

DISCUSSION

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DISCUSSION PAPER

// PAUL STEGER

Trickling Down or Trickling Away? Municipal Fiscal Responses to Higher-Level Tax Reforms

Trickling Down Or Trickling Away? Municipal Fiscal Responses To Higher-Level Tax Reforms

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Abstract

In many decentralized countries, local tax rates are set by local governments but are simultaneously linked to tax schedules that are determined by superior governments. In such systems, a change to the tax schedule by a superior level of government creates a vertical tax externality and affects local governments' budgets downstream. This raises the question whether federal tax changes provoke tax increases or other fiscal responses such as reductions of spending on the local level. In such a case, local government reactions eat away at the tax reform and its net effect might be different than anticipated by policymakers. To that end, I exploit a large-scale income tax cut in the Swiss canton of Bern to estimate a municipal response elasticity. I find that municipalities increase municipal tax disproportionately, resulting in higher municipal revenues and higher municipal spending. This implies a novel decentralization result such that municipalities' importance in taxation increases at the cost of cantonal importance. This response is much smaller when municipalities are more exposed to cross-municipal tax competition.

Keywords: Fiscal Federalism, Local Public Finance, Vertical Tax Externality, Tax Competition

JEL Classification: H71, H72, H73, H77, R51,

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1 Introduction and Related Literature

When it comes to implementing economic policy, comprehensive tax reforms always play a prominent role. Policymakers typically justify enacting such reforms by stimulating firm investment or providing incentives for households to extend labor supply. A lot of academic attention has been devoted to the question of whether these reforms stimulate real economic activity (Feldstein (1995), Gruber and Saez (2002), Saez (2010), Chetty et al. (2011), Kleven and Waseem (2013) and Kleven and Schultz (2014)). Implicitly, these papers assume that the intended tax change will materialize one-to-one in firms' or households' tax liability. However, in a wide range of countries, most notably those organized in a federal manner, tax policy is often conducted on multiple levels of government and distinct tiers of government (federal, state and municipal) levy taxes on the same tax base. More importantly, local government revenue often is a function of tax policies set on higher levels of government. Thus, a tax change on a higher level of government creates a vertical tax externality and affects local revenue downstream.

The focus of this paper is on the case of multiplicative concurrent taxation. This is a setting in which a statutory tax schedule is set by a higher level of government, while municipalities often determine the actual tax burden by levying a tax multiplier. For example, this system exists for income and corporate taxation in Switzerland, local and property taxation in Germany and in a variation for various taxes in the United States. In the US, some states tie their state income tax brackets to the federal tax brackets or state governments put limits on assessed property values for the property tax whose revenues accrue to local government. In such a scenario, a federal or state tax reform or change to property values will impact municipal budget through a mechanical and behavioral channel. Once the tax reform goes into effect, municipalities suffer an instantaneous change in mechanical revenue. The central question of this paper is to study a local government's fiscal responses following a higher-level government tax reform. That is, will municipalities raise their own taxes to off-set tax reform or will they pass on the tax changes on to citizens? If the former holds true, tax reforms somewhat trickle away while in the latter case they trickle down as intended by policymakers.

In most federal and some unitary countries, local taxes play an important role in local government financing. Combined with their prominent role in providing local public goods (Agrawal et al. (2022)), the downstream effects of large scale tax reforms on the federal level could be economically significant as local government could delay public investment projects or raise their own taxes as a response. That is, the net effect of a federal tax reform can play out quite differently than what policymakers on the federal level originally had in mind. Given the constant presence of tax reforms in policy debates, it is crucial to study potential fiscal policy responses downstream as it will help to understand the net effect of tax reforms more thoroughly. In an environment of tax competition, tax rates are typically to low and result in underprovided (local) public goods (Bucovetsky and Wilson (1991)). Hence, it is likely that a change in municipal revenues provokes a reaction. Additionally, in many countries municipal governments operate under balanced budget rules, which would necessitate a response.

The key aim of this paper is to estimate a municipal response elasticity to higher government tax reforms. Such an elasticity would provide insights into the nature and size of the municipal response. For estimation, I exploit a large-scale tax cut in 2011 and 2012 in the largest Swiss canton of Bern. Due to the high degree of fiscal decentralization both in revenue and spending choices, Switzerland is an ideal laboratory for studies on local public finance (Schmidheiny and Slotwinski (2018), Eugster and Parchet (2019), Parchet (2019)). Since every canton sets its own income tax system, cantons effectively

assume the role of a federal government in other countries. On top of that, municipalities determine one single tax multiplier every year which allows to identify municipal tax policy by a single variable. While I ideally would want to use variation created by tax reforms in multiple cantons, the frequent changes to cantonal tax schedules do not allow for clean assignments into treatment and control group. That is why, I rely on an exposure design which allows me to study municipal fiscal responses to a single tax reform. More precisely, using pre-reform municipal-level data on the taxpayer composition, I calculate the reform's impact on municipal budgets. One advantage of using pre-reform composition is that they are exogenous to ex-post municipal fiscal policy choices. To counter the concern that more impacted municipalities are not on different fiscal trajectories than those less impacted, I interact the impact variable with year dummies. This is similar to estimating a difference-in-difference model with continuous treatment and allows me to make inference about the existence of pre-trends. The overall rationale behind this approach is that a municipality that due to its taxpayer composition might suffer a stronger decrease in municipal tax revenues, might be prompted to react more strongly. I find that, on average, a one percent decrease in municipal revenue is associated with 5.72 percent increase in the local tax multiplier. Since this is more than what is needed to offset the mechanical revenue loss, municipal revenue increases as well. This improved fiscal situation then translates into a (positive) spending elasticity of 5.972 percent. As a consequence, a larger impact on the municipal budget is also associated with an increase in tax burdens. Interestingly, this increase is more pronounced for higher income individuals. The reason behind this is that the tax reform specifically targeted low- and medium income individuals but a multiplier increase affects every tax payer. Hence, I interpret these results as a trickling-away effect. Moreover, the relative increase in the importance of municipal taxation and the associated spending increase could be interpreted as an implicit fiscal decentralization tool. According to standard tax competition theory, local governments set too low tax rates and under-provide local public goods (Bucovetsky and Wilson (1991)). A revenue loss caused by the actions of a higher level of government could hand them a rationale to increase their taxes by more than what is needed and increase public spending.

Since municipalities find themselves in tax competition with other municipalities, the exposure to tax competition might be a decisive factor shaping the fiscal response. To study this more formally, I put forward a simple model of tax competition with a vertical tax externality closely following Parchet (2019). The model predicts that a stronger exposure to tax competition, modeled by a higher tax base elasticity, mutes the municipal tax increase to a higher level tax cut whereas a weaker exposure does the opposite. The intuition is that a very mobile tax base limits municipalities ability to react as the behavioral adverse impact on municipal budgets from an increased outflow of residents outweighs the (mechanical) revenue increase from a multiplier increase. I construct a sample of municipalities' which are more exposed to tax competition and a sample of less exposed municipalities to empirically verify the model predictions. Exposure to tax competition is measured by geographical proximity to (lower-tax) municipalities in bordering cantons who might see the cantonal tax cut in Bern as a reason to lower their own taxes following Parchet (2019). Since large urban centers which are far away from the border might not also compete with more distant urban centers in the rest of Switzerland as suggested by Janeba and Osterloh (2013), I include the canton's largest cities in this sample and whether or not they face tax competition from other large cities in Switzerland. I document a stronger tax multiplier increase in less exposed municipalities while the response is more muted in more exposed municipalities. Thus, exposure to tax competition is a decisive factor in understanding municipal responses to higher level tax reforms.

While horizontal tax externalities, more generally known as tax competition, have been widely discussed in the literature (Bucovetsky and Wilson (1991), Janeba (1998), Janeba and Osterloh (2013),

Schmidheiny and Slotwinski (2018), Parchet (2019), Eugster and Parchet (2019)), the phenomenon of vertical externalities has been dealt with to a lesser degree. The bulk of the literature has explored, how municipalities react when their neighbors and other competitors change their own taxes. This paper could contribute, both theoretically and empirically, to the literature by providing additional evidence on how municipalities react when their superiors change the taxes. In terms of theory, Keen and Kotsogiannis (2002) can be considered a seminal paper in that regard. The authors' key hypothesis is that the presence of tax competition and vertical tax externalities push equilibrium tax rates in two different directions. While tax competition tends to cause inefficiently low tax rates as competitors do not internalize the harm of cutting taxes on their neighbors, vertical externalities imply taxes too high relative to the social optimum. Given a mobile tax base, government tax policies from the bottom to the top will affect the size of the tax base. Yet, lower-level governments do not fully internalize their policies' impact on the base's size and as every government actor typically only cares about its constituents' welfare, vertical tax externalities result in excessively high taxes. Keen and Kotsogiannis (2002) show that the relative importance of either externality depends on the tax bases mobility. If the tax base is sufficiently mobile between local jurisdictions, the horizontal externality dominates because not internalizing own tax policies on the tax base size (vertical case) comes at a higher revenue cost. A further empirical implication would be that if municipalities' tax rates are higher the more fragmented the federation is (i.e. more smaller municipalities in a single state) and so vertical tax externalities dominate their horizontal counterpart. The reason is that if municipalities are very small, their own tax base is also small and hence each municipality only bears a vanishingly small part of the cost of reducing the overall tax base. In that sense, Brühlhart and Jametti (2006) provide empirical evidence for the presence of vertical tax externalities and their dominance over horizontal tax externalities. In a similar vein, Devereux et al. (2007) study the relative importance of vertical versus horizontal externalities in the case of excise taxes. The crucial determinant here is the curvature of the demand function. If the demand is inelastic, Devereux et al. (2007) find little responsiveness to changes in the federal taxes whereas strong responsiveness to other states' changes. In the case of elastic demand, there is little cross-state dynamics whereas state taxes do respond to federal tax changes. I contribute to this literature by studying twofold: First, I investigate the fiscal responses to a tax reform more closely and I provide evidence that these responses might increase municipal tax burdens and shifts fiscal power from cantons to municipalities.

Reingewertz (2018) and Perez-Sebastian et al. (2019) are somewhat most closely related to this project's question. They study how US states' corporate taxes behave with federal tax changes and generally find that states raise their taxes in response to federal tax hikes. However, their set-up is substantially different in that they mirror the US context of an "additive" vertical tax structure. Here, the contribution is that I study this question in a setting of multiplicative vertical tax dependency that is more familiar in continental Europe but also in parts of the US. This is important as the additive case discussed in these papers impacts local governments differently than a system of multiplicative tax dependencies. A federal change in an additive system only impacts local governments' revenue through a behavioral effect. That is, economic agents might adjust their labor supply or investment decisions as a response to federal tax changes and thus change the local tax base. The multiplicative setting is distinct in that it also incurs a mechanical change in local revenue. Hence, conclusions from these cannot be directly transferred to the case discussed in this paper.

This paper is structured as follows. To motivate the research question more broadly, section 2 presents the importance of local government taxation and spending across OECD countries and thus the policy relevance of studying vertical tax externalities more closely. Section 3 dives in more deeply into the Swiss institutional framework, section 4 and 5 are devoted to the empirical analysis. Section 6 concludes.

2 Vertical tax externalities around the world

Systems of concurrent taxation and vertical tax dependencies are widespread in advanced economies and take fairly different forms. Figure (1a), figure (1b) and 2 depict the extent of concurrent taxation in federal and unitary OECD countries. On the y-axis, I plot the share of state and local government tax revenue as a share of overall tax revenue. The rest is federal tax revenue and by definition not affected by downstream vertical tax externalities. Naturally, in federal countries sub-national tax revenue makes up a fairly large amount of overall tax revenue. In Canada, for instance, state and local tax revenue makes up almost 50 % of national tax revenue in 2023. US state tax revenue represents around 20 % of overall tax revenue. In similarly decentralized countries like Germany and Switzerland, local and state tax revenue is around 30 % to 40 % of overall tax revenue. It's important to note that even in unitary states, local government tax revenue as a share of overall tax revenue is non-negligible. In Sweden for instance, the number stands at 35 %. Unless a local or state governments has the power to fully set tax systems including tax rates and reliefs, its revenue is potentially subject to vertical tax externalities. While many state governments in federal countries (1a) can set their own tax rates and reliefs and are thus less prone to vertical tax externalities, this looks different for local governments in both federal and unitary states (1b, 2). However, in Germany for instance, almost all of states' tax revenue is subject to a tax sharing agreement. That is, states keep a certain fraction of overall tax revenues whereas the schedule is mostly set by the federal government. In this scenario, a tax reform induced by the federal government will have trickle-down effects on states' budgets.

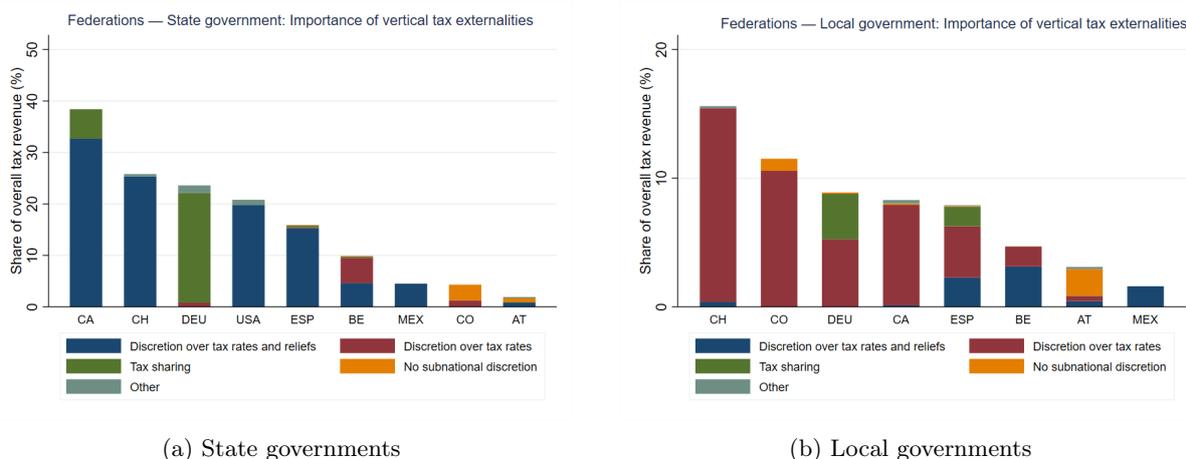


Figure 1: Importance of vertical tax relation in federal countries (Source: OECD Fiscal Decentralization Database, data from 2023)

In Switzerland, for instance, roughly 15 % of overall tax revenues is characterized by local government autonomy over tax rates. Across OECD countries, this share often refers to a setting in which local governments set a local tax multiplier or tax rate while the underlying tax schedule with reliefs and tax rates are set by higher-level governments. In Switzerland, this applies to the personal income and corporate tax (see 3 for details), in other states like Canada or the US, the most prominent tax is the property tax. Such systems could be classified as multiplicative concurrent taxation as local tax rates are directly tied to higher-level tax systems and a change to the latter mechanically trickles down. In Canada, roughly 8 % of national tax revenue is affected by a similar mechanism. For German local governments, this applies to around 5 % of overall tax revenue while another 4 % is covered by tax sharing agreements in which municipalities retain a certain degree of income tax and VAT revenues. In

both cases, a tax schedule change by the federal government will trickle down to local governments and directly affect their revenue resulting in a vertical tax externality. Data for US local governments is not provided by the OECD but the property tax as one of the most important revenue sources of US local governments (30 % in 2021) ¹ features a very distinct form of a vertical tax dependency. While local governments can autonomously change the tax rate, states often impose caps on the applied tax rates, the assessed value of property or on collected tax revenues in general. If states change those caps, downstream effects on the local government revenue are expected. Figure 2 shows that this mechanism also holds for local governments in less decentralized, unitary nations.

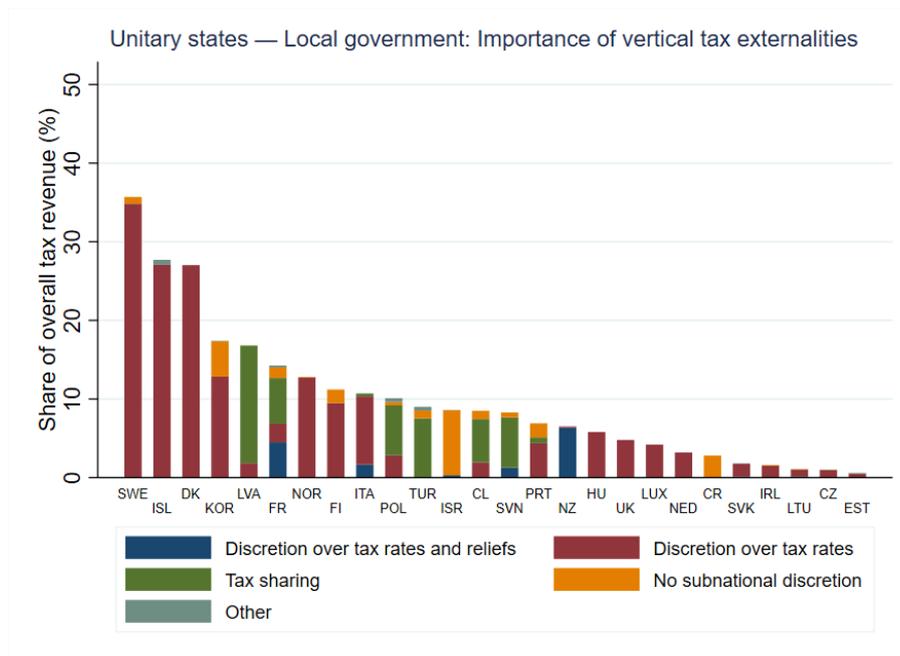


Figure 2: Importance of vertical tax relation in unitary countries (Source: OECD (2023))

In Sweden, almost 35 % of national tax revenue is covered by such a mechanism. Here, local governments can set their own flat income tax rate whereas the national government sets the tax base. In Iceland and Denmark, this covers still almost 30 % of national tax revenue. This goes to show that in many countries around the world, federal and unitary, a sizeable share of tax revenue is subject to downstream vertical tax externalities. That implies that the extent of potential local fiscal responses to federal tax reforms is economically sizeable. That is, if a local government decides to offset (mechanical) revenues losses of a federal tax cut by raising its own tax rate, this counterresponse might apply to 35 % of overall tax revenue. Hence, the net effect of tax reforms after factoring in local responses might be quite different. And since local governments barely have full tax autonomy (i.e. setting both rates, reliefs and exemptions), a federal tax reform affects a sizeable share of overall local government revenue.

Local governments and state governments play an important role in providing public services including infrastructure, education and childcare. Regarding public investment, local and state governments combined carry out the majority of public investment. This holds for unitary as well as federal states although the importance of the central government is even less pronounced for the latter (see figure 3). Since sizeable amounts of local and state tax revenue are subject to vertical tax externality, this implies that a sizeable portion of public investment is in principle affected by said externalities. That is, a

¹<https://taxpolicycenter.org/briefing-book/what-are-sources-revenue-state-and-local-governments>

(mechanical) reduction in local revenues due to federal tax reforms might spill over into local and state public investment.

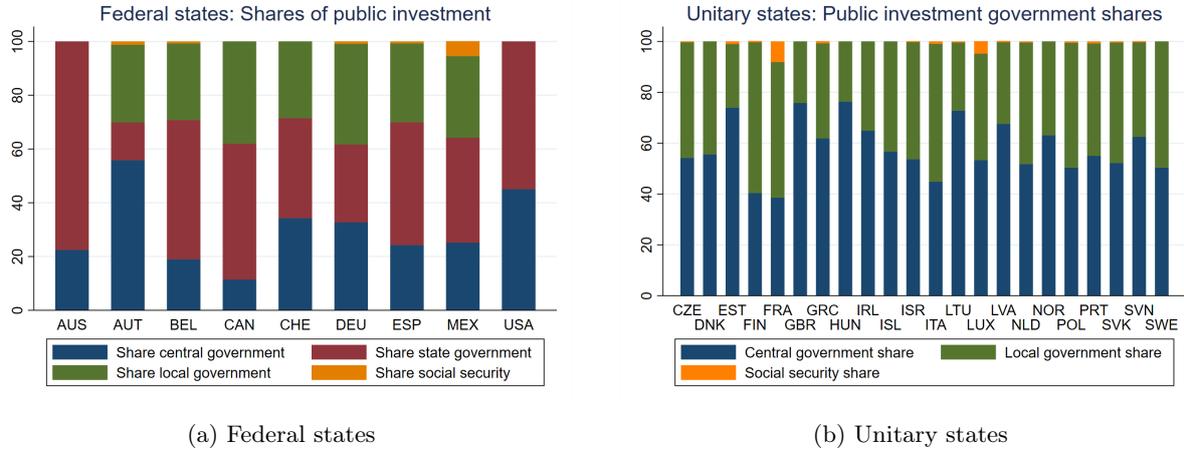


Figure 3: Public investment by government level (Source: OECD (2023))

For general government expenditure (current spending and public investment(4)), local and state governments' shares are lower because this includes social security spending which is mostly within the powers of the central government. However, the size of general government spending carried out by state and local governments exceeds well over 50 % in most countries, both unitary and federal. Possible adjustments in local and state governments' overall spending, if those are subject to a vertical tax externality, can also be expected.

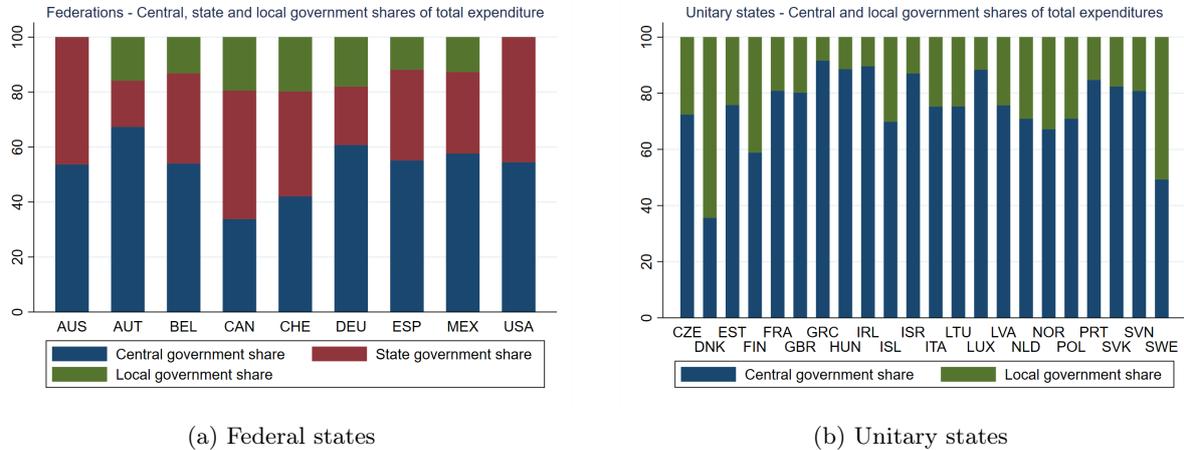


Figure 4: Expenditure by government level (Source: OECD (2023))

3 Institutional Setting: Swiss Fiscal Federalism

To provide empirical evidence for the hypotheses derived above, this paper draws on the Swiss fiscal institutional framework. Switzerland is characterized by a high degree of fiscal decentralization granting local governments considerable autonomy both in raising revenue and spending choices. There are three layers of government each with their own assigned responsibilities. The federal government is solely in charge of foreign affairs and national defense and parts of social security while the 26 cantons, the

equivalent of US states or German Länder largely have autonomy over education, healthcare, public safety and social security. Finally, the country's (as of 2023) 2131 municipalities represent the lowest level of government. While they are assigned a variety of policies by the federal and cantonal government, most notably welfare, they still enjoy discretion in selected areas of public policy, most prominently education, childcare and public infrastructure. As shown in figure 1, it is visible that municipal governments play a substantial role in the expenditure side of government policy. Although, municipalities' share in total expenditure has somewhat decreased over the last 30 years, it remains considerable and their share in public investment has grown in recent decades.

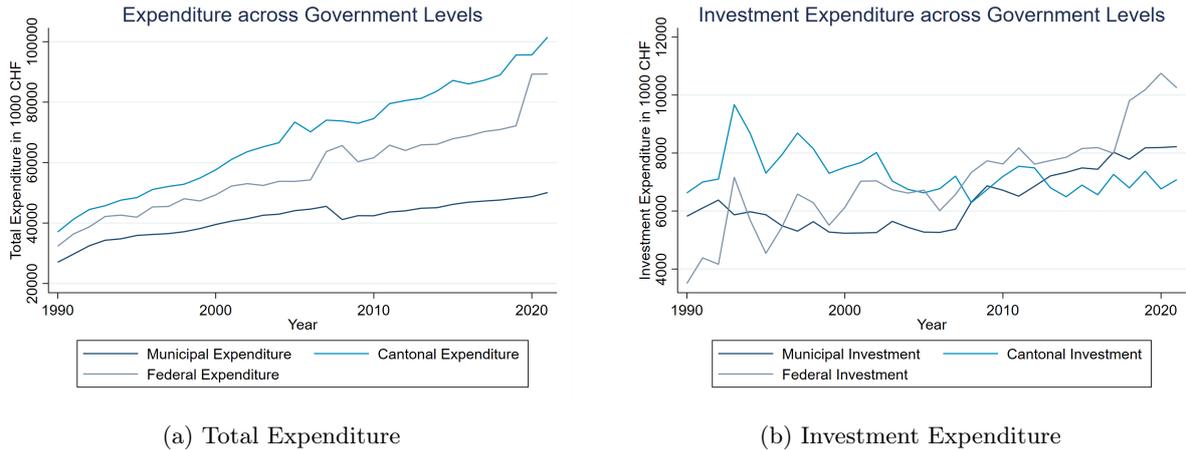


Figure 5: Expenditure items for different levels of government (Source: Federal Statistical Agency Switzerland (a) (2025))

On the revenue side, autonomy is even more pronounced with each government level being entitled to raise their own taxes. As depicted in table 1, there are federal and cantonal systems of taxation that operate separately from each other. Focusing on the most important taxes, the value added tax is exclusively set by the federal government and constitutes its most important revenue source. Further, the federal government levies a tax on household and corporate income ("*Direkte Bundessteuer*") whose proceeds solely accrue to the federal government. A special feature of Swiss fiscal federalism is that each canton sets its own statutory schedule, deductions and exemptions for a wide range of taxes. This is attractive from an empirical perspective as cantonal tax reforms naturally create treatment and control units within one country. While these tax systems are often very similar in their basic structure (such as the kind of deductions applied), the effective tax burden can differ remarkably across cantons.

Based upon the cantonal tax systems, tax authorities compute a so-called state tax ("*Einfache Staatsteuer*") that acts as base for the final tax payment owed to municipalities and cantons. While municipalities are not entitled to set full statutory tax schedules autonomously, they determine a local tax multiplier (in percent) which ultimately determines the tax owed to the municipality of residence. The final tax owed to the canton is calculated in a similar manner with a cantonal multiplier applied to the state tax. In the vast majority of Swiss cantons, municipalities set a single multiplier for natural persons (individual persons) and a single one for corporations making the tax systems comparable. The former pertains to all cantonal taxes that are levied on individuals such as income tax, wealth tax and inheritance tax while the latter is relevant for the cantonal corporate and capital income tax. Setting one multiplier for individual persons and corporations each implies that if there are for instance changes to the wealth tax schedule and municipalities decide to raise their multiplier, they also effectively increase the tax burden for the income and inheritance tax. In some cantons, the multiplier is the same for in-

dividuals and corporations while it is allowed to differ in some cantons. This implies that tax responses following an income tax reform might actually spill onto the corporate tax burden. It is important to stress that the income tax is residence based and it constitutes by far the most important revenue source for both municipalities and cantons. Very few cantons, however, grant municipalities the authority to raise their own property tax multiplier which is why these taxes are not considered further in this paper.

Taxation competencies:		
Federal	Cantons	Municipalities
Federal income tax	Income tax (residence based) Wealth Tax Inheritance Tax	Multiplier natural persons Multiplier for n.p. Multiplier for n.p.
Federal corp. inc. tax	Corporate inc. tax Tax on equity	Multiplier for corporate entities Multiplier for corporate entities
VAT Fuel tax ...	Property tax	(Own multiplier)

Table 1: Distribution of taxation competencies across government levels

To illustrate the system more formally, consider the following more detailed explanation. The system follows the same pattern for all other cantonal taxes. Municipal tax liability for a given individual i with taxable income y , resident in municipality j in canton c , can be written as:

$$T_{i,m,c} = m_{j,c} \cdot \underbrace{y_i(e_c, d_c)}_{\text{"state tax"}} \cdot \tau_c$$

, where $m_{j,c}$ refers to the municipal local tax multiplier and τ_c the tax rate that follows from the cantonal tax schedule. Naturally, taxable income y is a function of exemptions e and deductions d determined by the cantonal tax schedule. Similarly for the canton c , the cantonal tax liability is given by:

$$T_{i,c} = m_c \cdot \underbrace{y_i(e_c, d_c)}_{\text{"state tax"}} \cdot \tau_c$$

Individual i 's total tax liability to canton and the municipality is thus $T_i = T_{i,c} + T_{i,m,c}$ while municipal income tax revenue is simply the summed tax liabilities of a municipality's residents. The parameters relevant for municipal revenue set by the cantons are e_c, d_c, τ_c while $m_{j,c}$ is autonomously set by municipal governments.

Figure 5 shows the evolution of aggregate revenue and tax revenue of all three government levels over time. While municipal revenue is substantially lower and evolved less dynamically than its cantonal and federal counterparts, it is still sizeable in volume and further underscores the importance local governments play in fiscal policy in a decentralized nation such as Switzerland.

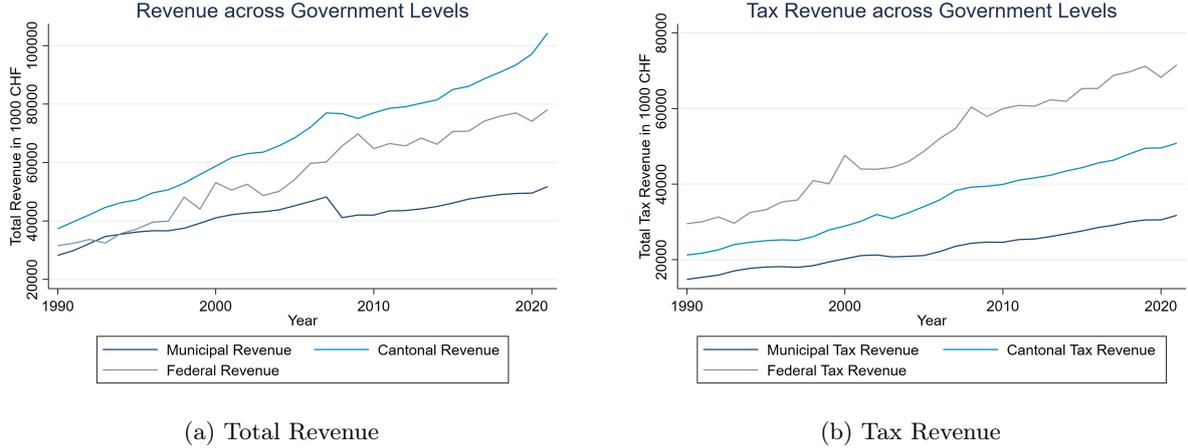


Figure 6: Revenue items for different levels of government (Source: Federal Statistical Agency Switzerland (a) (2025))

In terms of the political process of setting these parameters, both cantons and municipalities fix their multiplier m_c and $m_{j,c}$ annually by a simple vote whereas changing the cantonal tax schedule can be more involved. Some cantons require any change to the tax law to be decided by popular vote (cantonal referendum) while some simply can choose between a popular and parliamentary vote. When it comes to the local tax multiplier, the political process depends on the city size. In larger cities, the decision is left to the town council whereas in smaller municipalities the final vote is left to the local electorate in a municipal assembly. That is, the municipal administration typically proposes its budget plan which the local tax multiplier is a part of and eligible citizens can reject or accept the budget proposal. Local tax multipliers are typically set at the beginning of each year and remain the same for the rest of the year.

4 Empirical Analysis

4.1 Background: Tax Reform of 2011

To study municipal counter-responses more closely, I zoom into a specific canton and use a small and fairly large-scale tax reform in the canton of Bern. Although it would be empirically desirable to exploit tax reforms across all cantons, this is difficult to implement. Most cantons change their tax schedule on a regular basis (see table 7 in the Appendix) and so there is no stable control group for a longer horizon analysis. As a result, I investigate a single income tax reform in the Swiss canton of Bern. This canton is the second largest in terms of population size and landmass and contains around 374 municipalities. In 2011, the canton passed a large-scale tax reform with a strong focus on income tax cuts (*Steuergesetzrevision 2011*²). The first was enacted as the result of a cantonal referendum whereas the second was passed with a simple parliamentary vote. The reforms contained a variety of tax reliefs, but the main focus was on bracket creep compensation and a reduction of marginal tax rates and, to a lesser degree, a cut in corporate taxes (see figure 7 for the changes to the tax schedule). The aspects of the tax reform that are relevant to municipal finances went into effect in 2011 and 2012 which is why the empirical analysis will treat the year 2011 as the first year of the tax reform. While the cantonal government did not provide information on the (mechanical) revenue loss of said reform on the municipal level, they provide aggregate revenue estimates of 2011 reform. The tax reform results in

²<https://www.taxinfo.sv.fin.be.ch/taxinfo/544ed097-b733-4f23-9717-3fece532be75>

municipal revenue losses of around CHF 106.6 mio. (as opposed to CHF 202.5 mio. for the cantonal government) as of 2011³ with CHF 66.5 mio. municipal revenue losses coming from changes to the income tax schedule. With 983,000 inhabitants in 2010, this makes for (income tax related) revenue losses of about CHF 67.65 per capita. The effect of the tax reform on the cantonal statutory tax schedule is shown in figure 7. The stepwise ascending curves show the marginal tax rates by tax brackets whereas the smooth lines represent the average tax rate. It is clear that the reform has reduced the statutory tax burden for all taxable income groups with a stronger decline for in the lower and medium parts of the taxable income distribution.

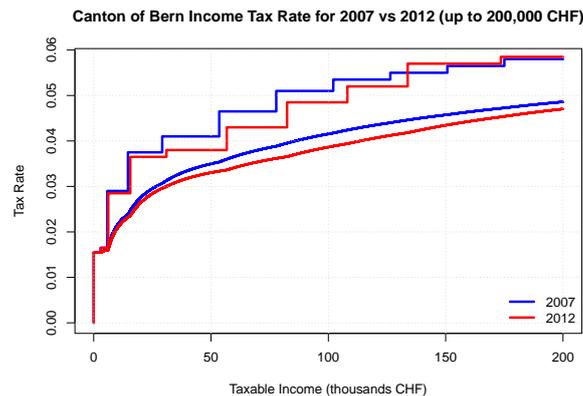
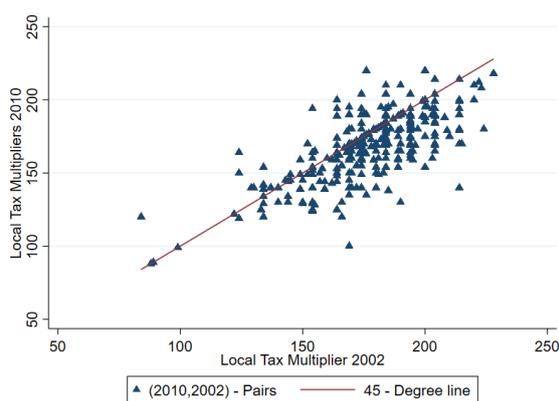


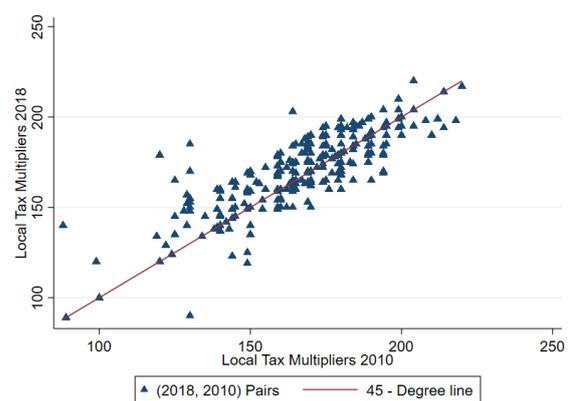
Figure 7: Marginal and Average Tax Rates: 2007 vs. 2012

4.2 Data and Descriptive Statistics

Figure 8 plots the municipal tax multipliers in the years prior to the reform (left panel) and in the post-reform years (right panel). If an observation lies below the 45-degree line, the municipal tax multiplier was higher in 2002 (2010) vs. 2010 (2018). If an observation lies above the 45-degree line, the respective municipality charged a lower tax multiplier in 2002 (2010) vs. 2010 (2018).



(a) Municipal tax multipliers in Bern: 2010 vs. 2002



(b) Municipal tax multipliers in Bern: 2018 vs. 2010

Figure 8: Local multiplier changes 2018 vs. 2010 and 2010 vs. 2002

We can see that in the pre-reform period, most municipalities lowered their multiplier or kept it the same while in the post-treatment period, the picture is more mixed. More municipalities have raised

³<https://www.taxinfo.sv.fin.be.ch/taxinfo/544ed097-b733-4f23-9717-3fece532be75>

their multiplier between 2018 and 2010 than in the pre-reform period. It is striking that while most multiplier changes are closely situated around the 45-degree line, some increases are substantial in size. Whether or not this is driven by a municipality’s exposure to the cantonal tax reform, is subject of the next section where the reform’s impact on municipal budgets and the subsequent response is investigated more thoroughly.

The evolution of tax liabilities across the different gross incomes, that is the sum of taxes paid to the canton of Bern and its municipalities, reveals an interesting pattern. Cantonal tax liabilities which are only affected through taxation decision by the canton itself decreased between 2010 and 2018 by up to 0.45 percentage points. On the other hand, however, average municipal tax liabilities decreased by substantially less. Interestingly, for very high incomes municipal tax liabilities actually increased. This is due to the nature of the tax interaction: A tax reform might target low and middle-income taxpayers more strongly while high-income earners might benefit less. However, if a municipality then increases its own multiplier it raises the tax burden across the board. So income groups who might only marginally benefit from a tax reform might end up paying more as the increased multiplier is levied on their income as well.

Table 2: Change in tax burdens across the income distributions (percentage points)

Variable	Change 2018 vs. 2010	
	Cantonal Tax Liability	Municipal Tax Liability (average)
Gross income: CHF 25k	-0.2760	-0.1134
Gross income: CHF 50k	-0.3060	-0.0870
Gross income: CHF 100k	-0.3940	-0.1083
Gross income: CHF 200k	-0.4585	-0.1140
Gross income: CHF 500k	-0.2896	0.0092
Gross income: CHF 1000k	-0.2056	0.0683

4.3 Econometric Strategy & Data

In a situation in which all municipalities in a canton are affected by the reform, the main empirical challenge is to accurately define treatment and control status. Hence, I rely on a dynamic exposure design similar to a shift-share approach (Autor et al. (2013), Goldsmith-Pinkham et al. (2020), Borusyak et al. (2022)). The shift component represents the change to the cantonal tax schedule after 2010 and the share component is a variable that captures taxpayer composition to predict the (mechanical) revenue loss on municipal finances due to the tax reform. For a municipality i and the civil status $j \in$ (unmarried, married) of its residents, it is defined as follows:

$$\text{Exposure}_{i,2010} = \frac{\sum_{j \in J} N_j \cdot (\overline{\text{TaxPayment}}_{i,j,pre} - \overline{\text{TaxPayment}}_{i,j,post})}{\text{Municipal Revenue}_{i,2010}} \quad (1)$$

The basic intuition of the exposure variable is to approximate tax payments to the municipality using the municipality specific pre-reform tax base in 2010 and approximate the mechanical revenue loss by setting it against the pre- and post-reform tax schedule. That is, I use the average taxable incomes of unmarried and married taxpayers before the enactment of the reform and calculate the tax liability using the pre-reform and post-reform cantonal tax schedule. The distinction between married and unmarried couples is crucial as the canton applies two different statutory tax schedule based on civil status. The municipal level data is provided by the Swiss tax authority (Federal Tax Authority (b) (2025)). By using a pre-determined tax base, I can isolate the mechanical budgetary effect from the behavioral effects of

the tax reform and the results are not contaminated by post-treatment effects such as increased labor supply. Intuitively, as behavioral effects take time to materialize, local policymakers first experience the mechanical revenue loss which might then prompt a counterreaction. Crucially, municipal fiscal policy choices post-reform have no effect on the exposure variable as the tax reform is decided by on the cantonal level and the share component is pre-determined. To estimate how strongly affected municipal budgets are, I divide the exposure variable by pre-reform municipal revenue. To ensure that municipal fiscal policy is not influenced by the exposure variable prior to the 2011 tax reform, I incorporate the exposure variable in a difference-in-difference regression and interact the exposure variable with year dummies $t \in (2004, 2003, \dots, 2018)$. The event indicators are binned at both ends of the sample period (Schmidheiny and Siegloch (2023)). I run the following regression:

$$Y_{it} = \alpha_i + \gamma_t + \sum_{k \neq -1} \beta_k (\text{Exposure}_i \times \mathbf{1}\{t = k\}) + \mathbf{X}'_{it} \boldsymbol{\delta} + \varepsilon_{it} \quad (2)$$

I analyze the fiscal response in a timespan between 2006 and 2018. This gives me five pre-treatment years to assess pre-trends and 7 post-treatment years to assess medium-run fiscal responses. α_i denotes municipality fixed effects, γ_t time fixed effects and \mathbf{X}_{it} is a vector of time-varying control variables. These constitute the lag of a municipality’s population in logarithms, the share of left-wing votes in federal elections, the logarithm of equity a municipality has and the local employment rate. Y_{it} captures municipal outcomes such as municipal revenues, the logarithm of local tax multiplier, municipal public investment and current spending (both in logarithms). Additionally, I will estimate the effect on effective tax burdens in Bern municipalities for gross incomes of 25k, 50k, 100k, 200k, 500k and 1000k in order to gauge whether or not municipal counterresponses can actually make cantonal reforms trickle away. In line with a difference-in-difference approach, I expect $\beta_k = 0$ for $t < 2011$ such that more affected municipalities do not find themselves on different fiscal trajectories prior to treatment. Since the exposure variable is defined as the percentage share of overall municipal revenue lost through the reform, $\hat{\beta}$ estimates by how much percent the local tax multiplier changes for an instantaneous 1 % drop in municipal revenues and can be interpreted as an elasticity. If $\hat{\beta} < 1$, municipalities raise multipliers and therefore overall revenue by less than one percent for a one percent drop in local revenues and if $\hat{\beta} \geq 1$, municipalities use the cantonal reform to enact revenue-neutral or revenue-raising multipliers.

Since the exposure variable relies on average taxable incomes (more granular data is not available) and thus only imperfectly captures local income distributions, it remains an imperfect approximation of the revenue loss from the cantonal reform. To cross-validate the precision of this approach, I approximate (aggregate) municipal revenue from income taxation using data used in equation 1 and contrast it with aggregate municipal tax revenues from income taxation according to government data (Federal Statistical Agency Switzerland (a) (2025)). I cannot correlate both data on the municipal level because in the budget data it is impossible to separate income tax revenue from other tax revenues that accrue to municipalities such as corporate or wealth taxation. For all municipalities, government data states municipal tax revenue from income taxation in Bern to be CHF 1.682 billion in 2010. The approximation according to data used in 1 yields overall tax revenue of about CHF 1.735 billion in 2010. The close fit is reassuring as to the accuracy of relying on average taxable incomes to approximate the revenue losses.

The distribution of the exposure variable is depicted in 9. We can see that for the majority of municipalities, the revenue loss for municipal budgets is around 0.5 % and 1 %.

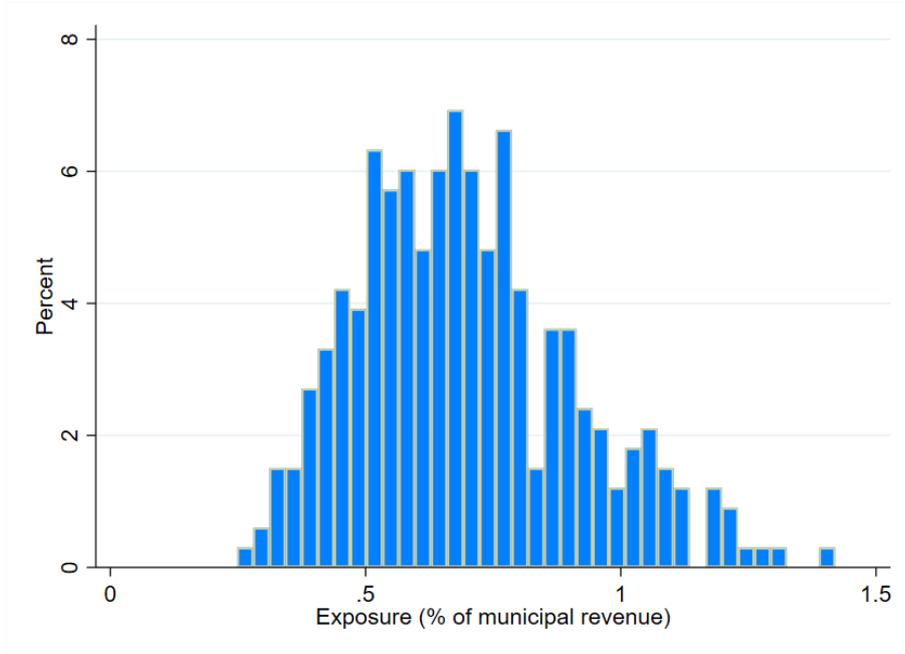


Figure 9: Distribution of the exposure variable

The data used in this analysis come from a variety of sources. Data on municipal budgets and municipal tax multipliers are taken from Fiscal Authority Canton of Bern (2022). Voting shares on the municipal level for federal elections in Switzerland are taken from Federal Statistical Agency Switzerland (2023). The tax burdens (municipal and combined) are taken from Federal Tax Authority (a) (2025). Since those are only available after 2010 and so pre-trends could not be assessed, I calculate these tax burdens back to 2006 using the Bern tax code from 2006 until 2010. These are provided by <https://www.lexfind.ch/fe/de/search>. Data to compute the exposure variable are provided by Federal Tax Authority (b) (2025). Other control variables to capture local economic structures such as the employment share are taken from Parchet (2019).

4.4 Results

4.4.1 Effect on municipal fiscal policy

10 shows the event study plot for the tax multiplier response for a one percent drop in local revenue caused by the cantonal tax reform. We can see that even in the year of the reform enactment, municipalities instantaneously raised their multipliers. In the subsequent years, multipliers continued to increase and stabilized within 6 years after the reform. Reassuringly, there are no diverging pre-trends which suggests that municipalities who suffered greater income losses were on similar fiscal trajectories. It is striking that the estimated coefficient is well above one in the years following the reform which indicates that municipalities raised their multiplier by more than what would have been needed to offset the reform-induced losses.

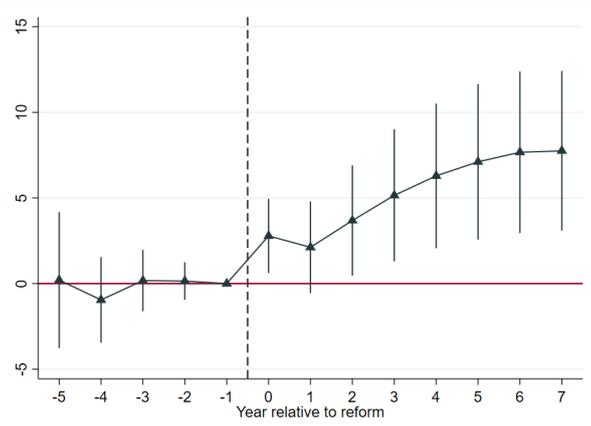


Figure 10: Effect on municipal tax multipliers

Looking at municipal spending (excluding public investment), we can see that this revenue-raising approach shown in figure 10 translates into higher municipal revenues. As shown by figure 11, revenue increases by more than the multiplier increase would suggest. This is likely due to the fact that municipalities levy one multiplier for individuals and corporations. That is, the tax reform targets income taxation but a subsequent multiplier hike also increases revenue from wealth, inheritance and corporate taxation.

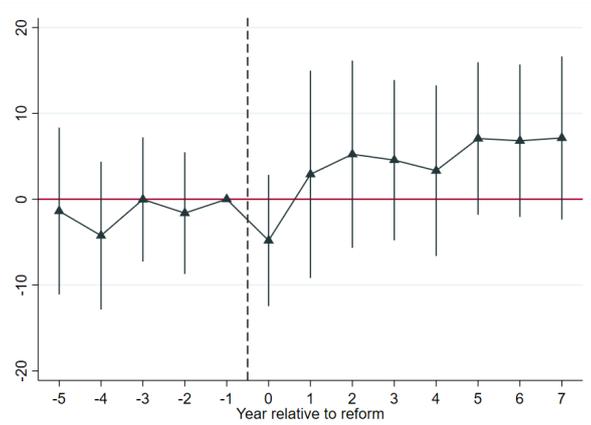


Figure 11: Effect on municipal revenues

This increased municipal revenue then also translates into higher municipal spending (current spending, excludes public investment). As it seems, municipalities see the cantonal tax reform as a reason to increase their own revenue to spend more on local public goods. From a theoretical point of view, this could be rationalized that previously municipalities under-provided public goods due to tax competition. This mirrors the central result by Bucovetsky and Wilson (1991).

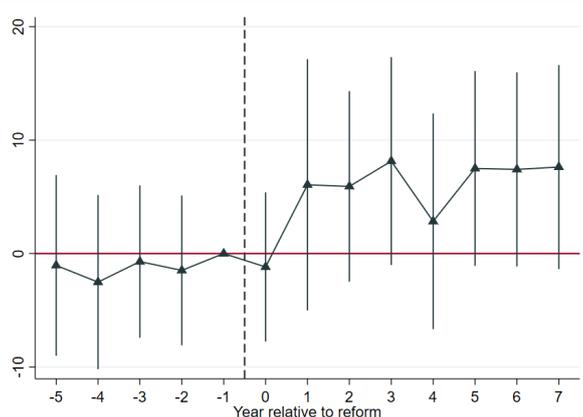


Figure 12: Effect on municipal spending

I run a canonical difference-in-differences model (see table 3) to derive elasticities. I find that a one percent decline in municipal revenue leads, on average, to a 5.72 percent increase in the municipal tax multiplier and the result is highly statistically significant. Since this overcompensates for the mechanical revenue loss, municipal spending increases by 5.972 percent. Overall, municipal revenue increases by roughly 7 % reflecting the fact that the multiplier increase also increases tax burdens for wealth taxation, inheritance taxation and corporate taxation. In essence, the cantonal tax reform raises municipalities' importance in taxation and spending thus implicitly works as a decentralization tool.

Table 3: Generalized Difference-in-differences

	Municipal Tax Multiplier	Municipal Spending	Municipal Revenue
Exposure	5.720*** (2.007)	5.972 (3.825)	7.009** (3.486)
Observations	5799	5791	5791
R-squared	0.867	0.991	0.992
Controls	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.4.2 Effect on tax burdens

The fact that revenue increased after the reform enactment should be reflected in tax burdens. For that end, I run 1 on the tax burden (in percent) of the municipal and cantonal tax for gross incomes of CHF 25k, 50k, 100k, 200k, 500k and 1000k. The results are shown in 13. We can see that following the years of the tax reform, a one percent drop in mechanical revenue leads to an increase in the tax burden of up to 0.5 percentage points. As a result, the cantonal tax cut actually increased tax burdens. The reason for this is the large increase in tax multipliers as depicted in figure 10. Interestingly, this effect increases with the gross income level. While low-income and middle-income earners see smaller increases in their tax burdens, high-income earners see larger increases in their tax burdens. This might be driven by the fact that the tax cut targeted small and medium income tax burdens more than those of high-income earners. But as the increase in the tax burden resulting from a local tax multiplier hike is the same for every taxpayer, it increases the burden more for those benefit less from the actual reform.

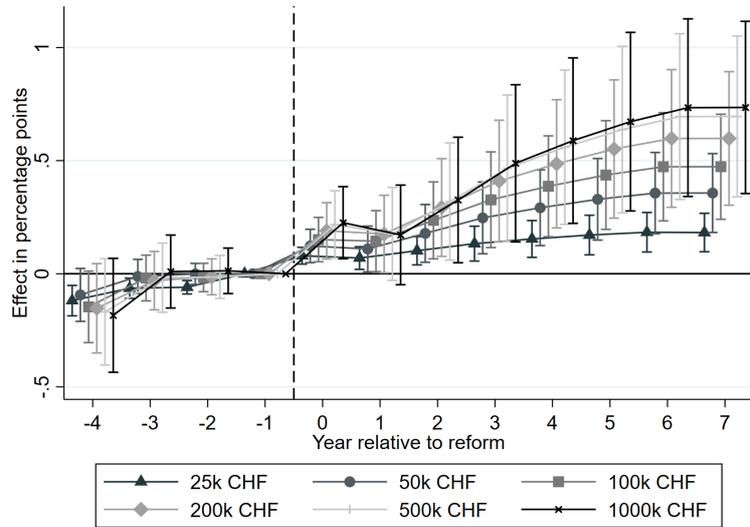


Figure 13: Effect on tax burdens for different gross income levels

Table 13 summarizes the burden increases from a generalized difference-in-differences approach. Concerning distributional effects, high-income earners are affected more from the municipal response. However, this might change according to the structure of a tax reform. For instance, a reduction of top marginal tax rates which benefits high-income individuals more might cause for more tax burden at the lower end of the income distribution.

Table 4: Effect of Exposure

	CHF 25k	CHF 50k	CHF 100k	CHF 200k	CHF 500k	CHF 1000k
Exposure	0.192*** (0.039)	0.267*** (0.071)	0.364*** (0.096)	0.446*** (0.120)	0.501*** (0.144)	0.516*** (0.153)
Observations	4875	4875	4875	4875	4875	4875
R-squared	0.929	0.898	0.899	0.898	0.896	0.895
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5 The role of tax competition

Since a municipality's tax choices do not happen in a isolation but are affected by the policy choices and expectations towards other municipalities, it is worthwhile to study how tax competition shapes the policy behavior presented above. To that end, in this section I present a simple model of tax competition (the full model can be found in the Appendix in subsection 7.1) with a vertical tax externality to get a sense of how it might shape the response.

5.1 Theoretical predictions

The theoretical analysis is based on the model of residence-based income tax competition put forward by Parchet (2019). In this model, municipal governments $j = 1, 2$ compete over an (imperfectly) mobile tax base (N_j) maximizing residents' welfare by setting local income tax rates m_j and by providing a local public good g_j . The vertical tax externality is modeled through multiplying the local tax rate with a federal/cantonal tax rate (mirroring the Swiss case) such that household consumption and municipal government revenue look as follows:

$$c = (1 - m_j t)w, \quad R_j = N_j m_j t w$$

The intuition is that a change in t will cause an effect on municipal government revenue, potentially triggering a counterreaction by changing m_j . Reflecting the standard result of tax competition theory (Bucovetsky and Wilson (1991)), tax competition forces municipalities to underprovide local public goods and hence a deterioration in local government revenue through a decrease in t might result in an increase in m_j . Crucially, this response depends on the municipality's exposure to tax competition which I model through different degrees of household mobility. In a symmetric equilibrium, the equilibrium multiplier is given by:

$$m^* = \frac{1 - \varphi}{t(2 - \varphi)}$$

Differentiating m^* with respect to t yields:

$$\frac{\partial m^*}{\partial t} = -\frac{1 - \varphi}{t^2(2 - \varphi)} < 0$$

φ represents the elasticity of the tax base with respect to the local tax rate and depicts municipal governments' ability to attract households via lower local tax multiplier. If $\varphi \rightarrow 0$, we represent the case of 'no competition', the local multiplier response converges to a constant and the whole federal tax cut is fully undone. The more intense tax competition, the weaker the tax response. Tax competition effectively limits municipal governments' room to maneuver fiscally. Intuitively speaking, if more exposed to tax competition the behavioral effect from increasing local tax multipliers (loss of tax base) outweighs the mechanical positive revenue effect. According to this simple model, the tax response should be more muted for municipalities which are more exposed to tax competition.

5.2 Empirics

5.2.1 Measuring tax competition

Empirically defining exposure to tax competition is a challenging task. Many scholars have attempted at properly defining who actually competes with whom. Parchet (2019) and Eugster and Parchet (2019) stress the importance of geographical proximity such that a municipality mainly competes within its close neighbors. Janeba and Osterloh (2013) argue that metropolitan structures matter as well such that large cities compete with other large cities far away as well as with its direct neighbors. I follow Parchet (2019) by constructing a border sample of municipalities which are located close to another cantonal border. Parchet (2019) finds that the intensity of tax competition is strong within a radius of 10 kilometers and strongly decays afterwards. Similar to his approach, I argue that municipalities in cantons bordering Bern (cantons of Solothurn, Jura, Freiburg, Vaud, Neuchâtel and Luzern) might see

the canton's tax reform as a reason to lower their own taxes which makes them more exposed to tax competition. For Bern municipalities, it is particularly relevant when those competitors have lower tax burdens.⁴ To incorporate the arguments put forward by Janeba and Osterloh (2013), I incorporate the cities which qualify as a center according to Parchet (2019) and compare their effective tax burden to the one in the 20 biggest cities in the whole of Switzerland. More precisely, I construct the sample of strongly exposed municipalities the following way:

$$\text{Tax competition sample} = \begin{cases} \text{yes, if within 10 km of cantonal border} \\ \text{yes, if a an agglomeration according to Parchet (2019)} \\ \text{no, if otherwise} \end{cases}$$

To account for the fact that not only the border proximity matters but also the effective tax burdens in the potential competitors, I refine the sample in the following manner and define four additional, but separate criteria for inclusion to have four different tax competition samples.:

1. If the average tax burden of close (≤ 10 km) municipalities in bordering cantons is lower
2. If the population-weighted average tax burden of close (≤ 10 km) municipalities in bordering cantons is lower. This should account for the fact that it might matter more if there is a low tax big city nearby.
3. If the tax burden in the closest neighbor of a bordering canton is lower
4. If the (inverse) distance-weighted average tax burden of close (≤ 10 km) municipalities in bordering cantons is lower. This is done to account for the fact that it might matter more if there is a low tax big city nearby. This should account for the fact that a low tax city nearby might matter more if the city is very close.

Any municipality that is not included in the tax competition sample is referred to as belonging to the interior sample. It is noteworthy that in terms of fiscal outcomes, the tax competition sample's (here with criterion 2) fiscal parameters are comparable across municipalities as shown by Table 5:

⁴I use the tax burden for single earners with an annual gross income of CHF 100,000. However, the tax burden is also lower for other income levels.

	Full sample		Interior Sample		Tax competition Sample	
	Mean	SD	Mean	SD	Mean	SD
Budgetary variables:						
Tax multipliers	169.423	(21.740)	170.892	(18.801)	168.765	(22.937)
Tax revenues p.c.	2048.258	(557.095)	1975.668	(397.026)	2080.760	(613.317)
Current spending p.c.	4320.737	(1257.497)	4216.659	(1252.767)	4367.339	(1259.152)
Staff expenditure p.c.	683.345	(308.157)	643.595	(298.115)	701.143	(311.451)
Service expenditure p.c.	859.093	(392.705)	864.442	(423.485)	856.698	(378.919)
Public investment p.c.	906.147	(905.884)	775.249	(646.122)	964.759	(996.109)
Equity p.c.	2108.660	(2789.662)	2196.223	(1959.901)	2069.452	(3092.386)
Debt capital p.c.	4309.348	(2390.103)	4155.271	(2736.475)	4378.338	(2219.712)
Exposure to tax reform p.c.	28.467	(7.358)	27.971	(5.087)	28.690	(8.175)
Other variables:						
Left-voting vote share	16.846	(7.572)	18.537	(7.820)	16.054	(7.334)
Highly educated share	13.690	(5.113)	13.516	(4.086)	13.772	(5.534)
Mid-educated share	82.058	(5.781)	82.519	(3.920)	81.843	(6.467)
No-education share	4.252	(3.967)	3.966	(1.629)	4.386	(4.674)
Unemployment rate	2.546	(1.431)	2.557	(1.514)	2.541	(1.393)
Population	2525.196	(7703.035)	3537.567	(13205.128)	2071.896	(2760.469)
Altitude	628.762	(175.847)	540.192	(128.485)	670.279	(179.855)
N	388		268		120	

Table 5: Descriptive statistics: Interior vs. tax competition sample

Admittedly, there can be other forms of measuring exposure to tax competition. For instance, one attractive approach would be that if a municipality is home to highly mobile high-income individuals, its ability to increase tax multipliers would be severely limited. Unfortunately, I do not have access to such granular data on a municipality level.

5.2.2 Results

I run equation 2 on the four respective tax competition and interior samples. Figure 14 depicts the event study plots. We can see that the tax multiplier increases following the 2011 tax reform are more pronounced in those municipalities less exposed to tax competition. This is consistent across all specifications of tax competitions. Interestingly, in the year of the reform ($t = 0$) the response is almost identical whether or not a municipality is more or less exposed to tax competition. The divergence happens only one or two years into the reform.

Figure 14: Exposure tax competition: Event-study graphs

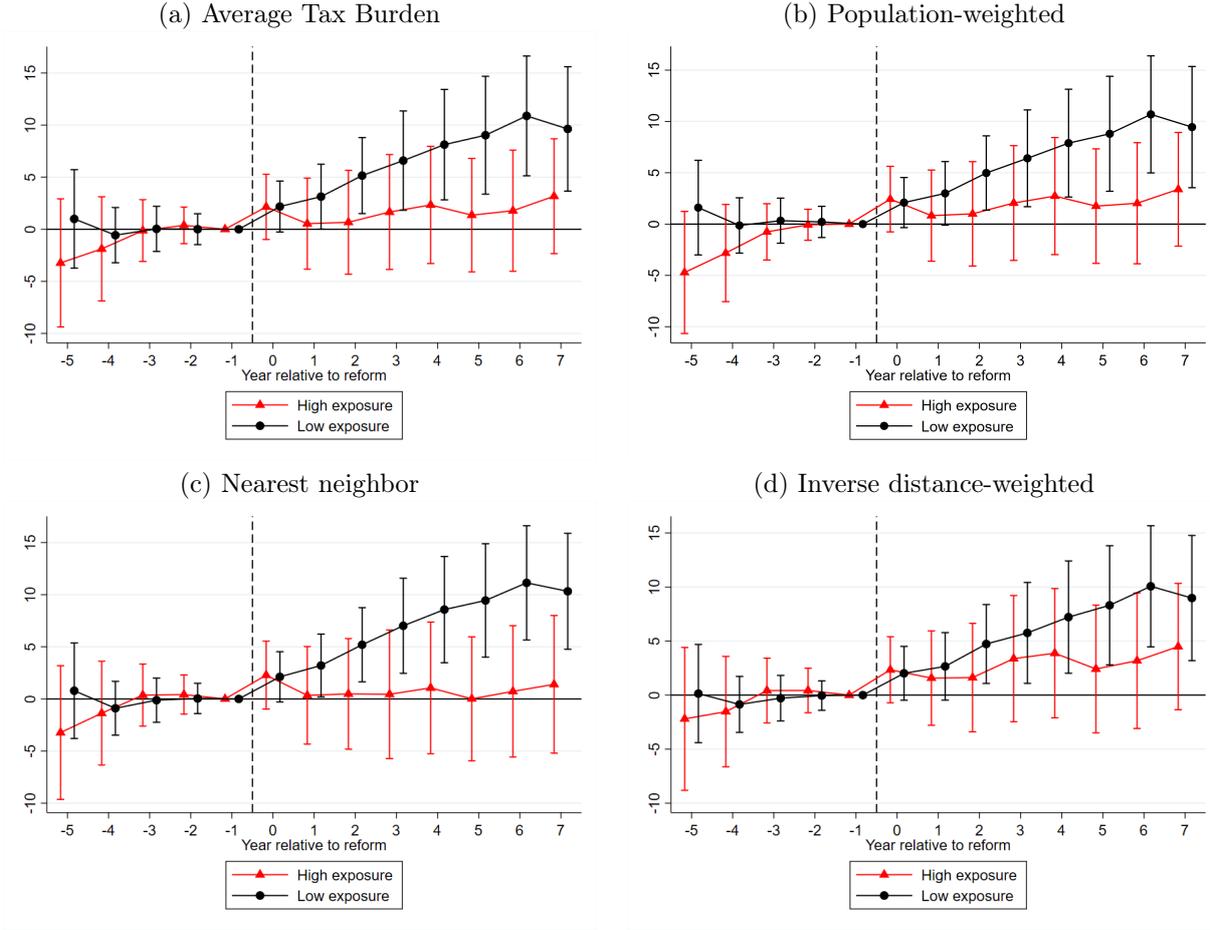


Table 6 contains the response from a generalized difference-in-differences estimation ⁵. This represents the overall treatment effect and confirms the insights from figure 14. We can see that in highly exposed municipalities, the estimated municipal tax response elasticity ranges from 2.399 to 4.709 while in less exposed municipalities, it ranges from 6.036 to 7.094. Additionally, the elasticity for the more exposed municipalities is much less precisely estimated. I interpret these findings as confirming the theoretical

Table 6: Regression Table: Generalized Difference-in-differences

	Population weighted		Closest Neighbor		Average rate		Distance weighted	
	High	Low	High	Low	High	Low	High	Low
Exposure by revenue	4.709*	6.036**	2.399	7.094***	3.530	6.612***	4.093	6.553***
	(2.464)	(2.469)	(2.888)	(2.375)	(2.607)	(2.488)	(2.589)	(2.431)
Observations	2038	4317	2082	4273	2128	4227	2085	4270
R-squared	0.839	0.871	0.831	0.879	0.833	0.874	0.831	0.876
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

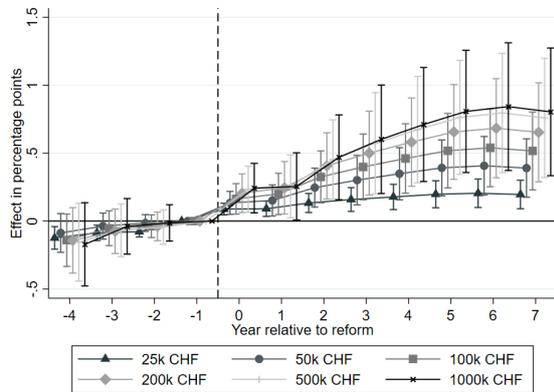
Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

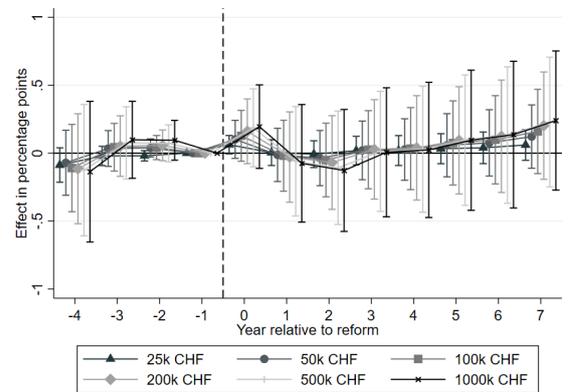
predictions about the effect of tax competition on municipal counterresponses. A higher exposure to tax competition dampens the effect and so the 'trickling-away' effect of a tax reform is much more felt in

⁵The relevant regression equation looks as follows: $Y_{it} = \alpha_i + \gamma_t + (Exposure_i Post(t > 2011)) + \mathbf{X}'_{it} \delta + \epsilon_{it}$

less exposed municipalities. This can also be seen by the effects on tax burdens as shown in figure 15. While tax burdens have substantially risen as a response to revenue losses, this effect is less visible in tax competition municipalities.



(a) Tax Burdens: Interior Sample



(b) Tax Burdens: Tax Competition Sample

Figure 15: Tax competition and tax burdens

Figure 15 refers to the tax competition specification that takes the average tax rate of municipalities in close proximity. For the other specifications, the results look comparable but are relegated to the Appendix (see 8.2).

6 Conclusion

This paper studies the question of local fiscal responses to changes in the tax schedule by superior governments. In decentralized nations, local governments typically enjoy varying degrees in fiscal autonomy. However, local tax policy is often linked to tax schedules that are determined by superior governments. In such systems, a change to the tax schedule creates a vertical tax externality and affects local governments' budgets downstream. The goal of this paper is to study local governments' fiscal response on the revenue and expenditure side once a superior government has altered the tax schedule. More precisely, I estimate a municipal response elasticity to tax reforms enacted by higher-level governments. This question is relevant for understanding how tax reforms propagate through fiscal federalism. That is, local government tax hikes could water down the reductions in tax burdens as envisaged by superior governments. In such a case, although a higher-level government tax cut is supposed to trickle down, reduce household tax burdens and stimulate labor supply, consumption or investment, it might somewhat trickle away as the net effect is quite different.

In order to understand this propagation mechanism more thoroughly, I exploit a large-scale tax reform in the Swiss canton of Bern that lowered tax burdens across the board. I approximate the mechanical loss for municipal budgets and estimate the municipal budgetary response in a difference-in-differences setting with continuous treatment. A one percent reform-induced drop in municipal revenue is met by an average increase in the municipal tax multiplier by 5.720 percent. As a result, municipal revenue increases by more than would have been needed to offset the mechanical revenue loss. This also translates into higher municipal spending. I interpret this finding in light of standard theory on tax competition (Bucovetsky and Wilson (1991)). Municipalities compete with other municipalities and this causes inefficiently low taxes and thus an underprovision of local public goods. Local policymakers might see the reform-induced drop in municipal revenue as a reason to increase local taxes and subsequently increase spending. An increase in municipal revenues following a cantonal tax cut also increases municipality's share of overall tax revenue and so the main results can implicitly be interpreted as an novel mechanism of fiscal decentralization.

The paper has limitations but also offers interesting avenues for future research. For instance, focusing on one tax reform in one canton could limit the findings' external validity. Furthermore, further measures of tax competition are desirable to make the findings about how tax competition shapes the fiscal responses more robust. Data on the share of highly mobile high-income earners on the municipal level could deliver further evidence. Since I solely focus on income taxation, the firm side is left out of the picture. However, it would be an interesting research avenue to study whether and how the fiscal responses differ depending on the subject taxed.

In addition to inspiring further research on this topic, the results of this paper could be insightful for policymakers as they draft income or corporate tax reforms to stimulate economic growth. When lower-level governments possess tax autonomy and see a drop to their revenue following the reform, this paper offers insights into the nature of potential responses. As a result, the macroeconomic effects of the tax reform might not be what policymakers intended in the first place. Depending on the structure of the tax system of local government, the local government response can also change the distributional nature of the tax system. If policymakers want to ensure that municipal fiscal responses don't make their tax reform trickle away, they could think of compensation mechanisms that prevent or mitigate a decline in municipal revenue.

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7 Appendix

7.1 Theoretical Appendix

I put forward a novel model combining a residence-based income tax competition (Parchet (2019)) with an additional layer of government to model both horizontal and vertical tax externalities and their interaction. Ex ante, it is not straightforward to imagine what a local response to a federal tax change looks like. In the case of non self-financing tax cuts, local governments have various options of equalizing revenue losses. They could raise their own multiplier, reduce public good spending or a combination of both. In addition, this response is likely to depend strongly on the presence and intensity of tax competition. The model's main purpose is therefore to give an intuition how to think about municipal counterreactions and, more importantly, generate empirically testable hypotheses. In the real world, the model could represent a national government granting income taxation powers to its states or municipalities. Further, it could represent a (sub-federal) state government setting its own tax system whilst handing fiscal autonomy to its municipalities which would closely mirror the Swiss context.

7.1.1 Model Environment

I consider a federation populated by $J = 2$ jurisdictions (states, or municipalities) which compete for (imperfectly) mobile households via setting both a local tax multiplier and a public good. The federal economy is populated by a unit mass of identical households with exogenous labor income w and preferences $U(c, g)$ over a private consumption good c and a locally provided public good g . To keep the model tractable and derive closed-form solutions, I assume a logarithmic utility function $U(c, g)$. Every household i decides once where to reside among jurisdictions. Within each jurisdiction, a locally provided public good g_j is financed via a residence-based linear income tax which is the product of a local tax rate m_j and a federal tax t . This should reflect the institutional setting of multiplicative tax dependencies as discussed above. The composite local tax $m_j \cdot t$ is levied upon all residents in a given municipality N_j . To finance the local public good, local governments use tax revenue $R_j = m_j t N_j w$. Ceteris paribus, a change in t will mechanically lower R_j . The aim of the model is to understand the response of m_j and as a result g_j in a context of a mobile tax base. Providing the local public good in units of the private consumption good is associated with a cost function $C(g_j, N_j)$, which depends on the level of the public good and the population size. It is important to note that the migration channel fully pins down behavioral effects of taxation and for tractability reasons there is no subsequent adjustment in labor supply. Broadly speaking, local population sizes can thus be interpreted as local labor supply. As a consequence, local governments' budget constraint reads as follows:

$$C(g_j, N_j) \leq m_j t N_j w$$

I assume that local governments provide a pure public good such that the cost function is simply given by:

$$C(g_j, N_j) = C(g_j) = g_j \tag{3}$$

For the sake of simplicity, I restrict the analysis to a pure public good. That is, the marginal cost of providing a local public good is constant and independent of population size.

Households are identical in their preferences for the private and public good, but are heterogeneous in their preferences for a given location. Once individual i decides to reside in jurisdiction j , her indirect

utility is given by:

$$V_{ij} = U(c_j(m_j, t), g_j(m_j, t)) + \varepsilon_{ij} = \log(c_j) + \theta \log(g_j) + \varepsilon_{ij}$$

$U(c_j(m_j, t), g_j(m_j, t))$ is the part of utility that is common to all households. θ denotes a valuation parameter of the public good. Private consumption is determined by $c_j = (1 - m_j t)w$ whereas public good provision is determined by the government budget constraint. The idiosyncratic location preference parameter ε_{ij} measures a household's exogenous preference for a given location. Like Parchet (2019), I assume that utility decreases with the local tax rate. Although higher tax revenues necessarily result in a higher public good level, this is assumed to be outweighed by the associated drop in private consumption. This assumptions provides a rationale why local governments engage in tax competition as it allows local governments to use aggressive tax policies to attract mobile households.

Assumption 1: Utility decreases with the local tax multiplier: $\frac{\partial V_j}{\partial m_j} < 0$

Ultimately, individual will reside in jurisdiction j if it generates higher utility than any other location j' . For the stability of the migration equilibrium, individual utilities V_{ij} are equalized in the migration equilibrium such that no household will find it optimal to relocate any longer. If, for instance, one jurisdiction decides to cut its local tax multiplier to attract households, local population size will increase up until the household for whom higher consumption does not outweigh her idiosyncratic valuation of jurisdiction j . Assuming that ε_{ij} follows an Extreme Value I distribution, with mean zero and variance $\pi^2 \beta^2 / 6$ and the scale parameter β assumed to be one, equilibrium population sizes are given by:

$$N_j = \Pr(V_{ij} > \max_{k \neq j} V_{ik}) = \frac{\exp(V_j/\beta)}{\exp(V_1/\beta) + \exp(V_2/\beta)} = \frac{\exp(V_j)}{\exp(V_1/\beta) + \exp(V_2/\beta)} \quad (4)$$

Population sizes reflect the probability of a household choosing to reside in jurisdiction j based on the tax and public good bundle. As V is strictly increasing in consumption, the numerator in equation (4) increases with lower taxes and hence makes jurisdiction j more attractive to reside. Population sizes react to local tax changes as follows:

$$\frac{\partial N_j}{\partial m_j} = N_j(1 - N_j) \left[\frac{\partial V_j}{\partial m_j} - \frac{\partial V_{-j}}{\partial m_j} \right] < 0$$

At this stage, it is worthwhile to discuss how population size vary with different degrees of exogenous attachment to different locations. In other words, higher attachment to a certain jurisdiction reflect less mobility induced by policy changes. This is represented by $\beta \rightarrow \infty$, as very large realizations of the idiosyncratic location preference ε_{ij} become more likely. In that case, the population size in j boils down to $N_j = 1/2$. In this case, population sizes are independent of local fiscal policy. and there is no argument for tax competition. However, if home attachment becomes irrelevant, that is, households become more responsive to policy change, households choose the region with the highest U with probability one. The effect of location $-j$'s policy on j 's population size is given by:

$$\frac{\partial N_j}{\partial m_{-j}} = -N_j N_{-j} \left(\frac{\partial V_{-j}}{\partial m_{-j}} - \frac{\partial V_j}{\partial m_{-j}} \right) > 0$$

That is, an increase in any other jurisdiction has a positive externality on jurisdiction j as it increase the local tax base. Following Parchet (2019), I assume that population is a concave function of local tax rates. That is, I assume:

Assumption 3: Population sizes are a concave function of local tax rates: $\frac{\partial^2 N_j}{\partial m_j^2} < 0$

This is consistent with a Laffer-curve type interpretation of local tax revenue. If tax rates become punitively high, the outflow of households (behavioral effect) limits the mechanical effect of taxation. Further, a change in the federal tax t has no effect on population sizes as it affects every household in the federation simultaneously and does not render a specific location to be more attractive relative to others.

7.1.2 Equilibrium

In each jurisdiction j , the local government anticipates the effect of its tax own policy on migration flows and maximizes the utility of a representative resident by optimally choosing the public good level g_j and its local tax rate m_j , taking other jurisdictions' policy as given. The government problem looks as follows:

$$\max_{m_j, g_j} U((1 - m_j t)w, g_j) \quad \text{subject to: } g_j \leq m_j t N_j w$$

Thus, the marginal payoff function (Parchet (2019)) or local tax reaction function F_j for jurisdiction j , depending on the tax rates of all the other jurisdictions, is implicitly given by:

$$F_j = wt \left(-\frac{1}{c_j} + \frac{\theta}{g_j} N_j (1 - \varphi_j) \right) = 0 \quad (5)$$

where U_c and U_g are marginal utilities and $\varphi_j = -\frac{\partial N_j}{\partial m_j} \frac{m_j}{N_j}$ is jurisdiction j 's tax base elasticity with respect to its own tax rate. At this point, I assume the degree of mobility is such that local governments cannot increase local tax revenue by setting competitively low tax rates. That is, jurisdiction j 's tax base elasticity is smaller than 1. In reverse, this implies that within a certain interval, local tax increases will also increase local revenue. Together with Assumption 3, this implies that local tax revenue R_j has a Laffer-Curve type interpretation shape with $\frac{\partial R_j}{\partial m_j} > 0$ and $\frac{\partial^2 R_j}{\partial m_j^2} < 0$. While increasing the local tax has a positive effect on tax revenue, this additional effect declines with the intensity of the tax hike.

Assumption 3: No-self financing tax cuts: $\varphi_j = -\frac{\partial N_j}{\partial m_j} \frac{m_j}{N_j} < 1$

In equilibrium, local tax multipliers satisfy $F_j = 0$ for $j = 1, 2$. This then yields:

$$N_j \frac{\theta c_j}{g_j} = N_j \frac{1 - m_j t}{m_j t N_j} = \frac{1}{1 - \varphi_j} \quad (6)$$

The optimality condition resembles a Samuelson condition with the aggregate rate of transformation between the public and private good on the left hand side and measure of the marginal cost of providing the public good on the right hand side. However, the right hand side is somewhat distorted with $\frac{1}{1 - \varphi_j}$ constituting a markup over the marginal cost in local public good provision. If there is no mobility, such that $\varphi_j \rightarrow 0$, we recover the Samuelson condition for public good provision. This in line with the standard result of the tax competition literature that competing for a mobile tax base leads to an inefficiently low provision of public goods (Bucovetsky and Wilson (1991)). Note, that if $\beta \rightarrow \infty$, we recover a standard Samuelson condition:

$$N_j \frac{\theta c_j}{g_j} = 1 \quad (7)$$

In a symmetric equilibrium such that $m_1 = m_2 = m^*$, $N_1 = N_2 = 1/2$ and $\varphi_1 = \varphi_2 = \varphi$, I derive a closed-form solution for the local tax multiplier and the local public good:

$$m^* = \frac{1 - \varphi}{t(2 - \varphi)}, \quad g^* = \frac{1 - \varphi}{2(2 - \varphi)} \quad (8)$$

We can see that the level of the local tax rate and the local public good crucially depends on the level of household mobility. Consider first the inertia benchmark ($\varphi = 0$):

$$m^* = \frac{1}{2t}, \quad g^* = \frac{1}{4}$$

When $\varphi \rightarrow 1$ and households are increasingly mobility, we have $m^* \rightarrow 0$ and $g^* \rightarrow 0$ exemplifying the classical insights from tax competition theory.

7.1.3 Comparative Statics

Since federal governments are no strategic actor in this model, the effect of change in the exogenous federal tax rate on local equilibrium tax multipliers has to be interpreted as to how local multipliers would be different if the federal rate was higher or lower initially. Consider the change in jurisdiction j 's multiplier as a response to a change in t :

$$\frac{\partial m^*}{\partial t} = -\frac{1 - \varphi}{t^2(2 - \varphi)} < 0 \quad (9)$$

This shows that equilibrium local tax rates react negatively to an exogenous federal tax hike. Conversely, if the federal government cuts its tax rate, local governments raise its own tax rate. Intuitively, this rests in the Samuelson condition (6). Tax competition induces inefficiently low public good provision, so tolerating the loss in local government revenue would exacerbate the matter of inefficiently low provided public goods.

To understand how local governments' multiplier change as a response to a higher value of t in general, it is useful to consider the benchmarking case of inert migration. As described above, this follows from $\beta \rightarrow \infty$ and subsequently $\varphi \rightarrow 0$. In this case, public good provision is efficient and any federal change will be completely undone as local governments have no incentive to provide anything than the efficient public good level. By differentiating local tax revenue and setting the marginal effect to zero, the *complete undoing* case is given by ⁶:

$$\frac{\partial R^*}{\partial t} = 0 \iff \frac{\partial m^*}{\partial t} = -\frac{m^*}{t}$$

If we compare this to the local government's response with respect to m^* under inert migration we see that:

$$\lim_{\beta \rightarrow \infty} \frac{\partial m^*}{\partial t} = \frac{1}{2t^2} = \frac{1}{2}$$

This implies that in the case of a federal tax hike, local governments lower the local tax rate proportionally such that the tax burden on residents remains the same. Considering a tax cut, the result is mirrored. Local governments will raise their own tax such that there is no change in tax burdens. Since mobility is the reason for local governments to engage in tax competition, local governments fully undo federal

⁶Alternatively, this can be derived by totally differentiating $c = (1 - m_j t)w$ and setting $dc = 0$

changes as the intensity of tax competition declines. However, the local policy response changes when relaxing the case of zero mobility.

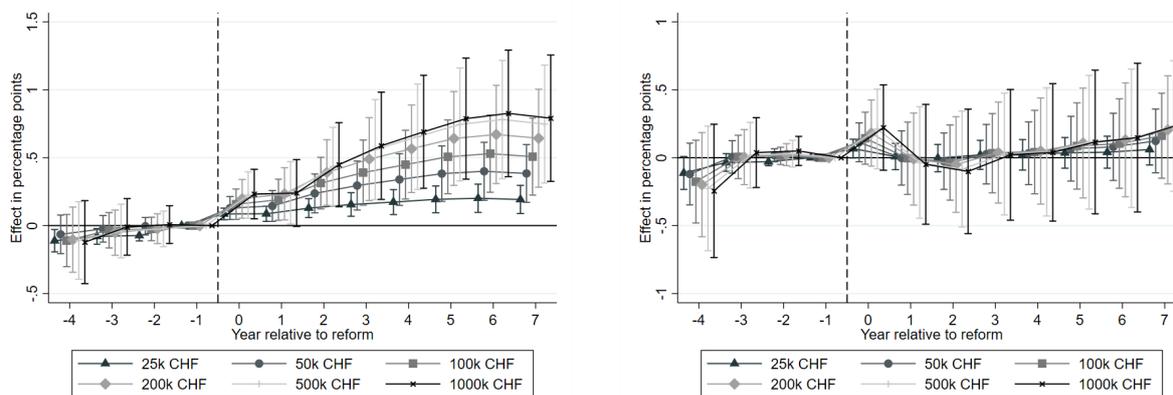
8 Empirical Appendix

8.1 Tax Reforms across all cantons

Cantons	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Appenzell-AR (AR)	0	0	0	0	REF	REF	0	0	0	0	0	0	0
Aargau (AG)	0	0	0	0	REF	0	0	0	0	REF	0	0	0
Bern (BE)	0	0	0	0	0	REF	REF	0	0	0	0	0	0
Basel-Land (BL)	0	0	REF	REF	0	0	0	0	0	0	0	0	0
Fribourg (FR)	0	0	REF	REF	REF	REF	REF	0	0	0	0	0	0
Luzern (LU)	0	0	REF	0	0	REF	0	0	0	0	0	0	0
Neuchâtel (NE)	0	0	REF	REF	REF	REF	0	0	0	0	0	0	0
Obwalden (OW)	0	0	REF	REF	REF	0	0	0	0	0	0	0	0
St. Gallen (SG)	0	0	0	REF	0	0	0	0	0	0	0	0	0
Schaffhausen (SH)	0	0	0	0	REF	0	0	0	0	0	0	0	0
Solothurn (SO)	0	0	REF	REF	REF	0	0	0	0	0	0	0	0
Schwyz (SZ)	0	0	0	0	REF	0	0	0	0	0	0	0	0
Thurgau (TH)	0	0	0	REF	REF	0	0	0	0	0	0	0	0
Uri (UR)	0	0	0	0	0	0	REF	0	0	0	0	0	0
Ticino (TI)	REF	REF	REF	REF	0	0	REF	0	0	0	0	0	0
Zug (ZG)	0	0	0	REF	REF	REF	0	0	0	0	0	0	0
Zürich (ZH)	0	0	0	0	0	0	REF	0	0	0	0	0	0

Table 7: Tax Reforms from 2006-2018 indicated by REF

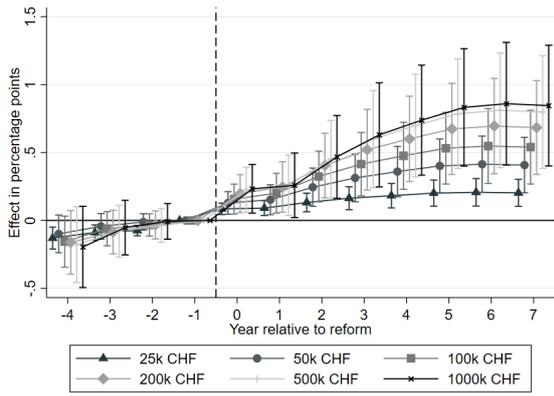
8.2 Tax competition and tax burdens



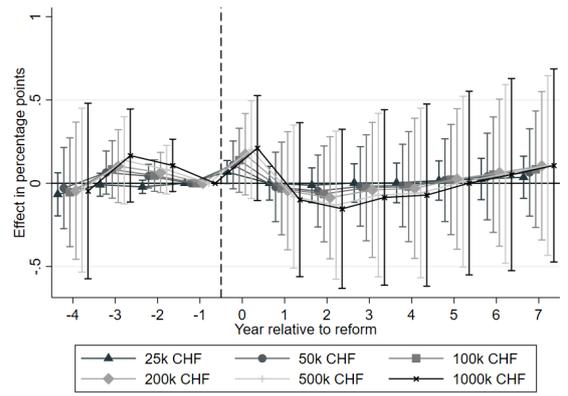
(a) Tax Burdens: Interior Sample

(b) Tax Burdens: Tax Competition Sample

Figure 16: Tax competition and tax burdens:

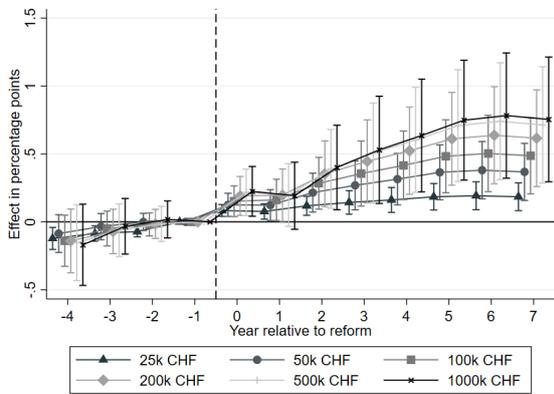


(a) Tax Burdens: Interior Sample

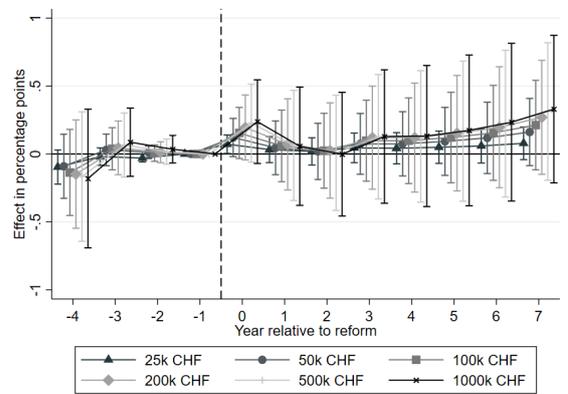


(b) Tax Burdens: Tax Competition Sample

Figure 17: Tax competition and tax burdens



(a) Tax Burdens: Interior Sample



(b) Tax Burdens: Tax Competition Sample

Figure 18: Tax competition and tax burdens



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