The Influence of Intergovernmental Grants on Local Taxes: Evidence from Switzerland[†]

Nicola Mauri [‡]
Linus Peter [§]

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Abstract

This paper investigates the income and substitution effects of intergovernmental grants. We examine tax responses to the reform of a municipal-level transfer system in a Swiss canton. The reform altered transfer formulas, which lead to a change in sums of several grants and an increase in the equalization rate of a capacity equalization scheme, providing quasi-experimental variation to identify income effects and the "incentive effect" of equalization grants. Our analysis shows that local taxes adjusted to changes in transfer sums but not to changes in equalization rates. This finding contrasts with previous studies showing positive tax responses to increased equalization rates at the local level. Further examination of the heterogeneity in our results however reveals that municipalities with a stronger perception of tax competition, as measured by ballot results from a previous federal vote on corporate taxation, did respond to the incentive effect created by the reform.

Keywords: fiscal equalization; tax competition; equalization rate; fiscal federalism; regional science

JEL: H71, H77, R51

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[‡]Swiss Federal Tax Administration (ESTV) and University of Lausanne. Contact: nicola.mauri@estv.admin.ch.

[§]Swiss Graduate School of Public Administration (IDHEAP) of the University of Lausanne. Contact: linus.peter@unil.ch.

1. Introduction

The delegation of taxation and spending responsibilities to sub-central governments often involves intergovernmental grant arrangements.[1] The architecture of these transfer mechanisms is crucial, as it can significantly influence local tax setting; when central authorities introduce or revise a transfer scheme, this can lead to behavioral adjustments of sub-central governments. Given the growing volume of transfers between jurisdictions and government layers in many countries (Baicker et al., 2012; OECD, 2022; Clemens and Veuger, 2023), and the documented influence of local taxes and spending on household and firms decisions (see e.g. Brülhart et al., forthcoming; Agrawal et al., 2022) as well as housing prices (e.g. Basten et al., 2017; Allers and Vermeulen, 2016), understanding how intergovernmental grants shape local fiscal policy is increasingly relevant.

In this paper, we exploit a reform in the municipal-level transfer system of a Swiss canton (State) to study its impact on local tax rates. This law revision modified the transfer formulas of a fiscal capacity equalization scheme, which redistributes resources from wealthier to poorer jurisdictions according to a standardized measure of the local tax base, and of a set of (general-purpose) transfers tied to socio-economic and geo-topographic variables. Two main incentive changes were created by the reform. First, these adaptations generated a shift in local budget constraints – i.e. an income effect. Second, due to the kinked nature of the capacity equalization formula, the reform altered the sensitivity of the equalization grants to changes in fiscal capacity for jurisdictions above a given threshold. Certain municipalities hence saw an exogenous increase in the "equalization rate" (the rate of change in equalization transfers induced by a small change in fiscal capacity). For those jurisdictions, the law revision also entailed an incentive to raise taxes due to a type of substitution effect, known as the "incentive effect" of equalization grants (Köthenbürger, 2002; Bucovetsky and Smart, 2006): a larger compensation in transfers for reductions in the local tax base means that taxes can be increased with smaller financial consequences.[2]

We use the rule changes induced by the reform as source of exogenous variation to identify how the law revision impacted local taxes. Based on the official grant regulations and formulas, tax base and transfers data, we construct two separate treatment variables: the total change in transfer amounts, and the change in the equalization rate. More specifically, we follow the empirical literature on the incentive effect of equalization transfers and compute the two treatments keeping tax base values fixed to the last pre-reform year (see e.g. Buettner and Krause, 2020; Egger et al., 2010). This way, these variables solely

[1] In this paper, we use the terms *transfers* and *grants* interchangeably.

[2] Other types of transfers can also create substitution effects. For instance, matching grants, which are designed to match a specific sub-central expenditure as a fixed proportion of the expense, have been shown to increase spending (Leung, 2022; Bundorf and Kessler, 2022). See Clemens and Veuger (2023) for further discussion on other forms of substitution effects.

capture the changes due to the new rules. The empirical analysis therefore allows for the estimation of plausibly causal effects.

Our results show that local taxes adjusted to the change in transfer volumes due to the new system. We find that a one thousand Swiss Francs per capita increase in transfer amount leads to a 9-10 percentage point decrease in the local tax rate. For the average municipality in the sample, this is equivalent to a 110 Swiss Francs per capita (or around 7%) decrease in tax revenues. The empirical analysis moreover shows that, on average, municipal taxes did not respond to the change in the equalization rate. This is surprising in light of the relatively large increase in the the latter (+48% for most 'treated' municipalities), and the previous comparable empirical evidence which finds small but significant tax adjustments to equalization rates (Egger et al., 2010; Miyazaki, 2020). We argue that the low mobility of municipalities' tax bases coupled to the limited salience of the equalization rate is a plausible explanation for the lack incentive effect in our baseline results.

As an extension, we also investigate the heterogeneity of tax responses with respect to three dimensions: the perception of tax base mobility, the composition of the local tax base at the time of the reform, and topographic constraints. The first is measured by the local share of 'yes' ballots to a previous federal vote aiming at lower corporate taxation, the second by the ratio of corporate to private taxable income, and the third by the share of land that cannot be used for building or farming. The results show that municipalities with higher shares of 'yes' to the federal vote slowly raised their taxes after the reform as a response to the increase in the equalization rate. This suggests that local preferences and perception of the mobility of the tax base might play a role in the magnitude of fiscal adjustments. We furthermore do not find heterogeneous responses according to terrain constraints or local tax base composition.

This study is first to take advantage of the institutional context of Switzerland to explore the income and substitution effects of intergovernmental transfers.[3] Our empirical setting exhibits two main advantages to study tax responses. Firstly, relative to other high-income countries, Swiss local governments enjoy a considerable level of autonomy over their own finances (Brülhart et al., 2015). Municipalities generally have a single decision variable to determine the tax burden of firms and households: a multiplier that is applied to the canton-level tax schedule, with a perfect overlap of tax bases. This makes jurisdictions' full tax policy stance quantifiable through a single number. Given that municipal taxes are raised on personal income and wealth as well as on corporate income and capital,

[3] Widmer and Zweifel (2012) use Swiss data at the cantonal level to look at how the inter-cantonal equalization scheme impacted the efficiency of public service provision. The highly decentralized nature of the fiscal architecture of Switzerland has furthermore been exploited, among other things, to test empirically the influence of culture on tax competition (e.g. Eugster and Parchet, 2019), to analyze the role of direct democracy on fiscal policy (e.g. Brülhart and Jametti, 2019), to investigate income sorting (e.g. Schmidheiny, 2006; Basten et al., 2017), or to consider welfare consequences of local taxes Brülhart et al. (forthcoming). For a more extensive description of Switzerland's fiscal setting, see Brülhart et al. (2023).

changes in the municipal multiplier affect a very broad local tax base, which makes up most of their tax revenues.[4] Second, we examine the largest Swiss canton in terms of number of municipalities. We know from existing theoretical developments that this implies that most local governments probably behave as "price takers" in fiscal competition (see e.g. the seminal work of Zodrow and Mieszkowski (1986); Wilson (1986), or Köthenbürger (2002) in the context of fiscal equalization). Issues related to market power when fiscal policy is decided are therefore likely to be small.

More generally, this study builds upon literature exploring empirically how intergovernmental grants impact fiscal decisions of local governments.[5] Income effects from grant changes have been shown to influence both expenditure and tax rates (see, among others, Dahlberg et al., 2008; Dahlby, 2011; Berset and Schelker, 2020; Berset et al., 2023; Shani et al., 2023; Helm and Stuhler (forthcoming); Köthenbürger and Loumeau, 2023). Substitution effects from intergovernmental transfers – in particular the incentive effect of equalization grants – are subject to growing empirical scrutiny at the local and state level (Baretti et al., 2002; Dahlby and Warren, 2003; Smart, 2007; Ferede, 2017; Rauch and Hummel, 2016; Buettner and Krause, 2020; Holm-Hadulla, 2020). Furthermore, this paper contributes to a small number of studies examining empirically how local preferences influence local taxes and fiscal adjustments (Eugster and Parchet, 2019; Baekgaard and Kjaergaard, 2016; Liu, 2016; Lago-Penas, 2008).

The remainder of the paper is organized as follows. Section 2 details the institutional setting of this study, including information on how the reform impacted tax-setting incentives. Section 3 presents our data, our identification strategy and the baseline econometric specification. Section 4 describes and discusses the results. Section 5 concludes.

2. Institutional background

2.1 Fiscal architecture and transfers of the canton of Bern

Switzerland is a highly fiscally decentralized country, commonly described as a "federation of federations". Much of its taxing powers are delegated to sub-federal governments: cantons (i.e. states) and municipalities, which collect roughly equivalent shares of total tax revenues (Brülhart and Jametti, 2019). Local governments are on average relatively small and enjoy a very strong autonomy on their taxation decisions relative to other decentral-

[4] Local tax multipliers in Switzerland govern around 50% of their total revenue and some 70-80% of their total tax revenue, which is comparable to the scope of taxation of Canadian provinces (Smart, 2007; Ferede, 2017) but much larger than the scope of German municipal business tax rates (Buettner, 2006; Egger et al., 2010; Rauch and Hummel, 2016; Holm-Hadulla, 2020), Japanese municipal capital tax rates (Miyazaki, 2020) or German state-level real estate transfer taxes (Buettner and Krause, 2020).

[5] For a broader overview of the existing theoretical and empirical studies, see Clemens and Veuger (2023) and Lago et al. (2024).

ized high-income countries (Brülhart et al., 2015; OECD, 2022). This general institutional setting can be considered an ideal empirical ground to investigate intergovernmental relations and local fiscal policy.

In this study, we examine the canton of Bern, located in the central part of Switzerland, which is the second most populous canton and has the largest number of municipalities (352 local jurisdictions in 2017). The cantonal government sets different tax schedules on its main tax bases: personal income and wealth, corporate profits and capital.[6] At the local level, a common legal framework regulates budgetary decisions and the relevant tax bases. Municipal fiscal policy decisions are based on a single scalar (the "tax multiplier") that shifts the schedules on personal income and wealth, corporate profits and capital simultaneously, and must face a compulsory vote by the electorate of the municipality to be modified.[7] The vast majority of tax revenue is generated from personal tax bases (income and wealth) which make up on average 80% of tax receipts, and can be characterized as the main source of tax competition between municipalities. The remaining 20% stem from corporate tax bases and property taxes.[8] The municipal tax multiplier therefore embodies the main lever of fiscal policy decisions made at the local level.

Canton Bern's intergovernmental grants system, first implemented in 2002, consists of a fiscal capacity equalization (CE) scheme and a set of vertical transfers (i.e. between the canton and municipalities) which depend on various socio-economic and geo-topographic characteristics.[9] All transfers are lump-sum and not earmarked. The capacity equalization scheme is designed to reduce the spatial inequalities in revenues across municipalities, and is based on the measure of fiscal capacity $B_{i,t}$ for municipality i in year t, which is computed as the three-year average of the comprehensive per capita tax base (i.e. the sum of personal and corporate tax bases) multiplied by a unique standardizing tax multiplier (set by decree by the cantonal executive branch).[10] Municipalities with fiscal capacity above

[6] Additionally, the canton decides on taxes for lottery winnings, a "tax at the source" (*Quellensteuer*) for foreigners and a tax on capital of holding firms. These are however not part of the municipal tax base.

[7] As a simple example, consider the personal income of a single individual with a yearly taxable income of 50,000 Swiss francs in 2012. Given the applicable cantonal income tax schedule, taxes due would amount to 1,973 Swiss Francs. This number would hence represent the relevant tax base for the municipality where the individual resides. If that jurisdiction is the city of Thun for instance, then a tax multiplier of 1.72 would be multiplied with the 1,973 CHF to compute how much the individual owes the municipality. The same applies analogously to the other personal and corporate tax bases.

[8] Municipalities can also set a property tax, but given its small share of tax revenues (∼8%), we consider the tax multiplier as the main fiscal instrument of interest in this study.

[9] See Rühli et al. (2013) for detailed descriptions of other inter-municipal equalization schemes in Switzerland.

[10] Added to this is the three-year average property tax base multiplied by a standardized property tax. The fact that the standardizing rates are not influenced by municipalities' taxes implies that the equalization scheme is in practice equivalent to a tax base equalization scheme. Consequently, any change in the tax multiplier will influence equalization grants only through the tax base response. It moreover

the cantonal average B_t^* pay equalization transfers, while those below average receive transfers. The equalization scheme moreover presents a kink at the so-called "minimum endowment" threshold fiscal capacity, determined by decree as a fixed percentage of B_t^*: for municipalities below that target fiscal capacity, canton-funded transfers bridge the gap to the minimum endowment. Vertical non-capacity equalization transfers can be classified into two main categories. First, cost-sharing transfers take into account the common responsibility of certain tasks between the two layers of government (in the domains of schooling, welfare, social security and public transport expenditures). Although the tasks are formally shared between the canton and municipalities, in practice the canton implements them and then requires local governments to financially contribute according to a legally defined formula. For each cost-sharing domain, the canton therefore determines a sum based on a fixed (legally defined) percentage of its expenditure for that specific policy, that is to be paid by municipalities. How much jurisdiction i contributes then depends on various socio-economic characteristics (e.g. population, number of pupils or number of public-transport stops).[11] Second, the remaining transfers are vertical grants that compensate for differential geographic, topographic and socio-economic constraints in public service provision. So-called *centrality* transfers compensate spillovers and the high socio-economic costs of larger cities. These grants require municipalities within the agglomerations of Bern, Biel, and Thun (the main towns of the canton) to fund a sum, decided by the canton, according to their relative fiscal capacity compared to the other municipalities of the agglomeration. This sum is then allocated to the agglomeration center municipality. *Geo-topographic grants* on the other hand aim to offset high infrastructure costs in rural areas. These transfers are effectively subsidies from the canton which depend on socio-economic and geographic variables such as population, municipal area or the length of streets.[12]

Formally, total intergovernmental transfers $T_{i,t}$ are defined as:

$$\begin{aligned} T_{i,t} &= T_{i,t}^{\text{CE}} + T_{i,t}^{\text{non-CE}}, \\ T^{\text{CE}} &= \gamma(B_t^* - B_{i,t}) + \max\{0, \lambda B_t^* - (B_{i,t} + \gamma(B_t^* - B_{i,t}))\} \\ T_{i,t}^{\text{non-CE}} &= \sum_j T_{i,t}^j \end{aligned} \tag{2.1}$$

where $T_{i,t}^{\text{CE}}$ represents capacity equalization transfers and $T_{i,t}^{\text{non-CE}}$ refers to the sum of the j non-capacity equalization grants (i.e. cost-sharing, centrality and geo-topographic

differs from revenue equalization schemes, which redistribute directly based on tax revenues (which can be mechanically changed through the tax rate).

[11] The cost-sharing scheme hence essentially functions as a way for the canton to "send a bill" to municipalities. Cost-sharing transfers hence cannot be compared to matching grants, which function as fixed-rate subsidies from central to sub-central governments.

[12] Before 2012, this class of transfers was also conditional on tax multipliers, but the conditionality was removed with the reform. We discuss this further in the next section.

transfers). $\gamma \in [0,1]$ is a parameter, decided by decree by the canton, determining the proportion of the difference between the cantonal average fiscal capacity B_t^* and i's fiscal capacity $B_{i,t}$ that is to be compensated through CE transfers. This parameter governs how redistributive the equalization system is. The parameter $\lambda \in [0,1]$ determines the target minimum endowment threshold of the capacity equalization as a fraction of the cantonal average. Transfers included in $T_{i,t}^{\text{non-CE}}$ depend on socio-economic, geographic and topographic characteristics (population, number of pupils, street length, municipal area, number of full-time equivalent teachers or the number of primary school classes). These grants are formally defined and described in detail in Appendix A.2.

To examine the tax-setting incentives associated to the CE transfers, we define the equalization rate $\alpha_{i,t}$ of the equalization system as follows:

$$\alpha_{i,t} = -\frac{\partial T_{i,t}^{CE}}{\partial B_{i,t}} = \begin{cases} \gamma & \text{if } \frac{B_{i,t}}{B_t^*} > \phi \\ 1 & \text{if } \frac{B_{i,t}}{B_t^*} \leq \phi \end{cases}, \tag{2.2}$$

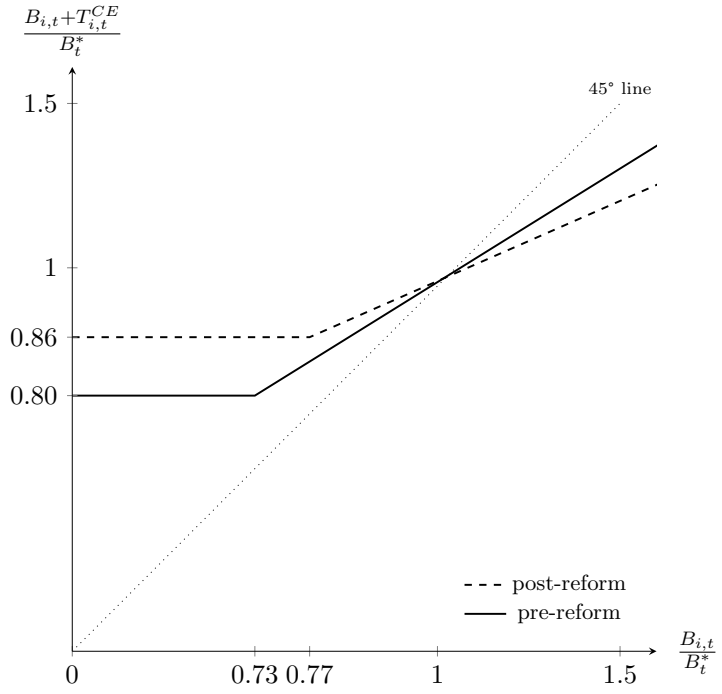
$$\text{where } \phi = \frac{\lambda - \gamma}{1 - \gamma}.$$

In words, the equalization rate represents the extent to which the CE system compensates a local government for a small decrease in its fiscal capacity. Municipalities face a discontinuity in the equalization rate schedule at relative fiscal capacity $\frac{B_{i,t}}{B_t^*} = \phi$. For municipalities below that threshold, any small change in the relative fiscal capacity is fully compensated by transfers ($\alpha = 1$). This is due to the additional minimum endowment grants that ensure a post-transfer relative fiscal capacity of λ. Municipalities with relative fiscal capacity above ϕ face a unique marginal equalization rate ($\alpha = \gamma$).[13]

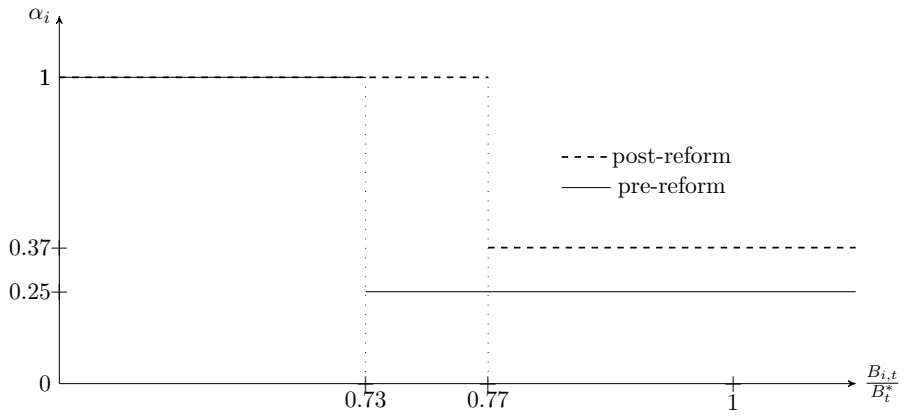
The timing of transfers occurs as follows. Municipalities must transmit in every year t (in June) detailed information on their accounts for $t-1$ to the cantonal tax administration, which is responsible for computing the fiscal capacity measure and the ensuing transfers. The cantonal authorities compute the fiscal capacity measure based on years $t-1$ to $t-3$ and determine by end of September of year t the amount of transfers due or paid from the equalization scheme. The equalization payments occur effectively in $t+1$. The timing of vertical transfers is different, as it involves additional variables. Municipalities in this case make down-payments in t for the cost-sharing arrangement of the same year, based on variables communicated the previous year by the cantonal administration. In $t+1$ the differences between effective costs and down-payments of year t are paid out.

[13] The effect of the fiscal capacity $B_{i,t}$ on the canton-wide average B_t^* is assumed to be null in equation (2.1). For the overwhelming majority of jurisdictions, this is true. For larger jurisdictions such as the cities of Bern, Biel or Thun, which account for most of the population of the canton, a small increase in $B_{i,t}$ might have a small positive impact on B_t^*. This in turn means that the equalization rate might be slightly lower than 1 or γ for those larger towns (by 1-2 percentage-points in practice).

Figure 1: The capacity equalization scheme of canton Bern before and after the reform



(a) Fiscal capacity before and after transfers



(b) The equalization rate schedule

Note: These figures graphically overlay the pre-reform on the post-reform equalization system. In panel (a), the vertical axis shows relative fiscal capacity after equalization transfers $\frac{B_{i,t}+T^{CE}_{i,t}}{B^*_t}$. The horizontal axis presents pre-transfer relative fiscal capacity $\frac{B_{i,t}}{B^*_t}$. The 2012 law change induced an increase in the minimum endowment $\lambda = 0.8$ to $\lambda = 0.86$, which implies $\phi = 0.73$ before and $\phi = 0.77$ after 2012. In panel (b), the vertical axis shows the equalization rate. The change in λ and γ implied a shift of the threshold ϕ and an increase of the equalization rate α. Full lines represent the pre-reform case, dashed lines the post-reform.

2.2 The 2012 law revision

From 2008 on, Bern's cantonal executive branch (with a left-of-center majority) expressed concerns that equalization transfers were not redistributive enough and that certain verti-

cal grants set wrong incentives with respect to budgetary decisions (Ecoplan, 2017). The cantonal government hence put forward a comprehensive revision of the inter-municipal grants law: the 2012 FILAG (*Finanz- und Lastenausgleichgesetz*) reform. The cantonal parliament (consisting of around 51% of right-of-center parliamentarians at the time) as well as municipality associations were consulted and largely approved the project. The capacity equalization scheme was amended to expand redistribution through an increase in γ and the target threshold λ: the former was raised from 0.25 to 0.37 and the latter from 0.8 to 0.86. This implied a shift of threshold ϕ from 0.73 to 0.77. The reform also included a change in the standardizing multiplier, which was lowered.[14]

Figure 1 illustrates the consequences of the reform on capacity equalization transfers. Panel (a) shows pre- and post-transfer relative fiscal capacity before (solid line) and after (shaded line) the reform. The 45 degree line represents the case with no equalization. With equalization, municipalities either locate above (with $\frac{B_{i,t}}{B_t^*} < 1$) or below (with $\frac{B_{i,t}}{B_t^*} > 1$) this line according to their status of recipient or contributor. The extension of the target threshold λ joint to the increase in parameter γ induced a higher and longer segment with full equalization, as well as a flatter slope for relative fiscal capacities above ϕ. Panel (b) shows the schedule of equalization rate $\alpha_{i,t}$ as a function of relative fiscal capacity. For values of (pre-transfer) relative fiscal capacity between 73-77% of the cantonal average, the pre- to post-reform equalization rate increased by 75 percentage points while for relative fiscal capacity values above 77%, the increase equals 12 percentage points. For values of relative fiscal capacity below 73%, the reform did not entail any change in the equalization rate.

The reform additionally entailed formulaic changes in various non-capacity equalization transfers. In particular, cost-sharing transfers for schooling and social security have been reorganized through the reform, and a new cost-sharing transfer has been implemented to compensate a new task distribution between the canton and the municipalities in the social-security domain. Furthermore, the new system replaced centrality grants by so-called *socio-demographic* transfers, which are vertical transfers based on an index of local social and demographic characteristics. The conditionality of geo-topographic grants on local tax multipliers was removed, and a (per-capita) ceiling was set. Changes to non-capacity equalization transfers are listed and described in more detail in Appendix A.2.

[14]Note that the standardizing multiplier affects fiscal capacity measures $B_{i,t}$ of all jurisdictions the same way. All else being equal, a change in the unique standardizing rate does not affect the ranking of municipalities, since it shifts the average fiscal capacity B_t^* as well. This change however impacted the volume of transfers from the equalization scheme.

2.3 Income and substitution effects from the reform

The different changes brought on by the 2012 FILAG reform generated two main tax-setting incentives.[15] On the one hand, the rule changes led to variation in the volume of transfers booked in the municipalities' accounts. This revenue shift yields an *income effect*, which is predicted to negatively impact local taxes (Buettner, 2006; Dahlby, 2011). On the other hand, the increase in the faced equalization rate of certain local governments creates the incentive to raise taxes: a higher (lower) equalization rate means that for a small loss in the local tax base, the local government is compensated more (less). Tax hikes, which deplete the local tax base, are thereby less (more) costly in terms of municipal revenues. Higher equalization rates are therefore predicted to impact positively local taxes. This form of substitution effect is henceforth referred to as the *incentive effect* (Köthenbürger, 2002; Bucovetsky and Smart, 2006).

The theoretical intuition behind these effects lies in the fact that local governments can be thought as choosing tax rates such that the marginal cost of public funds (MCPF) equates the marginal rate of substitution (MRS) between private and public consumption.[16] The MCPF represents the marginal cost of raising one additional dollar of public funds, and is positively impacted by the local tax rate. An increase in the volume of transfers booked by a municipality leads to more spending through the binding local budget constraint, which decreases the MRS. The local government hence lowers taxes, which in turn increases the MRS and decreases the MCPF until both equate again.[17] An increase in the equalization rate creates two simultaneous effects. Firstly, jurisdictions contributing will pay more and those receiving will receive more. This budgetary effect is analogous to the income effect described previously. Secondly, the higher equalization rate *directly* decreases the MCPF. This must be compensated through a tax increase such that the equality between MRS and MCPF holds (Köthenbürger, 2002; Bucovetsky and Smart, 2006). Intuitively, given that the equalization scheme compensates to a larger extent for local tax base variation, the effect on municipal revenues of a tax rate change become less important.[18] Consequently,

[15] Changes in cost-sharing transfers did not influence tax-setting (or spending) incentives other than through the change in sums. This is due to the nature of the cost-sharing scheme, which requires municipalities to partially fund specific cantonal expenditures at a rate based on relative socio-economic variables. See Appendix A.2. The revisions made to geo-topographic and centrality grants – which were partly conditional on the local tax base or rate before 2012 – are discussed in Section 3.

[16] For a more formal presentation of the income and incentive effects, see for instance Köthenbürger, 2002; Bucovetsky and Smart, 2006; Buettner, 2006.

[17] A more formal derivation of this mechanism is shown in Proposition 2 in Buettner (2006).

[18] Dahlby and Warren (2003) also emphasize that the incentive effect also depends on the local tax rate: for municipalities with higher local tax rates, the degree of redistribution of the equalization system is lower than for low-tax jurisdictions because their revenues exceed the fiscal capacity measure. In the robustness section of this paper, we replace the equalization rate by the "equalization base effect", which essentially represents the change in *total revenues* for a small increase in the tax base (and not only the

local policymakers are incentivized to increase taxes because the pressure of tax base mobility is weakened by a higher equalization rate.
Differentiating empirically between the income and incentive effect is crucial to understand how the reform influenced local tax rates. For this, we create two treatment variables: the change in total transfer sums and the change in the equalization rate due to the reform. Our approach is detailed in the next section.

3. Empirical strategy

3.1 Data and identification

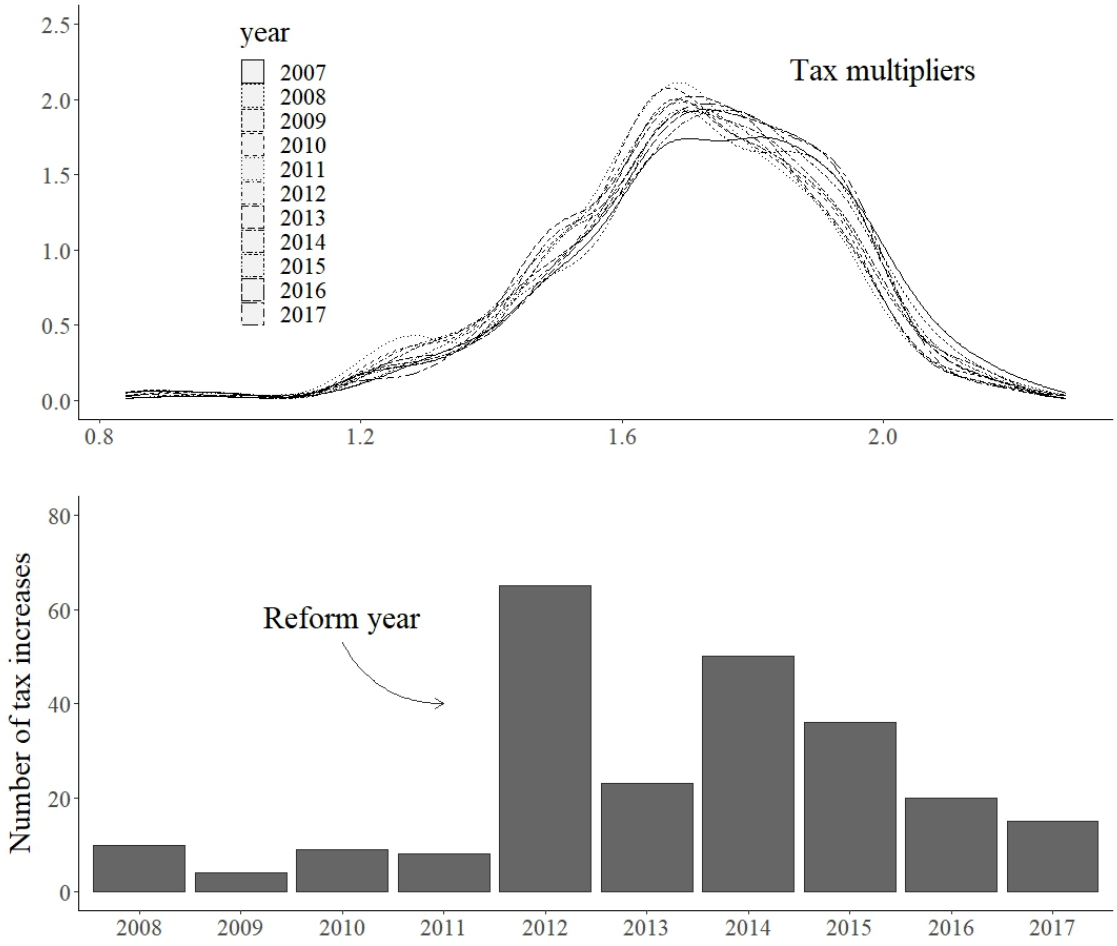
To examine how the 2012 reform influenced the local governments' policy choices, we gather data on municipalities of the canton Bern which did not merge during years 2007 to 2017. We rely on publicly available data from two main sources. On the one hand, the finance department of the canton of Bern provides detailed information on fiscal equalization transfers, the relative fiscal capacity, municipal tax multipliers and yearly municipal financial statements.[19] On the other hand, socio-economic and geographic variables as well as other covariates are taken from the Swiss federal statistical office.[20] The balanced baseline sample of the analysis follows 325 municipalities over 11 years. The symmetric window around the 2012 revision of the equalization mechanism has been chosen to minimize the risk of capturing potential effects related to the first introduction of the equalization system in 2002.
Our analysis focuses on the effect of the reform on municipal tax multipliers. Figure 2 presents a graphical representation of the time and cross-sectional variation of the latter. Panel (a) exhibits the density of values assumed by municipal tax multipliers over different years. As described in the institutional context, the unique municipal tax multiplier shifts the cantonal schedule for various tax bases such as personal income and wealth, corporate profit, and capital. The figure reveals that the degree of variability across jurisdictions is substantial for each year. Specifically, some residents or firms are subject to a municipal tax bill that is more than double that of others with the same taxable income, wealth, capital, or profit. Moreover, variation is not limited to cross-sectional differences; the superposition of the multiplier distributions for different sample years reveals ample yearly variation. Panel (b) of Figure 2 provides a comprehensive picture of the number of tax hikes that took place between 2008 and 2017. Prior to the reform period, tax increases

change in transfers as shown in (2.2)).

[19] This can be found on https://www.fin.be.ch/de/start/themen/Finanzen/FinanzundLastenausgleich.html.

[20] See https://www.bfs.admin.ch/bfs/de/home/statistiken/regionalstatistik/atlanten/statistischer-atlas-schweiz.html.

Figure 2: Cross-sectional and time variation of municipal tax multipliers



Note: These figures show the variation of municipal tax multipliers in the sample. Panel (a) displays the density of multiplier tax multiplier values for all sample years. Panel (b) displays the number of tax multiplier increases between year 2008 and 2017.

were a relatively rare occurrence, averaging 7.7 positive tax changes per year. However, the years following the reform period saw a significant uptick in the number of tax hikes, with the reform year alone registering 65 tax increases across various jurisdictions in the sample. The subsequent year, 2013, saw a comparatively lower number of tax increases (23), but the trend resurged in 2014 and 2015, with 50 and 36 tax hikes respectively. The number of tax increases then declined to 20 in 2016 and 15 in 2017. This figure suggests that the reform had a substantial impact on municipal fiscal policies not only in the reform year itself, but also in the years that followed.[21]

In order to correctly identify how the apparent tax policy adjustments relate to the reform, we construct two separate treatments using the official transfers formulas as well as fiscal

[21] Appendix Figure A.1.1 additionally shows that tax multipliers were on a downward trend before 2012, which started reverting after the reform.

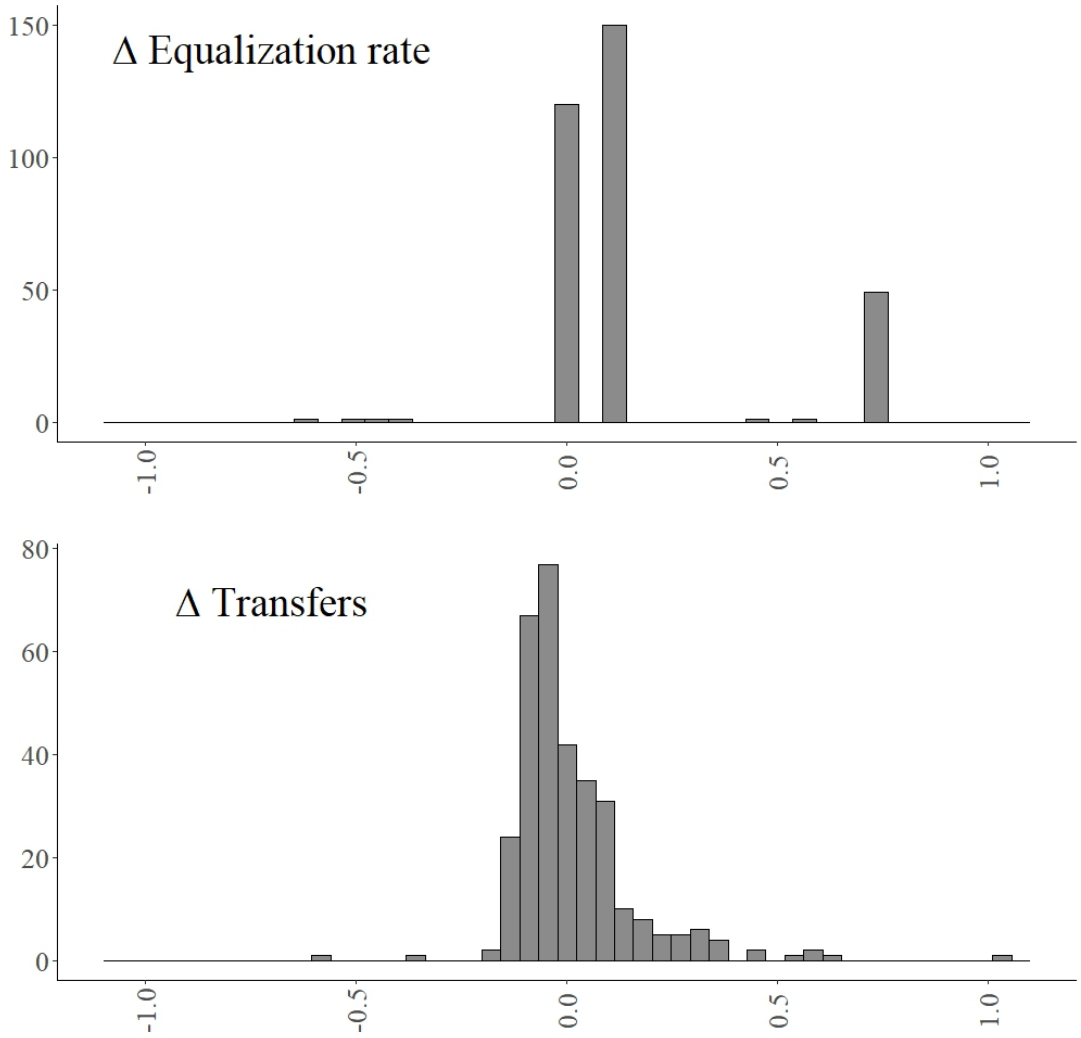
capacity and transfer sums data for years 2011 and 2012. We follow the empirical literature studying equalization scheme reforms (see e.g. Egger et al. (2010), or more recently Buettner and Krause (2020)) and compute the change in total transfer amounts (ΔT_i) and the change in the equalization rate ($\Delta \alpha_i$) keeping the relevant input variables fixed at the 2011 level.[22] More specifically, we compute "counterfactual" 2012 equalization grant sums and equalization rates using 2011 tax base and population, but the new transfer rules. We then take the difference with the actual 2011 equalization rate and grant sums, which we computed using pre-reform formulas. Grants not part of the capacity equalization scheme could however not be simulated using the same procedure due to unavailable input data. We hence simply take the first difference between 2012 and 2011 for all other transfers outside the equalization scheme. Given that these transfers depend mostly on exogenous socio-economic and geo-topographic variables (see Table A.2.1 in the appendix), it is reasonable to assume that the 2012-2011 change in sums captures mostly the change in rules. Treatments ΔT_i and $\Delta \alpha_i$ therefore are likely to grasp variation in tax multipliers linked to the change in transfer formulas, not underlying changes in economic conditions.

Figure 3 shows the distribution of the values taken by the two treatments. The upper graph displays the change in the equalization rate only linked to the formulaic alterations. Four main treatment groups can be distinguished. Firstly, 36% of our sample municipalities see no change in their equalization rates due to the reform. These are jurisdictions with fiscal capacity below the minimum endowment value, meaning that they enjoy full equalization (i.e. $\alpha = 1$) before and after the reform. Secondly, 46% of the sample jurisdictions see an increase of 12 percentage points (α of 0.25 before and 0.37 after, equivalent to a 48% equalization rate increase). Thirdly, a smaller group of 15% of the local governments in our sample see a 75 percentage point hike in the equalization rate (α of 0.25 before and 1 after, corresponding to a 300% increase). Finally, the reform created equalization rate cuts for certain municipalities, and others observe treatment values between 12 and 75 percentage points. These intermediate treatment values are taken by 7 municipalities who saw an *ex-post* cut in their minimum endowment transfers by the cantonal authorities.[23] The bottom graph shows the values taken by our second treatment, which measures the change in transfer sums in thousands of Swiss Francs per capita linked to the system change. The distribution is slightly right-skewed, and exhibits a mode right below zero. Most municipalities hence ended up paying more or receiving less as a general implication

[22] This approach essentially mimics the procedure first proposed by Gruber and Saez (2002) for studying the effects of tax rate changes in the context of intergovernmental grant systems.

[23] The intergovernmental grant regulations include the possibility for the cantonal government to cut minimum endowment transfers for municipalities under certain conditions. These include a financial situation decided as "very good" by the canton (measured by an index which encompasses the interest burden, gross debt and equity or the balance sheet deficit per inhabitant), or if a municipality refuses to implement a merger study when it is required by the canton to do so. This possible cut is communicated yearly and simultaneously to the transfer sums.

Figure 3: Main treatment variables



Note: This figure shows the distribution of values taken by the two treatment variables: the change in the equalization rate and the change in transfer sums due to the reform. The variables are calculated by keeping tax base and population fixed to 2011 levels – letting only legally defined exogenous parameters change. The change in equalization rate takes values between -0.63 and 0.75, while the change in transfer sums is expressed in thousands of CHF per capita.

of the reform.[24]

Although our treatment variables are likely to capture the most salient incentive changes due to the *FILAG* reform, certain additional modifications from the new law can raise concerns with respect to the causal identification of the incentive and income effects. In particular, two grants that were conditional respectively on the local tax base or on the tax multiplier before 2012 were removed and replaced with the new law (see Appendix Section

[24]Appendix Figure A.1.2 displays the geographic distribution of both treatments. The maps show a large spatial variability in treatment values and suggest that both treatment are only weakly correlated.

Table 1: Summary Statistics

Variable	Mean	SD	Min	Max
Municipal tax multiplier	1.71	0.21	0.84	2.28
Δ Equalization rate	0.17	0.26	−0.63	0.75
Δ Transfers	0.01	0.15	−0.59	1.02
Relative fiscal capacity (in %)	81.58	25.98	24.82	287.70
Population (in thousands)	2.73	8.45	0.03	133.80
Productive density (thou. inhabitants/km^2)	0.29	0.50	0.01	5.19
Share of foreigners (in %)	8.07	5.98	0.00	33.17
Housing vacancy rate (in %)	1.52	1.78	0.00	17.65
Share of population above 65 (in %)	19.20	3.25	10.13	33.33
Share of population below 19 (in %)	20.70	3.11	1.89	43.90

Note: This table reports the mean, standard deviation, minimum and maximum of all variables used in the regression. The baseline sample follows 325 municipalities during 11 years (2007-2017). Municipal tax multipliers, equalization rates, relative fiscal capacity and equalization transfers are taken from the cantonal finance administration of Bern. The remaining variables were accessed from the federal statistical office. # of observations: 3575.

A.2 for further details). Centrality transfers, whose sum depended on the relative fiscal capacity within the agglomeration, were replaced by 'socio-demographic' grants, funded by the canton and independent of the local tax base. The removal of centrality transfers might have influenced tax-setting incentives – which could blur our estimations of the incentive effect of the capacity equalization grants. While the sums represented on average only around 2% of municipal tax revenues for those contributing, we nonetheless implement our estimations without jurisdictions that had to contribute as a robustness check. Furthermore, geo-topographic transfers were eligible only for jurisdictions validating the following conditions: a tax multiplier above 110% of the median and total municipal road length or surface per-capita greater than or equal to 80% of the median. The reform removed conditionality on local taxes. This change could also blur identification. It is however unlikely given their weight in municipalities' budgets: less than 2% of total tax revenues on average, compared to the average 25% of equalization grants. Moreover, the elimination of the conditionality on tax multipliers means that the local governments' fiscal policy can 'freely' respond to the incentive changes yielded by the reform. In appendix Section A.3, we provide some evidence that the removal of conditionality in this category of transfers did not impact local taxes. Finally, a small "correction" in the cost-sharing transfer sums occurred in 2014 as a consequence of a first evaluation of the effects of the reform (Ecoplan, 2017). As this might be correlated to the rule changes from 2012, we apply our empirical analysis without years after 2013 as another robustness check.
Table 1 displays summary statistics (mean, standard-deviation, minimum and maximum) of the different variables used in this study. The average relative fiscal capacity is ef-

fectively close to the minimum endowment target threshold. The distribution otherwise is relatively skewed: the richest municipality, *Saanen*, has a relative fiscal capacity almost three times that of the average jurisdiction of canton Bern. Population, productive density (i.e. the number of inhabitants per km^2 of surface not covered by lakes, steep hills, rocks etc.), the housing vacancy rate and share of individuals above 64 and below 19 exhibit substantial variation, mostly stemming from cross-sectional differences between municipalities

3.2 Econometric specification

Our baseline regression equation writes as follows:

$$\tau_{i,t} = \beta_1(\Delta\alpha_i \times \text{after}_t) + \beta_2(\Delta T_i \times \text{after}_t) + \mathbf{X}_{i,t}\boldsymbol{\lambda} + \zeta_t + \psi_i + \xi_i t + e_{i,t}, \tag{3.1}$$

where $\tau_{i,t}$ is the municipal tax multiplier for municipality i in year t. Treatments $\Delta\alpha_i$ and ΔT_i respectively represent the change in the equalization rate and in total intergovernmental transfers in thousands of Swiss Francs per capita due to the reform.[25] The indicator function after_t takes value 1 for years after 2011. Time varying controls $\mathbf{X}_{i,t}$ include population, productive density, housing vacancy rate, share of foreigners and share of individuals above 64 and below 19. Given that $\Delta\alpha_i$ essentially compares poorer to richer municipalities, it is important to also control for differences in tax base sizes. We hence follow Buettner and Krause (2020) and additionally provide estimation results which include as a time-varying covariate the relative tax base level. This allows to compare the treatments net of tax base differences. Finally, equation (3.1) also includes year (ζ_t) and municipality (ψ_i) fixed effects, as well as a municipality-specific linear time trend ($\xi_i t$). The latter allows taking into account municipality-specific trajectories in tax multipliers. Variable $e_{i,t}$ is the error term.

The coefficient β_1 represents the effect on the local tax multiplier of a 1 percentage point increase in the equalization rate α_i. Coefficient β_2 can be interpreted as the effect of a one thousand Swiss Francs per capita increase in grants on the local tax rate. Figure 3 suggests that $\Delta\alpha_i$ can be considered a multivalued discrete treatment, and ΔT_i a purely continuous one. Callaway et al. (2024) show that two-way fixed-effects estimates on multivalued and continuous treatments can be decomposed into *level effects* (comparing untreated units to a specific dose d of the treatment D) and *causal responses* (effect of

[25] Buettner and Krause (2020) use a similar approach to capture the changes in the degree of redistribution of the German state-level equalization system. The authors however use the computed variables as instruments. In our case, the preferred specification is the equivalent to the "reduced form" regression (i.e. regressing the outcome variable directly on the instrument). The reason for this is that ΔT_i and $\Delta\alpha_i$ show correlation coefficients of 0.91 and 0.84 respectively with the actual 2011 to 2012 change in total transfers and equalization rates. Implementing an IV strategy hence yields qualitatively the same empirical results as shown in section 4.

a marginal increase from dose d to d'). Interpretation of such coefficients might require stronger assumptions than the usual parallel trends assumption. In our case, a "strong parallel trends" assumption is needed to interpret β_1 and β_2 as average causal responses: for any dosage of the treatment D, the change in outcomes of all units is the same had they experienced dosage $D = d^{'}$ instead of $D = d$. The strong parallel trends assumption is hence a form of homogeneous treatment effects assumption. In the context of this study, this means that any municipality would have had the same tax response, had they faced a given change in the equalization rate or transfer sum due to the reform. While there are (to date) no statistical tests to assess the likelihood of this assumption to hold, we nonetheless implement the following as a robustness check: we estimate regression equation (3.1) with a binary version of $\Delta\alpha_i$ and a discretized version of ΔT_i. The change in the equalization rate is replaced by an indicator taking the value 1 for positive values of $\Delta\alpha_i$. With a binary treatment, the parallel trends assumption suffice to interpret the coefficient β_1 as an average treatment effect (treated municipalities being those with an increase in the equalization rate). Furthermore, ΔT_i is discretized into 4 groups. We create indicator variables for *medium-low* changes in grant sums (taking the value 1 for ΔT_i between the 25th and 50th percentile), *medium-high* (taking the value 1 for ΔT_i between the 50th and 75th percentile) and *high* (change in grants bigger than the 75th percentile of ΔT_i). The lowest quartile is used as a comparison group. Thanks to this approach, we can assess whether there is treatment effects heterogeneity across doses of ΔT_i.[26] If we can conclude that treatment effects heterogeneity is not strong, then β_2 can be interpreted as an average causal response parameter meeting the "minimum requirements" for causal interpretation (Callaway et al., 2024; Blandhol et al., 2022).

4. Results

4.1 Baseline regressions

Estimated coefficients from equation (3.1) are reported in Table 2. The change in the equalization rate and the change in transfer sums are sequentially added in the regression in columns (1) to (6). Columns (7) and (8) include the time varying control variables. Odd columns include year and municipality fixed effects, while pair columns also add municipality-specific linear time trends. The first two columns show coefficients on the change in the equalization rate. The estimates are very close to zero and not statistically significant. In the next two columns on the other hand, the estimates on the change in transfer sums are negative, statistically significant and quantitatively meaningful in both specifications. A one thousand per capita increase in the change in transfers is

[26] We follow here recent studies which also use continuous treatments in other contexts (Lindo et al., 2020; Assaad et al., 2023; Kunaschk, 2024).

Table 2: Baseline regression results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ Equalization rate × after	0.001	−0.011			−0.003	−0.015	−0.005	−0.017
	(0.023)	(0.018)			(0.024)	(0.018)	(0.023)	(0.018)
Δ Transfers × after			−0.104**	−0.088**	−0.105**	−0.090**	−0.106**	−0.104***
			(0.041)	(0.035)	(0.042)	(0.035)	(0.043)	(0.034)
Relative tax base							−0.003***	−0.001***
							(0.000)	(0.000)
Population in thousands							0.003	−0.026*
							(0.005)	(0.014)
Productive density							0.000	0.000
							(0.000)	(0.000)
Share of population above 65							0.003	−0.001
							(0.004)	(0.003)
Share of population below 19							−0.002	0.002
							(0.002)	(0.002)
Share of foreigners							−0.005*	−0.002
							(0.003)	(0.002)
Housing vacancy rate							0.001	0.001
							(0.001)	(0.001)
Municipality-specific linear time trends	no	yes	no	yes	no	yes	no	yes
Municipality fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
# of observations	3575	3575	3575	3575	3575	3575	3575	3575

Notes: This table reports estimates from equation (3.1). Odd columns include municipality and year fixed effects. Pair columns additionally include municipality-specific linear time trends. Standard errors are clustered at the municipal level. Stars indicate the following significance levels: * 0.1, ** 0.05 and *** 0.01.

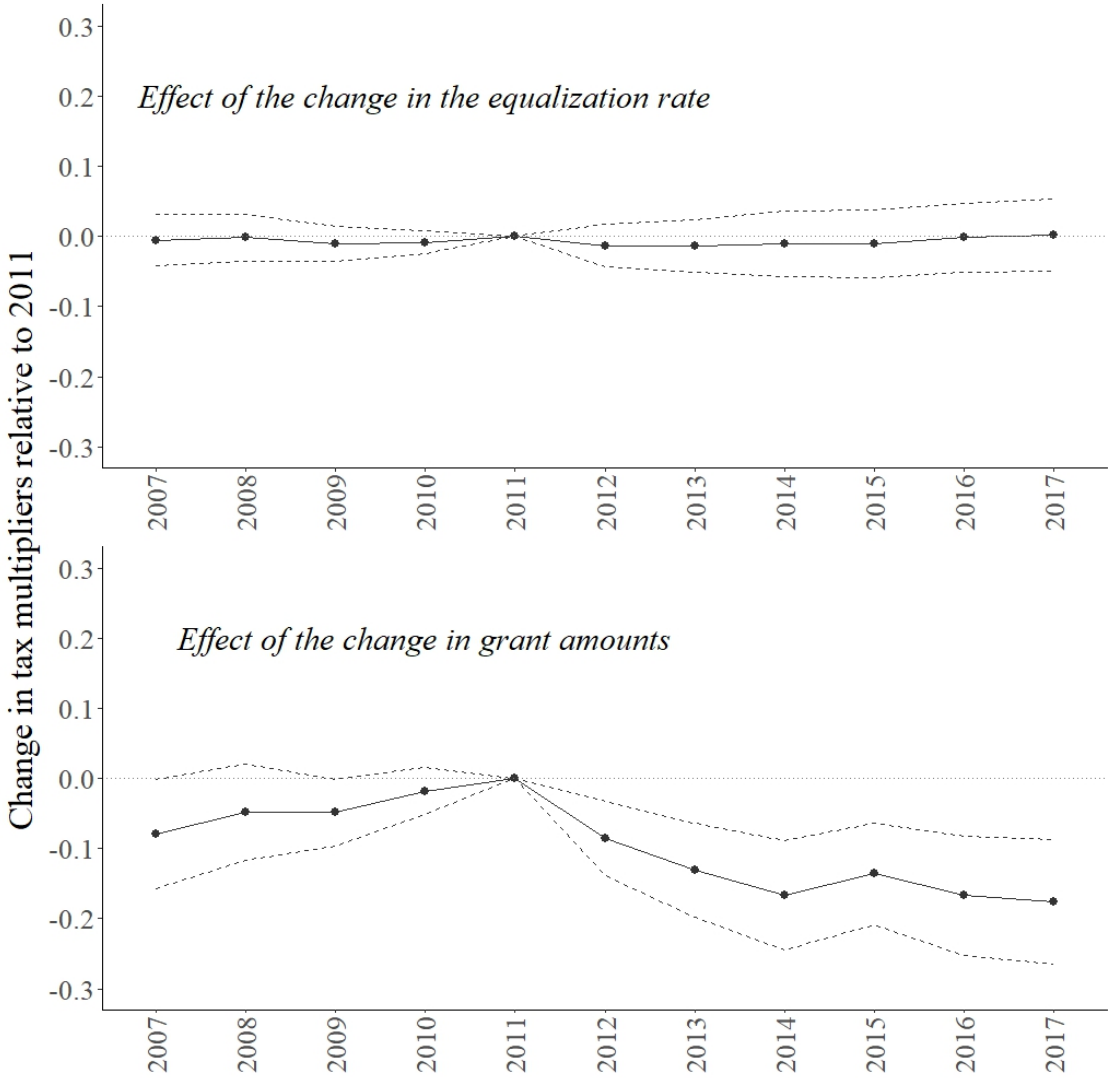
associated with a 9-10 percentage-point decrease in the local tax multiplier. Taking the average municipality, this is equivalent to a 7% decrease in tax revenues. When including both treatments together, the estimated coefficients suggest that local governments' tax multipliers responded to the change in transfer sums but not to the variation in the equalization rate. This result is robust to the inclusion of time-varying control variables, including relative tax base level, shown in the last columns (7) and (8).

To investigate how the reform dynamically impacted local taxes, we estimate the following regression equation:

$$\tau_{it} = \Lambda_i + \Gamma_t + \sum_{j \neq 2011} \beta_1^j (\Delta\alpha_i \times I\{\text{year}_t = j\}) + \beta_2^j (\Delta T_i \times I\{\text{year}_t = j\}) + \epsilon_{it}, \qquad (4.1)$$

where $I\{\text{year}_t = j\}$ is an indicator function taking the value 1 for year j (with 2011 as the reference period). Λ_i and Γ_t are municipality and year fixed effects. Coefficients β_1^j and β_2^j measure how the change in equalization rate and in transfer sums linked to the 2012 reform impacted municipal tax multipliers of municipalities. The estimates from equation (4.1) are graphically displayed in Figure 4. The upper graph shows the coefficients on the change in the equalization rate $\Delta\alpha_i$, while the bottom graph shows the coefficients on the change in transfer sums ΔT_i due to the reform. In the years before and after the reform, no effect of the change in the equalization rate on tax multipliers is detected. The bottom graph however shows that local taxes responded immediately from 2012 on to the change

Figure 4: Tax multiplier responses to income and incentive effects



Notes: These figures plot estimated coefficients and 95% confidence intervals derived from equation (4.1). The above plot shows the effect of $\Delta\alpha_i$ (coefficients β_1^j for $j = 2007, ..., 2017$), while the bottom plot shows the effect of ΔT_i (coefficients β_2^j for $j = 2007, ..., 2017$). 2011 is used as reference year. Standard errors are clustered at the municipal level. # of observations: 3575.

in transfer volumes. The evolution of tax multipliers exhibits a slight inverted-v shape, but there is no sign of significant pre-trends.

Overall, our baseline results suggest that local governments did not respond to the change in the equalization rate, but adapted their tax multipliers to the change in transfer volumes associated to the new law. We hence find evidence of an income effect on local taxes generated by the reform, but no incentive effect linked to the change in equalization rates is observed. This is somewhat surprising in light of the relatively large increase in the equalization rate due to the reform: 12 percentage points, equivalent to a 48% increase, or 75 percentage points, equivalent to a tripling of the previous equalization

rate. Furthermore, previous empirical literature at the local level has provided some evidence of – albeit small – tax responses to changes in equalization rates (Egger et al., 2010; Miyazaki, 2020).

In what follows, we test the robustness of the main results, and then explore potential heterogeneity in the observed tax responses. In section 4.4 we then discuss a plausible explanation as to why our baseline results do not show evidence of an incentive effect by relating our empirical setting to recent existing literature.

4.2 Robustness checks

Table 3 shows the estimation results of different robustness checks. We first of all address two potential measurement issues related to treatment $\Delta\alpha_i$ in Panel A and B. Our approach to capture the incentive effect is to examine the equalization rate. Another alternative approach is to look more generally at the degree of redistribution of the equalization system. The latter can notably be measured through the "equalization base effect", can be defined as the overall revenues change (tax and transfers revenues) with a small increase in the local tax base (see e.g. Dahlby and Warren, 2003; Buettner and Krause, 2020). This measure essentially scales the equalization rate by the ratio between the standardized and actual local tax multiplier.[27] We compute the equalization base effect by replicating the procedure we used for our baseline treatments – that is, keeping the relevant input variables fixed to the 2011 level and only letting the reform changes apply. The resulting equalization base effect treatment is shown in Figure A.1.3. For ease of interpretation, we discretize the measure into a positive and a negative equalization base effect. Results on this variable are shown in Panel A. Across all specifications, the coefficients on positive and negative base effects are not statistically significant. The estimates on ΔT_i are qualitatively unchanged compared to the baseline. Furthermore, we estimate equation (3.1) restricting the sample to municipalities that always or never received minimum-endowment transfers in Panel B. This allows to compare municipalities with a permanent increase in the equalization rate due to the 2012 reform to municipalities with no change over the whole sample period. Results in Table 3 Panel B are qualitatively the same as the baseline results: no statistically significant effect of the change in equalization rates. Coefficients on the change in transfers are however stronger than those of the baseline sample.

We now examine potential issues related to simultaneous rule changes in the intergovernmental grants' system. In Panel C, we estimate the baseline regression equation (3.1) on a subsample of municipalities which did not contribute to the so-called centrality grants.

[27] The equalization base effect is computed as follows. Let $k_{i,t}$ be the comprehensive non-standardized tax base of municipality i averaged over the previous three years, and $\bar{\tau}$ the unique standardizing rate. We follow Buettner and Krause (2020) and define the equalization base effect for year t as $-\frac{\partial T^{CE}_{i,t}}{\partial B_{i,t}} \frac{\partial B_{i,t}}{\partial k_{i,t}} \frac{1}{\tau_{i,t}}$. Plugging in equation (2.2) and noting that $\frac{\partial B_{i,t}}{\partial k_{i,t}} = \bar{\tau}$, this gives $\alpha_{i,t} \frac{\bar{\tau}}{\tau_{i,t}}$.

Table 3: Robustness regression results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Equalization base effect								
Negative base effect × after	−0.008	−0.002			0.004	0.008	0.000	0.010
	(0.012)	(0.009)			(0.013)	(0.010)	(0.013)	(0.010)
Positive base effect × after	−0.002	−0.010			0.005	−0.004	−0.001	−0.005
	(0.018)	(0.013)			(0.018)	(0.013)	(0.018)	(0.013)
Δ Transfers × after			−0.104**	−0.088**	−0.109**	−0.096**	−0.106**	−0.111***
			(0.041)	(0.035)	(0.044)	(0.037)	(0.045)	(0.036)
# of observations	3575	3575	3575	3575	3575	3575	3575	3575
Panel B: Permanent $\Delta\alpha_i$								
Δ Equalization rate × after	−0.016	0.021			−0.077	−0.017	−0.065	−0.008
	(0.055)	(0.027)			(0.061)	(0.031)	(0.060)	(0.030)
Δ Transfers × after			−0.155***	−0.104***	−0.173***	−0.108**	−0.165***	−0.118***
			(0.053)	(0.039)	(0.059)	(0.042)	(0.061)	(0.041)
# of observations	2486	2486	2486	2486	2486	2486	2486	2486
Panel C: No centrality grants contrib.								
Δ Equalization rate × after	0.001	−0.012			−0.004	−0.017	−0.007	−0.020
	(0.024)	(0.019)			(0.025)	(0.019)	(0.023)	(0.018)
Δ Transfers × after			−0.109**	−0.097***	−0.109**	−0.100***	−0.118**	−0.116***
			(0.043)	(0.036)	(0.044)	(0.037)	(0.046)	(0.036)
# of observations	3003	3003	3003	3003	3003	3003	3003	3003
Panel D: No post 2013 years								
Δ Equalization rate × after	−0.006	−0.005			−0.008	−0.009	−0.013	−0.011
	(0.021)	(0.018)			(0.021)	(0.018)	(0.020)	(0.018)
Δ Transfers × after			−0.068*	−0.124***	−0.069*	−0.125***	−0.074**	−0.129***
			(0.036)	(0.035)	(0.037)	(0.035)	(0.037)	(0.033)
# of observations	2275	2275	2275	2275	2275	2275	2275	2275
Panel E: Discretized $\Delta\alpha_i$ and ΔT_i								
Δ Equalization rate (high) × after	0.007	0.000			−0.011	−0.016	−0.008	−0.018*
	(0.011)	(0.009)			(0.013)	(0.011)	(0.013)	(0.010)
Δ Transfers (medium low) × after			−0.020	−0.029**	−0.020	−0.029**	−0.029*	−0.031**
			(0.016)	(0.012)	(0.016)	(0.012)	(0.016)	(0.012)
Δ Transfers (medium high) × after			−0.039**	−0.043***	−0.042**	−0.048***	−0.050***	−0.051***
			(0.017)	(0.013)	(0.017)	(0.013)	(0.017)	(0.013)
Δ Transfers (high) × after			−0.049***	−0.043***	−0.054***	−0.052***	−0.058***	−0.055***
			(0.018)	(0.013)	(0.021)	(0.015)	(0.020)	(0.015)
# of observations	3575	3575	3575	3575	3575	3575	3575	3575
Time-varying controls	no	no	no	no	no	no	yes	yes
Municipality-specific linear time trends	no	yes	no	yes	no	yes	no	yes
Municipality fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes

Notes: This table reports different robustness estimation results. Panel A shows results when considering the *equalization base effect* instead of the equalization rate. Panel B considers a restricted sample made of municipalities which either never or always received minimum endowment grants throughout the sample period. Panel C removes jurisdictions which were contributors of so-called centrality grants. Panel D shows the estimates of (3.1) without years after 2013. Panel E presents estimated coefficients for binary treatment $\Delta\alpha_i$ and a multi-valued ΔT_i. "Δ Equalization rate (high)" corresponds to municipalities with $\Delta\alpha_i > 0$. Treatment "Δ Transfers" is separated into quartiles, taking the lowest as reference group. Odd columns include municipality and year fixed effects. Pair columns additionally include municipality-specific linear time trends. Time varying controls include relative tax base level, population, population shares over (under) 65 (19), productive density, share of foreigners, housing vacancy rate. Standard errors are clustered at the municipal level. Stars indicate the following significance levels: * 0.1, ** 0.05 and *** 0.01.

The results are qualitatively the same as what is shown in Table 2. Furthermore, in Panel D we omit all years after 2013 to verify whether our estimates are driven by the correc-

tion in transfer volumes of the cost-sharing arrangements that occurred in 2014 (Ecoplan, 2017). Coefficients across all specifications are lower than in the baseline, but estimates are however larger in regressions with municipality-specific time-trends. This is unsurprising given the slightly inverted-v shaped trend shown by the evolution of tax multipliers in the bottom plot of Figure 4. Overall, results presented in panels C and D suggest that the smaller changes in other grants due to the reform do not explain our baseline results. Finally, Panel D shows the estimation results with binary $\Delta\alpha_i$ and ΔT_i discretized into 4 groups (by quartile). Both treatments use the lowest value as comparison group. The coefficient estimates on the high change in the equalization rate is qualitatively unchanged compared to the baseline. Coefficients on the different treatment intensities of the change in grant sums exhibit meaningful variation. Across all specifications, the magnitudes of the coefficients are slightly bigger (in absolute value) for higher intensities. An increase in treatment value from 'low' to 'medium low' means a 2-3 percentage point decrease in the tax multiplier, while an increase from 'low' to 'medium high' or 'high' yields a 4-5 percentage point decrease in the tax multiplier. This result tells us that there is seemingly some treatment effect heterogeneity, especially between the 'medium low' and 'medium high'/'high' treatments. The relatively small differences in coefficient values between intensities however suggest that treatment effect heterogeneity is of limited importance in our analysis.

4.3 Extension: the heterogeneity of tax responses

As a final empirical exercise, we exploit the large diversity present at the Swiss local level to examine heterogeneity in tax responses to the incentive and income effects created by the reform. We analyze three main potential sources of heterogeneity.

Firstly, political preferences and attitudes towards tax competition have notably been shown to influence tax reaction functions and more generally fiscal policy adjustments (Lago-Penas, 2008; Baekgaard and Kjaergaard, 2016; Liu, 2016; Eugster and Parchet, 2019). It is therefore plausible that changes in the equalization rate or transfer sums might lead to different response magnitudes according to local preferences. Attitudes towards fiscal competition are measured using the share of 'yes' ballots per municipality from the so-called 'USR II' national vote of 2008 (*Unternehmenssteuerreform II*).[28] Given that local parliaments are documented as having an important role in tax-setting at the Swiss

[28]This vote was held due to an optional referendum triggered by left-wing parties and trade unions. An optional referendum takes place if 50'000 citizens entitled to vote or eight cantonal governments request it within 100 days of a federal law revision. The optional referendum constitutes together with the citizens' initiative the two main pillars of Swiss direct democracy. Usually, Swiss voters are requested to take part in public referenda up to 4 times a year (Braun, 2008). Further information can be found (in French and German) under https://www.admin.ch/gov/de/start/dokumentation/medienmitteilungen.msg-id-13430.html or https://swissvotes.ch/vote/531.00.

municipal level (Brülhart and Jametti, 2006), federal vote results can be seen as a relevant metric to gauge local and cantonal preferences (see e.g. Funk and Gathmann, 2013; Eugster and Parchet, 2019; Roth, 2020). Contentwise, the USR II was a reform of the federal tax law explicitly aiming at lowering corporate tax rates in Switzerland. The main arguments put forward by the proponents were that it would ease the fiscal conditions for SME's and increase the international competitiveness of Switzerland's tax system.[29] A representative follow-up survey notably reports that 70% of yes-voting participants thought that international tax competition forces Switzerland to constantly optimize its tax position (Hirter and Linder, 2008). Voting results from the USR II can therefore reasonably be used as a measure of how strongly mobile the tax base is perceived (or, analogously, how fierce tax competition is).[30] We interpret a high share of 'yes' ballots in a given municipality as indicating that its citizens have a strong perception of fiscal competition. The existing empirical evidence on tax competition and preferences shows that higher perception of tax competition is associated with stronger tax reaction functions (Liu, 2016; Agrawal et al., 2022). In light of these findings, we expect that municipalities with higher shares of 'yes' ballots to the USR II vote will generally have stronger responses to both the change in the equalization rate (more positive) and transfer sums (more negative).

Second, we also examine whether geographic characteristics play a role. Heterogeneous local conditions have been documented theoretically and empirically as leading to different fiscal outcomes (Wilson, 1991; Peralta and van Ypersele, 2005; Brülhart et al., 2015; Krapf and Staubli, 2024). In our empirical context, municipalities face very different topographic and geographic conditions – which can in turn limit how much leeway they have to increase or decrease taxes.[31] A municipality in a mountainous region with little exploitable land, for instance might be forced to set higher taxes. That jurisdiction might in turn be less responsive to a change in grants. We measure these constraints using the share of municipal area which is "unproductive" – meaning that it cannot be harvested

[29] An official communication of the federal council (i.e. the Swiss national executive organ) on the USR II for instance mentioned that "tax systems are in competition with each other. [...] [The reform] is therefore indispensable for a small country like Switzerland, which has to compensate for its natural handicaps to preserve its well-being and jobs." (Merz, 2007). On the other hand, the Swiss socialist party for instance argued that, as a result of the reform, "cantonal tax competition will pull the average [corporate tax rate] down further (e.g. Zug has announced a reduction in the partial tax rate from 70% to 50%, Nidwalden from 50% to 30%. Schwyz still taxes at 25%, Glarus even at 20%)" (SSP, 2007).

[30] The idea of perceived tax base mobility is consistent with the interpretation of Agrawal et al. (2022), who write that "the existence of strategic interactions in the presence of mobility relies on information available to the policymaker about mobility. If the policymaker believes the tax base is mobile, but it is not, strategic interactions may still arise. Similarly, if the tax base is mobile but politicians do not believe it to be so, then no reaction function will arise." (pages 66-67).

[31] The western and southern part is generally pre-alpine, hilly, or even mountainous. The north and middle part of the canton can be described as flat. The eastern part is located on the *Jura* hill range, which is made of many small valleys.

or exploited in any way, including to build. We expect local governments with higher geographic constraints to exhibit weaker responses to both treatments.

Finally, we also examine whether the composition of the tax base at the time of the reform played a role in the fiscal adjustments. Several empirical studies show that local tax rates are sensitive to the composition of the tax base (see e.g. Langenmayr and Simmler, 2021; Ly and Paty, 2020). Local governments might respond differently to incentives given the type of tax base their jurisdictions hosts. For this, we compute the ratio between corporate and personal income for each jurisdiction using 2011 federal-level tax data. Municipalities with above-median ratios of corporate to personal income are predicted to react more strongly to both treatments in light of the results from Langenmayr and Simmler, 2021; Ly and Paty, 2020 which show that a more mobile tax base is linked with lower taxes.

The three variables are transformed into indicators taking the value of one if their underlying value is above the median to avoid extrapolated coefficients.[32] Figure A.1.4 displays interesting spatial variation in the three dimensions we study. The variables are (sequentially) included in equation (3.1) as interactions with both treatments. Table 4 presents the regression results. Column (1) shows the baseline result with the two treatments. Columns (2)-(4) shows the estimates of the interaction with the shares of yes to USR II. Columns (5)-(7) considers the heterogeneity with respect to geographic constraints. Columns (8)-(10) present the interaction with the corporate to personal income ratio. Finally, columns (11)-(13) simultaneously include all three heterogeneity variables.

Panel A examines the heterogeneity of tax responses to the change in the equalization rate. Coefficients on the interaction between the change in the equalization rate and the share of 'yes' ballots of the USR II vote are positive and statistically significant across the different specifications – also when additionally including in the regression the share of unproductive land and the ratio of corporate to personal income in columns (11)-(13). Quantitatively, the estimates show that a one percentage point increase in the equalization rate is associated with an increase of around 0.04-0.12 percentage points in the local tax multiplier, depending on the specification. The negative and statistically significant coefficient on $\Delta\alpha_i$ for jurisdictions with below-median shares of 'yes' votes to USR II, shown in columns (2) to (4), becomes closer to zero and not statistically different from zero when controlling for the share of unproductive land and the 2011 ratio of corporate to income tax base. These results suggest that local governments with stronger perceptions of tax competition reacted in a stronger way to the change in the equalization rate.[33] In Appendix A.4, we additionally examine the differential evolution of tax multipliers between jurisdictions with above- and below-median votes to USR II. Our results show that

[32] The share of 'yes' ballots to USR II and the share of unproductive land are collected from the Swiss national statistical office. The former is unfortunately not available for 8 municipalities. The corporate to private income tax base ratio has been kindly provided by the Swiss federal tax administration.

[33] This result is in line with Liu (2016), who shows that countries with stronger preferences for economic development and tax competition are linked to stronger tax reaction functions.

municipalities with higher shares of 'yes' slowly but steadily increased their taxes from 2013 on as a response to the change in equalization rates. The estimates on the share of unproductive land exhibit the expected coefficient sign, but are not robust to the inclusion of municipality-specific linear time trends and time-varying covariates. The coefficients on the interaction of the change in the equalization rate with the ratio of corporate to personal income show a negative sign and are not statistically different from zero.
Panel B shows the heterogeneity in tax responses to the change in total transfer sums. In contrast to Panel A, the coefficients on the interactions of the change in transfers with the shares of yes to USR II are not significant, although they show the expected sign. Local governments with above-median shares of unproductive land show signs of stronger tax responses to an increase in the amount of transfers – although the results are statistically significant only when including time-varying controls. Our estimates on the interaction with the corporate to personal income ratio nonetheless seem to suggest that a higher composition of firms yields stronger tax cuts from a marginal increase in the grant sums. When included all together however, none of the different interactions are statistically significant. More generally, evidence shown in Panel B does not suggest strong heterogeneity in tax responses to an income effect.

4.4 Discussion

The previous set of empirical results has shown that local jurisdictions in the canton of Bern have adjusted their local taxes as a response to the budget shift associated to the new rules. Their fiscal policy has however – for most jurisdictions – remained unaffected by the change in equalization rates. Evidence of an income effect is reasonably robust, and in line with previous literature examining municipal adjustments to budget shifts.[34,35] Our results however provide only mitigated support for an incentive effect. On average, the change in equalization rates has not affected local taxes. For municipalities with above-median share of 'yes' votes in USR II, we nonetheless find 0.04 to 0.12 percentage point increases in local taxes to a one percentage point increase in the equalization rate. This is a plausible range of magnitudes compared to studies closest to ours. Egger et al. (2010),

[34]In the Swiss context, Berset and Schelker (2020) for instance find tax revenue cuts from a "transfer windfall" of around 3%. Helm and Stuhler (forthcoming) on the other hand find municipal business tax and property tax cuts associated to a change in grants – due to an exogenous shock to an underlying parameter of the German municipal level equalization schemes – which imply that municipalities cut tax revenues around 11-16% in response to an increase in grants after 10–15 years. The 7% decrease in tax revenues implied by our estimates for the average municipality yielded by the reform hence seems plausible.

[35]It is worth noting that we do not find evidence of a "flypaper effect", whereby the change in transfers would translate into more public expenditure compared to an increase in private income through lower taxes. When applying our baseline analysis to public expenditure, we do not find significant and robust results on either treatment.

find local business tax rates decreases of 0.04 percentage-points for a 1 percentage-point decrease in the equalization rate, which is very close to the increase in additional corporate taxes found for Japanese municipalities in Miyazaki (2020). Given the relatively strong increase in the equalization rate and the plausibly sound quasi-experimental setting provided by the 2012 FILAG reform, it is nevertheless surprising that a more generalized incentive effect is not observed in our study. What explains this contrasting result?

Two institutional factors together provide a reasonable explanation. Firstly, this paper's analysis examines a tax instrument set on a broad tax base, overwhelmingly made of personal income and wealth (around 80% of tax revenues on average).[36] Close studies looking at effects of equalization rates at the local level however examined corporate taxes (Egger et al., 2010; Miyazaki, 2020). While estimates of personal income tax base elasticities lie between -0.1 to -0.4 (see Saez and Giertz, 2012, for an overview), corporate tax base elasticities are estimated to be up to two to four times bigger than that: between -0.75 and -0.8 (see e.g. Riedl and Rocha-Akis, 2012; Krapf and Staubli, 2024). The relatively low tax base mobility of personal income tax bases therefore could explain the lack of unambiguous evidence for an incentive effect in our study; if most jurisdictions face a tax base with low mobility, a change in the equalization rate – which shields local governments further from the consequences of mobility – might remain unnoticed. Furthermore, the results from the heterogeneity analysis suggest that "perceived" mobility is also important. Those jurisdictions with higher perception of tax competition and tax base mobility have slowly and steadily increased their taxes as a response to the equalization rate hike. Tax base mobility (and the awareness of it) can therefore be understood as a crucial factor in tax responses to the incentive effect.

Secondly, we base our identification of the incentive effect on an exogenous change in the equalization rate. This variable is however arguably not very conspicuous to local policymakers – in particular due to the numerous grant rules and their potential complexity.[37] In the existing literature on incentive effects of equalization grants at the local level, studies which investigate equalization rates have systematically found lower tax responses than other papers focusing on different equalization parameters or measures of redistribution. These differences could be attributed to the salience of the parameter examined within the equalization system. Rauch and Hummel (2016) and Holm-Hadulla (2020) for instance examine the impact of "standardized rates", which are parameters used to com-

[36] Even though Switzerland is considered to lead the OECD countries with respect to the share of tax revenues generated by the personal wealth tax, it only accounts for around 3.5% of all tax revenues (Brülhart and Schmidheiny, 2018).

[37] This is consistent with an official survey of the municipal policymakers commissioned by the canton (Ecoplan, 2017). The results of this survey suggest that local policymakers consider that the lack of transparency in the capacity equalization comes from the minimum endowment transfer mechanism. The respondents also mention that, although they have access to an official spreadsheet to help calculations, this tool is difficult to understand due to complexity of the different grant formulas.

pute fiscal capacity, on local business taxes in Germany (the municipal *Gewerbesteuer*). The authors respectively find tax increases of around 0.4-0.6 percentage points to a one percentage-point increase in standardized tax rate, and an elasticity of around 0.3. These magnitudes are notably higher than in the paper of Egger et al. (2010), who find an elasticity of the local business tax to the equalization rate of around 0.011 (equivalent to a 0.04 percentage-point change). Rauch and Hummel (2016) justify the strong responses they observe by the fact that "standard tax multipliers provide an easy-to-read signal to local policymakers. [...] In contrast to changes in eligibility criteria, adjustment levels, or marginal contributions rates, which may also influence local tax multipliers as shown in the previous literature, standard tax multipliers have the same magnitude as actual multipliers." (Rauch and Hummel, 2016, p. 913).[38] In comparison, equalization rates are arguably less easily identifiable to local policymakers. The mitigated evidence of an incentive effect in this study might hence also be linked to the limited salience of the equalization rates.

[38] Baskaran (2021) also mentions that the salience of standardized rates allows local politicians to more easily introduce tax hikes by blaming the upper-level government's policies, which could explain the larger incentive effects observed in those studies.

Table 4: Heterogeneity regression results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Panel A: Incentive effect heterogeneity													
Δ Equalization rate × after	−0.003	−0.054*	−0.055***	−0.055***	0.043	0.008	0.007	0.020	−0.004	−0.005	−0.005	−0.033	−0.030
	(0.024)	(0.028)	(0.019)	(0.019)	(0.029)	(0.024)	(0.022)	(0.035)	(0.025)	(0.024)	(0.035)	(0.026)	(0.025)
Δ Equalization rate × after		0.135***	0.093**	0.089**							0.129***	0.091**	0.086**
× above median share of yes votes to USR II		(0.047)	(0.039)	(0.037)							(0.042)	(0.036)	(0.035)
Δ Equalization rate × after					−0.091**	−0.045	−0.050				−0.062	−0.029	−0.034
× above median share of unproductive land					(0.044)	(0.036)	(0.035)				(0.041)	(0.032)	(0.032)
Δ Equalization rate × after								−0.051	−0.023	−0.026	−0.034	−0.013	−0.014
× above median 2011 corp./pers. tax base								(0.047)	(0.036)	(0.035)	(0.039)	(0.032)	(0.032)
Δ Transfers × after	−0.105**	−0.103**	−0.083**	−0.099***	−0.096**	−0.088**	−0.104***	−0.111***	−0.094***	−0.109***	−0.099**	−0.086**	−0.104***
	(0.042)	(0.041)	(0.032)	(0.031)	(0.040)	(0.035)	(0.034)	(0.042)	(0.036)	(0.035)	(0.042)	(0.034)	(0.033)
Panel B: Income effect heterogeneity													
Δ Equalization rate × after	−0.003	0.005	−0.014	−0.016	0.003	−0.011	−0.014	0.000	−0.013	−0.015	0.011	−0.010	−0.012
	(0.024)	(0.024)	(0.019)	(0.018)	(0.022)	(0.018)	(0.018)	(0.024)	(0.018)	(0.018)	(0.022)	(0.019)	(0.018)
Δ Transfers × after	−0.105**	−0.045	−0.073	−0.086*	−0.098	−0.117*	−0.133**	−0.084*	−0.071*	−0.092**	−0.047	−0.107	−0.123*
	(0.042)	(0.047)	(0.045)	(0.045)	(0.070)	(0.068)	(0.065)	(0.051)	(0.042)	(0.041)	(0.086)	(0.069)	(0.068)
Δ Transfers × after		−0.097	−0.018	−0.022							−0.049	0.010	0.002
× above median share of yes votes to USR II		(0.074)	(0.066)	(0.063)							(0.078)	(0.062)	(0.061)
Δ Transfers × after					0.019	0.055	0.058				0.017	0.072	0.067
× above median share of unproductive land					(0.084)	(0.077)	(0.073)				(0.085)	(0.074)	(0.070)
Δ Transfers × after								−0.112	−0.093	−0.065	−0.106	−0.104	−0.076
× above median 2011 corp./pers. tax base								(0.080)	(0.074)	(0.074)	(0.085)	(0.075)	(0.075)
Time-varying controls	no	no	no	yes	no	no	yes	no	no	yes	no	no	yes
Municipality-specific linear time trends	no	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes
Municipality fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
# of observations	3575	3487	3487	3487	3575	3575	3575	3575	3575	3575	3487	3487	3487

Notes: This table reports different heterogeneity estimation results. Panel A shows results when considering the incentive effect, and Panel B the income effect. Column (1) shows our baseline results with no further interaction. Columns (2)-(4) examine how the incentive of income effect changes with the share of 'yes' ballots to the 2008 USR II reform. Columns (5)-(7) exhibit coefficients on the interaction of the treatments with the share of unproductive land. Columns (8)-(9) present estimates from the interaction of treatments with the ratio of corporate to private taxable income. Finally, columns (11)-(13) include all interactions simultaneously. Odd columns include municipality and year fixed effects. Pair columns additionally include municipality-specific linear time trends. Time varying controls include relative tax base level, population, share population over (under) 65 (19), productive density, share of foreigners, housing vacancy rate. Standard errors are clustered at the municipal level. Stars indicate the following significance levels: * 0.1, ** 0.05 and *** 0.01.

5. Summary and conclusion

This paper examined the tax responses of municipalities of the canton of Bern, Switzerland, to a revision of their inter-municipal transfers system. The reform entailed two main changes. On the one hand, the equalization rate of a capacity equalization system – which measures the rate of change of transfers for a small change in fiscal capacity – was increased for certain municipalities. On the other hand, the amendments of the formulas of the capacity equalization scheme as well as vertical canton-municipality transfers, dependent on socio-economic and geographic factors, led to changes in total transfer amounts. We exploited these rules changes to construct two treatment variables that plausibly identify the income effect created by the change in total transfer amounts, and the incentive effect associated to the increase in the equalization rate. Our approach follows a common procedure implemented in the literature investigating the incentive and income effects of intergovernmental grants. We calculate the change in equalization rates and total transfer amounts induced by the reform with the help of counterfactual equalization rates and transfer amounts by keeping relevant input variables (population, tax base) fixed to the last pre-reform period. These treatment variables were included in our regression models as multivalued/continuous treatments.

We found robust evidence that local tax multipliers responded to the budget shift created by the change in total transfer amounts. However, we did not find that tax rates responded to the change in equalization rates on average. Based on the current state of the empirical literature on incentive effects, we interpret the mitigated evidence of an incentive effect as due to a lower mobility of the tax base analyzed in our study and the limited salience of the equalization rate. Policy discussions on whether introducing or revising a given intergovernmental arrangement should hence finely acknowledge the institutional setting to evaluate the plausibility of induced behavioral adjustments.

An examination of the heterogeneity behind our baseline results moreover showed that municipalities with higher perception of tax competition – measured by the share of 'yes' ballots to a previous federal vote on corporate taxation – did respond to the change in equalization rates by increasing their taxes. Consistent with more recent empirical literature on tax competition, this result suggests that attitudes of local policymakers towards tax competition and their perception of tax base mobility might play a crucial role in how local governments respond to incentives created by intergovernmental grant schemes.

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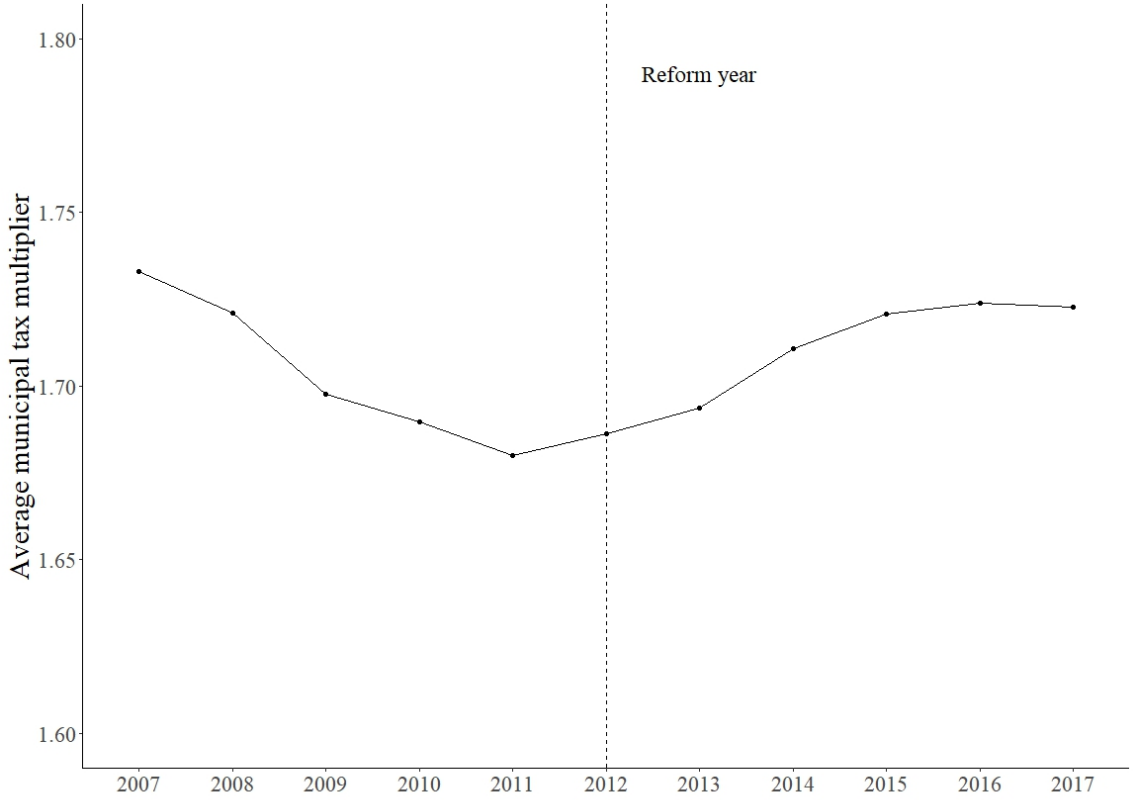
Appendix

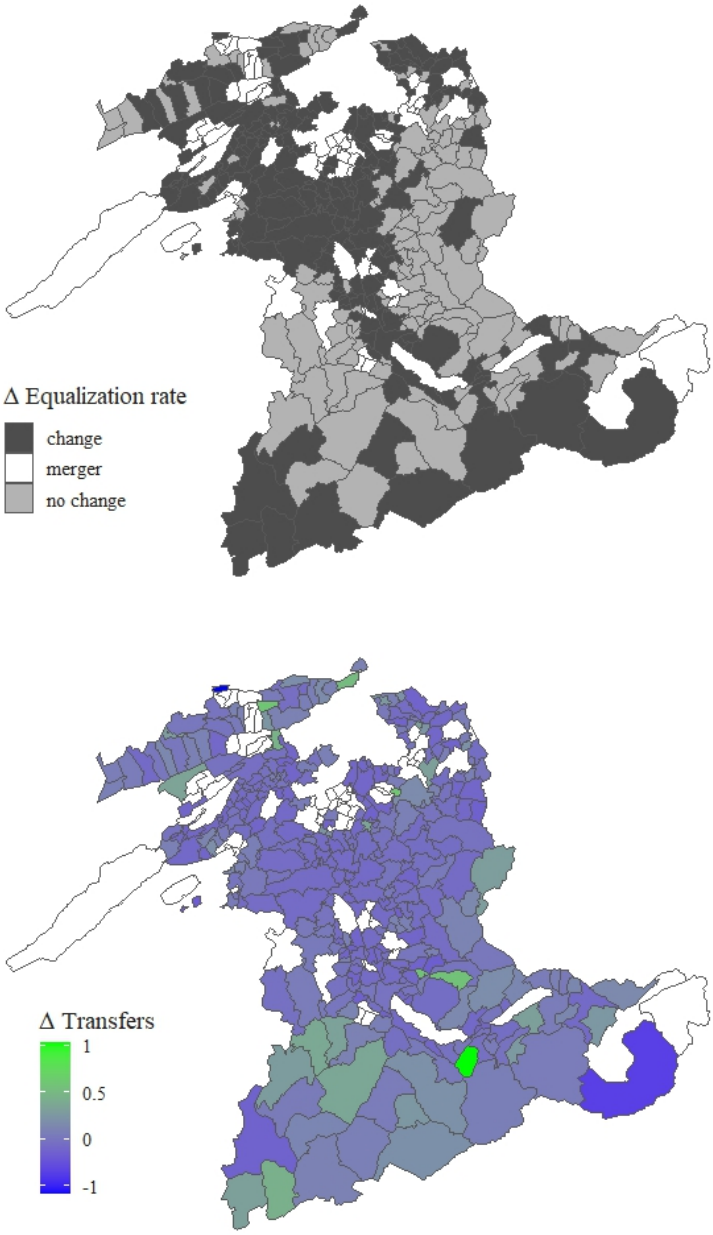
A.1 Supplementary figures

Figure A.1.1: Evolution of tax multipliers 2007 to 2017



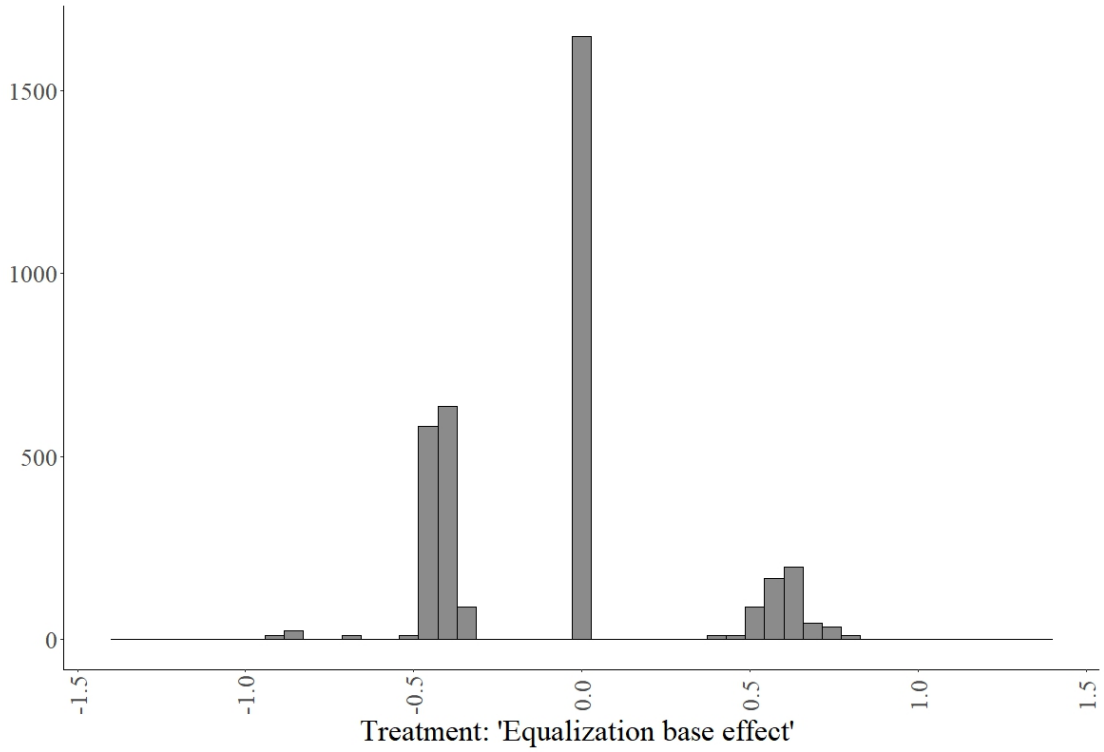
Note: This figure shows the evolution of the average municipal tax multiplier in our sample years 2007-2017. In 2012 the FILAG reform took place.

Figure A.1.2: Treatments among the municipalities of the canton of Bern



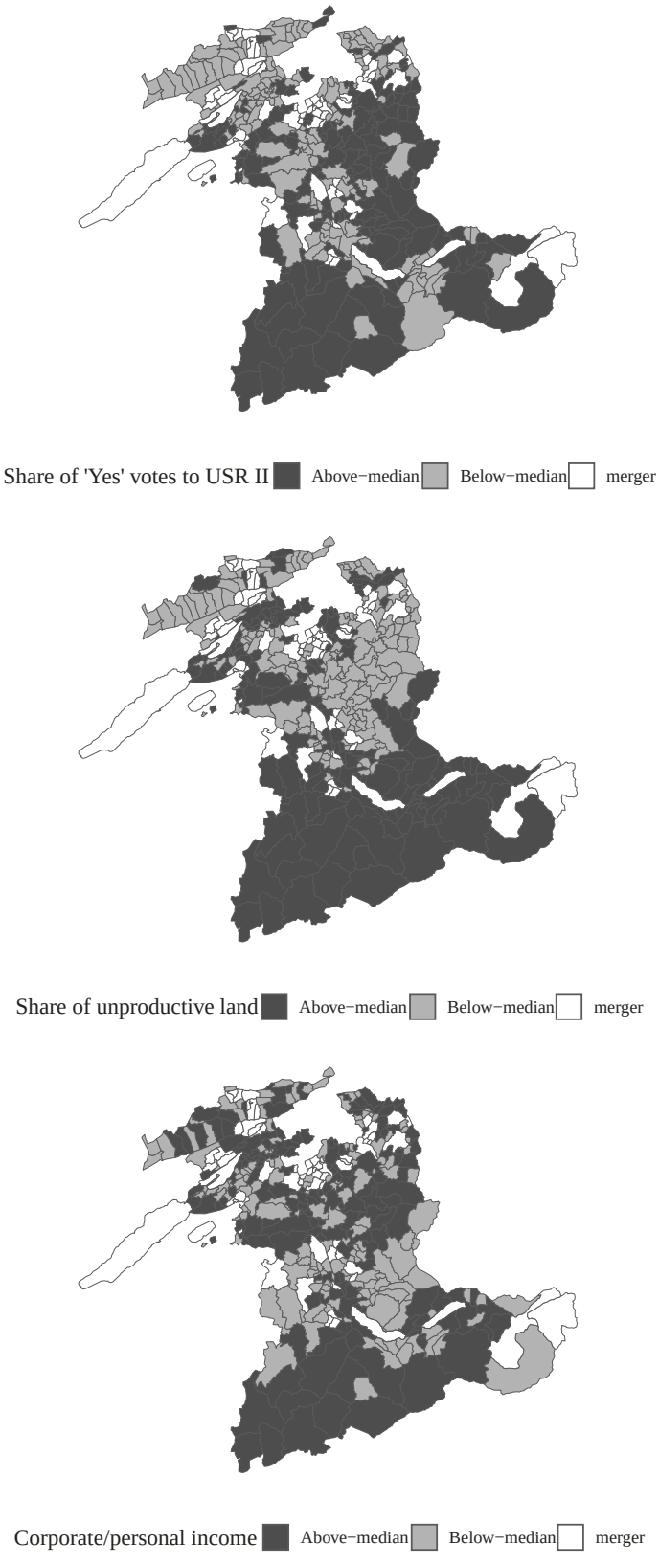
Note: This figure shows a map of the treatments' distribution across the 2012 municipalities of canton Bern. The upper map shows in black municipalities with a change in the equalization rate ($\Delta\alpha_i$) due to the law revision. The bottom map shows the values taken by the total change in transfer amounts (ΔT_i) in CHF per capita. Jurisdictions with no color are municipalities which merged during the sample years.

Figure A.1.3: Equalization base effect



Note: This figure shows the distribution of the "equalization base effect", which represents how municipal revenues change with a small increase in the local tax base. This measure is computed as $-\frac{\partial T^{CE}_{i,t}}{\partial B_{i,t}} \frac{\partial B_{i,t}}{\partial k_i} \frac{1}{\tau_{i,t}} = \alpha_{i,t} \frac{\bar{\tau}}{\tau_{i,t}}$, following Buettner and Krause (2020), where $k_{i,t}$ is the comprehensive non-standardized tax base of municipality i averaged over the previous three years, and $\bar{\tau}$ the unique standardizing rate.

Figure A.1.4: Maps of the municipalities of the canton of Bern



Note: This figure shows maps displaying the three heterogeneity dimensions analyzed in the paper. Jurisdictions with no color are municipalities which merged during the sample years.

A.2 Additional institutional details

Table A.2.1: Non-capacity equalization transfers

Pre-reform	
Centrality transfers	$0.25M^p \frac{B_i}{\sum_k^K B_k} < 0$
Geo-topographic grants	$M^a \max\{\frac{p_i(a_i - 0.8a^*)}{\sum_j p_j(a_j - 0.8a^*)}, 0\} + M^s \max\{\frac{p_i(s_i - 0.8s^*)}{\sum_j p_j(s_j - 0.8s^*)}, 0\} \geq 0$
Cost-sharing transfers	
School	$M^{\text{teachers}}(0.3\frac{\text{pupils}_i}{\sum_j \text{pupils}_j} + 0.5\frac{\text{p}_i}{\sum_j \text{p}_j} + 0.2\frac{\text{classes}_i}{\sum_j \text{classes}_j}) < 0$
Social help	$M^{\text{social help}} \frac{p_i}{\sum_j p_j} < 0$
Social ins. & Family	$M^{\text{social insurance}} \frac{p_i}{\sum_j p_j} + M^{\text{family}} \frac{p_i}{\sum_j p_j} < 0$
Public transp.	$M^{\text{public transport}}(0.67\frac{\text{stops}_i}{\sum_j \text{stops}_j} + 0.33\frac{p_i}{\sum_j p_j}) < 0$
Post-reform	
Socio-demographic grants	$M^{soc} \frac{I_i^{\text{social}}}{\sum_j I_j^{\text{social}}} \geq 0$
Geo-topographic grants	$\max\{0.5M^a \frac{p_i(a_i - 0.8a^*)}{\sum_j p_j(a_j - 0.8a^*)} + 0.5M^s \frac{p_i(s_i - 0.8s^*)}{\sum_j p_j(s_j - 0.8s^*)}, 1200p_i\} \geq 0$
Cost-sharing transfers	
School	$M^{\text{teachers}} \frac{\text{full-times}_i}{\sum_j \text{full-times}_j} + T^{\text{pupils}}(\text{pupils}_i, I^{\text{schools-social}}, I^{\text{schools-geo}}) < 0$
Social help	$M^{\text{social help}} \frac{p_i}{\sum_j p_j} < 0$
Social ins. & Family	$M^{\text{social insurance}} \frac{p_i}{\sum_j p_j} + M^{\text{family}} \frac{p_i}{\sum_j p_j} < 0$
Public transp.	$M^{\text{public transport}}(0.67\frac{\text{stops}_i}{\sum_j \text{stops}_j} + 0.33\frac{p_i}{\sum_j p_j}) < 0$
New division of tasks	$M^{\text{to canton}} \frac{p_i}{\sum_j p_j} + M^{\text{to municipality}} \frac{p_i}{\sum_j p_j} < 0$

Notes: This table lists all transfers which are not part of the capacity equalization scheme. Variables M designate sums in CHF which are invoiced (or distributed) to local governments according to the relevant socio-economic variable in the formula. p_i represents local population of i, a_i the total municipal area (a^* its median), s_i the total municipal streets length (s^* its median), pupils_i the number of pupils in primary and secondary school registered, classes_i the number of primary and secondary school classes, full-times_i the number of full-time equaivalent teachers, and stops_i the number of public transportation stops within the territory of i. I^{social} is an index of socio-economic characteristics. $I^{\text{schools-social}}$ and $I^{\text{schools-geo}}$ are indexes measuring the number of pupils, weighted by some additional socio-economic or geographic factors respectively.

In addition to the fiscal capacity equalization system, the intergovernmental grant system also includes two other broader categories of transfers : a set of grants aiming compensating heterogeneous "structural" conditions in revenue raising ability across municipalities, and a number of cost-sharing transfers. The goal of the former is to ensure that geographic, topographic and socio-demographic characteristics do not impair the provision of public

services. The role of the latter is to portion the financial burden of certain public services, formally shared between levels of government. All these grants are non-earmarked and do not depend on expenditure of municipalities.

Table A.2.1 lists all grants which are not part of the fiscal capacity equalization scheme. In the following, I briefly describe each transfer, its formula and how it was impacted by the 2012 law revision.[39] So-called *centrality* grants redistribute funds from municipalities located in the agglomeration of bigger towns (Bern, Thun and Biel) towards the center municipality of the agglomeration in order to compensate spillovers. A given amount M^p, decided by the canton, is funded by municipalities of the agglomeration according to their relative fiscal capacity compared to the total fiscal capacity of all K municipalities within the agglomeration. For those jurisdictions paying centrality transfers, the transfer volume represents on average around 2% of total municipal tax revenues. This category is removed with the 2012 reform and replaced by a grant compensating for differences in socio-demographic characteristics ("Socio-demographic grants" in Table A.2.1). Its amount for municipality i depends on the sum M^{soc} chosen by the cantonal government, and an index of socio-economic measures I_i^{social} (which is in turn a function of the number of foreign nationals, unemployed, old-age benefits recipients, and inhabitants). *Geo-topographic grants* compensate the geographic-topographic differences of local jurisdictions. Before 2012, municipalities are eligible for such transfers if their total per capita municipal area a_i (per capita street length s_i) is bigger than 80% of the median total per capita municipal area a^* (street length s^*), and if their tax multiplier is strictly bigger than the median tax multiplier. If these conditions are met, sums M^a and M^s, which are chosen by the canton, are distributed among the eligible recipient jurisdictions according to the relative difference in total per capita municipal area (street length) with 80% of the median. The 2012 law revision removed the conditionality of these grants on the local tax multiplier, set different weights on both grants, and added a ceiling of 1200 Swiss Francs per capita. Put together, geo-topographic and socio-demographic transfers represent around 2% of total municipal tax revenues (both before and after 2012).

The intergovernmental transfers system also includes a cost-sharing scheme, first introduced in 2002. For every cost-sharing transfer, a sum M to be "invoiced" to all municipalities is determined as a fixed percentage of total cantonal expenditure in that domain. The cost-sharing mechanism then allows the canton to "send a bill" to the local governments so that they financially participate. How much municipality i contributes then depends on one or more socio-economic variables. The costs of primary and secondary school teachers' salaries are distributed across jurisdictions mainly according to the number of pupils, of classes offered, and of inhabitants. The pre-reform system is a weighted average of those socio-economic variables. The post-reform scheme introduced a more

[39] For further details, official reports in German can be found under https://www.fin.be.ch/de/start/themen/Finanzen/FinanzundLastenausgleich/erfolgskontrollen-filag.html.

complex set of rules. The share of the sum M^{teachers} paid by i depends on the number of "full-time" equivalent employed teachers in the classes. Furthermore, this amount is diminished by a grant paid to the municipality dependent on the number of pupils and two indexes mirroring the socio-economic composition of the municipality and its geographic location.[40] The sums designated by the canton for cost-sharing of social help, social insurance, family allowances and public transportation are distributed across local governments according to population and/or the number of public transportation stops.
Finally, the 2012 law-revision also included a small revision of task division between the layers of government (certain expenses related to child-protection, to old-age services and to social help are switched from municipalities to canton, while certain expenses of youth services are delegated to municipalities). To compensate the canton and municipalities for these additional or fewer expenditures, the reform adds a transfer matching this difference associated to the new rules. This transfer persisted in years 2012-2017, and represents on average a bit less than 4% of the average municipal tax revenues.

A.3 Identification check: did the abolishing of conditional transfers influence taxation incentives?

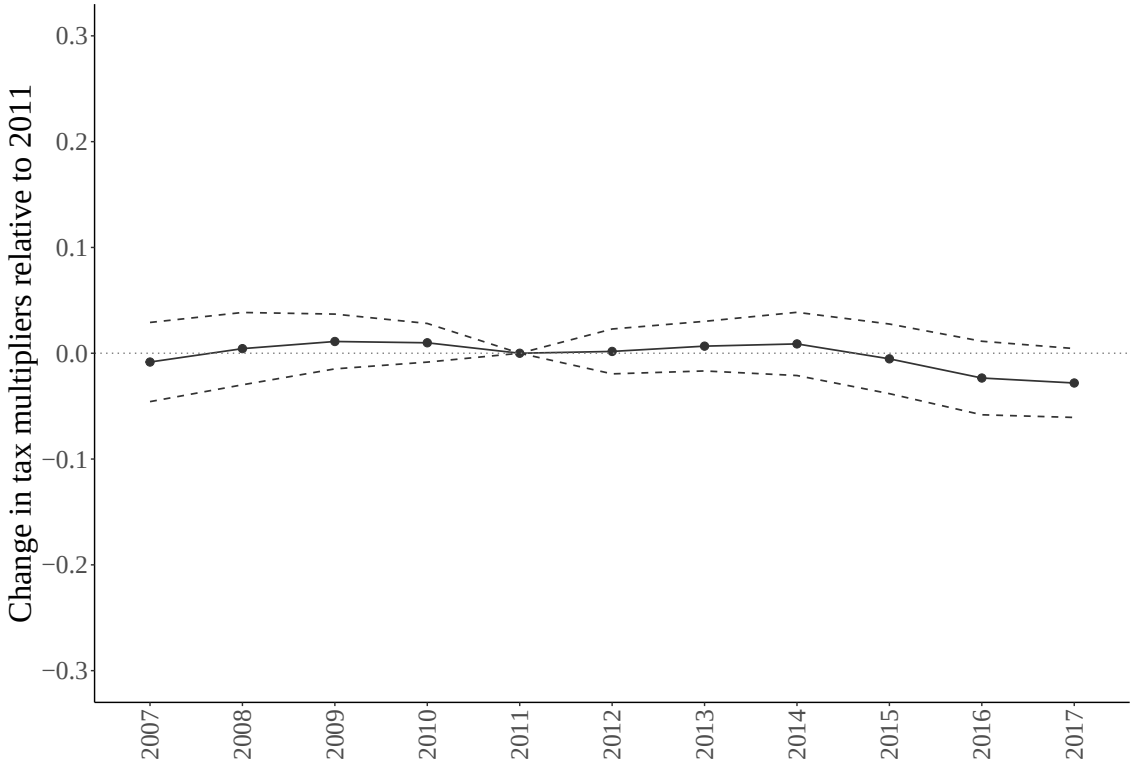
The reform of 2012 removed the conditionality on the tax multiplier for geo-topographic grants. These transfers were, before 2012, conditional on the tax multiplier being above 110% of the average and either the road length per-capita or the total surface of the municipality per capita above 80% of median levels. In order to test whether the abolishing of the conditional nature of these transfers affected the tax-setting incentives of municipalities, we conduct an event-study type of approach on municipalities with treatment $\Delta\alpha = 0$, i.e. which did not see a change in their faced equalization rate. We create two subgroups within this set of municipalities: those who received the class of transfers conditional on the tax multiplier in 2011, and those who did not. The effect of the removal of this class of conditional transfers is estimated using the following equation:

$$\begin{aligned}\tau_{i,t} = \mu_t + \zeta_i + & \\ \sum_{j \neq 2011} & \varphi^j(I\{i \text{ received geo-topo. grants in } 2011\} \times I\{\text{year}_t = j\}) \\ + \beta^j(\Delta T \times I\{\text{year}_t = j\}) & + \eta_{i,t},\end{aligned} \tag{A.31}$$

where $\tau_{i,t}$ is the local tax multiplier, μ_t and ζ_i municipality and year fixed effects, φ^j are "lead" and "lag" coefficients on the interaction between an indicator function taking 1 for municipalities that received geo-topogaphic grants in 2011 and respectively indicator functions taking 1 for pre-reform years $j = 2007, ..., 2010, 2012, ..., 2017$. Year 2011 is used

[40] The exact construction of these indexes can be found in the official legal documents (in French and German): https://www.lexfind.ch/fe/fr/tol/20650/versions/110596/de.

Figure A.3.1: Robustness: conditional transfers



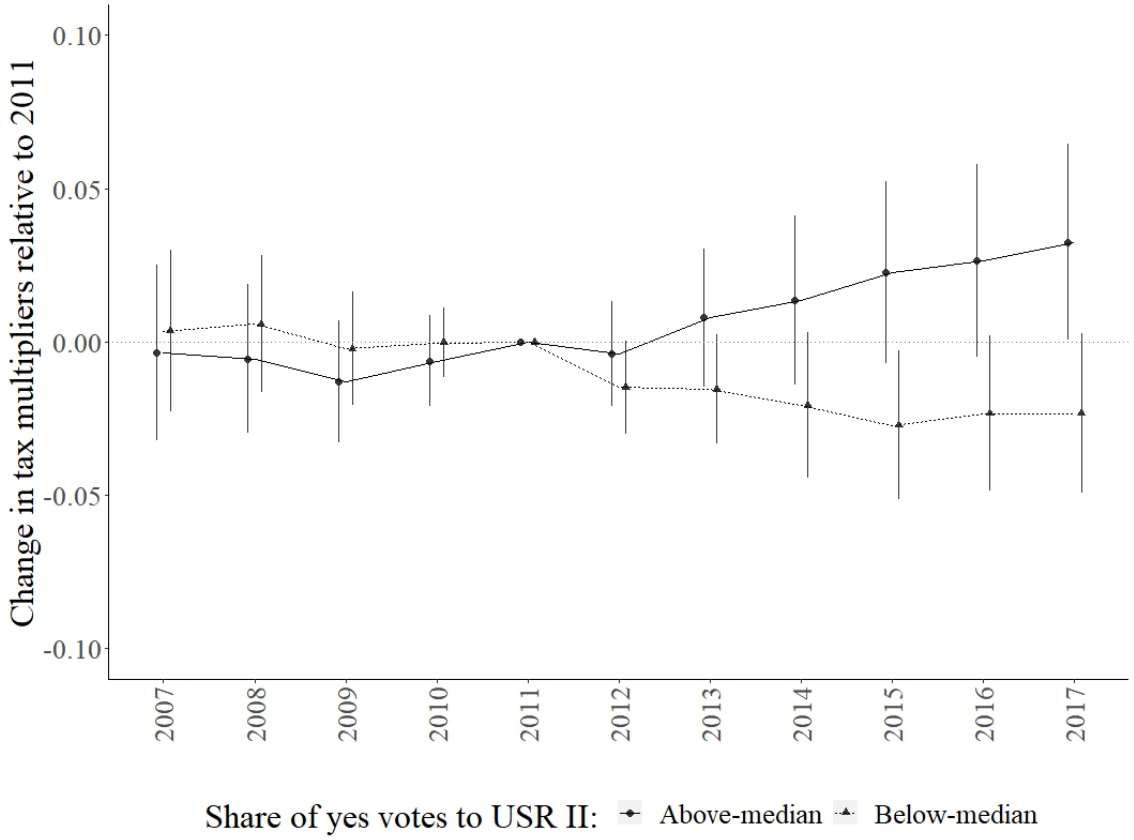
Note: Note: This figure displays the estimated coefficients and 95% confidence intervals derived from equation (A.31). Standard errors are clustered at the municipality level.

as the reference. $\eta_{i,t}$ is the error term.

Figure (A.3.1) reports the estimated coefficients. For all sample years, the two subgroups of municipalities cannot be statistically differentiated from another. Years 2016 and 2017 show a decrease in taxes of municipalities who received transfers at least once compared to those who never received conditional transfers. This suggests that the removal of the conditional nature of this class of transfers had little effect on tax-setting incentives of municipalities.

A.4 Tax responses and local preferences: dynamic effects

Figure A.4.1: Tax multiplier responses to a change in the equalization rate according to 'yes' ballots during the USR II vote



Notes: This figure plots the estimated coefficients and 95% confidence intervals derived from equation (A.41). 2011 is used as reference year. Standard errors are clustered at the municipal level. # of observations: 3575.

To investigate the dynamics behind our results on the interaction of $\Delta\alpha_i$ with the share of yes to USR II (shown in Table 4), we estimate the following regression equation:

$$\tau_{it} = \nu_i + \mu_t + \sum_{j \neq 2011} \beta_1^{j,l} D_{it}^l \times I\{\text{year}_t = j\} + \beta_1^{j,h} D_{it}^h \times I\{\text{year}_t = j\} + \beta_2^j \Delta T \times I\{\text{year}_t = j\} + \varepsilon_{it}, \tag{A.41}$$

where D_{it}^l is an indicator function taking the value 1 for municipalities which have a positive change in the equalization rate (i.e. $\Delta\alpha_i > 0$) and have below-median share of 'yes' ballots to USR II. Conversely, D_{it}^h is an indicator function taking the value 1 for municipalities which have a positive change in the equalization rate and above-median share of 'yes' ballots to USR II. ν_i and μ_t are municipality and year fixed effects. Coefficients $\beta_1^{j,l}$ and $\beta_1^{j,h}$ measure how the change in equalization rate impacted tax multipliers of municipalities with respectively high and low perception of tax competition compared to municipalities with no change.

The estimates of interest from equation (A.41) are shown in Figure A.4.1. Both groups of municipalities do not exhibit signs of statistically significant pre-trends. After the reform however, a wedge forms in the trajectory of tax multipliers between jurisdictions with higher and lower perception of tax competition. Local governments with lower shares of 'yes' ballots to USR II have a slight decrease in their tax multipliers compared to municipalities with no change in $\Delta\alpha_i$. Their tax multipliers are however relatively stable over the post-reform period, and cannot be statistically distinguished from municipalities with no change in the equalization rate. Jurisdictions with above-median shares of 'yes' to USR II on the other hand exhibit a slow, but constant, increase in their tax multipliers associated to the increase in the equalization rate. We interpret this result as showing that municipalities with stronger perception of tax base mobility gradually responded to the incentive effect created by the reform.