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Contents

MEASURING EXPENDITURE NEEDS AND PUBLIC SAFETY TRANSFERS IN MEXICO

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ABSTRACT: *In this paper we deal simultaneously with two crucial problems in today's Mexico: a fiscal federalism that is seriously-flawed in the allocation of transfers to the local governments and the large number of offences linked with organized crime, a category in which the country is among the highest ranking. In this paper we suggest a more equitable and effective allocation of public safety transfers to state governments. The proposal is based on measuring expenditure needs through the method of principal components.*

KEY WORDS: *fiscal federalism; decentralization; public safety transfers; factor analysis*

JEL: H53, H72, H73, H76

1. INTRODUCTION

Mexico is a decentralized country in which allocations are made by a central government to 32 regional governments (31 states and the Federal District) and 2.447 local governments. A weakness in the Mexican system is that sub-national governments have low levels of financial autonomy, among the lowest in the OECD countries (see Figure 1). Approximately 90% of their overall income comes from the central government. Moreover, these transfers are carried out through fifteen different funds that take explicitly into account neither the measurement of expenditure needs nor the fiscal capacity of the state and local governments. (Cabrera and Lozano, 2008)[7].

The economic theory of fiscal federalism emphasizes that those transfers assigned to state and local governments should cover both horizontal and vertical financial imbalances (Bird, 1993 [3] and 1996 [4]). At the same time, the necessity of incorporating assessments and measurements of expenditure needs and fiscal capacity

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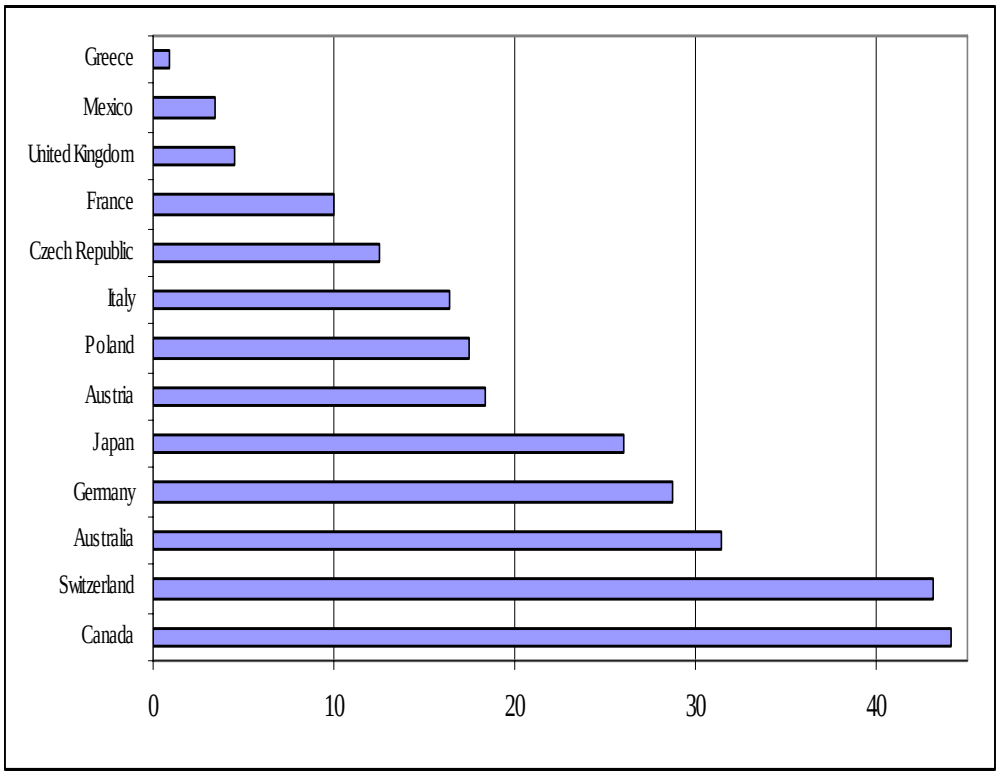
in assigning those transfers must be emphasized (Ahmad et al, 2007 [2], and Shah, 1994 [15] and 1996 [16]). According to Shah: "*A leveling program which doesn't take into account the aspect of (the needs of) expenditure can not be defended on the basis of effectiveness and equity"* (Shah, 1996: 100) [16].



Source: OECD (2006) [14]

Figure 1. OECD: Fiscal Revenue of Local Governments as a Percentage of the Total for Selected OECD Countries (2002)

The economic theory of fiscal federalism emphasizes that those transfers assigned to state and local governments should cover both horizontal and vertical financial imbalances (Bird, 1993 [3] and 1996 [4]). At the same time, the necessity of incorporating assessments and measurements of expenditure needs and fiscal capacity in assigning those transfers must be emphasized (Ahmad et al, 2007 [2], and Shah, 1994 [15] and 1996 [16]). According to Shah: "*A leveling program which doesn't take into account the aspect of (the needs of) expenditure can not be defended on the basis of effectiveness and equity"* (Shah, 1996: 100) [16].

The manner in which transfers are distributed to state governments in Mexico is especially worth examining given their low financial autonomy. Such considerations motivate this research.

2. MEASURING EXPENDITURE NEEDS

The measurement of expenditure needs has been the focus of recent attention due to its importance in vertical and horizontal equalizing. Broadway (2006) [5] stresses the importance of creating an index of expenditure needs, whereas Ahmad and Searle (2006) [1] support simultaneously taking into account income capacities and expenditure needs to obtain a satisfactory transfer scheme. This insistence on the importance of better measurement of expenditure needs can also be found in López Laborda (2006) [13] and De la Fuente (2005) [8].

However, the measurement of expenditure needs is far from being an easily solvable problem, and according to different scholars, it is more complicated than the determination of the fiscal capacity. Shah (1996:12) [16] points out that *"expenditure needs have been traditionally seen as more difficult to be defined and measured than their equivalents in income, that is fiscal capacity,"* a viewpoint shared by Solé-Olle (2003:3) [17] who states *"as regards quantifying fiscal capacity, both literature on economics and compared experience have developed a methodology which has become standard. On the other hand, explicit leveling of expenditure needs is less common in the compared system and there exists little consensus about the more appropriate techniques for its quantification"*.

The complexity of measuring expenditure needs can be seen in the diversity of options regarding its implementation. According to Boex and Martinez-Vázquez (2004)[6], the options for measuring expenditure needs can range from the very simple to highly sophisticated, including: i) value of previous expenditure; ii) normative per capita equal expenditure; iii) weighed indexes of needs; iv) "superior" expenditure rules for customers; v) traditional expenditure rules (for physical inputs) and; vi) representative expenditure system.

Although the last option is most-often recommended by different scholars, its estimation is not easy. The two most commonly used methods are the Direct one and that of Statistical Assessment. In the first, the explanatory variables for each expenditure function are defined with their weights based on such subjective criteria as political negotiations and expert opinions. The second method applies regression and multivariate statistical techniques to available data in order to find those variables which significantly affect each expenditure function and their respective importance.

As far as Mexico is concerned, there are few works related to the assessment of expenditure needs, and the existing ones have focused on expenditure in education. Gershberg (1993) [10], as well as Lamoyi (2004) [12], analyze expenditure in basic education using the regression method. Espuelas (2004) [9], studies the same expenditure but uses the method of the principal components. In a more recent work, Ahmad, González, Anaya, Brosio, García-Escribano, Lockwood and Revilla (2007) [2] emphasize the necessity of determining expenditure needs in order to establish leveling systems. These authors carry out an assessment of expenditure needs for Mexico by using three expenditure categories (Education, Health and "Others"), establishing explicative variables for each, and adjusting them in an ad hoc manner, in an attempt to make them mutually balanced.

3. METHODOLOGY

In the case of Mexico, we have opted for the second approach, one based on multivariate statistics. Towards this objective, a representative budget for the public safety expenditure function of the state governments, expressed as an index, is shown in equation (1).[1] The importance of the included variables, and their weights, is a result of principal components analysis.

$$\mathrm{SPEI}_s = \beta_1\left(\frac{X_{1,s}}{\Sigma X_{1,s}}\right) + \beta_1\left(\frac{X_{2,s}}{\Sigma X_{2,s}}\right) + \ldots + \beta_k\left(\frac{X_{k,s}}{\Sigma X_{k,s}}\right) \qquad (1)$$

where: $\sum_{1}^{k} \beta = 1$

Where $SPEI_s$ is the expenditure index for public safety for each state government *s*, the X_i are those variables determining expenditure in public safety, and β*'s* are the weights of each variable. Obviously, the difficulty is determining the vector of explanatory variables and the weights to be applied. Several other studies have addressed this problem, and there is no clear consensus in either the specialized literature or in compared experience. The determination of variables is generally based on theoretical and logical arguments derived from the data analysis. The previously cited literature provides guidance for the variables considered for inclusion in the estimation of equation (1). Variables are sought which will allow the capture of variations in the costs of different demands, economies of scale, or levels of congestion.

To capture the level of demand for public security we consider total population and the number of people ten years of age and older. Similarly, we include as possible explanatory variables those explain the level of expenditure on security and are typically employed in these kinds of functions:

- inmate population;
- the number of arrest warrants issued over one year;
- the number of criminals sentenced;
- the number of registered crimes against health;
- the number of violent or accidental deaths over the year.

Finally, as territorial or dispersion variables (to capture cost variability), we consider the number of inhabitants in communities with fewer than 15.000 and fewer than 2.500 inhabitants. The variables, shown in Table 1, are for 2005 and from the National Institute for Statistics and Geography known by its acronym in Spanish, INEGI.

[1]This expenditure category includes the administration and management of courts, jails, prisons and correctional facilities and generally all those dealing with the maintenance of law and order (police and traffic), that is from administration to the supply of tools and equipment.

Table 1. Variables in the Public Safety Expenditure Function

C_p	Total Population
C_pobmayor10	Population ten years of age and older
C_penit	Inmate population
C_oa	Arrest warrants issued in one year
C_delsal	Crimes against health (drugs)
C_senten	Criminals sentenced in first-grade trials (federal jurisdiction)
C_mviolen	Number of violent or accidental deaths
C_hab2_5	Number of inhabitants in communities with fewer than 2.500 people
C_hab15	Number inhabitants in communities with fewer than 15.000 people

The data of the variables refer to 2005. Source: Instituto Nacional de Estadística y Geografía.

4. RESULTS

This method of principal components has been used in different models assessing expenditure needs and allows for flexibility in the management of highly co-lineal variables, a common problem with regression methods. Indeed, we find that just two factors explain 94% of the total explained variance (67.4 and 26.6 per cent, respectively). Furthermore, the determinant of the correlation matrix is extremely close to zero that is the variables are highly colinear.

The KMO and Bartlett's tests, displayed in Table 2.c, indicate that the selection method is valid.

Table 2.a. Correlation Matrix(a)

		C_penit	C_oa	C_delsal	C_senten	C_p	C_hab15	C_pobmayor10
Correlation	C_penit	1,000	,895	,680	,863	,734	,544	,729
	C_oa	,895	1,000	,799	,897	,552	,343	,549
	C_delsal	,680	,799	1,000	,857	,207	,014	,204
	C_senten	,863	,897	,857	1,000	,448	,233	,445
	C_p	,734	,552	,207	,448	1,000	,884	1,000
	C_hab15	,544	,343	,014	,233	,884	1,000	,885
	C_pobmayor10	,729	,549	,204	,445	1,000	,885	1,000
Sig. (1-tailed)	C_penit		,000	,000	,000	,000	,001	,000
	C_oa	,000		,000	,000	,001	,030	,001
	C_delsal	,000	,000		,000	,132	,470	,135
	C_senten	,000	,000	,000		,006	,104	,006
	C_p	,000	,001	,132	,006		,000	,000
	C_hab15	,001	,030	,470	,104	,000		,000
	C_pobmayor10	,000	,001	,135	,006	,000	,000	

a Determinant = 3,27E-007

Using these results the adjustments for the two factors can be determined. Factor 1 includes the variables inmate population (C_penit), arrest warrants carried out (C_oa), confirmed sentences (C_senten), and crimes against health (C_delsal). Consequently this factor has been named *Fdelinquency*. In turn, factor 2 includes the variables total population (C_p), population 10 years of age and older (C_pobmayor10) and population in places with fewer than 15.000 inhabitants (C_hab15), thus the factor has been designated *Fpopulation*. The derived figure (using the *Varimax* method) of

the components and the coefficient matrix of the results allow visualization of these factors (see Figure 2).

Table 2.b. Total Variance Explained

Compo-nent	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4,716	67,365	67,365	4,716	67,365	67,365	3,377	48,237	48,237
2	1,861	26,579	93,944	1,861	26,579	93,944	3,199	45,707	93,944
3	,160	2,282	96,226						
4	,110	1,570	97,796						
5	,094	1,347	99,142						
6	,060	,852	99,995						
7	,000	,005	100,000						

Extraction Method: Principal Component Analysis.

Table 2.c. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		,828
Bartlett's Test of Sphericity	Approx. Chi-Square	400,749
	degrees of freedom	21
	Marginal significance	,000

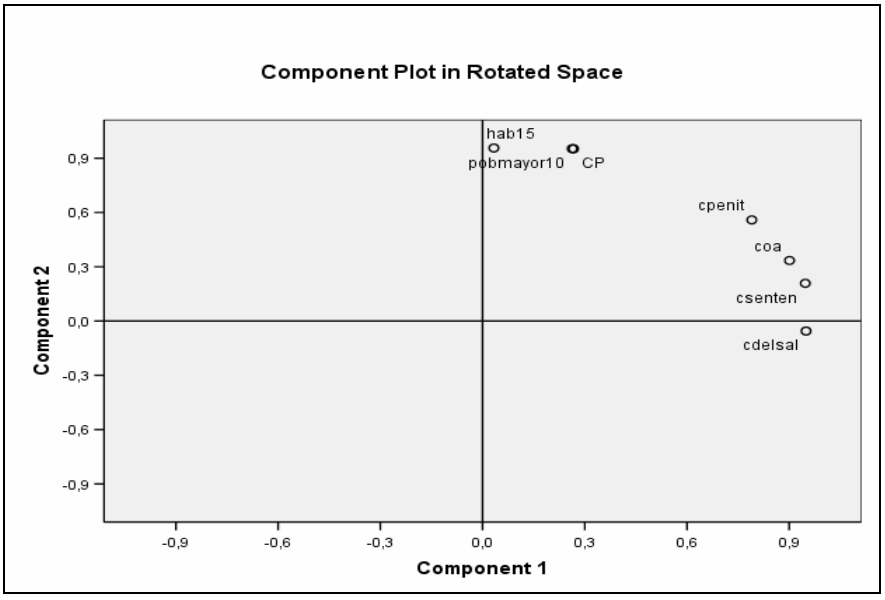


Figure 2. Component plot in rotated space

The final weighs for each variable are shown in Table 3.

Table 3. Factors and Weights for the Included Variables

Fdelincuency (Weight: 0.71707613)		**Fpopulation (Weight: 0.28292387)**	
Variable	Weight	Variable	Weight
C_penit	0.17338285	C_penit	0.0791701
C_oa	0.24088825	C_p	0.29459093
C_delsal	0.31206852	C_hab15	0.33077754
C_senten	0.27366038	C_pobmayor10	0.29546142

The index of expenditure needs resulting from these adjustments is shown in table 4.

Table 4. Expenditure Needs in Public Safety

States	**SPEI**		**Ordered by Index**	**SPEI**
Aguascalientes	0.009170		Jalisco	0.093990
Baja California	0.073757		Sonora	0.087024
Baja California, South	0.011970		State of México	0.079078
Campeche	0.009483		Baja California	0.073757
Coahuila	0.022221		Veracruz	0.050410
Colima	0.012026		Chihuahua	0.046922
Chiapas	0.040233		Michoacán	0.043909
Chihuahua	0.046922		Guanajuato	0.041482
Durango	0.019873		Sinaloa	0.040769
Guanajuato	0.041482		Chiapas	0.040233
Guerrero	0.026021		Puebla	0.034579
Hidalgo	0.018781		Tamaulipas	0.033836
Jalisco	0.093990		Nuevo León	0.033271
State México	0.079078		Oaxaca	0.027961
Michoacán	0.043909		Morelos	0.026126
Morelos	0.026126		Guerrero	0.026021
Nayarit	0.014446		Coahuila	0.022221
Nuevo León	0.033271		Durango	0.019873
Oaxaca	0.027961		Hidalgo	0.018781
Puebla	0.034579		San Luis Potosí	0.018615
Querétaro	0.018125		Querétaro	0.018125
Quintana Roo	0.013769		Tabasco	0.017638
San Luis Potosí	0.018615		Nayarit	0.014446
Sinaloa	0.040769		Quintana Roo	0.013769
Sonora	0.087024		Yucatán	0.012882
Tabasco	0.017638		Zacatecas	0.012281
Tamaulipas	0.033836		Colima	0.012026
Tlaxcala	0.009355		Baja California, South	0.011970
Veracruz	0.050410		Campeche	0.009483
Yucatán	0.012882		Tlaxcala	0.009355
Zacatecas	0.012281		Aguascalientes	0.009170

The results indicate that the expenditure needs are very unequal across the Mexican states. Based on the calculated indexes, just four states (Jalisco, Sonora, State of Mexico, and Baja California) should receive a third of all public security expenditures. Indeed, the indexes suggest that the thirteen highest ranked states should be allocated more than 70% of the funds available for public safety. Of these thirteen states, five (Baja California, Sonora, Chihuahua, Tamaulipas y Nuevo León) share a border with the United States. Coahuila is the only state having a border with the US that is not in the top thirteen.

A rather obvious hypothesis is that drug trafficking accounts for the high levels of insecurity in these states. The three states that comprise the Yucatan Peninsula; Quintana Roo, Yucatán, and Campeche; are among the eight states with the lowest levels of insecurity as measured by the index.

A comparison of the SPEI with an alternative measure of organized criminal activity, the number of criminals sentenced at the federal level by each state government in 2007, suggests that our index is a useful measure of expenditure needs. Figure 3 clearly shows a strong positive correlation between the two measures.

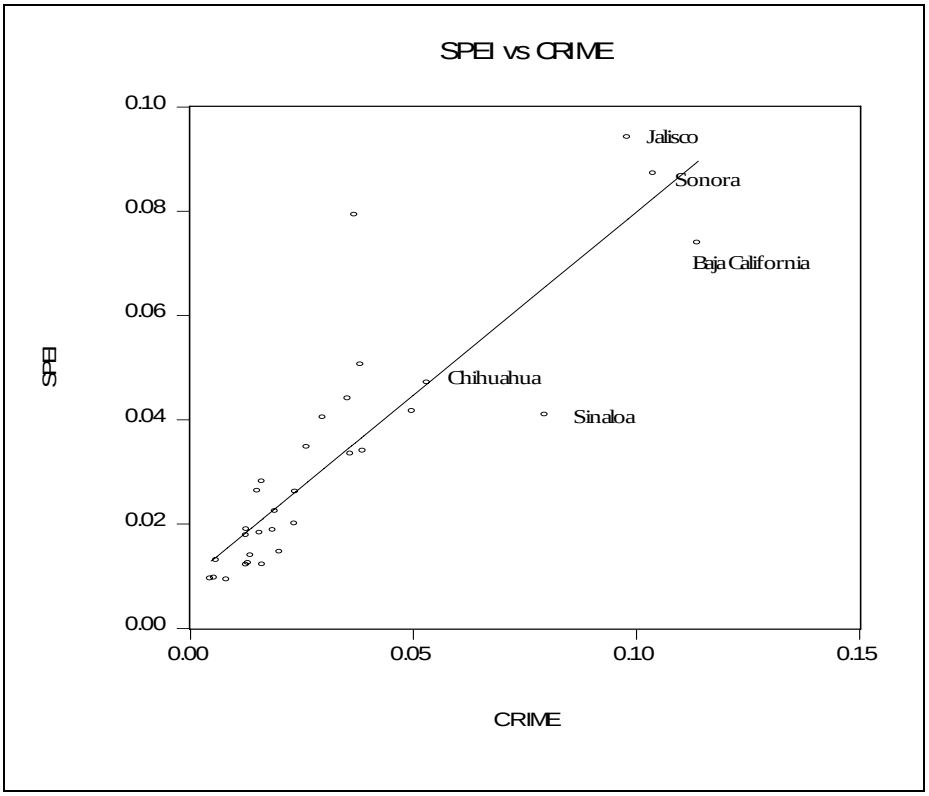


Figure 3. SPEI vs CRIME

5. CONCLUSIONS

We have developed an index of expenditure needs for public security in each Mexican state that, among its advantages, is based on quantifiable factors thus independent of manipulation by governments. A potential use is as the criterion for allocating transfers from the central to the state governments for this category of expenditure. The proposal satisfies the needs of equity and effectiveness, as it is based on an objective methodology. Of course, this methodology could be applied to other expenditure categories, for the purpose of determining the total amount of transfers from the federal government to state governments.

REFERENCES:

[1]. Ahmad, E.; Searle, B. - *On the Implementation of Transfers to Subnational Governments*, in Ahmad, E., y Brosio, G. (Eds.), Handbook of Fiscal Federalism, Edward Elgar Publishing, UK, 2006, pp.381-404

[2]. Ahmad, E.; González, A.; Brosio, G.; García, E.; Lockwood, B.; Revilla, E. - *Why Focus on Spending Needs Factors? The Political Economy of Fiscal Transfer Reform in Mexico*, IMF Working Paper, WP 07 252, 2007

[3]. Bird, R. - *Threading the Fiscal Labyrinth: Some Issues in Fiscal Decentralization*, National Tax Journal, vol.46, no.2, 1993, pp.207-227

[4]. Bird, R. - *Fiscal Flows, Fiscal Balance and Fiscal Sustainability*, in Bird, R. y Vaillancourt, F. (Eds.), Perspectives on Fiscal Federalism, World Bank Institute, Washington, DC, 2006, pp.81-97

[5]. Boadway, R. - *Intergovernmental Redistributive Transfers: Efficiency and Equity*, en Ahmad, E., y Brosio, G. (Eds.), Handbook of Fiscal Federalism, Edward Elgar Publishing, UK, 2006, pp.355-380

[6]. Boex, J.; Martínez-Vazquez, J. - *Designing Intergovernmental Equalization Transfers with Imperfect Data: Concepts, Practices, and Lessons*, Working Paper 04-21, Georgia State University, International Studies Program, 2004

[7]. Cabrera-Castellanos, L.; Lozano-Cortés, R. - *Decentralization and Fiscal Federalism in Mexico*, MPRA Paper 10572, University Library of Munich, Germany

[8]. De la Fuente, A. - *Los mecanismos de cohesión territorial en España: un análisis y algunas propuestas*, Documento de trabajo No.62, Fundación Alternativas, 2005

[9]. Espuelas, L. - *Una evaluación del sistema de transferencias para la financiación de la educación básica en México*, Universidad de Zaragoza, 2004, Available in: http://www.uib.es/congres/ecopub/papers/edu1/espuelas.pdf

[10]. Gershberg, I. - *Fiscal Descentralization, Intergovernmental Relations and Education Finance: Welfare an Efficiency Considerations in Educational Expenditures and Outcomes in Mexico*, UMI Microform, no.8413835, ProQuest Information and Learning Company, 1993

[11]. INEGI - *Estadísticas judiciales en materia penal de los Estados Unidos Mexicanos* Instituto Nacional de Estadística, Geografía e Informática (NEGI), 2007

[12]. Lamoyi, B. - *Transferencias y equidad horizontal. Los desequilibrios financieros horizontales en la financiación de la educación básica en México* (Memoria presentada en el Master en Hacienda Pública y Análisis Económico IX edición del IEF, España), 2004

[13]. López Laborda, J. - *Veinticinco años de financiación autonómica: Balance y Perspectivas*. Mediterráneo Económico, no.10, 2006, pp.197-219

[14]. **OCDE** - *Factbook 2006: Economic, Environmental and Social Statistics*, 2006

[15]. Shah, A. - *The Reform of Intergovernmental Fiscal Relations in Developing and Emerging Market Economies*, The World Bank Policy and Research Series, no.23, June, 1994

[16]. Shah, A. - *A Fiscal Need Approach to Equalization*, Canadian Public Policy, vol.22, no.2, 1996, pp.99-115

[17]. Solé-Ollé, A. - *Determinantes del gasto público local: ¿necesidades de gasto o capacidad fiscal?*, Estudios sobre la Economía Española 66, FEDEA, 2001