4-2006

# Mexican northern border municipalities, financial dependence and institutions

Jorge Ibarra Salazar

Andre V. Mollick
*The University of Texas Rio Grande Valley*

# MEXICAN NORTHERN BORDER MUNICIPALITIES, FINANCIAL DEPENDENCE AND INSTITUTIONS*

**Jorge Ibarra Salazar**
Associate Professor
jaibarra@itesm.mx
Department of Economics
Tecnológico de Monterrey, Campus Monterrey
Av. E. Garza Sada 2501 Sur
Monterrey N.L. 64849, MEXICO
(52) (81) 8358-2000, ext. 4305 and 4306
Fax (52) (81) 8358-2000, ext. 4351

**André Varella Mollick**
Associate Professor
amollick@panam.edu
Department of Economics and Finance
University of Texas-PanAmerican
1201 West University Dr.
Edinburg, TX 78541-2999, USA
Phone: (956) 316-7913
Fax: (956) 384-5020

**Abstract:** Regional and institutional aspects of local public finances are studied in this paper. Mexican Northern Border municipalities have experienced economic and populational growth rates that are much higher than other Mexican regions. These heterogenous laws of motion result in higher demand for public services and infrastructure. The different institutional framework, both fiscal and legal, faced by municipalities in every Mexican State might impact the fiscal behavior of local governments. This article studies whether border municipalities are more financially dependent on central authorities due to the high demand for public services in their jurisdictions and their inability to obtain sufficient funding. We estimate several econometric models for the more representative 300 Mexican municipalities in the year 2000. We find a strong and negative relationship between income and financial dependence, as expected. We also uncover that institutional and regional factors should not be omitted in the model specifications. Classic statistical theory, based on the estimations, finally suggests that the border Mexican municipalities of Ciudad Juárez and Puerto Peñasco have systematically lower financial dependence than others. There is not, however, a general rule regarding border municipalities and financial dependence.

**Keywords:** Border municipalities, Federal transfers, Financial dependence, Fiscal federalism, Institutional framework.

**JEL** Classification: R5, H7.

* The authors would like to thank Lida Sotres Cervantes for superb work in constructing the data set employed in this article and to Cynthia J. Brown and José de Jesús Salazar for helpful discussions on this subject. We also acknowledge several useful comments from an anonymous referee of this journal. The usual disclaimer applies. The authors acknowledge financial support from the "Cátedra de Investigación del Tecnológico de Monterrey: Agenda Económica de la Frontera Norte de México" (Research Group on the Economic Agenda of Mexican North Border sponsored by Monterrey Tec.).

## 1. INTRODUCTION

Mexican subnational public sector finances underwent major changes during the last 25 years. The "Sistema Nacional de Coordinación Fiscal" (SNCF, the National System of Fiscal Coordination), established in 1980, increased the amount of non-conditional transfers ("participaciones federales") to states and municipalities. Subsequently, the Constitutional Reform of Article 115 in 1983 transferred fiscal functions and responsibilities to municipal governments. It remains a topic of discussion whether the SNCF has increased the degree of financial independence of Mexican subnational governments. One would expect the Constitutional Reform to reduce the degree of financial dependence once new sources of own revenues become available. In fact, one of the explicit objectives of the Constitutional Reform was to reduce financial dependence.

In addition to changes in fiscal institutions at the national level, the institutional frameworks faced by municipalities within their states have changed. These additional forces could also affect the degree of financial dependence. Particularly interesting is the case of Mexican Northern border municipalities, whose economic, demographic and migratory dynamics contrast with the rest of Mexico. This study investigates whether the institutional fiscal setting at the state level, together with location (municipalities sharing a common border with the U.S.), impact the financial independence of local governments. We expect, with higher than average inflows of capital and labor, higher demand for public services and infrastructure in border municipalities. An argument based on fiscal effort suggests that local governments would exploit their fiscal capacity to the maximum, lessening their lower degree of financial dependence relative to non-border localities. However, border municipalities may be simply more financially dependent on central authorities due to the high demand for public services in their jurisdiction and their inability to obtain sufficient funding.

Concerning the effects of federal institutional changes, Ibarra Salazar et al. (2001) find that after 1980 the degree of financial dependence of Mexican municipalities is significantly higher than the years preceding SNCF. For the northern border municipalities in particular, Ordóñez Barba (1995) finds that the Constitutional Reform did exert positive effects on financial autonomy, though not uniformly. In fact, the benefits seem to be higher for municipalities with a relatively high stage of urbanization, having a population over 250,000 people. Additional studies on the public finances of Mexican northern border municipalities include Zepeda Miramontes (1992), Ordóñez Barba (1995), Cabello y Ortiz (1998), and Ibarra Salazar (2003), who recently documents that northern state governments show less dependence than other Mexican states.

Studies have hitherto ignored the effects that regional characteristics and different institutional settings may have on municipal public finances. This study puts forward such an institutional approach, incorporating regional aspects of the U.S.-Mexican border area, in order to analyze these effects on financial dependence. Because of the economic dynamics and demographics of the area, as well as pressure from migration, border municipalities face a higher demand for public services, compared to non-border localities. The main hypothesis of this study is precisely based on this fact. The constraints border municipalities face when responding to such an environment are then twofold: the fiscal intergovernmental agreement signed in 1980 and the distribution scheme to transfer federal funds that ignore border-related characteristics. Given such a scenario, local governments in northern border municipalities necessarily exploit their own limited resources in the face of heavy demand for infrastructure and public service. Pursuing this reasoning, we would thus expect that the degree of border municipalities dependence is lower than non-border municipalities.

In order to confirm or refute the validity of this conjecture, we estimate different econometric models of financial dependence using a data set of the 300 more representative Mexican municipalities, as defined by Mexico's Instituto Nacional de Estadística Geografía e Informática (INEGI) for the year 2000.

Each model controls for economic (municipality level-GDP per capita) and fiscal (amount of federal non-conditional transfers as well as concentration of fiscal revenues in a given municipality) measures, together with dummy variables that take into account geographic (sharing the border with the U.S.) and institutional (state idiosyncracies) differences.

This study offers four major contributions. First, it presents empirical evidence, at the local level, of regional features that quantitatively affect financial dependence. Second, it quantifies the role of the states in introducing systematic (regulatory or due to the state's economic orientation) components on the financial dependence of municipalities. Third, it provides a novel approach, based on classic statistical theory, to handle municipality public finances that receive *shocks* at the national level, through the institutional framework, and at the local level, thorough migration and capital flows. We provide evidence that these fluctuations are much higher than the ones affecting the nation as a whole. Fourth, the paper provides insights and policy implications on a public finance issue which is not exclusive to Mexican localities.

The results confirm two of these hypotheses. We find that institutional and regional factors systematically affect differences in the degree of financial dependence. Classic statistical theory, based on the estimations, suggests that the border counties of Ciudad Juárez and Puerto Peñasco have systematically lower financial dependence than other counties. There is not, however, a consensus regarding border municipalities and financial dependence.

The plan of this paper is as follows. Section 2 discusses the recent economic background of border municipalities. Section 3 provides the empirical methodology and the various models to be estimated, while section 4 contains the major results of the paper. Sector 5 summarizes the work and presents policy implications.

## 2. THE BACKGROUND OF BORDER MUNICIPALITIES

As can be seen in Figure 1, until the early 1980s own source municipality revenues were higher than non-conditional federal transfers. Since then, transfers increased to the point of representing a higher amount than own source revenues. Particularly, in 1983 the Constitutional Reform brought about a sharp change in the trend of own source revenues. Since then, both series follow a very similar trend.

[Figure 1]

Studies on municipal public finance agree in that the SNCF has strengthened county finances. It has increased revenues [Ortega Lomelín (1994), Cabrero Mendoza (1998)] and it has also led, in the long-run, to an increase in the degree of dependence on federal transfers as argued by Ortega Lomelín (1994), Pérez González (1995), Nickson (1995), Arellano Cadena (1996), Sempere and Sobarzo (1996), Aguilar Villanueva (1996), Cabrero Mendoza (1998), García del Castillo (1999), and Cabrero Mendoza and Carrera (2000).

Various studies acknowledge that the northern Mexican border shows more economic dynamism than other Mexican regions. It is also perhaps more dynamic than other border regions elsewhere in the world as argued by Ganster (1998). Arroyo García (2001) recently points out that, as a result of the industrial decentralization started in 1985, there has been a geographic redistribution in growth. Northern states in Mexico as a consequence have grown faster. This point has been reinforced by studies such as Mendoza Cota and Martínez (1999), Chamboux-Leroux (2001) and Mendoza Cota (2001) on agglomeration economies. These studies emphasize that economic openness and more integration with the U.S. economy have led employment to grow faster in Mexican border cities.

Figure 2 illustrates growth in manufacturing employment in border municipalities at more than double the national aggregate during 1988-1998. Figure 3 shows the real value of manufacturing production growing 2.6 times faster in border municipalities than the national for the same period.

[Figures 2 and 3]

The "maquiladora industry" captures a large part of the employment and production capacity along the U.S. - Mexican border. Large flows of foreign direct investment to the northern Mexican region during the late 1980s and early 1990s changed the region's manufacturing industry. This has brought about trends towards agglomeration of those manufacturing sectors that typically lean towards global manufacturing demand, such as: automotive and electronics.

High demographic turnover is another feature of Mexican border municipalities. Cruz Piñeiro (1990), Corona Vázquez (1991), Guillén López (1996), Ganster (1998), and Marmolejo and León (1998) stress that the region has registered much higher population growth than the national figures. As shown in Figure 4, the population growth of northern border municipalities is more than twice the national rate over the 1990-2000 period. Cruz Piñeiro (1990), Corona Vázquez (1991), Ganster (1998), and Margáin (1999) discuss several economic reasons for the causes of these changing demographic patterns. Figure 5 shows the percentage of residents in border municipalities ("Municipios Fronterizos") that were born in other state (34%), compared to national figures (18%).

[Figures 4 and 5]

The degree of financial dependence is measured by the ratio of resources coming from non-conditional federal transfers to operational revenue. Mexican municipalities receive two types of federal closed transfers: non-conditional ("participaciones federales") and conditional ("aportaciones federales").[1] The former are discretional, while the latter are assigned to specific purposes. According to the Fiscal Cordination Law ("Ley de Coordinación Fiscal"), the amount transferred to the states is allocated from seven funds.[2]

Federal non-conditional transfers to municipalities must account for at least 20% of the amount their respective states receive. However, border or coastal municipalities, where there is transit of

[1] Arellano Cadena (1996) presents an historic overview of the allocating non-conditional federal transfers' schemes. See Ortiz Ruiz (1996) for details on calculating the coefficients and Courchene and Díaz Cayeros (2000) for a description of the Mexican system of transfers.
[2] The general fund ("fondo general de participaciones", FGP), the most important quantitatively, is constituted with 20% of the federal tax revenue ("recaudación federal participable", RFP). The other funds are composed of: federal excise taxes; 1% or RFP by federal user charges

exported or imported goods, take part in the 0.136% of federal tax revenue (RFP). Border or coastal municipalities involved in oil exports receive 3.17% of the additional charge on oil extraction, excluding extra charges. Besides, states must assign 100% of the Municipal Fund ("Fondo de Fomento Municipal"), which is constituted by 1% of the federal tax revenues, to the corresponding municipalities. In some states, at the discretion of state governments and approved by the local congresses, there are also transfers to municipalities from state taxes. The criteria to assign the transfer revenues to counties of each state are decided by the local congresses.

A modification in the Fiscal Coordination Law ("Ley de Coordinación Fiscal") in 1998 created the "aportaciones federales", conditional transfers to states and municipalities, which are to be applied to education, health services, social infraestructure, and public security. These were previously assigned on a discretionary basis through a bargaining process. This change reflected the creation of Item 33 of the federal budget. Table 1 presents the different transfers received by municipal governments.

[Table 1]

## 3. METHODOLOGY

We employ cross-sectional Mexican municipality data for the year 2000. The sample contains the 300 more representative municipalities according to Mexico's INEGI. We define a border municipality as one in which there is geographical border with the U.S. Application of this criterion yields the following 14 border municipalities: Mexicali, Tecate and Tijuana in Baja California; Juárez in Chihuahua; Acuña and Piedras Negras in Coahuila; Aguaprieta, Caborca, Nogales, Puerto Peñasco and San Luis Río Colorado in Sonora; and Matamoros, Reynosa and Río Bravo in Tamaulipas.

Table 2 contains the description of variables and data sources. Table 3 presents descriptive statistics of the series used in the estimations as well as the correlation matrix. The demand-related

coordination; the 80% of the real value of subrogated agricultural and cattle taxes; the federal tax on vehicles; the federal tax on new autos; and a contingency reserve.

independent variable used to control for economic differences within counties is per capita border GDP, estimated under two different criteria: i) employed population; and ii) income of employed population. In the former, GDP of municipality i in state j ($YML_{ij}$) is calculated multiplying GDP of state j by the proportion of employed population in municipality i ($PO_i$) in the state ($PO_j$): $YML_{ij} = GDP_j \frac{PO_i}{PO_j}$. This procedure, adopted by Sánchez Almanza (2000) and Unikel (1976) assumes that partial labor productivity is the same in the municipalities of each state. In order to obtain a proxy for variations in inter-municipality productivity, we estimate the proportion of income of employed population of municipality i in state j. Since income data are presented based on the distribution of employed population by ranges of minimum wages, we determine the wage mass of each range by multiplying its class midpoint value by the number of persons employed in each range. For municipality i GDP in state j, we estimate ($YM_{ij}$) by multiplying GDP in state j by the percent wage mass that municipality i represents in state j (that is, the proportion of income of employed population in municipality i ($IPO_i$) to state's income ($IPO_j$): $YM_{ij} = GDP_j \frac{IPO_i}{IPO_j}$. This procedure assumes all employed workers in each range have the same wage. In both methods, municipality GDP per-capita is calculated by dividing county GDP by its population. Table 3 shows that municipality GDP estimated with income of employed workers (*YM*) has more variation than estimated GDP through employed workers (*YML*). Although we estimate the models with both measures of local GDP, we report only the results with YM. Note also in table 3 that the average of the dependent variable (*DEP*) is 69.36, with minimum value of 25.50 for Tampico, Tamaulipas, and maximum of 98.73 for Jonuta in Tabasco.

[Tables 2 and 3]

The dependent variable of the empirical model is the degree of municipality financial dependence (*DEP*). Independent variables include the concentration of state tax revenues in a given municipality (*CONC*), the per capita municipality GDP (*YM* or *YML*), the amount received as transfers (*T*) different

from "participaciones federales", and dummy variables that identify border municipalities (*DTMF* and *DCMF*) and to control for differences in the institutional setting that counties face in their respective states (*DE*).[3]

Given the high correlation coefficient found between *T* and *CONC* (0.58 in Table 3), we estimate the empirical models with these independent variables entering individually and not jointly. We consider the model with *T* as the benchmark model. Discussion of the model with *CONC* is available upon request. We expect a negative relationship between *DEP* and *YM*: the higher GDP per capita in a municipality, *ceteris paribus*, the higher will be own revenue collection, particularly taxes, which serves to reduce the degree of dependence on federal transfers. We also expect municipalities with a high share of local fiscal revenues, added at the state level, (*CONC*) to exhibit a lower degree of dependence. It is difficult to envisage, however, an ex-ante clear link between *DEP* and *T* since the expenditure price elasticity would be crucial.[4]

The state dummy variables (*DE*) capture the different institutional settings that municipalities face in a given state. Poterba and von Hagen (1999) and Kirchgassner (2001) have shown the effect of budgetary institutions on subnational fiscal performance. The rules of the game that local treasury offices face are approved largely by local congresses. This would mean that some states distribute, apart from federal funds, state revenues to municipalities. The criteria that regulate the allocation of transfers to municipalities are also different: 84% of states employ relative population as criterion; 52% refer to property tax collection; 45% to a measure of fiscal effort based on local municipality revenues; 42% to water usage charges; 39% to equal parts distribution of funds; 29% to revenues from previous fiscal

[3] We acknowledge, as an anonymous referee has suggested, that the economic activity generated by migrants should be incorporated in the empirical model. We are not aware, however, of such data availability for the 300 municipalities considered in this study. We leave the construction of a possible proxy on migration flows and a full assessment on their effects for future work.

[4] Revenue received by means of conditional transfers, other than "participaciones federales," could affect financial dependence through the municipality's own resources. If, as a consequence of conditional transfers, county expenditures increase by a larger amount than the transfer, own resources would have to rise [Stine (1994), p. 804] and municipality dependence would fall. Otherwise, such transfers would affect municipality expenditure, without requiring the generation of additional own source revenue. In such a scenario, the local government would apply the transfers on the expenditure item for which it was conceived. However, the amount received by the municipality could create a disincentive to exploit own revenue sources if federal government takes care of the fiscal needs, moving up the degree of

budgets. Other criteria employed are the territorial area of municipalities and social indicators, such as welfare and violence [Indetec (2000a and 2000b)]. We believe the DE's capture differences in financial dependence of the municipalities in each state according to this framework. Finally, the identification of border municipalities takes two forms: through $DTMF_{ij}$ (1 for every municipality i bordering the U.S. in state j, and 0 elsewhere) and with the set of variables $DCMF_{ij}$ (one variable for each one of the 14 Mexican municipalities in the sample bordering the U.S.).

We consider three hypotheses related to municipality financial dependence on the federal entity. First, the institutional background is a major factor explaining variations in the degree of dependence of Mexican municipalities (*DEP*): hypothesis H1. Second, controlling for state political and institutional related differences, the variables that identify border municipalities with the U.S. contribute to explaining variations in *DEP*: hypothesis H2. Third, controlling for differences in the institutional setting, border municipalities have a lower degree of dependence than non-border municipalities, which turns out to be hypothesis H3.

The unrestricted model to test H1, called *Model 1*, considers the effects of independent variables as well as a dummy variable for the institutional setting of each municipality in the state ($DE_{ij}$):

$$\ln (Dep_{ij}) = \beta_j DE_{ij} + \theta \ln (YM_{ij}) + \tau \ln (T_{ij}) + \varepsilon_{ij}, \qquad (1)$$

where: $i = 1, ..., 300$ represents each municipality in the sample and $j = 1, ..., 31$ indexes the corresponding state, $\varepsilon_{ij}$ is the error term and "ln" indicates the natural logarithm. In model (1) the constant term of the counties in state j is equal to $\beta_j$, although it may be different for municipalities located in a different state. Such differences, if any, would suggest effects of institutional settings on financial dependence. If such differences in states do not generate different degrees of municipality dependence, then $\beta_1 = \beta_2 = ... = \beta_{31}$.

---

dependence. Therefore, the effect on the degree of local government dependence would depend, in general, on the reaction to federal

These would be the restrictions (J = 31) to test H1 utilizing *Model 1* as the benchmark. The J restrictions are associated with the population parameters under the null hypothesis. The alternative is that the $\beta$'s are different. Accordingly, the *Restricted Model* can be expressed as follows:

$$\ln (Dep_{ij}) = \beta + \theta \ln (YM_{ij}) + \tau \ln (T_{ij}) + \varepsilon_{ij}. \quad (2)$$

To test H2, we employ the two dummy variables for border municipalities previously defined. The unrestricted *Model 2* that contains variable $DTMF_{ij}$, considers the independent variables, the state dummies, and identifies border municipalities through a single dummy variable, taking the form:

$$\ln (Dep_{ij}) = \beta_j DE_{ij} + \delta DTMF_{ij} + \theta \ln (YM_{ij}) + \tau \ln (T_{ij}) + \varepsilon_{ij}, \quad (3)$$

It assumes that differences in dependence between border and non-border municipalities, controlled for the independent variables, are captured by the coefficients $\beta_j$ and $\delta$. In *Model 2* the intercept of non-border municipalities located in state j equals $\beta_j$, while the intercept for the border municipalities located in state j equals $\beta_j + \delta$. When $\delta < 0$, there is evidence that dependence on federal transfers of border municipalities would be less than dependence of non-border municipalities in the same state. However, if there is no difference in the degree of dependence between border and non-border municipalities in the same state, $\delta$ would equal zero.

To test whether the degree of dependence of a border municipalities is the same as that of a non-border municipalities, located in different states, one would need to compare the value of $\delta + \beta_k$ of the border municipality (in border state k) with $\beta_j$ of the non-border municipality in the non-border state j. Denoting by $\Omega$ the set of border states and by $\Theta$ the set of non-border states, $\Omega \cup \Theta = \Psi$ refers to the

---

transfers and, especially, on the expenditure price elasticity.

whole set of Mexican state entities. In order to prove this hypothesis, the set of restrictions one would need to impose on the population parameters of *Model 2* to prove H2 is: $\delta + \beta_{k \in \Omega} = \beta_{j \in \Psi}$ for all k $\in \Omega$ and for all j $\in \Psi$. This could be accomplished restricting $\delta$ to be zero and the $\beta$ parameters to be equal for the 31 states. The *Restricted Model* remains the same as in (2).

*Model 3* defines the unrestricted model with dummy variables to identify each border municipality and includes a different intercept for each border municipalities, under the assumption that the parameters for the variables *YM* and *T* are equal for the municipalities in the sample:

$$\ln (Dep_{ij}) = \beta_j DE_{ij} + \delta_i DCMF_{ij} + \theta \ln (YM_{ij}) + \tau \ln (T_{ij}) + \varepsilon_{ij}. \qquad (4)$$

Following Hsiao (1999) on fixed effects models, $DCMF_{ij}$ helps capture the effects of those omitted variables in the model that are specific to each border municipality. Although we control for the institutional setting at the state level through *DE*, the variable *DCMF* could contain information of political and institutional nature at the local level that is not included in (4). The political party of the state governor and of the county mayor, the composition of local assemblies and local elections are political factors that could affect the financial structure of local governments. Fiscal effort[5] is another factor that could affect the degree of dependence and is not included in the model. *Ceteris paribus*, if a municipality raises the tax rate one would expect that own source revenues would increase and thus that dependence would diminish.

In (4), the intercept of non-border municipalities that belong to state j equals $\beta_j$, while for the border municipality i in state j it would equal $\beta_j + \delta_i$. The set of restrictions on the parameters of the null hypothesis from *Model 3* are that $\delta_i$ equals zero for the 14 border municipalities and $\beta_1 = \beta_2 = ... = \beta_{31}$.

[5] The concept is due to Musgrave and Musgrave (1980) and has been empirically implemented by Badu and Li (1994) and Mercer and Gilbert (1996). It is defined as the ratio between revenue generated from taxes and revenue from taxes if the standard tax rate were applied. It is thus the ratio between the observed tax rate and the standard tax rate.

The set of restrictions on the parameters under the null would be $\delta_i + \beta_{k \in \Omega} = \beta_{j \in \Psi}$ for every border municipality i belonging to border state k and for all states j. These would indicate that, controlling for *YM*, *T* (or *CONC*) and differences in the institutional setting, there is no difference in the degree of dependence in each border municipality compared to the rest of municipalities. Introducing these restrictions on *Model 3* leads to the *Restricted Model*.

In order to prove H1 and H2, we construct $F = [(SSE_R - SSE_U)/J] / [SSE_U/(N-K)]$, where J is the number of restrictions, N is the number of observations, K is the number of parameters to estimate in the unrestricted model, $SSE_U$ refers to the sum of squared residuals of the unrestricted model and $SSE_R$ refers to the sum of squared residuals of the restricted model. In order to address the more contentious issue surrounding H3, we construct the t-statistic, using *Model 3*, by comparing the degree of dependence of each border municipality with all non-border municipalities. The statistic to determine whether financial dependence of municipalities i, located in border state k, is less than the financial dependence of municipalities located in state j is:

$$t = \frac{\hat{\delta}_i + \hat{\beta}_k - \hat{\beta}_j}{\sqrt{\text{var}(\hat{\delta}_i + \hat{\beta}_k - \hat{\beta}_j)}}, \qquad (5)$$

where: $\text{var}(\hat{\delta}_i + \hat{\beta}_k - \hat{\beta}_j) = \text{var}(\hat{\delta}_i) + \text{var}(\hat{\beta}_k) + \text{var}(\hat{\beta}_j) + 2\text{cov}(\hat{\delta}_i, \hat{\beta}_k) - 2\text{cov}(\hat{\delta}_i, \hat{\beta}_j) - 2\,\text{cov}(\hat{\beta}_k, \hat{\beta}_j)$.

## 4. RESULTS

We first check the correlation matrix in order to minimize multicolineality problems. Table 3 shows that *CONC* and *T* have high positive correlation (0.58), followed by *CONC* and *YM* (0.49). Of course, correlation between the two estimated municipality per capita GDP measures (*YM* and *YML*) is very strong (0.87). We will estimate several models taking into account municipality GDP per capita

based on income of employed personel (*YM*) instead of *YML*, since the former adjusted better in the sense of generating more dispersion in municipality income levels. The qualitative results, however, do not change with respect to the income aggregate used.

Since the error variance of different cross-section units displays heteroscedasticity, we perform the estimation with the Newey-West matrix that is robust to autocorrelation and heteroscedasticity. Table 4 presents the results of the models with *YM* and *T* as independent variables, together with dummy variables for the institutional setting and border geographic location as referred to in equations (1) to (4). Model 2 contains a single dummy variable for all border municipalities (14 in our sample), which turns out not to be statistically significant. This shows that the degree of financial dependence of border municipalities is not different from those observed in non-border municipalities located in the same state. As expected, the degree of financial dependence shares a negative and strong relationship with local income, which is observed throughout the models.

[Table 4]

It was mentioned ealier (see footnote 4) that the relationship between *T* and *Dep* could be either positive or negative. The results show that transfers do not help explain the variation in the degree of financial dependence of municipalities. This finding may be due to the fact that such transfers do not change the municipality expenditures requiring own resources. This remains a topic for further research.

To address the conjecture that state dummy variables - and therefore the institutional setting - play an important role in the extent of municipality financial dependence, we present first a Wald test on all parameters of the state dummy variables. We report in line DE (WALD) the result statistic: 81.82 for *Model 1*, 77.34 for *Model 2* and 77.25 for *Model 3*. Each statistic rejects the null hypothesis that all parameters of the variables *DE* are equal. This supports the idea that the institutional setting faced by Mexican municipalities in their respective states causes signficant differences with respect to the degree of financial dependence.

In order to test the second hypothesis for *Model 2* in (3) with respect to the *Restricted Model* in (2), we should prove jointly that $\delta$ is equal to zero and the parameters of state dummies are equal. Table 4 reports the F statistic that considers the sum of squared errors for the restricted and unrestricted equations. In line "Fcalc." we report that F = 5.26, which rejects the null at the 1% confidence level (critical values are approximately 1.46 and 1.35, respectively). The rejection of the null, consistent with the J-restrictions on the parameters being true, implies that the dummy variable to identify border municipalities and the state dummies should be present in the model to explain variations in financial dependence within Mexican local government units.

Focusing now on *Model 3*, which introduces a dummy variable for each border municipality, the F-statistic is 4.48. This again rejects the null at the 1% level. This means that the reduction in the sum of squared errors from 13.47 in the *Restricted Model to* 7.50 in *Model 3* is statistically significant. Therefore, border-region and institutional features are relevant to explain variations in border financial dependence. The first two hypotheses of this study are thus confirmed statistically for our cross-section of 300 representative Mexican municipalities.[6]

Taking *Model 3* as the reference, we calculate the t-statistic in (5) such that we address the more controversial hypothesis put forward in this paper: whether border municipalities have a lower degree of financial dependence relative to non-border municipalities. Table 5 reports the results for the model.[7] Two major results appears. First, financial dependence in all border municipalities is lower than municipalities located in the state of Campeche, a state typically high on oil related activities and threfore with high share of federal transfers. See the very negative t-statistic in the row of that state across all border municipalities. Second, financial dependence in the municipalities of Cd. Juárez and Puerto Peñasco is much lower than non-border municipalities. However, the same pattern is not found for the remaining

[6] We also estimated the empirical model with *CONC* included as independent variable instead of *T*. We did not include both in the right hand side due to multicolineality. Those estimations suggest that both institutional differences and regional features of border municipalities help explain variations in the degree of financial dependence for Mexican logal governments. These are not included to save space and are available upon request from the interested reader.

border municipalities, which casts doubt on a general rule relating border municipalities to their degree of financial dependence. This suggests that the link is more complicated than previously conjectured. The dynamics in the region may lead to underachievment of "fiscal discipline" in border municipalities. In this case, demand for more public services fueled by the fast growing border population erodes any possible effort of fiscal restraint.

[Table 5]

## 5. CONCLUDING REMARKS

Studies on local financial dependence have hitherto ignored the effects that regional characteristics and different institutional frameworks may have had on municipality-level public finances. This article puts forward an institutional approach combined with regional matters and U.S.-Mexican border features. Given the constraints border municipalities face (the 1980 fiscal intergovernmental agreement and the distribution scheme of funds ignoring border-related characteristics), local governments in northern border municipalities would have to exploit all limited sources of own resources to respond to the heavy demand for infrastructure and public services. We would thus expect that the degree of border municipalities dependence would be lower than non-border municipalities.

Our estimates suggest, however, that only the municipalities of Cd. Juárez and Puerto Peñasco exhibit a lower degree of financial dependence relatively to non-border municipalities. This casts doubt on a generalization regarding border municipalities and the degree of financial dependence, suggesting a different mechanism. Less fiscal discipline and more demand for public services by the fast growing border population erodes any effort of fiscal restraint. Put differently, the demand effect of new migrants to the region overshadows any effort of sound public finance that would have lowered financial dependence on federal transfers.

[7] The results with the model including *CONC* are qualitatively the same and and available upon request from the interested reader.

Several policy implications may be drawn from this study. Governments in Mexican northern border municipalities do require fiscal tools to handle specific shocks to their regions, caused either by a sudden reversal of capital inflows or by excess supply of labor through immigration. Apart from federal initiatives, such tools have to be approved by local (state and municipal) congresses. The need to amplify the fiscal powers of local governments has been discussed in Merino (2001) and Díaz Cayeros and McLure (2000). Another implication would be reestructure the distributive criteria of federal transfers to capture migratory or other economic impulses of the border region. The negative effect of this option would be an increase in financial dependence that might reduce the fiscal effort of municipalities. Besides, changing the distributive criteria might cause some municipalities to have the amount of incoming transfers fall, which would require compensatory policies for such local entities.

This study could be extended along several dimensions. Models with political party differences in local entities and with fiscal effort measures by Mexican municipalities could be explored. Similarly, the effects of conditional transfers on the revenue structure and on financial dependence needs to be further explored. It could be particularly interesting to consider what has happened after the creation in 1998 of the Federal Budget's Item 33, known as "aportaciones federales". These topics are left for further research.

## REFERENCES


Aguilar Villanueva L (1996) El Federalismo Mexicano: Funcionamiento y Tareas Pendientes. In Hernández Chávez A (ed) ¿Hacia un Nuevo Federalismo?. El Colegio de México y Fondo de Cultura Económica, Mexico: 109-152

Arellano Cadena R (1996) Necesidades de Cambio en las Relaciones Hacendarias Intergubernamentales en México. In Arellano Cadena R (ed) México Hacia un Nuevo Federalismo Fiscal. Gobierno del Estado de Puebla y Fondo de Cultura Económica, Mexico: 121-149.

Arroyo García F (2001) Dinámica del PIB de las Entidades Federativas de México, 1980-1999. Comercio Exterior 51 (7): 583-599.

Badu Y and Li S (1994) Fiscal Stress in Local Government: A Case Study of the Tri-Cities in the Commonwealth of Virginia. The Review of Black Political Economy 22 (3): 5-17.

Cabello A and Ortiz E (1998) Finanzas de los Municipios de los Estados de la Frontera Norte de México. Revista iapem 4 (40): 80-98.

Cabrero Mendoza E and Carrera A (2000) Fiscal Decentralisation and Institutional Constraints. Paradoxes of the Mexican Case. Documento de Trabajo de la División de Administración Pública del CIDE 85.

Cabrero Mendoza E (1998) Las Políticas Descentralizadoras desde el Ambito Regional. Análisis de Desequilibrios Regionales, Gasto e Ingreso Público y Relaciones Intergubernamentales (1983-1993). In Cabrero Mendoza E Las Políticas Descentralizadoras en México (1983-1993). Logros y Desencantos. Centro de Investigación y Docencia Económicas y Miguel Angel Porrúa, Mexico: 101-187.

Chamboux-Leroux J (2001) Efectos de la Apertura Comercial en las Regiones y la Localización Industrial en México. Comercio Exterior 51 (7): 600-609.

Corona Vázquez R (1991) Principales Características Demográficas de la Zona Fronteriza del Norte de México. Frontera Norte 3 (5): 141-156.

Courchene T and Díaz Cayeros A (2000) Transfers and the Nature of the Mexican Federation. In Giugale M and Webb S (ed) Achievements and Challenges of Fiscal Decentralization: Lessons from Mexico. The World Bank, Washington D.C.: 200-236.

Cruz Piñeiro R (1990) Mercado de Trabajo y Migración en la Frontera Norte: Tijuana, Ciudad Juárez y Nuevo Laredo. Frontera Norte 2 (4): 61-93.

Díaz Cayeros A and McLure C (2000) Tax Assignment. In Giugale M and Webb S (ed) Achievements and Challenges of Fiscal Decentralization: Lessons from Mexico. The World Bank, Washington D.C.:177-199.

Ganster P (1998) La Región Fronteriza entre Estados Unidos y México. Border PACT Report: http://www.borderpact.org/

García del Castillo R (1999) Los Municipios en México. Los Retos ante el Futuro. Centro de Investigación y Docencia Económicas y Miguel Angel Porrúa, Mexico.

Guillén López T (1996) Gobiernos Municipales en México: Entre la Modernización y la Tradición Política. El Colegio de la Frontera Norte y Miguel Angel Porrúa, Mexico.

Hsiao C (1999) Analysis of Panel Data. Cambridge University Press, Cambridge.

Ibarra Salazar J (2003) Dependencia Financiera en las Participaciones Federales de los Estados Fronterizos Mexicanos. Frontera Norte 15: 87-123.

Ibarra Salazar J, Sandoval Musi A and Sotres Cervantes L (2001) Participaciones Federales y Dependencia de los Gobiernos Municipales en México, 1975-1995. Investigación Económica 61 (237): 25-62.

Indetec (2000ª) Criterios de Distribución de Participaciones Federales a Municipios de las Entidades Federativas para 2000. Revista Hacienda Municipal 72: 66-93.

Indetec (2000b) Criterios para la Distribución de Participaciones Federales a Municipios por las Entidades Federativas para 2000. Revista Hacienda Municipal 73: 84-108.

Kirchgassner G (2001) The Effects of Fiscal Institutions on Public Finance: A Survey of the Empirical Evidence. In Winer S and Shibata H (ed) Political Economy and Public Finance. Edward Elgar and the International Institute of Public Finance, Cheltenham Northampton: 145-177.

Margáin E (1999) Globalización y Desarrollo Sustentable en la Frontera de México y Estados Unidos. Comercio Exterior 49 (10): 871-877.

Marmolejo F and León F (1998) La Educación Superior en la Frontera México-Estados Unidos. Border PACT Report: http://www.borderpact.org/

Mendoza Cota E (2001) Specialization, Agglomeration and Urban manufacturing Growth in the Northern Border Cities of Mexico. Journal of Borderlands Studies 16 (2): 71-83.

Mendoza Cota E and Martínez G (1999) Globalización y Dinámica Industrial en la Frontera Norte de México. Comercio Exterior 49 (9): 795-806.

Mercer T and Gilbert M (1996) A Financial Condition Index for Nova Scotia Municipalities. Government Finance Review October: 36-38.

Merino G (2001) Federalismo Fiscal: Diagnóstico y Propuestas. Gaceta de Economía Primavera: 145-185.

Musgrave R and Musgrave P (1980) Public Finance in Theory and Practice. Third Edition McGraw-Hill, Tokyo.

Nickson R (1995) Local Government in Latin America. Lynne Rienner, Boulder.

Ordóñez Barba G (1995) Finanzas Públicas y Estructura Administrativa: Bases para la descentralización de los Municipios Fronterizos del Norte de México. In Pp. In Guillén López T and Ordóñez Barba G (ed) El Municipio y el Desarrollo Social de la Frontera Norte. El Colegio de la Frontera Norte, Mexico: 133-175.

Ortega Lomelín R (1994) Federalismo y Municipio. Fondo de Cultura Económica, Mexico.

Ortiz Ruiz M (1996) La Mecánica de la Distribución de Participaciones en Ingresos Federales a los Estados y Municipios (Un Ejemplo Numérico). Instituto para el Desarrollo Técnico de las Haciendas Públicas, Guadalajara.

Pérez González H (1995) Estructura de las Haciendas Públicas Municipales. Federalismo y Desarrollo 48: 54-60.

Poterba J and von Hagen J (1999) Fiscal Institutions and Fiscal Performance. Chicago University Press and NBER, Chicago.

Sánchez Almanza A (2000) Marginación e Ingreso en los Municipios de México. Universidad Nacional Autónoma de México y Miguel Angel Porrúa, Mexico.

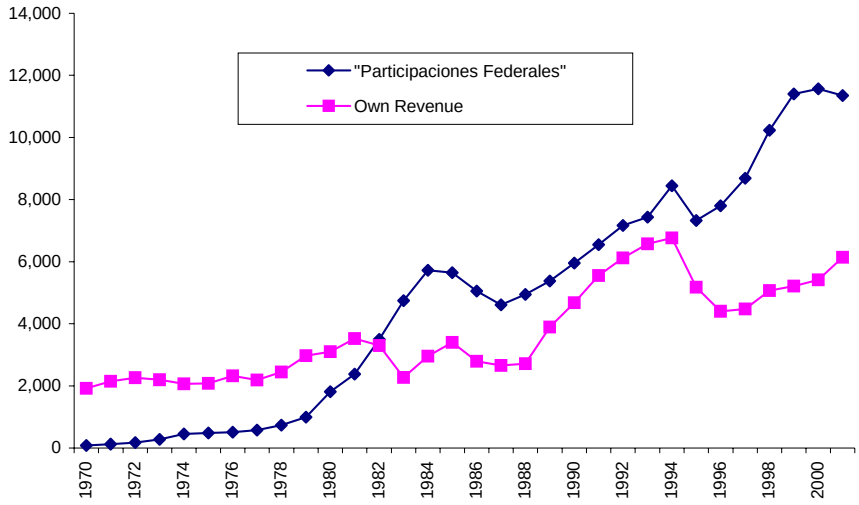
Sempere J and Sobarzo H (1996) La Descentralización Fiscal en México: Algunas Propuestas. In Arellano Cadena R (ed) México Hacia un Nuevo Federalismo Fiscal. Gobierno del Estado de Puebla y Fondo de Cultura Económica, Mexico: 165-196.

Stine W (1994) Is Local Government Revenue Response to Federal Aid Symmetrical? Evidence from Pennsylvania County Governments in an Era of Retrenchment. National Tax Journal 47: 799-816.

Unikel L (1976) El Desarrollo Urbano de México: Diagnóstico e Implicaciones Futuras. El Colegio de México, Mexico.

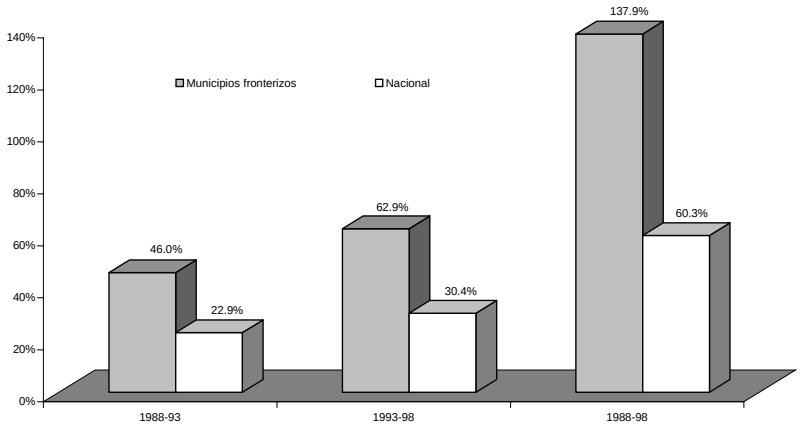
Zepeda Miramontes E (1992) El Gasto Público en la Frontera Norte. Frontera Norte 4 (7): 5-43.

**Figure 1. MEXICO: Evolution of Own Source Revenues and Non-conditional Federal Transfers to Municipalities, 1970-2001. (1994 Million of Mexican Pesos)**



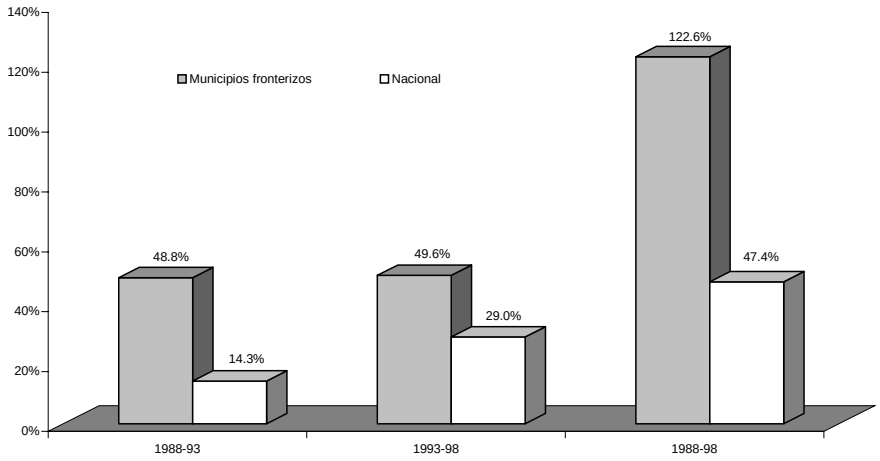

Source: INEGI. Finanzas Públicas Estatales y Municipales de México.

**Figure 2. MEXICO: National and Northern Border Municipalities Employment Growth Rates in Manufacturing, 1988-1998.**



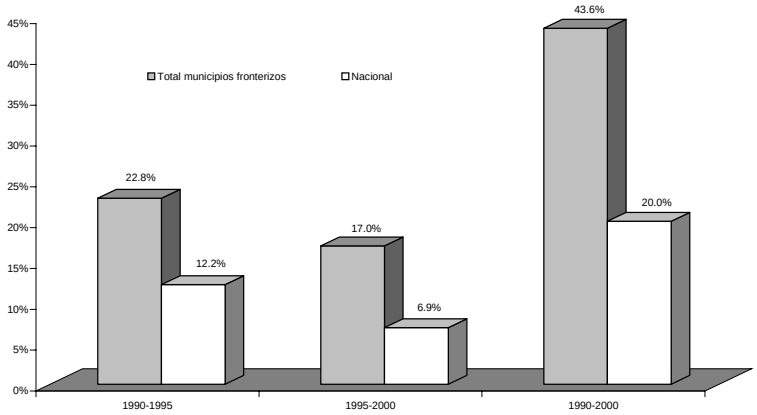

Sources: INEGI. XII Censo Económico 1999, XI Censo Económico 1994, X Censo Económico 1989.

**Figure 3. MEXICO: National and Northern Border Municipalities Manufacturing Production Real Growth Rate, 1988-1998.**



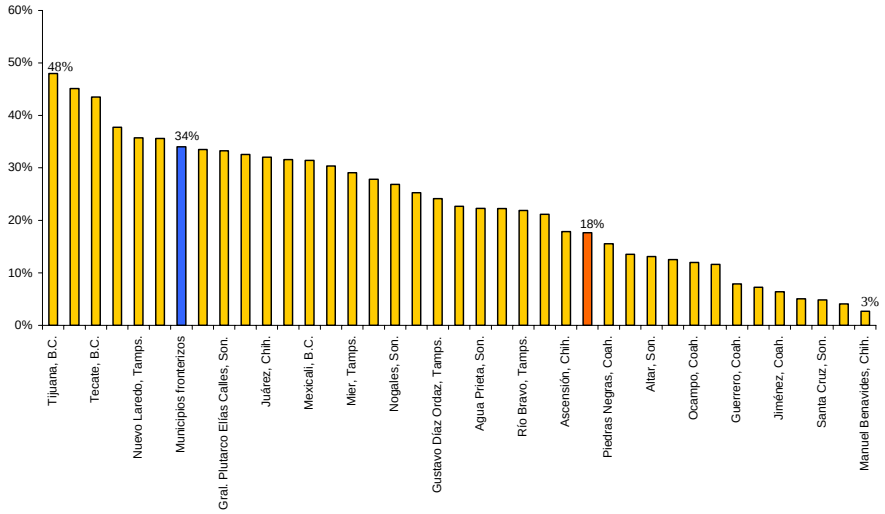

Sources: INEGI. XII Censo Económico 1999, XI Censo Económico 1994, X Censo Económico 1989.

**Figure 4. MEXICO: National and Northern Border Municipalities Population Growth Rate, 1990-2000.**




Sources: INEGI, XI Censo de Población y Vivienda, 1990. INEGI, Conteo de Población y Vivienda, 1995. INEGI, XII Censo General de Población y Vivienda, 2000.

**Figure 5. MEXICO: Northern Border Municipality Residents that Were Born in Other States, 2000. (Percentajes)**




Source: INEGI. XII Censo de Población y Vivienda 2000.

**Table 1. MEXICO: Transfers to Municipal Governments**

| Source | Integration | Type |
|---|---|---|
| Revenue-sharing transfers (*Participaciones federales*) received by State government (See footnote 2) | 20% of the amount received by states | Non-conditional |
| Municipal Fund (*Fondo de Fomento Municipal*) | 100% of the amount received by states | Non-conditional |
| *Aportaciones Federales* | The amount is determined in the Federal Budget of every year. | Conditional |
| Transit of exported or imported goods* | 0.136% of federal tax revenues | Non-conditional |
| Transit of oil exports* | 3.17% of the additional charge on oil extraction | Non-conditional |
| State Taxes | Every state decides | Non-conditional |

* These are distributed only to the coastal or border municipalities through which such good are imported or exported

**Table 2. Definitions of Variables and Sources of Information**

| Variable | Description | Source |
|---|---|---|
| $Dep_{ij}$ | Measures the degree of municipality dependence on non-conditional federal transfers. Calculated by the ratio between revenue from "participaciones federales" to municipality *i* in state *j* and its operational revenue (taxes, charges, non-conditional transfers, products, benefits and other revenue). | Own construction based on INEGI: *Finanzas Públicas Estatales y Municipales de México*: Aguascalientes, 2001. |
| $CONC_{ij}$ | Measures concentration of fiscal revenue in the municipality *i* of state *j*. Calculated as the ratio of tax revenues in municipality *i* to the total municipal tax revenues in state *j*. | Own construction based on INEGI: *Finanzas Públicas Estatales y Municipales de México*: Aguascalientes, 2001. |
| $YM_{ij}$ | Denotes the Gross Domestic Product per capita in municipality *i* of state *j*. It was estimated by weighting GDP of state *j* by the percentage that income of employed population in municipality *i* represents with respect to to the total income of employed population in state *j*. | Own construction based on INEGI: *Sistema de Cuentas Nacionales de México* en http://www.inegi.gob.mx. INEGI. *XII Censo General de Población y Vivienda 2000*: Aguascalientes, 2001. |
| $YML_{ij}$ | Denotes the Gross Domestic Product per capita in municipality *i* of state *j*. Estimated according to Sánchez Almanza (2000) and Unikel (1976), in which GDP of state *j* is multiplied by the percent employed population in municipality *i* with respect to employed population in state *j*. | Own construction based on INEGI: *Sistema de Cuentas Nacionales de México* en http://www.inegi.gob.mx. INEGI. *XII Censo General de Población y Vivienda 2000*: Aguascalientes, 2001. |
| $T_{ij}$ | Amount received in municipality i of state j by concept of transfers different from non-conditional federal transfers ("participaciones federales"), incluiding or those of the budgetary item 33. | INEGI: *Finanzas Públicas Estatales y Municipales de México*: Aguascalientes, 2001. |
| $DTMF_{ij}$ | A dummy variable to consider differences in financial dependence across border municipalities. It equals 1 if municipality *i* in state *j* is in the north border and 0 in any other case. Border municipalities in our sample are: Mexicali, Tecate and Tijuana in Baja California; Juárez in Chihuahua; Acuña and Piedras Negras in Coahuila; Auguaprieta, Caborca, Nogales, Puerto Peñasco and San Luis Río Colorado in Sonora; and Matamoros, Reynosa and Río Bravo in Tamaulipas. | Own construction. |
| $DCMF_{ij}$ | A set of dummy variables to consider difference in dependence of each border municipality. It equals 1 for each border municipality *i* in state j and 0 elsewhere. | Own construction. |
| $DE_{ij}$ | Dummy variable to control for political and institutional differences within municipalities of each state. It equals 1 if the municipality *i* belongs to state *j* and 0 elsewhere. | Own construction. |

Note: The total of observations corresponds to the 300 municipalities selected by Mexico's INEGI for the year 2000.

**Table 3. Descriptive Statistics and Correlation Coefficients**

| | *Average* | *Minimum* | *Maximum* | *Standard Deviation* | *Jarque-Bera [Probability]* |
|---|---|---|---|---|---|
| ***Dep*** | 69.36 | 25.50 | 98.73 | 16.50 | 5.90 [0.052] |
| ***CONC*** | 0.088 | 0.0003 | 0.857 | 0.148 | 1089.93 [0.00] |
| ***YML*** | 44,450 | 18,027 | 98,634 | 18,458 | 53.87 [0.00] |
| ***YM*** | 43,251 | 8,028 | 130,121 | 21,691 | 71.21 [0.00] |
| ***T*** | 52,997,074 | 2,131,506 | 3.75E+08 | 57,305,236 | 1432.67 [0.00] |

***Correlation Matrix***

| | ***Dep*** | ***CONC*** | ***YML*** | ***YM*** | ***T*** |
|---|---|---|---|---|---|
| ***Dep*** | 1 | | | | |
| ***CONC*** | -0.33 | 1 | | | |
| ***YML*** | -0.40 | 0.27 | 1 | | |
| ***YM*** | -0.57 | 0.49 | 0.87 | 1 | |
| ***T*** | -0.25 | 0.58 | 0.13 | 0.29 | 1 |

Notes: ***Dep*** measures financial dependence of municipalities; ***CONC*** represents the concentration of fiscal revenue generated in the municipality; ***YML*** is municipality GDP per capita, calculated based on employed population; ***YM*** is municipality GDP per capita, calculated based on the wage of employed population; and ***T*** measures the amount of conditional transfers, different from federal transfers. The "Jarque-Bera" statistics measure normality of the series. Its null hypothesis is of a normal distribution and its "p-value" is reported below the statistic (n = 300 observations). See Table 2 for further data description.

## Table 4. Parameter Estimates of Model Coefficients.

| | Border County | Model 1 | Model 2 | Model 3 | Restricted Model |
|---|---|---|---|---|---|
| **C** | | | | | 7.46*** |
| | | | | | (0.36) |
| **log (*YM*)** | | -0.39*** | -0.39*** | -0.38*** | -0.30*** |
| | | (0.03) | (0.03) | (0.03) | (0.03) |
| **log (*T*)** | | 0.01 | 0.01 | 0.007 | -0.007 |
| | | (0.02) | (0.02) | (0.01) | (0.02) |
| ***DCMF*$_1$** | **Mexicali** | | | 0.37* | |
| | | | | (0.20) | |
| ***DCMF*$_2$** | **Tecate** | | | 0.25 | |
| | | | | (0.20) | |
| ***DCMF*$_3$** | **Tijuana** | | | 0.40** | |
| | | | | (0.20) | |
| ***DCMF*$_4$** | **Ciudad Juárez** | | | -0.48*** | |
| | | | | (0.05) | |
| ***DCMF*$_5$** | **Acuña** | | | 0.04 | |
| | | | | (0.08) | |
| ***DCMF*$_6$** | **Piedras Negras** | | | 0.22*** | |
| | | | | (0.08) | |
| ***DCMF*$_7$** | **Agua Prieta** | | | 0.04** | |
| | | | | (0.02) | |
| ***DCMF*$_8$** | **Caborca** | | | -0.06*** | |
| | | | | (0.02) | |
| ***DCMF*$_9$** | **Nogales** | | | 0.22*** | |
| | | | | (0.02) | |
| ***DCMF*$_{10}$** | **Puerto Peñasco** | | | -0.51*** | |
| | | | | (0.03) | |
| ***DCMF*$_{11}$** | **S.L. Río Colorado** | | | 0.17*** | |
| | | | | (0.02) | |
| ***DCMF*$_{12}$** | **Matamoros** | | | 0.19* | |
| | | | | (0.11) | |
| ***DCMF*$_{13}$** | **Reynosa** | | | 0.08 | |
| | | | | (0.11) | |
| ***DCMF*$_{14}$** | **Río Bravo** | | | 0.06 | |
| | | | | (0.11) | |
| ***DTMF*** | | No | 0.04 | No | No |
| | | | (0.09) | | |
| **DE (WALD)** | | 81.82*** | 77.34*** | 77.25*** | No DE's |
| | | [0.00] | [0.00] | [0.00] | |
| **SSE** | | 8.27 | 8.25 | 7.50 | 13.48 |
| **Fcalc** | | 5.42*** | 5.26*** | 4.48*** | |
| **Adj. $R^2$** | | 0.55 | 0.55 | 0.57 | 0.34 |
| **D.W.** | | 2.11 | 2.11 | 1.98 | 1.47 |

Notes: The variables are defined in Table 2. Fcalc = $[(SSE_R - SSE_U)/J] / [SSE_U / (N-K)]$, where $SSE_U$ represents the sum of squared errors of the unrestricted model; $SSE_R$ represents the sum of squared errors of the restricted model; J are the restrictions; N is the number of observations, and K is the number of estimated parameters in the unrestricted model. The Fcalc statistic is compared with the F distribution with [J, (N-K)] degrees of freedom. We denote ***, **, and * to rejection of $H_0$ at 1%, 5% and 10%, respectively. DE (WALD) means the hypothesis test on all DE's being equal. The standard deviations are computed by the Newey-West variance-covariance matrix. The 31 estimated parameters of the state dummy variables (*DE*) for *Models 1 to 3* are not presented due to space constraints.

**Table 5. Statistics on the Degree of Financial Dependence of Border Municipalities Against No-Border Municipalities.**

| | Baja California | | | Chihuahua | Coahuila | | Sonora | | | | | Tamaulipas | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mexicali | Tecate | Tijuana | Ciudad Juárez | Acuña | Piedras Negras | Agua Prieta | Caborca | Nogales | Puerto Peñasco | San Luis Río Colorado | Matamoros | Reynosa | Río Bravo |
| Aguascalientes | -4.46 | -8.22 | -3.37 | -13.35 | -2.16 | 3.58 | -1.72 | -4.93 | 3.69 | -15.47 | 2.15 | 2.08 | -1.22 | -2.00 |
| Baja California | 1.85 | 1.29 | 1.98 | 0.00 | 2.33 | 3.25 | 2.40 | 1.88 | 3.27 | -0.39 | 3.01 | 3.00 | 2.46 | 2.40 |
| Baja California Sur | -0.13 | -1.21 | 0.13 | -3.41 | 0.71 | 2.42 | 0.83 | -0.12 | 2.46 | -4.24 | 1.98 | 1.93 | 0.96 | 0.81 |
| Campeche | -14.21 | -20.41 | -12.44 | -22.36 | -14.62 | -8.49 | -13.66 | -16.97 | -8.32 | -27.06 | -10.09 | -8.66 | -11.60 | -12.60 |
| Chihuahua | -2.26 | -4.59 | -1.57 | -9.58 | -0.32 | 3.62 | -0.05 | -2.22 | 3.71 | -10.38 | 2.64 | 2.69 | 0.31 | -0.08 |
| Chiapas | -1.04 | -2.92 | -0.47 | -7.73 | 0.65 | 3.92 | 0.86 | -0.93 | 3.98 | -7.84 | 3.13 | 3.41 | 1.30 | 0.99 |
| Coahuila | -0.69 | -2.07 | -0.31 | -5.38 | 0.48 | 2.80 | 0.63 | -0.64 | 2.85 | -5.86 | 2.21 | 2.26 | 0.88 | 0.65 |
| Colima | -1.49 | -5.71 | -0.73 | -9.33 | 0.92 | 6.59 | 1.33 | -1.98 | 6.68 | -14.87 | 5.12 | 4.32 | 1.49 | 1.22 |
| Durango | -4.02 | -7.13 | -2.50 | -16.37 | -0.24 | 6.84 | 0.22 | -3.48 | 6.91 | -14.27 | 5.23 | 6.46 | 1.11 | 0.30 |
| Guerrero | 1.79 | -0.06 | 2.20 | -3.96 | 3.41 | 6.43 | 3.63 | 1.93 | 6.47 | -5.29 | 5.69 | 5.75 | 3.91 | 3.91 |
| Guanajuato | 4.40 | 1.44 | 4.88 | -4.12 | 6.06 | 10.00 | 6.24 | 4.13 | 9.97 | -4.86 | 9.19 | 10.94 | 8.01 | 8.74 |
| Hidalgo | 1.32 | -1.55 | 1.93 | -7.27 | 3.71 | 8.34 | 3.97 | 1.41 | 8.36 | -8.52 | 7.28 | 7.80 | 4.76 | 4.94 |
| Jalisco | 3.90 | 1.40 | 4.31 | -4.10 | 6.55 | 10.97 | 6.80 | 4.36 | 10.98 | -5.93 | 9.91 | 9.79 | 7.10 | 7.44 |
| México | 2.86 | -0.27 | 3.48 | -6.68 | 4.83 | 9.30 | 5.00 | 2.62 | 9.29 | -6.84 | 8.38 | 10.30 | 6.90 | 7.39 |
| Michoacán | 3.75 | 1.61 | 4.16 | -2.74 | 5.26 | 8.44 | 5.41 | 3.69 | 8.47 | -3.71 | 7.70 | 8.17 | 6.15 | 6.11 |
| Morelia | -3.25 | -8.06 | -1.92 | -14.33 | 0.13 | 8.07 | 0.65 | -3.73 | 8.10 | -16.31 | 6.25 | 6.36 | 1.42 | 0.90 |
| Nayarit | 0.86 | -0.32 | 1.15 | -2.89 | 1.79 | 3.65 | 1.91 | 0.88 | 3.69 | -3.56 | 3.19 | 3.24 | 2.13 | 1.99 |
| Nuevo León | -2.62 | -5.39 | -1.76 | -11.83 | -0.22 | 4.92 | 0.12 | -2.49 | 5.08 | -12.08 | 3.62 | 3.42 | 0.57 | 0.09 |
| Oaxaca | 1.12 | -1.96 | 1.82 | -8.28 | 3.69 | 8.79 | 3.92 | 1.18 | 8.82 | -9.15 | 7.63 | 8.18 | 4.87 | 4.81 |
| Puebla | 1.51 | -3.00 | 2.11 | -7.93 | 6.84 | 14.49 | 7.69 | 2.76 | 14.38 | -15.46 | 12.46 | 9.54 | 5.72 | 7.20 |
| Querétaro | -2.22 | -7.60 | -1.03 | -12.97 | 1.36 | 9.46 | 1.89 | -2.85 | 9.39 | -16.51 | 7.67 | 7.61 | 2.58 | 3.19 |
| Quintana Roo | 0.03 | -1.09 | 0.32 | -3.51 | 0.93 | 2.72 | 1.05 | 0.05 | 2.76 | -4.21 | 2.27 | 2.27 | 1.22 | 1.06 |
| San Luis Potosí | -3.59 | -6.03 | -2.57 | -13.02 | -0.86 | 4.09 | -0.51 | -3.24 | 4.17 | -12.21 | 2.90 | 3.36 | -0.09 | -0.72 |
| Sinaloa | 2.59 | -0.62 | 3.19 | -7.04 | 5.01 | 9.87 | 5.25 | 2.59 | 9.82 | -7.82 | 8.85 | 10.55 | 6.88 | 8.13 |
| Sonora | -2.77 | -8.29 | -1.24 | -15.47 | 1.61 | 11.68 | 2.11 | -3.21 | 11.55 | -16.89 | 9.64 | 10.11 | 3.37 | 4.20 |
| Tabasco | -4.12 | -6.79 | -3.15 | -12.27 | -1.74 | 2.89 | -1.41 | -4.13 | 2.96 | -12.90 | 1.76 | 2.02 | -1.14 | -2.19 |
| Tamaulipas | -0.35 | -1.46 | -0.09 | -3.57 | 0.48 | 2.18 | 0.60 | -0.35 | 2.22 | -4.54 | 1.75 | 1.71 | 0.74 | 0.60 |
| Tlaxcala | -3.84 | -9.02 | -2.82 | -11.69 | -1.98 | 3.90 | -1.62 | -5.33 | 3.96 | -17.53 | 2.47 | 2.30 | -0.89 | -2.10 |
| Veracruz | -4.60 | -7.23 | -3.30 | -15.19 | -1.37 | 4.45 | -0.92 | -4.12 | 4.53 | -13.77 | 3.06 | 3.67 | -0.55 | -1.42 |
| Yucatán | -4.94 | -8.36 | -3.39 | -16.88 | -1.36 | 6.04 | -0.80 | -4.61 | 6.17 | -15.64 | 4.28 | 4.60 | -0.23 | -1.07 |
| Zacatecas | 1.77 | -0.79 | 2.30 | -5.94 | 3.83 | 7.80 | 4.10 | 1.87 | 7.79 | -7.16 | 6.90 | 7.62 | 4.90 | 5.38 |

Note: The statistic tests the null $\delta_i + \beta_k = \beta_j$ against the alternative $\delta_i + \beta_k < \beta_j$ for border municipality i in border state k. It is calculated by $t = \frac{\hat{\delta}_i + \hat{\beta}_k - \hat{\beta}_j}{\sqrt{\text{var}(\hat{\delta}_i + \hat{\beta}_k - \hat{\beta}_j)}}$.