CREMA

Center for Research in Economics, Management and the Arts

Strategic Tax Competition in Switzerland: Evidence from a Panel of the Swiss Cantons

Lars P. Feld

Emmanuelle Reulier

Working Paper No. 2005 - 19

CREMA Gellertstrasse 24 CH - 4052 Basel www.crema-research.ch

Strategic Tax Competition in Switzerland: Evidence from a Panel of the Swiss Cantons

by

Lars P. Feld
Philipps-University of Marburg, Public Finance Group and CESifo
and
Emmanuelle Reulier
CREM CNRS UMR c6211, University of Rennes

Abstract:

Tax competition is discussed as a source of inefficiency in international taxation and in fiscal federalism. Two preconditions for the existence of such effects of tax competition are that mobile factors locate or reside in jurisdictions with – ceteris paribus – lower tax rates and that taxes are actually set strategically in order to attract mobile production factors. It is well known from studies about Swiss cantonal and local income tax competition that Swiss taxpayers reside where income taxes are low. In this paper, empirical results on strategic tax setting by cantonal governments are presented for a panel of the Swiss cantons from 1984 to 1999. Completing the evidence on Swiss tax competition, the income tax rates in cantons are the lower, the lower are the tax rates of their neighbors.

Keywords: Tax competition, strategic tax setting, personal income taxes.
JEL Classification: H71, H73, H24.

This version April 15, 2005 – This project has been started while the second author visited the University of St. Gallen. Financial support from the University of Rennes 1 (France) and the hospitality of the University of St. Gallen are gratefully acknowledged.

Mailing Address: Prof. Dr. Lars P. Feld
Philipps-University of Marburg
Public Finance Group
Am Plan 2
D-35037 Marburg/Lahn
phone: +49 6421 28 21702
fax: +49 6421 28 24852
e-mail: feld@wiwi.uni-marburg.de

1. Introduction

Since TIEBOUT (1956), analyses of fiscal federalism have been mainly focused on the mechanisms and properties of market-like competition between jurisdictions. Tiebout emphasizes the efficiency enhancing impact of a voting-by-feet mechanism to help individuals to find their place of residence where local public goods are provided in accordance with their preferences. In contrast to that, the modern tax competition literature establishes that such a competition for mobile production factors between jurisdictions entails numerous sources of inefficiencies that lead to a suboptimal level of public services or to a race to the bottom in tax rates (for surveys on the literature see OATES, 1999; WILSON, 1999 and WILSON and WILDASIN, 2004). By strategically lowering corporate or individual income tax rates, jurisdictions may attract mobile capital or labor from other jurisdictions. The outflow of these factors leads to an increase of the tax burden on factor incomes that remain in the jurisdictions from which they emigrate or to a decrease in tax revenue that is needed to cover inframarginal costs of public goods. Moreover, as SINN (2003) points out, tax competition may also cause less redistribution and lead to a dismantling of the social welfare state.

However, authors like SALMON (1987) and BESLEY and CASE (1995) have used alternative explanations of public decision-making processes in a setting of fiscal federalism. In a world of imperfect and asymmetric information, voters have restricted possibilities to assess the performance of the representatives in their polity. Selfish representatives aim at gathering political rents and hence have incentives to keep information about their opportunistic behavior hidden from voters. However, voters can draw inferences on politicians' behavior by comparing it to the performance of governments and parliaments in neighboring jurisdictions. Other things being equal, these neighbors serve as yardsticks for the voters' evaluation. A worse performance in their own jurisdiction compared to other jurisdictions leads to a punishment of representatives by throwing them out of office in the next elections. In such a concept, public choice would not only be driven by information gathering from neighboring ju risdictions, but also by mimicking behavior. Because representatives anticipate the yardstick mechanism, they are able to stay in power by adapting to the policies of their neighbors.

A number of articles has presented evidence that tax rates in one jurisdiction are positively depending on tax rates in neighboring or other competing jurisdictions (LADD, 1992; CASE, 1993; HEYNDELS and VUCHELEN, 1997; FIGLIO, KOLPIN and REED, 1999; SAAVEDRA, 2000; BRETT and PINKSE, 2000; HAYASHI and BOADWAY, 2001; BRUECKNER and SAAVEDRA, 2001; BÜTTNER, 2001; BORDIGNON, CERNIGLIA and REVELLI, 2003; FELD, JOSSELIN and ROCABOY, 2003 and SOLÉ-OLLÉ, 2003). With the exception of BESLEY and CASE (1995), the literature has difficulties to establish a link between tax mimicking and the re-election of representatives such that this evidence could either be interpreted as evidence for tax competition or for yardstick competition. It is thus no surprise that, in his survey on mimicking behavior of competing jurisdictions in the U.S. welfare system, BRUECKNER (2000) assesses these results as indicating the infamous race to the bottom phenomenon of fiscal competition.

In tax competition models, a pre-condition for the existence of a race to the bottom is the fiscally induced mobility of at least one production factor (WILSON, 1999). In yardstick competition models, labor and capital are usually assumed to be physically immobile (BESLEY and CASE, 1995; WREDE, 2001; BODENSTEIN and URSPRUNG, 2001; BESLEY and SMART, 2001; FELD, JOSSELIN and ROCABOY, 2003). Indirect evidence that helps to distinguish these two classes of models from each other could thus use the existing extent of fiscally induced mobility as a precondition. Given a relatively high fiscally induced mobility of factors of production between jurisdictions, a positive correlation between the jurisdiction's tax rate and the average of competing jurisdictions' tax rates would lend support to the tax competition hypothesis. On the contrary, a relatively low fiscally induced mobility together with such a positive correlation between tax rates would provide some (weak) evidence in support of the yardstick competition model.

In that respect, evidence from Switzerland is quite interesting. As KIRCHGÄSSNER and POMMEREHNE (1996), POMMEREHNE, KIRCHGÄSSNER and FELD (1996), FELD (2000, 2000a), FELD and KIRCHGÄSSNER (2001) and SCHMIDHEINY (2003) for individual income taxes and FELD and KIRCHGÄSSNER (2003) for corporate income taxes show, fiscally induced mobility at the Swiss cantonal and local levels is relatively important. In particular high income earners and firms with high rates of return on capital reside or locate in places where taxes are – ceteris paribus – low in relative terms. Following the suggestions by BRUECKNER (2003), the existence of strategic tax setting of Swiss sub-federal jurisdictions could hence provide such indirect evidence for the existence of tax competition.

In this paper, evidence for the existence of strategic tax competition at the Swiss cantonal level is provided for a yearly panel data set of the 26 cantons from 1984 to 1999. Most of the empirical analyses of strategic tax setting has been conducted for the U.S. CASE (1993) and BESLEY and CASE (1995) provide panel evidence for U.S. states, while LADD (1992) analyses tax mimicking at the U.S. county level and BRUECKNER and SAAVEDRA (2001) at the city level. The outside U.S. evidence is provided by HEYNDELS and VUCHELEN (1998) for Belgian municipalities, BÜTTNER (2001) for German local jurisdictions, BORDIGNON, CERNIGLIA and REVELLI (2003) for Italian municipalities, SOLÉ-OLLÉ (2003) for Spanish communities and FELD, JOSSELIN and ROCABOY (2003) for a panel of French regions. In contrast to these studies, this paper provides the first outside U.S. evidence on strategic tax setting at the regional level in a country with very important fiscally induced mobility

In addition, Switzerland is particularly interesting because it is the only country in Europe in which sub-federal jurisdictions, the cantons and communities, have a considerable power to tax individual and corporate income (FELD and SCHNEIDER, 2001). The differences in (effective) tax rates across Swiss cantons are much more impressive than those in any other European country. The Swiss cantonal level thus provides excellent opportunities to study tax competition issues. Moreover, Swiss sub-federal jurisdictions mainly finance their budgets by income taxes, while U.S. states use sales taxes to a much larger extent. 20 percent of the revenue of state and local governments in the U.S. stems from sales taxes, 17 percent from property taxes (used at the local level) and 15 percent from individual and corporate income taxes. 19 percent of revenue are grants from the federal level and 29 percent user charges and other revenue sources (Economic Report of the President, 1999, Table B-86). In contrast, Swiss cantons and local jurisdictions obtain 50 percent of their revenue from individual and corporate income taxes (FELD and KIRCHGÄSSNER, 2001). This study therefore provides the first study on individual income tax competition for a country where income taxes at the sub-federal levels really matter quantitatively.

What makes the evidence in this paper particularly interesting is the distinction among different income tax brackets. In contrast to property taxes (U.S. and French evidence), local business taxes (German and French evidence), and individual income tax surcharges (Belgian evidence), individual income tax schedules of the Swiss cantons are highly progressive. Hence, it is useful to look at the strategic interdependence between jurisdictions across the different tax brackets. CASE (1993) considers the progressivity of the income tax schedule in her study on U.S. income tax competition by looking at the tax liability in three different tax brackets ($ 25'000, $ 40'000, $ 100'000). The data set in this paper allows for an analysis of the whole income tax schedule. We analyze 12 tax brackets, but report only 11 of them leaving out the least interesting group of taxpayers below a yearly taxable income of Sfr 30'000 (a 100 Swiss francs being approximately 60 U.S.-$) in order to meet the adding up condition of the reported system estimates. These data allow for an investigation as to whether tax competition exists to a different extent for different groups of taxpayers. According to our results it appears that tax rates of individuals earning more than Sfr 100'000 taxable income a year are to a larger extent prone to strategic interaction with competing jurisdictions than those of lower income earners, although the differences are not extreme.

The paper is organized as follows: In *Section 2*, the development of selected income tax rates for selected cantons is provided to give the reader a sense of tax competition in Switzerland. The basic econometric model is presented in *Section 3* and the estimation results in *Section 4*. *Section 5* offers concluding remarks.

2. The Development of Tax Rates in Switzerland[1]

A natural starting point for an analysis of tax competition in individual income taxation is an investigation into the race to the bottom phenomenon. It can be argued from a theoretical point of view that jurisdictions compete with each other by decreasing their income tax rates repeatedly such that inefficiently low tax rates result. More exactly, 'inefficiently low' means that tax rates are too low to finance that level of public services that is preferred by the residents of those jurisdictions. In the public discussion, a race to the bottom is however simply associated with decreasing tax rates across time. Such a development is often interpreted as evidence for the existence of tax competition.

Figures 1 to *3* exhibit the development of Swiss cantonal and local income tax rates from 1983 to 1999 for ten selected cantons. The selection of cantons follows from the political discussion in Switzerland according to which the agglomeration cantons, like Zurich and Geneva, are challenged by surrounding, more rural cantons. The canton Zurich is supposed to be in a tax competition game with the cantons of Zug, Schwyz and Nidwalden, the three cantons with the lowest (individual and corporate) tax rates in Switzerland. The canton Geneva is supposed to compete mainly with Vaud, while the canton Basle-City is supposed to compete with Basle-County. In addition, the canton Berne is included which is not very much exposed to tax competition due to its geographical proximity to the traditionally high tax French speaking Swiss cantons. Finally, an additional canton is included in order to control for a less

---

1. A description of the Swiss tax system is provided by FELD (2000, 2000a) and FELD and KIRCHGÄSSNER (2001) for individual income taxes and FELD and KIRCHGÄSSNER (2003) for corporate income taxes.

politically exposed jurisdiction. The composition of cantons varies somewhat due to this additional 'control' canton.

Figure 1: Cantonal and (Weighted) Local Individual Income Tax Rates (in %) on Annual Taxable Income of Less than Sfr 30'000, 1983 – 1999

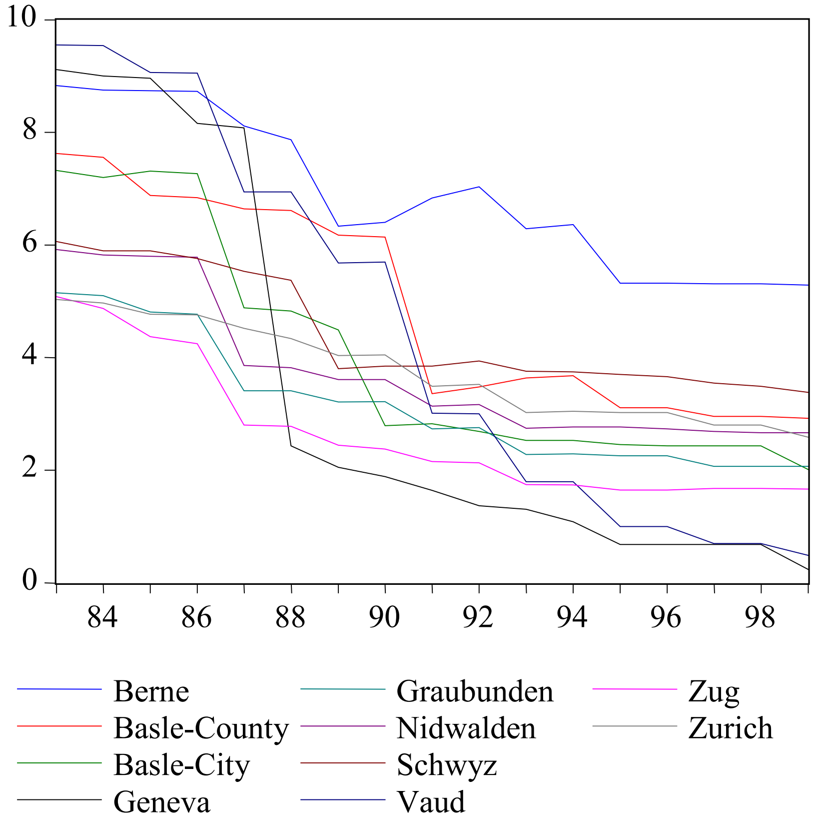
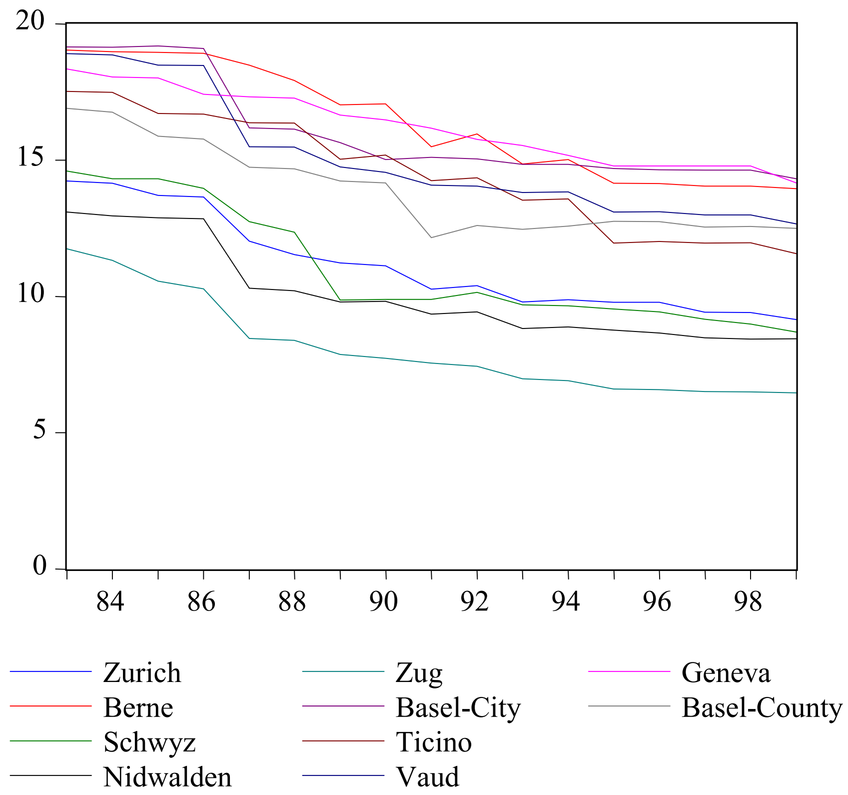


Figure 1 indicates the development of the cantonal tax rates on annual taxable income of less than Sfr 30'000 from 1983 to 1999. It is obvious that these tax rates have considerably declined during that period, most notably in the cantons of Geneva and Vaud. In Geneva the low income tax rates in 1999 are only ten percent of those in 1983, in Vaud this relationship is similar. Zurich cut its income tax rates in this income class by half, from 5 percent to 2.6 percent during this time period. While the reduction in Berne is about 40 percent and thus not pretty much less than the respective reduction in Schwyz, the level of low income taxation in Berne remains highest in Switzerland.

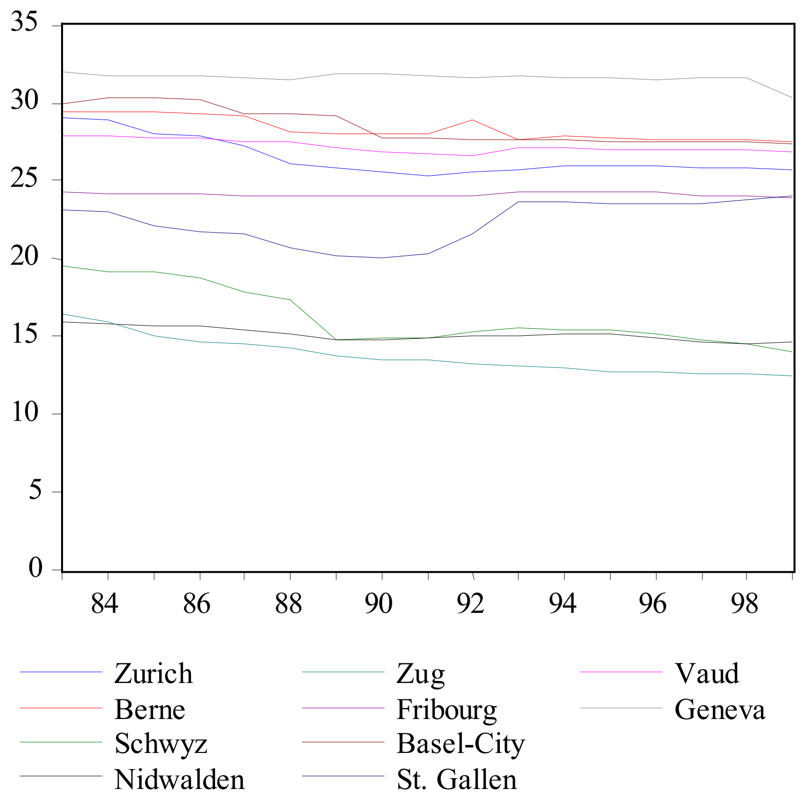
Figure 2 represents the respective development of cantonal tax rates on middle incomes, i.e. annual taxable income in the bracket of Sfr 80'000 to 100'000. Although the re duction of income tax rates on these incomes is more modest than those presented above, it still appears to be considerable. The canton Zurich reduced tax rates on middle incomes by 5 percentage points to 9.15 percent in 1999, which is about one third of the level in 1983. In the case of Schwyz the reduction amounts to 40 percent; and Zug even cut its tax rates on middle incomes by nearly one half. The reduction of these tax rates in the canton Berne is more modest amounting to slightly more than a quarter. This is expected given the fact that Berne is much less exposed to competition than Zurich. In Geneva it is less than a quarter, while Vaud cut these rates by about a third.

Figure 2: Cantonal and (Weighted) Local Individual Income Tax Rates (in %) on Annual Taxable Income of Sfr 80'000 to 100'000, 1983 – 1999



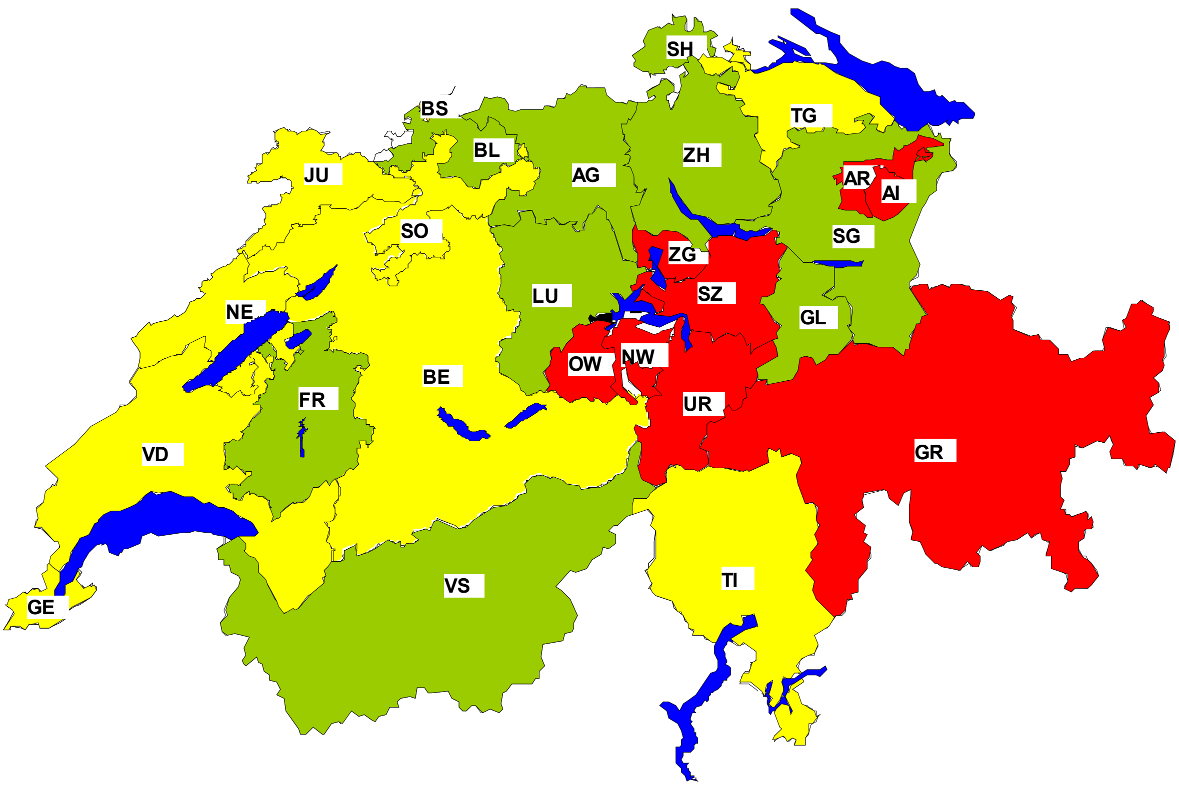
The development of tax rates on income of Sfr 1 million and more from 1983 to 1999, indicated in *Figure 3* is exhibiting an even more modest decline for most cantons, most notably for Zurich, Schwyz, Zug and Nidwalden as the core example of tax competition. On the other hand, some cantons like St. Gallen have even increased their tax rates on high income taxpayers in the beginning of the nineties. The development in St. Gallen can be explained by the cantonal formal requirement to increase tax rates, when budget deficits increase above a certain threshold. The beginning of the nineties can be characterized as a period during which cantons experienced relatively high budget deficits due to the severe recession of the nineties.

Figure 3: Cantonal and (Weighted) Local Individual Income Tax Rates (in %) on Annual Taxable Income of Sfr 1 Million and More, 1983 – 1999



While the descriptive data for low incomes in *Figure 1* are most clearly lending itself to a race to the bottom interpretation, such an assessment is much less justified for higher income tax brackets. At first glance, this appears to be surprising since high income taxpayers are supposed to be more mobile than low income tax earners and the existing evidence for Swiss cantons indicates that the residence decision of these groups of taxpayers is much more influenced by taxation than that of low income earners. On the other hand, low income groups get tax relief for many other reasons apart from tax competition issues. For example the cantons may reduce tax rates in order to facilitate welfare recipients to join the labor market and reduce the implicit marginal tax rate. The tax competition game may thus be fiercer in the middle income range than with respect to the higher income classes. Such a kind of competition may make sense when it is taken into account that middle income earners are often those who start a career and end up with much higher salaries later on. An example would be a married couple with university degrees thinking about having kids and looking for a place of residence to settle for a longer time period. Their starting salaries in Switzerland are in the range of Sfr 70'000 to 100'000. Getting them before they become less mobile due to family reasons is a reasonable goal for cantonal tax authorities. Before this example is generalized it is useful to have a more closer look at the strategic interaction of tax setting in different Swiss cantons.

Figure 4: Cantonal and (Weighted) Local Individual Income Tax Rates (in %) on Annual Taxable Income of Sfr 500'000 and More in 1999



In *Figure 4*, the Swiss cantons are grouped according to their income tax rates on annual taxable incomes of Sfr 500'000 and more in order to illustrate the potentially occurring strategic interaction among cantons. The red (dark grey) cantons comprise the group with the lowest tax burden between 12 percent (Zug) and 20 percent (Graubuenden). The green (middle grey) cantons are those with tax burdens between 21 percent (Glarus) and 24 percent

(Aargau), while the yellow (light grey) cantons have tax rates between 24 percent (Thurgau) and 28 percent (Geneva). This classification into three groups is useful, although the range in the low tax group is higher than in the two other groups. The income tax burden is usually higher in the Western than in the Eastern part of Switzerland. However, in each larger geographical area, cantons with relatively low tax rates exist that challenge the higher tax economic centers. This holds for the comparison of Zurich with Zug and Schwyz, but also for St. Gallen with both Appenzell or Berne with Fribourg and the Valais. This geographical pattern somewhat reflects the illustrations from *Figures 1* to *3*, but it also points to the fact that strategic interaction may take place in two different ways. On the one hand, and quite obvious from *Figure 4*, geographical neighbors compete with each other. On the other hand, larger geographical areas, the metropolitan centers with their lower tax surrounding areas may compete with each other, for example Geneva with Zurich. Such a kind of twofold strategic tax competition should be reflected in the econometric specification to which we now turn.

3. An Econometric Analysis for Swiss Cantons

The basic econometric specification follows the models of CASE (1993), BÜTTNER (2001) and FELD, JOSSELIN and ROCABOY (2003). The two latter papers also present theoretical models as a basis for the econometric specification, FELD, JOSSELIN and ROCABOY (2003) a yardstick competition model and BÜTTNER (2001) a tax competition model. It thus suffices in this paper to draw the basic lines of arguments. These theoretical models of tax (and of yardstick) competition suggest that the tax rates in each canton depend on tax rates of competing jurisdictions. In the econometric specifications used here, we first assume that the income tax rates in canton *i* are influenced by the (unweighted average of) income tax rates in geographically neighboring cantons. By taking the unweighted average of neighbors' tax rates, we weight each neighbor of each canton equally. In a second subsequent specification, we assume that the taxes in canton *i* are influenced by the geographically neighboring cantons both at the local level and at the regional level. Each neighbor j of a canton i has its own neighbors k which influence the tax rates of canton j. Neighboring cantons at the regional level of a canton i thus correspond to the local cantonal neighbors for each of the local neighbors of a canton i. This specification follows HEYNDELS and VUCHELEN (1997) implicitly hypothesizing that the influence of the fiscal policy of neighboring cantons at the regional level should be lower than the one of neighboring cantons at the local level.

In addition to neighbors' taxes, a few other economic and demographic variables have an impact on tax policy at the Swiss cantonal level. Cantonal tax policies do not only depend on the capacity to generate revenue by own taxes, but also on grants from other jurisdictions. Thus, we include federal lump-sum grants per capita in the analysis reflecting the availability of alternative funds. We do not include spending variables or bond financing in order to circumvent (additional) endogeneity problems. Moreover, we introduce standard control variables like cantonal income per capita, the cantonal unemployment rate as a proxy for business cycle developments and the accompanying necessity to increase social welfare spending and financing, and demographic factors like population size, the share of the population younger than 20 years and older than 65 years. A regional dummy is included that takes on the value of one for German speaking cantons and zero otherwise. As mentioned above, it is well-known that tax rates are higher in French and Italian speaking cantons than in the German speaking ones. These differences might reflect cultural differences between the Swiss cantons that have to be considered to avoid an omitted variable bias in the estimates. The estimation equation of the first specification thus finally becomes:[2]

$$(1) \qquad t^g = \beta_0{}^g + \beta_1 \hat{t}^g_{t-1} + \beta_2 X_{t-1} + \varepsilon,$$

where $\hat{t}^g_{t-1}$ is a [NT×1] vector of the average of cantons' geographic neighbors' taxes of the previous period for T years in income class g; X_{t-1} is an [NT×k] matrix of k observable can

2. See again CASE (1993) pp. 141.

tons' economic and demographic characteristics of the preceding period, β_0^g is a constant term for each income class *g* and ε is an error term which is assumed to be normally distributed with zero mean and constant variance. The parameter β_1 indicates to what extent a canton's tax policy is influenced by the tax policy in neighboring cantons. We estimate this model in a specification with time fixed effects for the levels of the eleven different tax rates comprising the income tax schedule. Due to these different tax brackets, *equation (1)* describes a system of eleven equations which vary according to the income tax rate in each income class *g* and the neighboring cantons' tax rates of each income class *g*. The vector X_{t-1} of economic and demographic control variables remains the same for all eleven classes. The eleven tax brackets are the following ones:

Sfr 30'000 $< Y_1 >$ Sfr 50'000; Sfr 50'000 $< Y_2 <$ Sfr 60'000;

Sfr 60'000 $< Y_3 <$ Sfr 80'000; Sfr 80'000 $< Y_4 <$ Sfr 100'000;

Sfr 100'000 $< Y_5 <$ Sfr 150'000; Sfr 150'000 $< Y_6 <$ Sfr 200'000;

Sfr 200'000 $< Y_7 <$ Sfr 300'000; Sfr 300'000 $< Y_8 <$ Sfr 400'000;

Sfr 400'000 $< Y_9 <$ Sfr 500'000; Sfr 500'000 $< Y_{10} <$ Sfr 1'000'000;

$Y_{11} \geq$ Sfr 1'000'000;

with Y_g as taxable income in income class *g*. Data on average effective tax rates across time are consistently available for these eleven income classes only for married taxpayers without children. The difference to singles and married taxpayers with two children, as the other two types of ('normal') taxpayers available is not very important, but tax rates on retiree income deviates considerably. This is something that should be kept in mind for the next section.

Equation (1) cannot be consistently estimated by OLS because there is an obvious endogeneity problem. Hausman tests indicate that the neighboring tax rates at the local level or at the regional level are endogenous (available upon request). So β_1 is correlated with the error term ε and OLS estimates will be biased and inconsistent. Thus, we basically estimate our system by using instrumental variables. We follow BÜTTNER (2001) who uses a method proposed by KELEJIAN and ROBINSON (1993) and KELEJIAN and PRUCHA (1998) using spatial lags of the local characteristics as instruments. The instruments are the (unweighted) averages of the economic and demographic controls X_{t-1} of the neighbors.

An additional problem arises because the data set used has a panel structure making the existence of a first-order autocorrelation in the error terms highly probable (see *Figures 1* to *3*). Instead of using a lagged endogenous variable and instruments to control for potential biases, we correct the standard errors for autocorrelation and heteroscedasticity by using a GMM method. We thus estimate the system of equations by GMM using spatial lags of controls as instruments.

4. Estimation Results

Table 1 contains the results for the baseline model in which the neighboring jurisdictions are supposed to be the only competitors of the canton under consideration. The overall performance of the model is relatively well. The adjusted R^2 indicates that 66 to 76 percent of the variance of the different income tax rates in the system can be explained. The Jarque-Bera test statistics indicate that the hypothesis of normal distribution can be rejected for five of the eleven income groups at least on the ten percent level. Among these income groups are middle/upper income classes from Sfr 200'000 to less than Sfr 400'000. Since these are relatively important groups, the problem of non-normality of the residuals is going to be addressed subsequently.

As the χ^2-statistics in the last column of *Table 1* indicate, the hypothesis that neighbors' tax rates of the previous period have no impact on the income tax rate of the canton under consideration cannot be rejected at any conventional significance level for the whole system of equations. However, in each single income class except for the lower one, neighbors' tax rates of the previous period are significantly different from zero at least on the 5 percent significance level. For the nine classes of incomes higher than Sfr 60'000 annual taxable in come, neighbors' tax rates are even significant on the 1 percent level. In addition, there is a positive relationship between the income tax rates of a canton and those of its neighbors indicating that cantons appear to reduce their tax rates when the neighbors reduce them and increase tax rates when neighbors increase them. Of the control variables, only population size and the share of the old population are significantly different from zero for the whole system according to the χ^2-statistics. Since higher tax rates for married taxpayers without children – ceteris paribus – imply lower tax rates for retirees, the significantly positive coefficients for the old population, in particular in the lower income groups, is no surprise.

– Table 1 about here –

The estimation results presented in *Table 2* are robust estimations controlling for outliers with dummy variables (as mentioned in the notes to *Table 2*). The Jarque-Bera test statistics now indicate that the hypothesis of normal distribution of the residuals can be rejected only at the 10 percent level for income classes from Sfr 400'000 to less than Sfr 500'000. This hypothesis is also rejected at the 5 percent level for the income class from Sfr 500'000 to less than Sfr 1'000'000. The explanatory power of the model increases. The adjusted R^2 is now at least at 0.74. Moreover, for ten of the eleven income classes in the system, 80 to 85 percent of the variance can be explained. The χ^2-statistics in the final column of *Table 2* indicate that the explanatory power of the single variables increases as well. This does not only hold for the two control variables mentioned before. In addition, the neighbors' tax rate and the regional dummy variable are now significant for the whole system on the 1 and 5 percent level respectively. Moreover the influences of the population and the share of old population increase. Finally, lump-sum grants are significantly different from zero on the 5 percent level for income classes from Sfr 100'000 to less than Sfr 300'000. As the sign of the coefficient is negative, we can say that a rise in the amount of lump-sum grants induces a decrease of the tax rate for the middle and middle-upper income classes. As the coefficients for the regional dummy indicate, the German speaking cantons have significantly lower tax rates than other cantons. This result appears to be stronger for the middle income classes. Again, the hypothesis that cantonal income tax rates positively depend upon respective neighbor's tax rates cannot be rejected according to our results. It is interesting to note that in the income class of Sfr 30'000 to less than Sfr 50'000, neighbors' tax rates are significant but only on the 5 percent level. This corroborates the conjecture mentioned in *Section 2* that the common trend of declining tax rates in this income class is not only induced by tax competition.

– Table 2 about here –

The estimated coefficients of the average of neighbors' tax rates of the previous period increase with income up to the income class of Sfr 200'000 to less than Sfr 300'000. The coefficients decline in the remaining three upper income groups to levels below the one estimated in the income class of Sfr 200'000, but are still higher than those in the income groups below Sfr 80'000. As the results of the Wald tests on equality of paired coefficients presented in *Table 3* indicates, these differences are however not statistically significant.

Table 3 about here –

The smaller region kind of tax competition between neighbors may not be the only way tax competition takes place. Larger regional areas might be in locational competition with each other. In order to check the possibility that tax rates of a canton are influenced by the tax setting behavior of local and regional neighboring cantons, though perhaps to different extents, the following model is proposed:

$$(2) \qquad t_t^g = \gamma_0^g + \gamma_1 \hat{t}_{t-1}^{g,local} + \gamma_2 \hat{t}_{t-1}^{g,regional} + \gamma_3 X_{t-1} + \varepsilon$$

where $\hat{t}_{t-1}^{g,local}$ is a [NT×1] vector of the average of cantons' local neighbors' taxes of the previous period for *T* years in income class *g*; and $\hat{t}_{t-1}^{g,regional}$ is a [NT×1] vector of the average of cantons' regional neighbors' (the neighbors' of the neighbors') taxes of the previous period for *T* years in income class *g*. The parameters γ_1 and γ_2 indicate to what extent a canton's tax policy is influenced by the tax policy of local neighboring cantons and of regional neigh boring cantons respectively. We estimate this model for the eleven different tax rates comprising the income tax schedule. The results are presented in *Table 4*.

– Table 4 about here –

The overall performance of the model (2) is quite well because 67 to 76 percent of the variance of the different equations of the system can be explained. The χ^2-statistics indicates that four explanatory variables are significantly different from zero for the whole system. These are the local neighbors' tax, the regional neighbors' (the neighbors' of the neighbors') tax and also the population and the share of the older population. With respect to demographic and economic variables, the estimated coefficients and the Wald tests associated to them are quite similar to those obtained by estimating model (1).

But focusing on the mimicking coefficients at the local and at the regional level provides interesting insights. First, all the mimicking coefficients at the local level are significantly different from zero on the 5 percent and for the nine highest income classes on the 1 percent level. Those coefficients are positive and quite similar in size to those estimated in model (1). Choosing a specification for the estimation model which enlarges the geographical area of competitive cantons thus leads to similar results as far as tax mimicking behavior at the local level is concerned. Second, this new system allows to consider a possible influence of tax setting in neighboring cantons at the regional level. It is interesting to note that, although the χ^2-statistic is significant on the 5 percent level for the whole system, the coefficients of the regional neighboring tax rates (the neighbors' of the neighbors') are significantly different from zero on the 5 percent level only for the income classes from Sfr 50'000 to less than Sfr 150'000. The absolute size of local and regional mimicking coefficients is quite similar for those income classes. Third, the results of the Wald test of equality of paired coefficients indicate that the intensity of tax mimicking at the local level is the same for all income classes (*Table 5*). Moreover, at the regional level, tax mimicking has a similar magnitude in the income classes from Sfr 50'000 to less than Sfr 150'000 (*Table 6*). And in each equation for income classes from Sfr 50'000 to less than Sfr 150'000, it is not possible to reject the hypothesis that the intensity of mimicking at the local level is similar to the one at the regional level (*Table 7*).

– Table 5, 6, 7 about here –

All those results provide evidence for the strategic tax setting behavior of cantonal authorities. When tax rates for the income classes from Sfr 50'000 to less than Sfr 150'000 are politically decided, the cantonal finance secretary at the same time pays attention to the local as well as to the regional neighboring tax rates of the previous period. But as regards the other income classes, only the tax rate of local neighboring cantons of the previous period appears to be considered. This result could be explained by the fact that taxpayers in the income classes from Sfr 50'000 to less than Sfr 150'000 correspond to young adults who just start working. For those couples, it is a crucial moment of their life because they have to decide the place where they want to reside. These young couples are going to consider a residence place within a larger range than others. This evidence of strategic tax setting corresponds nicely with the results by FELD (2000, 2000a) and FELD and KIRCHGÄSSNER (2001) for cross sections of Swiss cantons in 1990 on the one hand and FELD and FREY (2000) for a panel of Swiss cantons in the period from 1981/82 to 1993/94 on the other hand. While these cross section studies find the quantitatively most important negative impact of tax rates in the income class of Sfr 100'000 and above, this panel data analysis finds the strongest negative impact for the income classes between Sfr 75’000 and 200'000.

– Table 8 about here –

Non-normality of the residuals in some income classes is a similar problem in this specification as it is before. Controlling for outliers improves the estimates once again. It should be noted from the results of *Table 8* that, controlling for outliers, the lump-sum grants and the regional dummy become significant at the 5 percent and 10 percent level for the whole system. Otherwise, the structure of estimates remains relatively robust and confirms the results about the mimicking behavior of cantonal authorities.

5. Concluding Remarks

Tax competition is of great public interest in particular in the European Union. Nevertheless empirical evidence strongly establishing the existence, not mentioning the inefficiency, of tax competition is scarce. Obtaining such evidence is the more important, since competing theoretical hypotheses as to the usefulness of tax competition exist.

In this paper, evidence on strategic tax setting is provided on the basis of a simultaneous equations model with eleven income tax rates for the Swiss cantons using panel data from 1984 to 1999. The results lend support for the hypothesis that strategic interactions between sub-federal jurisdictions in Switzerland exist. Income tax rates in the cantons – ceteris paribus – depend positively on local neighbors' tax rates of the previous period for all taxable income classes and also on regional neighbors' (the neighbors' of the neighbors') tax rates of the previous period for taxable income classes from Sfr 50'000 to less than Sfr 150'000. If neighboring cantons reduce their income taxes, the canton of consideration reduces its tax rates as well. This result indicates that the largest extent of tax competition among neighbors is obtained for middle income groups.

The results are in line with evidence obtained for the U.S. sub-federal jurisdictions, for Canadian provinces or municipalities of British Columbia, but also for Belgian and Italian municipalities and Spanish and German local jurisdictions. In addition to the new insights from the evidence over a whole range of income tax rates presented in this paper, the results are however also adding to the current understanding of individual income tax competition in Switzerland. Since Swiss taxpayers choose their place of residence in cantons where they find favorable tax conditions (FELD and KIRCHGÄSSNER, 2001), a spatial interdependence of income tax rates provides evidence for the existence of tax competition in Switzerland.

References

BESLEY, T. and A.C. CASE (1995), Incumbent behavior: Vote-seeking, tax-setting, and yardstick competition, *American Economic Review* 85, 25 – 45.

BESLEY, T. and M. SMART (2001), Does tax competition raise voter welfare?, mimeo, London School of Economics, October 2001.

BRETT, C. and J. PINKSE (2000), The determinants of municipal tax rates in British Columbia, *Canadian Journal of Economics* 33, 695 – 794.

BODENSTEIN, M. and H.W. URSPRUNG (2001), Political yardstick competition, economic integration, and constitutional choice in a federation, CESifo Working Paper No. 501, June 2001.

BORDIGNON, M., F. CERNIGLIA and F. REVELLI (2003), In search of yardstick competition: A spatial analysis of Italian municipality property tax setting, *Journal of Urban Economics* 54, 199 – 217.

BRUECKNER, J.K. (2000), Welfare reform and the race to the bottom: Theory and evidence, *Southern Economic Journal* 66, 505 – 525.

BRUECKNER, J.K. (2003), Strategic interaction among governments: An overview of empirical studies, *International Regional Science Review* 26, 175 – 188.

BRUECKNER, J.K. and L.A. SAAVEDRA (2001), Do local governments engage in strategic property tax competition?, *National Tax Journal* 54, 203 – 229.

BÜTTNER, T. (2001), Local business taxation and competition for capital: The choice of the tax rate, *Regional Science and Urban Economics* 31, 215 – 245.

CASE, A.C. (1993), Interstate tax competition after TRA86, *Journal of Policy Analysis and Management* 12, 136 – 148.

FELD, L.P. (2000), *Steuerwettbewerb und seine Auswirkungen auf Allokation und Distribution: Ein Überblick und eine empirische Analyse für die Schweiz*, Mohr Siebeck, Tübingen.

FELD, L.P. (2000a), Tax competition and income redistribution: An empirical analysis for Switzerland, *Public Choice* 105, 125 – 164.

FELD, L.P. und B.S. FREY (2000), *Die Auswirkungen des kantonalen Steuerwettbewerbs auf den Kanton Zürich: Möglichkeiten einer rationalen Reform*, Gutachten zuhanden der Finanzdirektion des Kantons Zürich, Zurich.

FELD, L.P. and G. KIRCHGÄSSNER (2001), Income tax competition at the state and local level in Switzerland, *Regional Science and Urban Economics* 31, 181 – 213.

FELD, L.P. and G. KIRCHGÄSSNER (2003), The impact of corporate and personal income taxes on the location of firms and on employment: Some panel evidence for the Swiss cantons, *Journal of Public Economics* 87, 129 – 155.

FELD, L.P. and F. SCHNEIDER (2001), State and local taxation, in: N.J. SMELSER and P.B. BALTES (eds.), *International encyclopedia of the social and behavioral sciences*, *Vol. 22*, Elsevier, Oxford, 14955 – 14961

FELD, L.P., J.-M. JOSSELIN and Y. ROCABOY (2003), Tax mimicking among regional jurisdictions, in: A. MARCIANO and J.-M. JOSSELIN (eds.), *From economic to legal competition: New perspectives on law and institutions in Europe*, Edward Elgar, Cheltenham, 105 – 119.

FIGLIO, D.N., V.W. KOLPIN and W.E. REID (1999), Do states play welfare games?, *Journal of Urban Economics* 46, 437 – 454.

HAYASHI, M. and R. BOADWAY (2001), An empirical analysis of intergovernmental tax interaction: the case of business income taxes in Canada, *Canadian Journal of Economics* 34, 481 – 503.

HEYNDELS, B. and J. VUCHELEN (1997), Tax mimicking among Belgian municipalities, *National Tax Journal* 51, 89 – 101.

KELEJIAN, H.H. and I.R. PRUCHA (1998), A generalized spatial two-stage least squares procedure for estimating a spatial autoregressive model with autoregressive disturbances, *Journal of Real Estate Finance and Economics* 17, 99 – 121.

KELEJIAN, H.H. and D.H. ROBINSON (1993), A suggested estimation for spatial interdependent models with autocorrelated errors, and an application to a county expenditure model, *Papers in Regional Science* 72, 297 – 312.

KIRCHGÄSSNER. G. and W.W. POMMEREHNE (1996), Tax harmonization and tax competition in the European Union: Lessons from Switzerland, *Journal of Public Economics* 60, 351 – 371.

LADD, H.F. (1992), Mimicking of local tax burdens among neighboring counties, *Public Finance Quarterly* 20, 450 – 467.

OATES, W.E. (1999), An essay on fiscal federalism, *Journal of Economic Literature* 37, 1120 – 1149.

POMMEREHNE, W.W., G. KIRCHGÄSSNER and L.P. FELD (1996), Tax harmonization and tax competition at state-local levels: Lessons from Switzerland, in: G. POLA, R. LEVAGGI and G. FRANCE (eds.), *Developments in Local Government Finance: Theory and Policy*, Edward Elgar, Cheltenham 1996, 292 – 330.

SAAVEDRA, L.A. (2000), A model of welfare competition with evidence from AFDC, *Journal of Urban Economics* 47, 248 – 279.

SALMON, P. (1987), Decentralisation as an incentive scheme, *Oxford Review of Economic Policy* 3, 24 – 43.

SCHMIDHEINY, K. (2003), Income segregation and local progressive taxation: Empirical evidence from Switzerland, HWWA Discussion Paper No. 248, Hamburg.

SINN, H.-W. (2003), *The new systems competition*, Blackwell, Oxford.

SOLÉ-OLLÉ, A. (2003), Electoral accountability and tax mimicking: The effects of electoral margins, coalition government and ideology, *European Journal of Political Economy* 19, 685 – 713.

TIEBOUT, C.M. (1956), A pure theory of public expenditures, *Journal of Political Economy* 64, 416 – 424.

WILSON, J.D. (1999), Theories of tax competition, *National Tax Journal* 53, 269 – 304.

WILSON, J.D. and D.E. WILDASIN (2004), Capital tax competition: Bane or boon?, *Journal of Public Economics* 88, 1065 – 1091.

WREDE, M. (2001), Yardstick competition to tame the Leviathan, *European Journal of Political Economy* 17, 705 – 721.

Table 1: GMM-Model of Strategic Tax Setting, Neighbors' Tax, 26 Swiss Cantons, 1984 – 1999

Dependent variable, t	TAX 30	TAX 50	TAX 60	TAX 80	TAX 100	TAX 150	TAX 200	TAX 300	TAX 400	TAX 500	TAX 1m	χ^2
Constant	2.748	-1.026	-3.317	-5.326	-4.669	-1.459	-0.908	-3.621	-3.980	-2.626	0.662	2.71
	(0.44)	(-0.16)	(-0.47)	(-0.64)	(-0.48)	(-0.12)	(-0.07)	(-0.22)	(-0.21)	(-0.13)	(0.03)	
Neighbors' Tax, t-1	0.327	0.404*	0.510**	0.609**	0.645**	0.668**	0.679**	0.679**	0.673**	0.670**	0.717**	14.84
	(1.49)	(2.09)	(2.59)	(3.07)	(3.13)	(3.34)	(3.41)	(3.33)	(3.23)	(3.09)	(2.81)	
Population, t-1	0.137**	0.145*	0.124	0.001	0.094	0.085	0.129	0.244(*)	0.343*	0.397**	0.493**	25.12**
	(2.64)	(2.08)	(1.51)	(1.15)	(0.90)	(0.77)	(1.05)	(1.83)	(2.45)	(2.68)	(2.80)	
Share of Old Population, t-1	0.121	0.288**	0.340**	0.417**	0.420**	0.377*	0.403*	0.505*	0.544(*)	0.533(*)	0.514	22.00*
	(1.62)	(3.47)	(3.76)	(3.80)	(3.29)	(2.36)	(2.21)	(2.11)	(1.92)	(1.72)	(1.37)	
Share of Young Population, t-1	0.077	0.143	0.159	0.151	0.126	0.069	0.043	0.059	0.038	-0.381	-0.128	4.52
	(0.67)	(1.39)	(1.47)	(1.16)	(0.82)	(0.35)	(0.19)	(0.20)	(0.11)	(-0.01)	(-0.27)	
Income, t-1	-0.116*	-0.078(*)	-0.059	-0.038	-0.035	-0.042	-0.032	-0.018	-0.021	-0.025	-0.044	7.52
	(-2.38)	(-1.70)	(-1.17)	(-0.61)	(-0.49)	(-0.47)	(-0.30)	(-0.13)	(-0.13)	(-0.14)	(-0.20)	
Lump-Sum Grants, t-1	0.095	-0.084	-0.150	-0.226	-0.299	-0.456(*)	-0.533(*)	-0.532	-0.579	-0.624	-0.628	6.30
	(0.60)	(-0.54)	(-0.83)	(-1.11)	(-1.34)	(-1.71)	(-1.67)	(-1.22)	(-1.07)	(-1.01)	(-0.75)	
Unemployment Rate, t-1	-0.109	0.064	0.152	0.168	0.179	0.123	0.088	0.299	0.381	0.439	0.372	3.13
	(-0.39)	(0.25)	(0.53)	(0.48)	(0.42)	(0.24)	(0.16)	(0.44)	(0.50)	(0.52)	(0.33)	
Regional Dummy	-0.194	-0.941	-1.037	-1.101	-1.229	-1.635	-1.854	-1.864	-1.679	-1.480	-1.154	6.04
	(-0.28)	(-1.47)	(-1.46)	(-1.31)	(-1.22)	(-1.40)	(-1.41)	(-1.15)	(-0.93)	(-0.75)	(-0.46)	
F-Test: Time Effects	36.72**	42.44**	41.64**	42.74**	34.40**	25.02*	17.92	8.83	6.88	5.83	4.31	
$\overline{R^2}$	0.71	0.74	0.76	0.74	0.70	0.66	0.66	0.66	0.68	0.69	0.73	
SER	1.02	1.11	1.13	1.28	1.47	1.74	1.84	2.01	2.16	2.24	2.43	
Jarque-Bera	2.39	2.81	1.65	13.58**	9.25**	1.66	10.47**	6.13*	2.10	1.20	5.75(*)	

Notes: GMM-Time series (HAC) under the options : one step weighting matrix, iterate coefficient, Pre-whitening, Kernel Options Bartlett, Bandwidth selection Andrews. The numbers in parentheses are the t statistics of estimated parameters. '**' ,'*', '(*)' denote significance at the 1, 5, 10 percent levels, respectively. $\overline{R^2}$ is the adjusted coefficient of determination. SER is the standard error of regression and J.-B. the value of the Jarque-Bera-test on normality of the residuals.

Table 2: Robustness of the GMM-Model of Strategic Tax Setting to Outliers, Neighbors' Tax, 26 Swiss Cantons, 1984 – 1999

Dependent variable	TAX 30	TAX 50	TAX 60	TAX 80	TAX 100	TAX 150	TAX 200	TAX 300	TAX 400	TAX 500	TAX 1m	χ^2
Constant	-1.315	-2.695	-4.276	-6.934	-7.845	-4.568	-5.919	-7.873	-3.906	0.358	8.983	8.00
	(-0.22)	(-0.48)	(-0.76)	(-1.16)	(-1.16)	(-0.57)	(-0.70)	(-0.88)	(-0.34)	(0.03)	(0.44)	
Neighbors' Tax, t-1	0.444*	0.556**	0.679**	0.837**	0.885**	0.902**	0.969**	0.942**	0.834**	0.768**	0.717**	71.29**
	(2.18)	(3.08)	(4.20)	(5.96)	(6.19)	(5.84)	(6.35)	(6.49)	(4.90)	(3.88)	(2.61)	
Population, t-1	0.151**	0.130**	0.113*	0.112(*)	0.118	0.133(*)	0.190*	0.314**	0.410**	0.463**	0.541**	71.47**
	(3.19)	(2.75)	(2.16)	(1.83)	(1.54)	(1.72)	(2.33)	(3.69)	(4.59)	(4.70)	(3.93)	
Share of Old Population, t-1	0.167*	0.287**	0.320**	0.398**	0.444**	0.410**	0.446**	0.555**	0.553**	0.490*	0.397	41.62**
	(2.24)	(3.42)	(3.87)	(4.45)	(4.55)	(3.44)	(3.47)	(3.81)	(2.94)	(2.16)	(1.17)	
Share of Young Population , t-1	0.120	0.131	0.133	0.115	0.104	0.035	0.011*	0.019	-0.037	-0.100	-0.279	5.92
	(1.16)	(1.38)	(1.44)	(1.15)	(0.93)	(0.27)	(0.08)	(0.12)	(-0.18)	(-0.40)	(-0.72)	
Income, t-1	-0.098*	-0.074(*)	-0.062	-0.042	-0.029	-0.058	-0.056	-0.054	-0.073	-0.086	-0.103	7.19
	(-2.10)	(-1.69)	(-1.43)	(-0.91)	(-0.57)	(-0.96)	(-0.87)	(-0.71)	(-0.79)	(-0.76)	(-0.60)	
Lump-Sum Grants, t-1	0.123	-0.063	-0.145	-0.224	-0.311*	-0.380*	-0.402*	-0.369(*)	-0.400	-0.445	-0.504	9.96
	(0.92)	(-0.45)	(-1.00)	(-1.54)	(-2.09)	(-2.37)	(-2.44)	(-1.90)	(-1.52)	(-1.30)	(-0.87)	
Unemployment Rate, t-1	-0.160	-0.103	-0.002	0.011	-0.041	-0.030	-0.050	0.119	0.263	0.426	0.460	6.14
	(-0.62)	(-0.42)	(-0.01)	(0.04)	(-0.14)	(-0.10)	(-0.17)	(0.32)	(0.56)	(0.71)	(0.48)	
Appenzell Rhodes Extérieur	0.424	-0.881(*)	-1.369*	-1.545**	-1.988**	-2.755**	-3.228*	-2.986**	-3.232**	-3.174**	-3.140*	49.23*
	(1.30)	(-1.87)	(-2.23)	(-2.94)	(-2.99)	(-2.77)	(-2.52)	(-2.62)	(-2.87)	(-2.66)	(-2.21)	
Luzern	1.026*	2.329**	2.566**	3.387**	3.893**	4.061**	4.188**	4.642**	4.473**	3.986**	3.206**	288.85**
	(2.31)	(9.88)	(10.01)	(13.86)	(13.97)	(9.85)	(9.52)	(8.70)	(6.47)	(4.66)	(2.63)	
Glarus	0.437	0.818*	1.266**	1.882**	1.986**	2.506**	3.157**	3.867**	4.186**	4.516**	4.961**	75.28**
	(1.40)	(2.05)	(3.20)	(5.36)	(5.31)	(6.17)	(6.85)	(6.50)	(4.80)	(3.81)	(2.77)	
Vaud	-0.844	0.394	0.098	-1.077**	-2.134**	-3.237**	-3.640**	-3.931**	-3.485**	-3.192**	-3.095**	63.77**
	(-1.05)	(0.89)	(0.24)	(-2.84)	(-4.76)	(-6.14)	(-6.35)	(-5.17)	(-4.68)	(-4.35)	(-3.21)	
Aargau	1.015**	0.656*	0.589(*)	0.695	1.022*	1.461**	2.062**	2.794**	2.681**	2.391**	2.047*	111.78**
	(2.81)	(2.41)	(1.95)	(1.61)	(2.03)	(2.99)	(4.26)	(5.94)	(4.99)	(3.91)	(2.47)	
Regional Dummy	-0.492	-1.039(*)	-1.062(*)	-1.172(*)	-1.574*	-1.957*	-2.017*	-2.176*	-2.054**	-1.787	-1.682	21.13*
	(-0.82)	(-1.89)	(-1.90)	(-1.94)	(-2.36)	(-2.57)	(-2.53)	(-2.36)	(-1.86)	(-1.35)	(-0.83)	
F-Test: Time Effects	77.24**	104.19**	122.28**	139.94**	121.84**	83.53**	70.26**	38.87**	19.58	11.18	4.67	
$\overline{R^2}$	0.74	0.80	0.83	0.85	0.83	0.82	0.82	0.85	0.85	0.84	0.83	
SER	0.96	0.97	0.95	0.99	1.11	1.28	1.32	1.35	1.49	1.64	1.92	
Jarque-Bera	2.62	3.49	1.79	2.57	3.50	1.67	1.50	1.68	4.90(*)	7.09*	4.05	

Notes: GMM-Time series (HAC) under the options: one step weighting matrix, iterate coefficient, Pre-whitening, Kernel Options Bartlett, Bandwidth selection Andrews. The numbers in parentheses are the t statistics of estimated parameters. '**' ,'*', '(*)' denote significance at the 1, 5, 10 percent levels, respectively. $\overline{R^2}$ is the adjusted coefficient of determination. SER is the standard error of regression and J.-B. the value of the Jarque-Bera-test on normality of the residuals. Outliers are the cantons of Luzern, Appenzell a.Rh, Glarus, Aargau and Vaud.

Table 3: Results of Wald Tests of Equality of Paired Coefficients of Neighbors Tax Rates

	Neighbors' TAX 30	Neighbors' TAX 50	Neighbors' TAX 60	Neighbors' TAX 80	Neighbors' TAX 100	Neighbors' TAX 150	Neighbors' TAX 200	Neighbors' TAX 300	Neighbors' TAX 400	Neighbors' TAX 500
Neighbors' TAX 30	-									
Neighbors' TAX 50	0.19	-								
Neighbors' TAX 60	0.96	1.64	-							
Neighbors' TAX 80	1.91	2.69	1.56	-						
Neighbors' TAX 100	2.00	2.36	1.21	0.37	-					
Neighbors' TAX 150	2.13	2.20	1.01	0.27	0.07	-				
Neighbors' TAX 200	1.95	2.10	0.95	0.26	0.10	0.02	-			
Neighbors' TAX 300	1.85	1.69	0.71	0.17	0.05	0.01	0.00	-		
Neighbors' TAX 400	1.71	1.44	0.59	0.12	0.02	0.00	0.00	0.01	-	
Neighbors' TAX 500	1.56	1.24	0.49	0.09	0.02	0.00	0.00	0.01	0.01	-
Neighbors' TAX 1m	1.58	1.22	0.57	0.17	0.08	0.04	0.03	0.05	0.10	0.20

Note : The cells contain the absolute values of the χ^2-test statistics of the Wald test. '**' ,'*', '(*)' denote significance at the 1, 5, 10 percent levels, respectively.

Table 4: GMM-Model of Strategic Tax Setting, Local and Regional Neighbors' Tax, 26 Swiss Cantons, 1984 – 1999

Dependent variable	TAX 30	TAX 50	TAX 60	TAX 80	TAX 100	TAX 150	TAX 200	TAX 300	TAX 400	TAX 500	TAX 1m	χ^2
Constant	0.904	-5.839	-7.280	-8.471	-4.996	4.919	6.722	7.810	12.551	16.862	19.336	13.70
	(0.12)	(-0.83)	(-1.02)	(-1.10)	(-0.58)	(0.44)	(0.51)	(0.47)	(0.66)	(0.83)	(0.83)	
Local Neighbors' Tax, t-1	0.513*	0.426*	0.502**	0.554**	0.549**	0.582**	0.600**	0.643**	0.657**	0.664**	0.774**	29.62**
	(1.98)	(2.25)	(3.03)	(3.66)	(3.61)	(3.47)	(3.54)	(3.44)	(3.28)	(3.19)	(3.67)	
Regional Neighbors' Tax, t-1	0.073	0.475*	0.485*	0.512*	0.515*	0.369	0.309	0.273	0.238	0.213	0.351	19.81*
	(0.21)	(1.96)	(2.20)	(2.42)	(2.31)	(1.53)	(1.17)	(0.87)	(0.66)	(0.55)	(0.82)	
Population, t-1	0.101*	0.117(*)	0.091	0.055	0.024	-0.013	0.012	0.099	0.188(*)	0.238*	0.343**	27.17**
	(2.02)	(1.83)	(1.27)	(0.76)	(0.30)	(-0.16)	(0.13)	(0.96)	(1.74)	(2.09)	(2.58)	
Share of Old Population, t-1	0.103	0.255**	0.298**	0.355**	0.323**	0.223(*)	0.246	0.297	0.286	0.254	0.202	34.08**
	(1.32)	(3.20)	(3.53)	(3.72	(3.03)	(1.67)	(1.56)	(1.44)	(1.19)	(0.98)	(0.66)	
Share of Young Population , t-1	0.048	0.126	0.121	0.090	0.013	-0.131	-0.159	-0.212	-0.316	-0.405	-0.576	14.67
	(0.46)	(1.34)	(1.27)	(0.86)	(0.11)	(-0.84)	(-0.83)	(-0.85)	(-1.10)	(-1.32)	(-1.58)	
Income, t-1	-0.112**	-0.091*	-0.090*	-0.090(*)	-0.106(*)	-0.116	-0.107	-0.121	-0.151	-0.168	-0.243	17.02
	(-2.61)	(-2.02)	(-1.99)	(-1.78)	(-1.87)	(-1.58)	(-1.20)	(-1.02)	(-1.10)	(-1.13)	(-1.35)	
Lump-Sum Grants, t-1	0.146	-0.001	-0.051	-0.129	-0.195	-0.410(*)	-0.495(*)	-0.483	-0.513	-0.561	-0.540	10.16
	(1.04)	(-0.04)	(-0.31)	(-0.75)	(-1.04)	(-1.79)	(-1.79)	(-1.30)	(-1.14)	(-1.10)	(-0.81)	
Unemployment Rate, t-1	0.042	0.310	0.376	0.423	0.435	0.092	0.059	0.288	0.288	0.252	0.170	9.29
	(0.12)	(0.98)	(1.25)	(1.36)	(1.13)	(0.19)	(0.11)	(0.42)	(0.37)	(0.29)	(0.15)	
Regional Dummy	0.450	-0.065	-0.083	-0.074	-0.174	-1.068	-1.383	-1.360	-1.349	-1.379	-1.018	6.48
	(0.53)	(-0.08)	(-0.11)	(-0.09)	(-0.18)	(-0.91)	(-1.03)	(-0.80)	(-0.72)	(-0.69)	(-0.42)	
F-Test: Time Effects	57.92**	60.76**	58.48**	53.12**	42.00**	30.34*	21.93	10.94	8.42	7.31	6.26	
$\overline{R^2}$	0.71	0.74	0.76	0.75	0.72	0.69	0.68	0.67	0.68	0.69	0.68	
SER	1.01	1.12	1.13	1.27	1.44	1.65	1.78	2.00	2.16	2.26	2.65	
Jarque-Bera	4.28	8.13*	10.38**	8.17*	2.69	9.09*	17.57**	6.54*	1.31	0.00	3.77	

Notes: GMM-Time series (HAC) under the options : one step weighting matrix, iterate coefficient, Pre-whitening, Kernel Options Bartlett, Bandwidth selection Andrews. The numbers in parentheses are the t statistics of estimated parameters. '**' ,'*', '(*)' denote significance at the 1, 5, 10 percent levels, respectively. $\overline{R^2}$ is the adjusted coefficient of determination. SER is the standard error of regression and J.-B. the value of the Jarque-Bera-test on normality of the residuals.

Table 5: Results of Wald Tests of Equality of Paired Coefficients of Local Neighbors Tax Rates

	Local Neighbors' TAX 30	Local Neighbors' TAX 50	Local Neighbors' TAX 60	Local Neighbors' TAX 80	Local Neighbors' TAX 100	Local Neighbors' TAX 150	Local Neighbors' TAX 200	Local Neighbors' TAX 300	Local Neighbors' TAX 400	Local Neighbors' TAX 500
Local Neighbors' TAX 30	-									
Local Neighbors' TAX 50	0.17	-								
Local Neighbors' TAX 60	0.00	0.81	-							
Local Neighbors' TAX 80	0.03	1.01	0.49	-						
Local Neighbors' TAX 100	0.02	0.62	0.18	0.01	-					
Local Neighbors' TAX 150	0.07	0.74	0.30	0.08	0.24	-				
Local Neighbors' TAX 200	0.10	0.82	0.39	0.15	0.30	0.06	-			
Local Neighbors' TAX 300	0.21	1.05	0.58	0.34	0.45	0.22	0.25	-		
Local Neighbors' TAX 400	0.24	1.04	0.59	0.35	0.43	0.24	0.24	0.08	-	
Local Neighbors' TAX 500	0.25	1.01	0.58	0.34	0.41	0.24	0.22	0.07	0.04	-
Local Neighbors' TAX 1m	0.74	2.05	1.50	1.16	1.24	1.02	1.16	1.16	1.66	2.55

Note : The cells contain the absolute values of the χ^2 -test statistics of the Wald test. '**' ,'*', '(*)' denote significance at the 1, 5, 10 percent levels, respectively.

Table 6: Results of Wald Tests of Equality of Paired Coefficients of Regional Neighbors Tax Rates

	Regional Neighbors' TAX 30	Regional Neighbors' TAX 50	Regional Neighbors' TAX 60	Regional Neighbors' TAX 80	Regional Neighbors' TAX 100	Regional Neighbors' TAX 150	Regional Neighbors' TAX 200	Regional Neighbors' TAX 300	Regional Neighbors' TAX 400	Regional Neighbors' TAX 500
Regional Neighbors' TAX 30	-									
Regional Neighbors' TAX 50	2.97(*)	-								
Regional Neighbors' TAX 60	2.56	0.01	-							
Regional Neighbors' TAX 80	2.06	0.06	0.08	-						
Regional Neighbors' TAX 100	1.75	0.04	0.05	0.00	-					
Regional Neighbors' TAX 150	0.66	0.22	0.38	1.44	2.94(*)	-				
Regional Neighbors' TAX 200	0.38	0.41	0.62	1.58	2.47	0.68	-			
Regional Neighbors' TAX 300	0.22	0.42	0.55	1.05	1.34	0.34	0.10	-		
Regional Neighbors' TAX 400	0.12	0.47	0.58	0.97	1.15	0.36	0.17	0.17	-	
Regional Neighbors' TAX 500	0.08	0.51	0.61	0.95	1.08	0.37	0.20	0.19	0.17	-
Regional Neighbors' TAX 1m	0.28	0.09	0.11	0.20	0.22	0.00	0.02	0.11	0.40	1.00

Note : The cells contain the absolute values of the χ^2-test statistics of the Wald test. '**' ,'*', '(*)' denote significance at the 1, 5, 10 percent levels, respectively.

Table 7: Results of Wald Tests of Equality of Paired Coefficients of Neighbors and Regional Tax Rates

	Local Neighbors' TAX 30	Local Neighbors' TAX 50	Local Neighbors' TAX 60	Local Neighbors' TAX 80	Local Neighbors' TAX 100	Local Neighbors' TAX 150	Local Neighbors' TAX 200	Local Neighbors' TAX 300	Local Neighbors' TAX 400	Local Neighbors' TAX 500	Local Neighbors' TAX 1M
Regional Neighbors' TAX 30	1.52										
Regional Neighbors' TAX 50		0.03									
Regional Neighbors' TAX 60			0.00								
Regional Neighbors' TAX 80				0.03							
Regional Neighbors' TAX 100					0.02						
Regional Neighbors' TAX 150						0.79					
Regional Neighbors' TAX 200							1.52				
Regional Neighbors' TAX 300								1.96			
Regional Neighbors' TAX 400									2.10		
Regional Neighbors' TAX 500										2.16	
Regional Neighbors' TAX 1m											1.45

Note : The cells contain the absolute values of the χ^2-test statistics of the Wald test. '**' ,'*', '(*)' denote significance at the 1, 5, 10 percent levels, respectively.

Table 8: Robustness of the GMM-Model of Strategic Tax Setting to Outliers, Local and Regional Neighbors' Tax, 26 Swiss Cantons, 1984 – 1999

Dependent variable	TAX 30	TAX 50	TAX 60	TAX 80	TAX 100	TAX 150	TAX 200	TAX 300	TAX 400	TAX 500	TAX 1m	χ^2
Constant	-5.680	-6.788	-7.092	-7.731	-5.205	4.338	8.243	13.152	16.549	19.028	22.983	14.64
	(-0.73)	(-1.04)	(-1.16)	(-1.20)	(-0.74)	(0.54)	(0.92)	(1.17)	(1.19)	(1.21)	(1.07)	
Local Neighbors' Tax, t-1	0.856**	0.603**	0.635**	0.669**	0.624**	0.610**	0.621**	0.615**	0.627**	0.658**	0.733**	38.82**
	(2.94)	(3.35)	(4.17)	(4.84)	(4.61)	(4.55)	(4.85)	(3.96)	(3.41)	(3.24)	(2.97)	
Regional Neighbors' Tax, t-1	0.575	0.591**	0.561**	0.535**	0.539**	0.387*	0.319(*)	0.277	0.263	0.254	0.312	18.45(*)
	(1.41)	(2.60)	(2.92)	(2.96)	(2.95)	(2.32)	(1.84)	(1.33)	(1.01)	(0.86)	(0.84)	
Population, t-1	0.116*	0.097(*)	0.088	0.100	0.101	0.080	0.121	0.202**	0.277**	0.323**	0.408**	25.76**
	(2.06)	(1.70)	(1.45)	(1.54)	(1.36)	(1.13)	(1.61)	(2.61)	(3.16)	(3.22)	(2.78)	
Share of Old Population,	0.083	0.189*	0.206**	0.262**	0.260**	0.187(*)	0.166	0.145	0.121	0.067	-0.043	26.39**
t-1	(0.96)	(2.35)	(2.73)	(3.20)	(2.93)	(1.89)	(1.46)	(0.93)	(0.60)	(0.29)	(-0.13)	
Share of Young Population	0.088	0.099	0.091	0.060	0.008	-0.117	-0.181	-0.278	-0.362(*)	-0.428(*)	-0.577(*)	14.05
t-1	(0.82)	(1.10)	(1.06)	(0.64)	(0.08)	(-0.99)	(-1.33)	(-1.58)	(-1.67)	(-1.74)	(-1.67)	
Income, t-1	-0.091(*)	-0.082(*)	-0.091*	-0.098*	-0.105*	-0.111*	-0.120*	-0.141(*)	-0.161(*)	-0.166	-0.186	8.61
	(-1.94)	(-1.90)	(-2.30)	(-2.32)	(-2.34)	(-2.20)	(-2.14)	(-1.81)	(-1.66)	(-1.51)	(-1.24)	
Lump-Sum Grants, t-1	0.013	-0.133	-0.160	-0.203(*)	-0.283*	-0.496**	-0.542**	-0.556**	-0.624*	-0.697*	-0.821	22.85*
	(0.10)	(-1.02)	(-1.24)	(-1.66)	(-2.30)	(-3.90)	(-3.91)	(-2.73)	(-2.30)	(-2.13)	(-1.58)	
Unemployment Rate, t-1	-0.163	0.048	0.205	0.321	0.325	0.032	0.063	0.265	0.299	0.334	0.258	9.82
	(-0.48)	(0.17)	(0.81)	(1.34)	(1.25)	(0.12)	(0.26)	(0.80)	(0.72)	(0.66)	(0.32)	
Regional Dummy	-0.006	-0.200	-0.048	-0.036	-0.361	-1.439(*)	-1.574*	-1.570	-1.486	-1.361	-1.363	18.65(*)
	(-0.01)	(-0.28)	(-0.08)	(-0.06)	(-0.50)	(-1.92)	(-1.98)	(-1.47)	(-1.16)	(-0.95)	(-0.71)	
Appenzell Rhodes	0.726*	-0.591	-1.127*	-1.478**	-2.173**	-3.475**	-3.950**	-3.770**	-4.058**	-3.964**	-3.709**	85.24**
Extérieur	(2.18)	(-1.39)	(-2.07)	(-3.21)	(-3.56)	(-3.99)	(-3.79)	(-3.98)	(-4.15)	(-3.72)	(-2.88)	
Glarus	-1.047**	-1.474**	-1.724**	-1.946**	-2.329**	-3.312**	-3.588**	-4.001**	-4.217**	-4.337**	-4.562**	116.75**
	(-2.61)	(-4.95)	(-5.84)	(-6.63)	(-7.24)	(-9.08)	(-8.63)	(-6.97)	(-5.79)	(-5.08)	(-3.73)	
Nidwald	0.653	0.872*	1.379**	1.931**	2.105**	2.495**	3.170**	4.083**	4.774**	5.572**	6.860**	84.02**
	(2.05)	(2.17)	(3.50)	(5.21)	(5.46)	(6.00)	(6.39)	(5.32)	(4.40)	(4.07)	(3.55)	
Vaud	-1.260	0.410	0.407	-0.696*	-1.614**	-2.660**	-2.999**	-3.312**	-3.058**	-2.898**	-3.031**	67.86**
	(-1.49)	(0.94)	(1.19)	(-2.04)	(-3.90)	(-5.26)	(-5.83)	(-4.82)	(-4.26)	(-4.11)	(-3.74)	
F-Test: Time Effects	83.64**	104.65**	105.60**	95.46**	76.53**	63.80**	49.24**	18.59	11.75	9.50	7.38	
$\overline{R}^2$	0.72	0.76	0.80	0.80	0.79	0.81	0.81	0.81	0.81	0.81	0.81	
SER	1.01	1.06	1.04	1.13	1.25	1.30	1.35	1.51	1.67	1.78	2.06	
Jarque-Bera	7.20*	2.48	6.61*	5.40(*)	1.25	0.55	0.65	5.48(*)	3.36	1.86	0.79	

Notes: GMM-Time series (HAC) under the options : one step weighting matrix, iterate coefficient, Pre-whitening, Kernel Options Bartlett, Bandwidth selection Andrews. The numbers in parentheses are the t statistics of estimated parameters. '**' ,'*', '(*)' denote significance at the 1, 5, 10 percent levels, respectively. $\overline{R}^2$ is the adjusted coefficient of determination. SER is the standard error of regression and J.-B. the value of the Jarque-Bera-test on normality of the residuals. Outliers are the cantons of Appenzell a.Rh, Glarus, Nidwald and Vaud.