The flypaper effect: evidence from a natural experiment in Hesse

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Abstract

Theory suggests that transfers should have an effect on local fiscal policy that is similar to an equivalent increase in local incomes. Yet much of the empirical literature shows that local governments use transfers primarily to increase expenditures. Recent contributions have revisited this so called flypaper effect by using quasi-experimental methods, and some have found that the evidence for the flypaper effect dissipates once endogeneity of transfer receipts is accounted for. This paper contributes to the growing body of quasi-experimental research on the flypaper effect by exploiting a natural experiment in the German state of Hesse. Using discontinuities in the Hessian municipal transfer allocation formula to construct a set of instruments for municipal transfer receipts during the 2001-2010 period, it provides strong evidence in favor of the flypaper effect.

Keywords: Equalization transfers, Local fiscal policy, Population thresholds

JEL codes:H70, H71, H72

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1 Introduction

Fiscal capacities typically vary between the sub-national jurisdictions of a country: some regions have access to abundant tax bases while others find it difficult to collect sufficient tax revenues. Since most countries consider geographical differences in living conditions to be a problem, they attempt to equalize fiscal capacities between regions by means of equalization transfers. There appears to be a political consensus that for reasons of national unity, public goods consumption should not differ too much between individuals that live in different regions of a country. Beyond such political considerations, the case for equalization transfers can also be made in terms of economic efficiency. With diminishing marginal utility of consumption, a reduction in consumption differentials between regions will result in a net-welfare gain for the country as a whole. Alternatively, equalization transfers can also be perceived as a insurance scheme that protects regions against asymmetric fiscal shocks (Bucovetsky, 1998).

Whatever the goals that the central government wants to pursue with transfers, they are fungible. Local governments can use transfers either to expand expenditures or to reduce taxes. Theoretically, the effects of an increase in transfer receipts on local fiscal policy should be similar to an equivalent increase in local incomes (Bradford and Oates, 1971). According to standard median voter theory, local governments should use a certain share of the transfers to increase expenditures while using the remainder to reduce taxes. However, much of the early empirical literature on this issue has found that transfers tend to increase expenditures too much relative to the theoretical benchmark and decrease taxes too little (Hines and Thaler, 1995). This phenomenon is usually named the flypaper effect: “money sticks where it hits”.

One obvious problem that the empirical literature on the flypaper effect faces is the endogeneity of transfers to the fiscal decisions made by local governments. In particular omitted variables complicate the empirical analysis. For example, observing a positive association between transfers and tax rates cannot be interpreted as proof that transfers are not used to reduce tax rates. It is possible that regions that choose high tax rates for some unobserved reason witness an outflow of tax bases and are then compensated by the central government by means of higher transfers. Similarly, observing a positive correlation between transfers and expenditures does not indicate a causal effect. For example, unobserved legislative changes at some higher tier of government may increase both transfers receipts and expenditure obligations.

Since is questionable whether the early empirical literature has sufficiently addressed such endogeneity problems, the evidence in favor of the flypaper effect provided in this literature is suspect. Indeed, several recent contributions using quasi-experimental methods find that the flypaper effect disappears once endogeneity is accounted for. Knight (2002), for example, uses political variables to instrument for federal highway aid grants in the US and finds no evidence for the flypaper effect. Gordon (2004) uses a discontinuity in the allocation formula for school grants in the US and finds that the flypaper effect vanishes once endogeneity is accounted for and the specification is made sufficiently flexible to allow for delayed adjustments.

Yet the quasi-experimental evidence on the existence of the flypaper effect is not unambigious. Apart from questioning the identification strategy in Knight (2002), Dahlberg et al. (2008) point out that Knight (2002) and Gordon (2004) use very specific grant programs. Dahlberg et al. (2008) therefore focus on general purpose transfers paid by the Swedish central government to its municipalities and apply an identification strategy that is based on discontinuities in the grant allocation formula. More specifically, the exploit the fact that Swedish municipalities that have outmigration flows above 2% within a certain time-frame receive extra grants while those below do not. Exploiting this disontinuity in a instrumental regression framework, they find strong evidence in favor of the flypaper effect. Swedish municipalities appear to use grants almost exclusively to increase spending.

Against the backdrop of this mixed evidence, I study in this paper the flypaper effect with a dataset covering 414 municipalities[1] in the German state of Hesse over the period 2001-2010.[2] More specifically, I investigate whether equalization transfers affect total public expenditures, the business tax rate multiplier, or the property tax rate multiplier of Hessian municipalities.

The main contribution of this paper is a convincing identification of the effect of equalization transfers on fiscal policy. Identification is facilitated by a unique feature of the Hessian municipal fiscal equalization law that results in a natural experiment. According to the Hessian equalization law, transfers to a municipality are determined by comparing a measure of its fiscal need to a measure of its fiscal capacity. If the fiscal capacity of a municipality falls short of its fiscal need, equalization transfers are paid such that fiscal capacity reaches a certain fraction of the assessed fiscal need. The fiscal capacity measure is based on available own tax revenues per capita. Fiscal need, on the other hand, is a positive function of population size that increases disproportionately. In a nutshell, the equalization law presumes that more populated municipalities have disproportionately larger fiscal needs. Therefore, an otherwise identical inhabitant receives a larger weight in the calculation of the fiscal need measures during the equalization process if she lives in a larger municipality. And because of this feature of the law, larger municipalities will receive ceteris paribus more transfers *per capita*.

That inhabitants of larger municipalities receive a larger weight in the fiscal need formula is a common feature of the municipal equalization laws of almost all German States. However,

[1]Hesse has 426 municipalities. This number includes five so called cities with county status and seven cities with a special status. These twelve cities have more responsibilities and a different financial structure than the standard municipality. I therefore do not include them in the dataset.

[2]I focus on this period because the most recent Hessian State Development Plan (*Landesentwicklungsplan*) was passed in the second half of 2000 (see `http://www.landesplanung-hessen.de/wp-content/uploads/2011/01/LEP_Text.pdf`). Among other determinations, state development plans define which municipalities are to be treated as regional centers. Such designations are important for the allocation of transfers. See below for more details.

Hesse is unique in that the relationship between weights and population size is discontinuous (Lenk and Rudolph, 2003).[3] At various thresholds, the weight of each inhabitant increases discontinuously. For example, inhabitants of municipalities below 5000 inhabitants receive a weight of 107 in the equalization formula, whereas inhabitants of municipalities above 5000 and below 7500 receive a weight of 121. Consequently, a municipality with 5001 inhabitants will receive, ceteris paribus, about 13% more transfers per capita than a municipality with 5000 inhabitants. That is, crossing the threshold from 5000 to 5001 will increase the weight of *all* inhabitants in the municipality for the determination of transfers, and this will result in a discontinuous increase in transfers.

Because of this feature of the Hessian equalization law, the weight bracket in which a municipality falls according to its population size should be a significant predictor of the transfers it will receive. Therefore, dummy variables indicating the various brackets can be used as instruments to identify the effect of transfers on local expenditures and taxation – as long as municipal fiscal capacity does not change with population size.

In reality, however, municipalities that fall into different population brackets will have different fiscal capacities. Unfortunately, I do not have data available on the fiscal capacity measures used to determine transfers during the equalization process. Moreover, fiscal capacity is to some extent an outcome variable as it is determined by the tax and expenditure policies of municipalities, which in turn will be affected by transfers. It is therefore inappropriate to control for fiscal capacity explicitly (Angrist and Pischke, 2009). However, as shown below municipal tax revenues per capita – a variable that is related but not identical to fiscal capacity as defined by the equalization law- increase in population size, indicating that controlling for population size is sufficient to account of differences in fiscal capacity. Indeed, the dummy variables for the various population weight brackets turn out to be

[3] See also *Anlage 1* of the Hessian fiscal equalization law, i. e. the *Finanzausgleichsgesetz (FAG)*

strong instruments for transfers per capita once the first stage is conditioned on municipal population size.

Apart from ensuring instrument strength, controlling for population size also plays an essential role in ensuring the validity of the dummy variables for the different weight brackets as instruments. The identifying assumption in the instrumental variables regressions is that the weight bracket in which a municipality falls according to its population size only affects expenditures or taxes by affecting transfers and has therefore no direct effect on the outcome variables. This exclusion restriction is clearly demanding in its unconditional form. Indeed, larger municipalities receive bigger weights in the Hessian equalization formula precisely because of the presumption that they have more expenditure needs. Consequently, population size should be included as a control variable.

Including only population size alone may not be sufficient to achieve conditional independence of the instrument, however. There may be additional factors that are correlated with both the population brackets and the outcome variables but are not sufficiently picked up by population size. This issue boils down to whether municipalities that fall into different population brackets are comparable after conditioning on population size.

The assumption that municipalities that fall into a lower bracket represent a valid control group for municipalities that fall into higher brackets (and are thus treated with larger weights) is defensible for brackets that are close to each other. For example, municipalities with population sizes between 5001 and 7500 are a reasonable control group for municipalities that fall into the next higher bracket of 7501 to 10000 (and vice versa). It is more difficult to defend this assumption for municipalities that fall into the 20001 to 30000 bracket or even higher brackets. Very large municipalities might pursue different fiscal policies than smaller ones not only because of population size differences but also for some unobserved reason. I deal with this problem by including only municipalities with population size below 20000 in the baseline regressions. However, I will consider municipalities with up to 30000 inhabitants in a robustness check. Around 85% of all Hessian municipalities have a population size below 20000.

Restricting the sample to relatively comparable municipalities is particularly important in view of the fact that I cannot include municipal fixed effects in the instrumental variables regressions. The reason for this is that there are only very few transitions of municipalities from one to another weight bracket during the 2001-2010 period. Given the small number of transitions, there is not sufficient within variation in the instruments to significantly predict the within variation in transfers per capita in the first stage. However, I will control for several time-varying control variables, in addition to time fixed effects and lagged dependent variables.

The closest precedent to this paper is Dahlberg et al. (2008), which uses a similar methodology to study the flypaper effect in Sweden. With respect to recent evidence on the effects of transfers from Germany, Buettner (2006) uses a regression discontinuity framework to explore whether equalization transfers limit tax competition in the state of Baden-Wuerttemberg. His study differs from this paper in that it focuses on the effect of the equalization rate[4] on the local tax choice. In a nutshell, he investigates if municipalities that face a higher equalization rate have fewer incentives to attract mobile firms by choosing lower business tax rates. He does not study how transfers as a whole affect fiscal policy and his results offer few implications regarding the flypaper effect. Egger et al. (2010) study the same question as Buettner (2006) with data from the state of Lower-Saxony. In contrast to Buettner (2006), they rely on a difference-in-difference approach to identify the effects of transfers on local business tax rates. However, they reach similar conclusions.

The remainder of this paper is structured as follows. The next section provides a over-view of how municipalities are financed in Hesse and discusses the municipal equalization scheme

[4]The equalization rate refers to the share of the shortfall between assessed fiscal need and fiscal capacity that is compensated by general purpose transfers.

in detail. Section 3 establishes that the discontinuties in the Hessian equalization law can be exploited to construct strong instruments for transfer receipts of municipalities. Section 4 presents the empirical model. Section 5 presents the results. A conclusion is offered in Section 6.

2 Fiscal arrangements in Hesse

Germany is constitutionally a two tier federation. Only the federal and state tiers posses sovereignty. Administratively, however, there are up to five tiers. Below the federal and the state tier, the federation is divided into *Regierungsbezirke*, *Kreise* (counties) and *Kreisfreie Städte* (cities with county status), and *Gemeinden* (municipalities). The lowest tier are the municipalities. The next higher tier are the counties, which always comprise several municipalities. Cities with county status are a hybrid arrangement that are simultaneously responsible for municipal and county tasks.[5] A *Regierungsbezirk* is comprised of several counties and cities with county status and is in general responsible for some higher level administrative tasks. The counties are responsible for tasks that have a wider geographical scope, for example for organizing the short-distance public traffic system, garbage collection, and the control of foodstuffs. On the revenue side, they rely mostly on transfers from state governments and contributions from the municipalities that are located within the county in question (*Kreisumlage*). The *Regierungsbezirke* only exist in a few states and their specific responsibilities vary. Municipalities, cities with county status, and counties exist in all sixteen states of the federation.

In the following, I will focus on the municipalities and disregard the other administrative tiers. Despite being the lowest tier of government, the municipalities play an highly important role in the administrative and fiscal landscape of the federation. On the expenditure

[5] As indicated previously, there are seven large towns that are technically municipalities but have responsibilities akin to cities with county status (municipalities/towns with special status).

side of the budget, they are responsible for the provision of several important public goods, for example schools, law and order, and local infrastructure. On the revenue side, they can independently levy user fees and set certain tax rates. Of these, two are important for municipal budgets: the local business tax (*Gewerbesteuer*) and the local tax on buildings and estates (*Grundsteuer B*). I will refer to the *Grundsteuer B* henceforth as property tax. Technically, the municipalities do not choose a rate for these taxes, but a multiplier on a federation-wide base rate. In practice, the multiplier determines the effective tax rate for these two taxes, and I will use the terms tax multiplier and tax rates interchangeably.

Apart from own source revenues, municipalities receive revenues from several taxes that are shared with the state and federal tier. They are entitled to a fraction of income and value added tax revenues that is collected within their administrative boundaries. While revenues from these taxes typically constitutes a large share of municipal income, municipalities are not allowed to set the rates. Income and value added tax rates are the same throughout the federation.

Finally, municipalities in all states receive transfers from their state government. The transfer systems function in very general terms as follows. A fiscal capacity measure is calculated for each municipality based on municipal tax revenues. This measure is then compared to a fiscal need measure. If fiscal capacity falls short of fiscal need, the municipality in question receives a fraction of the shortfalls. If fiscal capacity exceeds the fiscal need, the municipality receives, depending on the state, either some minimum amount of transfers, no transfers, or has to transfer some of its revenues to the state government or other municipalities.

The specific rules that govern the allocation of transfers differ between states. In the following, I describe the transfer system in the state of Hesse since I will use Hessian data in the empirical analysis. This state is located in the middle of Germany (See Figure 2 for a map). It is one of the wealthier states of the German federation. In the equalization system between states (*Länderfinanzausgleich*), it has always been a net-payer. Politically, it has witnessed both right- and left-wing governments during its history. Its geographical extent and the number of inhabitants, about six million, is average for Germany. The distribution of the population into municipalities largely follows a standard Zipf's Law, as indicated by Figure 4 which shows the histogram of municipal population sizes.

The municipal equalization scheme in Hesse works as follows. The Hessian state government first determines the total amount of resources that are to be used for transfers. This amount is a political decision and varies between years. In general, it depends on the fiscal situation of the state government. If state revenues have been large in a given year, more resources are typically available for transfers and vice versa.

Once the total amount of resources to be paid as transfers has been determined, specific fractions of the total amount are allocated for different transfer programs. The most important transfer programs are general purpose transfers to the different administrative tiers (*Schlüsselzuweisungen*) and special purpose transfers, for example for the financing of schools and local roads.

About half of all resources allocated to the transfer programs are typically used to fund general purpose transfers to the municipalities and counties. The share allocated to the municipalities is divided between them according to the municipal equalization law. As in all German states, the law defines measures for fiscal capacity and fiscal need of a municipality. As indicated previously, the measure for fiscal capacity is based on tax revenues. It is not identical to tax revenues, however, because for certain municipal taxes, most notably the business and property taxes, hypothetical instead of the real rates are used in conjunction with the actual tax bases to calculate hypothetical tax revenues. The idea is that with such an adjustment, the fiscal capacity measure reflects the municipal *potential* to raise revenues more accurately than raw tax revenues. The intention behind this adjustment is that municipalities that obtain tax revenues only because they set higher tax rates and not because they posses more valuable tax bases should not be punished by lower transfers.

The fiscal capacity measure is compared with a fiscal need measure. For the unconditional grant program, fiscal need is primarily a function of population size. There is the presumption in Hesse as in almost all German states, that expenditure needs increase disproportionally in population size. Irrespective of the validity of this presumption, it is a fact that municipal equalization laws typically allow for what is called *Einwohnerveredlung* when calculating the fiscal need of a municipality. That is, inhabitants of municipalities are weighted according to the total population size of the municipality. Therefore, the assessed fiscal need *per capita* typically increases in with population size.

Most states with *Einwohnerveredlung* use a smooth weight function. That is, a small increase in population size in a municipality results in an equivalently small increase in the weight of each inhabitant when calculating the fiscal need measure. Hesse, however, is unique in that it employs a discontinuous function to map population size to weights. A marginal increase in population size does typically not affect the weight of a municipal inhabitant. But at certain thresholds, a marginal increase results in a large jump in the weight of *all* inhabitants of a municipality.

Table 1 shows the weight function (*Hauptansatz*) according to the equalization law.[6] Inhabitants of municipalities with less than 5000 inhabitants receive a weight of 107, once a municipality has 5001 inhabitants each of them receives a weight of 114, and so forth for all thresholds until 50000 inhabitants.[7] This weighting procedure gives fictional population sizes for the municipalities. Total fiscal need is then calculated by multiplying the fictional municipal population size by a "basic amount" (*Grundbetrag*). The basic amount varies between years and is determined endogenously such that resources allocated to general pur-

[6] The *Finanzausgleichsgesetz* from which these figures are obtained is accessible online under http://www.rv.hessenrecht.hessen.de.

[7] There are some additional weighting procedures for specific municipalities. See below.

pose transfers equal actual transfer payment. The basic amount does not differ between municipalities in a given year, however.

Once total fiscal need is calculated according to this formula, it is contrasted with the total fiscal capacity of a municipality. If fiscal capacity falls below fiscal need, a fraction of the difference is completely equalized. More specifically, any shortfall in fiscal capacity below 80% of fiscal need is completely equalized. Shortfalls in fiscal capacity above 80% are equalized with a rate of 1/2. If fiscal capacity is larger than fiscal need (i. e. if the municipality in question is fiscally abundant), this municipality only receives a minimum amount of general purpose transfers. In Hesse, the minimum transfers vary by population size.[8]

3 Transfers and Thresholds

The weighting formula for calculating fiscal need should induce a discontinuity in actual transfer receipts at the population thresholds. Everything else equal, transfers per capita should be constant for population sizes within the threshold but display discontinuous jumps at the thresholds. In practice, the ceteris paribus assumption is untenable. Fiscal capacities, in particular, will vary with population size, which will result in a non-constant relationship between transfers per capita and population size within and between the thresholds. Nonetheless, there should be discontinuous jumps at the thresholds. This is confirmed by Panel a of Figure 3 in which the the empirical distribution of population size is plotted against transfers per capita for Hessian municipalities in the period 2001-2010. In this figure, I exclude municipalities that have been identified as outliers according to the Hadi-

[8]Fiscally abundant municipalities with with less than 7500 inhabitants receive 5 Euro per inhabitant, municipalities between 7501 and 30000 inhabitants receive 7 Euros, and municipalities with more than 50000 receive 15 Euro per inhabitant. Certain municipalities, i. e. those designated as central towns, receive different minimum transfers. See below for details on central towns.

method (Hadi, 1992). This is done only for presentational convenience and does affect only four observations.

Within each of the weight brackets as defined in Table 1, the figure includes a least square fit of transfers per capita against population size. The linear fits indicate that in general, there is a negative relationship between population size and transfers (which as argued below can presumably be explained by the fact that fiscal capacities increase with population size). However, at the 5000, 7500, and 15000 thresholds, there are noticeable jumps in transfers per capita. No such noticeable jump is observable at the 10000 threshold. And for municipalities with more than 20000 inhabitants, there is even a noticeable drop in transfers per capita.

On balance, the location in a particular weight bracket appears to affect transfers per capita in an expected way for municipalities with less than 20000 inhabitants: there are significant discontinuities for all but the threshold at 10000 inhabitants. Regarding the 10000 threshold, note that the linear plot between population size and transfers per capita for the 7501-10000 bracket has a different slope than in the other brackets. It appears that the absence of a discontinuity at 10000 can be explained by the fact that increases in population size do not decrease transfers as much as in the other weight brackets.

There are two reasons why this might be the case. The first is that certain municipalities receive weights not according to the standard formula as described by Table 1 but according to whether they are designated a "central town" (*Mittelzentrum* or *Mittelzentrum mit Teilfunktion eines Oberzentrums*) by the most recent State Development Plan in 2000. These towns are responsible for the provision of certain public goods with a wider geographical scope. Inhabitants of these municipalities receive a weight of at least 125 irrespective of its actual population size. The second reason is that the distribution of fiscally abundant municipalities that only receive the minimum transfers might not balanced within the 7501-10000 bracket. Panel b of Figure 3 therefore plots population size against transfers per capita after dropping central towns and fiscally abundant municipalities.[9] In this figure, a noticeable discontinuity is present at the 10000 threshold. Except for the bracket with 15000-20000 inhabitants, the negative relationship between population size and transfers continues to be present as well.

In order to confirm that the discontinuities in transfers per capita at the thresholds are due to the weighting formula in assessing fiscal need, Figure 4 plots the tax revenues per capita of municipalities against their population size, both with and without central towns and fiscally abundant municipalities. Within each bracket, a linear regression line is provided. Recall that tax revenues are related to fiscal capacity as defined by the equalization law. If the discontinuities in transfers per capita identified in Figure 3 are not due to the weighting formula but are rather due to discontinuities in underlying economic or demographic variables, they should show up in tax revenues per capita. As Figure 4 indicates, no discontinuities are present in municipal tax revenues at the thresholds below 20000. In fact, the only thresholds where a discontinuity can be observed is at 20000. Municipalities with just above 20000 inhabitants appear to have distinctly higher tax revenues than municipalities just below 20000 inhabitants. But it is difficult to derive stark conclusions from this observation as the number of municipalities with more than 20000 inhabitants is limited. The apparent increase in tax revenues at 20000 might be just due to chance. Still, the possibility of a discontinuity in tax revenues at the 20000 threshold indicates that restricting the sample to municipalities with less than 20000 inhabitants in the regressions is a reasonable strategy.

This graphical evidence suggests that the discontinuities in the weighting formula can be used to identify the effect of transfers on local fiscal policy by means of instrumental variables regressions. Conditional on population size, which is according to Figure 4 positively related to tax revenues (and hence to fiscal capacity), dummy variables indicating the location of

[9] Note that I do not have data on fiscal capacity and fiscal need as assessed by the state government during the equalization process. Therefore, I treat all municipalities that receive the minimum amount of transfers for their population bracket in a given year as abundant.

a municipality in a given weight bracket should be a significant predictor of the transfers per capita it receives. That is, municipalities with more inhabitants should receive more transfers per capita.

Table 2 presents OLS regressions where transfers per capita of Hessian municipalities in the 2001 to 2010 period are regressed on dummy variables that are 1 for municipalities that fall in a given year into the respective population brackets and 0 else. Municipalities with less than 5000 inhabitants are the reference category. If the weighting formula in the Hessian municipal equalization law really induces discontinuities in transfers per capita, the dummy variables indicating the population brackets above the reference bracket should display positive and increasingly larger coefficients.

In Model I of Table 2, only the the dummy variables are included. When other control variables, in particular population size, is missing from the model, the dummy variables indicating the population brackets above 5000 inhabitants displays negative coefficients. As argued previously, this can be explained by the fact that larger municipalities have more tax revenues and thus a higher fiscal capacity. Once population size is included in the model, the dummy variables display positive and mostly increasing coefficients up until the 20000 threshold. Note that it does not matter whether population size is included only with a linear polynomial (Model II) or with up to cubic polynomials (Model III).

Including time fixed effects (Model IV) and a set of time-varying control variables (Model V) does not change the pattern that until the 20000 threshold, municipalities in higher population brackets receive increasingly higher transfers per capita. In particular, note that including a variable measuring the size of the municipal council does not change the findings regarding the population brackets. This is important as there is some (but not complete) overlap in the population thresholds defining the weights in the equalization formula and population thresholds that determine council size according to the Hessian municipal electoral law. That is, the council size increases discontinuously at 3000, 5000, 10000, and 25000 inhabitants. To identify the effect of transfers, it might hence be important to include this variable. In addition to council size, I include as control variable demographic variables (population share of above 65 and below 15 year old), and dummy variables indicating whether a municipality has been designated a central town or is fiscally abundant.

Overall, the results in Table 2 confirm that the dummy variables indicating the different population brackets can serve as strong instruments for transfer receipts for municipalities which have fewer than 20000 inhabitants.

4 Empirical model

I estimate models of the following form to study the causal effect of transfers on local expenditures and taxation:

$$y_{it} = a + \text{Transfers per capita}_{it} + \delta y_{i,t-1} + \gamma f(\text{Population size})_{it} + \beta \mathbf{x}_{it} + \epsilon_{it}, \tag{1}$$

where y is either real expenditures per capita (deflated by the CPI to 2005 values), the business tax multiplier, or the property tax multiplier. f(Population size) is a polynomial function of population size (I include up to cubic terms). x is a vector of additional control variables. I also include in all regressions the lagged dependent variable y_{t-1} to account for persistence in the outcome variables.

The variable of interest is real transfers per capita (deflated by the CPI to 2005 values). To account for the endogeneity of real transfers per capita, I instrument transfers with the dummy variables that indicate the various population brackets. The identifying assumption is that the sample is sufficiently homogeneous to ensure that the dummy variables induce quasi-random variation in transfers once population size, i. e. the treatment determining variable, is controlled for. The validity of this assumption can be checked by means of over-identification tests. An alternative test is proposed by Altonji et al. (2005a,b). In the current context, their approach boils down to estimating models with and without control variables, and to investigate whether the estimates for the potentially endogenous variable change between these two sets of models. If the instrument induces quasi-random variation in the endogenous variable, the coefficient estimates should not differ much between these two sets of models. Moreover, including additional control variables might increase efficiency. I use the control variables included in Table 2. Of these the dummies indicating central towns and abundant municipalities might be particularly important as indicated by Figure 3. It might also be important to control for council size as it is a discontinuous function of population size.

I estimate Model (1) for all outcome variables with TSLS.[10] To account for for heteroscedasticity and autocorrelation, I use heteroscedasticity and autocorrelation robust standard errors. Weak identification is tested with the Cragg-Donald and Kleinbergen-Paap F statistics (Baum et al., 2002). The Kleinbergen-Paap F statistic is robust to non-i.i.d errors, but there are no critical values available with which to evaluate the statistic. The Cragg-Donald F statistic is not robust, but the statistic is easier to evaluate. In addition, I provide in the appendix the first-stage of the baseline regressions, including the first-stage F-statistics and the coefficient estimates for the instruments. Over-identification is tested with the Hansen-J statistic.

5 Results

5.1 Baseline results

Table 3 presents the results for (real) total municipal expenditures per capita. I first report OLS regressions and then compare the TSLS results. The OLS model suggests that transfers

[10]Note that since Model (1) does not include municipal fixed effects in addition to the lagged dependent variable, the issue of the Nickel-Bias (Nickell, 1981) does not arise.

result in lower expenditures per capita. However, the TSLS models show that this finding is presumably due to endogeneity, i. e. the TSLS regressions result in a positive coefficient estimate for transfers per capita. One explanation for the negative coefficient in the OLS regression is that municipalities that have lower fiscal capacity receive more transfers and spend at the same time less. Once transfers per capita are instrumented with the population bracket dummies, their effect on expenditures per capita turns positive. In fact, an increase in transfers per capita of 1 Euro increases expenditures by slightly more than 1 Euro. This result provides strong evidence in favor of the flypaper effect.

It is curious that an increase in transfers by 1 Euro increases expenditures by more than 1 Euro, according to Model (V) even by about 1.5 Euro. This indicates very high levels of crowding in of local expenditures by transfers. One plausible explanation for this result is that municipalities use expenditures to attract additional tax bases (for example by improving local infrastructure), and that this increases local tax revenues, which in turn allows regions to increase expenditures even further. The regressions in Table 3 appear to capture the overall reduced form effect of transfers on expenditures.

Table 4 presents the results for the business tax multiplier. Transfers appear to be irrelevant for taxation. Only in the last model, a weakly negative effect can be observed. However, the effect is numerically small. The estimates indicate that an increase in transfers per capita by 100 Euros reduce the business tax multiplier by 2.5 points. Given that the average multiplier was around 300 during the sample period, this effect is economically unimportant. Overall, no meaningful effect of transfers on business taxation can be observed.

Finally, Table 5 presents the results for the property tax. The results are similar to those for the business tax multiplier. The effect of transfers per capita is both statistically insignificant and numerically small. Overall, it appears that transfers have no effect on taxation. In particular, they are not used to decrease levels of taxation.

5.2 Robustness checks

Table 6 reports the result of several robustness checks based on the baseline models. In the panel of Table 6 entitled *Linear control function*, I include only a linear function of population size to check whether the results were driven by the particular functional form of the control function. The results are not noticeably different, however. When no control variables are included, the estimated coefficient for transfers per capita in the expenditure model turns insignificant. However, the z-statistic continues to be relatively large and the coefficient is close to 1. Once additional control variables are included, transfers have a statistically significant positive effect. The effect of transfers on tax policy is both statistically insignificant and numerically small according to this robustness check.

In the panel entitled *Quadratic control function*, I include a quadratic control function. The results regarding the effect of transfers are even closer to the baseline results than when a linear control function is included. Overall, the results are robust to the choice of the control function.

In the panel entitled *Different thresholds*, I test how applying different values for the thresholds changes the estimates. The rationale for this robustness check is as follows. In the Hessian equalization law, municipalities that transition into a lower population bracket will continue to receive the weight of the next higher bracket for another year if their population has only declined by less than 10% of the threshold they have crossed. For example, a municipality whose population declines from 11000 to 9001 will continue to receive the weight intended for the 10000 to 15000 bracket for another year. Now there have been only very few transitions during the sample period, and it might appear that this feature of the law can be ignored. The problem is the 7500 threshold. If the population of a municipality falls below the 7500 threshold, it will continue to receive the weight for the 7501-10000 threshold indefinitely and not only for a year as long as its population size remains within the 10% limit (i. e. is above 6750). Unfortunately, I do not have data on which municipalities with population sizes above 6750 but below 7500 have been treated with the weights intended for the 7500-10000 during the sample period. As a concise check of the robustness of the results to differently defined thresholds, therefore, I report regression results where all thresholds have been redefined such that they are 10% lower. That is, instead of associating a weight of 107 to municipalities with less than 5000, this weight is only associated with municipalities with up to 4500 inhabitants. A weight of 114 is associated with municipalities with population size between 4500 and 6750. A weight of 121 is associated with municipalities with a population size between 6750 and 9000 etc.

The results for this robustness check are reasonably similar to the baseline findings. That is, transfer per capita appear to increase expenditures per capita. While the coefficient is insignificant, the z-statistic is large once control variables are added. Moreover, the coefficient estimate is close to one. The lower significance values of the coefficient can presumably be explained by the fact that the redefined threshold do not accurately capture the true weights that the municipalities received during the equalization process.

The panel entitled *municipalities with less than 30000 inhabitants* reports regressions where all municipalities with fewer than 30000 inhabitants are included in the sample. While the results for taxation do not differ much from the baseline results, transfers appear to have no effect on expenditures when no control variables are included. In fact, the estimated coefficient for transfers is negative even if the z-statistic is very low. Once control variables are included, the coefficient turns positive and displays a relatively large z-statistic. Note that the instruments are not weak in these regressions. The Cragg-Donald Wald F statistic is around 17 while the Kleinbergen-Paap Wald F statistic is at least over 8.

The fact that the coefficient is negative in the regressions without control variables but turns positive once control variables are included suggests that municipalities with over 20000 inhabitants are qualitatively different from municipalities with less than 20000 inhabitants for reasons not directly related to population size. Consequently, the assumption of conditional independence of the instruments is violated once the sample in expanded to include such municipalities, leading to biased coefficient estimates. Including additional control variables to explicitly control for some of the qualitative differences appears to reduce the bias, leading to a coefficient for transfers that is positive, close to one, and which displays a reasonably large z-statistic.

In order to confirm that qualitative difference of such magnitudes only emerge for municipalities with population sizes above and below 20000 but not for lower thresholds, I report in the panel entitled *municipalities with less than 15000 inhabitants* regressions where all municipalities with a population size larger than 15000 have been dropped. Here, the results are not qualitative different from the baseline estimates. The most notable difference is that transfers appear to have an even larger effect on expenditures within this subgroup of municipalities. An increase in transfers per capita by 1 Euro increases expenditures per capita by about 2 Euros.

Finally, I report in the panel entitled *Clustered standard errors* regressions where hypothesis tests and diagnostic tests have been calculated with clustered standard errors. While the baseline regressions control for autocorrelation by relying on Newey-West standard errors, it might be worthwhile to allow for arbitrary forms of over-time correlation in municipal transfers receipts. On the other hand, allowing for arbitrary correlation by means of clustered standard errors could lead to unnecessarily large standard errors.

Indeed, the main difference between the results from this robustness check and the baseline models is that the Kleinbergen-Paap Wald F statistic is smaller. Nevertheless, transfers continue to display a statistically significant effect on expenditures while being insignificant for taxation.

6 Conclusion

This paper has studied how transfers affect local expenditures and taxation by exploiting a natural experiment in the German State of Hesse. Identification is facilitated by discontinuities in the allocation formula for general purpose grants to Hessian municipalities. Using these discontinuities in a instrumental variables framework, this paper provides strong evidence in favor of the flypaper effect. This finding is not only in line with recent results by Dahlberg et al. (2008), who apply a similar methodology for Sweden, but also with much of the early empirical literature on the flypaper effect.

While the effects of transfers are similar to those found for Sweden, it is still to early to conclude that the flypaper effect is a general phenomenon of local public finance because evidence based on quasi-experimental methods remains scare. Moreover, some of the existing quasi-experimental contributions, e. g. Knight (2002) and Gordon (2004), contradict the findings both in this paper and in Dahlberg et al. (2008). More evidence is therefore required to reach definite conclusion on the existence or absence of the flypaper effect. It should be, however, possible to obtain such evidence as it is likely that local transfer systems around the world will provide many more opportunities to exploit natural experiments.

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Table 1: Thresholds for population weights in the Hessian fiscal equalization law

Population	Weight
<= 1	2
> 1 and <= 5000	107
> 5000 and <= 7500	114
> 7500 and <= 10000	121
> 10000 and <= 15000	124
> 15000 and <= 20000	126
> 20000 and <= 30000	127
> 30000 and <= 50000	129
> 50000	130

[a] This table presents the weights per inhabitant each municipality within different population brackets receives in determining its fiscal need. Thresholds according to *Anlage 1* of the Hessian *Gesetz zur Regelung des Finanzausgleichs (FAG)*.

Table 2: Equalization transfers and population thresholds, Hessian Municipalities, 1991-2010

	I	II	III	IV	V
	b/z	b/z	b/z	b/z	b/z
Bracket=5001-7500	-14.087***	1.391	24.943***	25.597***	24.663***
	(-2.857)	(0.254)	(3.241)	(3.438)	(3.136)
Bracket=7501-10000	-4.332	26.639***	65.182***	65.399***	64.080***
	(-0.665)	(3.144)	(5.058)	(5.219)	(5.809)
Bracket=10001-15000	-23.033***	28.831***	75.538***	76.413***	74.307***
	(-4.682)	(2.879)	(4.631)	(4.849)	(5.267)
Bracket=15001-20000	-29.292***	48.945***	92.295***	93.064***	99.000***
	(-3.964)	(3.254)	(4.270)	(4.424)	(5.679)
Bracket=20001-30000	-90.042***	26.205	45.148	44.456	74.345***
	(-15.666)	(1.226)	(1.590)	(1.593)	(3.323)
Bracket=30001-50000	-117.694***	66.878**	37.107	36.276	79.403***
	(-17.778)	(2.091)	(1.032)	(1.025)	(2.788)
Council size					0.650
					(0.922)
Population share <15					16.195***
					(8.412)
Population share >65					9.021***
					(13.111)
Central town					10.252*
					(1.938)
Abundant municipality					-146.714***
					(-41.188)
Population (linear)	No	Yes	Yes	Yes	Yes
Population (cubic)	No	No	Yes	Yes	Yes
Year dummies	No	No	No	Yes	Yes
N	4131	4131	4131	4131	4131
Municipalities	414	414	414	414	414
F	85.440	81.347	64.483	45.649	133.710

[a] This table presents OLS regressions with population size and the population thresholds in the Hessian fiscal equalization law. The dependent variable is (real) transfers per capita. These regressions relate transfers per capita to the thresholds at 5000, 7500, 10000, 15000, 20000, and 30000 at which the weight of each municipal inhabitant increases discontinuously in the equalization formula. In Model II, population size is included linarly. Model III-V include linear, quadratic, and cubic terms of popuation size. The last model (Model V) also includes additional control variables. All Hessian municipalities except twelve special status cities are included in the sample. Outliers as identified by the Hadi-method are excluded.

[b] Stars indicate significance levels at 10% (*), 5% (**) and 1%(***).

[b] z-statistics in parentheses.

[c] z-statistics and hypothesis tests based on heteroscedasticity and autocorrelation robust standard errors.

Table 3: Equalization transfers and expenditures, Hessian Municipalities, 2001-2010, OLS and TSLS regressions

	OLS	TSLS I	TSLS II	TSLS III
	b/z	b/z	b/z	b/z
Transfers per cap.	-0.394***	1.265**	1.197**	1.562**
	(-4.518)	(2.015)	(1.991)	(2.415)
Expenditures$_{t-1}$	0.621***	0.703***	0.716***	0.662***
	(14.944)	(14.054)	(14.274)	(13.857)
Council size				-2.694
				(-1.001)
Population share <15				-31.076**
				(-2.325)
Population share > 65				-7.011
				(-1.029)
Central town				30.603
				(1.180)
Abundant municipality				458.064***
				(4.359)
Population (cubic)	Yes	Yes	Yes	Yes
Year dummies	No	No	Yes	Yes
N	3295	3295	3295	3295
Municipalities	370	370	370	370
F	94.576	54.316	39.880	42.577
Hansen-J (p-value)		0.318	0.322	0.121
Cragg-Donald Wald F statistic		14.061	15.783	18.296
Kleinbergen-Paap Wald F statistic		7.278	7.969	9.170

[a] This table presents OLS and TSLS regressions with the (real) total expenditures per capita as dependent variable. The independent variable of interest is (real) transfers per capita. Instruments for transfers per capita in the TSLS regressions are dummy variables for each weight bracket. The sample is restricted to all municipalities with population size below 20000. Outliers as identified by the Hadi-method are excluded.
[c] Stars indicate significance levels at 10% (*), 5% (**) and 1%(***).
[d] z-statistics in parentheses.
[e] z-statistics and hypothesis tests based on heteroscedasticity and autocorrelation robust standard errors.
[f] The first-stage regressions for the TSLS estimations can be found in Table **??** in the appendix.

Table 4: EQUALIZATION TRANSFERS AND BUSINESS TAX MULTIPLIERS, HESSIAN MUNICIPALITIES, 2001-2010, TSLS REGRESSIONS

	OLS b/z	TSLS I b/z	TSLS II b/z	TSLS III b/z
Transfers per cap.	0.001	-0.025	-0.025	-0.025*
	(1.008)	(-1.618)	(-1.615)	(-1.719)
Business tax multiplier$_{t-1}$	0.971***	0.958***	0.957***	0.955***
	(145.432)	(83.878)	(81.862)	(89.414)
Council size				-0.032
				(-0.543)
Population share $<$15				0.023
				(0.093)
Population share $>$ 65				0.337**
				(2.071)
Central town				-0.173
				(-0.368)
Abundant municipality				-5.152**
				(-2.118)
Population (cubic)	Yes	Yes	Yes	Yes
Year dummies	No	No	Yes	Yes
N	3298	3298	3298	3298
Municipalities	370	370	370	370
F	4894.824	4782.948	2080.329	1815.413
Hansen-J (p-value)		0.797	0.852	0.553
Cragg-Donald Wald F statistic		7.385	8.068	10.880
Kleinbergen-Paap Wald F statistic		4.165	4.560	6.052

[a] This table presents OLS and TSLS regressions with the local business tax multiplier as dependent variable. The independent variable of interest is (real) transfers per capita. Instruments for transfers per capita in the TSLS regressions are dummy variables for each weight bracket. The sample is restricted to all municipalities with population size below 20000. Outliers as identified by the Hadi-method are excluded.

[c] Stars indicate significance levels at 10% (*), 5% (**) and 1%(***).

[d] z-statistics in parentheses.

[e] z-statistics and hypothesis tests based on heteroscedasticity and autocorrelation robust standard errors.

[f] The first-stage regressions for the TSLS estimations can be found in Table **??** in the appendix.

Table 5: EQUALIZATION TRANSFERS AND PROPERTY TAX MULTIPLIERS, HESSIAN MUNICIPALITIES, 2001-2010, TSLS REGRESSIONS

	OLS b/z	TSLS I b/z	TSLS II b/z	TSLS III b/z
Transfers per cap.	-0.001	0.004	0.005	0.005
	(-0.497)	(0.223)	(0.248)	(0.242)
Property tax multiplier$_{t-1}$	0.962***	0.958***	0.958***	0.950***
	(193.285)	(70.230)	(72.615)	(98.776)
Council size				0.009
				(0.116)
Population share <15				-0.806**
				(-2.270)
Population share > 65				0.110
				(0.627)
Central town				-0.515
				(-0.738)
Abundant municipality				-0.806
				(-0.253)
Population (cubic)	Yes	Yes	Yes	Yes
Year dummies	No	No	Yes	Yes
N	3298	3298	3298	3298
Municipalities	370	370	370	370
F	8883.875	8932.653	3628.130	2840.704
Hansen-J (p-value)		0.090	0.092	0.083
Cragg-Donald Wald F statistic		8.592	9.187	12.331
Kleinbergen-Paap Wald F statistic		4.629	4.871	6.471

[a] This table presents OLS and TSLS regressions with the local business tax multiplier as dependent variable. The independent variable of interest is (real) transfers per capita. Instruments for transfers per capita in the TSLS regressions are dummy variables for each weight bracket. The sample is restricted to all municipalities with population size below 20000. Outliers as identified by the Hadi-method are excluded.
[c] Stars indicate significance levels at 10% (*), 5% (**) and 1%(***).
[d] z-statistics in parentheses.
[e] z-statistics and hypothesis tests based on heteroscedasticity and autocorrelation robust standard errors.
[f] The first-stage regressions for the TSLS estimations can be found in Table **??** in the appendix.

Table 6: Equalization transfers and fiscal policy, Hessian Municipalities, 2001-2010, TSLS regressions, Robustness checks

	With control variables			Without control variables		
	Expenditures	Business tax	Property tax	Expenditures	Business tax	Property tax
1. Linear control function						
Transfers per cap.	0.925	-0.017	0.037	1.224*	-0.020	0.030
	(1.393)	(-1.238)	(1.491)	(1.776)	(-1.417)	(1.358)
N	3295	3298	3298	3295	3298	3298
Municipalities	370	370	370	370	370	370
F	47.317	2479.449	3569.505	49.076	2001.749	2786.602
Hansen-J (p-value)	0.044	0.887	0.406	0.006	0.875	0.405
Cragg-Donald Wald F statistic	11.623	9.019	7.826	14.541	11.205	11.036
Kleinbergen-Paap Wald F statistic	5.964	5.308	4.064	7.973	7.058	6.439
2. Quadratic control function						
Transfers per cap.	0.974*	-0.019	0.013	1.285**	-0.026*	0.009
	(1.765)	(-1.510)	(0.693)	(2.088)	(-1.828)	(0.480)
N	3295	3298	3298	3295	3298	3298
Municipalities	370	370	370	370	370	370
F	43.339	2307.307	3760.554	46.163	1879.710	2922.183
Hansen-J (p-value)	0.066	0.911	0.060	0.006	0.759	0.058
Cragg-Donald Wald F statistic	16.931	10.931	9.467	18.232	12.471	12.754
Kleinbergen-Paap Wald F statistic	8.658	6.454	5.162	9.445	7.373	6.924
3. Different thresholds						
Transfers per cap.	0.699	0.003	-0.019	0.913	-0.010	-0.006
	(0.866)	(0.122)	(-0.640)	(1.468)	(-0.699)	(-0.324)
N	3295	3298	3298	3295	3298	3298
Municipalities	370	370	370	370	370	370
F	44.010	2396.826	3465.663	46.239	2105.993	2878.405
Hansen-J (p-value)	0.224	0.424	0.120	0.421	0.341	0.091
Cragg-Donald Wald F statistic	6.355	3.005	3.564	15.590	10.312	10.004
Kleinbergen-Paap Wald F statistic	3.536	1.761	2.047	8.804	5.663	5.372
4. Municipalities with less than 30000 inhabitants						
Transfers per cap.	-0.096	0.002	0.021	0.747	-0.013	0.005
	(-0.170)	(0.171)	(1.171)	(1.174)	(-1.018)	(0.257)
N	3569	3574	3574	3569	3574	3574
Municipalities	399	399	399	399	399	399
F	43.298	2755.897	3686.700	41.861	2313.325	3010.264
Hansen-J (p-value)	0.000	0.452	0.147	0.000	0.310	0.237
Cragg-Donald Wald F statistic	17.848	18.903	12.867	17.035	14.570	13.084
Kleinbergen-Paap Wald F statistic	9.625	11.512	8.026	8.254	8.156	7.009
5. Municipalities with less than 15000 inhabitants						
Transfers per cap.	2.180**	-0.041	-0.027	2.648***	-0.030	-0.036
	(2.259)	(-1.426)	(-0.884)	(2.757)	(-1.321)	(-1.164)
N	3019	3021	3021	3019	3021	3021
Municipalities	338	338	338	338	338	338
F	28.596	1538.935	3149.573	30.197	1568.422	2449.921
Hansen-J (p-value)	0.382	0.851	0.574	0.781	0.451	0.705
Cragg-Donald Wald F statistic	10.038	4.050	4.729	13.126	5.968	6.989
Kleinbergen-Paap Wald F statistic	5.300	2.290	2.573	7.115	3.376	3.692
6. Clustered standard errors						
Transfers per cap.	1.197	-0.025	0.005	1.562**	-0.025	0.005
	(1.554)	(-1.367)	(0.233)	(1.987)	(-1.537)	(0.226)
N	3295	3298	3298	3295	3298	3298
Municipalities	370	370	370	370	370	370
F	39.246	1520.337	3333.389	48.713	1419.934	2600.999
Hansen-J (p-value)	0.614	0.908	0.052	0.303	0.620	0.053
Cragg-Donald Wald F statistic	15.783	8.068	9.187	18.296	10.880	12.331
Kleinbergen-Paap Wald F statistic	2.225	1.287	1.366	2.667	1.819	1.949

[a] This table presents several robustness checks on how equalization transfers affect fiscal policy based on the baseline regressions presented in Tables 3, 4, and 5. The following robustness checks are conducted . First, instead of a cubic control function for population size, the models reported in row 1 use a linear control function while the model reported in row 2 use a quadratic control function. The results reported in row 3 are obtained after redefining the transfer thresholds such that they are 10% lower than the baseline thresholds. The results in row 4 are from regressions where all municipalites with less than 30000 inhabitants are included in the sample. The results in row 5 are from models where only municipalities with less than 15000 inhabitants are included. Results in row 6 are for models where standard errors are clustered at the level of municipalities.

[b] All models include as control variables the lagged dependent variable and time fixed effects. The first three colums for each robustness check report results for these models. The last three colums report results where additonal control variables are included.

Table 7: Definition of Variables

Label	Description
Transfers per cap.	Real unconditional transfers per capita (*Schlüsselzuweisungen*).
Expenditures per cap.	Real total expenditures per capita (sum of current and capital expenditures).
Business tax multiplier	Business tax multiplier (*Gewerbesteuerhebesatz*) which determines the effective business tax rate in a municipality.
Property tax multiplier	Property tax multiplier (*Grundsteuer B Hebesatz*) which determines the effective property tax rate in a municipality.
Bracket=5001-7500	Dummy variable = 1 if population size $\geq$5001 & $\leq$7500, else 0.
Bracket=7501-10000	Dummy variable = 1 if population size $\geq$7501 & $\leq$10000, else 0.
Bracket=10001-15000	Dummy variable = 1 if population size $\geq$10001 & $\leq$15000, else 0.
Bracket=15001-20000	Dummy variable = 1 if population size $\geq$15001 & $\leq$20000, else 0.
Bracket=20001-30000	Dummy variable = 1 if population size $\geq$20001 & $\leq$30000, else 0.
Bracket=30001-50000	Dummy variable = 1 if population size $\geq$30001 & $\leq$50000, else 0.
Population	Population size municipality.
Council size	Number of members in the municipal council.
Population share <15	Population share of municipal inhabitants younger than 15.
Population share >15	Population share of municipal inhabitants older than 65.
Central town	Dummy= 1 if municipality designated as central town (*Mittelzentrum)* by **?**.
Abundant municipality	Dummy=1 if municipality receives in a given year only the minimum transfers to which it is eligable according to its population size.

Most of the data was obtained from the *Hessische Gemeindestatistik* available at `http://www.statistik-hessen.de`. Fiscal variables are deflated with the federal CPI obtained from the German Council of Economic Experts (*Sachverständigenrat* at `http://www.sachverstaendigenrat-wirtschaft.de`). Information on central towns was obtained from the *Landesentwicklungsplan Hessen 2000* available at `http://www.landesplanung-hessen.de`. Information on the council size threshold was obtained from `http://www.wahlrecht.de/kommunal/hessen.html`. Finally, fiscally abundant municipalities are defined as those municipalities that receive the minimum transfers per capita as stipulated by the Hessian municipal equalization law (available online at `http://www.rv.hessenrecht.hessen.de`).

Table 8: SUMMARY STATISTICS

Variable		Mean	Std. Dev.	Min.	Max.	N
Transfers per cap. (real)	overall	163.709	90.205	3.937	1048.123	4135
	between		79.081	5.668	341.267	414
	within		43.535	-108.302	939.245	9.988
Expenditures per cap. (real)	overall	1648.492	466.716	403.748	7636.820	4136
	between		362.981	1057.717	5352.759	414
	within		293.866	1.499	6529.229	9.990
Business tax multiplier	overall	323.327	26.289	200.000	430.000	4140
	between		25.114	250.000	400.000	414
	within		7.862	235.327	386.327	10
Property tax multiplier	overall	257.443	36.469	140.000	400.000	4140
	between		33.470	140.000	366.000	414
	within		14.568	170.443	386.443	10
Population	overall	10.204	7.845	0.622	43.741	4140
	between		7.851	0.678	43.293	414
	within		0.170	9.180	11.169	10
Council size	overall	30.956	7.600	15.000	45.000	4140
	between		7.535	15.000	45.000	414
	within		1.054	23.756	38.156	10
Population share <15	overall	9.712	1.048	5.992	14.097	4140
	between		0.858	6.908	12.518	414
	within		0.604	5.866	12.822	10
Population share > 65	overall	19.466	2.818	11.462	31.762	4140
	between		2.425	13.843	29.997	414
	within		1.441	13.343	23.993	10
Central town	overall	0.227	0.419	0.000	1.000	4140
	between		0.419	0.000	1.000	414
	within		0.000	0.227	0.227	10
Abundant municipality	overall	0.068	0.252	0.000	1.000	4140
	between		0.195	0.000	1.000	414
	within		0.160	-0.832	0.968	10

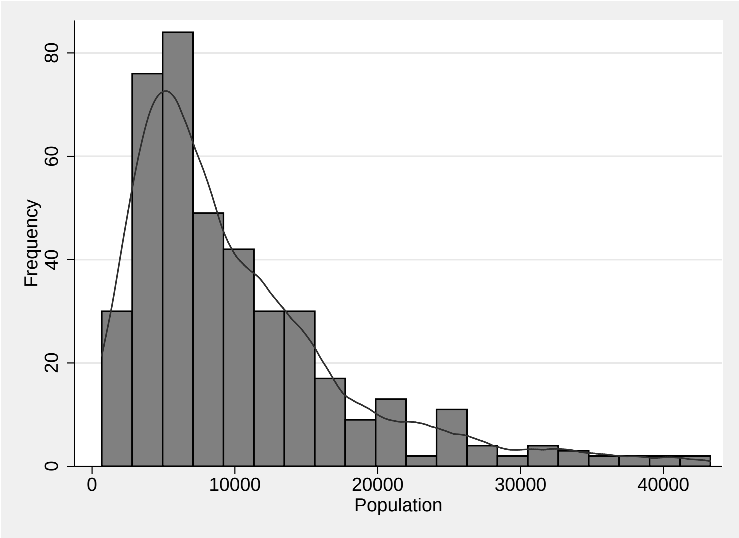
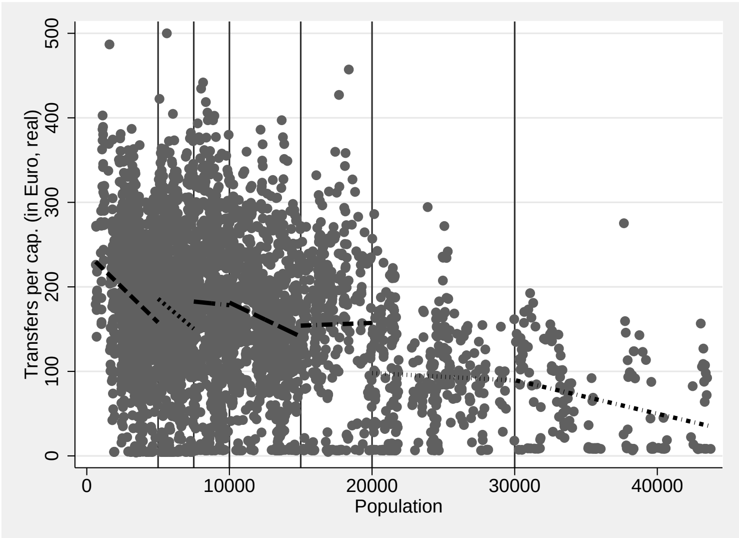
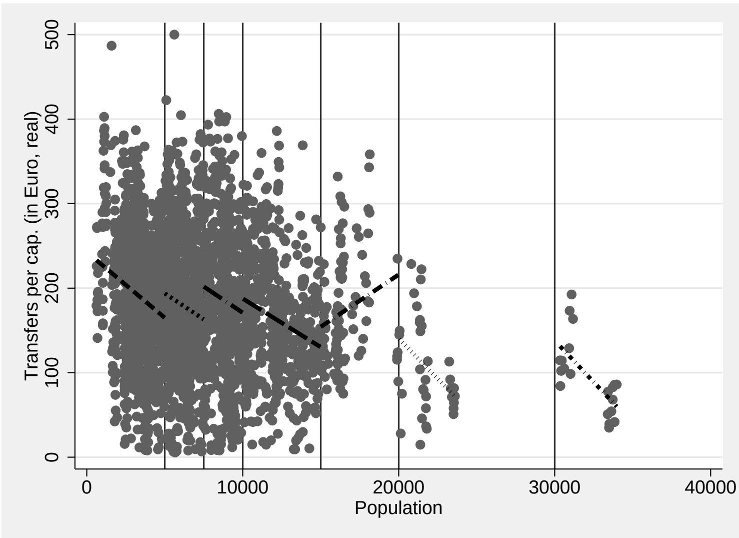


Figure 1: DISTRIBUTION OF POPULATION SIZE This figure describes the number of municipalities in Hesse with a given population size. .

Figure 2: GEOGRAPHICAL LOCATION OF HESSE.

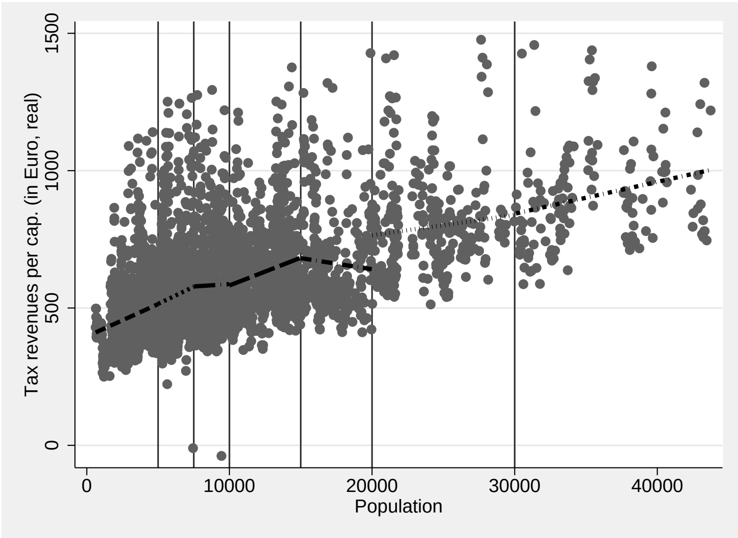


(a) All observations

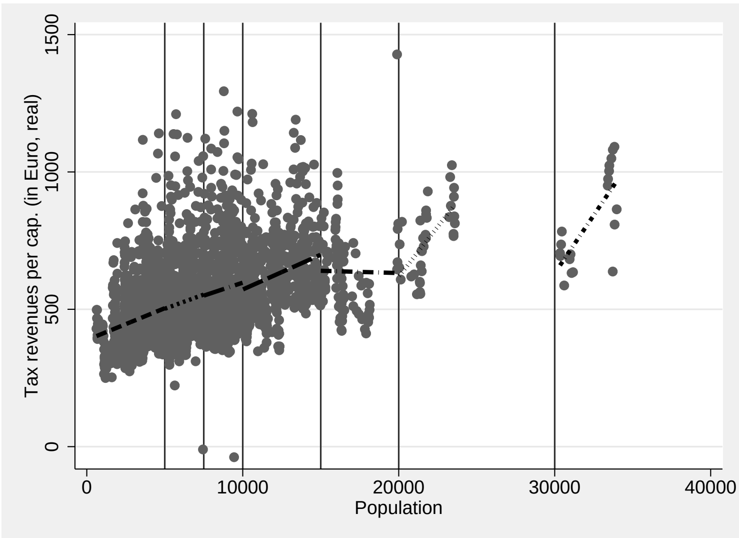


(b) All observations except central towns and fiscally abundant municipalities

Figure 3: Transfers per capita and population size: This figure presents a a scatter plot of (real) transfers per capita against population size. Vertical lines mark the thresholds at which the weight of inhabitants increases discontinuously (at 5000, 7500, 10000, 15000, 20000 and 3000). Within each bracket, the data is fitted linearly. Outliers as identified by the Hadi-method are excluded.



(a) All observations



(b) All observations except central towns and fiscally abundant municipalities

Figure 4: Tax revenues per capita and population size: This figure presents a a scatter plot of (real) tax revenues per capita against population size. Vertical lines mark the thresholds at which the weight of inhabitants increases discontinuously (at 5000, 7500, 10000, 15000, 20000 and 3000). Within each bracket, the data is fitted linearly. Outliers as identified by the Hadi-method are excluded.

Appendix

Table A.1: Equalization transfers and expenditures, Hessian Municipalities, 2001-2010, First stage of the TSLS regressions in Table 3 (Expenditures)

	TSLS I b/z	TSLS II b/z	TSLS III b/z
Bracket=5001-7500	30.837***	32.400***	20.363**
	(3.674)	(4.008)	(2.314)
Bracket=7501-10000	71.253***	73.802***	59.893***
	(4.941)	(5.233)	(4.827)
Bracket=10001-15000	63.647***	67.563***	40.758**
	(3.201)	(3.482)	(2.136)
Bracket=15001-20000	74.895***	77.782***	53.372**
	(2.956)	(3.137)	(2.318)
Expenditures$_{t-1}$	-0.052***	-0.056***	-0.036***
	(-8.978)	(-9.721)	(-7.617)
Council size			2.472**
			(2.267)
Population share <15			15.250***
			(7.209)
Population share > 65			9.821***
			(12.496)
Central town			10.902*
			(1.760)
Abundant municipality			-147.534***
			(-29.381)
Population (cubic)	Yes	Yes	Yes
Year dummies	No	Yes	Yes
N	3295	3295	3295
F	18.402	25.807	102.963

[a] This table presents the first-stage regressions for the TSLS regressions reported in Table 3.
[b] The dependent variable is whether a state is ruled by a coalition government.
[c] Stars indicate significance levels at 10% (*), 5% (**) and 1%(***).
[d] z-statistics in parentheses.
[e] z-statistics and hypothesis tests based on heteroscedasticity and autocorrelation and autocorrelation robust standard errors.

Table A.2: Equalization transfers and expenditures, Hessian Municipalities, 2001-2010, First stage of the TSLS regressions in Table 4 (Business tax multiplier)

	TSLS I	TSLS II	TSLS III
	b/z	b/z	b/z
Bracket=5001-7500	23.304***	24.531***	19.931**
	(2.830)	(3.111)	(2.240)
Bracket=7501-10000	55.751***	57.513***	50.668***
	(3.876)	(4.100)	(4.127)
Bracket=10001-15000	60.933***	65.268***	46.115**
	(3.053)	(3.356)	(2.424)
Bracket=15001-20000	78.243***	82.178***	65.533***
	(3.052)	(3.276)	(2.869)
Business tax multiplier$_{t-1}$	-0.466***	-0.497***	-0.422***
	(-5.742)	(-6.230)	(-6.354)
Council size			1.542
			(1.378)
Population share <15			13.746***
			(6.191)
Population share > 65			9.650***
			(12.025)
Central town			5.094
			(0.814)
Abundant municipality			-165.164***
			(-38.280)
Population (cubic)	Yes	Yes	Yes
Year dummies	No	Yes	Yes
N	3298	3298	3298
F	12.875	19.523	106.543

[a] This table presents the first-stage regressions for the TSLS regressions reported in Table 4.
[b] The dependent variable is whether a state is ruled by a coalition government.
[c] Stars indicate significance levels at 10% (*), 5% (**) and 1%(***).
[d] z-statistics in parentheses.
[e] z-statistics and hypothesis tests based on heteroscedasticity and autocorrelation and autocorrelation robust standard errors.

Table A.3: Equalization transfers and expenditures, Hessian Municipalities, 2001-2010, First stage of the TSLS regressions in Table 5 (Property tax multiplier)

	TSLS I	TSLS II	TSLS III
	b/z	b/z	b/z
Bracket=5001-7500	22.292***	22.929***	19.572**
	(2.813)	(2.992)	(2.257)
Bracket=7501-10000	58.645***	59.650***	55.026***
	(4.184)	(4.335)	(4.505)
Bracket=10001-15000	64.267***	67.006***	52.714***
	(3.235)	(3.442)	(2.761)
Bracket=15001-20000	77.448***	79.307***	70.131***
	(2.990)	(3.112)	(3.027)
Property tax multiplier$_{t-1}$	0.647***	0.632***	0.415***
	(12.136)	(11.987)	(8.264)
Council size			1.256
			(1.153)
Population share <15			16.170***
			(7.516)
Population share > 65			7.351***
			(8.751)
Central town			2.686
			(0.417)
Abundant municipality			-160.908***
			(-42.129)
Population (cubic)	Yes	Yes	Yes
Year dummies	No	Yes	Yes
N	3298	3298	3298
F	27.150	26.383	134.944

[a] This table presents the first-stage regressions for the TSLS regressions reported in Table 5.
[b] The dependent variable is whether a state is ruled by a coalition government.
[c] Stars indicate significance levels at 10% (*), 5% (**) and 1%(***).
[d] z-statistics in parentheses.
[e] z-statistics and hypothesis tests based on heteroscedasticity and autocorrelation and autocorrelation robust standard errors.