Income Heterogeneity and the Flypaper Effect

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October 12, 2007

Abstract

The purpose of this paper is to analyze the determinants of the local public expenditures and, in particular, try to explain the so called 'flypaper effect'. The analysis uses a political economy model to relate the existence and size of the flypaper effect to observable municipal characteristics such as the average tax base, income dispersion and whether or not a change in the average tax base affects the tax share of the majority voter. The empirical part of the study is based on Swedish data on municipal expenditures and revenues for the period 1996-2004. The results show that the size of the flypaper effect varies among municipalities depending on the relative composition of grant and tax base.

*The author would like to thank Thomas Aronsson, Tomas Sjögren, David Granlund, Magnus Wikström, Kurt Brännäs and seminar participants at Umeå University for helpful comments and suggestions. A research grant from the Wallander-Hedelius Foundation is gratefully acknowledged.

Key words: Income Dispersion, Local Public Expenditures, Intergovernmental Relations

JEL classification: D31, H72, H77

1 Introduction

This paper addresses the question of whether the source of local public revenue matters for the size of local public expenditures. To be more specific, does an increase in the tax revenues (due to an increase in the tax base) affect the expenditures in the same way as a transfer payment (e.g., grant) of the same size from the central government? According to the basic median voter model, where the tax price is treated as exogenous from the perspective of the median voter, the source of public revenues does not matter in this respect.[1] This is so because a transfer payment from the central to the local government is effectively equivalent to a transfer payment to the decisive voter. However, there is an extensive empirical literature that finds that local public spending responds more to increased transfers from the central government than to a corresponding increase in the tax base, an empirical finding that has been labelled the "flypaper effect".[2] This paper investigates the determinants of municipal expenditures in Sweden and, in particular, how the composition of grants and tax base as well as the distribution of private income contribute to the flypaper effect. The empirical application is based on panel data for the period 1996-2004.

Several competing hypotheses aim to explain the flypaper effect: fiscal

[1] See Bradford and Oates (1971a,b).

[2] The result was labelled the "flypaper effect" by Cournant, Gramlich and Rubinfeld (1979) following Arthur Okun's observation that "money sticks where it hits".

illusion (Cournant et al., 1979; Oates, 1979), budget maximizing by government agents (Romer and Rosenthal, 1980), uncertainty and risk aversion (Fosset, 1990; Turnbull, 1992), mental accounting (Hines and Thaler, 1995) etc.[3] None of these studies model the flypaper effect explicitly in a theoretical context. This paper focuses, instead, on income heterogeneity, and the regression equation will be related to a background theoretical model, where voters differ with respect to income.

The evidence for the existence of a flypaper effect is ambiguous. The early empirical literature dealing with the flypaper effect was criticized for not separating lump-sum grants from matching grants. Moffit (1984) emphasized the problem of ignoring the simultaneous determination of matching grants and public expenditures. Recent studies addressing these problems have been criticized for using an inappropriate functional form, e.g., studies that use a linear-in-variables functional form often found support for a flypaper effect, while studies based on logarithms of all variables found no support (Becker, 1996; Worthington and Dollery, 1999). Hamilton (1983) contends that empirical support for the flypaper effect is affected by the omitted variable biases. Subsequent efforts to correct for omitted variables that may correlate with intergovernmental transfers came to different conclusions regarding the flypaper effect (Knight, 2002; Gordon, 2004; Dahlberg et al., 2007). Empirical support for a flypaper effect has generally been demonstrated for certain situations, rather than across the board. For example, the effect has been shown to occur for different kinds of municipalities and different categories of expenditures (Moisio, 2002). Other studies have found that the response in local public expenditures to a change in the lump-sum transfers from the cen-

[3]A good survey is given by Bailey and Connolly (1998).

tral government is asymmetric, depending on whether the transfer increases or decreases (Gramlich, 1987; Gamkhar and Oates, 1996; Karlsson, 2006).

This paper presents a simple political model for local public expenditures, where the voters are divided into two groups: low-income and high-income earners. The results imply that the source of marginal revenue (i.e. whether it originates from an increase in the transfers or an increase in the tax base) will matter for the local public expenditure decision, and that the effect on the majority voters' tax share, caused by a change in the tax base, will be crucial for finding a flypaper effect. The intuition is that a change in the private income for any of the two voter groups affects the relative financial burden (tax share) of the majority voter group and, therefore, its willingness to use taxation as a marginal source of funds for public expenditures. In addition to income levels of the majority voters, the model emphasizes that the spread of private income will be important for local public expenditures.[4]

The empirical part of the paper estimates a model of local public expenditures from Swedish municipalities and tests for a flypaper effect. The local characteristics that affect the flypaper effect according to the theoretical model, such as the average tax base, the distribution of private income and the relative number of low income earners, will also be considered in the regressions. The data is particularly suited for studying the flypaper effect because transfers from the central to the local government in Sweden are, to a large extent, general grants. The use of general grants eliminates (at least in principle) the risk that grants and expenditures are determined simulta-

[4]Using US data Todo-Rovira (1991) found that income dispersion among voters matters when explaining local public expenditures. King (1984) also found that heterogeneity in income matters for the public expenditure decision.

neously. The empirical analysis finds evidence of flypaper effects in Sweden during the study period.

The outline of the paper is as follows. In Section 2, a political model for local public expenditures is presented and discussed. The empirical part of the study is carried out in Section 3. Section 4 summarizes the results and concludes.

2 A Political Model for Local Public Expenditures

Consider a municipality that consists of two types of immobile residents who differ in ability; a low-ability type and a high-ability type. Let n^i denote the number of individuals of ability-type i. Ability-type i derives utility from the consumption of a private good, c^i, and from the consumption of public services, g. The consumption of private goods is determined by the net income, $c^i = w^i(1-t)$, where w^i is the gross income and t is the income tax rate, while the consumption of the public service is determined via the public expenditure decision. We assume that the utility function is separable in c and g, meaning that ability-type i's utility can be written as

$$u^i = v(c^i) + z(g) \tag{1}$$

where the functions $v(\cdot)$ and $z(\cdot)$ are assumed to be increasing and strictly concave in their respective arguments.

The local government raises revenues by using the proportional labour income tax and receives a lump-sum transfer, b, from the central government. If ability-type i is the majority voter, the resource allocation will be determined as if a local planner solves

$$\max_{t,g} \; n^i[v(c^i) + z(g)] \tag{2}$$

subject to the private budget constraint defined above and the local public budget constraint

$$(n^i w^i + n^j w^j)t + (n^i + n^j)b = g \tag{3}$$

for $j \neq i$. The Lagrangian can be written

$$\mathcal{L} = n^i[v(c^i) + z(g)] + \lambda[(n^i w^i + n^j w^j)t + (n^i + n^j)b - g] \tag{4}$$

where λ is the Lagrange multiplier. The first-order conditions become

$$\lambda \;:\; (n^i w^i + n^j w^j)t + (n^i + n^j)b - g = 0 \tag{5}$$

$$t \;:\; -n^i w^i v^i_c + (n^i w^i + n^j w^j)\lambda = 0 \tag{6}$$

$$g \;:\; n^i z_g - \lambda = 0 \tag{7}$$

The flypaper effect will be evaluated by examining whether an increase in the tax base affects the municipal expenditures in the same way as an increase in the transfer payment from the central government. The tax base and the transfer payment are considered exogenous from the local government's point of view.

At the same time, note that a change in the tax base may, in addition to its effect on the municipality's budget, imply a change in the income distribution among the residents in the municipality. This additional effect (previously not discussed in the flypaper literature) does not appear when the transfer payment changes. As a point of reference in the theoretical analysis, I will measure the flypaper effect by comparing the effect on the local public expenditures following an increase in the transfer payment with the effect of a spread-preserving increase in the mean private income. Define the mean private income (or average tax base) and the wage differential between the high-ability type and the low-ability type as $\bar{w} = (n^i w^i + n^j w^j)/(n^i + n^j)$ and $\tilde{s} = w^j - w^i$, respectively. For further use, note also that w^i and w^j can be written in terms of $\bar{w}$ and $\tilde{s}$

$$w^i = \bar{w} - \frac{n^j}{(n^i + n^j)}\tilde{s} \tag{8}$$

$$w^j = \bar{w} + \frac{n^i}{(n^i + n^j)}\tilde{s} \tag{9}$$

Differentiating the first-order conditions with respect to $\bar{w}$ and b, holding $\tilde{s}$ constant and denoting the Hessian determinant by $|\bar{H}|$, yields

$$\partial g/\partial \bar{w} = -[(n^i + n^j)t\rho + \zeta\delta]/|\bar{H}| \tag{10}$$

$$\partial g/\partial b = -(n^i + n^j)\rho/|\bar{H}| \tag{11}$$

where

$$\begin{aligned} \rho &= n^i(\bar{w} - \frac{n^j}{(n^i + n^j)}\tilde{s})^2 v^i_{cc} \\ \zeta &= (n^i + n^j)\bar{w} \\ \delta &= n^i v^i_c + n^i(\bar{w} - \frac{n^j}{(n^i + n^j)}\tilde{s})(1-t)v^i_{cc} - (n^i + n^j)\lambda \\ |\bar{H}| &= -(n^i z_{gg}\zeta^2 + \rho) > 0 \end{aligned}$$

We are now ready to analyze if the source of local public revenue matters for the local public expenditures.

2.1 Implications of Income Heterogeneity

Equations (6), (8), (9), (10) and (11) together imply

$$\frac{\partial g/\partial b}{\partial g/\partial \bar{w}} = \frac{1}{t + (1-t)\varphi^i} \tag{12}$$

where

$$
\begin{aligned}
\varphi^i &= \frac{(n^i + n^j)\bar{w} + n^j \frac{\tilde{s}}{\epsilon^i}}{(n^i + n^j)\bar{w} - n^j \tilde{s}} \\
\epsilon^i &= \frac{v^i_{cc}}{v^i_c} c^i
\end{aligned}
$$

The magnitude of the expression on the right hand side of equation (12) depends on local characteristics, $(\bar{w}, \tilde{s}, n^i, n^j)$. A flypaper effect exists if a transfer payment from the central government stimulates the municipal expenditures more than an increase of the same size in the tax base, i.e. $(\partial g/\partial b)/(\partial g/\partial \bar{w}) > 1$. The opposite effect, $(\partial g/\partial b)/(\partial g/\partial \bar{w}) < 1$, will be referred to as a 'negative' flypaper effect. The elasticity of marginal utility with respect to consumption, ϵ^i, reflects the curvature of the utility function (the relation between ϵ^i and the flypaper effect is analyzed in Appendix).[5]

Equation (12) implies that $(\partial g/\partial b)/(\partial g/\partial \bar{w}) = 1$ if, and only if, $\varphi^i = 1$. Let us begin by considering two special cases when this will occur. First, if $\tilde{s} = 0$ $(\bar{w} = w^i = w^j)$, the majority voter will represent a single ability-type in the local economy and the result corresponds to that of a one-consumer model. The marginal valuation of private consumption is, in this case, equal to the marginal valuation of public consumption, i.e. $\lambda/v^i_c \equiv 1$. Second, the source of marginal revenue does not matter for the public expenditures when the elasticity of marginal utility with respect to private consumption, ϵ^i, equals minus one.[6] This result is further discussed in the Appendix.

[5] This elasticity is also known as the coefficient of relative risk aversion, defined as $\varepsilon^i = |\epsilon^i|$, when the utility function is used to describe attitudes towards risk.

[6] Consider a Cobb-Douglas form of $v(c^i)$, i.e., $v^i = (1/(1-a)) \times (c^i)^{1-a}$. If $a = |\epsilon^i|$ approaches 1, then the utility function approaches a logarithmic utility function, for which $(\partial g/\partial b)/(\partial g/\partial \bar{w}) = 1$.

Returning to the general model, note that a flypaper effect can only exist if $\varphi^i < 1$. For $|\epsilon^i| < 1$, this requires that $w^i < w^j$ ($\tilde{s} > 0$). A spread-preserving increase in the mean tax base implies that the tax share of the majority voters increases if the majority voters earn a low income. As a relatively larger financial burden falls on the majority voters, taxation becomes a less attractive source of marginal funds for the municipality from the view of the majority voters. In this case, differentiation of equation (12) shows that the flypaper effect decreases, as the mean tax base, $\bar{w}$, increases. Under the same conditions, an increase in the number of the low-income earners, n^i, reduces the size of the flypaper effect, whereas an increase in the spread of income, $\tilde{s}$, increases the size of the flypaper effect, ceteris paribus.[7]

Let us also consider the situation where the high-income earners are the majority voters. If $|\epsilon^i| < 1$, this means that $\varphi^i > 1$. In this case, we find a 'negative' flypaper effect, i.e. $(\partial g/\partial b)/(\partial g/\partial \bar{w}) < 1$. The intuition is analogous to that given above. On the other hand, if $|\epsilon^i| > 1$, and the high-income earners are in majority, we have $(\partial g/\partial b)/(\partial g/\partial \bar{w}) > 1$, indicating that a flypaper effect exists.[8]

As we indicated above, it is not entirely clear from earlier empirical literature how the flypaper effect should be measured. What happens if we do not condition on income spread, or if we were to control for spread in such

[7] The Cobb-Douglas form of $v(c^i)$ mentioned in footnote 6 yields $|\epsilon^i| = a$. Differentiation of equation (12) with respect to a shows that the flypaper effect decreases as the marginal utility of private income decreases (i.e. as a increases), if the low-ability type is decisive.

[8] The majority of estimates in the literature estimating the coefficient of relative risk aversion are in the interval $0.5 - 2$. Blanchard and Fischer (1989) refer to the empirical evidence based on consumption choices over time, where the estimates vary substantially, but usually lie around or above unity.

a way that the relative private income remains unaffected when the average tax base increases? If we were to increase the majority voters' income without controlling for income spread (i.e. increase w^i with w^j held constant), and then compare the resulting change in g with the effect of an additional transfer payment of the same size, we would expect to find a flypaper effect, independent of the ability-type in majority (at least if $|\epsilon^i| < 1$ and the derivative $\partial\epsilon^i/\partial\bar{w}$ is sufficiently small). By analogy, an increase in the minority voters' tax share makes taxable income a more attractive source of marginal funds for the municipality. In this case we would, therefore, expect to find a 'negative' flypaper effect. Finally, if the tax share of each voter group remains unaffected, then $(\partial g/\partial b)/(\partial g/\partial\bar{w}) = 1$, and we are back in the traditional representative agent model.

3 Empirical Analysis

The empirical part of the paper begins with a presentation of some institutional characteristics related to the intergovernmental transfer system as well as a description of the data. The empirical model and the estimation results follow.

3.1 Data and Institutional Characteristics

The sample consists of a panel containing 290 Swedish municipalities over a nine year period (1996-2004.)[9] The data were obtained from Statistics Swe-

[9]The number of Swedish municipalities increased during the study period from 288 (1996-1998) to 289 (1999-2002) to 290 (2003). Three large municipalities are excluded from the study (Malmö, Göteborg and Gotland) due to partly joint expenditures between the

den and the Swedish Labour Market Board. Swedish municipalities collect tax revenues by using a proportional income tax. This tax is the most important source of funds for the majority of municipalities, followed by user fees and general grants.[10] The study chooses this particular period due to a significant policy change in 1993 regarding transfers from the central government to the municipalities. The Swedish intergovernmental transfer system is built around formula-based general grants which, in theory, eliminate the risk that transfers and expenditures are determined simultaneously. The policy reform implemented in 1993 replaced most matching grants by a system of general grants.[11] The current system contains two parts. First, a transfer from the central government to the municipalities, which is interpretable as a general grant based on the number of residents in the municipality. Second, the system also contains an element of revenue sharing in the sense that resources are redistributed among municipalities such that municipalities with high taxable income or low structural costs compensate municipalities with low taxable income or high structural costs.[12] Therefore, for the former type of municipality, our measure of total grant may be negative.

municipality and the region. In addition, seven observations are excluded due to missing values in the dependent variable (see Greene, 2003). This leaves us with an unbalanced panel containing between 282 and 287 municipalities.

[10]During the study period (1996-2004), the tax revenues as a share of the total revenues decreased from 68.2 % to 67.4 % for the municipalities while the unconditional transfers decreased from 11.6 % to 9.4 % on average.

[11]In addition to the general grants, a smaller amount of matching grants was also used by the central government during the period of study.

[12]A minor reform was implemented in 1996, when the equalization part of the system was made financially neutral from the view of the central government (see Law Proposition 1995/96:64). The calculation of the grant formulas was subject to minor modifications in 1998 (see Law Proposition 1998/99:89).

Let us now turn to the variables to be used in the estimations. The municipality's total net operating expenditure, g, is the dependent variable. This includes the sum of expenditure on child care, elderly care, compulsory education etc.[13] The expenditure variable is adjusted by Statistics Sweden to ensure that it measures the running expenditures net of fees and matching grants. Variables characterizing a municipality's revenue, beside the exogenous grant variable, b, and the tax base, $\bar{w}$, are therefore not considered in the analysis. All monetary variables are expressed in real per capita terms using the Swedish CPI (2004 is the base year).

The measure of income spread used in Section 2 is operationalized by using the standard deviation of private income, which is estimated annually for each municipality.[14] As discussed in the theoretical section above, the existence of a flypaper effect depends on the relative size of the majority voters' private income. This will be taken into account by introducing a variable measuring the relative number of low-income earners in each municipality. A low-income earner is defined as a citizen earning less than 200,000 SEK per year, adjusted by the Swedish CPI (based year 2004).[15] This definition

[13]The municipalities' business activities are excluded from the analysis.

[14]Data on the income distribution in each municipality is collected by Statistics Sweden. The following intervals are defined for the period 1996-1997; 0, 0.1-39.9, 40-59.9, 60-79.9, 80-99.9, 100-119.9, 120-139.9, 140-159.9, 160-179.9, 180-199.9, 200-219.9, 220-259.9, 260-299.9, 300-399.9, 400+, and the following for 1998-2004; 0, 0.1-39.9, 40-79.9, 80-119.9, 120-159.9, 160-199.9, 200-239.9, 240-279.9, 280-319.9, 320-359.9, 360-399.9, 400-499.9, 500-599.9, 600+. The data refers to the number of residents in each interval. The income is reported in current prices (thousands of SEK). The standard deviation is estimated for each municipality and each year by using the mean income in the municipality and applying a lognormal density function to the income distribution.

[15]This threshold earnings level is chosen because the interval 0-199.9 is given for the

implies that the share of low-income earners in all municipalities decreases over time, on average, from 72 % in 1996 to 57 % in 2004, due to economic growth and inflation. Therefore, in order to adjust for economic growth and inflation, the annual share of low-income earners in the municipality is related to the annual share of low-income earners in the country. A dummy variable, d, equals one if the share of low-income earners in the municipality is larger than the share of low-income earners in the country.[16]

Following the literature on the determinants of municipal expenditures, the estimations will include relevant local characteristics such as population density, age structure of the population, political preferences and political strength. The population density, $Dens$, is measured by the number of residents per square kilometre. The classification of the age variables corresponds to the formulas used when calculating the structural cost due to the age structure in the municipalities. Political preferences are controlled by including the share of the seats in the municipal parliament occupied by members of either the Social Democratic Party or the Left Party, $Left$. Political strength is represented by a Herfindahl index, $Herf$, i.e. the sum of the squared shares of each party in the local parliament. Finally, a variable measuring the unemployment rate, $Unempl$, is also included as a control variable.[17] National income tax and expenditure policy are not included in

entire period (see previous footnote). The number of residents earning less than 200,000 SEK per year, adjusted by the CPI (2004 is the base year), is calculated by using a lognormal distribution. Use of this threshold income level implies that low-income earners are exempt from paying income tax to the central government. Measured in 2004 prices, earnings that exceeded 249,000 in 1996 or 308,000 in 2004 were subject to this additional income tax.

[16]This is the case for 1469 observations out of 2566.

[17]Other control variables were also tested, but these had no effect on the qualitative

the analysis.[18] Descriptive and summary statistics for these variables are presented in Tables A1-A2 in the Appendix.

3.2 Specification of the Empirical Model

We will first consider a benchmark version of the model where the flypaper effect is measured in the same way as in the earlier empirical literature. In this specification, the municipalities' expenditures, g, are explained solely by the grants, b, the sum of the grant and the tax base, θ, and by the standard determinants of local government expenditures, $\mathbf{x}$. The estimating equation is given by

$$g_{it} = \beta_0 + \beta_1 b_{it} + \beta_2 \theta_{it} + \boldsymbol{\beta}_{11} \mathbf{x}_{it} + \mu_i + \gamma_t + \varepsilon_{it} \tag{13}$$

where subindex i refers to municipality and subindex t to time period. The parameter μ_i is a municipality specific effect, γ_t a year specific effect, and ε_{it} is an error term. In order to be able to test the existence of a flypaper effect, the variable θ is defined as the sum of the general grant and the tax base, i.e. $\theta = b + \bar{w}$. According to the benchmark model, an increase in the grant

results discussed below. For example, alternative classifications of the age variables, a version of the Left-variable where the Environmental party is included and a version of the Unemployment-variable which includes persons in vocational training.

[18]The models to be estimated contain municipality specific fixed effects and period specific effects. As is common in earlier comparable literature, we abstract from the influences of central government taxation and expenditures on the municipal expenditures (see description of models in the next section).

affects the municipal expenditures in the same way as an increase in the tax base if $\beta_1 = 0$; a flypaper effect exists if $\beta_1 > 0$.

The first extension of the benchmark model means that the standard deviation of private income, $\tilde{s}$, is part of the set of explanatory variables.

$$\begin{aligned} g_{it} &= \beta_0 + \beta_1 b_{it} + \beta_2 \theta_{it} + \beta_3 \tilde{s}_{it} + \beta_4 \tilde{s}_{it} b_{it} + \beta_5 \tilde{s}_{it} \theta_{it} \\ &\quad + \boldsymbol{\beta}_{11} \mathbf{x}_{it} + \mu_i + \gamma_t + \varepsilon_{it} \end{aligned} \tag{14}$$

The standard deviation of private income enters the regression both as a separate effect and as an interaction effect with b and θ, respectively. These variables will also be present in the other extensions discussed below.

The second extension aims to test whether the flypaper effect is larger in municipalities with a higher share of low-income earners than in other municipalities. This will be done by using the dummy variable, d, distinguishing municipalities with a relatively high share of low-income earners, both as a separate effect and as interaction effects with b and θ.

$$\begin{aligned} g_{it} &= \beta_0 + \beta_1 b_{it} + \beta_2 \theta_{it} + \beta_3 \tilde{s}_{it} + \beta_4 \tilde{s}_{it} b_{it} + \beta_5 \tilde{s}_{it} \theta_{it} \\ &\quad + \beta_6 d_{it} + \beta_7 d_{it} b_{it} + \beta_8 d_{it} \theta_{it} + \boldsymbol{\beta}_{11} \mathbf{x}_{it} + \mu_i + \gamma_t + \varepsilon_{it} \end{aligned} \tag{15}$$

Finally, the third extension aims to estimate a flypaper effect that captures non-linear properties in the revenue variables. This allows the flypaper effect to vary between municipalities depending on the relative composition of grants and taxable income. The composition of grants and tax base in the municipality is closely related to the relative number of low-income earners. More specifically, this extension means that the square of the grant and the square of the variable measuring the sum of grants and taxable income are added to the regressors.[19]

$$g_{it} = \beta_0 + \beta_1 b_{it} + \beta_2 \theta_{it} + \beta_3 \tilde{s}_{it} + \beta_4 \tilde{s}_{it} b_{it} + \beta_5 \tilde{s}_{it} \theta_{it} + \beta_9 \hat{b}_{it}^2 + \beta_{10} \hat{\theta}_{it}^2 + \boldsymbol{\beta}_{11} \mathbf{x}_{it} + \mu_i + \gamma_t + \varepsilon_{it} \quad (16)$$

The inclusion of the quadratic effects results in a less restrictive model compared to the linear specifications. The null hypotheses to be tested in the models presented above, which imply that the local public spending does not depend on the source of marginal revenue, are summarized in Table 1.

Table 1. Null Hypotheses

Model	$(\partial g/\partial b)/(\partial g/\partial \bar{w})$	Null Hypothesis
$[I]$ Benchmark Model	$\frac{\beta_1+\beta_2}{\beta_2}$	$\beta_1 = 0$
$[II]$ First Extended Model	$\frac{\beta_1+\beta_2+(\beta_4+\beta_5)\tilde{s}_{it}}{\beta_2+\beta_5\tilde{s}_{it}}$	$\beta_1 = \beta_4 = 0$
$[III]$ Dummy Variable Model	$\frac{\beta_1+\beta_2+(\beta_4+\beta_5)\tilde{s}_{it}+(\beta_7+\beta_8)d_{it}}{\beta_2+\beta_5\tilde{s}_{it}+\beta_8 d_{it}}$	$\beta_1 = \beta_4 = \beta_7 = 0$
$[IV]$ Quadratic Model	$\frac{\beta_1+\beta_2+(\beta_4+\beta_5)\tilde{s}_{it}+2\beta_9\hat{b}+2\beta_{10}\hat{\theta}}{\beta_2+\beta_5\tilde{s}_{it}+2\beta_{10}\hat{\theta}}$	$\beta_1 = \beta_4 = \beta_9 = 0$

Following most other earlier studies on local public expenditure determination, we assume that the tax base can be treated as exogenous in the regression.[20] To test this assumption, this paper instruments for the tax

[19]The means are subtracted from the variables, before taking the square, in order to reduce the multicollinarity between the linear and quadratic terms, i.e. $\hat{b}_{it}^2 = (b_{it} - \bar{b})^2$ and $\hat{\theta}_{it}^2 = (\theta_{it} - \bar{\theta})^2$. The short period of study motivates the use of the global means.

[20]The assumption of exogeneity has been questioned. For example, empirical studies based on Swedish data imply that a change in taxation affects the labour supply (Blomquist, 1983; Aronsson and Palme, 1998), and to some extent migratory behaviour (Westerlund and Wyzan, 1995).

base by using the indicators of industry structure in each municipality or time-lags of the tax base as instrumental variables. However, the potential instruments failed the validity test thus precluding their use in this study.[21]

3.3 Results

The estimation results are presented in Table 2.[22] First, we present several specification tests.[23] A Hausman test implies that a fixed effects model is preferred to a random effects model in all specifications estimated. A Bhargava et al. modified Durbin-Watson (DW) test examines whether the residuals are serially correlated.[24] Two null hypotheses are both rejected in all models estimated: (1) that the residuals are serially independent and (2) that the residuals form a random walk. Moreover, a modified Wald test for group-wise heteroskedasticity in the fixed effects model (denoted 'Hettest' in Table

[21]Hansen's J-test rejects the joint null hypothesis that the instruments are uncorrelated with the error term. This test is applicable in the presence of serial correlation and heteroskedasticity.

[22]For the municipalities included in the regressions, the grant revenue can be either positive or negative. Using the entire sample increases estimate precision. Nevertheless, the qualitative results discussed below hold even when municipalities with non-positive grant revenues are excluded.

[23]The part of the general grants that compensate for structural cost differences depends on local characteristics. The compensation for structural cost differences may, as a consequence, be correlated with potentially omitted variables. It is, therefore, important to be aware of the possibility that unobservable factors simultaneously affect the equalization of structural cost differences and expenditures. Estimations have, therefore, also been made for the situation where the part of the grant variable that equalizes structural cost differences has been excluded. The estimation results reported in Table 2 are robust to these changes.

[24]The critical values can be found in Bhargava et al. (1982).

2; see Greene, 2003) rejects the null of homoskedasticity. The existence of serial correlation and groupwise heteroskedasticity in the fixed effects model implies that the estimates of the standard errors need to be corrected. This is done using White's estimator of the variance-covariance matrix. All tests are reported in Table 2.

The first column refers to the benchmark model. As can be seen from Table 2, the grant variable and the sum of grants and tax base significantly affect the municipal expenditures. The estimate and t-value of the parameter associated with the grant variable supports the existence of a flypaper effect. The point estimate of the flypaper effect becomes $(\partial g/\partial b)/(\partial g/\partial \bar{w}) = 2.88$, which is somewhat smaller than in previous studies.[25]

Turning to the effects of local characteristics (the vector $\mathbf{x}$), the results are qualitatively similar to those of earlier comparable literature on local public expenditures. Political preferences have significant effects on the expenditures, but the political strength in the municipal parliament does not. The results suggest that a municipality represented by a large share of socialist parties are associated with higher public expenditures than other municipalities, ceteris paribus. Regarding other municipal characteristics, recall that the municipalities are responsible for providing comprehensive education and elderly care. We find that the higher the share of individuals in the age corresponding to upper secondary education (age 16-18), and the higher the share of the oldest residents in the municipality (age 75-), the higher the per capita expenditures. The results also indicate that the per capita expendi-

[25]Based on Swedish data collected during a period with specific grants (before 1993), Aronsson and Wikström (1995) simulated the effect of replacing a system of specific grants with a system of general grants and predicted that the flypaper effect would be about 6 in a new system of general grants.

ture decreases as the population density in the municipality increases, which indicates that the municipalities benefit from economics of scale.

The estimation results for equation (14) are presented in the second column. The standard deviation of private income has neither a significant effect on the local public expenditures, nor the estimated magnitude of the flypaper effect. The parameter estimate of the flypaper effect is nearly unaffected as the spread of income increases, whereas an F-test rejects the null that $\beta_1 = \beta_4 = 0$ ($\chi^2 = 97.71$).

The third column[26] refers to the model where the municipalities with a high share of low-income earners are distinguished by a dummy variable ($d = 1$ if the share of low-income earners in the municipality is larger than the share of low-income earners in the country). As can be seen from Table 2, the flypaper effect is larger for municipalities with a higher share of low-income earners, $(\partial g/\partial b)/(\partial g/\partial \bar{w}) = 3.66$, than for the other municipalities, $(\partial g/\partial b)/(\partial g/\partial \bar{w}) = 2.60$. An F-test rejects the null that $\beta_1 = \beta_4 = \beta_7 = 0$ ($\chi^2 = 37.79$) and a Likelihood ratio-test rejects the null hypothesis that the dummy variable does not explain local public expenditures.

[26]The qualitative results in models $[III]$ and $[IV]$ are unaffected if the standard deviation, $\tilde{s}_{it}$, is excluded.

Table 2. Estimation results (period 1996-2004) per capita.

	$[I]$	$[II]$	$[III]$	$[IV]$
b	0.354^{***}	0.365^{***}	0.240^{***}	0.267^{***}
	(9.79)	(9.88)	(5.41)	(6.69)
θ	0.188^{***}	0.167^{***}	0.150^{***}	0.124^{***}
	(12.07)	(9.56)	(8.61)	(6.78)
$\tilde{s}$		2.21×10^{-8}	1.53×10^{-8}	-7.44×10^{-8}
		(0.35)	(0.25)	(-1.09)
$\tilde{s}b$		-3.49×10^{-12}	-2.73×10^{-12}	1.85×10^{-12}
		(-1.26)	(-1.00)	(0.63)
$\tilde{s}\theta$		-2.11×10^{-13}	-1.56×10^{-13}	4.68×10^{-13}
		(-0.48)	(-0.37)	(0.99)
d			-1793.7^{***}	
			(-2.84)	
db			0.173^{***}	
			(3.38)	
dθ			0.005	
			(0.99)	
$\hat{b}^2$				$1.77\times10^{-5***}$
				(5.91)
$\hat{\theta}^2$				$-3.77\times10^{-7**}$
				(-2.46)
Left	21.21^{**}	22.15^{**}	19.79^{*}	18.26^{*}
	(2.05)	(2.14)	(1.92)	(1.83)
Herf	-7.83	-7.12	-3.16	1.88
	(-0.57)	(-0.51)	(-0.23)	(0.14)
Unempl	57.48	71.25	90.90^{**}	112.2^{**}
	(1.27)	(1.57)	(2.00)	(2.47)

(Continued on next page).

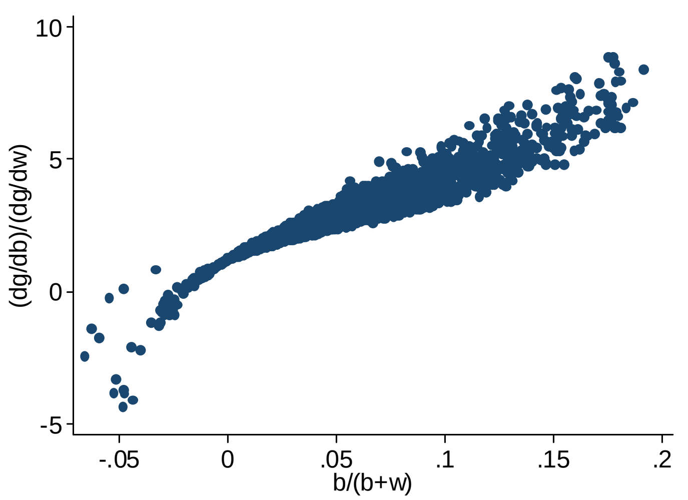
Table 2. (Continued).

	$[I]$	$[II]$	$[III]$	$[IV]$
Age 0-6	90.93	69.75	85.89	83.16
	(0.84)	(0.65)	(0.79)	(0.72)
Age 7-15	96.97	81.32	113.6	231.8**
	(1.16)	(0.97)	(1.33)	(2.42)
Age 16-18	732.4***	715.27***	691.8***	726.1***
	(5.05)	(4.93)	(4.74)	(4.91)
Age 65-74	-256.3***	-223.6**	-179.7*	-184.0**
	(-2.86)	(-2.47)	(-1.94)	(-2.00)
Age 75-	314.5***	205.9***	316.8***	199.3*
	(2.84)	(2.75)	(2.78)	(1.69)
Dens	-9.45×10^{4}***	-7.70×10^{4}***	-8.35×10^{4}***	-9.69×10^{4}***
	(-3.79)	(-2.93)	(-3.15)	(-3.75)
Adjusted R^2	0.878	0.879	0.880	0.881
F, Listed variable	27.02	21.82	18.12	17.85
F, Individual effects	842.92	786.57	698.38	758.90
F, Time effects	37.26	38.07	36.59	34.33
χ^2 Fixed vs Random	148.27	120.90	137.60	38.27
Hettest	1.0×10^{30}	9.8×10^{29}	19553.1	1.3×10^{30}
DW	1.18	1.18	1.18	1.22
LR Extensions vs $[I]$		14.08	36.34	93.00
LR Extensions vs $[II]$			22.26	78.92
No. of observations	2566	2566	2566	2566
No. of groups	287	287	287	287

Note: t-values in parentheses (obtained by using White's estimator of the variance-covariance matrix). The regressions in Table 2 include municipality specific effects and period specific effects. ***, ** and * denote significance at the 1, 5 and 10 percent level, respectively.

Finally, the estimation of the model including the square of b and θ, respectively, is presented in the fourth column. The quadratic effects are significant. The advantage of including the quadratic effects is that they

Figure 1: The Flypaper Effect Estimated by the Quadratic Model



allow for a more flexible interpretation of the flypaper effect, meaning that the size of the flypaper effect varies among municipalities depending on the relative composition of grant and tax base. A large proportion of grant in relation to the sum of grants and tax base corresponds to a relatively high number of low-income earners. An F-test rejects the null that $\beta_1 = \beta_4 = \beta_9 = 0$ ($\chi^2 = 45.69$) whereas Likelihood ratio-tests reject that the first two models fit the data better than the quadratic model. The flypaper effect is illustrated graphically in Figure 1 by plotting it against the ratio between grants and the sum of grants and tax base for each municipality and each year.[27] According to Figure 1, the size of the flypaper effect becomes larger as the grants increase relative to the sum of grant and tax base. The

[27]An illustration of the flypaper effect by plotting it against the relative number of low-income earners in the municipality gives the same picture as Figure 1.

point estimate of the flypaper effect is about eight for the municipality with the highest share of grants in relation to the sum of grants and tax base, whereas it takes a negative value for the municipalities with the lowest share of grants.[28]

A functional form that is linear-in-variables is most frequently used in the empirical literature dealing explicitly with the flypaper effect. Likelihood ratio-tests reject the linear model against the more general quadratic alternative (see above). However, some researchers argue in favour of using a logarithmic functional form (Becker, 1996; Worthington and Dollery, 1999). A Pe-test, developed by MacKinnon, White, and Davidson (1983), implies that the quadratic model (where the underlying explanatory variables are not transformed into logarithms) is preferred to a logarithmic specification.[29] It is difficult to compare results from the logarithmic model with results from the models discussed above because the parameters in the logarithmic model refer to elasticities rather than marginal effects. The results from estimating a logarithmic version of the model are, nevertheless, presented in the Appendix.

[28]The negative values in Figure 1 can, most likely, be explained by a poor fit between the data and the functional form in the tails.

[29]A Box-Cox transformation rejects the functional form of the benchmark model, both when it is linear-in-variables and when it is logarithmic in all variables. However, the estimates of the transformed parameters in the Box-Cox model are closer to result in a model that is linear-in-variables, and the χ^2-statistic is closer not to reject this functional form.

4 Conclusion

The model for local public expenditures considered in this paper implies that the income distribution in the municipality matters for the majority voters' marginal valuation of different sources of public revenue. Specifically, this paper found that the average tax base, the income spread in the municipality and the share of low-income earners all contribute to the existence and size of the flypaper effect. The model implies that the effect on the majority voters' tax share, caused by a change in the tax base, will be crucial for finding a flypaper effect. In the case of a single ability-type in the local economy, there is no flypaper effect, and the results correspond to a representative agent model.

The empirical analysis is based on panel data containing between 282 and 287 Swedish municipalities and nine years, 1996-2004. The benchmark model, which corresponds to previous empirical literature, results in a point estimate of the flypaper effect of about three. However, Likelihood ratio-tests reject the benchmark specification when it is tested against more general models. The first extension of the benchmark model introduces the standard deviation of private income and finds that this measure of income dispersion does not seem to affect the size of the flypaper effect. The second extension aims to examine whether the size of the flypaper effect is larger in municipalities where the share of low-income earners is relatively high. This is examined by using a dummy variable-approach. The results imply that the size of the flypaper effect is larger in municipalities where a relatively high share of the residents are low-income earners. Finally, the model that includes the quadratic effects allows for a more flexible interpretation of the flypaper effect, meaning that the size of the flypaper effect varies among municipalities depending on the relative composition of grant and tax base. The estimation results illustrate that the flypaper effect becomes larger as the proportion of grants in relation to the sum of grant and tax base increases.

Appendix

ϵ^i and the Flypaper Effect

To begin with, combine equations (6) and (7). This gives

$$\psi^i z_g - v_c^i = 0 \tag{A2}$$

where

$$\psi^i = (n^i w^i + n^j w^j)/w^i$$

Rewriting equation (11) in terms of ϵ^i gives that $\partial g/\partial b = 0$ when $\epsilon^i = 0$, and $\partial g/\partial b > 0$ when $|\epsilon^i| > 0$. The underlying mechanism is seen in equation (A2) and is illustrated in Figure 2(I), which for simplicity assumes a linear relationship between $\partial g/\partial b$ and $|\epsilon^i|$. Equation (A2) implies that $\partial g/\partial b = 0$ when v_c^i is constant, i.e. when $\epsilon^i = 0$, because if v_c^i is constant, g must remain constant as well for equation (A2) to apply. An increase in $|\epsilon^i|$ changes the curvature of the utility function (with respect to private consumption) and makes it possible to increase g by increasing b.

Besides affecting the marginal utility of private consumption (i.e. the second term on the left hand side of equation (A2)), an increase in $\bar{w}$ will also have indirect effects on the local public expenditures via the tax share of each ability-type; an effect which arises via ψ^i in equation (A2). A change in ϵ^i, therefore, results in a larger effect on $\partial g/\partial \bar{w}$ relative to the effect on $\partial g/\partial b$.

Rewriting equation (10) in terms of ϵ^i gives that $\partial g/\partial \bar{w} \neq 0$ when $\epsilon^i = 0$. In the situation where the low-income earners are the majority voters we find that $\partial g/\partial \bar{w} < 0$ when $\epsilon^i = 0$, because an increase in $\bar{w}$ will increase the tax share of the low-income earners (i.e. decrease ψ^i in equation (A2)) and, therefore, has to be balanced by a decrease in g. Now, by increasing $|\epsilon^i|$, the effect via the tax share dominates the effect on the marginal utility of private consumption until $|\epsilon^i| = \kappa > 0$, when $\partial g/\partial \bar{w} = 0$ (see Figure 2(II)). The relation between ϵ^i and the flypaper effect is illustrated in Figure 2(IV). If the low-income earners are in majority, a flypaper effect will exist when $\kappa < |\epsilon^i| < 1$, and a 'negative' flypaper effect will exist when $|\epsilon^i| > 1$.

The marginal effects on spending of $\bar{w}$ and b will be the same if, and only if, $|\epsilon^i| = 1$. To see this, start by taking the derivative of the local public budget constraint in equation (3) with respect to b and $\bar{w}$, respectively,

$$\frac{\partial g}{\partial b} = (n^i + n^j)(1 + \bar{w}\frac{\partial t}{\partial b}) \quad \text{(A3)}$$

$$\frac{\partial g}{\partial \bar{w}} = (n^i + n^j)(t + \bar{w}\frac{\partial t}{\partial \bar{w}}) \quad \text{(A4)}$$

To derive the expressions for $\partial t/\partial \bar{w}$ and $\partial t/\partial b$, respectively, we begin by substituting equation (7) into equation (6), which gives a modified first-order condition for the tax rate;

$$\Omega_t = -(\bar{w} - \frac{n^j}{n^i + n^j}\tilde{s})v_c^i + (n^i + n^j)\bar{w}z_g = 0 \quad \text{(A5)}$$

Differentiating with respect to $t, \bar{w}$ and b, while using that $g = t(n^i + n^j)\bar{w} + (n^i + n^j)b$ from the local public budget constraint, we have

$$\frac{\partial t}{\partial \bar{w}} = -[(n^i + n^j)z_g + t(n^i + n^j)^2\bar{w}z_{gg} - v_c^i - v_{cc}^i c^i]/\Omega_{tt} \quad \text{(A6)}$$

$$\frac{\partial t}{\partial b} = -[(n^i + n^j)^2\bar{w}z_{gg}]/\Omega_{tt} \quad \text{(A7)}$$

Substituting equations (A6)-(A7) into equations (A3) and (A4), and rearranging gives (rewrite v_{cc}^i in terms of ϵ^i by using that $\epsilon^i = (v_{cc}^i/v_c^i)c^i$)

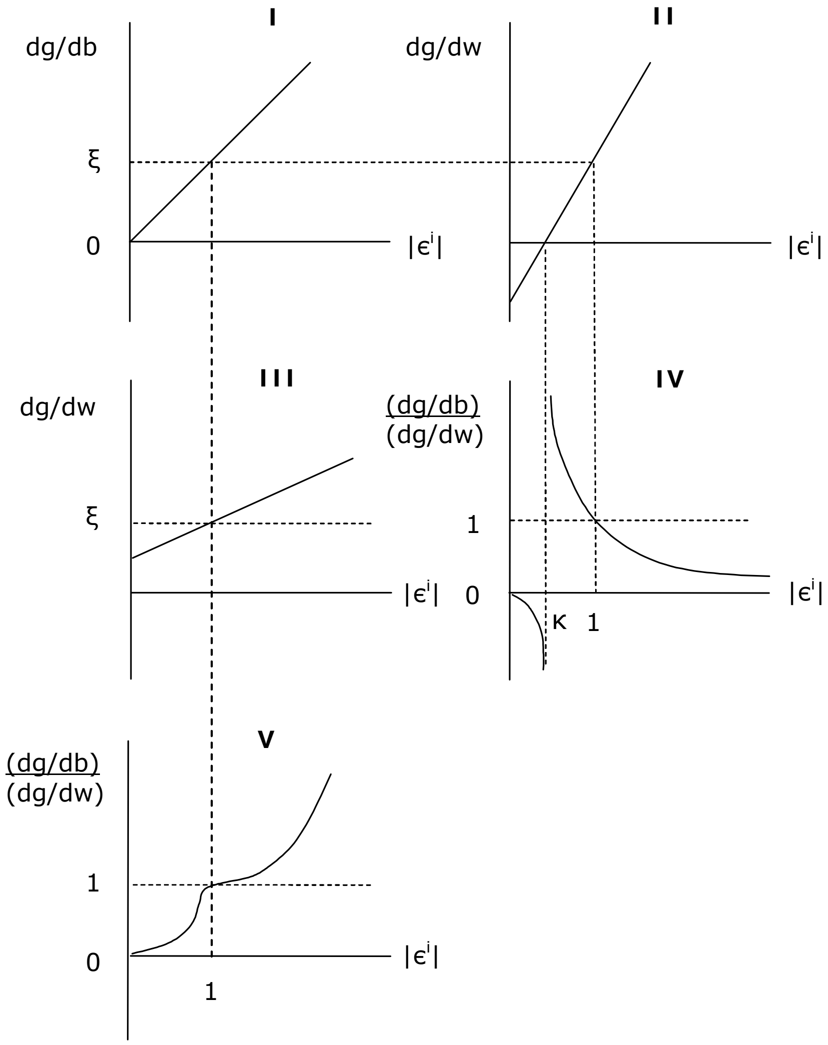
$$\frac{\partial g}{\partial b} = [(n^i + n^j)(w^i)^2(\frac{v_c^i}{c^i})\epsilon^i]/\Omega_{tt} \tag{A8}$$

$$\frac{\partial g}{\partial \bar{w}} = \begin{array}{c} [(n^i + n^j)(w^i)^2(\frac{v_c^i}{c^i})\epsilon^i(\epsilon^i t - (1-t)) \\ + \bar{w}(n^i + n^j)v_c^i(1+\epsilon^i))]/\Omega_{tt} \end{array} \tag{A9}$$

Note that the indirect effects on the local government expenditures via the tax shares of both ability-types disappear as $\epsilon^i = -1$, and so does the flypaper effect, i.e. $(\partial g/\partial b)/(\partial g/\partial \bar{w}) = 1$.

Finally, let us also consider the situation where the high-income earners are in the majority (see Figure 2(III)). In this case we find that $\partial g/\partial \bar{w} > 0$ when $\epsilon^i = 0$, because an increase in $\bar{w}$ will increase the tax share of the high-income earners and, therefore, has to be balanced by an increase in g. As a consequence, an increase in ϵ^i results in a smaller effect on $\partial g/\partial \bar{w}$ relative to the effect on $\partial g/\partial b$. A flypaper effect will exist when $|\epsilon^i| > 1$, and a 'negative' flypaper effect will exist when $0 < |\epsilon^i| < 1$ (see Figure 2(V)). The marginal effects of $\bar{w}$ and b on spending will be the same if, and only if, $|\epsilon^i| = 1$.

Figure 2: The relation between ϵ^i and the Flypaper Effect



Descriptive Statistics

Table A1. Description of the variables

Variable	Description
g	Total net operational expenditures (SEK per capita).
b	Total unconditional grants to the municipality (SEK per capita).
$\bar{w}$	Taxable income in the municipality (SEK per capita).
$\tilde{s}$	The standard deviation from the mean income in the municipality (SEK).
d	A dummy variable that equals one if the share of low-income earners in the municipality is larger than the share of low-income earners in the country. A low-income earner is defined as a citizen earning less than 200,000 SEK per year. The earnings are adjusted by the Swedish CPI (2004 is the base year).
Left	The percentage of the seats in the municipal parliament held by Social Democrats and members of the Left Party.
Herf	A herfindahl index measuring political strength in the municipal parliament.
Unempl	The percentage of unemployed.
Age 0-6	The percentage of residents aged 6 or younger.
Age 7-15	The percentage of residents aged 7-15.
Age 16-18	The percentage of residents aged 16-18.
Age 65-74	The percentage of residents aged 65-74.
Age 75-	The percentage of residents aged 75 or older.
Dens	The population density, residents per square kilometre. This variable is divided by the factor ten thousand for computational purposes.

Note: g, b, w and $\tilde{s}$ are adjusted by the Swedish CPI (2004 is base year). The income variable used for calculating $\tilde{s}$ and d is based on the population aged 16 and above.

Table A2. Summary statistics

	1996		2004		1996-2004	
Variable	Mean	Std.dv.	Mean	Std.dv.	Mean	Std.dv.
g	29199.8	3487.6	36838.9	3871.0	33042.5	4482.8
b	5733.7	3884.6	7287.3	5502.4	6795.4	4557.8
w	97666.6	12851.1	128842.1	17212.2	111336.7	17815.2
$\tilde{s}^{a)}$	5.71×10^{8}	3.15×10^{9}	4.46×10^{8}	7.56×10^{9}	3.49×10^{8}	5.90×10^{9}
Left	50.77	11.94	46.82	11.19	47.79	11.73
Herf	29.82	5.77	25.22	4.64	25.96	5.29
Unempl	7.23	1.94	3.92	1.12	4.62	2.00
Age0-6	9.08	0.95	7.07	1.09	7.67	1.22
Age7-15	11.53	1.03	12.10	1.11	12.32	1.17
Age16-18	3.66	0.38	4.12	0.37	3.76	0.40
Age65-74	9.51	1.72	9.48	1.57	9.35	1.64
Age75-	9.18	2.21	9.78	2.25	9.58	2.26
Dens	0.0114	0.0389	0.0118	0.0411	0.0116	0.401

$^{a)}$ The extreme values are created by poor fit (in a few municipalities) between the income distribution and the lognormal density function, which is used when the standard deviation is calculated. Even if some of the observations show high values, this is not considered as sufficient for excluding the observations. Nevertheless, omitting the extreme values from the analysis had no effect on the qualitative results discussed in Section 3.

The Logarithmic Estimation Results

Studies that use a functional form that is linear-in-variables often find support for a flypaper effect, while studies that use a functional form that is logarithmic in all variables do not find any support (Becker, 1996; Worthington and Dollery, 1999). The reader should note that a logarithmic estimation yields coefficients equal to elasticities and not marginal effects on spending.

In order to compare the results, the estimated elasiticities are often converted into marginal effects. The marginal effects on spending by an increase in either b or θ are given by

$$\begin{aligned} \frac{\partial g}{\partial b} &= \beta_1^{\log} \times \frac{g}{b} \\ \frac{\partial g}{\partial \theta} &= \beta_2^{\log} \times \frac{g}{\theta} \end{aligned}$$

Does the use of a logarithmic functional form alter the results discussed in the empirical part of this paper? The model to be estimated is written.[30]

$$\ln g_{it} = \beta_0 + \beta_1 \ln b_{it} + \beta_2 \ln \theta_{it} + \boldsymbol{\beta}_6 \ln \mathbf{x}_{it} + \mu_i + \gamma_t + \varepsilon_{it} \tag{A10}$$

An extended version of equation (A10) which aims to test whether the flypaper effect is larger for municipalities with a higher share of low-income earners than for other municipalities is estimated.

$$\begin{aligned} \ln g_{it} &= \beta_0 + \beta_1 \ln b_{it} + \beta_2 \ln \theta_{it} + \beta_3 d_{it} + \beta_4 d_{it} \ln b_{it} \\ &\quad + \beta_5 d_{it} \ln \theta_{it} + \boldsymbol{\beta}_6 \ln \mathbf{x}_{it} + \mu_i + \gamma_t + \varepsilon_{it} \end{aligned} \tag{A11}$$

The estimation results are presented in Table A3. The first column in Table A3 refers to the estimation for a simplified version of equation (A11)

[30]The observations where the municipality's total grant revenue is non-positive are excluded in order to make a logarithmic estimation possible. The sample will, therefore, be reduced by 123 observations. This leaves us with an unbalanced panel containing between 265 and 282 municipalities. Furthermore, the standard deviation of private income in each municipality for each year, $\tilde{s}$, is excluded due to collinarity problems.

where $\beta_3 = \beta_4 = \beta_5 = 0$. The null hypothesis ($\beta_1 = 0$) means that the elasticity of the grant variable equals the elasticity of θ. Following Becker (1996), and calculating the marginal effects at the means, the point estimate of the flypaper effect in this model becomes $(\partial g/\partial b)/(\partial g/\partial w) = 1.30$. The estimate of the marginal effect of grants is less than the estimate reported in Section 3. This results in a smaller flypaper effect than in the benchmark model. The t-value of the grant coefficient is significant at the 1 percent level.

The results of estimating equation (A11) are reported in the second column. The results imply that the flypaper effect is larger for municipalities with a relatively high share of low-income earners, $(\partial g/\partial b)/(\partial g/\partial w) = 2.22$, than for the other municipalities, $(\partial g/\partial b)/(\partial g/\partial w) = 1.26$. The qualitative result in this model is, therefore, equivalent to the result presented in Section 3 (even if the size of the flypaper effect is smaller in the logarithmic model). An F-test rejects the null that $\beta_1 = \beta_4 = 0$ ($\chi^2 = 13.82$).

Table A3. Estimation results (logarithmic specification).

	$[I]$	$[III]$
b	0.013***	0.011***
	(3.80)	(3.49)
θ	0.674***	0.675***
	(10.80)	(10.39)
d		-0.115
		(-0.54)
db		0.039***
		(3.63)
$d\theta$		-0.019
		(-0.92)
$Left$	0.013	0.016
	(1.00)	(1.16)
$Herf$	0.011	0.011
	(0.87)	(0.94)
$Unempl$	0.017***	0.017***
	(2.76)	(2.79)
$Age\ 0-6$	-3.26×10^{-4}	0.006
	(-0.02)	(0.24)
$Age\ 7-15$	0.091**	0.083**
	(2.50)	(2.28)
$Age\ 16-18$	0.070***	0.062***
	(4.23)	(3.75)
$Age\ 65-74$	-0.021	-0.013
	(-0.80)	(-0.47)
$Age\ 75-$	0.035	0.039
	(1.06)	(1.18)

(Continued on next page).

Table A3. (Continued).

	$[I]$	$[III]$
Dens	-7.62×10^{-3}	-3.05×10^{-3}
	(-0.38)	(-0.15)
Adjusted R^2	0.877	0.878
F, Listed variable	15.63	13.76
F, Individual effects	781.87	680.72
F, Time effects	27.23	28.55
χ^2 Fixed vs Random	44.87	167.77
Hettest	1.0×10^{25}	5.0×10^{28}
DW	1.15	1.16
LR		20.17
No. of observations	2443	2443
No. of groups	282	282

Note: *t*-values in parentheses (obtained by using White's estimator of the variance-covariance matrix). The regressions in Table 1 include municipality specific effects and period specific effects. ***, ** and * denote significance at the 1, 5 and 10 percent level, respectively.

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