result that consensus governments would tend to spend less on education in absolute terms. Furthermore, it is not clear from the outset whether strong governments (as measured by their percent of the vote) are prepared to spend more or less money on education.

Thirdly, the financial resources of the Cantons are included in the analysis. It is assumed that there is positive income elasticity with regard to spending on

education, i.e., richer Cantons will spend more on education for the simple reason that they have greater tax revenues. A Canton's economic status is expressed in the per capita gross domestic product.

Fourthly, our analysis controls for three variables that are commonly used in similar empirical literature. The unemployment rate in a Canton is used as a marker for potential competition between educational spending and other public spending on social welfare. A high unemployment rate would therefore be expected to constrain spending on education. The percentage of students attending the academic track (*Gymnasium*) in upper secondary level of education is also taken into account. We use this control variable to verify whether Cantons with a high percentage of students attending the academic track in upper secondary level of education would for that reason already spend more at the lower secondary level of education (*Sekundarstufe I*).⁷ Finally, our analysis also controls for a Canton's average degree of urbanicity. This variable can be used to express various interactions that are difficult to explain later with a single specific hypothesis. Although urban centers are associated with lower spending on education because of their typically efficient school and class size, they may also be expected to spend more on education for other reasons. The main such reason is the parents' educational background, which is higher in urban centers than in rural areas. This is due among other things to the fact that the diversity of education available at the upper levels of schooling is better developed in urban centers, which in turn influences highly qualified parents in their choice of address. Hence, it is legitimate to assume that parents in urban areas have both higher educational aspirations and a greater appreciation of the rewards a good education brings. This, in turn, suggests that the median voter in an urban center will have and assert a greater preference for allocating funds to education.

Methods

The empirical part below contains panel estimates that take advantage of the fact that authority for education rests with the individual Cantons. This circumstance coupled with a fairly high degree of Cantonal freedom in fiscal policy affairs suggests that Cantons are at liberty to independently decide how much they want to spend on the educational system. This allows us to investigate changes in educational spending not only as a function of time but also as a cross-section of the individual Cantons. As in the USA, this enables the observer to estimate structural and institutional effects within a fairly narrow time window on the basis of a large number of observations. 26 Cantons over a period of 13 years (1990-2002) gives a panel of 338 observations. The estimates include dummy variables to represent *fixed* effects for all Cantons and all years of observation.

The first panel models using average spending per pupil as a dependent variable estimate effects on the amount spent both in cross-section and longitudinally per pupil. This type of estimation helps to identify the factors that impact on how much an education system is willing or able to spend per pupil. However, a different model is employed to investigate how changes in the numbers of pupils

⁷ A disadvantage of this variable was that the relevant data was missing for one canton. Nevertheless, calculations using this variable were carried out for the remaining 25 cantons. The variable proved non-significant, however, prompting a decision not to include this variable in the empirical data shown.

and in the number of retired people impact total spending on education. To obtain a clearer picture of the demographic factors influencing spending on education, we use a model specifying all variables as *first differences*. The differences in each case refer to a three-year interval. An interval of three years is recommended because (as argued by Baum & Seit 2003) annual changes would not reveal large enough variations in the data. An interval longer than three years is unsuitable too because the number of observations would be greatly reduced. The first difference model leaves four observation points with 26 Cantons in each case, resulting in a maximum number of 104 observations. The individual periods of time are used as dummy variables for fixed effects in the first difference models.

Data specifications

Dependent variables (spending on education)

When specifying the dependent variables, a number of decisions were necessary that automatically mean that the present study is comparable with the Swiss papers cited in the foregoing to a limited extent only. For instance, the method used to calculate educational spending is not fully standardized and identical in all Cantons.⁸ To maximize comparability as far as possible, three limitations were introduced: Firstly, educational spending was analyzed only for the compulsory school level (primary and lower secondary schools). This data displays the highest degree of comparability between the Cantons, and structural differences can be offset to a large extent on the basis of the use of fixed effects for each individual Canton. Furthermore, limiting the data to the compulsory school level makes it easier to interpret the results, as there is no need to take account of the different educational system structures between the various Cantons at the upper secondary level of education and at the tertiary level.⁹ Secondly, the total current expenditure of the Canton and the local governments for the primary and lower secondary schools was calculated without investment expenditures. Investment expenditure profiles are too erratic to be compared in any meaningful sense as a function of time and between the Cantons. Thirdly, we limited ourselves to the post-1990 period while the cited older Swiss studies also included the 1980s in their analysis. A shorter observation period was chosen for two main reasons. Firstly, the comparability and quality of pre-1990 data are fairly poor because it is impossible to distinguish between current expenditure and capital spending in the period before 1990. Furthermore, the demographic profile in the 1980s was not yet characterized by an aging society and declining numbers of school-age children; instead, the 1980s figures reflect vigorous immigration. As a result, the 1980s would not be representative for the subsequent period thereafter. The

⁸ The figures are from the Swiss Federal Department of Finance. Minor adjustments were made to the data from two cantons because specific deviations in the data generation methods would have compromised comparison with the other cantons.

⁹ Educational systems differ greatly between the individual cantons at upper secondary level of education in terms of their structure and specializations, for example as regards the design and uptake of vocational training vs. general education specializations. These different forms and educational traditions are in some cases a matter of different cultures. They are cost-relevant and difficult to offset using dummy variables. At the tertiary level, very different traditions between the cantons with regard to universities, institutes of technology, universities of applied sciences and teacher training colleges would have to have been taken into account.

advantage of 1990-2002 as an observation period, in comparison, is that our analysis can integrate both a period characterized by rising numbers of school-age children and the start of a period marked by declining numbers of pupils.

Ladd & Murray (2001) criticized Poterba's empirical studies (1998) by saying that the latter applied his data at State-level and asserting that investigations at the lower government level (County-level) would have produced different results. Education spending figures at local government level would only have been available on an aggregate basis in our study. Therefore, analysis at municipal government level would not have been possible even if it had been desired. This limitation is not a fundamental problem in the current case, however. Although the specific decision-making processes differ from Canton to Canton, it is legitimate to assume, for the sake of simplification, that most decisions relating to educational spending are made on a Cantonal level and are merely implemented at municipal government level. Hence, the Cantons would be the right level of aggregation for analysis in Switzerland's case.

Independent variables

Unless otherwise stated, all data is taken from official Swiss Federal Statistical Office figures. Other sources had to be used for the variables pertaining to the political system, however.¹⁰ Other data of the kind included in some other studies, such as the Local Government Autonomy Index, were not used if the data was generated only once during the period of study or would not be meaningful at the Cantonal level of aggregation. In such cases, the variables would point to politically based structural differences between the Cantons but there would be no likely specific correlation with the dependent variables analyzed here.

The degree of urbanicity was calculated from census data from 1990 and 2000. The values between 1990 and 2000 were determined by linear extrapolation.

The variable "strength of governing parties" was defined as the percent of the vote obtained by the governing political parties in Cantonal government elections.

Empirical results

Determination of spending on education per student

The first step is to estimate factors determining average spending on education for a child of compulsory school age. Model 1 includes all independent variables while model 2 contains only the significant variables from the first estimation.

The results show that the percent of retired people of the population has a negative impact on average spending on education per pupil, albeit only at a 10% level of significance. The percentage of non-nationals among the residential population, the national income by Canton and per capita, and degree of urbanicity correlate positively with spending, however. In other words, the analysis shows that, in contrast to certain US studies, a large number of non-

¹⁰ The figures pertaining to percents of the vote and numbers of governing parties are taken from various issues of the publication entitled "Année Politique Suisse".

national pupils¹¹ results in more being spent on education per pupil. This is probably due to higher spending on integration. Integration costs are particularly high among children with a different mother tongue and among children whose parents have low educational qualifications. Because of Switzerland's past migration policy migrants with low educational qualifications had been the preferred immigrants for a long period of time. The positive income elasticity shows that richer Cantons also spend more on education per pupil. Our figures do not reveal whether this outcome is due only to structural differences between the Cantons or whether the same result would emerge in the case of changes in Cantonal income in one particular Canton. Given that Cantonal income is no longer significant in the first-difference model, this effect is probably attributable to higher overall prices and incomes in the richer Cantons. What can be concluded without doubt is that the input prices in the educational process are reflected in higher spending on education in rich Cantons, but there is no hard evidence that more inputs are invested in quantitative terms.

*Table 1: Determination of educational spending per pupil (1990-2002)
Dependent variable: educational spending per pupil (log)
Panel estimations (generalized least squares)*

Independent variables	<i>Model 1</i>		<i>Model 2</i>	
	Coefficient	Std. Err.	Coefficient	Std. Err.
Percentage of retired	-0.0145*	0.0081	-0.0141*	0.0082
Percentage of non-nationals	0.0376***	0.0084	0.0326***	0.0062
Per capita Cantonal income	0.0021**	0.0009	0.0021**	0.0009
Unemployment rate	0.0009	0.0036		
Degree of urbanicity	0.0028**	0.0012	0.0026**	0.0012
No. of governing parties	-0.0120*	0.0068	-0.0118**	0.0060
Strength of governing parties	0.0000	0.0004		
Heterogeneity of the population	-0.0033	0.0043		
National language (1=German)	-0.0997	0.0915		
No. of observations	338		338	
Log likelihood	745.95		748.36	
Autocorrelation (AR1 term)	0.5957		0.6219	

*, **, *** stand for levels of significance of 10, 5 and 1%, respectively. All estimates estimated with fixed effects for Cantons and years. Panel estimates control for heteroscedasticity and serial autocorrelation. Per capita Cantonal income in CHF 1,000.

¹¹ The percentage of non-national school children correlates very closely with the non-national residential population (0.94). Non-national residential population was included in the calculations to ensure that the same variables are used in both models, i.e. also in the first difference model. It would not have been possible to use the percentage of non-national school children in the first difference model because this number would have been multicollinear to the overall number of school children. Calculations based on the percentage of non-national pupils produce qualitatively identical results to those obtained using the non-national residential population as the variable in determining average spending per pupil.

While the strength of the governing parties seems to have no effect on educational spending, the number of governing parties has a negative effect.¹² In keeping with the hypothesis as formulated, this means that a greater compulsion toward achieving consensus solutions and hence accommodating the interests of many particular interests has a negative effect on the educational budget above all else.

Determining changes in overall spending on education

Our second model uses a panel with first differences. All variables are included in the regression in the analysis of absolute change between year t and t_3 . This form of analysis should be particularly suitable for estimating how spending on education reacts in response to demographic changes. The results show only the coefficients of the significant variables. A dummy was used as a control variable for the Canton of Geneva, which was significant in all calculations. The other Canton dummies were also tested but were not statistically significant. Inclusion of the dummy for the Canton of Geneva has no appreciable effect on the other coefficients, however. Furthermore, one observation was excluded from the calculations¹³ because it was an obvious outlier with no apparent explanation.

Table 2: Determination of changes in educational spending (1990-2002): Dependent variable: educational spending ($t_3 - t$) Panel estimations (generalized least squares)

Independent variables	Coefficient	Std. Err.	95% Conf. Interval	
Δ number of pupils	7181.24***	2179.25	2909.99	11452.5
Δ number of retirees	-4036.70***	1517.64	-7011.214	-1062.18
Δ number of non-nationals	3462.54***	764.22	1964.69	4960.39
Period 93-96	3014597	3244674		
Period 96-99	7795896***	3595090		
Period 99-02	1.21e+07***	3058338		
Canton Geneva	-4.13e+07***	8468780		
Number of observations	103			
Log likelihood	-1745.04			

*, **, *** stand for levels of significance of 10, 5 and 1%, respectively. Panel estimates control for heteroscedasticity.

¹² It is important to note that, although the percents of the vote correlated positively with average spending on education per pupil, they also correlated positively with Cantonal income per capita and the percent of non-nationals in the residential population. The results of the estimates should be interpreted thus: if Cantonal income per capita and the percent of non-nationals in the residential population are controlled for, the effect of the governing parties' percent of the vote is significantly negative.

¹³ This relates to a change in educational spending in the canton of Zurich from 1999 to 2002. Due to the 2002 observation, this variable takes on dimensions that can only be attributable to changes in the basis of calculation. This observation was excluded in order to avoid falsifying the estimates because of this outlier.

One pupil more or less raises or lowers educational spending by approximately CHF 7,200. Average spending on education in real terms during the period of observation was CHF 12,116¹⁴, however. In other words, the system is inelastic in its response to changes in the number of students. If the number of students declines, educational spending does not decline in proportion; the actual reduction is only approximately 60% of the average spending per pupil. A phenomenon that results in a lowering of the average cost per pupil when the number of pupils rises, because marginal cost is lower than average cost, proves to be a cost-driving element when the number of school-age children declines.

Forecasts

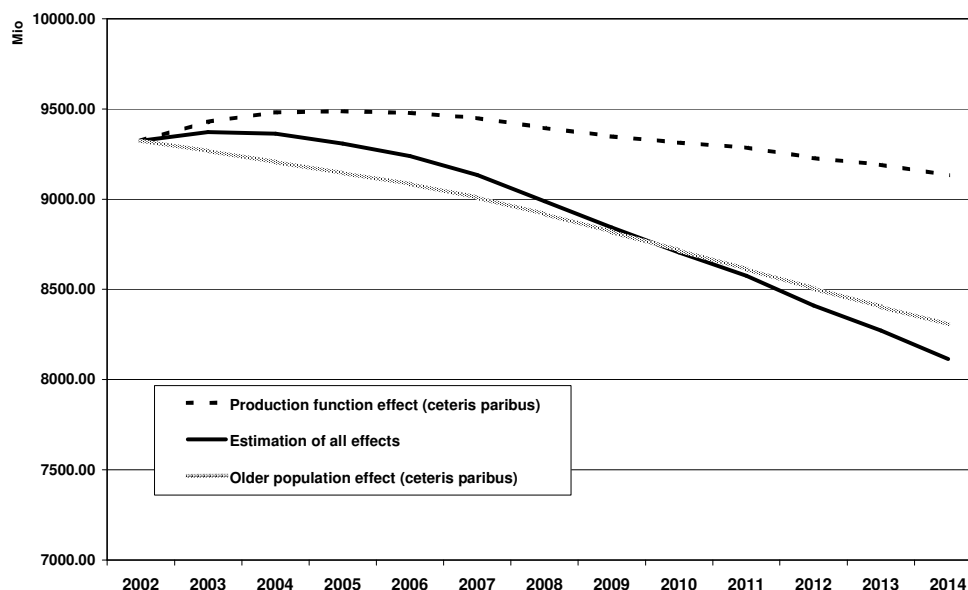
Any forecasts should admittedly be interpreted with caution on the basis of the panel calculations shown. They are intended more for the purposes of illustration than as a basis for precise predictions of future spending on education. The three significant factors influencing spending on education – number of students, percentage of non-nationals among the residential population, and percentage of retired people – all have the advantage of being represented in routine demographic scenarios presented by the Swiss Federal Statistical Office. We can therefore extrapolate figures for educational spending on the basis of these scenarios and the calculated coefficients up to the year 2014. Various calculations and conclusions can be achieved. An overall assessment of the model in Table 2 shows straight off that educational spending for the compulsory period of schooling is set to decline by more than 14% by 2014 in real terms from a high in 2004. The numbers of students (see Appendix) is set to decline by approximately the same level during the same period, i.e. the best forecast for the next ten years is a proportional decline in educational spending. This in itself is nothing spectacular. However, it is important to remember that this predicted decline is only partly due to reactions in the educational system itself; it is also partly due to the pressure exerted by an aging population on the educational budget. Estimates based on a *ceteris paribus* assumption (e.g., in this case assuming no change in the percentage of retired persons in the population as a whole) (see Graph 1) show that the reduction in spending on the basis of declining numbers of school-age children (mitigated by the increasing percent of non-nationals among the residential population) would be far short of a proportional decline. In other words, the educational system obviously saves much more due to the exogenous pressure on the educational budget than it would if it were to adapt to changes in the numbers of school-age children with the same (in)elasticity as in former years.

Interesting features are also brought to light by simulations whereby the average coefficients applicable to Switzerland are linked with Cantonal predictions for numbers of pupils, non-nationals and retirees. The appendix contains two projected forecasts for the Cantons of Berne and Zurich for illustrative purposes. Comparison of the two Cantons shows that Cantons (Zurich in this case) come under much greater pressure to adapt if the numbers of school-age children do not decline sharply during the forecast period while the percentage of seniors

¹⁴ The 95% confidence interval is also below the mean.

increases. In this instance, political pressure on the educational budget is likely to force educational policymakers and administrators to save even more money than might possibly have been saved by a proportional decline in spending. In other words, so much pressure will be brought to bear that the average cost per pupil must decline in response to that pressure. The logical conclusion is that Cantons with a very high percentage of seniors in relation to the decline in the number of pupils may see a disproportionate reduction in spending.

Graph 1: *Educational spending in Switzerland (forecast 2004-2014)*¹⁵



In contrast, the Canton of Berne can offset part of the budget pressure from the senior population thanks to a declining school-going population. However, in the same manner as for the total Swiss average, the Canton will be forced to cut costs on a proportional basis, i.e. to cut its current average amount of spending per pupil, which the Canton has probably not done in the past. The hope of budgetary relief through a decline in the school-age population, a so-called “demographic windfall” is hence unlikely to be realized.

Conclusions

The present paper estimated the factors exerting an influence on the average amount of educational spending per pupil and the changes in overall education finance over time by means of a panel of Swiss Cantons. There are, with respect to the study objectives, two advantages of the data set utilized. First, the system of

¹⁵ The production function effect keeps the number of retirees constant and only estimates the influence of the number of pupils and non-nationals on educational spending. The older population effect estimates educational spending with all other effects constant and the estimation of all effects considers the influence of all three exogenous variables.

fiscal and educational federalism in Switzerland allows panel estimates with numerous observations to be made, which, in turn, allows the influence of institutional factors and demographic patterns to be estimated quite well. Second, the period of observation (1990-2002) encompasses demographic patterns that can, at least in a basic sense, be considered representative of future patterns. The influence of an aging population and a declining number of school-age children can therefore be estimated based not only on the different proportions within the cross-section of the Cantons.

The key findings of the calculations are summarized as follows: Consistent with international evidence, educational spending exhibits a significantly inelastic response to variations in the number of pupils. This has a positive effect when the school-age population is growing yet is problematic during times of a structurally induced decline in the number of pupils. Nevertheless, it is *not* likely that educational spending will subside only very slowly in the future. This is because of the significant and highly negative influence of the elderly population on education budgets that has been observed. A possible explanation for the strong influence of elderly citizens on education finance in Switzerland – despite mixed international evidence on this issue – could be the fact that Swiss citizens have a considerable voice in how public funds are spent due to the country's deeply rooted tradition of direct democracy.

If the study findings are corroborated going forward, then the education system will be forced to make much deeper cuts in spending than it would have otherwise made voluntarily as judged by historical evidence. Furthermore, in some Cantons education finance is likely to decline not only in proportion to the decline in school-age children but at a proportionally slightly faster rate. In other words, even the average real amount of spending per student will have to be reduced. This will present the education system with completely new challenges. Up to now the education system's main problem was its inability to translate the increasing average amount of spending per pupil into overall greater efficiency. The absence of such correlation between resources and outputs led to structural efficiency problems within education systems, especially in highly developed countries. Now education systems will have to demonstrate, however, that they are capable of dealing with a reduction in resources without sacrificing efficiency. This will be no easy task for, just as more inputs do not automatically lead to more output, it is not certain whether a reduction in inputs will not be without consequences on output.

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Appendices

Descriptive statistics

Variables	Mean	SD	Minimum	Maximum
Spending on education in millions	330	355	17.6 (AI 90)	1720 (ZH 02)
Number of pupils	26,887	26,457	1,569 (AI 90)	108,573 (ZH 01)
Education spending per pupil	11,602	1,784	8,820 (UR 90)	19,777 (GE 90)
AHV pensioners (in %)	15.74	2.18	11.33 (ZG 90)	22.88 (BS 01)
Non-national residential population (in %)	17.11	6.52	6.07 (NW 90)	37.96 (GE 95)
Heterogeneity (in %)	14.26	6.06	1.40 (NW 90)	33.45 (BS 96)
Unemployment rate (in %)	2.70	1.88	0 (UR/AI 90)	7.8 (GE/TI 97)
Cantonal income per capita	44,898	10,148	28,887 (JU 95)	87,388 (BS 00)
Degree of urbanicity (in %)	58.56	30.80	0 (UR/OW/GL/AI)	100 (BS 90-02)
No. of ruling political parties	3.36	0.93	1 (AI 90-98)	5 (ZH 89-01, ZG 98-01, BS 89-95, VD 94-01, GE 97-00)
Strength of ruling political parties (in %)	82.97	9.98	50.6 (GE 93-96)	100 (UR 89-91/96-99, NW 98-01, ZG 98-01)

The abbreviations for the respective Cantons and the time period to which the data pertain are given in parentheses.

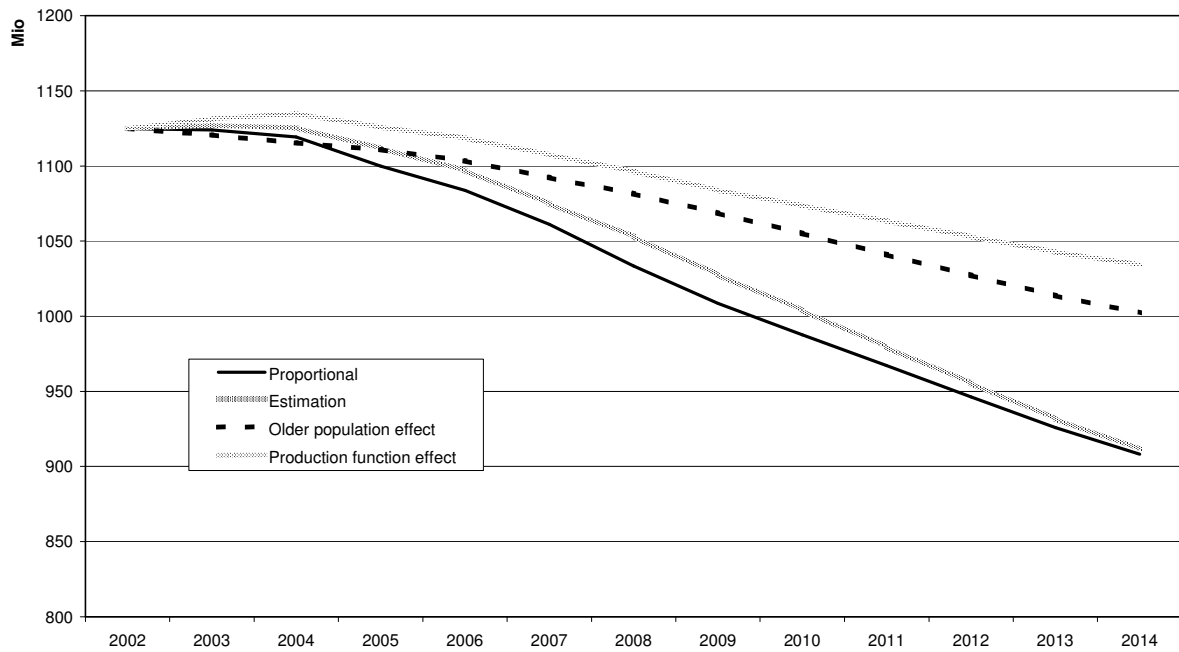
Descriptive statistics for the variables applied in the projections

Change from 2003-2014 in percent (Basis: 2003)				
	Mean*	Std. Dev.*	Minimum	Maximum
Number of pupils	-16.39	9.14	71.69 (SH)	105.06 (GE)
Over-65s	21.75	10.22	95.45 (BS)	147.28 (NW)
Non-national residential population	6.20	7.07	93.67 (UR)	123.57 (AI)
Values for the change in Switzerland:				
Number of pupils		-13.24		
Over-65s		6.47		
Non-national residential population		21.23		

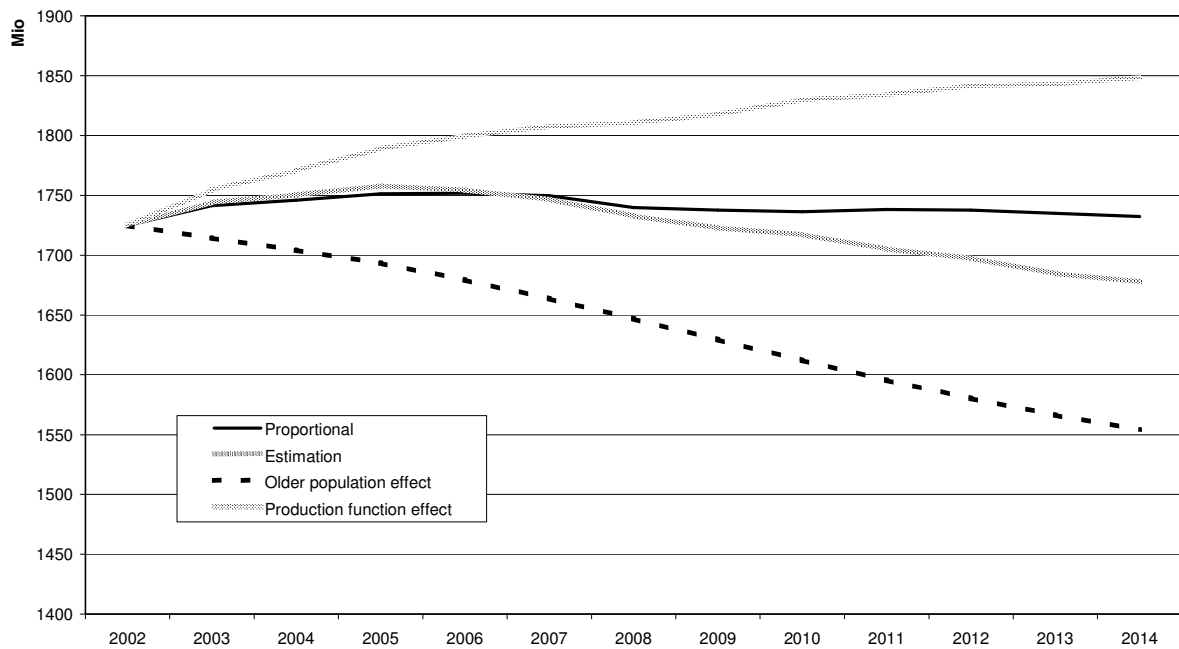
* These values correspond to the average values from the Cantonal readings.

Projections

Canton Berne



Canton Zurich



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