FISCAL ILLUSION AND LOCAL GOVERNMENT SPENDING IN MEXICO

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In this paper we estimate the effect of transfers on expenditure of local Mexican governments. We find evidence of the flypaper effect over the years 1975 to 2000 in a partial sense. According to the linear model, and consistent with previous studies for postwar United States, the effect of grants at local expenditures is statistically positive (0.753) and at the grantor's outlays is statistically negative (–3.250). The estimation in first-differences confirms only the result for local governments. Therefore, as grants increase, state and municipal government outlays increase, while the statistic effect at the grantor's level is not robust.

1 INTRODUCTION

In Public Sector Economics, standard reasoning suggests that aid from federal to local governments should theoretically have the same effect as an increase in local income. However, lump-sum aid has proved to carry more stimulus, according to earlier evidence reviewed in Gramlich (1977) and Fisher (1982). In the late-1970s, the phenomenon was dubbed the "flypaper effect", in a reference to the regularity that money sticks where it hits. Theoretically, the mechanism contends that lump-sum transfers to local governments tend to be spent rather than passed on to local citizens via tax cuts. As an implication, if transfers grow over time, local government expenditures should grow. Conversely, given the recent trend towards decentralization, government size reduction should follow, although several studies recognize its difficult measurement as pointed out by Ebel and Yilmaz (2002).

Surveys, such as Hines and Thaler (1995) and Oates (1999), have reviewed the extensive literature on the flypaper effect. And new ideas have been advanced as possible explanations, ranging from asymmetries in government expenditure in Stine (1994) to specification errors in Megdal (1987) and Wyckoff (1991), and to individual confusion in Wyckoff (1991). The hypothesis of individual confusion, in particular, implies that grants can be understood only in terms of their perceived price changes. This idea follows the seminal contribution by Logan (1986), who extended the state of knowledge in checking for grantor's effects in addition to the then common local effects of grants. The results in Logan (1986) were that federal direct expenditures fall as grant aid increases and computed a different functional form implied by the dual illusory assumption. In order to check if the

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non-linear specification is preferred to the linear one, Logan (1986) conducts Davidson and MacKinnon (1981) J-tests on United States data from 1947 to 1983, which invariably confirmed preference for the non-linear model.

The major contribution of the setup in Logan (1986) is to relate voter's perceptions to three models of government spending. First, when government federal taxes do not come into the crucial voter's perception problem, we can refer to the *no illusion model*. Second, when grants increase government spending via an income effect, one has the *grants as a windfall illusion model*. Third, when grants cause one form of illusion to be balanced by the other, the *dual illusion model* is operative. In this case, the crucial voter's illusion that the local government is offering more services for the taxes is offset by the illusion that the national government is offering less. This would imply a contraction in the size of the national government and an expansion in the subnational government. The latter appear to be the case in the U.S. for the annual period 1947-1983 as documented in Logan (1986), for Canada in Hammes and Wills (1987), and for Australia over 1949 to 1992 in Stewart (1996).

This paper applies this vast literature to Mexican data over the years 1975 to 2000. We can think of several reasons to justify this work. First, there has been hitherto no empirical study on the flypaper effect using Mexican data. Second, the soft budget constraint faced by state and municipal governments (GIUGALE; TRILLO; OLIVEIRA, 2000; GAMBOA, 1997; TRILLO, 1997) and the empirical evidence pointing out that institutional reforms on the intergovernmental fiscal arena increased financial dependence on unconditional transfers (IBARRA SALAZAR; SANDOVAL; SOTRES CERVANTES, 1999, 2001) may contribute positively to the likelihood of the flypaper effect in Mexico. Third, the studies that exist for other countries have not addressed the possible non-stationarity of some series and the problems derived from "spurious regressions". Conducting unit root analysis, we find in this paper that while the series for unconditional transfers follows a stationary process, other series (local and federal expenditures, as well as output and unemployment) very likely contain unit roots, which would require at least estimates in first-differences.

The results in this paper can be simply summarized. Adopting the methodology proposed by Logan (1986) to Mexican data, the ordinary least squares (OLS) estimates typically suffer from serial correlation problems. Econometrically more robust are the estimates obtained under the seemingly unrelated regression (SUR) methodology. In the linear model, the effect of grants at local expenditures is statistically positive (0.753) and at the grantor's outlays is statistically negative (–3.250), a result similar to the one found by Logan (1986) for postwar United States. While the sample period of 26 years is admittedly short for unit root analysis, our results cast doubt on the mechanic application of the methodology.

We conduct next estimation in first-differences and find that the effect of grants at local expenditures is statistically positive (0.802) and at the grantor's outlays is not significant. The results in this paper favor a local positive effect of unconditional transfers, while the result at the grantor's expenditures is less clear-cut.

This paper contains four more sections. Section 2 discusses the institutional background of Mexican intergovernmental public sector finances, section 3 introduces data issues, section 4 provides the results, and section 5 concludes the work and points out further research routes.

2 THE MEXICAN INSTITUTIONAL FRAMEWORK

The National System of Fiscal Coordination (NSFC) is the institutional arrangement comprising the intergovernmental fiscal relations of the Mexican federal, state and municipal levels of government, the administrative rules of coordination on tax collection, as well as the different governmental offices related with fiscal coordination. It comprehends the national fiscal authority and the representatives of the state fiscal authorities. It also includes an institute (*Indetec*) whose purpose is to serve as a technical advisor of sub-national governments and analyst of the system in general. The legal framework of the system includes mainly the Mexican Constitution and the Fiscal Coordination Law (*Ley de Coordinación Fiscal*).

The actual arrangement of fiscal coordination, that became effective in Mexico since 1980, had as its purposes to avoid tax overlapping among the different governmental levels and to adequate the fiscal structure to the newly created Value Added Tax (VAT). Through the NSFC adhesion agreement, the Mexican states and municipalities suppressed own revenue sources in favor of the federal government, who in exchange shared those revenues with them.

Currently the total amount of Revenue Sharing Transfers (RST) distributed among state governments consists of seven funds: a general transfer fund constituted by 20% of federal tax revenue (FTR);[1] a fund integrated with a 1% of the FTR, distributed among those entities coordinated with the federal government on the collection of revenues derived from certain user charges; the revenues accrued to the vehicle use tax and the new vehicles tax, both federal taxes, are transferred entirely to the corresponding state; a 8% and a 20% of tax collection on tobacco and alcoholic beverages taxes respectively; a contingency reserve integrated with 0.25% of FTR, which is distributed among those states whose RST revenue do not growth as much as the FTR; and finally, an amount equivalent in real terms to the 80% of taxes collected by state governments on agricultural and cattle activities.

1. The integration of the general transfer fund has changed since its implementation. During 1980 it represented 16.89% of FTR; during 1991-1995, the fund was constituted with 18.51% of FTR; and since 1996 it is a 20% of FTR. See Indetec (1996) for more details.

According to the Fiscal Coordination Law, municipal governments on a given state must be given a minimum of 20% of RST received by the corresponding state government, and 100% of the Municipal Promotion Fund. The assignation formula is decided by the state legislature. Some state governments also transfer state tax revenues to the municipal governments. Furthermore, the federal government directly distributes transfers to the municipal governments in which either trade of goods (in case of border or coastal counties) or oil extraction is realized.

After the implementation of the 1980 fiscal agreement, the RST distribution scheme suffered two major modifications. First, during 1988-1989, the 30% of the VAT collection was assigned directly to the corresponding state, plus a transfer similar to that of the previous year, calculated over an adjusted fund. Second, during 1991 a new distribution formula for the general fund became effective. Three distribution criteria were included: population of the state, dynamic and structure of the geographically imputable taxes[2] and a compensatory component. The actual weighting for each of the first two criteria is 45.17% and 9.66% for the third one.[3] The compensatory share is calculated as the inverse of the amount per capita accrued to the first two criteria.

In addition to the above changes in the assignation formula, since 1996 the integration of the general transfer fund was increased from 18.51% to 20% of FTR. Furthermore, and in line with the expenditure decentralization process, since 1998 a modification in the Fiscal Coordination Law instituted the so-called *Aportaciones Federales*: conditional federal transfers to state and municipal governments directed to education, health, security, and social infrastructure, among the most important expenditure items. Before the creation of *Aportaciones Federales*, the *Ramo 26* of the federal budget was the main instrument to provide matching grants for states and municipalities to finance social infrastructure. The assignment of funds in *Ramo 26* was negotiated through the *Convenios de Desarrollo Social*. This process could be influenced by the state governor bargaining power or by political events in the localities (elections).

Municipal governments faced an additional change that influenced public finances. The Constitutional reform of Article 115 in 1983 redistributed fiscal competences and assigned contributions over property to the municipalities, like the property tax, which was previously a revenue source of the states. The reform also incorporated the right to Mexican municipalities to share federal tax revenues.

2. Their purpose is to identify the state in which the tax is generated. The actual imputable taxes are: on the use and property of vehicles, on new vehicles, on gasoline, tobacco, beer and alcoholic beverages.

3. These distribution criteria and their integration are contained in Articles 2ª and 3ª of the Fiscal Coordination Law. Courchene and Díaz-Cayeros (2000) analyze the Mexican transfer system, Cardena (1996) presents a historic review of the RST distribution schemes, and Ortiz Ruiz (1996) presents the calculation mechanism of the RST coefficients.

On the expenditure side, Article 115 defined as municipal public services: potable water provision and sewage system, public lighting, cleaning, markets and supply centers, cemeteries, slaughterhouse, streets, parks and gardens, public security and transit, and those which could be determined by the local legislatures. It was also established that these services could be offered coordinated with state governments, and that municipalities themselves could reach agreements on provision with other local governments so as to ensure an efficient service provision.

Although the constitutional reform had the purpose of strengthen local finances, by increasing municipal own revenues, different studies conclude that the reform did not reduced financial dependence (IBARRA SALAZAR; SANDOVAL; SOTRES CERVANTES, 2001; PÉREZ GONZÁLEZ, 1995), that few municipalities are really likely to play the role assigned in Article 115 (VILLANUEVA, 1996), and that the effective scope of the constitutional reform has resulted limited in practice (GARCÍA DEL CASTILLO, 1999).

3 THE DATA

The data set used in this paper consists of annual time series from 1975 to 2000, taken from several sources. Output, or gross domestic product (*Y*), is taken from Mexican Central Bank (Banxico, *Banco de México*), at the site: www.banxico.org.mx

Local (state and municipal) government expenditure (*GSM*) is taken from Mexico's INEGI: "Finanzas Públicas Estatales y Municipales de México", various years, and refers to the sum of administrative expenses, public works and development, and transfers and debt payments from states. Federal government expenditure (*GF*) comes from the Finance Ministry. It refers to the net released expenditure of federal government and is also called net budgeted expenditure. It comprehends the gross expenditure minus debt payments (*amortizaciones*), the not payed expenditure executed during a budgeted term (ADEFAS), and the authorized expenditure that was not authorized or payed (ECONOMÍAS). For the years 1990-2000, it was calculated the executed net expenditures minus ADEFAS. The executed expenditure is the part of the budget authorized that is payed in the budget year regardless the payment is realized in the same year of the budget or the next. The executed net federal expenditures and ADEFAS are taken from INEGI's El *ingreso y el gasto público en México*, editions 1995 and 2001.

Unconditional transfers (*unc*) comes from the Mexican Finance Ministry (SHCP) until 1983 and from INEGI's *Anuario Estadístico de los Estados Unidos Mexicanos* from 1987 onwards. Conditional transfers (*Aportaciones Federales*, *Convenios de Desarrollo Social*) were obtained from various sources and are not included in *unc*.

Population (*pob*) is from various INEGI's issues, such as: *Estadísticas históricas de México for the years 1970-1990*, *Conteo de población y vivienda and XII Censo General de Población y Vivienda* from 1991 onwards.

The unemployment rate (*u*) comes from Mexico's INEGI website: www.inegi.gob.mx. It comprises people of 12 years old or over that in the week of reference did not work though were available to work and have tried to look for work in the last two months before the week of reference and did not succeed. From 1999 onwards, *u* covers 45 urban areas.

4 EMPIRICAL METHODOLOGY

Following the constrained maximization problem in Logan (1986), we employ the following reduced form expenditure equations:

$$GSM = \alpha_0 + \alpha_1(1/\theta_1^P)Y + \alpha_2(\theta_2^P/\theta_1^P) + \alpha_3(1/\theta_1^P) + \varepsilon \quad (1)$$

$$GF = \beta_0 + \beta_1(1/\theta_2^P)Y + \beta_2(\theta_1^P/\theta_2^P) + \beta_3(1/\theta_2^P) + \nu \quad (2)$$

where *GSM* denotes local (state and municipalities) expenditures, *Y* represents gross real income (GDP), *GF* represents federal expenditures (excluding grants to subnational governments), θ_1^P are the voter's perceived price of recipient (local) expenditures, θ_2^P are the voter's perceived price of federal expenditures, and ε and ν denote the error term, assumed to be white noise. The α's and β's are parameters of the Stone-Geary utility function of the crucial voter, assumed to be well-behaved and function of federal expenditures, local expenditures, and output.

As the receipt of aid decreases the perceived price of recipient expenditures, it causes the voter to spend a larger fraction of his income at the local level. As mentioned by Logan (1986), the coefficient on *Y* in (1) grows with aid. At the same time, the financing of aid increases the perceived price of grantor expenditures, causing the voter to spend a smaller fraction of income there. This causes the coefficient on *Y* in (2) to fall with aid. Logan (1986) compares this *complete illusory specification* with competing alternative hypothesis. As the former is non-linear compared to the latter (non-nested alternatives) models, the J-test proposed by Davidson and MacKinnon (1981) can be used to discriminate between the models. In his particular case for the years 1947-1983 in the United States, Logan (1986) favors the complete form of illusion. This implies that grants not only have *GSM* but also have done so at the expense of *GF*.

The perceived prices are the only pieces of information available to the voter: his tax burden and the level of expenditures at either local or national levels. A proxy for θ_1^P is necessary and the information for computing the perceived price is *A/GSM*: the recipient's government's aid as a fraction of the recipient's expenditures. Total federal aid as a fraction of total state and local expenditures is taken as a proxy. Including the unemployment rate to take into account the cyclical pattern of government expenditures, noting that unconditional transfers are given by *A* and substituting the proxies for θ_1^P and θ_2^P, one has:

$$GSM = \alpha_0 + \alpha_1[1/1-(A/GSM)]Y + \alpha_2[(1+A/GF)/1-(A/GSM)] + \\ + \alpha_3[1/1-(A/GSM)] + \alpha_4 U + \varepsilon \quad (3)$$

$$GF = \beta_0 + \beta_1[1/1+(A/GF)]Y + \beta_2[(1-A/GSM)/1+(A/GF)] + \\ + \beta_3[1/1+(A/GF)] + \beta_4 U + \varepsilon \quad (4)$$

One also has the following linear specifications, which are consistent with the grants as windfall hypothesis or the nonillusory model:

$$GSM = \alpha_0 + \alpha_1 Y + \alpha_2 A + \alpha_3 U + \varepsilon \quad (5)$$

$$GF = \beta_0 + \beta_1 Y + \beta_2 A + \beta_3 U + \varepsilon \quad (6)$$

The required information for computing the perceived price for θ_1^P is *A/GSM*, the recipient government aid as function of its total expenditures. However, total federal aid is taken as proxy in conformity with Logan (1986) and with the purpose of this paper that is to focus at the flypaper in Mexico at an aggregate level.

The non-linear models in (3) or (4) may be more appropriate as happened to be the case in Logan (1986) for United States annual data over the years 1947-1983. Alternatively, the simpler specifications in (5) and (6) may fit nicely. We employ Mexican data on the years 1975-2000 to decide which set of specifications is more adequate and the results are mixed as shown below.

4 EMPIRICAL RESULTS

Although suffering from low power in this context, we conduct unit root tests. Both tests of unit roots employed (ADF and KPSS) are ambiguous with respect to the stationarity of federal expenditures or output. According to table 1, the only series that is possibly stationary in levels is unconditional transfers (*unc*), according to both tests. There are thus reasons to suspect that the estimates of models (3) to (6) in levels are seriously flawed due to spurious regressions considerations. After presenting the benchmark results, we will come back to this issue.

TABLE 1
Unit root tests (yearly): Mexico – 1975-2000

Unit root test and series	Trend?	Series in levels for tests with constant and trend		Series in first differences for tests with constant only	
		ADF test	KPSS test	ADF test	KPSS test
unc	Yes, up	–4.719(4)***	0.092	–4.443(0)***	0.086
gf	No	–1.605(0)	0.206	–4.226(0)***	0.187
gsm	Yes, up	–1.029(1)	0.137*	–2.75(0)**	0.255
y	Yes, up	–1.185(0)	0.100	–3.961(0)***	0.133
u	No	–1.657(0)	0.449**	–4.302(0)***	0.083

Notes: All series, except the unemployment rate, are in per capita terms. The variables are defined as follows: *unc* stands for the real value of unconditional transfers from federal to local governments; *gf* stands for the real value of federal government expenditures; *gsm* stands for the real value of local government expenditures; *y* stands for the real GDP; and *u* represents the unemployment rate at the end of the year. In all cases, the Mexican consumer price index (CPI, 1994 = 100) is the deflator. ADF (*k*) refers to the Augmented Dickey-Fuller t-tests for unit roots, *k* is the selected lag length, and KPSS refers to the Kwiatkowski-Phillips-Schmidt-Shin test. For the series in levels, the ADF (*k*) and KPSS of each entry are estimated with a constant and trend as suggested by visual plots in figure 1. For the unit root tests in first-differences the test has only a constant. In the ADF tests, *k* is determined by the Campbell-Perron's lag length selection procedure developed formally in Ng and Perron (1995). The method starts with an upper bound, $k_{max} = 4$, on *k*. If the last included lag is significant, choose $k = k_{max}$. If not, reduce *k* by one until the coefficient of the last lag becomes significant (we use the 5% value of the asymptotic normal distribution to assess significance of the last lag). If no lags are significant, set $k = 0$. In the KPSS test the spectral estimation method is the Bartlett kernel and the bandwidth is verified for different values of the lag truncation parameter. Reported in the table are the statistics for lag truncation = 4; see the text for explanation. The symbols *, **, and *** attached to the figure indicate rejection of the null of no-stationarity at the 10%, 5%, and 1% levels, respectively.

The OLS estimation results of equations (3) to (6) are presented in tables 2 and 3. Table 2 reports the non-linear specifications in transfers, associated with equations (3) and (4). The first column, with GSM as the dependent variable, shows a statistically significant α_1 parameter, although serial correlation is a problem according to the DW statistic (0.687) and to the Breusch-Godfrey serial correlation LM test, which rejects the null at 7.827. We conduct first-order serial correlation correction in column 2 and the fit improves notably. However, none of the coefficients are statistically significant, which casts doubt on the validity of equation (3) for representing the government expenditures of local state and county units in Mexico.

TABLE 2

Least squares estimations of non-linear specifications

$GSM = \alpha_0 + \alpha_1 [1/1 - (A/GSM)] Y + \alpha_2 [(1 + A/GF)/1 - (A/GSM)] + \alpha_3 [1/1 - (A/GSM)] + \alpha_4 U + \varepsilon$ (3)

$GF = \beta_0 + \beta_1 [1/1 + (A/GF)] Y + \beta_2 [(1 - A/GSM)/1 + (A/GF)] + \beta_3 [1/1 + (A/GF)] + \beta_4 U + \varepsilon$ (4)

Dep. variables →	Dep. variables			
Regressors (α's or β's) ↓	GSM	GSM	GF	GF
α_0	–0.002 (0.005)	–0.002 (0.014)	0.129*** (0.029)	0.188*** (0.026)
α_1	0.165*** (0.056)	0.069 (0.051)	0.224*** (0.058)	0.197*** (0.066)
α_2	0.001 (0.001)	0.0002 (0.0003)	–0.036*** (0.005)	–0.012 (0.009)
α_3	–0.004 (0.013)	–0.005 (0.008)	–0.109*** (0.029)	–0.160*** (0.023)
α_4	–0.0007 (0.0003)	–0.0002 (0.0002)	–0.0003 (0.0008)	–0.0004 (0.0007)
AR(1)		1.045*** (0.082)		0.867*** (0.101)
Sample size	26	25	26	25
Adj. R^2	0.778	0.931	0.743	0.883
D.W. stat.	0.687	1.505	1.109	1.140
Nº of iterations		9		15
JB-normality	0.395 [0.821]	1.036 [0.596]	2.600 [0.272]	1.902 [0.386]
Breusch-Godfrey Serial Cor. LM	7.827*** [0.003]	NA	4.171** [0.032]	NA
Serial Cor. ARCH	2.516 [0.126]	1.050 [0.317]	0.062 [0.806]	0.204 [0.656]

Notes: The variables are as defined in table 1. For each specification, the model is estimated by OLS and the with the correction for serial correlation by the Marquandt algorithm. For the estimation without first-order serial correlation correction, the Newey-West HAC standard errors and covariance matrix is employed with lag truncation = 2. NA refers to the fact that the Breusch-Godfrey Serial Cor. LM test requires no ARIMA term in the specification, which is not the case. The mark *** indicates rejection of the null at the 1% level, ** indicates rejection at the 5% level, and * at the 10% level.

Columns 3 and 4 of table 2 report the effects of the variables on the grantor's expenditures: GF is now the dependent variable. It turns out that the β_1 parameter is statistically positive and significant at 0.197 for the equation corrected for serial correlation, implying a positive effect on GF of higher income. The β_3 parameter is also statistically significant. Note, however, that the positive β_1 parameter violates the original conjecture that the financing of aid increases the perceived price of grantor expenditures, causing the voter to spend a smaller fraction of income there. This should cause the coefficient on Y in (4) to fall with aid.

TABLE 3
Least squares estimations of linear specifications

$$GSM = \alpha_0 + \alpha_1 Y + \alpha_2 A + \alpha_3 U + \varepsilon \quad (5)$$

$$GF = \beta_0 + \beta_1 Y + \beta_2 A + \beta_3 U + \varepsilon \quad (6)$$

Dep. variables →	Dep. variables			
Regressors (α's or β's) ↓	GSM	GSM	GF	GF
α_0	–0.009 (0.006)	–0.002 (0.003)	0.0160 (0.030)	0.0047 (0.028)
α_1	0.059 (0.043)	0.023 (0.020)	0.047 (0.200)	0.229 (0.207)
α_2	1.822** (0.767)	0.751*** (0.183)	0.308 (2.090)	–3.392 (2.287)
α_3	0.0002 (0.0005)	–0.000009 (0.0001)	0.0002 (0.0015)	0.00006 (0.0010)
AR(1)		1.097*** (0.063)		0.857*** (0.138)
Sample size	26	25	26	25
Adj. R^2	0.653	0.955	–0.121	0.647
D.W. stat.	0.272	1.215	0.381	1.238
Nº of iterations for convergence		9		84
JB-normality	0.948 [0.623]	0.069 [0.966]	4.045 [0.132]	3.753 [0.153]
Breusch-Godfrey Serial Cor. LM	34.37*** [0.000]	7.288*** [0.005]	26.929*** [0.000]	3.092* [0.070]
Serial Cor. ARCH	11.20*** [0.003]	1.849 [0.188]	0.587 [0.451]	1.025 [0.322]

Notes: The variables are as defined in table 1. For each specification, the model is estimated by OLS and with the correction for serial correlation by the Marquandt algorithm. The Newey-West HAC standard errors and covariance matrix is employed with lag truncation = 2. The mark *** indicates rejection of the null at the 1% level; ** indicates rejection at the 5% level; and * at the 10% level.

Table 3 conveys a more straightforward view of the federal and local expenditure process in Mexico since the equation to estimate is linear in the parameters. The critical term is now either the α_2 parameter or the β_2 parameter, since they show the sensitivity of local or federal expenditures to grants to subnational governments, respectively. The first column, with GSM as the dependent variable, shows a statistically significant α_2 parameter, although serial correlation is again a problem according to the DW statistic (0.272) and to the Breusch-Godfrey and ARCH serial correlation LM tests, at standard confidence levels. We conduct first-order serial correlation correction in column 2 and the fit improves substantially. This implies that equation (5) for representing the

government expenditures of local state and county in Mexico yields a statistically significant α_2 parameter of 0.751. The problem is that the Breusch-Godfrey and serial correlation LM keeps referring to substantial serial correlation problems at 7.288.

As before, columns 3 and 4 of table 3 report the effects of the variables on the grantor's expenditures (GF). It turns out that none of the β's parameters are statistically positive for either of the estimates. As in the case for local expenditures, this indicates that the linear model is not a very good one for predicting federal government expenditures in Mexico.

In order to see if the bad quality of the estimates is due to econometric specifications, we employ Zellner's SUR methods. The idea is that the system method takes into account heteroskedasticity and contemporaneous correlation in the errors across equations. This may be appropriate if the error term of the equation for local expenditures is correlated with the error term of the equation for federal expenditures.

Table 4 contains the results under SUR estimation methods. We are now conducting joint estimation of the processes for local and federal expenditures. In column 1 the linear model yields statistically significant α_2 parameter of 0.753 on local expenditures, which is the response of GSM to transfers. This suggests that increases in unconditional transfers lead to rises in local spending: the flypaper effect. In column 2 the linear model yields statistically significant β_2 parameter of –3.250 on federal expenditures, which is now the response of GF to transfers. In this sense, the result is in agreement with Logan (1986) for the United States case at federal level data (found to be –2.12 in his study.)

Columns 3 and 4 of table 4 contains the SUR joint estimation of equations (3) and (4). Column 3 shows the non-linear model yields no statistically significant terms, while column 4 yields all–except for the unemployment rate parameter– statistically significant terms. In the last column, in particular, the effect of output on local government expenditures is 0.192, after the correction for serial correlation. The coefficient of determination of the regression is 0.880 and there remains some serial correlation according to the Durbin-Watson statistic (1.106).

We conduct next estimation of the two models under SUR techniques but in first differences since we found that only unconditional transfers are stationary in levels in table 1. As usual, estimating the model in first-differences obviously reduces the overall R^2 of the model, but serial correlation is considerably diminished. Table 5 contains the estimates of the SUR models in first-differences. None of the equations now has indication of serial correlation and the overall explanatory power varies notably across the columns. For instance, in the linear model, the α_2 coefficient is 0.802, but neither α_1 nor the β_1 is statistically significant, which does not support the flypaper effect. The α_3 coefficient is significant and negative, implying that higher unemployment leads to lower state and county expenditures.

TABLE 4

SUR estimates of linear and non-linear specifications

System 1: $GSM = \alpha_0 + \alpha_1 [1/1 - (A/GSM)] Y + \alpha_2 [(1 + A/GF)/1 - (A/GSM)] + + \alpha_3 [1/1 - (A/GSM)] + \alpha_4 U + \varepsilon$ (3)

$GF = \beta_0 + \beta_1 [1/1 + (A/GF)] Y + \beta_2 [(1 - A/GSM)/1 + (A/GF)] + \beta_3 [1/1 + (A/GF)] + \beta_4 U + \varepsilon$ (4)

System 2: $GSM = \alpha_0 + \alpha_1 Y + \alpha_2 A + \alpha_3 U + \varepsilon$ (5)

$GF = \beta_0 + \beta_1 Y + \beta_2 A + \beta_3 U + \varepsilon$ (6)

Dep. variables →	Linear model		Logan's non-linear model	
Regressors	Dep. variables		Dep. variables	
(α's or β's) ↓	GSM	GF	GSM	GF
α_0	–0.002	0.009	–0.003	0.205***
	(0.004)	(0.024)	(0.016)	(0.023)
α_1	0.020	0.205	0.068	0.192***
	(0.016)	(0.147)	(0.044)	(0.056)
α_2	0.753***	–3.250*	0.0002	–0.014*
	(0.235)	(1.885)	(0.0002)	(0.008)
α_3	–0.00001	–0.0002	–0.005	–0.172***
	(0.0001)	(0.001)	(0.007)	(0.020)
α_4			–0.0002	–0.0005
			(0.0002)	(0.0006)
AR(1)	1.093***	0.817***	1.038***	0.886***
	(0.060)	(0.130)	(0.071)	(0.079)
Sample size	25	25	25	25
Adj. R^2	0.955	0.644	0.930	0.880
D.W. stat.	1.200	1.188	1.486	1.106
No. of iteratons	615	615	21	21

Notes: The method of estimation is Zellner's SUR. First-order serial correlation is corrected by the non-linear Marquandt algorithm. The mark *** indicates rejection of the null at the 1% level; ** indicates rejection at the 5% level; and * at the 10% level.

We also conduct extensive J-tests on the linear versus non-linear models for all sets of estimations in tables 2 to 5. Contrary to Logan (1986), however, we do not find unidirectional results. In the Mexican case, the Davidson and MacKinnon (1981) tests do not support clearly one model against the other.

TABLE 5
SUR estimates of linear and non-linear specifications: differenced model

System 1:

$$\Delta(GSM) = \alpha_0 + \alpha_1 [1/1 - (A/GSM)] \Delta(Y) + \alpha_2 [(1 + A/GF)/1 - (A/GSM)] + + \alpha_3 [1/1 - (A/GSM)] + \alpha_4 \Delta(U) + \varepsilon \quad (3)$$

$$\Delta(GF) = \beta_0 + \beta_1 [1/1 + (A/GF)] \Delta(Y) + \beta_2 [(1 - A/GSM)/1 + (A/GF)] + \beta_3 [1/1 + (A/GF)] + + \beta_4 \Delta(U) + \varepsilon \quad (4)$$

System 2:

$$\Delta(GSM) = \alpha_0 + \alpha_1 \Delta(Y) + \alpha_2 A + \alpha_3 \Delta(U) + \varepsilon \quad (5)$$

$$\Delta(GF) = \beta_0 + \beta_1 \Delta(Y) + \beta_2 A + \beta_3 \Delta(U) + \varepsilon \quad (6)$$

Dep. variables →	Linear model		Logan's non-linear model	
Regressors	Dep. variables		Dep. variables	
(α's or β's) ↓	Δ (GSM)	Δ (GF)	Δ (GSM)	Δ (GF)
α_0	–0.003***	0.004	–0.002	0.057**
	(0.001)	(0.004)	(0.002)	(0.025)
α_1	0.006	0.182	0.062	0.179*
	(0.013)	(0.124)	(0.046)	(0.095)
α_2	0.802***	–1.013	0.0003	0.029**
	(0.201)	(0.983)	(0.0003)	(0.012)
α_3	–0.0002***	–0.00004	0.004	–0.057***
	(0.0001)	(0.0012)	(0.003)	(0.021)
α_4			–0.0002	0.0002
			(0.0002)	(0.001)
AR(1)	0.758***	0.086	0.357	0.546***
	(0.114)	(0.203)	(0.243)	(0.194)
Sample size	24	24	24	24
Adj. R^2	0.523	–0.058	0.280	0.135
D.W. stat.	1.695	1.815	1.751	1.892
Nº of iterations	26	26	1000	1000

Notes: The method of estimation is Zellner's SUR. First-order serial correlation is corrected by the non-linear Marquandt algorithm. The mark *** indicates rejection of the null at the 1% level; ** indicates rejection at the 5% level; and * at the 10% level.

5 CONCLUDING REMARKS

This paper employs the fiscal illusion hypothesis proposed by Logan (1986) together with studies that emphasize institutional features of Mexican public sector by Ibarra Salazar, Sandoval and Sotres Cervantes (1999, 2001) to evaluate Mexican transfers data over the years 1975 to 2000. As the OLS estimates typically suffer from serial correlation problems, the more robust SUR methodology finds that, in the linear model, the effect of grants at local expenditures is statistically positive (0.753) and at the grantor's outlays is statistically negative (–3.250), a result similar to the one found by Logan (1986) for postwar U.S. data.

Standard unit roots tests on the basic variables, however, suggest that unconditional transfers are stationary processes but other series are likely non-stationary in levels. While the sample period of 26 years is admittedly short, our results cast doubt on the model's application to Mexican data. We conduct next estimation in first-differences and find that the effect of grants at local expenditures is statistically positive (0.802) and at the grantor's outlays is not significant. Combined with the results in levels, the results in this paper thus favor the local positive effect of unconditional transfers, while the result at the grantor's expenditures is less clear-cut.

In the period under study sub national governments faced a soft budget constrain. The federal government implemented a bailout process during the 1994 financial crisis and applied extraordinary transfers, which were assigned under discretionary basis. The result in this paper suggests that municipal and state governments, without a binding fiscal constraint, increased its expenditure in response to increasing unconditional transfers.

As perhaps the first study to evaluate the flypaper effect to Mexican data, we find that the econometric points above clearly cast doubt on the replication of the model in Logan (1986) to Mexico. The recent attempt by Knight (2002) under instrumental variables provides a different explanation, in which a vector of control characteristics may alter significantly the previous evidence in favor of the positive effect at state spending due to grant receipts. We leave this extension for further research.

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