Are incentive effects from fiscal equalization underestimated? Evidence from a Swiss reform

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Abstract

This paper investigates incentive effects of fiscal equalization on local tax rates. I propose three refinements to current empirical estimations of these incentive effects. I show that local policy makers may conceive of changes in equalization transfers as stemming from discrete rather than marginal changes in the tax base, thus considering "supramarginal" equalization rates. Second, I study "effective" equalization rates, conditioned on the current tax rate. Third, I model and control for parallel shifts in the budget constraints. I investigate the reform of an inter-municipal equalization scheme in Switzerland. My baseline estimate from supramarginal equalization rates is 2-3 times larger than found in previous studies.

JEL-Classification: H71, H77, R51

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1 Introduction

How does fiscal equalization affect the policy incentives facing state and local governments? Delegation of taxing powers to sub-national governments within federations usually also implies redistribution of fiscal resources. Equalization schemes typically aim to allow all jurisdictions to fund a certain minimum level of publicly provided goods or services. It has been shown that higher equalization rates lead to higher sub-federal equilibrium tax rates (Baretti, Huber, and Lichtblau 2002; Smart 2007; Buettner 2006; Egger, Köthenbürger, and Smart 2010; among others). The logic behind this result is that, with mobile tax bases, transfers compensating for changes in the local tax base work as subsidies for tax increases. Fiscal equalization has thus been thought of as a corrective device for "race-to-the-bottom" tax competition (Köthenbürger 2002; Bucovetsky and Smart 2006). However, to the extent that sub-federal governments may have Leviathan preferences, the resulting equilibrium tax rates could be sub-optimally high (Brülhart and Jametti 2019). In that case, fiscal equalization implies a standard equity-efficiency trade-off as known in many other policy contexts.

In this paper, I propose three refinements to the empirical estimation of incentive effects of fiscal equalization. These refinements suggest that the incentive effects have been underestimated in related analyses. Past estimates of the effect of a 1 percentage-point increase in the equalization rate on local tax rates range from +0.01 to +0.23 percentage-points (Egger, Köthenbürger, and Smart 2010; Miyazaki 2020; Buettner and Krause 2020; Buettner 2006). My estimations suggest that the relevant incentive effect may be 2-3 times bigger.[1]

The main innovations of this research are the following. First, I show that for measuring the extent of equalization it can be important to consider the implications of discrete changes in jurisdictions' tax bases instead of focusing on marginal changes as done in the literature to date. Indeed, it is natural to conceive of local decision makers as reasoning in terms of discrete potential changes in their tax base – say by attracting a very wealthy family or a profitable firm.[2] Most of the existing literature, however, considers the implications of marginal changes in tax bases. Given that equalization schedules typically feature non-linearities, focusing on equalization rates with respect to marginal changes can conceal the effect of thresholds in equalization schedules that only enter the analysis when discrete changes are considered.[3] I refer to equalization rates for discrete changes in tax bases as "supramarginal" equalization rates.

Second, a policy-relevant measure of equalization rates should not only consider statutory equalization schedules but ought also to condition on jurisdictions' own tax rates. I refer to this as an "effective" equalization rate: from the point of view of the local policy maker, any change in transfer amounts through the equalization scheme should be compared to the change in own tax revenue of the jurisdiction. Take a high-tax and a low-tax locality that both consider lowering their tax rate to attract additional taxpayers. If the

1. I summarise in Appendix A.1 all relevant past estimates of the incentive effect, the empirical settings and variables used.

2. The idea of lumpy changes in the tax base has been investigated in the foreign direct investment literature, through models of jurisdictions bidding for a large multinational firm (e.g. Black and Hoyt 1989 or Davies and Eckel 2010).

3. Non-linear equalization schedules can for instance be found in Germany (Egger, Köthenbürger, and Smart 2010), Japan (Miyazaki 2020) or Canada (Smart 2007).

statutory equalization rate lies somewhere between the tax rates of those two jurisdictions, only the high-tax locality will have any incentive to lower their tax rate – the low-tax locality would actually benefit, in fiscal terms, from increasing theirs. Hence, the effective incentive effect of a given statutory equalization rate will depend on jurisdictions' own tax rates. Ignoring this in empirical estimations will unnecessarily mask potentially sizable heterogeneity and thus introduce measurement error.

Third, reforms of equalization schemes that serve to identify incentive effects empirically also have income effects that need to be accounted for: changes in the volume of equalization grants also impacts tax-setting incentives. I model this feature explicitly. In order to isolate incentive effects from parallel shifts in the local budget constraint empirically, changes in the volume of equalization transfers need to be quantified and controlled for. I refer to the variation in equalization amounts as "net equalization transfers". My estimates show that transfers volume redistribution do not affect local tax rates, consistent with Leviathan preferences of local governments.[4]

In order to examine these refinements, I use a quasi-experimental setting allowing me to exploit an exogenous change in equalization rates and transfers and thus estimate plausibly causal effects. My identification strategy relies on the reform of a kinked inter-municipal equalization schedule that naturally creates treated and control municipalities affected or not by a change in the statutory equalization rate. In a second step, I instrument the change in marginal/supramarginal, nominal/effective equalization rates faced by all municipalities and estimate elasticities of municipal tax rates. Compared to past

4. I however additionally find a significant impact of the amount of transfers on total expenditure, consistent with the so-called "flypaper-effect" of intergovernmental grants (Inman 2008).

findings, I observe large increases in tax rates for marginal equalization rates (0.08 percentage-points for a 1 percentage-point increase in the equalization rate) and even larger for supramarginal equalization rates (0.25 percentage-points for a 1 percentage-point increase in the equalization rate).[5]

Finally, this is the first academic study of fiscal equalization among municipalities within a Swiss canton. This setting has two main attractive features. One advantage is that municipalities have a single decision variable to set the tax level: a multiplier that is applied to the canton-level tax schedule, with a perfect overlap of tax bases. This makes jurisdictions' full tax policy stances quantifiable through a single number. Given that municipal taxes are raised on personal income and wealth as well as on corporate income and capital, changes in the municipal multiplier affect a very broad local tax base. Another advantage of this empirical setting is that Swiss municipalities are small jurisdictions (with a median population of around 1,000 inhabitants). They are thus set in a homogeneous institutional and economic environment, which makes them highly comparable. Figure 1 illustrates the special nature of my empirical setting. Municipal multipliers in Switzerland govern around 50% of their total revenue and approximately 70-80% of their total tax revenue, which is comparable to taxing powers of Canadian provinces (Smart 2007) but much larger than the scope of German municipal business tax rates (Buettner 2006; Egger, Köthenbürger, and Smart 2010), Japanese municipal capital tax rates (Miyazaki 2020) or German state-level tax rates (Baretti, Huber, and Lichtblau 2002; Buettner and Krause 2020).

The impact of equalization rates on tax rates has previously been explored empirically by a number of authors using different specifications of the the

5. These magnitudes are equivalent to elasticities of 0.026 for marginal equalization rates and 0.068 for supramarginal equalization rates.

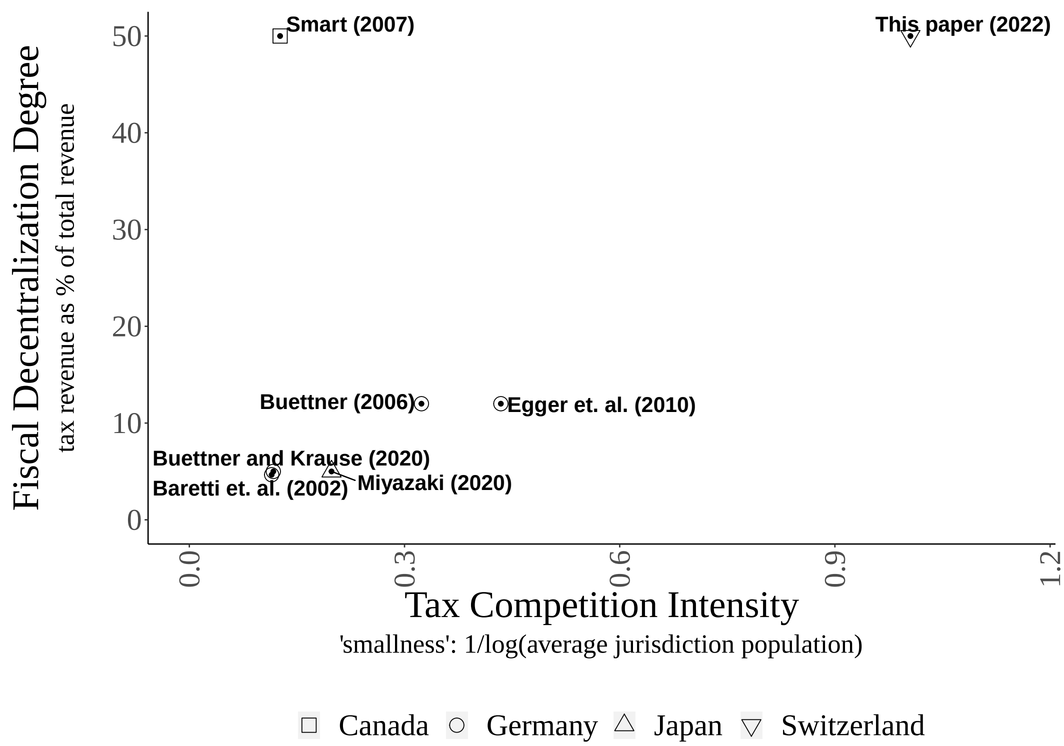

Figure 1: Recently studied empirical settings according to the degree of fiscal decentralization and smallness of jurisdictions. Jurisdiction size is measured using the average population. The relevant tax revenue refers to the income generated by the tax rate investigated in the paper. Decentralization is constructed as the ratio of the relevant tax revenue to the jurisdictions total revenue (including federal transfers). Jurisdiction sizes, tax and total revenues have been taken either from the papers themselves or from the respective statistical office: for German state level data (Baretti, Huber, and Lichtblau 2002, Buettner and Krause 2020): https://www.destatis.de/DE/Themen/Staat/Oeffentliche-Finanzen/_inhalt.html, for German municipal level data concerning Baden-Württemberg (Buettner 2006): https://www.statistik-bw.de and for Lower-Saxony (Egger, Köthenbürger, and Smart 2010): https://www.statistik.niedersachsen.de/startseite/ , Canadian province level data (Smart 2007): https://www150.statcan.gc.ca and Japanese municipal level information (Miyazaki 2020): https://www.e-stat.go.jp/en.

equalization rate. One common approach has been to exploit simulations to compute equalization transfers and therefore equalization rates. Baretti, Huber, and Lichtblau (2002) construct implicit marginal equalization rates by taking into account the complex setting of vertical and horizontal transfers of the German state-level revenue-sharing scheme. The authors show that high marginal equalization rates are correlated with low tax enforcement activity and therefore tax revenue. At the German municipal level, Buettner (2006) proceeds similarly by computing marginal equalization rates based on all types of transfers from and to municipality, state and federal governments. The author finds increases between 0.13 to 0.23 percentage-points in the tax rates as a response to a 1 percentage-point increase in the marginal equalization rate. More recently, Buettner and Krause (2020) use the delegation of taxing powers to German states in order to study the impact of horizontal equalization transfers on tax policy. They simulate a small shock to the tax base in order to compute marginal equalization rates. Their findings suggest that when being able to set their own tax rate, German states react strategically to the marginal equalization rate and increase their real-estate transfer tax by 0.013 percentage-points for a 1 percentage-point increase in the marginal equalization rate.

Another common approach to measure incentive effects has been to use the statutory equalization rate, set by law. Smart (2007) uses a reform in the Canadian States equalization scheme to show that recipient jurisdictions decreased their effective tax rates as a response to a cut in the marginal equalization rate. Canadian provinces are predicted to increase their effective tax rates by 0.14 percentage-points as a response to a 1 percentage-point increase in the marginal equalization rate. Miyazaki (2020) examines the kinked equalization schedule faced by Japanese municipalities to show that higher statutory equalization rates led to implementing additional corporate taxes. Egger, Köthenbürger, and Smart (2010) is the study most closely related to this research. The authors use a reform in the equalization scheme of Lower Saxony (Germany) to measure its impact on municipal business taxes. The authors use a change in statutory equalization rates faced by municipalities below and above a target tax base level. They show a positive causal impact of changes in statutory the equalization rate on local business tax rates. The authors measure increases of 0.04 percentage-points to an increase of 1 percentage-point in the marginal equalization rate. Available pre-reform periods are however not exploited to statistically exclude possible pre-trends that may undermine the results. By working with marginal equalization rates, Egger, Köthenbürger, and Smart (2010) also exclude the possibility that local decision makers optimise assuming discrete changes in the tax base. Given the kinked equalization schedule investigated, this distinction is likely to matter as the true incentive effect may be underestimated.

The remainder of the paper is organized as follows. Section 2 introduces the model. Section 3 details the reform, data and issues concerning endogeneity and identification. Section 4 shows the empirical results and offers a discussion. Section 5 concludes.

2 Theoretical foundations

The policy incentives created by fiscal equalization can be analysed based on the canonical tax competition model of Zodrow and Mieszkowski (1986) and Wilson (1986), in the spirit of Köthenbürger (2002). This model considers a small jurisdiction within a large and fragmented federation, implying a partial equilibrium approach. Local governments compete for a mobile factor and face a tax base equalization scheme with statutory equalization rate α.[6] Using this set-up, I show that the net effect of a small change in the equalization rate on equilibrium tax rates can be decomposed into an incentive and a redistribution effect.

Suppose a federation that is composed of a large number N of jurisdictions i, which are in turn composed of many (identical) households. Identical firms produce output with a strictly concave production function $F(K_i, L_i)$, using labor L_i and capital K_i, and exhibiting constant returns to scale. Each household inelastically supplies one unit of immobile labor and are endowed with capital $\overline{K}_i$. Capital is fully mobile across jurisdictions and fixed at the national level. The production function can be written in its intensive form $f(k_i)$, where k_i describes the capital-labor ratio for jurisdiction i. The average capital-labor ratio can be described as k^*.[7] Capital and labor markets are perfectly competitive. This insures that the net rates of return are the same across jurisdictions at a single rate r. Capital is therefore allocated according to the net-of-tax return, which is embodied in the arbitrage condition $f'(k_i) - \tau_i = r$, where τ_i is the capital tax rate. Jurisdictions are assumed too small to affect the economy net return on capital.These assumptions imply that $\frac{dk_i}{d\tau_i} = \frac{1}{f''(k_i)} < 0$. Households in each jurisdiction derive utility from a private good c_i and a public good g_i. Private consumption is paid through (residual) wage income $w_i = f(k_i) - f'(k_i)k_i$ and capital income rk^*. Public goods are funded by tax revenue $\tau_i k_i$ and by equalization transfers from a tax base equalization

6. See Köthenbürger (2002) for a theoretical investigation on tax base versus tax revenue equalization schemes.

7. Note that $\frac{\partial k^*}{\partial \tau_i} = 0$ given the small size of jurisdiction i. Since capital is fixed on the national level, the capital outflow for a region increasing taxes and the capital inflow for the other region mitigate and fully compensate each other.

scheme $\alpha(k^* - k_i)$. Jurisdictions can either be "contributors" or "recipients" of the equalization system according to their relative tax base level. The equalization scheme is moreover characterised by the statutory equalization rate α which defines how much of the difference between actual and target tax base level is received/payed in equalization transfers. This parameter is set at the federal level. Following the literature on tax-competition, I assume a quasilinear utility such that the consumer problem is given by

$$\max_{c,g} U_i = c_i + \Gamma(g_i) \tag{1}$$

$$s.t.\ \ c_i = f(k_i) - f'(k_i)k_i + rk^* \tag{2}$$

$$g_i = \tau_i k_i + \alpha(k^* - k_i). \tag{3}$$

Let us now uncover the optimal choice of taxation from the local government. It is assumed that the local policy maker chooses the tax rate such as to maximize the utility of a representative resident. The optimization problem of jurisdiction i can be written as

$$\max_{\tau_i} W_i = f(k_i) - f'(k_i)k_i + rk^* + \Gamma(\tau_i k_i + \alpha(k^* - k_i)). \tag{4}$$

From this unconstrained maximization problem I get the necessary and sufficient first-order condition:

$$\underbrace{-k_i}_{\frac{\partial c_i}{\partial \tau_i}} + \underbrace{\Gamma_g}_{MRS_i} \underbrace{[k_i + (\tau_i - \alpha)\frac{dk_i}{d\tau_i}]}_{\frac{\partial g_i}{\partial \tau_i}} = 0. \tag{5}$$

Re-arranging equation (5) yields $MRS_i \equiv \Gamma_g = -\frac{\partial c_i}{\partial \tau_i} / \frac{\partial g_i}{\partial \tau_i} \equiv MCPF_i$, where $MCPF_i$ stands for the marginal cost of public funds. Benevolent governments therefore set the tax rate by equating the cost of raising one more unit of public funds to households' marginal rate of substitution.

2.1 The incentive effect of fiscal equalization

I am interested in how the choice of the local tax rate changes following an exogenous shock on the statutory equalization rate α. For that, I use equation (5) in order to derive an explicit expression:

$$\frac{d\tau_i}{d\alpha} = \Omega^{-1}\Big[\underbrace{-\Gamma_{gg}(k^* - k_i)(k_i + (\tau_i - \alpha)\frac{dk_i}{d\tau_i})}_{\text{redistribution effect}} + \underbrace{\Gamma_g \frac{dk_i}{d\tau_i}}_{\text{incentive effect}}\Big], \tag{6}$$

where

$$\Omega = -\frac{dk_i}{d\tau_i} + \Gamma_{gg}\Big[k_i + (\tau_i - \alpha)\frac{dk_i}{d\tau_i}\Big]^2 + 2\Gamma_g \frac{dk_i}{d\tau_i} < 0 \tag{7}$$

is the second order condition for the local governments optimization problem. An increase in the equalization rate yields two possibly countervailing effects. On the one hand, the slope of the budget constraint of local governments is affected by the change in α: this designates the "incentive effect" of fiscal equalization. On the other hand, the level of the budget constraint is affected through an increased volume of equalization transfers, I name this the "redistribution effect".[8] The incentive effect is strictly positive, meaning that contributors as well as recipients see their marginal cost of public funds decrease as the marginal equalization rate increases. However, the redistribution effect created by the transfers' volume shift reinforces (mitigates) the incentive effect for equalization contributors (recipients). This is due to the consequent larger redistribution of equalization transfers that impacts negatively the marginal rate of substitution for recipients and positively for contributors.[9]

8. The redistribution effect was first mentioned in Köthenbürger (2002) and can be interpreted as an income effect shifting the jurisdictions' budget constraint in parallel fashion.

9. As equation (6) suggests, the net effect for local governments can be negative. This is illustrated in Figure 7. See a more detailed analysis in Appendix A.2 of the effects of a

The existence of the redistribution effect depends critically on the benevolence assumption because the parallel shift of the local budget constraint translates into higher public good consumption, and hence a change of the residents' marginal rate of substitution. When looking at revenue-maximizing Leviathans, an increase in the marginal equalization rate leads unambiguously to an increase in equilibrium tax rates because the local government does not take into account the agents' disutility from higher taxes which impact private consumption.[10] In the literature, Egger, Köthenbürger, and Smart (2010) or Smart (2007) choose this approach and drop the benevolent assumption. Buettner (2006) on the other hand integrates parallel shifts of the budget constraint by investigating grants that are unconditional on the jurisdictions' tax base which he calls "virtual grants". In my setting, the income effect created by transfers is linked to more redistribution from contributors to recipients. The increase in transfers affects local taxes in the same way as grants unconditional on the tax base, but the positive or negative change in transfers depends on whether a jurisdiction is contributor or recipient of the equalization system. In practice, most equalization systems are however characterised by additional grants from upper-level governments that may depend on on local factors directly unrelated to the local tax-base (think of topographic features for instance). A change in these transfers would also yield a shift of the local budget constraint similarly as the redistribution effect. In Appendix A.4, I show that an exogenous increase in additional transfers impacts negatively the

change in the equalization rate on the net effect between the redistribution and incentive effects.

10. I relax the benevolence assumption in Appendix A.3 by allowing a "degree of benevolence" to vary. I show that greater benevolence leads to lower tax-raising incentive effects because the local decision maker takes into account the optimal mix of public and private goods of the representative resident.

optimal tax rate choice of a local government. This analysis is analogous to the effect of virtual grants on equilibrium tax rates studied by Buettner (2006). In the empirical analysis of this study I control for the income effects created by local budget constraint shifts by including a variable capturing the total variation in equalization transfers from the horizontal equalization mechanism and vertical grants.

2.2 Going beyond the *marginal* equalization rate

While the stylized model above shows how equalization grants conditional on the relative tax base impact tax-setting incentives through shifts in the marginal cost of public funds, the model cannot account for discrete changes in tax bases.

As Keen and Konrad (2013) recognize, this class of tax competition models interpret capital k_i as a continuous, homogeneous good. However, models of foreign direct investment (FDI) consider a "lumpy" framework where local governments bid in order to attract a large multinational plant or firm (see e.g. Black and Hoyt 1989, Haufler and Wooton 1999, Kind, Knarvik, and Schjelderup 2000, Davies 2005, Davies and Eckel 2010 and Ferrett and Wooton 2010). The lumpy and discontinuous nature of variations in a jurisdictions' tax base hence can be thought of in our framework as shocks of various intensities on the tax base (by attracting a new firm or investment) which in turn impact equalization grants. To see this, let $T_i(k_i) = \alpha(k^* - k_i)$ represent the equalization function observed by jurisdiction i. Totally differentiating and rearranging the equation gives $\alpha = -dT_i/\, dk_i$. The equalization rate can hence be thought in terms of large or small changes in capital dk_i and its corresponding changes in grants dT_i. Drawing from the results of the literature on

FDI, the relevant equalization rate perceived by local policy makers plausibly would not be a marginal equalization rate (i.e. infinitesimally small changes in the tax base) but what I designate as a “supramarginal” equalization rate (i.e. larger, discrete changes in the tax base). If the equalization schedule is linear, marginal and supramarginal equalization rates are equivalent. If the equalization schedule however displays kinks or discontinuities, these may differ. This differentiation is hence particularly relevant in empirical applications as most equalization transfer functions have non-linearities (see for instance Smart 2007 for Canada, Egger, Köthenbürger, and Smart 2010 in Germany or Miyazaki 2020 for Japan).

Figure 2 illustrates a typical case of non-linear equalization transfers function characterised by a statutory equalization rate which varies with the tax base level k_i. Jurisdictions with tax base below average k^* receive transfers while those above contribute. Note that the transfer function exhibits a kink at threshold value $\hat{k}$ which is set exogeneously. Let j be a jurisdiction with tax base value k_j, receiving amount T_j of transfers. With a small positive increase in the tax base, bringing j to tax base value $k_j^{'}$, jurisdiction j will observe a change of transfers $T_j - T_j^{'}$. For this marginal change in the tax base, the equalization rate can be computed as $\alpha = -(T_j^{'} - T_j)/(k_j^{'} - k_j)$. Now imagine a very large shock on the tax base, moving j to $k_j^{''}$. Under a linear equalization scheme, as the dashed line suggests, the equalization rate would be computed as $\alpha = -(\widetilde{T}_j^{''} - T_j)/(k_j^{''} - k_j)$ instead of the actual equalization rate which writes as $\alpha = -(T_j^{''} - T_j)/(k_j^{''} - k_j)$. In a setting with non-linear equalization transfer functions, marginal and supra-marginal equalization rates hence differ. In the empirical application of this paper, I hence take into account the discrete nature of changes in the tax base by differentiating between the marginal and supramarginal equalization rate when studying the effect of the

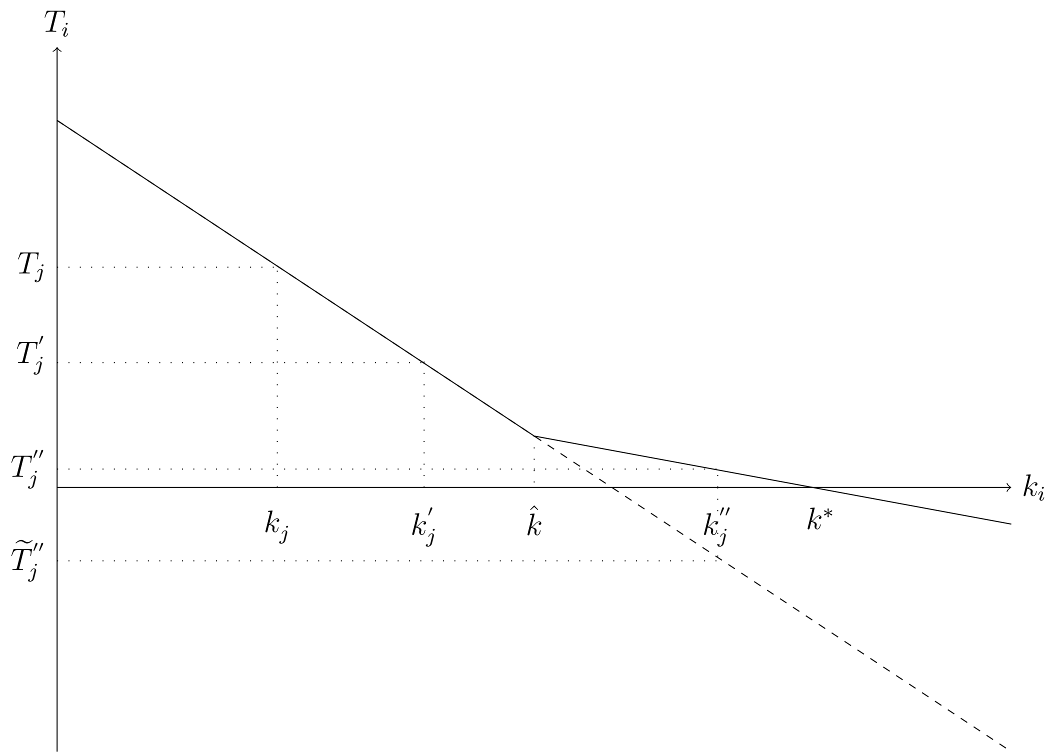

Figure 2: This figure illustrates a typical case of non-linear equalization transfers function. The horizontal axis refers to per-capita tax base k_i and the vertical axis to the equalization transfers amounts T_i. For jurisdiction j, a small or larger shock on the tax base do not yield the same equalization rate.

reform of a discontinuous equalization scheme on local taxes.

Recent reports on the German and Swiss equalization systems emphasized the need to not only investigate "nominal" equalization rates, calculated solely based on tax base or capacity variations, but also "effective" equalization rates, which take into account the tax revenue generated by the change in the tax base (Burret, Bury, and Feld 2018, Leisibach and Schaltegger 2019). The effective equalization rate is defined as $\alpha^e = \alpha/\tau_i = -dT_i/\,\tau_i dk_i$, where τ_i is the local tax rate. The idea behind this measure is that for an increase in the tax base dk_i, local policy makers consider the tax revenue generated by the increase in the tax base minus the foregone equalization transfers stemming from the tax base increase. To see this, think of jurisdiction j considering a tax decrease in order to attract additional capital. A decrease in the tax rate leads to change in total revenues $-\partial g_i/\partial\tau_i = -k_i - (\tau_i - \alpha)\frac{dk_i}{d\tau_i}$. The tax decrease would mechanically diminish total revenues by $-k_i$. Given the mobility of the tax base, capital inflows will increase total revenues at rate $\tau_i\frac{dk_i}{d\tau_i}$ but simultaneously decrease equalization transfers at rate $\alpha\frac{dk_i}{d\tau_i}$. Tax setting incentives may hence depend on the current tax rate: if the local tax rate is higher than the nominal equalization rate, a tax-base inflow would generate a net gain in total revenues for the municipality whereas for jurisdictions with taxes lower than the nominal equalization rate a tax-base inflow is a net loss. Keeping the local taxes constant, an increase in the nominal equalization rate means an increase in the effective equalization rate. In turn, an increase in the effective equalization rate means that for a given capital inflow the net gain of total revenue is smaller. Increases in effective equalization rates may hence also lead to local tax increases such as to insure a positive net gain from a potential tax base increase. I therefore additionally implement the effective equalization rate variable in the econometric analysis in order to capture potential heterogeneous responses to a change in the nominal equalization rate conditional on jurisdictions tax rates.

3 Empirical strategy

3.1 Municipal fiscal policy and equalization in the canton Bern

Switzerland is a highly fiscally decentralized country that delegates much of its taxing powers to sub-federal governments: cantons and municipalities. This federal fiscal architecture includes an equalization system between cantons (states), and they in turn implement equalization schemes among their municipalities.[11] In my empirical investigation I look at the canton of Bern, which is the second most populous canton and has the largest number of municipalities with around 300 local jurisdictions. Local governments in Bern enjoy a high level of autonomy in their budget decisions. The cantonal government sets the schedule of income, wealth and corporate tax rates. Municipal fiscal policy decisions are then based on the tax multiplier that is applied to the comprehensive tax base as defined at the canton level.[12]

Bern's municipal fiscal equalization scheme consists of vertical and horizontal transfers. The former contain canton-municipality cost-sharing payments and transfers unconditional on the municipal tax base. The latter stem from a "tax capacity" equalization system designed to reduce the spatial inequalities arising from differential tax base levels across municipalities. In the remainder of this paper, let B_i refer to the tax capacity of municipality i. This measure of the revenue raising capacity of a municipality is computed as the total tax base of the jurisdiction multiplied by a standardized tax multiplier that is chosen

11. For a detailed description of different municipal equalization systems, see Rühli (2013).

12. By law, changes in the municipal tax multiplier must face a compulsory vote by the electorate of the municipality, either through an assembly meeting or a ballot vote.

by the canton.[13] The statutory equalization rate α_i in this setting determines the rate at which the difference between the average and actual tax capacity of i is compensated for recipients and forfeited by contributors. The focus of this paper is on incentives created by the horizontal transfers scheme.

Formally, total equalization transfers for municipality i at time t are governed by the following function:

$$T_{i,t} = \alpha_{i,t}(B_t^* - B_{i,t}) + \Lambda_{i,t}, \tag{8}$$

where the statutory equalization rate is defined as

$$\alpha_{i,t} = \begin{cases} \alpha, & \text{if } B_{i,t} \geq \hat{B}_t \\ 1, & \text{if } B_{i,t} < \hat{B}_t, \end{cases} \tag{9}$$

and $\Lambda_{i,t}$ represents vertical transfers between the canton and the municipality. Municipalities' tax capacity $B_{i,t}$ is computed as $B_{i,t} = \bar{t}k_{i,t}$, where $\bar{t}$ is the unique standardizing multiplier and $k_{i,t}$ the comprehensive tax base of municipality i averaged over the three previous years. B_t^* is the cantonal average tax capacity. Municipalities face a discontinuity in the equalization schedule at $\hat{B}_t$ which is set as a target threshold (called the *Mindestausstattung*) chosen by the upper-level government.[14] For municipalities with tax capacity levels below the threshold, any small change in the harmonized tax capacity is fully compensated by a change in equalization transfers. Municipalities above the target

13. This harmonizing multiplier is set by decree from the cantonal government who computes it as a weighted average of the local tax multipliers. Since the first implementation of the equalization system in 2002, this standardized tax multiplier has changed only once: in the 2012 reform.

14. Similarly as the standardized multiplier, the target level of tax capacity is set by decree from the cantonal executive and is chosen as a percentage of the average tax capacity B^*. Since the 2002 introduction of the equalization system, this threshold has only been modified through the 2012 reform.

face a statutory equalization rate $\alpha \in (0, 1)$ which is decided at the cantonal level by decree. Vertical transfers consist of subsidies to municipalities determined by geographic, social or demographic characteristics and above-average tax-rates. Moreover, municipalities financially co-fund some public-transport, social security and other expenditures decided at the cantonal level through a cost-sharing scheme also contained in $\Lambda_{i,t}$.[15]

3.2 Identification: the reform

To measure the incentive effects of fiscal equalization I exploit a reform in the municipal equalization schedule of the canton Bern. In 2012, cantonal authorities decided to increase of the statutory equalization rate α and the target threshold $\hat{B}_t$, and to decrease the standardized tax multiplier.[16] The reform of the equalization schedule is illustrated in Figure 3. The statutory equalization rate was raised from 0.25 to 0.37 and the target threshold $\hat{B}_t$ from 80% to 86% of the average tax capacity. The unique harmonizing multiplier was lowered from 2.4 to 1.65.[17] The reform thus had a differential impact on municipalities

15. Appendix A.5 lists the different transfers included in $\Lambda_{i,t}$ in more detail.

16. From 2008 on, the cantonal executive branch (with a left-wing majority) expressed concerns that horizontal transfers were not redistributive enough and that vertical transfers set wrong incentives for municipalities, especially with respect to grants conditional on the current municipal multiplier. The cantonal government hence put forward a comprehensive reform of the system that would correct for tax-setting incentives and increase fairness of the system. The cantonal parliament (approx. 51% of right-wing parliamentarians) as well as municipality associations were consulted and largely approved the project.

17. The standardized multiplier shifts the horizontal equalization transfers schedule for all municipalities the same way. Given the panel structure of my data, which allows me to control for shocks affecting all municipalities in a given year, changes in the harmonizing multiplier which would affect municipal multipliers are not identified. For this reason, I focus my identification strategy on the statutory equalization rate α_i, which changed differently

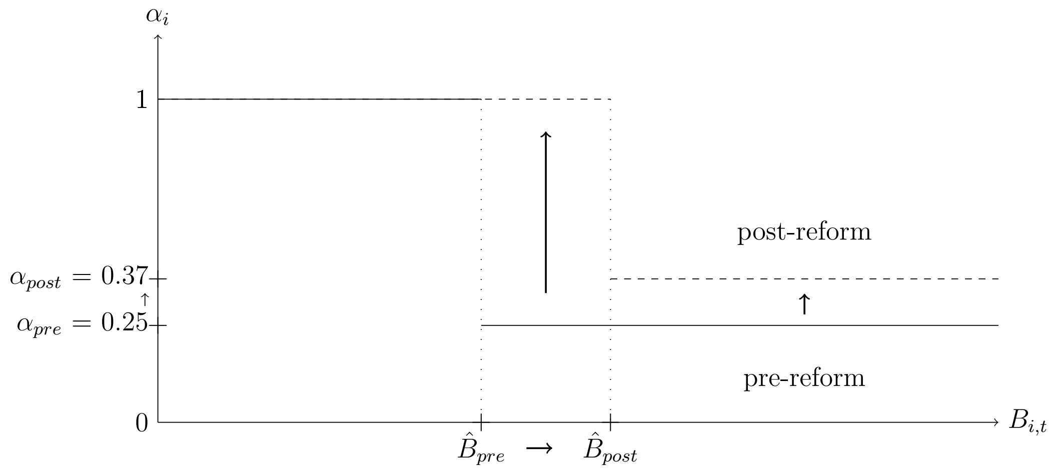

Figure 3: The equalization schedule and its reform. The horizontal axis represents the harmonized tax base and the vertical axis the statutory equalization rate. Cantonal authorities implemented a reform in 2012 by increasing of the statutory equalization rate and the minimum endowment threshold. Full lines represent the pre-reform schedule, dashed lines the post-reform schedule.

according to their per-capita tax capacity in 2012. Those slightly above the pre-reform target threshold saw their statutory equalization rate increase by 75 percentage points whereas those already above the post-reform target threshold in 2012 observed an increase of 12 percentage points. The discontinuous structure of the schedule and the nature of the reform naturally delimit groups of municipalities that are differentially affected by changes in their statutory equalization rates. This allows me to define treated and control municipalities respectively as those seeing an increase in their statutory equalization rate and those that did not.[18] A map of the treatment status by municipality is shown

for different municipalities.

18. As Figure 3 suggests, the treated could be separated into a "High-treatment" intensity (increase of 0.75 percentage points) and a "Low-treatment" intensity (increase of 0.12 percentage points). As the high-treated municipalities form around 10% of my sample, I refrain from looking at both groups separately in my baseline analysis. I nonetheless perform the

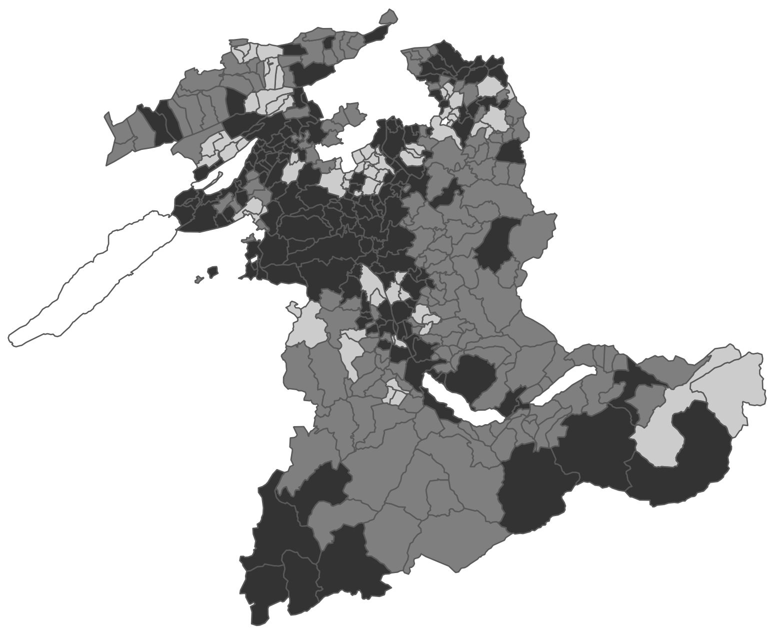

Figure 4: Treatment status of municipalities according to their change in statutory equalization rate in 2012. Light-grey areas represent municipalities that amalgamated between 2007-2017 which are excluded from the sample.

in Figure 4.[19]

The change in the statutory equalization rate also impacted effective equalization rates. Since B_i is defined here as the tax capacity of a municipality, the effective equalization rate can be written as $\alpha_i^e = \frac{\bar{t}}{\tau_j}\frac{dT^{FE}}{dB_i} = \frac{\bar{t}}{\tau_j}\alpha$, where $\bar{t}$ is the standardized tax multiplier. The concurrent change in the statutory equalization rate α_i and the harmonizing rate hence implied a mechanical change in the effective equalization rate α_i^e for some municipalities. Keeping tax multipliers

event-study analysis on the two separate treated groups in Appendix A.11 and A.12.

19. Note that I do not take into account municipalities that merged during the 2007-2017 period.

constant, municipalities with no change in their statutory equalization rates (i.e. control municipalities) saw a decrease in their effective equalization rates by -75 percentage-points. The treated municipalities on the other hand saw a limited increase in the effective equalization rate of 1.05 percentage points.

The reform of the equalization additionally entailed changes in vertical transfers and the cost-sharing scheme included in $\Lambda_{i,t}$. In order to replace vertical transfers that were linked with tax rates, the reform introduced transfers that are conditional only on measurable geographic and socio-demographic characteristics.[20] Furthermore, the reform contained a restructuring of the cost-sharing transfers between municipalities and the canton.[21] The net variation of the total equalization transfers (horizontal and vertical) allows me to measure the income effect created by the reform and therefore correctly identify

20. Before the 2012 reform, this specific category of vertical transfers were aimed at municipalities with high “structural needs”. To be eligible for these conditional transfers, a municipality had to have a multiplier above 110 and the surface per-capita higher than 80% of the median or a multiplier above 110 and street lengths per-capita higher than 80% of the median. The reform replaced these transfers by geo-topographic and socio-demographic characteristics (see Appendix A.5). This change does not affect my identification strategy for two reasons. Firstly, the conditional transfers were mostly targeted at municipalities in the control group which have high tax burdens, which means that the reform did not affect tax-setting incentives for those jurisdictions which face an equalization rate of 1. Second, the pre-reform condition for being eligible for these further vertical grants was a high tax multiplier: the potential incentive created by the abolishing of this condition would rather be to decrease taxes, not increase them. In Appendix A.7 I test whether the abolishing of the conditional nature of these transfers affected municipal tax multipliers by implementing an event-study on the control group, which saw no incentive change from the reform. I show that controls which received these conditional transfers cannot be statistically differentiated from controls which never received conditional transfers.

21. In particular grants for schooling and social security have been reorganized through the reform. See Appendix A.5 for more details

the incentive effect of the increase in the statutory equalization rate.

3.3 Econometric approach

In order to measure the incentive and redistribution effects induced by the fiscal equalization reform, my strategy is twofold. I first analyse the gradual difference over time in tax multipliers of treated and control municipalities by implementing a difference-in-difference approach with multiple pre- and post-treatment periods. Second, I quantify the incentive and redistribution effects by specifying alternative measures for the equalization rate and instrumenting the change in observed equalization rate with a counterfactual approach analogous to Gruber and Saez (2002).

3.3.1 The reform as an event-study

The average treatment effect of the reform is estimated by

$$log(m_{i,t}) = \mu_t + \phi_i + \beta_1 D_{i,t} + \mathbf{X}_{i,t}\boldsymbol{\lambda} + \epsilon_{i,t}, \tag{10}$$

where $m_{i,t}$ is the tax multiplier of municipality i at time t, $D_{i,t}$ is the indicator function taking the value 1 for the treatment group in the post-reform period. The regression contains municipality-level time varying controls $\mathbf{X}_{i,t}$ (net equalization transfers, share of population, net debt, government spending, share of foreigners, relative harmonized revenue, share of right wing votes at the last national election), and a set of fixed effects μ_t, ϕ_i. For robustness I alternatively also include linear municipality and district specific time trends such as to capture differential idiosyncratic trends and momentary shocks at different geographic levels.[22] β_1 measures the average treatment effect.[23] Given the availability of multiple pre- and post- reform years, I also look at the dynamics of the treatment effect on tax multipliers by estimating the following event-study regression in the spirit of Autor (2003):

$$log(m_{i,t}) = \psi_t + \delta_i + \sum_{\substack{t=2007 \\ t \neq 2011}}^{2017} \beta_t E_{i,t} + \mathbf{X}_{i,t}\boldsymbol{\gamma} + e_{i,t}, \tag{11}$$

where $E_{i,t}$ is an indicator function taking the value 1 for year t and if municipality i is part of the treatment group, with the last pre-reform period as the reference year. I include, as in the difference-in-difference specification, time and municipality level fixed-effects δ_i, ψ_t as well as time varying controls $\mathbf{X}_{i,t}$. This specification allows me to perform pre-trends checks to insure that the two group of municipalities did not have diverging levels in local taxation prior to the reform, and on the other hand to examine the progressive response of treated municipalities' multipliers after the reform. In order to settle concerns of selection into treatment for municipalities close to the threshold after the reform, I discard 40 "unstable" municipalities which changed groups in the post-reform period for this approach.[24]

22. Given the heterogeneity of local conditions (topographic notably) and the size of the territory of canton Bern, including district and municipality specific linear time trends capture shifts in local conditions that could explain changes in taxation decisions.

23. Falsification tests are performed in order to test the validity of the identification strategy for this difference-in-difference. I first artificially assign different treatment timings based on pre-reform years. I then address potential concerns that the results would only be driven by contributor municipalities that would increase their tax multipliers following a larger amount of horizontal equalization transfers to pay by assigning the treatment status according to the recipient or contributor status at the time of the reform.

24. This sample definition means that the only within variation that identifies the effect on local multipliers is the 2012 reform. In the second empirical approach, I however keep those

3.3.2 Dose-response framework

To estimate the elasticity of tax multipliers to alternative equalization rate measures, I use a "dose-response" approach where I study how the before-after change in equalization rates impacted local tax multipliers by aggregating the data in two periods.[25] In this second empirical application, I do not eliminate the 40 "unstable" municipalities from my sample. Instrumenting the change and equalization rates and volume of transfers is hence needed in order to avoid changes in local taxation that would be due to underlying economic conditions that affect municipalities' tax bases and simultaneously change their position on the equalization schedule (especially for these municipalities close to the threshold). For this, I borrow an instrumental variable approach from the literature on personal income taxes (Gruber and Saez 2002; Blundell, Duncan, and Meghir 1998 or Buettner and Krause 2020). The procedure consists in constructing counterfactual equalization rates keeping the economic environment constant before and after the reform. More precisely, I keep tax-base and tax rates constant to the 2011 level and compute counterfactual post-reform values of the equalization rates and net equalization transfers. The within change of these counterfactual variables hence captures solely the change in rules that is plausibly exogenous to other variables and local tax multipliers.

Before turning to estimation, I construct marginal, supramarginal and effective equalization rates. Using simulation, I compute these alternative measures

municipalities (which make around 12% of the sample) and instrument the equalization rate instead.

25. In my baseline estimation I average over 2007-2011 for the pre-reform period and 2013-2017 for the post-reform period. In Appendix A.15 and A.16 I use separately each post-reform year to estimate gradually the responses.

along two dimensions according to the following formulas:

$$\alpha_{i,t} = \frac{\Delta T^H_{i,t+1}}{\bar{t}(\Delta k_{i,t})}, \tag{12}$$

$$\alpha^{\mathrm{e}}_{i,t} = \frac{\bar{t}}{\tau_{i,t}} \cdot \alpha_{i,t}. \tag{13}$$

$T^H_{i,t+1}$ are the horizontal equalization transfers after the tax base shock Δ, $\alpha_{i,t}$ is the "nominal" equalization rate, $\alpha^{\mathrm{e}}_{i,t}$ the effective equalization rate, $\tau_{i,t}$ is the current tax multiplier, $k_{i,t}$ the comprehensive tax base and $\bar{t}$ the harmonizing multiplier.[26]

On the one hand I vary the magnitude of the shock to the tax base with positive nominal or proportional shocks Δ to the tax base. Small shock magnitudes measure marginal equalization rates, while larger shocks allow to compute supramarginal equalization rates. Since the equalization schedule is discontinuous, a large enough shock to the tax base of a municipality located to the left of the target threshold $\hat{B}_t$ in Figure 3 means that it can possibly end up in the right segment of the equalization schedule, hence facing a lower equalization rate after the tax base shock. On the other hand I distinguish nominal and effective equalization rates according to whether the shock is apprehended on the harmonized tax capacity (nominal equalization rate, equation (12)), or on the tax revenue conditional on the current tax rate (effective equalization rate, equation (13)).

To carry out the analysis, I jointly estimate the following equations using 3SLS,

26. Note that in equation 13 in divide the tax capacity by the standardized rate in order to only observe a shock on the tax base and not on tax capacity.

where I also take into account total government spending:[27]

$$\Delta log(m_{i,t}) = \beta_0^1 \Delta log(g_{i,t}) + \beta_1^1 \Delta \widehat{log(\alpha_{i,t}^{j,\delta}}) + \beta_2^1 \Delta \widehat{T_{i,t}^{FE}} + \mathbf{\Delta C}_{i,t}\boldsymbol{\eta^1} + \varepsilon_{i,t}^1 \quad (14)$$

$$\Delta log(g_{i,t}) = \beta_0^2 \Delta log(m_{i,t}) + \beta_1^2 \Delta \widehat{log(\alpha_{i,t}^{j,\delta}}) + \beta_2^2 \Delta \widehat{T_{i,t}^{FE}} + \mathbf{\Delta C}_{i,t}\boldsymbol{\eta^2} + \varepsilon_{i,t}^2, \quad (15)$$

where $\Delta m_{i,t}$ is the change in tax multiplier, $\Delta g_{i,t}$ is the change in per-capita total expenditure, $\Delta \widehat{log(\alpha_{i,t}^{j,\delta}})$ is the change in equalization rate instrumented by the change in its respective counterfactual with $j \in \{\text{nominal}, \text{effective}\}$ and computed with a shock of magnitude {1CHF, 1K, 10K, 100K, 500K, 1mio, 0.01ppt, 0.1ppt, 1ppt, 10ppt, 50ppt, 100ppt}. $\Delta \widehat{T_{i,t}^{FE}}$ is the change in net equalization transfers instrumented by the change in its simulated counterfactual. Time varying controls $\mathbf{\Delta C}_{i,t}$ are also included. Since I do not model explicitly government spending in the theoretical framework, I focus the analysis and solely present results of (14), where β_1^1 is the elasticity of the tax multiplier with respect to the equalization rate and β_2^1 is the semi-elasticity of the tax multiplier with respect to the net equalization transfers. The results from estimation of equation (15) can nevertheless be found in Appendix A.17.

3.4 Data and descriptive statistics

I collect data from the statistical office of the canton Bern which has detailed information on fiscal equalization transfers, tax multipliers and municipal finances. Socio-economic measures at the municipality level are available at the

27. The 3SLS estimation approach jointly estimates the two above equations by using the fact that their error term is correlated (which in practice is a combination of SUR and 2SLS approaches); the idea is that since budget decisions imply the simultaneity between spending and taxing decisions, $cor(\varepsilon_{i,t}^1, \varepsilon_{i,t}^2) \neq 0$ is likely to be verified. Using 3SLS instead of 2SLS would hence be more asymptotically efficient (Zellner and Theil (1962)). Hausman specification tests systematically reject (for all regressions) the alternative hypothesis according to which the 2SLS estimator is consistent but the 3SLS is not.

national statistical office. I can draw on a balanced panel data set of 325 municipalities for the years 2007-2017. Within this time period, 44 municipalities of the 395 in 2007 have merged. I exclude such observations completely from my sample. The symmetric window around the 2012 revision of the equalization mechanism has been chosen as to minimize measuring potential effects that would relate to the first introduction of the equalization system in 2002. Table 6 in Appendix A.6 shows summary statistics for my main variables of interest and controls. The upper panel lists the dependent and control variables that are used in my estimations. The bottom panel on shows the nominal and effective equalization rates computed with varying magnitudes. As simulated shocks grow in magnitude, the average equalization rate tends to decrease, which highlights the discontinuous structure of the equalization schedule. Effective equalization rates tend to be, at every shock magnitude, higher than their nominal counterparts. This is explained by average municipal tax multipliers that are lower than the harmonizing rate.[28] Recall that net equalization transfers consists of the sum of vertical and horizontal transfers. As Table 6 shows, the net equalization bill is on average negative, meaning that the average municipality pays more than receives it from the equalization system. This is driven by the vertical transfers $\Lambda_{i,t}$, where municipalities are net debtors to the canton.

28. Appendices A.8 and A.9 present correlations between marginal and supramarginal equalization rates respectively for nominal and effective rates. These correlation coefficients show how increases in the shock magnitude lead to lower correlation between statutory and the other equalization rates.

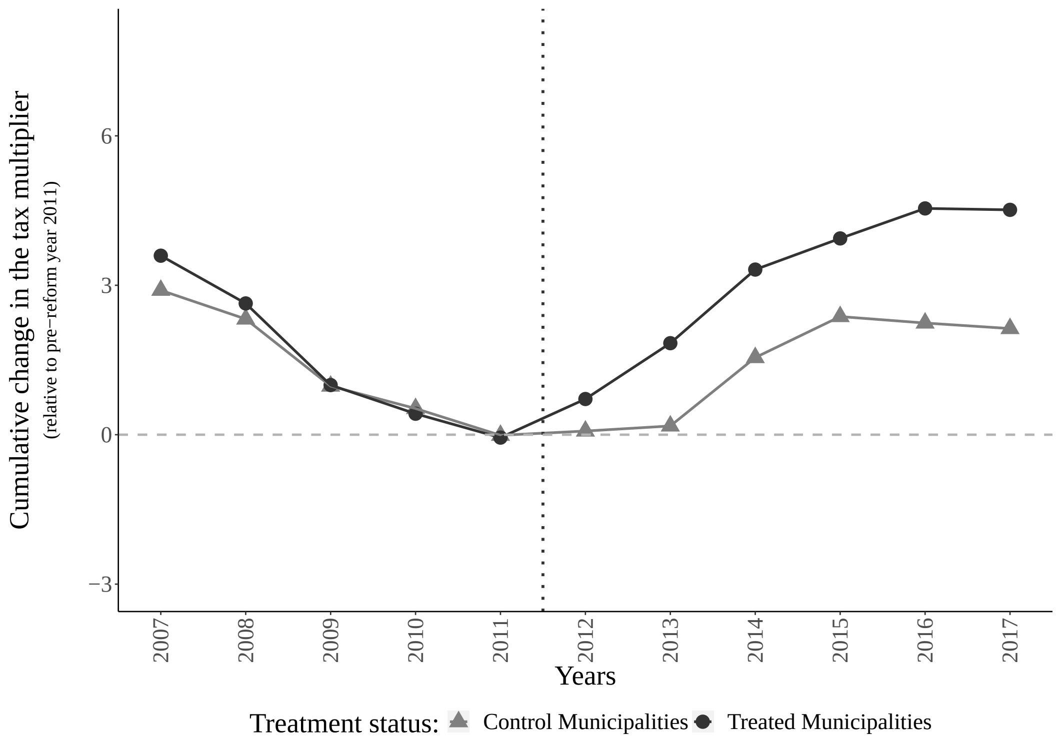

Figure 5: Cumulative change of the municipal tax multiplier. The vertical axis represents the average difference in municipal tax multipliers with respect to 2011. The horizontal axis represent years. A municipality is considered treated if it observed an increase in its statutory equalization rate in 2012. Municipalities which changed treatment status after the reform and those who amalgamated are excluded from the sample.

4 Results

4.1 Event-study analysis

Figure 5 shows the cumulative change in unconditional average tax multipliers with respect to the 2011 level for treated and control municipalities. The treated municipalities gradually adjusted their multipliers following the change in the statutory equalization rate in 2012. There is no evidence of potential pre-trends explaining the post-reform divergence in tax multipliers. Results

	Dependent variable			
	$\log(m_{i,t})$			
	(1)	(2)	(3)	(4)
$D_{i,t}$	0.0149*	0.0156**	0.0126***	0.0080*
(treated × period)	(0.0080)	(0.0079)	(0.0032)	(0.0043)
Controls	∅	✓	✓	✓
Year FE	✓	✓	✓	✓
Municipality FE	✓	✓	✓	✓
District-specific linear time trends	∅	∅	✓	∅
Municipality-specific linear time trends	∅	∅	∅	✓
# of observations	3135	3135	3135	3135

Table 1: Difference-in-Difference results. $D_{i,t}$ is an indicator function taking 1 for treated municipalities in the post-reform period. Controls are time-varying and include net equalization transfers, share of population, net debt, government spending, share of foreigners, relative harmonized revenue and share of right wing votes at the last national election. Standard errors are robust and clustered at the municipality level.

from the difference-in-difference estimation support this graphical evidence, as coefficients in Table 1, columns (1) and (2) confirm a positive impact of the reform on local tax multipliers for the treated. In columns (3) and (4), I add respectively municipality specific and district specific linear time trends as to control for potential differential trends that would be captured by the difference-in-difference estimator. Municipality-level linear time trends considerably reduces the coefficient and slightly diminishes its significance level. This is unsurprising given that municipalities tend to change their taxes slowly over time. The linear municipality level trend may therefore partly capture some of the causal impact of the reform on tax multipliers. Overall, my results suggest that the treated municipalities have increased their tax multipliers on average 1.3% more than the control municipalities as a result of the equaliza-

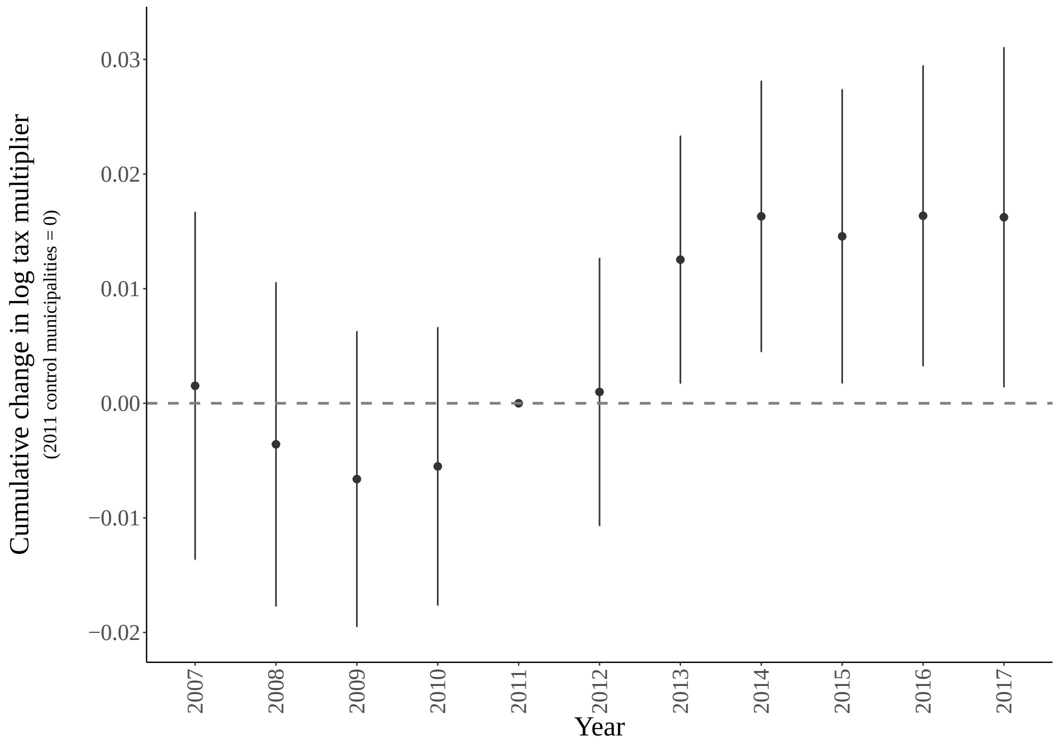

Figure 6: Treatment effect dynamics. This figure displays the coefficients and 95% confidence intervals of treatment-year dummies found in equation (11). The regression includes municipality and year fixed effects and a set of time-varying controls (net equalization transfers, share of population, net debt, government spending, share of foreigners, relative harmonized revenue and share of right-wing votes at the last national election). 2011 is used as a reference year. Standard errors are clustered at the municipality level. Numerical values and can be found in Appendix A.10.

tion reform.

Figure 6 shows that in periods prior to the reform, treatment and control municipalities cannot be statistically distinguished. From 2012 on, treated municipalities have slowly responded to the change in the statutory equalization rate by increasing their tax multipliers. The effect steadies around two years after the reform. The cumulative impact of the reform corresponds to an increase of around 1.6% of treated municipalities' multipliers compared to untreated which is not far from the average treatment effect measured previously.

Robustness of these findings is tested by performing two standard falsification tests: once addressing the timing concern, then the treatment assignment. I first carry out estimation of equation (10) with artificial treatment years 2010, 2009 and 2008 on a sub-sample including only pre-reform years. Results shown in Appendix A.13 do not suggest any divergence between control and treated when changing the reform year. Treatment status is then artificially assigned based on the relative harmonized revenue in 2011 according to the contributor versus recipient dichotomy. Coefficients on the placebo treatment group in Appendix A.14 are close to zero and not statistically significant, which is consistent with the interpretation that results from the event-study approach identify correctly the impact of the change in statutory equalization rate on tax multipliers.

4.2 Dose-response results

With the help of the different specifications of the equalization rate defined in equations (12) and (13), I now look at estimations of the tax elasticities. Table 2 shows the estimates of the impact of statutory, nominal marginal and nominal supramarginal equalization rates on tax multipliers from regression equation (14). Unsurprisingly, equalization rates based on shocks from 1CHF to 1K CHF and 0.01ppt to 1ppt yield similar coefficients as the statutory measure. The coefficient tends to decrease slightly when looking at the 100K or the 10ppt shock which suggests that these measures still capture the change in the marginal equalization rate but with more imprecision. This is confirmed when

Dependent variable:	Δ log($m_{i,t}$)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Statutory rate							
Δ log nominal equalization rate	0.026**						
	(0.011)						
Δ Net equalization transfers	−0.026						
	(0.021)						
Shock magnitude	Statutory						
Weak instruments test (p-value): α	0.00						
Weak instruments test (p-value): T^{FE}	0.00						
Panel B: Nominal shocks							
Δ log nominal equalization rate		0.026**	0.025**	0.021*	0.021	0.054***	0.068***
		(0.011)	(0.011)	(0.012)	(0.015)	(0.020)	(0.024)
Δ Net equalization transfers		−0.026	−0.026	−0.025	−0.022	−0.019	−0.016
		(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.022)
Shock magnitude		+1CHF	+1K	+10K	+100K	+500K	+1mio
Weak instruments test (p-value): α		0.00	0.00	0.00	0.00	0.00	0.00
Weak instruments test (p-value): T^{FE}		0.00	0.00	0.00	0.00	0.00	0.00
Panel C: Proportional shocks							
Δ log nominal equalization rate		0.026**	0.026**	0.025**	0.024*	0.057***	0.070***
		(0.011)	(0.011)	(0.012)	(0.014)	(0.021)	(0.024)
Δ Net equalization transfers		−0.026	−0.026	−0.025	−0.020	−0.020	−0.017
		(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Shock magnitude		+0.01ppt	+0.1ppt	+1ppt	+10ppt	+50ppt	+100ppt
Weak instruments test (p-value): α		0.00	0.00	0.00	0.00	0.00	0.00
Weak instruments test (p-value): T^{FE}		0.00	0.00	0.00	0.00	0.00	0.00
Controls	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓
Municipality FE	✓	✓	✓	✓	✓	✓	✓
# of observations	650	650	650	650	650	650	650

Table 2: Nominal equalization rates 3SLS regressions. Coefficients on log nominal equalization rates can be interpreted as elasticities. Each column in each panel is characterised by a different shock magnitude used in order to compute the equalization rate. Variables are averaged over years 2013-2017 for the post-reform period and over years 2007-2011 for the pre-reform period. Controls include net equalization transfers, share of population, net debt, government spending, share of foreigners, relative harmonized revenue and share of right wing votes at the last national election. Every regression is estimated using robust and clustered errors at the municipal level.

Dependent variable:	Δ log($m_{i,t}$)					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Nominal shocks						
Δ log effective equalization rate	0.009	0.008	0.001	−0.016	−0.048	−0.135***
	(0.012)	(0.012)	(0.013)	(0.017)	(0.029)	(0.043)
Δ Net equalization transfers	−0.026	−0.026	−0.024	−0.022	−0.018	−0.013
	(0.022)	(0.022)	(0.022)	(0.022)	(0.021)	(0.020)
Shock magnitude	+1CHF	+1K	+10K	+100K	+500K	+1mio
Weak instruments test (p-value): α^e	0.00	0.00	0.00	0.00	0.00	0.00
Weak instruments test (p-value): T^{FE}	0.00	0.00	0.00	0.00	0.00	0.00
Panel B: Proportional shocks						
Δ log effective equalization rate	0.009	0.009	0.006	−0.009	−0.035	−0.077**
	(0.012)	(0.012)	(0.013)	(0.015)	(0.028)	(0.037)
Δ Net equalization transfers	−0.026	−0.026	−0.026	−0.022	−0.019	−0.016
	(0.022)	(0.022)	(0.022)	(0.022)	(0.021)	(0.021)
Shock magnitude	+0.01ppt	+0.1ppt	+1ppt	+10ppt	+50ppt	+100ppt
Weak instruments test (p-value): α^e	0.00	0.00	0.00	0.00	0.00	0.00
Weak instruments test (p-value): T^{FE}	0.00	0.00	0.00	0.00	0.00	0.00
Controls	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Municipality FE	✓	✓	✓	✓	✓	✓
# of observations	650	650	650	650	650	650

Table 3: Effective equalization rates 3SLS regressions. Coefficients on log effective equalization rates can be interpreted as elasticities. Each column in each panel is characterised by a different shock magnitude used in order to compute the equalization rate. Variables are averaged over years 2013-2017 for the post-reform period and over years 2007-2011 for the pre-reform period. Controls include net equalization transfers, share of population, net debt, government spending, share of foreigners, relative harmonized revenue and share of right wing votes at the last national election. Every regression is estimated using robust and clustered errors at the municipal level.

looking at correlations between statutory and simulation-based equalization rates shown in Appendix A.8, tables 7 and 8 : equalization rates constructed based on 1K-100K and 0.01ppt-10ppt shocks are strongly correlated with the statutory measure. This correlation however decreases with shock magnitude. Supramarginal rates based on larger shocks yield considerably higher and statistically significant elasticities reaching the value of 0.07 for 100 percentage-point shocks. Correlation tables in appendix A.8 this time tell another story. Equalization rates based on 500k-1m CHF and 50ppt-100ppt are much less correlated with the statutory measure. Larger coefficients in Table 2 hence highlight the fact that municipalities that did not see any change in their statutory equalization rate may have reacted to changes in their supramarginal equalization rates because they conceive foregone equalization transfers in discrete terms. This suggests that past studies analyzing kinked or discontinuous equalization schedules have underestimated the incentive effects of fiscal equalization by focusing solely on variation in marginal equalization rates.

Looking at the responses of municipal tax multipliers to effective equalization rates in Table 3, I find small positive and even negative coefficients. Recall that the reform induced a large decrease on the effective marginal equalization rate for municipalities whose statutory equalization rate did not change and a limited increase for municipalities who did see an increase. Variation in the effective equalization rate is therefore mainly driven by control municipalities. When using larger shocks on tax bases, the effect becomes significantly negative. These results suggest that using the effective equalization rate as to measure the incentives created by equalization grants is not appropriate.

Given that the main results shown in Tables 2 and 3 are based on period aggregated data, I perform sensitivity tests regarding the post-reform year selection in Appendix A.15 for nominal equalization rates and Appendix A.16 for effective equalization rates. Similarly to Egger, Köthenbürger, and Smart (2010), I estimate changes in marginal/supramarginal and nominal/effective equalization rates using every post-reform year available. These figures again show the gradual reaction of local governments to the equalization reform. When looking at supramarginal rates, the effect is stronger and suggests a quicker reaction from municipalities.

Changes in the slope of municipal budget constraints by the reform have been shown to impact tax-setting by the various estimates on equalization rates. On the other hand, I do not find evidence of an income effect created by the shift in local budget constraints created by variation in total equalization grants from the reform. In Tables 2 and 3, the instrumented change in net equalization transfers shows a negative sign but no significance. One plausible conclusion from this observation would be that municipalities are revenue maximizers, meaning that the objective function of local governments does not take into account the relative marginal utilities of residents. Appendix A.3 demonstrates that a higher weight put on revenue maximization by jurisdictions is linked to lower redistribution effects. The same idea holds when considering variation in vertical transfers which create an income effect. If municipalities are non-benevolent, fiscal equalization might not be efficiency enhancing but rather lead to sub-optimally high taxes.

Based on the estimation results from equation (15), shown in A.17, the change in equalization transfers however led to a positive impact on total expenditure. An other explanation for the non-existence of income effects could consequently be attributed to the so-called "flypaper effect". This phenomenon is documented empirically and theoretically as a recurring "anomaly": changes in inter-governmental grants tend to translate into government expenditure but not into tax rates (Inman 2008, Bailey and Connolly 1998; Dahlberg et al. 2008; Allers and Vermeulen 2016; Leduc and Wilson 2017)).

5 Summary and conclusion

A number of studies to date have shown the existence of the tax raising incentives created by equalization transfers. This study adds to these by investigating three new empirical issues. I firstly distinguish marginal equalization rates (how much does a jurisdiction have to pay in equalization transfers for a small increase in the tax base?) from "supramarginal" equalization rates (how much does a jurisdiction have to pay in equalization transfers for a larger, discrete increase in the tax base?). This new measure allows me to take into account discontinuities in equalization schedules. The second refinement included in this paper is a measure of the equalization rate which conditions on current tax rates. Local decision-makers may in fact assess equalization transfers with respect to their impact on tax revenues rather than their impact on the tax base. This "effective" equalization rate takes account of the fact that jurisdictions face different incentive effects depending on their current tax rates. Not recognizing this may disregard important heterogeneity in incentives from fiscal equalization. Finally, I document and test the existence of income effects linked to changes in total amounts of transfers conditional and unconditional on the tax base.

I use a reform in a Swiss canton's inter-municipal equalization system to estimate incentive and redistribution effects. The reform entailed an increase of the statutory equalization rate for municipalities above a minimum threshold tax capacity. I first exploit this by implementing an event-study approach allowing me to look at the dynamics of the response of treated municipalities and verify that any observed effects are not driven by pre-existing trends. Second, I estimate the elasticity of tax multipliers with respect to marginal/supramarginal nominal/effective equalization rates. I instrument equalization rates by constructing counterfactual equalization rates keeping pre-reform tax bases and tax rates constant over time and allowing variation only from the reform itself (in the spirit of Gruber and Saez 2002).

Results show an elasticity of local tax rates with respect to supramarginal equalization rates of 0.070. My baseline estimate of the elasticity of local tax rates with respect to marginal equalization rates is of 0.025. This implies that local policy-makers consider discrete changes in their tax base by attracting businesses for instance and not only marginal increases or decreases. My findings suggest that past studies have underestimated the incentive effects of fiscal equalization on local taxation. My results also demonstrate that the response of tax rates to effective equalization rates ranges from small to negative according to the tax base shock magnitude used to compute the effective equalization rate. Finally, changes in volume of equalization transfers have no discerning effect on local tax rates, which suggests that local governments may take their policy decisions mostly as “revenue maximizers” rather than “utility maximizers”.

Whether the observed responses are efficiency and/or equity enhancing depends on the the level of tax competition and the efficient tax rates. Findings in this strand of literature still lack a measure of efficient tax level which could help assess the actual extent to which an equalization system needs reform or not. It is clear that future research must investigate a way to measure efficiency of tax levels. However, results from this study show that incentive effects may be larger than previously estimated and that jurisdictions tend to pursue revenue rather than utility maximization. This suggests that fiscal equalization schemes cannot avoid trading off more equitable distribution of tax revenues across jurisdictions against inefficiently high local tax rates.

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A Appendix

A.1 Literature: Empirical set-up and estimates

(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Baretti et. al. 2002	DE	Panel	state	tax revenue	1970-1988	nominal marginal	NA (tax-revenue sharing)
Buettner 2006	DE	RDD; FD	mun. (cities)	business tax	1980-2000	nominal marginal	+0.23ppt (RDD) & +0.13ppt (FD)
Smart 2007	CA	IV	state	effective tax rate	1972-2002	nominal marginal	+0.14ppt
Egger et. al. 2010	DE	DiD	mun.	business tax	1994-2004	nominal marginal	+0.04ppt
Buettner and Krause 2020	DE	DiD	state	real estate transfer tax	2006-2017	nominal marginal	+0.013ppt
Miyazaki 2020	JAP	RDD	mun.	effective additional corporate tax	1990-2000	nominal marginal	+ 0.01%
This paper 2021	CH	DiD, 3SLS	mun.	tax multiplier	2007-2017	marginal, vs. supra marginal, nominal vs. effective	nominal marginal: +0.08ppt; nominal supra: +0.25ppt; (effective marginal: +0.012ppt; effective supra: -0.28ppt)

(I): Paper; **(II)**: Country of study; **(III)**: Identification; **(IV)**: Government level ; **(V)**: Dependent variable (tax instrument) ; **(VI)**: Timing ; **(VII)**: Variable of interest (equalization rate measure); **(VIII)**: Incentive effect on tax instrument (for a 1ppt increase in the equalization rate)

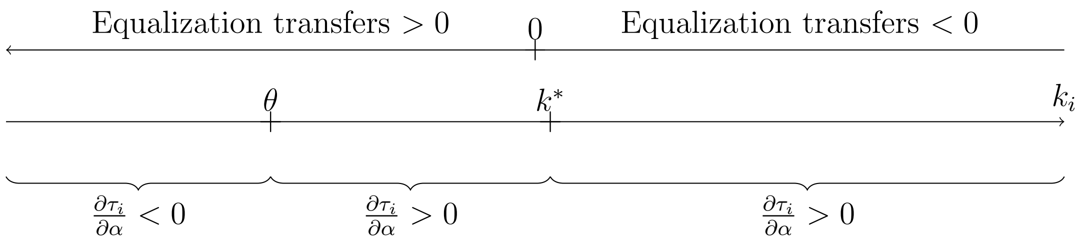

Figure 7: Net effect of a small change in α. θ represents the tax base value at which the income and incentive effect fully offset each-other.

A.2 The θ-threshold

In this subsection, I look at how different parameters may change the net effect of a reform changing the level of the nominal equalization rate α. More precisely I investigate how changes in the equalization rate, jurisdiction size or benevolence level move the threshold level of k_i where the net effect of a small increase in α leads to a decrease in the optimal tax rate due to larger redistribution effects than incentive effects.

As I have noted previously, according to how scarce the relative level of tax base is for a certain region, there may be a negative net effect of the equalization rate on the local tax rate. Threshold θ expresses the level of tax base k_i at which the the net effect is null, i.e. where the redistribution effect is perfectly offset by the incentive effect. Let me write this formally for the purely benevolent case as

$$\frac{d\tau_i}{d\alpha}\bigg|_{k_i=\theta_i} = \frac{-\Gamma_{gg}(k^* - \theta_i)(\theta_i + (\tau_i - \alpha)\frac{dk_i}{d\tau_i}) + \Gamma_g \frac{dk_i}{d\tau_i}}{-f''(\theta_i)\left[\frac{dk_i}{d\tau_i}\right]^2 + \Gamma_{gg}(\theta_i + (\tau_i - \alpha)\frac{dk_i}{d\tau_i})^2 + 2\Gamma_g \frac{dk_i}{d\tau_i}} \stackrel{!}{=} 0,$$

$$\Leftrightarrow \underbrace{-\Gamma_{gg}(k^* - \theta_i)(\theta_i + (\tau_i - \alpha)\frac{dk_i}{d\tau_i})}_{\text{redistribution effect } <0} = \underbrace{-\Gamma_g \frac{dk_i}{d\tau_i}}_{\text{Incentive effect } >0}.$$

I will henceforth refer to the left hand size (LHS) of the above equation as the “redistribution effect” and the right hand side (RHS) as the “incentive effect”. An interesting element of analysis is to investigate how the threshold moves on the k_i space when different variables and parameters move. This allows me to understand why certain relatively poor regions may actually decrease their τ_i when the equalization rate increases and how this proportion increases or decreases. Given that I have many relatively small (but of different sizes) regions, the threshold θ may be interpreted as a measure of the fraction of jurisdiction relying solely on transfers and not on their own fiscal revenues.

Let the solution to the equation above be the function $\theta_i = \theta(\alpha, \gamma_i, s_i)$. I now investigate the effect of these exogenous parameters on the level of θ by slightly perturbing the latter in the above equation and observe how the magnitude of income and incentive effects are affected.

I: $\frac{\partial\theta(\alpha,\gamma_i,s_i)}{\partial\alpha}$: How does the equalization rate shift θ? Let us first lay interest on the redistribution effect. Intuitively, it is increased as the equalization rate directly determines the level of transfers to the recipient. This is confirmed formally by the following expression:

$$\frac{\partial}{\partial\alpha}(-\Gamma_{gg}(k^* - \theta_i)(\theta_i + (\tau_i - \alpha)\frac{dk_i}{d\tau_i})) = -\frac{dk_i}{d\tau_i} > 0.$$

The way α affects the RHS of the initial equality is less clear as it affects the MRS. I find that

$$\frac{\partial}{\partial\alpha}(-\Gamma_g\frac{dk_i}{d\tau_i}) = -\Gamma_{gg}^2\frac{dk_i}{d\tau_i}(k^* - \theta_i) < 0.$$

Indeed a larger contribution rate around the threshold value θ means that the net effect becomes negative! Since the two effects move in opposite directions, I can say that the threshold moves to the right on the k_i space such that $\frac{\partial\theta(\alpha,\gamma_i,s_i)}{\partial\alpha} > 0$. This means that as α grows, so does the proportion of regions "dependent" on transfers.

II: $\frac{\partial\theta(\alpha,\gamma_i,s_i)}{\partial\gamma_i}$: I have considered until now only a purely benevolent objective of the government. Let us re-introduce the intermediate case in order to understand how the level of benevolence may affect the threshold. Thus I have that

$$\left.\frac{d\tau_i}{d\alpha}\right|_{k_i=\theta_i} = \frac{\gamma(-\Gamma_{gg}(k^*-\theta_i)(\theta_i + (\tau_i-\alpha)\frac{dk_i}{d\tau_i}) + \Gamma_g\frac{dk_i}{d\tau_i}) + (1-\gamma)(\bar{t}\frac{dk_i}{d\tau_i})}{\gamma(-f''(\theta_i)\left[\frac{dk_i}{d\tau_i}\right]^2 + \Gamma_{gg}(\theta_i + (\tau_i-\alpha)\frac{dk_i}{d\tau_i})^2 + 2\Gamma_g\frac{dk_i}{d\tau_i}) + (1-\gamma)2\frac{dk_i}{d\tau_i}} \stackrel{!}{=} 0$$

$$\Leftrightarrow \underbrace{-\gamma\Gamma_{gg}(k^*-\theta_i)(\theta_i + (\tau_i-\alpha)\frac{dk_i}{d\tau_i})}_{\text{redistribution effect}>0} = \underbrace{-\gamma\Gamma_g\frac{dk_i}{d\tau_i}}_{\text{Incentive Effect }>0}\quad\underbrace{-(1-\gamma)(\bar{t}\frac{dk_i}{d\tau_i})}_{\text{Leviathan Effect}>0}.$$

Note that the effects taken from the benevolent case are highlighted by the degree of benevolence parameter γ_i and on the RHS I have a new element which depicts the "leviathan effect" which pressures local tax-rates upward. Let us now observe how the threshold moves with the level of benevolence. As for point I., I will observe how the different mitigating effects are influenced by an increase in γ_i and how the θ-threshold adapts. Concerning the redistribution effect, I get the following unambiguous result:

$$\frac{\partial}{\partial \gamma_i}(-\gamma\Gamma_{gg}(k^* - \theta_i)(\theta_i + (\tau_i - \alpha)\frac{dk_i}{d\tau_i})) = -\Gamma_{gg}(k^* - \theta_i)(\theta_i + (\tau_i - \alpha)\frac{dk_i}{d\tau_i}) > 0.$$

Turning now to the incentive and Leviathan effect, an increase in the degree will on one hand increase the incentive effect of the contribution rate but on the other hand decrease the Leviathan effect. Note that the net effect will depend on the size of the MRS, i.e. Γ_g in my case. This therefore writes as

$$\frac{\partial}{\partial \gamma_i}(-\gamma\Gamma_g\frac{dk_i}{d\tau_i} - (1-\gamma)(\bar{t}\frac{dk_i}{d\tau_i})) = (1-\Gamma_g)\frac{dk_i}{d\tau_i} \lesseqgtr 0.$$

In this particular tax competition context, it makes sense to assume that $\Gamma_g > 1$ given that local governments balance budgets and tend to set sub-optimal levels of publicly provided good (given race-to-the-bottom tax competition). [29] Given the assumption that the MRS is larger than unity, the net-effect of the the incentive and Leviathan effect is positive. This leads to the fact that the redistribution effect increases at a faster rate than the RHS given the mitigating influence of the Leviathan effect while increasing γ_i. As a consequence, θ increases. This makes intuitive sense since taking the limit of $\frac{d\tau_i}{d\alpha}$ as $\gamma_i \to 0$ gives the following result

$$\lim_{\gamma_i \to 0}\left[\frac{\gamma(-\Gamma_{gg}(k^* - k_i)(k_i + (\tau_i - \alpha)\frac{dk_i}{d\tau_i}) + \Gamma_g\frac{dk_i}{d\tau_i}) + (1-\gamma)(\bar{t}\frac{dk_i}{d\tau_i})}{\gamma(-f''(k_i)\left[\frac{dk_i}{d\tau_i}\right]^2 + \Gamma_{gg}(k_i + (\tau_i - \alpha)\frac{dk_i}{d\tau_i})^2 + 2\Gamma_g\frac{dk_i}{d\tau_i}) + (1-\gamma)2\frac{dk_i}{d\tau_i}}\right] = \frac{1}{2} > 0,$$

which is unambiguously positive for all jurisdictions, independently of their size and thus of their mobile factor sensitivity (i.e. semi-elasticity of local tax base k_i with respect to τ_i). This implicitly means that in the fully Leviathan case, $\theta_i = 0$. Therefore, my assumption of a MRS larger than one seems to be supported by this result.

29. Relaxing this assumption would lead to say that the public good is *over*-provided. Thus, $\Gamma_g < 1$ and this would lead to a decrease as a net effect of the incentive and leviathan effect. In turn the θ-threshold would need to increase as to keep the equality holding (and would have to decrease more than in the under-provision case given the net-sign of the incentive and leviathan effect) Therefore, even when relaxing the under-provision assumption, the result that $\frac{\partial\theta(\alpha,\gamma_i,s_i)}{\partial\gamma_i} > 0$ is robust.

A.3 Varying the "degree of benevolence"

One of the main assumptions of the model described in this study is the benevolence of local governments, meaning that they seek to maximize the representative citizens utility. This leads to possible redistribution effects when the volume of equalization transfer changes. I look here at an "in-between" case where local jurisdictions may partly act as revenue-maximizing Leviathans. Let $\gamma \in (0,1)$ represent the degree of benevolence of a given jurisdiction. The maximization problem of the local jurisdiction is then modified as to analyze a case where the local government has a certain degree of benevolence in the sense that it values utility of its citizens and not solely government revenue. This gives the following

$$\max_{\tau_i} \Omega_i = \gamma(f(k_i) - f'(k_i)k_i + rk^* + \Gamma(\tau_i k_i + \alpha(k^* - k_i))) + (1-\gamma)(\tau_i k_i + \alpha(k^* - k_i));$$

The first order condition then writes as

$$\gamma\{-f''(k)\frac{dk_i}{d\tau_i}k_i + \Gamma_g[k_i + (\tau_i - \alpha)\frac{dk_i}{d\tau_i}]\} + (1-\gamma)\{k_i + (\tau_i - \alpha)\frac{dk_i}{d\tau_i}\} = 0.$$

As before I get the effect of the equalization rate on the local tax rate for region i by applying the implicit function theorem to the first order condition stated above.

$$\frac{d\tau_i}{d\alpha} = \frac{\gamma(-\Gamma_{gg}(k^* - k_i)(k_i + (\tau_i - \alpha)\frac{dk_i}{d\tau_i}) + \Gamma_g \frac{dk_i}{d\tau_i}) + (1-\gamma)(\bar{t}\frac{dk_i}{d\tau_i})}{\gamma(-\frac{dk_i}{d\tau_i} + \Gamma_{gg}(k_i + (\tau_i - \alpha)\frac{dk_i}{d\tau_i})^2 + 2\Gamma_g \frac{dk_i}{d\tau_i}) + (1-\gamma)2\frac{dk_i}{d\tau_i}}$$

It it is therefore straightforward to see that as the benevolence degree tends to 1, we have the classical Welfare maximizing case and when $\gamma \to 0$ we get the pure leviathan case. It is worth mentioning that a higher degree of benevolence means a weaker incentive effect from fiscal equalization because local policy makers will take into account the optimal mix of public and private goods for the representative citizen. Since my empirical results do not show significance in a possible redistribution effect (through the net equalization transfers variable) in tables 2 or 3, I conclude that the benevolence level of local governments must be rather low.

A.4 Transfers windfall: the effects of a shock on unconditional grants

This paper has mainly focused on the horizontal redistribution component of fiscal equalization. In this brief subsection, I show that adding further transfers (i.e. a "transfer windfall") that are unconditional on the local tax rate leads to local jurisdictions decreasing the equilibrium tax rate. This effect is analogous to the redistribution effect that shown in equation (6). In order to investigate this "pure" redistribution effect, I add the unconditional transfers parameter Λ_i to the local governments budget constraint. This gives

$$g_i = \tau_i k_i + \alpha(k^* - k_i) + \Lambda_i \tag{16}$$

A increase (decrease) in unconditional transfers Λ_i affects the MRS between the public good and private consumption for the representative citizen. In turn, a local government may respond by decreasing (increasing) the tax rate as to bring back the MRS equal to the marginal cost of public funds such that the Samuelson condition holds. Given that Λ_i is orthogonal from the tax rate or the tax base level , I know that Λ_i is not explicitly included in the first order condition of the government's optimization problem. However, it enters the public good valuation function $\Gamma(.)$ through the financing of g_i. I can thus already guess that any behavioural changes due to an exogenous change in unconditional grants will be channeled through relative marginal utilities between public and private consumption. Therefore, I once again apply the implicit function theorem in order to investigate the effect of a small change in Λ_i. This gives the following for jurisdiction i:

$$\frac{d\tau_i}{d\Lambda_i} = \frac{-\overbrace{\left[k_i + \tau_i \frac{dk_i}{d\tau_i} - \alpha \frac{dk_i}{d\tau_i}\right]}^{g_\tau} \overbrace{\frac{\partial \Gamma_g(.)}{\partial \Lambda_i}}^{\frac{\partial MRS_i}{\partial \Lambda_i}}}{\underbrace{-\frac{dk_i}{d\tau_i} + \Gamma_{gg}(k_i + (\tau_i - \alpha)\frac{dk_i}{d\tau_i})^2 + 2\Gamma_g \frac{dk_i}{d\tau_i}}_{S.O.C.}}. \tag{17}$$

Simple optimization theory allows me to be sure that the denominator, which is also the second order condition of the maximization problem, is negative. This thus allows me to focus on the sign of the numerator. I firstly assume that g_τ is positive such that a small increase in the local tax rate increases the governments revenue.[30]Turning to the $\frac{\partial \Gamma_g(.)}{\partial \Lambda_i}$

30. This common assumption insures that local governments do not locate on the downward sloping side of the Laffer-curve.

expression, this can be seen as the change in relative marginal utilities when a transfer windfall hits jurisdiction i. Put simply, an increase (decrease) in unconditional grants will unambiguously decrease (increase) the marginal rate of substitution between public and private consumption because of the balanced budget condition. Under these conditions, it is pretty straight forward to show that $\frac{d\tau_i}{d\Lambda_i} < 0$. The logic behind this is that a positive (negative) change in Λ_i yields a decrease (increase) in the MRS for local jurisdiction i. In turn, the local government will decrease (increase) tax-rates such that the marginal cost of public funds equates the marginal rate of substitution. Overall an increase (decrease) in unconditional grants should thus be translated into higher (lower) public consumption and lower (higher) tax rate in similar magnitude.[31] My empirical results do not show sign of the existence of such redistribution effects on tax rates.

31. This theoretical finding is however often disproven by empirical findings which fail to observe changes in the tax rates and mostly identify 1-to-1 changes in government spending. This observation is commonly named as the "flypaper effect" (see Lundqvist 2015; Leduc and Wilson 2017 or Dahlberg et al. 2008 for causal analysis)

A.5 Equalization transfers before and after the reform

Before the 2012 reform		
Transfer	**Conditional on**	**Description**
Disparitätenabbau	tax capacity; statutory equalization rate	horizontal equalization system.
Mindestaustattung	tax capacity; target threshold	additional transfers if below target tax capacity
Pauschale abgeltung	discretionary	additional transfers for "centrality costs" for cities of Bern, Thun, Biel, Burgdorf and Langenthal.
Gemeinde mit hoher Gesamtsteueranlage	tax multiplier + road length per-capita or surface per-capita	transfers for municipalities with high structural costs related to infrastructure and maintenance.
Lastenausgleich		vertical cost-sharing scheme.
- Teachers	number of pupils; population; number of classes	
- Welfare transfers	population	
- Social security	population	
- Public transports	population; number of public transport stops	

Table 4: This table details the various transfers before the equalization reform of 2012.

After the 2012 reform		
Transfer	**Conditional on**	**Description**
Disparitätenabbau	tax capacity; statutory equalization rate	horizontal equalization system.
Mindestaustattung	tax capacity; target threshold	additional transfers if below target tax capacity
Pauschale abgeltung	discretionary	additional transfers for “centrality costs” for cities of Bern, Thun, Biel, Burgdorf and Langenthal.
Gemeinde mit übermässigen geo-topografischen Lasten	road length per-capita or surface per-capita	transfers for municipalities with high structural costs related to infrastructure and maintenance.
Gemeinde mit übermässigen sozio-demografischen Lasten	number of unemployed, social security recipients, refugees	transfers for social composition of municipalities
Lastenausgleich		vertical cost sharing scheme.
- Teachers	teachers hours worked	
- Welfare transfers	population	
- Social security	population	
- Public transports	population; number of public transport stops	
- Family allowances	population	
- New task-sharing	population	

Table 5: This table details the various transfers after the equalization reform of 2012.

A.6 Summary Statistics

	N	Mean	St. Dev.	Min	Max
Panel A: Municipal characteristics					
Municipal tax multiplier	3,575	1.707	0.214	0.840	2.280
Net equalization transfers	3,575	−0.819	0.458	−3.072	1.294
Share of foreigners	3,575	8.073	5.980	0.000	33.444
Right-to-center votes at last national election	3,575	63.594	10.908	32.813	93.296
Harmonized relative tax base	3,575	81.653	26.005	24.823	287.704
Treated	3,575	0.503	0.500	0	1
Government spending	3,575	5.461	2.289	2.419	86.617
Net Debt	3,575	−2.294	3.340	−41.560	6.163
Population	3,575	2.704	8.304	0.039	129.829
Panel B: Equalization rates					
Statutory equalization rate	3,575	0.621	0.341	0.250	1
Nominal equalization rates:	-	-	-	-	-
+0.01 ppt. shock	3,575	0.619	0.341	0.250	1
+0.1 ppt. shock	3,575	0.619	0.341	0.250	1
+1 ppt. shock	3,575	0.614	0.339	0.250	1
+10 ppt. shock	3,575	0.572	0.315	0.250	1
+50 ppt. shock	3,575	0.456	0.221	0.250	1
+100 ppt. shock	3,575	0.400	0.151	0.250	1
+1CHF shock	3,575	0.619	0.341	0.250	1
+1K shock	3,575	0.619	0.341	0.250	1
+10K shock	3,575	0.610	0.337	0.250	1
+100K shock	3,575	0.532	0.290	0.250	1
+500K shock	3,575	0.417	0.183	0.250	1
+1mio shock	3,575	0.373	0.117	0.250	1
Effective equalization rates:	-	-	-	-	-
+0.01 ppt. shock	3,575	0.677	0.362	0.267	1.649
+0.1 ppt. shock	3,575	0.677	0.362	0.267	1.649

+1 ppt. shock	3,575	0.672	0.360	0.267	1.649
+10 ppt. shock	3,575	0.625	0.329	0.267	1.649
+50 ppt. shock	3,575	0.500	0.217	0.267	1.453
+100 ppt. shock	3,575	0.442	0.140	0.267	1.379
+1CHF shock	3,575	0.677	0.362	0.267	1.649
+1K shock	3,575	0.677	0.362	0.267	1.649
+10K shock	3,575	0.667	0.355	0.267	1.649
+100K shock	3,575	0.582	0.298	0.267	1.649
+500K shock	3,575	0.458	0.170	0.267	1.335
+1mio shock	3,575	0.413	0.100	0.267	1.119

Table 6: Summary Statistics. In panel A, share of foreigners and right-to-center votes are taken from the Swiss national statistical office. The rest are retrieved from the statistical office from canton Bern. In panel B, statutory equalization rates are computed based on the harmonized tax base level. Nominal and effective marginal and supramarginal equalization rates are then computed using simulation. All monetary variables are in thousands of CHF per-capita. Population is in thousand of inhabitants.

A.7 Event-study: did the abolishing of conditional transfers change incentives?

Figure 8: This figure shows the coefficients of the event-study regression $log(m_{i,t}) = \psi_t + \delta_i + \sum_{\substack{t=2007 \\ t\neq 2011}}^{2017} \beta_t C_{i,t} + \mathbf{X}_{i,t}\boldsymbol{\gamma} + e_{i,t}$ on the control group, where I compare municipalities that received the class of transfers conditional on the tax multiplier at least once before the reform.

The reform of 2012 changed the conditions for receiving a class of vertical transfers named "Gemeinde mit hoher Gesamtsteueranlage". These transfers were, before 2012, conditional on the tax multiplier being above median and either the road length per-capita or the total surface of the municipality per capita above 80% of median levels. This changed with the reform which removed the condition on the tax multiplier and renamed the transfers "Gemeinde mite übermässigen geo-topografischen Lasten". See A.5 for more details on vertical and horizontal equalization grants transfers. In order to test whether the abolishing of the conditional nature of these transfers affected the tax-setting incentives of municipalities, I conduct an event-study type of approach on the control group, which did not see a change in their statutory equalization rate (and hence no simultaneous incentives change). I create two sub-groups within the controls: the treated-controls are municipalities which received the class of transfers conditional on the tax multiplier at least once before the reform, and the control-controls which did not. Figure 8 shows results for the following equation:

$$log(m_{i,t}) = \psi_t + \delta_i + \sum_{\substack{t=2007 \\ t \neq 2011}}^{2017} \beta_t C_{i,t} + \mathbf{X}_{i,t}\boldsymbol{\gamma} + e_{i,t}, \tag{18}$$

where $C_{i,t}$ is an indicator function taking the value 1 for year t and if control municipality i is part of the treated-controls, with the last pre-reform period as the reference year. I include time and municipality level fixed-effects δ_i, ψ_t as well as time varying controls $\mathbf{X}_{i,t}$. Results from Figure 8 show that except around 2016-2017, the two sub-groups of the control municipalities cannot be statistically differentiated from another. This suggests that the removal of the conditional nature of this class of transfers has little effect on tax-setting incentives of municipalities.

A.8 Nominal marginal and nominal supramarginal equalization rates

Nominal shock	Statutory	1CHF	1k CHF	10k CHF	100k CHF	500k CHF
Statutory						
1 CHF	1.00***					
1k CHF	1.00***	1.00***				
10k CHF	0.98***	0.98***	0.98***			
100k CHF	0.83***	0.83***	0.84***	0.87***		
500k CHF	0.62***	0.62****	0.63***	0.65***	0.83***	
1mio. CHF	0.56***	0.56***	0.57***	0.58***	0.76***	0.96***

Table 7: Correlation matrix of nominal equalization rates computed with fixed shocks of varying magnitudes. Statutory equalization rate is computed according to relative harmonized tax base level. Marginal equalization rates are based on 1CHF shocks on the tax base. Supramarginal equalization rates are computed using 1K, 10k, 100k, 500k and 1mio CHF shocks. Significance corresponds to *p<0.1; **p<0.05; ***p<0.01. # of observations: 3575.

Proportional shock	Statutory	0.01 ppt	0.1 ppt	1 ppt	10 ppt	50 ppt
Statutory						
0.01 ppt	1.00***					
0.1 ppt	1.00***	1.00***				
1 ppt	0.99***	0.99***	0.99***			
10 ppt	0.91***	0.91***	0.91***	0.93***		
50 ppt	0.72***	0.72***	0.72***	0.73***	0.84***	
100 ppt	0.64***	0.64***	0.64***	0.65***	0.75***	0.96***

Table 8: Correlation matrix of nominal equalization rates computed with proportional shocks of varying magnitudes. Statutory equalization rate is computed according to relative harmonized tax base level. Marginal equalization rates are based on 0.01ppt shocks on the tax base. Supramarginal equalization rates are computed using 0.1ppt, 1ppt, 10ppt, 50ppt and 100ppt CHF shocks. Significance corresponds to *p<0.1; **p<0.05; ***p<0.01. # of observations: 3575.

A.9 Effective marginal and effective supramarginal equalization rates

Nominal shock	Statutory	1 CHF	1k CHF	10k CHF	100k CHF	500k CHF
Statutory						
1 CHF	0.91***					
1k CHF	0.91***	1.00***				
10k CHF	0.89***	0.97***	0.98***			
100k CHF	0.75***	0.80***	0.80***	0.84***		
500k CHF	0.50***	0.53***	0.53***	0.56***	0.79***	
1mio. CHF	0.36***	0.41***	0.41***	0.44***	0.66***	0.95***

Table 9: Correlation matrix of effective equalization rates computed with fixed shocks of varying magnitudes. Effective rates are conditioned on current municipal tax multipliers. Statutory equalization rate is computed according to relative harmonized tax base level. Marginal equalization rates are based on 1CHF shocks on the tax base. Supramarginal equalization rates are computed using 1K, 10k, 100k, 500k and 1mio CHF shocks. Significance corresponds to *p<0.1; **p<0.05; ***p<0.01. # of observations: 3575.

Proportional shock	Statutory	0.01 ppt	0.1 ppt	1 ppt	10 ppt	50 ppt
Statutory						
0.01 ppt	0.91***					
0.1 ppt	0.91***	1.00***				
1 ppt	0.90***	0.99***	0.99***			
10 ppt	0.82***	0.90***	0.90***	0.92***		
50 ppt	0.61***	0.67***	0.67***	0.68***	0.81***	
100 ppt	0.49***	0.55***	0.55***	0.57***	0.69***	0.94***

Table 10: Correlation matrix of effective equalization rates computed with proportional shocks of varying magnitudes. Effective rates are conditioned on current municipal tax multipliers. Statutory equalization rate is computed according to relative harmonized tax base level. Marginal equalization rates are based on 0.01ppt shocks on the tax base. Supramarginal equalization rates are computed using 0.1ppt, 1ppt, 10ppt, 50ppt and 100ppt CHF shocks. Significance corresponds to *p<0.1; **p<0.05; ***p<0.01. # of observations: 3575.

A.10 Event-study regression

	Dependent variable
	$\log(m_{i,t})$
$D^T_{i,2007}$	0.002
	(0.008)
$D^T_{i,2008}$	-0.004
	(0.007)
$D^T_{i,2009}$	-0.007
	(0.007)
$D^T_{i,2010}$	-0.006
	(0.006)
$D^T_{i,2012}$	0.001
	(0.006)
$D^T_{i,2013}$	0.013^{**}
	(0.006)
$D^T_{i,2014}$	0.016^{***}
	(0.006)
$D^T_{i,2015}$	0.015^{**}
	(0.007)
$D^T_{i,2016}$	0.016^{**}
	(0.007)
$D^T_{i,2017}$	0.016^{**}
	(0.008)
Net equalization transfers	-0.039^{***}
	(0.008)
Controls	✓
Year FE	✓
Municipality FE	✓
# of observations	3135

Table 11: Treatment effect dynamics. This table gives the β_t coefficients on the regression $log(m_{i,t}) = \psi_t + \delta_i + \sum_{\substack{t=2007 \\ t\neq 2011}}^{2017} \beta_t E_{i,t} + \mathbf{X}_{i,t}\boldsymbol{\gamma} + e_{i,t}$. Controls $\mathbf{X}_{i,t}$ include share of population, net debt, government spending, share of foreigners, relative harmonized revenue and share of right wing votes at the last national election. Standard errors are heteroskedasticity robust and clustered at the municipal level. 2011 is used as reference year.

A.11 Event-study regressions: High-treatment

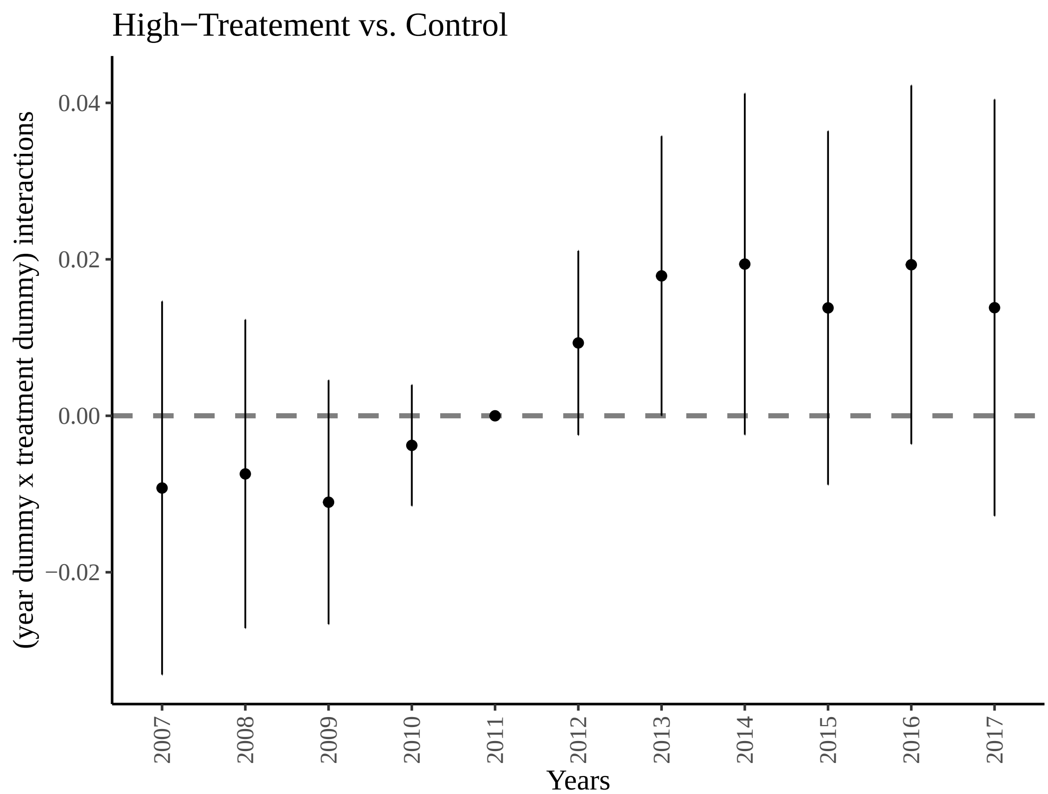

Figure 9: Treatment effect dynamics for municipalities receiving the "high-treatment". This figure shows the β_t^H coefficients on the regression $log(m_{i,t}) = \psi_t + \delta_i + \sum_{\substack{t=2007 \\ t\neq 2011}}^{2017} \beta_t^H H_{i,t} + \sum_{\substack{t=2007 \\ t\neq 2011}}^{2017} \beta_t^L L_{i,t} + \mathbf{X}_{i,t}\boldsymbol{\gamma} + \varepsilon_{i,t}$. $H_{i,t}$ is a dummy taking one if municipality i is in the high-treatment group and $L_{i,t}$ is a dummy taking one if municipality i i in the low-treatment group. Controls $\mathbf{X}_{i,t}$ include share of population, net debt, government spending, share of foreigners, relative harmonized revenue and share of right wing votes at the last national election. Standard errors are heteroskedasticity robust and clustered at the municipal level. 2011 is used as reference year.

A.12 Event-study regressions: Low-treatment

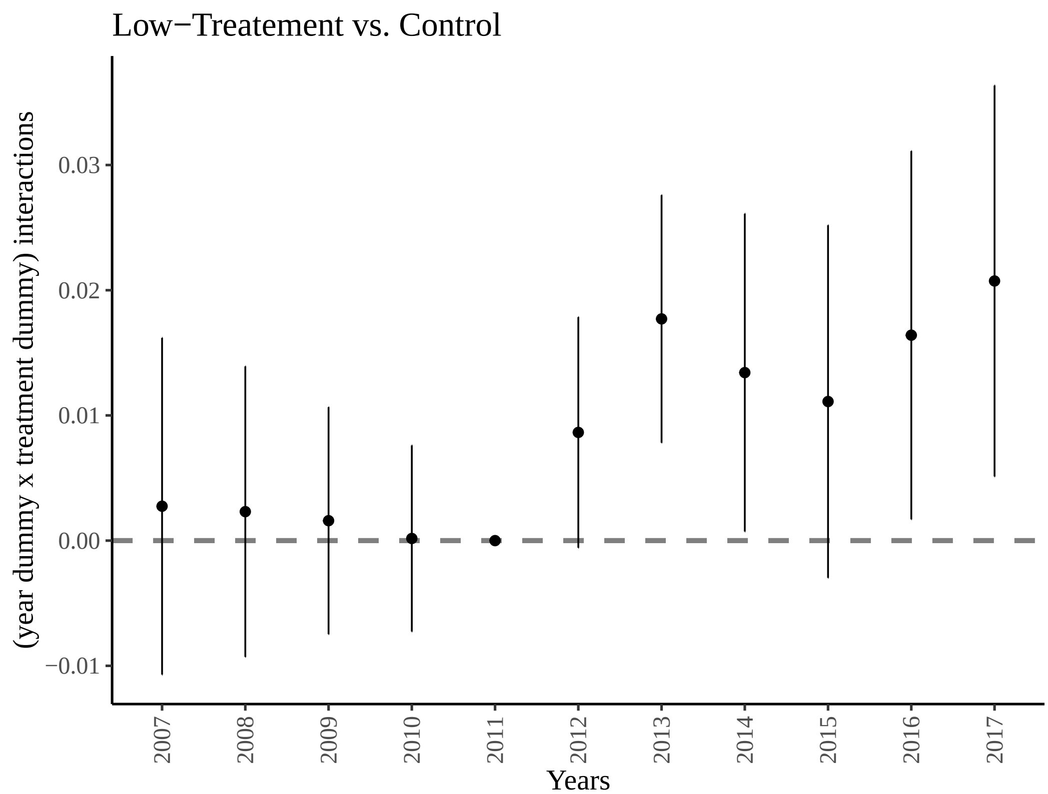

Figure 10: Treatment effect dynamics for municipalities receiving the "low-treatment". This figure shows the β_t^L coefficients on the regression $log(m_{i,t}) = \psi_t + \delta_i + \sum_{\substack{t=2007 \\ t\neq 2011}}^{2017} \beta_t^H H_{i,t} + \sum_{\substack{t=2007 \\ t\neq 2011}}^{2017} \beta_t^L L_{i,t} + \mathbf{X}_{i,t}\boldsymbol{\gamma} + \varepsilon_{i,t}$. $H_{i,t}$ is a dummy taking one if municipality i is in the high-treatment group and $L_{i,t}$ is a dummy taking one if municipality i i in the low-treatment group. Controls $\mathbf{X}_{i,t}$ include share of population, net debt, government spending, share of foreigners, relative harmonized revenue and share of right wing votes at the last national election. Standard errors are heteroskedasticity robust and clustered at the municipal level. 2011 is used as reference year.

A.13 Difference-in-difference: placebo year

	Dependent variable					
	$\log(m_{i,t})$					
	(1)	(2)	(3)	(4)	(5)	(6)
$D_{i,t}^{2010}$	0.001	−0.001				
(treated × post-2010)	(0.004)	(0.004)				
$D_{i,t}^{2009}$			−0.001	−0.004		
(treated × post-2009)			(0.005)	(0.005)		
$D_{i,t}^{2008}$					−0.002	−0.006
(treated × post-2008)					(0.005)	(0.005)
Placebo Treatment Year	2010	2010	2009	2009	2008	2008
Controls	∅	✓	∅	✓	∅	✓
Year FE	✓	✓	✓	✓	✓	✓
Municipality FE	✓	✓	✓	✓	✓	✓
# of observations	1425	1425	1425	1425	1425	1425

Table 12: Falsification test: placebo treatment year. Regression $log(m_{i,t}) = \mu_t + \phi_i + \beta_1 D_{i,t}^T + \mathbf{X}_{i,t}\lambda + \epsilon_{i,t}$ is run on pre-reform years (2007-2011) using 2008, 2009 and 2010 as placebo treatment year. $D_{i,t}^T$ is an indicator function taking 1 for treated municipalities in the post placebo treatment year T. Treatment assignment is unchanged, meaning that municipalities who saw an increase in their statutory equalization rate in 2012 are considered as treated. Control variables include net equalization transfers share of population, net debt, government spending, share of foreigners, relative harmonized revenue and share of right wing votes at the last national election. Standard errors are heteroskedasticity robust and clustered at the municipal level.

A.14 Difference-in-difference: placebo status

	Dependent variable	
	$\log(m_{i,t})$	
	(1)	(2)
$D_{i,t}$	-0.001	0.006
(placebo-treated × period)	(0.008)	(0.008)
Controls	∅	✓
Year FE	✓	✓
Municipality FE	✓	✓
# of observations	3135	3135

Table 13: Falsification test: placebo treatment group. Regression $log(m_{i,t}) = \mu_t + \phi_i + \beta_1 D_{i,t} + \mathbf{X}_{i,t}\lambda + \epsilon_{i,t}$ is run on all years (2007-2017) but with a placebo treatment assignment based on the recipient or contributor status in 2011. $D_{i,t}$ is an indicator function taking 1 for placebo-treated municipalities in the post-reform years. Control variables include net equalization transfers share of population, net debt, government spending, share of foreigners, relative harmonized revenue and share of right wing votes at the last national election. Standard errors are heteroskedasticity robust and clustered at the municipal level.

A.15 Elasticity measures: nominal equalization rates

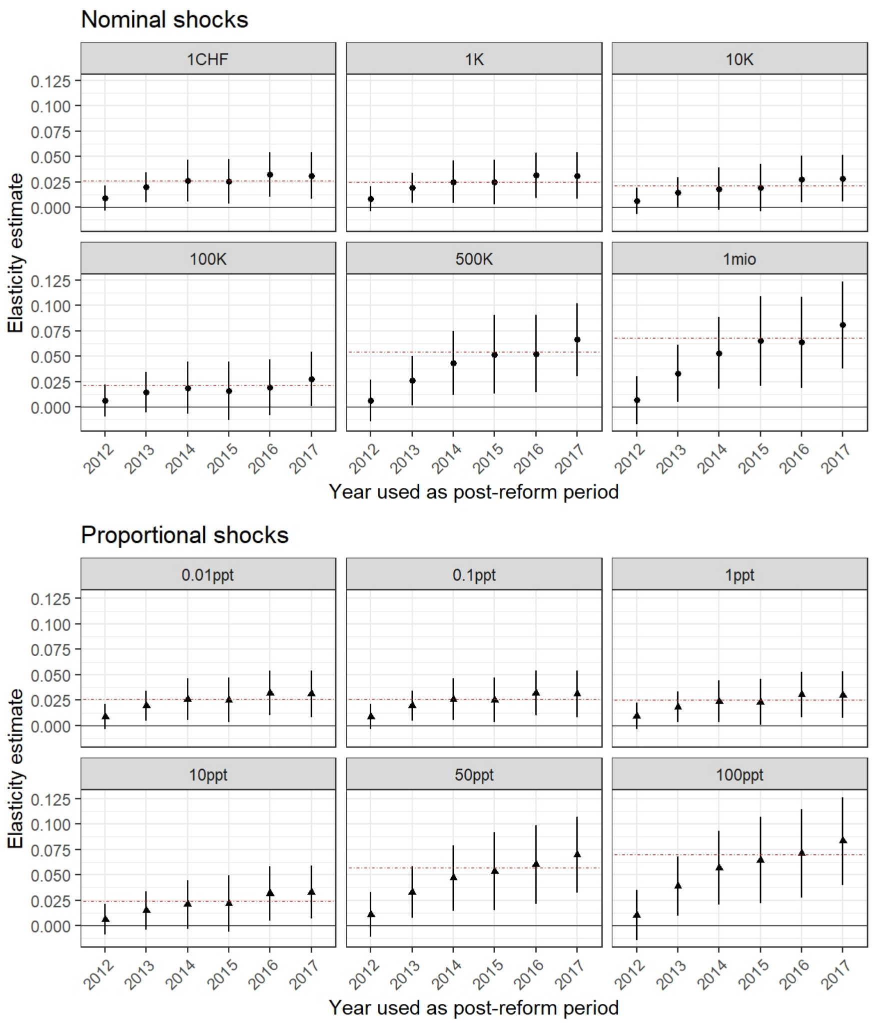

Figure 11: These coefficient plots exhibit elasticity measures on nominal marginal and supramarginal equalization rates according to year chosen as post-reform period. Variables are averaged over 2007-2011 for the pre-reform period. The coefficient and 90% confidence interval stem from the 3SLS jointly estimating $log(m_{i,t}) = \beta_0^1 log(g_{i,t}) + \beta_1^1 log(\widehat{\alpha_{i,t}^{\text{nominal},\Delta}}) + \beta_2^1 \widehat{T_{i,t}^{FE}} + \mathbf{X}_{i,t}\boldsymbol{\eta}^{\mathbf{1}} + \rho_t + \xi_i + \varepsilon_{i,t}^1$ and $log(g_{i,t}) = \beta_0^2 log(m_{i,t}) + \beta_1^2 log(\widehat{\alpha_{i,t}^{\text{nominal},\Delta}}) + \beta_2^2 \widehat{T_{i,t}^{FE}} + \mathbf{X}_{i,t}\boldsymbol{\eta}^{\mathbf{2}} + \rho_t + \xi_i + \varepsilon_{i,t}^2$. I plot here β_1^1. The equalization rates are instrumented using their respective counterfactual. Red horizontal line represents the estimate using the post-reform period as average over years 2013-2017 (coefficients from Table 2).

A.16 Elasticity measures: effective equalization rates

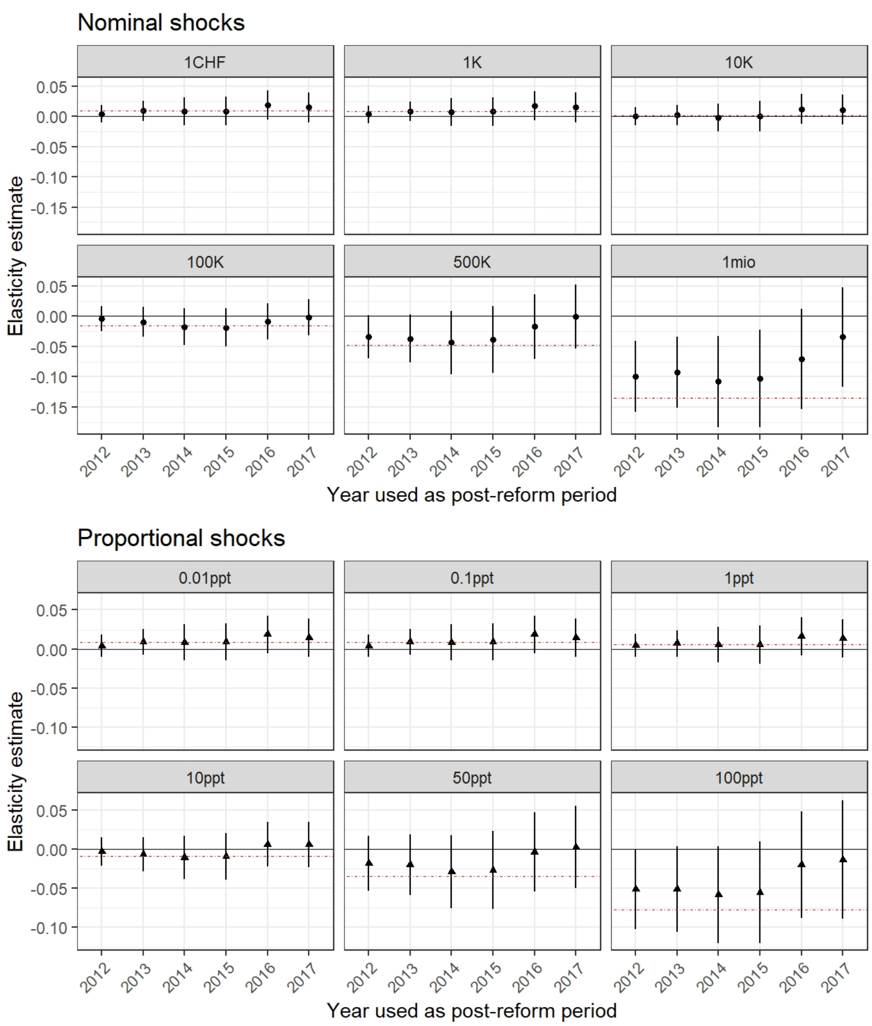

Figure 12: These coefficient plots exhibit elasticity measures on effective marginal and supramarginal equalization rates according to year chosen as post-reform period. Variables are averaged over 2007-2011 for the pre-reform period. The coefficient and 90% confidence interval stem from the 3SLS jointly estimating $log(m_{i,t}) = \beta_0^1 log(g_{i,t}) + \beta_1^1 log(\widehat{\alpha_{i,t}^{\text{effective},\Delta}}) + \beta_2^1 \widehat{T_{i,t}^{FE}} + \mathbf{X}_{i,t}\boldsymbol{\eta}^{\mathbf{1}} + \rho_t + \xi_i + \varepsilon_{i,t}^1$ and $log(g_{i,t}) = \beta_0^2 log(m_{i,t}) + \beta_1^2 log(\widehat{\alpha_{i,t}^{\text{effective},\Delta}}) + \beta_2^2 \widehat{T_{i,t}^{FE}} + \mathbf{X}_{i,t}\boldsymbol{\eta}^{\mathbf{2}} + \rho_t + \xi_i + \varepsilon_{i,t}^2$. I plot here β_1^1. The equalization rates are instrumented using their respective counterfactual. Red horizontal line represents the estimate using the post-reform period as average over years 2013-2017 (coefficients from Table 3).

A.17 Dose-response results: government spending

Dependent variable:	Δ log($g_{i,t}$)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Statutory rate							
Δ log nominal equalization rate	0.009						
	(0.032)						
Δ Net equalization transfers	0.142**						
	(0.058)						
Shock magnitude	Statutory						
Weak instruments test (p-value): α	0.00						
Weak instruments test (p-value): T^{FE}	0.00						
Panel B: Nominal shocks							
Δ log nominal equalization rate		0.015	0.016	0.003	0.066	0.139**	0.191***
		(0.032)	(0.032)	(0.033)	(0.042)	(0.056)	(0.066)
Δ Net equalization transfers		0.140**	0.140**	0.143**	0.143**	0.146**	0.154***
		(0.058)	(0.058)	(0.057)	(0.058)	(0.058)	(0.058)
Shock magnitude		+1CHF	+1K	+10K	+100K	+500K	+1mio
Weak instruments test (p-value): α		0.00	0.00	0.00	0.00	0.00	0.00
Weak instruments test (p-value): T^{FE}		0.00	0.00	0.00	0.00	0.00	0.00
Panel C: Proportional shocks							
Δ log nominal equalization rate		0.015	0.015	0.014	0.005	0.078	0.130*
		(0.032)	(0.032)	(0.033)	(0.040)	(0.059)	(0.067)
Δ Net equalization transfers		0.140**	0.140**	0.141**	0.142**	0.143**	0.149**
		(0.058)	(0.058)	(0.058)	(0.057)	(0.058)	(0.058)
Shock magnitude		+0.01ppt	+0.1ppt	+1ppt	+10ppt	+50ppt	+100ppt
Weak instruments test (p-value): α		0.00	0.00	0.00	0.00	0.00	0.00
Weak instruments test (p-value): T^{FE}		0.00	0.00	0.00	0.00	0.00	0.00
Controls	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓
Municipality FE	✓	✓	✓	✓	✓	✓	✓
# of observations	650	650	650	650	650	650	650

Table 14: Nominal equalization rates 3SLS regressions. Coefficients on log nominal equalization rates can be interpreted as elasticities. Each column in each panel is characterised by a different shock magnitude used in order to compute the equalization rate. Variables are averaged over years 2013-2017 for the post-reform period and over years 2007-2011 for the pre-reform period. Controls include net equalization transfers, share of population, net debt, government spending, share of foreigners, relative harmonized revenue and share of right wing votes at the last national election. Every regression is estimated using robust and clustered errors at the municipal level.

Dependent variable:	Δ log($g_{i,t}$)					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Nominal shocks						
Δ log effective equalization rate	-0.024	-0.024	-0.039	-0.003	-0.029	-0.048
	(0.034)	(0.034)	(0.034)	(0.046)	(0.083)	(0.134)
Δ Net equalization transfers	0.149^{**}	0.148^{**}	0.150^{***}	0.143^{**}	0.144^{**}	0.144^{**}
	(0.058)	(0.058)	(0.058)	(0.058)	(0.058)	(0.058)
Shock magnitude	+1CHF	+1K	+10K	+100K	+500K	+1mio
Weak instruments test (p-value): α^e	0.00	0.00	0.00	0.00	0.00	0.00
Weak instruments test (p-value): T^{FE}	0.00	0.00	0.00	0.00	0.00	0.00
Panel B: Proportional shocks						
Δ log effective equalization rate	-0.024	-0.024	-0.027	-0.065	-0.135^{*}	-0.191^{*}
	(0.034)	(0.034)	(0.034)	(0.042)	(0.077)	(0.107)
Δ Net equalization transfers	0.149^{**}	0.149^{**}	0.149^{**}	0.153^{***}	0.152^{***}	0.147^{**}
	(0.058)	(0.058)	(0.058)	(0.058)	(0.057)	(0.057)
Shock magnitude	+0.01ppt	+0.1ppt	+1ppt	+10ppt	+50ppt	+100ppt
Weak instruments test (p-value): α^e	0.00	0.00	0.00	0.00	0.00	0.00
Weak instruments test (p-value): T^{FE}	0.00	0.00	0.00	0.00	0.00	0.00
Controls	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Municipality FE	✓	✓	✓	✓	✓	✓
# of observations	650	650	650	650	650	650

Table 15: Effective equalization rates 3SLS regressions. Coefficients on log effective equalization rates can be interpreted as elasticities. Each column in each panel is characterised by a different shock magnitude used in order to compute the equalization rate. Variables are averaged over years 2013-2017 for the post-reform period and over years 2007-2011 for the pre-reform period. Controls include net equalization transfers, share of population, net debt, government spending, share of foreigners, relative harmonized revenue and share of right wing votes at the last national election. Every regression is estimated using robust and clustered errors at the municipal level.