Università
della
Svizzera
italiana

Faculty
of Economics

IdEP Economic Papers

2014 / 07

R. Parchet

Are local tax rates strategic complements or strategic substitutes?

Are Local Tax Rates Strategic Complements or Strategic Substitutes?

Raphaël Parchet*

University of Lugano (USI)

This version: September 2014

Abstract

The identification of strategic interactions among local governments is typically plagued by endogeneity problems. This paper proposes an identification strategy that makes use of a multi-tier federal system. State-level fiscal reforms provide an arguably exogenous source of variation in tax rates of local jurisdictions. Moreover, state borders spatially bound the effects of state-level fiscal reforms across areas that are otherwise highly integrated. Using the fact that local jurisdictions located close to a state border have some neighbors in another state, I propose to instrument the (average) tax rate of neighbor jurisdictions with the state-level tax rate of the neighboring state. I use this instrument to identify strategic personal income tax setting by local jurisdictions in Switzerland. In contrast to most of the existing empirical literature and to all results based on standard instruments, I find that tax rates are strategic substitutes in most cases. Tax rates are found to be strategic complements only in the context of large tax cuts.

JEL classification: H24, H71, H77
Keywords: tax competition, fiscal federalism

*I am grateful to Marius Brülhart, Gilles Duranton, Rafael Lalive and Kurt Schmidheiny for valuable comments and suggestions. I also thank David Agrawal and seminar participants at the Universities of Lausanne, Lugano, Aix-Marseille, Bern, Lucerne, St Gallen, as well as participants at UEA Atlanta, NTA Tampa, SEA Tampa, CBT Oxford, IEB Barcelona, IIPF Dresden and SSES Neuchâtel. I acknowledge financial support from the Swiss National Science Foundation (Sinergia Grants No. 130648 and 147668). I am indebted to Thomas Bruederli at search.ch for providing distance data. Contact: Raphaël Parchet, IRE and IdEP, Università della Svizzera italiana (USI), Via Maderno 24, 6900 Lugano, Switzerland. raphael.parchet@usi.ch

Tax competition has become one of the most hotly debated economic policy issues among as well as within nation states. The mobility of tax bases is often seen as placing an ever more severe constraint on the revenue-raising power of independent jurisdictions. This mechanism has been modeled formally in a well established theoretical literature (see, e.g., Wilson, 1999, for a review). Empirically, it has become standard to interpret positive spatial correlations in tax rates at the sub-national and international level as evidence of competition over mobile tax bases. I argue that this approach faces two important challenges. First, it implicitly assumes that tax competition implies strategic complementarity of competing jurisdictions' tax rates, even though this need not be the case in tax competition models. Second, identification of causal interactions is far from straightforward. My contribution is to propose a new identification method based on an instrument that exploits multi-tier tax setting in a federal system. Taking this estimation approach to data for local tax setting in Switzerland, I find that tax rates are strategic substitutes, except for large tax cuts.

Regarding strategic complementarity, many tax competition models indeed predict that, in an attempt to retain its mobile tax base, a jurisdiction will lower its tax rate when tax rates of neighboring jurisdictions fall. Tax reaction functions thus have a positive slope and tax rates are strategic complements. Yet, this result relies on some specific assumptions. First, standard models assume governments seek to maximize tax revenues, with expenditures adjusting through the budget constraint. As Wildasin (1988, 1991) shows, however, if governments instead optimize over expenditure levels with tax rates adjusting residually, tax reaction functions have a negative slope and tax rates are strategic substitutes. In this setting, a jurisdiction that faces a decrease in its tax base through a more competitive environment will increase its tax rate to maintain its current level of expenditure, even at the expense of a further adverse effect on its tax base. Second, even in a model where local governments maximize tax revenue, the slope of the reaction function depends on the elasticity of substitution between the public and the private good. As de Mooij and Vrijburg (2012) show, tax rates are strategic complements if public and private goods are close substitutes (as assumed in standard models) but strategic substitutes if public and private goods are close complements.[1]

[1]See also Brueckner and Saavedra (2001) and Chirinko and Wilson (2013) for a similar argument.

Empirical evidence has so far pointed towards positively-sloped tax reaction functions (see, e.g., Allers and Elhorst, 2005, on local tax competition and Devereux et al., 2008, on international tax competition over corporate tax rates).[2] These empirical studies apply spatial regression models where the tax rate in one jurisdiction is regressed on the average tax rate of neighboring jurisdictions. Identification of strategic interactions in these models is however plagued by two-way causality (see, e.g., Brueckner, 2003). The main challenge consists in disentangling endogenous strategic interactions from unobserved and spatially correlated characteristics such as preferences, topographical features, or institutions. The standard estimation method is either to assume that the estimated equation fully describes the true data generating process and to apply maximum likelihood methods, or to use an instrumental variable approach taking average characteristics of neighboring jurisdictions as instruments. As pointed out by Gibbons and Overman (2012), these methods generally do not offer reliable identification of causal relations. The first approach assumes implausibly that the true data generating process in known. With the second method, instruments are likely to be invalid due to endogenous population sorting and the existence of spatially correlated local shocks. The key for identification is to isolate variations in the tax rate of competing jurisdictions that can be plausibly considered as exogenous.

This paper proposes to make use of a multi-tier federal system. Fiscal reforms at the (upper-tier) state level provide an arguably exogenous source of variation in the tax rate levied at the (lower-tier) local level. Moreover, state borders spatially bound the effects of state-level fiscal reforms across areas that are otherwise highly integrated. I thus propose to identify strategic interactions among local jurisdictions using the fact that jurisdictions located close to a state border have some immediate neighbors in another state. As long as individual local jurisdictions do not significantly affect state-level tax setting, the state-level tax rate of the *neighboring* state is a valid instrument for the average tax rate of neighboring local jurisdictions. I use this new instrument to identify strategic personal income tax setting by local jurisdictions (municipalities) in Switzerland. I find that, once I instrument properly in this way, tax reaction functions have a negative slope and hence that tax rates are strategic substitutes. Decomposing this result according to the sign and

[2] A notable exception to the prevailing empirical results is the analysis by Chirinko and Wilson (2013) who find that tax reaction functions for corporate income taxes among U.S. states have a negative slope.

magnitude of the exogenous tax change suggests that tax rates are strategic complements only for large tax cuts.

Papers that are methodologically related to this study include Chirinko and Wilson (2008), Rathelot and Sillard (2008), Duranton et al. (2011) and Rohlin et al. (2014). These papers use state borders to identify the effect of local taxation on business location in the U.S., in France and in the UK. They confirm the existence of a tax-induced mobility of the tax base, but they do not analyze strategic interactions among local jurisdictions. Departing from estimating a spatial regression model, Lyytikäinen (2012) uses a fiscal reform in Finland that raised the minimum property tax rate affecting only a subset of municipalities to identify tax competition. He finds no evidence for strategic interactions whereas standard instrumental variables techniques indicate a strong and positive one. Isen (2014) also finds no evidence for spatial fiscal spillovers among neighboring jurisdictions in Ohio using close elections of local referenda as source of exogenous increase in taxation. Agrawal (forthcoming) explores the spatial pattern of local sales tax rates in the U.S. at state borders where state sales tax rates change discontinuously. His results suggest that local sales taxes are set as a function of the distance to state borders and of state tax differentials. Eugster and Parchet (2013) use a cultural border to identify strategic interactions among municipalities in Switzerland. Exploiting a discrete and measurable discontinuity in voter preferences between the French-speaking and the German-speaking regions in Switzerland, they find that tax competition does constrain income taxation of municipalities at the language border.

The paper proceeds as follows. Section 1 sets out my proposed identification strategy. Section 2 describes the empirical setting. Section 3 introduces the data while Section 4 presents the baseline results and shows that tax rates are strategic substitutes. Section 5 provides evidence that tax rates are strategic complements only for large negative tax changes. Section 6 concludes.

1 Identifying strategic interactions at state borders

I exploit two features of a prototypical federal system. First, different levels of governments, with full or partial fiscal autonomy, share the same tax base. Second, state borders bound spatially the effects of state-level fiscal policies across areas that are otherwise highly integrated. Consider, for simplicity, a federation with two levels of sub-federal governments that both levy a tax on personal income: states ("cantons" in Switzerland) levy a tax at rate t_c, and municipalities independently levy a tax on the same base at rate t_{ic}. The consolidated state plus municipal personal income tax rate in municipality i belonging to state c is therefore $T_{ic} = t_c + t_{ic}$. With mobile tax bases, this setting gives rise to two classical externalities studied in the literature: a vertical externality between the different levels of government that share the same tax base and an horizontal externality among neighboring jurisdictions with separate but interdependent tax bases (Keen and Kotsogiannis, 2002).

I propose to identify horizontal strategic interactions among municipalities in their tax setting by using state-level tax reforms of the neighboring state as a source of exogenous variation in the taxation of the neighboring municipalities. More specifically, I estimate the following linear regression model

$$T_{ic,t} = \alpha \overline{T}_{-i,t} + \beta' \mathbf{X}_{ic,t} + \gamma_i + \delta_{c,t} + \varepsilon_{ic,t} \ , \tag{1}$$

where $\overline{T}_{-i,t}$ is the weighted average of neighboring municipalities' consolidated tax rate, $\mathbf{X}$ is a vector of controls, γ_i and $\delta_{c,t}$ are municipality and state-year fixed effects, respectively. α is the coefficient of interest designed to measure strategic interactions among municipalities. Municipality fixed effects control for all unobservable time-invariant and municipality-specific features. Hence, identification of α is obtained through the comparison of different time-varying patterns in taxes. State-year fixed effects are key for the identification strategy (see below) by controlling for all events at the state level - including state strategic tax setting - that affect municipalities in the state simultaneously and identically. The main issue in the estimation of equation (1) arises because the tax rate of a neighboring municipality itself depends on the tax rate of municipality i. Moreover, many time-varying determinants of one jurisdiction's tax rate, such as local economic conditions, are likely to be unobservable and spatially correlated, such that $\overline{T}_{-i,t}$ will inevitably be correlated with $\varepsilon_{ic,t}$ and the estimation of α will be biased. I propose in this paper to instrument $\overline{T}_{-i,t}$ by the state tax rate of the neighboring state, $t_{-c,t}$.[3]

The instrument

Figure 1 illustrates the approach through a map. It shows a municipality i and its four main neighbors across a state border between two states, A and B.[4] $\overline{T}_{\{1,2,3,4\}}$ is instrumented by the state tax rate of state A, t_A. Consider that, for reasons unrelated to municipalities 1 to 4, state A raises t_A. Under some assumptions on vertical strategic interactions (discussed below), this raises the consolidated state plus municipal tax rate in municipalities 1 and 2, but does not directly change the tax bill a taxpayer has to pay by living in state B. Municipalities located in state B have no incentive to change their tax rate, unless tax bases are mobile and municipalities interact strategically in their tax setting.[5] Therefore, provided that taxpayers care only about their total tax bill and do not react differently to changes in state-level and municipality-level tax rates, the reaction of municipality i to a change in t_A will reveal the nature of the horizontal strategic interactions among municipalities.[6] Moreover, t_A can be used as an instrument for $\overline{T}_{\{1,2,3,4\}}$ if it satisfies two conditions. First, it has to be exogenous to tax decisions of individual municipalities.[7] Second, it should be relevant, i.e. it should imply sufficient variation in $\overline{T}_{\{1,2,3,4\}}$.

Regarding the exogeneity condition, a first requirement is that individual municipalities do not systematically affect state-level tax policies (no reverse causality). This is likely to be fulfilled in states with a sufficiently high number of municipalities and a population not too concentrated in municipalities close to one particular state border. To see this, assume that state A is composed by M municipalities of sizes n_j such that the state population

[3]I thus concentrate on what Agrawal (2014) calls "diagonal externalities". These externalities are conceptually different than "pure" horizontal externalities as they involve different levels of government, but they are empirically equivalent. In contrast to Agrawal (2014), I control for strategic tax interactions among states and use the tax rate of the neighboring state as an instrument to identify horizontal strategic interactions among municipalities across a state border.

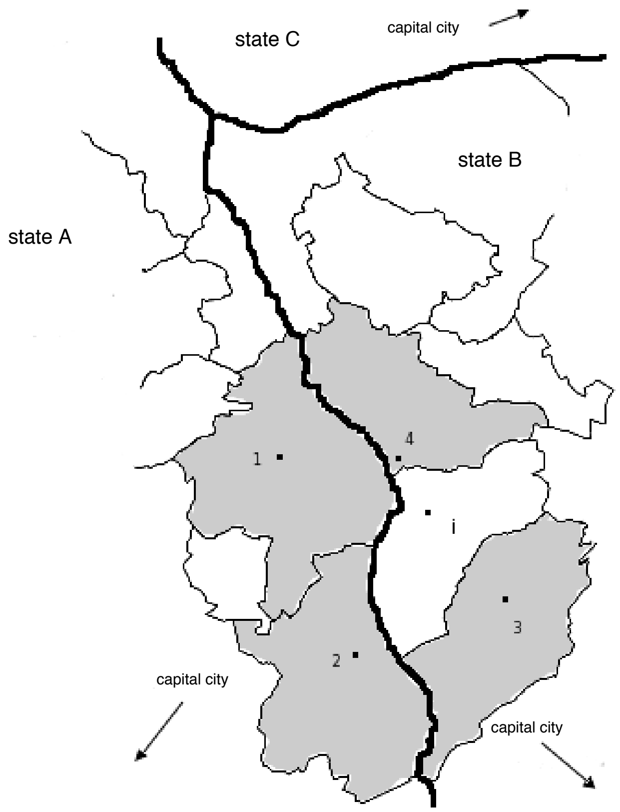
[4]The set of strategically relevant municipalities is not known and should be defined according to some prior. In this illustrative example, a maximum road distance of 5 kilometers between municipalities' main towns selects municipalities 1 to 4. The empirical part shows results for different distance bandwidths, with a baseline cutoff of 10 kilometers.

[5]I abstract here from political-economy mechanisms (such that "yardstick competition") that predict a positive spatial correlation in tax rates among neighboring municipalities, an outcome not supported by the empirical evidence provided by this paper.

[6]Taxpayers may be more aware of changes in tax rates at the local level than at the state level. I assume here that such salience-induced behaviors are absent.

[7]That is, $Cov(t_{-c,t}, \varepsilon_{ic,t}) = 0$ in equation (1).

Figure 1 – Neighboring municipalities across a state border



Note: This illustrative map represents municipalities in Switzerland at the state (cantonal) border between Bern, Aargau and Luzern. State borders are in bold. Points represent municipalities' population-weighted centroids. The main neighboring municipalities of municipality i are in grey. They are selected according to a maximum road distance to i's centroid of 5 kilometers.

$N = \sum_{j=1}^{M} n_j$. The tax base elasticity of municipality 1 to the tax rate of municipality i is $\varepsilon_{n_1,t_i} = \frac{\partial n_1}{\partial t_i}\frac{t_i}{n_1}$, whereas the state-level tax base elasticity of state A to the tax rate of municipality i is $\varepsilon_{N,t_i} = \varepsilon_{n,t_i}\frac{n_1+n_2}{N}$ (assuming $\varepsilon_{n_1,t_i} = \varepsilon_{n_2,t_i} = \varepsilon_{n,t_i}$). Hence, state A is unlikely to react to t_i provided $\frac{n_1+n_2}{N}$ is small enough.[8] Following the empirical literature on vertical strategic interactions, one may also assume that states act as first movers with municipalities reacting subsequently (see, e.g., Hayashi and Boadway, 2001). To further minimize the potential for reverse causality, I shall use $t_{-c,t-1}$ as instrument.

Second, state-level tax reforms in A should not be driven by some unobserved factors

[8] Note that any state-level fiscal decisions affect all municipalities similarly in the state, reducing further the likelihood of a state-level decision driven only by a subset of border municipalities.

that also affect the taxation decision of municipality i and its neighbors. The key concern here is the existence of (horizontal) strategic interactions among states themselves. These strategic interactions are controlled for in equation (1) by the state-year fixed effects $\delta_{c,t}$. These fixed effects capture all state-wide policies in one state as well as all confounding shocks that affect simultaneously all municipalities in one or in several states. State-year fixed effects imply that the identification of strategic interactions among neighboring municipalities stems from the within-state differential response of municipality i to changes in t_A, compared to other municipalities in the same state (state B) not affected by t_A, i.e. municipalities located at another border than the border with state A.[9]

So far, the instrument and the inclusion of state-year fixed effects capture confounding factors that occur at a small spatial scale (only border municipalities) or at a large spatial scale (state-wide shocks). Another concern for the instrument's validity is the existence of shocks that may affect the fiscal decision of state A and (only) border municipalities in state B. This arises if border municipalities share, e.g., the same labor market. Such local confounding factors will not be captured by state-year fixed effects. Yet, they are arguably a concern only if state A is a small state. In terms of Figure 1, the exogeneity assumption requires that state A is a large state with a capital city located "far away" from municipality i, such that their fiscal decisions are independent. In Section 4.3, I show that my results are robust to the exclusion of small states (cantons) and of states in which the capital city of located close to the state border. Note also that fiscal decisions driven by confounding factors are likely to be positively correlated, thus biasing the estimate of strategic interactions towards zero if tax rates are strategic substitutes.

Regarding the (first-stage) relevance of the instrument, state-level tax policies should imply economically and statistically significant variations of $\overline{T}_{\{1,2,3,4\}}$. If this condition were not satisfied, the instrument would be "weak" and the estimate of strategic interactions would be imprecisely measured and too high (in absolute value).[10] The effect of t_A on $\overline{T}_{\{1,2,3,4\}}$ depends, first, on the reaction of municipalities 1 and 2, that is on within-state A vertical interactions. Vertical interactions are even more likely to arise at state borders,

[9]This strategy comes at the price of discarding from the identifying set all states that share a border with only one other state.

[10]In the empirical section, I analyze 30 years of cantonal and municipal personal income taxation in Switzerland, showing important variations of the cantonal tax rate, both between cantons and over time (see Section 2).

where the common tax base may presumably easily relocate to and from another state.[11] The net effect of state-level tax policies on the consolidated tax rate of municipalities in the same state cannot be predicted, since the sign of vertical interactions is ambiguous (see, e.g., Keen and Kotsogiannis, 2002). However, the identification strategy of this paper requires no prior on this sign. All that is required is that municipalities 1 and 2 do not exactly offset changes in the state-level tax rate t_A. This can be tested by a first-stage F-test on the instrument.

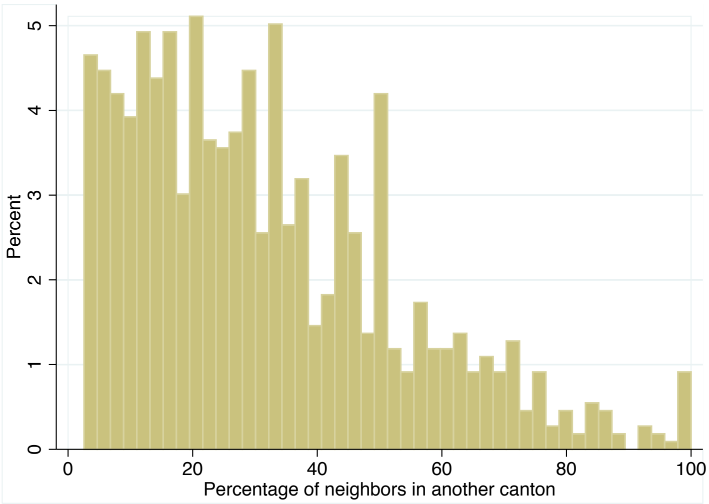
The quality of the first-stage estimation depends also on the reaction of i's neighbor municipalities located on the same side of the state border (municipalities 3 and 4). This reaction is likely to vary with the distance to the state border. Municipalities located further away from the border than i may react potentially less to t_A. The sign of the tax reaction function also matters. If tax rates are strategic substitutes, municipalities 3 and 4 will decrease their tax rates to any increase in T_{1A} and T_{2A}. Thus, the *average* tax rate of municipalities 1 to 4 may not change, even if T_{1A} and T_{2A} change and strategic interactions are strong. Overall, the total effect of state-level tax policies on $\overline{T}_{\{1,2,3,4\}}$ depends crucially on the share of neighboring municipalities directly affected by these reforms. I propose to follow the strategy used in the peer-effects literature and multiply the instrument by the share of neighboring municipalities located in another state than the state of municipality i (see, e.g., Moffitt, 2001; Lalive and Cattaneo, 2009). This strategy recognizes the fact that tax reforms in neighboring state will affect municipalities on the other side of the state border only if they affect the tax rate of a sufficient number of competing municipalities. In my illustrative example, $\overline{T}_{\{1,2,3,4\}}$ is thus instrumented by $t_A \times 0.5$.

Figure 2 plots the distribution of the shares of neighbor municipalities that are located in another canton than that of the reference municipality (using a 10 kilometers-distance cutoff). As expected, for most municipalities the majority of their neighbors belongs to the same canton. Nevertheless, the share of municipalities with a high number of neighbors in another canton is far from negligible.

I now proceed to apply this identification strategy to strategic personal income tax setting by Swiss municipalities.

[11] Brülhart and Jametti (2006) show that vertical interactions between municipalities and cantons play a significant role in the determination of local tax rates in Switzerland.

Figure 2 – Distribution of the percentage of neighboring municipalities in Switzerland located in another canton (state)



Note: Municipalities have at least one neighboring municipality within a road distance of 10 kilometers that is located in another canton

2 Setting

Switzerland is a highly decentralized country where the main political units are the 26 cantons and the 2,485 municipalities (in 2012). The number of municipalities per canton ranges from 3 to a maximum of 382, with an average of 96. In 2012, the average population per municipality was 3,235 with a maximum of 381,000.

2.1 Personal income taxation

Cantons and municipalities enjoy large fiscal autonomy. About 50% of cantonal and municipal revenue are raised through their own taxes. At both levels, the personal income tax is the main fiscal instrument, accounting for 61% of tax revenue at the cantonal level and 68% at the municipal level.[12] Personal income taxes are residence based, whereas corporate taxes are source based (with formula apportionment).

Cantons choose multiple aspects of their tax system. First, they set deductions and exemptions for the definition of the taxable income as well as a complete statutory tax schedule. Then, they fix annually a multiplier applied to the basic statutory tax schedule, thus determining applied tax rates in any given year. Any change in the tax base or

[12] Corporate taxes account for 18% (16% for municipalities) and wealth taxes for 8% (9%) of revenues.

schedule implies a revision of the fiscal law and is ultimately submitted to a referendum. In contrast, cantonal multipliers are adapted each year by cantonal parliaments to the canton's fiscal objectives.

Municipalities have to apply the cantonal definition of the tax base and schedule but can decide on a municipal tax multiplier that applies to the basic statutory tax rate. Municipal multipliers are fixed annually by municipal parliaments or citizen assemblies.[13] A central feature of this system is that municipalities are restricted to a single instrument, their tax multiplier, such that intra-cantonal variation in the consolidated personal income tax rate is perfectly captured by a single variable, municipal tax multipliers.[14]

On average, cantonal and municipal taxes account for similar shares of the consolidated tax liability.[15] The average consolidated cantonal plus municipal tax rate for an unmarried taxpayer with a gross annual income of CHF 1,000,000 (the highest income listed in official statistics) is 23% in 2012, ranging from 6% to a maximum of 30%.[16] The average tax rate at the cantonal level is 11%, ranging from 3% to 20%. Key to this paper, cantonal tax rates also exhibit important variation over time (see Appendix Figure A.1).

2.2 Cantonal borders

I concentrate on the consolidated municipal and cantonal tax rate for the personal income tax in municipalities close to a cantonal border. Figure 3 shows the 1,047 border municipalities in Switzerland, defined as having at least one neighbor within a road distance of 10 kilometers that is located in another canton. All border municipalities for which cantonal borders correspond to topographical particularities like the Alps in the South/South-East are thus not considered as road distances exceed the cutoff. Cantonal borders mostly

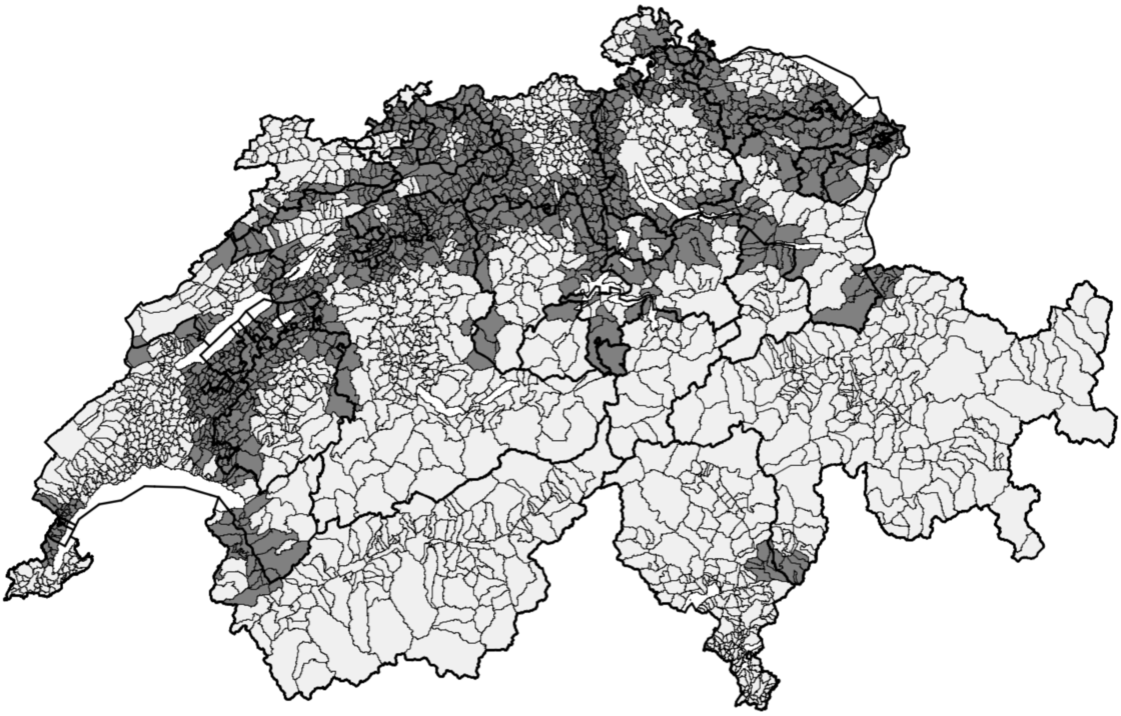
[13]In most cantons, multipliers are the same for personal income, wealth and corporate taxes. In the few cases where they differ, cantonal and municipal multipliers remain, in practice, highly correlated. Note also that, in some cantons, the corporate tax in set only by the canton. Finally, in a majority of cantons, other entities such as parishes are allowed to set their own tax multiplier. These multipliers are in general very low.

[14]Some exceptions exist. In the canton of Neuchâtel (before 2001) and in the canton of Solothurn (before 1986) municipalities were allowed to set their own tax schedule. In the canton of Basel-Stadt (3 municipalities), the municipal tax rate of the municipality of Basel is included into the cantonal tax rate. As this plausibly violates the exogeneity assumption of the instrument, I drop the canton of Basel-Stadt from the empirical analysis.

[15]Important variations across cantons exist. The cantonal share of the consolidated tax liability ranges from 25% in the canton of Schwyz to 95% in the canton of Glarus.

[16]In 2012, the average exchange rate was 0.9 Swiss Franc (CHF) to the US dollar.

Figure 3 – Municipalities within 10 km of a cantonal border



Note: Municipalities in gray have at least one municipality within a road distance of 10 km that is located in another canton. Cantonal borders are in bold. The canton of Basel-Stadt (3 municipalities) is not used in the sample (see Section 3.2). Road distances are taken from the online route planner search.ch.

do not coincide with language borders nor do they divide functional labor markets or other economic institutions. They do not deter mobility either. According to migration data, 30% of people arriving in or moving out border municipalities in my sample change their canton of residence (roughly two percent of the corresponding municipal population). Moreover, 15% of all employed individuals residing in these border municipalities commute daily to another canton, with an average commuting distance of 17 kilometers (Federal Population Census 2000).[17]

In order to gauge the representativeness of the retained sample of municipalities, Table 1 compares population characteristics (nationality, age, income, education), political orientation (support in favor of left-of-center parties), economic activity (employment shares by sector, unemployment, tourist destination), amenities (no. of movie theaters in the neighborhood) and geographic features (urban area, area, altitude, lake shore) of border

[17]This proportion rises to 33% when considering only individuals who work in different municipality from their municipality of residence.

Table 1 – Background characteristics of border and non-border municipalities

	Border municipalities	Non-border municipalities	Difference	
				in mean deviation
	(1)	(2)	(3)	(4)
Background characteristics				
Population (in 1,000)	2.46	2.89	−0.43	−15.87%
% Foreign nationals	9.55	10.60	−1.05***	−10.33%
% Young (≤ 20)	22.06	21.23	0.83***	3.85%
% Old (≥ 80)	13.09	14.26	−1.17***	−8.50%
% Primary sector	16.01	15.11	0.91*	5.87%
% Secondary sector	36.87	33.53	3.34***	9.56%
% Tertiary sector	47.11	51.36	−4.25***	−8.58%
Unemployment rate	1.44	1.69	−0.26***	−16.46%
Total employment (per capita)	0.25	0.28	−0.03***	11.54%
% Votes for left-of-center parties (national elections)	18.91	18.75	0.16	0.85%
Urban area	0.36	0.36	−0.00	0.00%
Center of urban area	0.03	0.03	−0.00	0.00%
Tourist destination	0.01	0.10	−0.09***	−150.00%
No. of movie theaters within 10 km	3.13	3.23	−0.10	−3.13%
Lake shore	0.13	0.18	−0.04***	−25.00%
Altitude (m.a.s.l.)	535.98	685.98	−150.00***	−24.10%
Productive area (km^2)	553.11	494.59	58.52***	11.27%
Migration-related characteristics				
% top 10% income	8.02	7.67	0.35	4.48%
% bottom 50% income	54.30	57.44	−3.14***	−5.60%
Gini index	0.32	0.34	−0.02***	−6.06%
% High education (tertiary)	15.93	15.16	0.77***	4.97%
% Intermediate education	79.68	80.82	−1.14***	−1.42%
% No education	4.40	4.03	0.37***	8.85%
No. of municipalities	1047	1423		

Note: *** p<0.01, ** p<0.05, * p<0.10. Border municipalities are defined as having at least one neighboring municipality within a road distance of maximum 10 km that is located in another canton. Urban area, center of urban area, tourist destination, and lake shore are binary variables. Source: Swiss Federal Statistical Office. Employment is the total full-time equivalent employment in the secondary and tertiary sectors. Source: Business Census. Votes for left-of-center parties in national elections provided by the Swiss Federal Statistical Office. Number of theaters within 10 km computed for each year based on data by the Swiss Federal Statistical Office. Productive area is the total area minus forest, water and alpine areas. Source: Swiss Federal Statistical Office. Top 10% income are taxpayers with a taxable income in the highest decile. Bottom 50% income are taxpayers with a taxable income below the median. In 2010, the top decile includes all taxpayers with a taxable income over CHF 105,000 (56,000 in 1983) and the median income is CHF 44,000 (24,000 in 1983). Income shares and the Gini index are computed using the Federal Income Tax statistics from 1983 to 2010. Source: Swiss Federal Tax Administration, Bern. Other data from the Swiss Federal Census of 1980, 1990 and 2000. Source: Swiss Federal Statistical Office. Standard errors are clustered two-ways, by municipality and by year.

and non-border municipalities. It appears from column (3) that differences between the two samples are statistically significant for a majority of background variables. Yet these differences are economically small. Column (4) reports these differences in percentage deviation from their mean. The most important difference is found for the variable "tourist destination" and reflect the location of most tourist resorts in the Alps. This also explains the difference in altitude. Other differences are small and I do not expect my conclusions to be driven by special features of border municipalities selected in my sample.[18]

3 Empirical analysis

3.1 The estimating equation

My starting point is equation (1)

[18] As I shall show in Table 2, coefficients measuring the spatial correlation of tax rates for all municipalities and for border municipalities are not statistically significantly different from each other.

$$T_{ic,t} = \alpha \overline{T}_{-i,t} + \beta' \mathbf{X}_{ic,t} + \gamma_i + \delta_{c,t} + \varepsilon_{ic,t} \ ,$$

where

$$\overline{T}_{-i,t} = \sum_{j \neq i}^{N} w_{ij} T_{j,t} \ .$$

$\overline{T}_{-i,t}$ is not restricted to municipalities within the same canton and may include municipalities across the canton border.[19] w_{ij} are ex ante chosen weights. As a baseline specification, I use uniform weights defined as

$$w_{ij}^{U} = \begin{cases} \frac{1}{N} \text{ if } d_{ij} \leq D \text{ km} \\ 0 \text{ otherwise} \ , \end{cases} \tag{2}$$

where d_{ij} is the shortest road distance between municipalities i and j, $N = \sum \mathbf{1}_{d_{ij} \leq D \text{ km}}$ and $D = 10$ km.[20]

Following the discussion in Section 1, $\overline{T}_{-i,t}$ is instrumented by $t_{-c,t-1} \times S_{ic}$ where $S_{ic} = \frac{N_{-c}}{N}$ is the share of neighboring municipalities located in the neighboring canton ($N_{-c} = \sum \mathbf{1}_{d_{ij} \leq D \text{ and } j \notin c}$). If municipalities have neighbors in more than one canton, the instrument becomes $\bar{t}_{-c,t-1} \times S_{ic}$ where $\bar{t}_{-c,t-1}$ is constructed with the same weights as in (2). To take into account any remaining correlations in the error term not captured by fixed effects, standard errors in all estimations are clustered two-ways, by municipality and by year.

3.2 Data

My main variable is the consolidated cantonal and municipal personal income tax rate by municipality between 1983 and 2012.[21] These tax rates are published by the Swiss Federal

[19] For this reason, the variable of interest is the consolidated cantonal and municipal tax rate at the municipality level, and not municipal tax multipliers that are not comparable across cantons.

[20] Appendix B presents results with alternative specifications of spatial weights.

[21] There were 2,485 municipalities in Switzerland in 2012. The canton of Basel-Stadt (3 municipalities) is dropped because its tax system plausibly violates the exogenity assumption of the instrument required by the identification strategy of this paper (see footnote 14). The district of Laufen (13 municipalities) and one municipality in the canton of Jura are dropped because they changed canton during the sample period. If municipalities merge, the average value of previous jurisdictions is reported for the new jurisdiction according to the list of municipalities as of December 31, 2012. If municipalities split, the average value of the new jurisdictions is reported for the previous jurisdictions. This is the case for six existing municipalities that are not included in the dataset. The merge of the 25 municipalities of the canton of Glarus into three municipalities in 2011 was not taken into account. Instead, I report missing values for that canton after

Tax Administration for a sample of the largest municipalities and are defined as shares of the consolidated cantonal, municipal and church tax liability in gross annual income for different categories of taxpayers (unmarried, married without children, married with two children) and income classes (from CHF 10,000 to CHF 1,000,000). I expand these data to all municipalities and compute cantonal tax rates for all cantons with a methodology detailed in the Web Appendix.[22]

The control vector **X** in equation (1) contains municipality characteristics including population, the percentage of foreign nationals, the percentage of young aged less than 20 and old aged more than 80, the percentage of employees in the secondary and tertiary sectors respectively, total full-time equivalent employment, the unemployment rate, the share of votes in favor of left-of-center parties in national elections and the number of movie theaters within 10 km. Average values of these variables for neighboring municipalities are also included in **X** with identical spatial weights to those applied to tax rates. Migration-related characteristics, listed in Table 1, are likely to be endogeneous and therefore not included in **X**. Other background characteristics show no or very little variation over time. They are captured by municipality fixed effects and thus are not included in the regressions. Note also that state (canton)-year fixed effects in equation (1) restrict the set of identifying observations to cantons that have more than one neighbor. This implies the exclusion from the set of identifying observations of 30 municipalities for a distance to a cantonal border of 10 kilometers.

4 Results

4.1 Baseline results

In the subsequent analysis, the dependent variable is the consolidated tax rate for an unmarried taxpayer with a gross annual income of CHF 1,000,000. This is the top income listed in official statistics and refers presumably to the most mobile tax base.[23] Results

2011.

[22]Some special features of the tax system or missing information prevent the computation of cantonal tax rates in the cantons of Neuchâtel (before 2001), Soloturn (before 1986) and Appenzell Innerrhoden (before 2001). To avoid spurious variation in $\overline{T}_{-i,t}$ when these cantons appear in the sample, values of neighboring municipalities are also set to missing.

[23]This corresponds to the top 0.1% income in 2010. Between 1983 and 2012, cumulative inflation is 60%. Cantons adjust their tax schedule for inflation on a regular basis. Theses adjustments are not a

Table 2 – Spatial correlations in tax rates

	All municipalities	Border municipalities	
	OLS	OLS	IV
	(1)	(2)	(3)
Tax rate of neighboring municipalities	0.439***	0.412***	0.662***
	(0.030)	(0.040)	(0.163)
First-stage F-test on instruments			6.053
Over-identification test (pvalue)			0.695
No. of observations	70,127	28,362	28,362
No. of municipalities	2428	1047	1047
No. of years	28.90	27.10	27.10

Note: Standard errors in parentheses. *** p<0.01, **p<0.05, *p<0.10. The dependent variable is the consolidated cantonal and municipal tax rate on personal income for an unmarried taxpayer with a gross annual income of CHF 1,000,000. Neighboring municipalities are municipalities within a maximum road distance of 10 kilometers ($D \leq 10$ km). Border municipalities have at least one neighboring municipality located in another canton. All estimations include population, % of foreigners, % of young and old people, % of employees in the secondary and tertiary sectors, total employment (per capita), unemployment rate, % votes in favor of left-of-center-parties and no. of movie theaters within 10 km as controls. Average values of neighboring municipalities are also included as controls. Spatial weights are uniform. All estimations include municipality and canton-year fixed effects. Instruments in column (3) are average value of controls in neighboring municipalities. The over-identification test reports the pvalue of the Hansen J statistic. Standard errors are clustered two-ways, by municipality and by year.

for other categories of taxpayers are presented in Appendix B.

Table 2 presents results based on equation (1) using the standard approach in the literature. In column (1), the explanatory variable of interest is the average tax rate of all neighboring municipalities within a road distance up to 10 kilometers, irrespective of the canton they belong to. In column (2), I consider only municipalities that have at least one neighbor located in another canton. These two columns are estimated with OLS, knowing that they are unlikely to be consistent as the tax rate of neighboring municipalities is endogenous, thus biasing the estimates upward (Brueckner, 2003). Column (3) follows the conventional approach in spatial econometrics and instruments the tax rate of neighboring municipalities with the average background characteristics of these jurisdictions. It thus assumes - improbably - that background characteristics of neighboring jurisdictions are orthogonal to unobserved determinants of taxation of municipality i.

All three estimates suggest positive and statistically significant spatial correlations in tax rates. The first two columns show no difference between border and non-border municipalities, and the coefficients are comparable to those found in previous studies. The instrumental variable strategy presented in column (3) does not qualitatively affect our

cause of concern as long as their are exogenous to municipal tax decisions. Only in the canton of Valais, municipalities fix their own adjustment level.

Table 3 – Strategic interactions in tax rates: IV strategy

	IV (T_{ic}) (1)	Reduced-form (T_{ic}) (2)	First-stage ($\overline{T}_{-i}$) (3)
Tax rate of neighboring municipalities	-0.497**		
	(0.219)		
Cantonal tax rate of neighb. cantons x share of municipalities		-0.140***	0.282***
		(0.054)	(0.052)
First-stage F-test on instrument			29.11
No. of observations	28,362	28,362	28,362
No. of municipalities	1047	1047	1047
No. of years	27.10	27.10	27.10

Note: Standard errors in parentheses. *** p<0.01, **p<0.05, *p<0.10. The dependent variable is the consolidated cantonal and municipal tax rate on personal income for an unmarried taxpayer with a gross annual income of CHF 1,000,000. Neighboring municipalities are municipalities within a maximum road distance of 10 kilometers ($D \leq 10$ km). Municipalities have at least one neighboring municipality located in another canton. All estimations include population, % of foreigners, % of young and old people, % of employees in the secondary and tertiary sectors, total employment (per capita), unemployment rate, % votes in favor of left-of-center-parties and no. of movie theaters within 10 km as controls. Average values of neighboring municipalities are also included as controls. Spatial weights are uniform. All estimations include municipality and canton-year fixed effects. Standard errors are clustered two-ways, by municipality and by year.

findings. The coefficient is even larger.[24]

These results are typical for the empirical tax competition literature. The positive and statistically significant coefficient is interpreted as evidence for the existence of tax competition over mobile tax bases. Yet, even if the overidentification test does not reject the null hypothesis of the absence of correlation between the instruments and the error term, it is hard to be convinced that these standard instruments are truly exogenous, due to endogenous population sorting and the existence of spatially correlated shocks.[25]

Table 3 presents results of my instrumental variable strategy. Cantonal tax rates of neighboring cantons ($t_{-c,t-1}$), multiplied by the share of municipalities located in these cantons (S_{ic}), are used to instrument the average tax rate of neighboring municipalities of municipalities located within a road distance of 10 kilometers from a cantonal border. The first column reports the IV estimate. The second and third columns decompose the IV estimates into the effect of the respective instrument on the tax rate of municipality i ("reduced-form") and its effect on the endogenous average tax rate of neighboring municipalities ("first-stage"), respectively.

[24]This is probably due to a weak instrument problem, as suggested by a first-stage F-test (reported below coefficient estimates), lying below the critical value of Stock and Yogo (2002).

[25]Note that the overidentification test is based on the assumption that at least one instrument is valid.

My central result is shown in the first column.[26] The IV estimate implies that a 10 percentage point increase in the average tax rate of neighboring municipalities leads a municipality to *decrease* its tax rate by 5 percentage points.[27] The reduced-form estimate presented in column (2) already identifies the existence and the nature of strategic interactions among municipalities. It is negative and quite precisely estimated. The first-stage coefficient is also statistically significant and the F-test is well above the critical value.[28]

The properly identified results presented in Table 3 contrast with those presented in Table 2 and lead to the opposite conclusion on the nature of the strategic tax setting among neighboring municipalities. Tax reaction functions are found to have a negative slope and tax rates are thus strategic substitutes rather than strategic complements. Hence, positive spatial correlations found in Table 2 seem to reflect simultaneous changes in tax rates due to common shocks or correlated changes in local conditions rather than strategic decisions. My result also suggests that instrumenting the average tax rate of neighboring municipalities by the characteristics of these municipalities does not provide the exogenous source of variation required for identification.

4.2 A pairwise approach

As discussed in Section 1, if tax rates are strategic substitutes, the first-stage estimate in a spatial regression model may be underestimated, biasing the IV estimate upward. An alternative strategy is to estimate a pairwise model. Under this approach, equation (1) is estimated for all pairs of border municipalities that are located in different cantons. It is thus redefined as:

$$T_{ic,t} = \alpha T_{-ic,t} + \beta' \mathbf{X}_{ic,t} + \gamma_p + \delta_{c,t} + \varepsilon_{ic,t} \ , \tag{3}$$

where $T_{-ic,t}$ is the tax rate of a neighboring municipality located in another canton and within a road distance of 10 kilometers, and γ_p is a pair fixed effect. Each pair appears

[26] The full set of estimated parameters is reported in Appendix Table A.1 (column (3)). Results do not change if no control variables or if only background characteristics of own municipalities are included in the regressions. See Appendix Table A.1, column (1) and column(2).

[27] The average value of the dependent variable, the consolidated cantonal and municipal tax rate for an unmarried taxpayer with a gross annual income of CHF 1,000,000 is 26%.

[28] Multiplying the cantonal tax rate of neighboring cantons by the share of municipalities located in these cantons turns out to be crucial for the relevance of the first-stage estimation. Without this multiplication, the first-stage coefficient is null and the F-test is far below the critical value. Results available upon request.

Table 4 – Cross-border interactions: a pairwise approach

	IV (T_{ic}) (1)	Reduced-form (T_{ic}) (2)	First-stage (T_{-ic}) (3)
Tax rate of paired municipality	-0.332***		
	(0.091)		
Cantonal tax rate of paired canton		-0.091***	0.274***
		(0.016)	(0.052)
First-stage F-test on instrument			28.15
No. of observations	146,236	146,236	146,236
No. of pairs	5324	5324	5324
No. of years	27.50	27.50	27.50

Note: Standard errors in parentheses. *** p<0.01, **p<0.05, *p<0.10. The dependent variable is the consolidated cantonal and municipal tax rate on personal income for an unmarried taxpayer with a gross annual income of CHF 1,000,000. The sample contains all pairs of municipalities located in two different cantons and within a maximum road distance of 10 kilometers. Each pair appears (at least) twice. All estimations include population, % of foreigners, % of young and old people, % of employees in the secondary and tertiary sectors, total employment (per capita), unemployment rate, % votes in favor of left-of-center-parties and no. of movie theaters within 10 km as controls. Values of the paired municipality are also included as controls. All estimations include pair and canton-year fixed effects. Standard errors are clustered two-ways, by pair and by year.

twice, with a given municipality being once on the left-hand side and once on the right-hand side of the equation. The tax rate of the municipality on the right-hand side of the equation is instrumented by the cantonal tax rate of the canton the municipality belongs to. Identification relies specifically on cross-border strategic interactions. It discards however from the analysis the reaction of municipality i to the tax rates of municipalities located in the same canton and sharing the same cantonal border. If tax rates are strategic substitutes, municipality i decreases its tax rate for any increase in the tax rate of a competing municipalities on the other side of the cantonal border. But it decreases less if other municipalities in the same canton also decrease their tax rate. The pairwise approach does not control for these “feedback” effects. The estimate of strategic interactions should then be higher (closer to zero if taxes are strategic substitutes) provided these effects have the same sign as cross-border interactions.

Table 4 presents results for the 5,324 municipality pairs based on a maximum road distance of 10 kilometers. These estimates confirm the existence and the nature of strategic interactions among municipalities where taxes are strategic substitutes. Column (3) shows that the first-stage coefficient is statistically significant and almost identical to the coefficient presented in Table 3. Reduced-form and IV estimates are however lower (in absolute value) than the corresponding estimates in Table 3.

These two approaches can be seen as two bounds for the estimation of the magnitude of strategic interactions: a 10 percentage points increase in the tax rate of the reference group leads to a decrease in tax rate between 3 and 5 percentage points.

4.3 Robustness

The validity of the identification strategy depends crucially on the exogeneity of the instrument. Canton-level fiscal reforms have to be orthogonal to unobserved determinants of taxation of municipalities located on the other side of the cantonal border. Concerns arise mainly if cantons substitute for fiscal decisions of border municipalities or if cantons and border municipalities react to a common shock. This could be an issue especially in small cantons where a high share of the cantonal population live in border municipalities or if the capital city is located close to a cantonal border.

Table 5 presents results of the IV strategy for a subset of "big" cantons. The share of the cantonal population living in border municipalities is computed for each canton pair. In column (1), cantons in which 70% or more of the cantonal population reside in municipalities located at one particular cantonal border are dropped. In columns (2), (3) and (4), the maximum population share is lowered to 50%, 40% and 30%, respectively. In column (5), all cantons in which the capital city is located within 10 kilometers from the cantonal border are dropped. This excludes from the analysis 4 cantons in column (1), 6 cantons in column (2), 9 cantons in column (3), 11 cantons in column (4) and 11 (different) cantons in column (5).[29] All municipalities sharing a border with these cantons are also discarded.

The first line of Table 5 reports IV estimates while the second reports reduced-form estimates. All coefficients are negative and precisely estimated, with the exception of the most restrictive specification in column (4) where the effect is identified using only 258 municipalities.[30] Baseline results are therefore robust to the exclusion of small cantons in

[29] These cantons are Appenzell Innerrhoden, Appenzell Ausserrhoden, Basel-Landschaft and Schaffhausen in column (1). In column (2), Zug and Solothurn are also dropped. Column (3) discards also Nidwalden, St. Gallen and Thurgau while column (4) also excludes Fribourg and Neuchâtel. In column (5), Appenzell Innerrhoden, Appenzell Ausserrhoden, Basel-Landschaft, Schaffhausen, Zug, Solothurn, St. Gallen, Thurgau, Aargau, Ticino and Luzern are discarded.

[30] This is not surprising given that, with canton-year fixed effects, the identifying set of observations is restricted to cantons which share a border with at least to other cantons.

Table 5 – Strategic interactions in big cantons

	Maximum population share at one cantonal border				
	70%	50%	40%	30%	no capital city at border
	(1)	(2)	(3)	(4)	(5)
Tax rate of neighboring municipalities	-0.322*	-0.458*	-0.797**	-0.222	-1.085***
	(0.175)	(0.241)	(0.392)	(0.285)	(0.419)
Reduced form					
Instrument	-0.125*	-0.156**	-0.187**	-0.075	-0.271***
	(0.065)	(0.079)	(0.080)	(0.096)	(0.093)
First stage F-test on instrument	52.25	61.35	26.95	36.50	26.06
No. of observations	23,730	17,509	13,769	7,482	9,071
No. of municipalities	864	629	499	258	337
No. of years	27.50	27.80	27.60	29	26.90

Note: Standard errors in parentheses. *** p<0.01, **p<0.05, *p<0.10. In column (1), cantons in which 70% of the cantonal population lives in municipalities located at one particular cantonal border are dropped. In columns (2), (3) and (4) this threshold is lowered to 50%, 40% and 30%, respectively. In column (4) cantons in which the capital city is located within 10 km from a cantonal border are dropped. The dependent variable is the consolidated cantonal and municipal tax rate on personal income for an unmarried taxpayer with a gross annual income of CHF 1,000,000. The instrument is the cantonal tax rate of neighboring cantons multiplied by the share of neighboring municipalities located in these cantons. Neighboring municipalities are municipalities within a maximum road distance of 10 kilometers ($D \leq 10$ km). Municipalities have at least one neighboring municipality located in another canton. All estimations include population, % of foreigners, % of young and old people, % of employees in the secondary and tertiary sectors, total employment (per capita), unemployment rate, % votes in favor of left-of-center-parties and no. of movie theaters within 10 km as controls. Average values of neighboring municipalities are also included as controls. Spatial weights are uniform. All estimations include municipality and canton-year fixed effects. Standard errors are clustered two-ways, by municipality and by year.

which the exogeneity assumption is less likely to hold. Strikingly enough, the coefficient is higher (in absolute value) as one "zooms in" the bigger cantons (with the exception of column (4)). As expected, potential violations of the exogeneity assumption bias the estimate of strategic interactions towards zero if tax rates are strategic substitutes.

Further robustness checks are presented in Appendix B. In Appendix B.1, I explore alternative spatial weights and show that strategic interactions are stronger among proximate jurisdictions (see also Section 5.1 below). Results presented in Appendix B.2 indicate that municipalities react to changes in tax rates targeting high-income taxpayers, but not to changes for other categories of taxpayers. I Appendix B.3 I show that results are also robust to the inclusion of several lags in order to take account of possible delays in tax adjustments.

4.4 Discussion

Results of this paper contrast to most of existing empirical findings. Tax rates as strategic substitutes are however fully consistent with several models of local tax setting. One explanation is that local government primarily target expenditure and adjust their tax rate residually (Wildasin, 1988, 1991).[31] Several features of the Swiss fiscal system makes this explanation highly plausible. First, Koethenbuerger (2011) notes that the fiscal capacity equalization scheme subsidizing local taxation in Switzerland, should provide an incentive for municipalities to maintain their current level of expenditure. Second, as municipalities fix only a single multiplier of the cantonal tax schedule, tax rates can be easily adjusted annually while expenditure are plausibly more sticky, at least in the short term.

Third, balance budget requirements at the municipality level may also reinforce an expenditure-preservation strategy. In the great majority of cantons, several "debt-brake" measures (restrictions on current account deficits and/or compulsory deficit amortization) limit the taxation of municipalities (see Appendix Table C.1 for an overview of current cantonal laws that regulate the budgeting process of municipalities). Under these rules, current budget deficits that follow a decrease in the tax base when neighboring tax rates fall, have to be amortized in the next budget, which must be balanced. Municipalities are then arguably more likely to increase their tax rate (and reduce their expenditure) rather than to preserve their tax base by lowering their tax rate (which should be compensated by further expenditure reductions). Moreover, in several cantons, the municipal tax multiplier has to be set such as to exactly balance the budget. A striking example is the canton of Ticino, in which municipalities, before 2012, should follow a mechanical rule in fixing their tax multiplier, that had to be equal to their (foreseen) fiscal needs divided by their tax base. In other cantons, the cantonal authority can fix (and increase) the municipal tax rate if the municipality takes no step to balance its accounts.[32]

5 Extensions

5.1 The spatial reach of strategic interactions

Table 6 explores the spatial reach of strategic interactions, that is the distance up to which municipalities interact strategically in their tax setting. Columns (1) to (4) show how municipalities located at different distances from a cantonal border react to changes

[31] As mentioned in the Introduction, another explanation is related to the elasticity of substitution between the public and the private good (de Mooij and Vrijburg, 2012; See also Brueckner and Saavedra, 2001 and Chirinko and Wilson, 2013).

[32] A complete analysis of the effect of different budgetary rules on municipal tax policy is beyond the scope of this paper and is left to future research.

Table 6 – Strategic interactions in tax rates for different distance bandwidths

	Distance to cantonal border			
	0-5 km	5-10 km	10-15 km	15-20 km
	(1)	(2)	(3)	(4)
Panel A: D = 5 km				
Cantonal tax rate of neighboring cantons	-0.157***			
	(0.046)			
No. of observations	13,128			
Panel B: D = 10 km				
Cantonal tax rate of neighboring cantons	-0.157***	-0.067**		
	(0.045)	(0.032)		
No. of observations	13,036	15,326		
Panel C: D = 15 km				
Cantonal tax rate of neighboring cantons	-0.161***	-0.081**	-0.136***	
	(0.042)	(0.034)	(0.050)	
No. of observations	12,780	14,997	9,597	
Panel D: D = 20 km				
Cantonal tax rate of neighboring cantons	-0.167***	-0.076**	-0.141***	0.004
	(0.041)	(0.036)	(0.051)	(0.028)
No. of observations	12,462	14,802	9,401	7,057
No. of municipalities	479	568	351	267

Note: Standard errors in parentheses. *** p<0.01, **p<0.05, *p<0.10. The dependent variable is the consolidated cantonal and municipal tax rate on personal income for an unmarried taxpayer with a gross annual income of CHF 1,000,000. Neighboring cantons are selected such that at least one neighboring municipality is located in these cantons. Neighboring municipalities are municipalities within a maximum road distance of 5, 10, 15, and 20, respectively. All estimations include population, % of foreigners, % of young and old people, % of employees in the secondary and tertiary sectors, total employment (per capita), unemployment rate, % votes in favor of left-of-center-parties and no. of movie theaters within 10 km as controls. Average values of neighboring municipalities are also included as controls. Spatial weights are uniform. All estimations include municipality and canton-year fixed effects. Standard errors are clustered two-ways, by municipality and by year.

in the cantonal tax rate of neighboring cantons. For this analysis, the cantonal tax rate of neighboring cantons is not multiplied by the share of municipalities located in these cantons. Panels A to D present the associated maximum road distance D used to select neighboring cantons in the four distance bandwidths.

Results suggest that municipal tax decisions interact more the closer the municipalities are located to the cantonal border. The effect is the strongest (in absolute value) between 0 and 5 kilometers from the border, decreases rapidly between 5 and 10 kilometers, and increases again between 10 and 15 kilometers. This pattern is consistent with tax rates being strategic substitutes. Municipalities between 15 and 20 kilometers do not react to fiscal reforms of neighboring cantons suggesting that strategic interactions are bound spatially. The spatial reach of strategic interactions can thus be estimated to be of some 15 kilometers.[33]

[33] This result is in line with the findings of Eugster and Parchet (2013).

Table 7 – Heterogeneity of strategic interactions

	Tax change in neighboring canton			
	50% Most negative	Negative	Positive	50% Most positive
	(1)	(2)	(3)	(4)
Tax rate of neighboring municipalities	0.194	-0.392	-0.716**	-0.315
	(0.118)	(0.248)	(0.308)	(0.286)
Reduced form				
Instrument	0.102	-0.159	-0.195**	-0.113
	(0.063)	(0.098)	(0.086)	(0.107)
First-stage F-test on instrument	24.87	24.64	12.51	8.72
No. of observations	9,605	20,447	7,148	1,859
No. of municipalities	361	767	280	94
No. of years	26.60	26.70	25.50	19.80

Note: Standard errors in parentheses. *** p<0.01, **p<0.05, *p<0.10. Tax change in neighboring cantons is the average yearly growth rate of cantonal tax rates over the sample period. The dependent variable is the consolidated cantonal and municipal tax rate on personal income for an unmarried taxpayer with a gross annual income of CHF 1,000,000. The instrument is the cantonal tax rate of neighboring cantons multiplied by the share of neighboring municipalities located in these cantons. Neighboring municipalities are municipalities within a maximum road distance of 10 kilometers ($D \leq 10$ km). Municipalities have at least one neighboring municipality located in another canton. All estimations include population, % of foreigners, % of young and old people, % of employees in the secondary and tertiary sectors, total employment (per capita), unemployment rate, % votes in favor of left-of-center-parties and no. of movie theaters within 10 km as controls. Average values of neighboring municipalities are also included as controls. Spatial weights are uniform. All estimations include municipality and canton-year fixed effects. Standard errors are clustered two-ways, by municipality and by year.

5.2 Heterogeneity of strategic interactions

Table 7 explores whether municipalities react differently to a positive and a negative change in the tax rate of neighboring cantons. With mobile tax bases, any increase (decrease) in the cantonal tax rate of neighboring cantons, and thus in the average tax rate of municipalities located in these cantons, implies a positive (negative) revenue shock for municipalities located on the other side of the cantonal border. Columns (2) and (3) present results for negative, respectively positive changes, while columns (1) and (4) concentrates on the 50% most negative (positive) changes.

I find that municipalities react differently to positive and negative tax rate changes by neighbors. As shown in columns (3) and (4), municipalities decrease their tax rate if competing municipalities increase their tax rate.[34] Interestingly, results in column (1) show that municipalities react positively to large negative shocks by reducing their tax rate (results are borderline statistically significant). In this case, tax rates are not strategic substitutes but strategic complements. This indicates that strategic interactions among municipalities are to some extent asymmetric. One explanation could be that munici-

[34] Small and statistically insignificant coefficients in column (4) may be due to the small sample size.

palities, overall, adjust residually their tax rate to keep their expenditure fixed, even at the expense of an adverse effect on their tax base. However, if their neighbors lower tax rates significantly (one might be tempted to say "aggressively"), they appear to primarily target tax revenue and therefore lower their tax rate to retain their tax base. This suggests that targeting primarily expenditure could be too costly in terms of taxpayers if the competition from neighboring jurisdictions is fierce.

6 Conclusions

I propose a method for identifying strategic interactions among local tax policies. Using exogenous variations in the tax rate of lower-level jurisdictions due to tax reforms in upper-level jurisdictions, I can identify strategic interactions among lower-level jurisdictions across a upper-lever jurisdictional border. This strategy is applied to Swiss municipalities and could also be taken to other federal countries, such as the U.S., where different levels of governments tax a common base (e.g. sales taxes).

In contrast to most existing findings, my results indicate that municipal tax reaction functions mostly have a negative slope, and that taxes rates are therefore strategic substitutes. This is consistent with a model of local tax setting where governments primarily target expenditure and adjust their tax rate residually, even at the expense of an adverse effect on the tax base. This behavior is also in line with "debt-brake" measures that govern the budgeting process of Swiss municipalities.

This paper also shows that tax rates are strategic complements if municipalities face large tax cuts by neighboring jurisdictions. The hypothesis that emerges is that municipalities aim to maintain a fixed level of expenditure and adjust their tax rates for small revenue shocks residually, even if this affects negatively their tax base. This reflects probably the most common situation since, in the short run, tax rates can be more easily adjusted than public spending. However, municipalities engage in tax competition if they face large competitive shocks, suggesting the existence of a threshold for negative revenue shocks above which local governments primarily target the preservation of their tax base. Further research might integrate this hypothesis in the explanation of the decision by local governments of their public policy.

References

Agrawal, D. R. (2014). Inter-federation Competition: Sales Tax Externalities with Multiple Federations, *Working Paper, University of Georgia* .

Agrawal, D. R. (forthcoming). The Tax Gradient: Spatial Aspects of Fiscal Competition, *American Economic Journal: Economic Policy* .

Allers, M. A. and Elhorst, J. P. (2005). Tax Mimicking and Yardstick Competition Among Local Governments in the Netherlands, *International Tax and Public Finance* **12**(4): 493–513.

Brueckner, J. K. (2003). Strategic Interaction among Governments: An Overview of Empirical Studies, *International Regional Science Review* **26**(2): 175–188.

Brueckner, J. K. and Saavedra, L. A. (2001). Do Local Governments Engage in Strategic Property-Tax Competition?, *National Tax Journal* **54**(2): 203–229.

Brülhart, M. and Jametti, M. (2006). Vertical versus Horizontal Tax Externalities: An Empirical Test, *Journal of Public Economics* **90**(10-11): 2027–2062.

Chirinko, B. and Wilson, D. J. (2013). Tax Competition Among U.S. States: Racing to the Bottom or Riding on a Seesaw?, *Working Paper* .

Chirinko, R. S. and Wilson, D. J. (2008). State Investment Tax Incentives: A Zero-Sum Game?, *Journal of Public Economics* **92**(12): 2362–2384.

de Mooij, R. A. and Vrijburg, H. (2012). Tax Rates as Strategic Substitutes, *Tinbergen Institute Discussion Papers* .

Devereux, M., Lockwood, B. and Redoano, M. (2008). Do Countries Compete over Corporate Tax Rates?, *Journal of Public Economics* **92**(5-6): 1210–1235.

Duranton, G., Gobillon, L. and Overman, H. G. (2011). Assessing the Effects of Local Taxation using Microgeographic Data, *The Economic Journal* **121**(555): 1017–1046.

Eugster, B. and Parchet, R. (2013). Culture and Taxes. Towards Identifying Tax Competition, *Discussion Paper no. 2013-39, University of St. Gallen* .

Gibbons, S. and Overman, H. G. (2012). Mostly Pointless Spatial Econometrics?, *Journal of Regional Science* **52**(2): 171–191.

Hayashi, M. and Boadway, R. (2001). An Empirical Analysis of Intergovernmental Tax Interaction: The Case of Business Income Taxes in Canada, *The Canadian Journal of Economics / Revue canadienne d'Economique* **34**(2): 481–503.

Isen, A. (2014). Do local government fiscal spillovers exist? Evidence from counties, municipalities, and school districts, *Journal of Public Economics* **110**(C): 57–73.

Keen, M. J. and Kotsogiannis, C. (2002). Does Federalism Lead to Excessively High Taxes?, *The American Economic Review* **92**(1): 363–370.

Koethenbuerger, M. (2011). How Do Local Governments Decide on Public Policy in Fiscal Federalism? Tax Vs. Expenditure Optimization, *Journal of Public Economics* **95**(11-12): 1516–1522.

Lalive, R. and Cattaneo, M. (2009). Social Interactions and Schooling Decisions, *The Review of Economics and Statistics* **91**(3): 457–477.

Lyytikäinen, T. (2012). Tax Competition Among Local Governments: Evidence from a Property Tax Reform in Finland, *Journal of Public Economics* **96**(7-8): 584–595.

Moffitt, R. A. (2001). Policy Interventions, Low-Level Equilibria, and Social Interactions, *in* S. N. Durlauf and H. P. Young (eds), *Social Dynamics*, The MIT Press, Cambridge MA, pp. 45–82.

Nickell, S. (1981). Biases in Dynamic Models with Fixed Effects, *Econometrica* **49**(6): 1417–1426.

Rathelot, R. and Sillard, P. (2008). The Importance of Local Corporate Taxes in Business Location Decisions: Evidence From French Micro Data, *The Economic Journal* **118**: 499–514.

Rohlin, S., Rosenthal, S. S. and Ross, A. (2014). Tax avoidance and business location in a state border model, *Journal of Urban Economics* **83**(C): 34–49.

Stock, J. H. and Yogo, M. (2002). Testing for Weak Instruments in Linear IV Regression, *NBER Technical Working Paper no 284* .

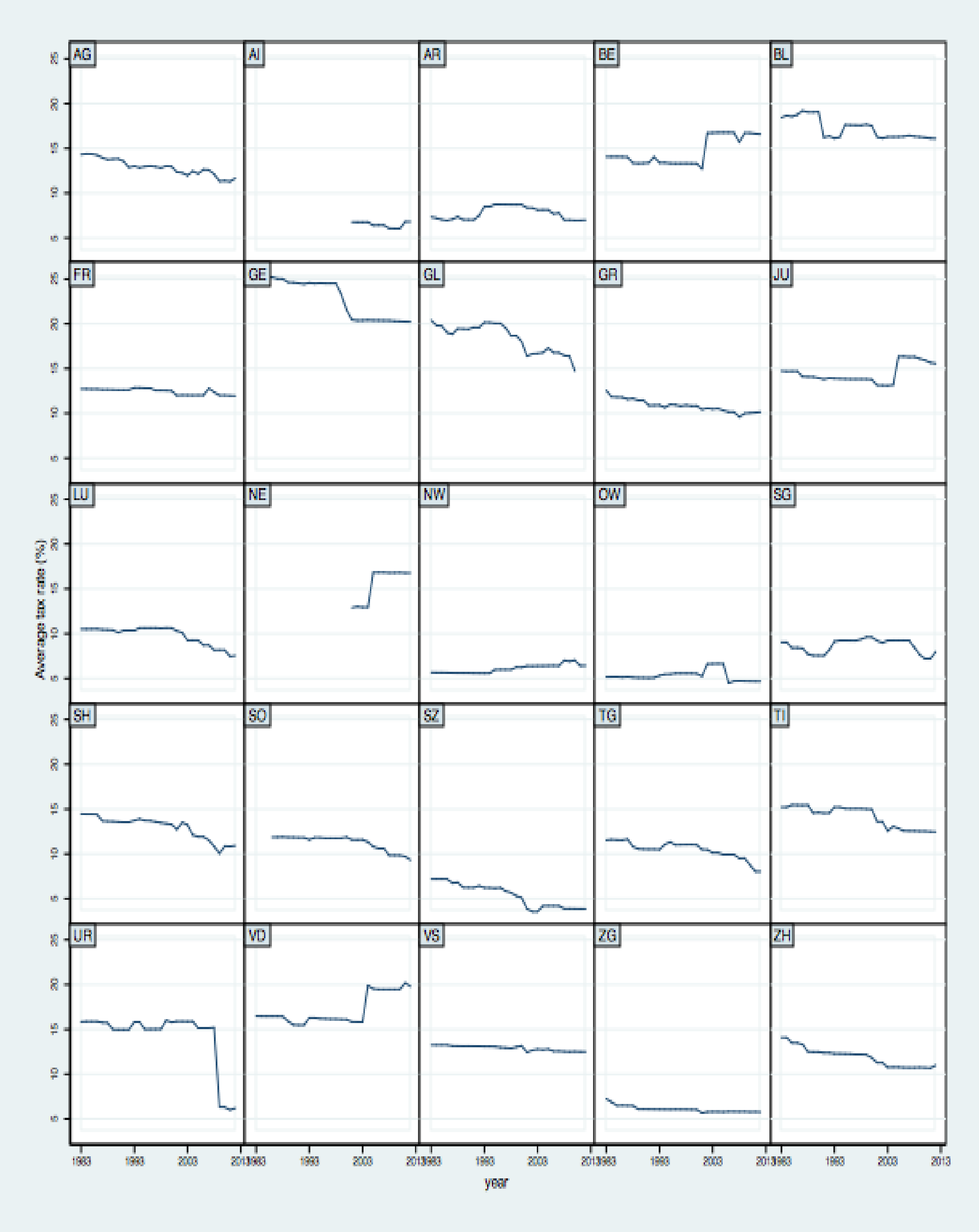
Wildasin, D. E. (1988). Nash Equilibria in Models of Fiscal Competition, *Journal of Public Economics* **35**(2): 229–240.

Wildasin, D. E. (1991). Some Rudimetary 'Duopolity' Theory, *Regional Science and Urban Economics* **21**(3): 393–421.

Wilson, J. D. (1999). Theories of Tax Competition, *National Tax Journal* **52**(2): 269–304.

A Appendix

Figure A.1 – Evolution of the cantonal personal income tax rate for an unmarried taxpayer with gross annual income of CHF 1,000,000



Note: Cantonal tax rates are computed using the methodology described in Section 3.2.

Table A.1 – Strategic interactions in tax rates

	no controls	$\mathbf{X}$	$\mathbf{X}$, $\bar{\mathbf{X}}$
	(1)	(2)	(3)
Tax rate of neighboring municipalities	-0.569**	-0.478**	-0.497**
	(0.256)	(0.228)	(0.219)
Population		-0.080	-0.128**
		(0.060)	(0.062)
% Foreigners		0.031***	0.025***
		(0.010)	(0.009)
% Young (≤ 20)		0.003	0.006
		(0.008)	(0.008)
% Old (≥ 65)		-0.033	-0.023
		(0.022)	(0.021)
% Secondary sector		-0.035***	-0.029***
		(0.007)	(0.006)
% Tertiary sector		-0.026***	-0.019***
		(0.007)	(0.006)
Unemployment rate		0.024	0.023
		(0.019)	(0.019)
Total employment (per capita)		-0.342	-0.445
		(0.486)	(0.463)
% Votes for left-of-center parties		-0.007*	-0.005
		(0.004)	(0.004)
No. of movie theaters within 10 km		-0.001	-0.012
		(0.010)	(0.015)
Population in neighboring mun.			0.180
			(0.141)
% Foreigners in neighboring mun.			0.091**
			(0.044)
% Young (≤ 20) in neighboring mun.			0.024
			(0.038)
% Old (≥ 65) in neighboring mun.			-0.200**
			(0.100)
% Secondary sector in neighboring mun.			-0.025
			(0.018)
% Tertiary sector in neighboring mun.			-0.072**
			(0.028)
Unemployment rate in neighboring mun.			0.039
			(0.067)
Total employment (per capita) in neighboring mun.			2.780*
			(1.643)
% Votes for left-of-center parties in neighboring mun.			-0.005
			(0.006)
No. of movie theaters within 10 km in neighboring mun.			-0.017
			(0.029)
First-stage F-test	24.53	26.03	29.10
No. of observations	28,362	28,362	28,362
No. of municipalities	1047	1047	1047
No. of years	27.10	27.10	27.10

Note: Standard errors in parentheses. *** p<0.01, **p<0.05, *p<0.10. The dependent variable is the consolidated cantonal and municipal tax rate on personal income for an unmarried taxpayer with a gross annual income of CHF 1,000,000. The instrument is the cantonal tax rate of neighboring cantons multiplied by the share of neighboring municipalities located in these cantons. Neighboring municipalities are municipalities within a maximum road distance of 10 kilometers ($D \leq 10$ km). Municipalities have at least one neighboring municipality located in another canton. Spatial weights are uniform. All estimations include municipality and canton-year fixed effects. Standard errors are clustered two-ways, by municipality and by year.

B Robustness checks

B.1 Alternative spatial weights

In Table B.1, I explore alternative specifications of spatial weights w_{ij}. Column (1) repeats for convenience the baseline result of Table 3. Column (2) follows the assumption that interactions are stronger the closer municipalities are in terms of road distance. Thus, inverse-distance weights are defined as

$$w_{ij}^{D} = \begin{cases} \frac{\frac{1}{d_{ij}}}{\sum \frac{1}{d_{ij}}} \text{ if } d_{ij} \leq D \text{ km} \\ 0 \text{ otherwise .} \end{cases} \tag{4}$$

Spatial weights in column (3) are defined according to relative population. If big municipalities act as "leader", more weight should given to neighboring municipalities that are bigger in terms of population:

$$w_{ij}^{P} = \begin{cases} \frac{\frac{pop_j}{pop_i}}{\sum \frac{pop_j}{pop_i}} \text{ if } d_{ij} \leq D \text{ km} \\ 0 \text{ otherwise .} \end{cases} \tag{5}$$

A last specification assumes that jurisdictions react not to the average tax rate of neighboring municipalities but to the lowest tax rate:

$$w_{ijt}^{M} = \begin{cases} 1 \text{ if } T_{jt} = \min(T_{kt}) \ \forall k,\, d_{ik} \leq D \text{ km} \\ 0 \text{ otherwise .} \end{cases} \tag{6}$$

In columns (2) and (3), newly defined average tax rates of neighboring municipalities are instrumented with the cantonal tax rate of neighboring cantons, multiplied with the share of the total distance, respectively population, represented by municipalities in these cantons. In column (4), the instrument is the minimum cantonal tax rate of neighboring cantons.

Results suggest that strategic interactions are more intense among municipalities that are geographically close. Both IV and reduced-form estimates are higher (in absolute

Table B.1 – Alternative spatial weights

	Spatial weights			
	Uniform w^U	Distance w^D	Population w^P	Minimum w^M
	(1)	(2)	(3)	(4)
Tax rate of neighboring municipalities	-0.497**	-0.634***	-0.358*	-0.852
	(0.219)	(0.204)	(0.184)	(0.560)
Reduced form				
Instrument	-0.140***	-0.191***	-0.111**	-0.099***
	(0.054)	(0.053)	(0.054)	(0.030)
First-stage F-test on instrument	29.11	46.29	33.48	5.424
No. of observations	28,362	28,362	28,362	27,582
No. of municipalities	1047	1047	1047	1028
No. of years	27.10	27.10	27.10	26.80

Note: Standard errors in parentheses. *** p<0.01, **p<0.05, *p<0.10. The dependent variable is the consolidated cantonal and municipal tax rate on personal income for an unmarried taxpayer with a gross annual income of CHF 1,000,000. In column (1), the instrument is the cantonal tax rate of neighboring cantons multiplied by the share of neighboring municipalities located in these cantons. In columns (2) and (3), the cantonal tax rate is multiplied by the share of total distance, respectively population, represented by municipalities in neighboring cantons. In column (4), the instrument is the lowest cantonal tax rate among neighboring cantons. Neighboring municipalities are municipalities within a maximum road distance of 10 kilometers ($D \leq 10$ km). Municipalities have at least one neighboring municipality located in another canton. All estimations include population, % of foreigners, % of young and old people, % of employees in the secondary and tertiary sectors, total employment (per capita), unemployment rate, % votes in favor of left-of-center-parties and no. of movie theaters within 10 km as controls. Average values of neighboring municipalities are also included as controls. All estimations include municipality and canton-year fixed effects. Standard errors are clustered two-ways, by municipality and by year.

value) in column (2) than the baseline of column (1). Coefficients in column (3), where large municipalities are assumed to be dominant players are slightly lower (in absolute value) than in the baseline. In the last column, municipalities are found to react to the lowest tax rate among their neighboring municipalities. The first-stage F-test however indicates that instruments are rather weak leading to an upward biased (in absolute value) and more imprecise IV estimate. The weak instrument problem in this case arises because the lowest consolidated tax rate is not necessarily found in the neighboring canton with the lowest cantonal tax rate.

B.2 Tax competition for different categories of taxpayers

So far, my dependent variable has been the consolidated cantonal and municipal tax rate on personal income for an unmarried taxpayer with a gross annual income of CHF 1,000,000. Table B.2 presents results for unmarried taxpayers and married taxpayers with two children, each with a gross annual income of CHF 50,000, 100,000, 500,000 and

Table B.2 – Tax competition for different categories of taxpayers

	Consolidated cantonal and municipal tax rate							
	Unmarried taxpayer with gross annual income of CHF				Married taxpayer with 2 children with gross annual income of CHF			
	50,000 (1)	100,000 (2)	500,000 (3)	1,000,000 (4)	50,000 (5)	100,000 (6)	500,000 (7)	1,000,000 (8)
Tax rate of neighboring municipalities	−0.341	−0.149	−0.315**	−0.497**	0.037	−0.084	−0.225	−0.373**
	(0.285)	(0.200)	(0.159)	(0.219)	(0.087)	(0.113)	(0.143)	(0.158)
Reduced-form								
Instrument	−0.062	−0.037	−0.112**	−0.140***	0.009	−0.023	−0.073	−0.131**
	(0.050)	(0.051)	(0.055)	(0.054)	(0.023)	(0.032)	(0.048)	(0.054)
First-stage F-test on instrument	13.09	22.27	55.04	29.11	33.11	35.96	67.17	58.67
No. of observations	29,409	29,409	29,409	28,362	29,409	29,409	29,409	29,409
No. of municipalities	1047	1047	1047	1047	1047	1047	1047	1047
No. of years	28.10	28.10	28.10	27.10	28.10	28.10	28.10	28.10

Note: Standard errors in parentheses. *** p<0.01, **p<0.05, *p<0.10. The instrument is the cantonal tax rate of neighboring cantons multiplied by the share of neighboring municipalities located in these cantons. Neighboring municipalities are municipalities within a maximum road distance of 10 kilometers ($D \leq 10$ km). Municipalities have at least one neighboring municipality located in another canton. All estimations include population, % of foreigners, % of young and old people, % of employees in the secondary and tertiary sectors, total employment (per capita), unemployment rate, % votes in favor of left-of-center-parties and no. of movie theaters within 10 km as controls. Average values of neighboring municipalities are also included as controls. Spatial weights are uniform. All estimations include municipality and canton-year fixed effects. Standard errors are clustered two-ways, by municipality and by year.

1,000,000.[35]

I find that strategic interactions are indeed identified for high-income unmarried taxpayers but not for other income classes. IV estimates are negative for all categories (except one) but statistically significant only for unmarried taxpayers with a gross income of CHF 500,000 and CHF 1,000,000 and married taxpayers with two children and a gross annual income of CHF 1,000,000. This suggests that municipalities react only to changes in the cantonal tax schedule that affect top-income taxpayers who presumably are the most mobile.

B.3 Strategic interactions in the long run

The analysis modeled by equation (1) concentrates on contemporaneous reactions to changes in the average tax rate of neighboring municipalities. This may not capture the full effect of strategic interactions if municipalities respond with a delay. Table B.3 presents therefore results for two dynamic versions of equation (1). Columns (1) and (2) show the estimation of an autoregressive distributed lag (ADL) model with one and two lags respectively. ADL models augment equation (1) by including the lagged dependent variable and lagged independent variables on the right-hand side. These models nest the most widely used dynamic processes but cannot be consistently estimated by fixed-effects OLS estimators.[36] Columns (3) to (7) report distributed lag models up to five lags. These models do not include the lagged dependent variable and thus can be consistently estimated. Note that the autoregressive model in column (1) is nested in a distributed lag model with an infinite number of lags.

Implied long-run IV coefficients are computed as the sum of coefficients on the tax rate of neighboring municipalities, divided by one minus the sum of coefficients on the lagged dependent variable for autoregressive distributed lag models in columns (1) and (2). Long-run reduced-form coefficients are computed analogously. They are reported at the bottom of Table B.3 together with their associated statistical significance levels. Baseline results for the reduced-form estimates are confirmed. Long-run coefficients are always negative

[35] A gross annual income of CHF 50,000 corresponds approximately to the median income over the period 1983-2010. A gross annual income of CHF 100,000 corresponds to the top 10%, a gross annual income of CHF 500,000 to the top 0.5% and a gross annual income of CHF 1,000,000 to the top 0.1%.

[36] The size of the bias shrinkes, however, with the number of time periods (Nickell, 1981).

Table B.3 – Strategic interactions in the long run

	Autoregressive Distributed Lag Model		Distributed Lag Model				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable (t-1)	0.876***	0.872***					
	(0.047)	(0.193)					
Dependent variable (t-2)		-0.030					
		(0.072)					
Tax rate of neighboring municipalities (t)	1.383	2.867	7.763	12.541	4.988	-2.096	-2.168
	(3.321)	(8.061)	(15.965)	(26.696)	(8.067)	(3.687)	(8.321)
Tax rate of neighboring municipalities (t-1)	-1.299	-2.639	-7.333	-11.586	-4.663	1.684	1.865
	(2.992)	(7.340)	(14.334)	(24.314)	(7.238)	(3.243)	(7.720)
Tax rate of neighboring municipalities (t-2)		0.068		0.262	0.107	-0.077	-0.094
		(0.272)		(1.068)	(0.371)	(0.321)	(0.240)
Tax rate of neighboring municipalities (t-3)					-0.267	-0.093	-0.095
					(0.219)	(0.387)	(0.356)
Tax rate of neighboring municipalities (t-4)						-0.524	-0.497
						(0.602)	(1.599)
Tax rate of neighboring municipalities (t-5)							0.023
							(1.311)
First-stage F-test on instruments	0.109	0.044	0.132	0.062	0.087	0.067	0.023
No. of observations	27,315	26,268	27,315	26,268	25,221	24,174	23,127
No. of municipalities	1047	1047	1047	1047	1047	1047	1047
No. of years	26.10	25.10	26.10	25.10	24.10	23.10	22.10
Long-term effect of tax rate of neighb. mun.	0.392	2.447	0.266	1.685	0.106	-1.147	-0.951
Test long-term effect = 0 (pval)	0.833	0.706	0.828	0.745	0.910	0.279	0.250
Long-term effect of instrument	-0.214	-0.244	-0.159	-0.183	-0.206	-0.218	-0.229
Test long-term effect = 0 (pval)	0.051	0.035	0.010	0.006	0.005	0.006	0.006

Note: Standard errors in parentheses. *** p<0.01, **p<0.05, *p<0.10. The dependent variable is the consolidated cantonal and municipal tax rate on personal income for an unmarried taxpayer with a gross annual income of CHF 1,000,000. instruments are the cantonal tax rate of neighboring cantons (multiplied by the share of neighboring municipalities located in these cantons) and their lags. Neighboring municipalities are municipalities within a maximum road distance of 10 kilometers ($D \leq 10$ km). Municipalities have at least one neighboring municipality located in another canton. All estimations include population, % of foreigners, % of young and old people, % of employees in the secondary and tertiary sectors, total employment (per capita), unemployment rate, % votes in favor of left-of-center-parties and no. of movie theaters within 10 km as controls. Average values of neighboring municipalities are also included as controls. Spatial weights are uniform. All estimations include municipality and canton-year fixed effects. Implied long-run coefficients are computed as the sum of coefficients on the respective variable, divided by one minus the sum of coefficients on the lagged dependent variable in columns (1) and (2). Standard errors are clustered two-ways, by municipality and by year.

and larger (in absolute value) than the baseline. They are also statistically significant at conventional levels. Long-run IV estimates are however not precisely estimated and not meaningful. This is due to a weak first stage as indicated by the first-stage F-test.[37]

[37] Note that the tax rate of neighboring municipalities and its lags are instrumented by the cantonal tax rate of the neighboring canton and its lags, and that instruments are already included with one-year lag.

C Budgetary rules

Table C.1 – Budgetary rules at the municipality level

Canton		"Debt-brake" measures		Role of municipal tax	
		Current account deficit	Budget deficit amortization	Budget setting	Sanction
		(1)	(2)	(3)	(4)
Aargau	(AG)	only if covered by net wealth	30% each year		
Appenzell Ausserrhoden	(AR)	only if covered by net wealth	within 7 years		tax fixed by canton
Appenzell Innerrhoden	(AI)	n/a	n/a	n/a	n/a
Basel-Landschaft	(BL)				
Basel-Stadt	(BS)	n/a	n/a	n/a	n/a
Bern	(BE)	only if covered by net capital	within 8 years		tax fixed by canton
Fribourg	(FR)	no higher than 5 % of revenue	minimum rate (no deadline)		tax increase
Geneva	(GE)	only if covered by net capital	within 4 years		tax fixed by canton
Glarus	(GL)		within 5 years		
Graubünden	(GR)		20% (no deadline)	balance budget (medium-term)	
Jura	(JU)				
Luzern	(LU)				
Neuchâtel	(NE)	only if covered by net capital	20% (no deadline)		tax fixed by canton
Nidwalden	(NW)		10% (no deadline)		
Obwalden	(OW)	no higher than 10% of revenue	within 8-10 years		
Schaffhausen	(SH)		minimum rate (no deadline)		
Schwyz	(SZ)	only if covered by net capital	within 5 years	balance budget (strict rule)	
Solothurn	(SO)			balance budget (medium-term)	
St. Gallen	(SG)	only if covered by net capital	within 2 years	balance budget (strict rule)	tax fixed by canton
Thurgau	(TG)		within 5 years		tax increase
Ticino	(TI)		within 4 years	balance budget (strict rule)	tax fixed by canton
Uri	(UR)		within 6 years		
Valais	(VS)	only if covered by net capital	within 4 years		
Vaud	(VD)		debt limit		
Zug	(ZG)		within 3 years		
Zürich	(ZH)	only if covered by net capital	within 5 years	balance budget (strict rule)	

Note: Municipality-level budgetary rules as stated in current cantonal laws.

IdEP Economic Papers

The series IdEP Economic Papers, ideally continues the work of the "Quaderni della Facoltà" the publication of which began in 1998 and ended in 2013.
For a complete list of the Quaderni see: http://econpapers.repec.org/paper/lugwpaper/

IdEP Economic Papers also gathers the legacy of the CEPRA Working Papers, published from 2012 to 2013.
The full list at: http://econpapers.repec.org/paper/lugwcepra/

2014:

No. 01
F. Mazzonna, F. Peracchi, *Unhealthy retirement? Evidence of occupation heterogeneity*

No. 02
L. Di Giorgio, M. Filippini, G. Masiero, *The relationship between costs and quality in nonprofit nursing homes*

No. 03
F.C. Billari, V. Galasso, *Fertility decisions and pension reforms : evidence from natural experiments in Italy*

No. 04
M. Jametti, M. Joanis, *Elections and de facto expenditure decentralization in Canada*

No. 05
M. Jametti, *Weathering the global financial crisis : is direct democracy of any help?*

No. 06
U. Pagano, M. Vatiero, *Costly institutions as substitutes : novelty and limits of the Coasian approach*

No. 07
R. Parchet, *Are local tax rates strategic complements or strategic substitutes?*