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Is the treatment of intergovernmental aid symmetric?

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In this note we use a variable parameter model to test for asymmetries in the treatment of intergovernmental aid. The central question is whether local government officials treat intergovernmental aid differently during periods of aid certainty and uncertainty. We find evidence of fiscal replacement for 94% of Wisconsin municipalities and fiscal inducement for only a small handful of municipalities. The lower the dependency on shared revenues, the higher the odds that the municipality will replace lost shared revenues with own source revenues.

I. Introduction

The effects of the 'new federalism' devolution policies promoted since the 1980s are once again being felt by local governments. Chronic fiscal shortfalls at the federal and state levels have resulted in fewer resources flowing to local governments. The question that has been advanced is how local officials are reacting to that reduction in aid. There is a vast fiscal federalism empirical literature that has examined how local officials treat aid transfers from higher units of government. This literature has consistently found evidence of the flypaper effect where intergovernmental aids have a much greater simulative affect then predicted by theory.

As noted by Bailey and Connelly (1998) much of the empirical literature has focused on exploring a range of hypotheses as to why the flypaper effect exists. But one perspective that has received surprisingly little attention centres on the symmetry of the treatment of intergovernmental aid. In other words, do local officials treat intergovernmental aid one way when aid is growing or stable and another when it is declining or unstable? Within the existing available literature this question has been cast within the framework of symmetry in the flypaper effect (Heyndels, 2001). Unfortunately, the vast majority of this literature is static in nature and cannot address these dynamic issues.

Given today's fiscal uncertainty and the changing fiscal relationship within the vertical hierarchy of governments, the question of whether the treatment of intergovernmental aid is symmetrical has been the focus of only a handful of studies. By focusing on the effects of intergovernmental aid reductions, or the introduction of instability and uncertainty into grant programs, the basic question centering on the flypaper effect has been redefined: do local officials treat intergovernmental aid different between periods of certainty and uncertainty in the flow of dollars? This applied research note is aimed at examining patterns of symmetry in the flypaper effect using

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a variable parameter approach within a simple system of equations by examining the treatment of intergovernmental aid in two distinct and fundamentally different points in time.

The empirical studies that have specifically looked at the issue of symmetry have found mixed results. Heyndels' (2001) analysis of Flemish municipalities, Volden's (1999) study of state responses to changes in federal AFDC payments and Levaggi and Zanola's (2003) study of health care expenditures in Italy find support for the asymmetries argument with evidence of replacement with local funds. Gamkhar and Oates' (1996) empirical examination of the impact of changes in Federal grants on state and local government expenditures during 1953–1991, however, reveals symmetry effects. Similarly, Gamkhar's (2000) study of changes in federal highway aid reveals an immediate reduction in state and local spending when aid was reduced. Goodspeed (1998) finds symmetry in New Jersey school districts' responses to changes in state aid; however, local districts were more responsive to increases in state aid than they were to reductions.

We suggest the notions of permanent (certainty) and transitory (uncertainty) income (or revenues) suggested by Deller and Walzer (1995) is the most reasonable theoretical framework to think about the problem. In short, when aid is stable and somewhat certain, local officials treat it as a permanent source of revenue and build the aid into base budget (i.e. the flypaper effect). But as the aid become more unstable and uncertain they treat the funds differently. The analogous example for a household would be how the household treats the difference between a permanent pay raise and winning the lottery with a single payout equal to the future stream of the pay raise.

Using audited financial data from the Wisconsin shared revenue program for the years 1990 and 2000, we estimate a simple variable parameter model within the framework of a system of equations to test if there has been a shift in municipalities' use of those funds over two time periods. The Wisconsin-shared revenues program provides a powerful test, because it is a pure grant program modelled after the now defunct federal revenue sharing program. Most studies of asymmetry and the broader flypaper effect are limited because the aid programs studied have restrictions on how the money can be used.

The fiscal constraints facing state government in Wisconsin coupled with a growing level of fiscal conservatism has introduced a great degree of uncertainty into the local fiscal planning process when considering shared revenues. At the beginning of the decade, the program was stable and expanding but recent fiscal uncertainty and changing political philosophies at the state level has called the robustness of the program into question. More importantly, recent proposals to eliminate or significantly cut the program have cast a cloud of uncertainty over the shared revenues program. We suggest that stagnation of the program along with the current political climate of reducing intergovernmental transfers has introduced a significant degree of uncertainty at the local level. Much like how individuals will treat transitory vs. permanent income, we maintain that intergovernmental aid have shifted from a permanent (certain) to a transitory (uncertain) source of revenues. If there has been a shift in how intergovernmental aid is treated at the local level, it should be apparent in Wisconsin.

II. A Simple Variable Parameter Model

To test for symmetry in the flypaper effect we use data from 1779 Wisconsin municipalities for the periods 1990 and 2000. Consistent with the broader empirical flypaper literature in which the question of symmetry has been explored we specify and estimate a simple per capita expenditure function:

$$\mathrm{PCE} = \alpha_0 + \alpha_1 \mathrm{PCI} + \alpha_2 \mathrm{SRPC} + \sum_{i=1,\ldots,m} \delta_i X_i + \varepsilon \quad (1)$$

where PCE is per capita expenditure, PCI is per capita income, SRPC is shared revenues per capita, X is a set of m control variables and ε is assumed to be a well behaved error term.

If the flypaper effect is asymmetric we would expect a shift in both the intercept term and the slope parameter associated with changes in intergovernmental aid in the following manner:

$$\alpha_0 = \beta_0 + \beta_1 \Delta\mathrm{SRPC} \quad \text{and} \quad \alpha_2 = \gamma_0 + \gamma_1 \Delta\mathrm{SRPC} \quad (2)$$

where ΔSRPC is the change in per capita intergovernmental aid, or more specifically shared revenues per capita, over the study period. The relationship outline in Equation 2 is our statement of asymmetry in the treatment of intergovernmental aid. By substituting Equation 2 into Equation 1 we have and rearranging terms we derive the equation to be estimated:

$$\mathrm{PCE} = \beta_0 + \beta_1 \Delta\mathrm{SRPC} + \alpha_1 \mathrm{PCI} + \gamma_0 \mathrm{SRPC} + \gamma_1 \Delta\mathrm{SRPC} * \mathrm{SRPC} + \sum_{i=1,\ldots,m} \delta_i X_i + \varepsilon \quad (3)$$

We focus our attention on what happens to per capita spending levels as intergovernmental aid, or in the Wisconsin case per capita shared

revenues, changes. Specifically we are interested in the partial derivative which in our linear specification is $\beta_1 + \gamma_1 \text{SRPC}$ ($\equiv \Psi$). Following the logic of Heyndels (2001) we maintain that if the partial (ψ) is equal to zero, then the treatment of intergovernmental aid is symmetric and local officials treat increases in intergovernmental aid the same as decreases. If the partial is negative ($\psi < 0$) then local officials will substitute own source revenues for the loss of intergovernmental aid or in the terminology of Heyndels (2001) we have fiscal replacement. If the partial is positive ($\psi > 0$) then declines in intergovernmental aid will induce further reductions in spending.

In addition to the central variables of interest outlined in Equation 3 we include eight ($m = 7$) control variables based on our review of the vast flypaper empirical literature: per capita income, number of households, percent of the population with a college degree, percent of the population 18-years-old and younger, percent of the employment classified as in professional occupations, percent of household living in poverty and property taxes per capita.

A serious limitation to our modelling approach is that of endogenity of property taxes to the decision making process. To avoid the problem of simultaneous equation bias we offer a simple system of equations. In general form the system can be stated as:

$$\text{PCE} = f(\text{PCI, SRPC, } \Delta\text{SRPC, PTAXPC, } X) \quad (4a)$$

$$\text{PTAXPC} = g\,(\text{PCE, SRPC, MHOUSEV}) \quad (4b)$$

where PCE, PCI and SRPC as defined above, X is a set of expenditure control variables, PTAXPC is property taxes per capita and MHOUSEV is median value of owner occupied housing. By using an instrumental variable approach, or more specifically a three-stage least squares, we explicitly account for the simultaneous nature of the decisions on expenditures and property tax levies.

The system includes five equations, one for property taxes (Equation 4(b)) and four expenditure equations (Equation 4(a)), one for total expenditures and one each for road maintenance, waste collection and broad classification of quality of life services in which we aggregate park and recreational services, libraries, cultural and nonK12 educational services expenditures. Because public education (K12) is independent of municipalities it is not considered in this study. Previous analysis of the Wisconsin shared revenues program has documented that the flypaper effect is sensitive to the types of public services being provided (Deller and Maher, 2005). For example, the flypaper effect is much more pronounced with 'luxury' services such as parks and recreation then 'necessary' services such as police and fire protection. If the manner in which intergovernmental aid is used, or the flypaper effect, varies by type of service, then any study of symmetry must allow for the same variation.

III. Empirical Results

The results of the three stage least squares analysis are presented in Table 1. The weighted system R^2 is 0.6246 suggesting that the system of equations explains about 62% of total variation in the endogenous variables. If we take a step back and look at the individual R^2s from the two-stage least squares results they range from 0.7856 for the total expenditure equation to a low of 0.0582 for the road maintenance expenditure equation. In general the model performs well from a system perspective.

The property tax equation performs as expected with higher levels of shared revenues exerting downward pressure on property taxes while higher levels of expenditures require higher taxes. The negative coefficient on median house value suggests that as property values increase the level of per capita property taxes decline slightly. Although we have no specific priors on how these control variables will influence spending a simple review of the results finds no surprises and all perform as expected.

Turning attention to the parameter of interest, ψ ($=\beta_1 + \gamma_1 \text{SSRPC}$) we find that it is equal to $-0.4817 + 0.0015 * (\text{SSRPC})$ for total expenditures per capita and when evaluated at the sample mean is -0.4418. The negative value can be interpreted as evidence of fiscal replacement. Given the high values of the t-statistic on the two parameters of interest (β_1 and γ_1) we can be fairly confident in the fiscal replacement result. Evaluating ψ for road maintenance at the sample mean yields -0.0140, for waste collection and disposal yields -0.1067 and for the broad category of services we label quality of life services produces a value of -0.0153. Thus, we have evidence of replacement.

If we evaluate the parameter of interest (ψ) for every observation in the data set we find that when shared revenues per capita reaches \$323 or above there is evidence of inducement ($\psi > 0$). But of the 1779 Wisconsin municipalities contained in the data set only 101 are at or above \$320 in shared revenues per capita. In other words, the higher the dependency the municipality has on shared revenues the more likely the municipality will respond to decreases in

Table 1. Results of the variable parameter models using three-stage least squares

	Per capita property taxes		Per capita total expenditures		Per capita quality of life services expenditures		Per capita waste disposal expenditures		Per capita road expenditures	
Intercept	176.6500	(2.72)	−91.1883	(1.69)	−12.1685	(0.39)	−187.9460	(3.31)	17.1313	(3.43)
Property taxes per capita	–		1.6906	(13.63)	0.1817	(5.58)	0.1118	(1.66)	0.0079	(1.49)
Shared revenues per capita (SRPC)	−3.2497	(8.98)	2.7145	(7.84)	0.4172	(4.49)	0.5224	(2.73)	0.0038	(0.25)
Change in shared revenues 1990–2000 (ΔSRPC)	–		−0.4817	(3.13)	−0.0778	(2.15)	−0.1163	(1.50)	−0.0152	(2.56)
Cross product (ΔSRPC ∗ SRPC)	–		0.0015	(3.14)	0.0002	(2.08)	0.0004	(1.50)	0.0001	(2.58)
Per capita income	–		0.0001	(0.10)	0.0013	(1.14)	−0.0008	(0.42)	−0.0003	(1.54)
Number of households	–		−0.0003	(0.02)	−0.0064	(0.45)	0.0199	(0.78)	−0.0017	(0.75)
Percent of population with at least a bachelor's degree	–		−0.0376	(1.53)	−0.0099	(0.45)	−0.0043	(0.11)	0.0022	(0.62)
Percent of the population under age 18	–		274.0299	(1.78)	−182.4510	(2.62)	497.7934	(3.81)	−34.0542	(3.02)
Percent of employment classified as professional occupations	–		107.8928	(1.50)	33.3863	(0.70)	118.7217	(1.38)	16.1677	(2.11)
Percent of households living in poverty	–		0.2125	(2.07)	0.2398	(3.16)	−0.1569	(1.15)	0.0053	(0.44)
Median value of owner occupied housing	−0.0015	(2.90)	–		–		–		–	
Per capita total expenditures	0.8071	(19.83)	–		–		–		–	
$\beta_1 + \gamma_1$SSRPC (ψ)	–		−0.4418		−0.0153		−0.1067		−0.0140	

Note: Number in parentheses is the absolute value of the *t*-statistic.

shared revenues by severely reducing programs and spending levels. These threshold levels are similar for waste and road services. For quality of life services, which includes parks and recreational services, libraries, conservation and community development programs and cultural and nonK12 educational services, however, the threshold in shifting from replacement to inducement is much lower; below $33 in shared revenues per capita, there is replacement, but above $33 there is inducement. The differences in the observed thresholds match the estimated value of the partial derivative (ψ).

IV. Conclusions

This applied research study contributes three general findings. First, the treatment of intergovernmental aid, widely referred to as the flypaper effect, is asymmetric and local officials respond to increases and decreases in intergovernmental aid programs differently. Second, local officials are more likely to respond to decreases in intergovernmental aid by substituting local dollars. Third, this substitution is more likely to take place when the services affected are deemed more vital or central to the needs of residents. In other words, the answer to the question if the flypaper effect is symmetric depends on the nature of the service.

When we evaluate the symmetry parameter for each observation across all four models we consistently find that municipalities that are the most dependent on shared revenues for the operating budget are most likely to cut spending substantially in response to decreases in shared revenues. The importance of this latter finding cannot be underestimated: the manner is which share revenues are distributed in Wisconsin's poorer municipalities tends to be disproportionately dependent on shared revenues. Thus, wealthier municipalities are less likely to be negatively affected by reduced shared revenues.

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