

# Subnational Bond Market Development: What Drives the Yield Spreads of Mexican *Cebures*?<sup>1</sup>

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A robust market for subnational bonds can provide emerging economies with additional tools to accelerate their economic growth. This article seeks to trigger a reflection on the factors that emerging nations such as Mexico would need to take into account if the aim is to issue bond instruments that are attractive to investors. This study assesses the factors affecting the yield spread of a sample of Mexican bonds known as *Cebures*. The analysis shows that only variables associated with the structure of the bond affect such yield spreads, not factors reflecting the financial strength of the issuing entity. Government policies aimed at modifying the implicit risk of this type of bonds may not be sufficient to alter bond buyer's risk perceptions.

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Un mercado de bonos subnacionales robusto puede dar a las economías emergentes herramientas adicionales para acelerar su desarrollo económico. Este artículo busca iniciar una reflexión sobre los factores que naciones emergentes como México deberían tomar en cuenta si el objetivo es emitir instrumentos de deuda atractivos a los inversionistas. El estudio evalúa los factores que afectan la dispersión del rendimiento de una muestra de bonos Mexicanos conocidos como *Cebures*. El análisis muestra que las variables que afectan la dispersión del rendimiento están asociadas con la estructura del bono y no con factores que reflejan la fortaleza financiera de la entidad emisora. Las políticas gubernamentales que busquen modificar el riesgo implícito en este tipo de bonos pueden no ser suficientes para alterar las percepciones de riesgo de los inversionistas.

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**Key words:** government finance, subnational bond markets, subnational debt, yield spreads, Mexico

## Introduction

In spite of Europe's bond market perils and the financial turmoil that it has created across the globe, bond markets still constitute a feasible way to secure the financial means to stimulate economic growth. The use of debt financing mechanisms has been growing in importance, especially among governments that consider capital markets as a potential source of resources to fund public investments or as a means to compensate declining tax revenues. Brazil and India are two examples. In Brazil, subnational debt already accounts for approximately 30% of the net debt of the public sector, while in India the debt of the states is approximately 27% of gross domestic product (Canuto & Liu, 2010).

This article seeks to initiate a discussion on the type of measures that subnational governments (SNGs) in Latin American economies could take into account if the aim is to issue bond instruments that are attractive to investors. The goal of the analysis is twofold. On the one hand, it seeks to identify the factors that contribute to shaping the yield spread of a bond. This is a key variable that bond investors monitor often and that reflects the premium that market participants demand to compensate the risk of investing in a particular bond instrument. The intention is to discuss if government intervention through public policy can be an effective tool to modify the risk perceptions of bond market participants. The topic of this article can be inserted into the broader discussion on how to develop subnational bond markets in emerging economies.

Experts such as Leigland (1997) consider that using the U.S. municipal bond market as a guideline in such endeavors is recommended, as this market is robust and well developed. He explains that a proper evaluation of the policy measures to accelerate subnational bond market development can be organized into two groups of factors: demand side and supply side. On the demand side, he includes market elements that may contribute to promote investors' familiarity and confidence, a strong credit quality, or market conditions that tend to facilitate the ability of those investors to trade securities freely. In terms of the supply side, the author mentions measures aimed at creating conditions that contribute to attaining tolerable borrowing costs, mechanisms to facilitate long-term debt amortization, or assistance mechanisms for small borrowers. The topic to be addressed in this article can be placed within the supply-side group of factors.

The study consists of a systematic evaluation of the determinants of the yield spread of a particular type of bond instrument that some Mexican state governments have been issuing. Such bonds, which are known as *Certificados Bursátiles*, or *Cebures*, are certificates that private and public entities issue and trade on Mexico's Stock Exchange.<sup>2</sup> Identifying the factors influencing the risk premiums (i.e., the yield spread) of this type of financial instruments is a necessary precondition to determine what policy measures could contribute to increase their attractiveness to investors and to reduce the cost of borrowing that issuers must cover. Identifying the factors that influence the risk premium of a bond will equip policymakers with additional elements to define the mix of desirable public policies to increase the attractiveness of SNG bonds and promote the development of the overall market. The research questions guiding the study are as follows.

1. Which factors contribute to shape the yield spread of Mexican *Cebures*?
2. How do the identified factors compare to the determinants of U.S. municipal bonds?
3. Can government policy manipulate these explanatory variables?

The following section overviews the relevant literature. Section 3 explains the methodology for the study, introduces the model to be estimated, and gives the data sources. The results of the estimation and a discussion the implications appear in Section 4. Section 5 concludes and identifies the areas for further exploration.

## Background Literature

The topic of this article can be included in the broader discussion of subnational bond market development. The issue has gained relevance over the last decade given the interest in diversifying the menu of revenue tools available to regional and local governments (Liu, 2010; Liu & Waibel, 2010; Platz, 2009) and also as a result of the decentralization of tax and expenditure responsibilities that is taking place in many countries. Those who consider that reallocation of responsibilities that decentralization implies can create situations of financial instability by softening the budget constraint that state and local governments face under centralized fiscal arrangements view it with concern (see Rodden, Eskeland, & Litvack, 2003). Situations of this type have resulted not only in policy proposals suggesting the crafting of legal frameworks to make SNG finances sustainable over the long run (Canuto & Liu, 2010; Sutherland, Price, & Joumard, 2005) but also in proposals to minimize the probability of a bailout (Hernández-Trillo & Smith-Ramírez, 2009).

Creating sound market-based bond markets is a multistage process that should take into account the legal, institutional, and political constraints that exist in each country. It is then of utmost importance to understand the specific conditions that exist in each of the bond markets that one wants to develop. The European experiences with financial market integration offer a good departure point to visualize the types of measures that need to be adopted to develop robust multijurisdictional government bond markets (Claes, De Ceuster, & Polfliet, 2002; DeGrauwe & Moesen, 2009; Melnik & Nissim, 2006). There are many empirical contributions using the European Union as a case study, and they are evolving. This applies also to the literature that analyzes bond markets (Booth, Georgopoulos, & Hejazi, 2007; Favero & Missale, 2012; Min, 1998; Wang, Wu, & Zhang, 2008). This line of research has paid close attention to factors that may contribute to narrowing the current yield spread differentials among government issued bonds.<sup>3</sup> Bond yield convergence is considered a necessary condition to create competitive Eurobond instruments.

Codogno, Favero, and Missale (2003, p. 506) offer an interesting work in this regard when analyzing the effect of macroeconomic fiscal fundamentals and international risk factors on yield spreads. They find that between 1999 and 2002, local and international risk factors affected yield differentials in government bonds issued in the eurozone but that their effect differed across European Union member countries. An interesting conclusion of their analysis states that:

To the extent that yield spreads depend on differences in liquidity of government bonds, they merely reflect the relative effectiveness of debt management policies in improving liquidity and differences in market microstructures. If yield differentials can be explained by the size of the overall debt issued by a specific member state, again only structural convergence could lead them to disappear. If instead yield differentials reflect specific features of primary markets where bonds are issued, such as the auction mechanism or the issuance calendar, as well as the degree of primary and secondary market efficiency, there is scope for policy action to narrow differentials further, and appropriate cost-minimizing debt management can lead to full convergence of yields.

Gómez-Puig (2008) also analyzes yield differentials among European sovereign borrowers and finds that, prior to the introduction of the Euro, spreads were

mostly determined by expectations of exchange rate fluctuations, differences in domestic tax regimes, differences in credit risk, and differences in market liquidity. More recently, von Hagen, Schuknecht, and Wolswijk (2011) have used standard portfolio theory to assess the effect of the probability of a government's default on its debt, liquidity premium, and the investor's risk premium on the yield spread of European and U.S. bonds prior to and following the financial crisis that occurred around 2008. The authors find that these determinants did not change prior to and following the crisis, but markets penalized fiscal imbalances most strongly after the 2008 Lehman Brothers default.<sup>4</sup> Studies of this type invite one to think about the extent to which similar variables contribute to shape the relevant risk and return measures of sub-sovereign bonds in emerging economies.

The debate about capital market integration taking place in the European context highlights the role of government intervention as a tool to promote bond yield convergence. This has been an important goal in Europe's plan to integrate capital markets because it facilitates the creation of more homogeneous securities that can be offered to a much larger potential market (Pagano & von Thadden, 2004), but to what extent is government intervention useful in promoting convergence? As Zigman and Cota (2011) explain, identifying the influence of fiscal and nonfiscal factors on movements in spreads can be of great importance for the conduct of fiscal policy. Fiscal policy, as they correctly point out, can help reduce the costs of government borrowing, reduce risks, induce a better organization of public debt instruments, and underpin economic growth.

Countries seeking to develop government bond markets need to take this salient issue into account. Should one expect governmental intervention to be effective in developing subnational bond markets in emerging economies? Will fiscal (or monetary) policies be effective in shaping the risk premium that the market currently demands of SNG bonds? These questions are usually addressed by using the bond markets of developed countries as case studies. Finding out whether similar results are to be obtained in emerging economies constitutes an important research topic that has been insufficiently explored.

This article seeks to contribute to the discussion by identifying the variables that shape yield spreads in the Mexican bond market and by comparing the obtained results with the U.S. municipal bond market. The following section explains the methodology for the study.

### Research Design

The study uses regression analysis to identify the determinants of yield spreads in a sample of Mexican and U.S. subnational bonds. The baseline model for the assessment is derived not only by applying elements of arbitrage price theory<sup>5</sup> and standard portfolio theory<sup>6</sup> but also by using the existing empirical literature as a reference. The explanatory variables of interest are grouped into the following categories: the equity market risk premium, the features of the bond instruments, the local financial environment of in the issuing entity, and the pertinent control variables. The model to be estimated is as follows:

$$YS_i^b = [Y_i^b - Y_i^f] = \alpha + \beta_1 [R_i^m - R_i^f] + \delta_1 BF_{i,t} + \delta_2 LE_{i,t} + controls + \epsilon$$

where:

$YS_t^b$  = Yield spread of bond "b" at time "t"

$[Y_t^b - Y_t^f]$  = Difference between the yield of bond "b" and the yield of a risk-free bond "f" at time "t"

$[R_t^m - R_t^f]$  = Difference between the market rate of return and the return offered by the risk free bond at time "t"

$Bf_{i,t}$  = Vector of features of the bond instrument issued by entity "i" at time "t"

$LE_{i,t}$  = Vector of prevailing local financial environment in the issuing entity "i" at time "t"

$\varepsilon$  = Error term

$\alpha, \beta_1, \delta_1, \delta_2$  = Regression parameters

The sample of Mexican subnational bonds consists of a particular type of securities known as *Certificados Bursátiles* or *Cebures*. These are publicly traded peso-denominated notes that issuers use as an alternative to commercial bank lending, or to the more traditional forms of financing (i.e., tax revenues and federal transfers). One of the features of such bonds is that issuers are required by law to set up private trusts (*fideicomisos irrevocables*) and to deposit the financial resources to guarantee bond repayments there. Trusts like these are examples of a special purpose vehicle where a sponsor transfers assets into an account to carry out a specific activity (Gorton & Souleles, 2007).

A dataset containing the necessary data to compute the equation depicted above was assembled with information from various sources. The data for Mexico were obtained from the National Banking and Securities Commission (Comisión Nacional Bancaria y de Valores, 2012), from information on initial public offerings reported by the Mexican Stock Exchange (Bolsa Mexicana de Valores, 2012), from the Bank of Mexico (Banco de México, 2012) and from the National Institute of Statistics and Geography (Instituto Nacional de Estadística y Geografía, 2012). Because the subnational bond market in Mexico is just starting to evolve, only a handful of states have opted for the issuance of *Cebures*. This fact limited the number of bond instruments available for analysis (state governments have issued only 43 bonds of this kind between 2001 and 2010). Table 1 provides information about these bonds.

The U.S. municipal bond market was used as a benchmark to evaluate the regression results for Mexico. In this case, the data were retrieved from the U.S. Municipal Securities Rulemaking Board (2012b), from the U.S. Bureau of Economic Analysis (2012) and from the Federal Reserve Bank of St. Louis (2012). The sample for the United States included 16,976 municipal bonds of various types (certificates of participation, General Obligation [GO] limited and unlimited bonds, GO unlimited notes, revenue bonds, special obligation bonds, and special tax bonds).

The calculation of the bond yield spread was done using the standard yield-to-maturity formula, as well as data on 28-day Mexican Treasury certificates (CETES) and the 3-month U.S. Treasury Bill (T-bills). The results were reported in basis points (bps).<sup>7</sup> The particularities of the Mexican subnational bond market required the formulation of some assumptions. First, that the buyers of a *Cebure* would hold the instrument upon maturity. Second, that the bonds were

**Table 1. Cebures Issued by State Governments in Mexico (2001–2010)**

State	Issuance year	Code	Amount	Maturity	Yield to maturity	Yield spread
			In millions of pesos <sup>a</sup>	In years	en %	In basis points (bps)
1 Chiapas	2007	CHIACB07	800	30	10.77	749.65
2 Chiapas	2007	CHIACB 07U	4,232.5 <sup>b</sup>	30	5.67	240.49
3 Chihuahua	2002	CHIHCB 02U	1,400	10	2.39	70.36
4 Chihuahua	2002	CHIHCB 02-2U	1,100	10	2.39	70.36
5 Chihuahua	2004	CHIHCB 04	1,000	10	3.23	36.65
6 Chihuahua	2004	CHIHCB 04-2	750	10	3.23	176.65
7 Chihuahua	2005	CHIHUCB05	1,220	10	8.96	341.24
8 Chihuahua	2006	CHIHCB 06	1,600	8	2.94	33.00
9 Chihuahua	2009	CHIHCB 09	4,200	13	3.90	316.43
10 Chihuahua	2009	CHIHCB 09-2	1,300	13	3.90	316.43
11 Hidalgo	2003	EDOHGO 03	700	7	8.75	649.48
12 Hidalgo	2003	EDOHGO 03-2	500	7	8.75	649.48
13 Hidalgo	2007	IFHGO07	2,450	12	9.48	620.84
14 Edo.Mex	2002	EDMEXCB 02	334.4	5	10.43	874.00
15 Edo.Mex	2002	EDMEXCB 02-2	185.6	5	10.43	874.00
16 Edo.Mex	2002	EDMEXCB 02-3	245.3	5	10.43	874.00
17 Edo.Mex	2002	EDMEXCB 02-4	619.4	5	10.43	874.00
18 Edo.Mex	2003	EDMEXCB 03	330.5	5	9.91	764.90
19 Edo.Mex	2003	EDMEXCB 03-2	284.8	5	9.91	764.90
20 Michoacan	2007	MICHCB07U	13,468.27 <sup>b</sup>	30	5.89	262.36
21 Nuevo Leon	2003	EDONL 03	978	12	9.53	727.46
22 Nuevo Leon	2003	EDONL 03-2	738	12	8.96	670.28
23 Nuevo Leon	2004	MYCTA 04U	2,250	25	1.82	35.73
24 Nuevo Leon	2006	ICVCB 06U	2,676.1	30	1.96	-64.81
25 Nuevo Leon	2006	EDONL 06	2,413	18	9.34	672.74
26 Oaxaca	2007	OAXCB07U	10,774.61 <sup>b</sup>	29.5	6.32	304.89
27 Puebla	2004	ATLIXCB 04U	520	15	2.04	58.05
28 Sinaloa	2004	EDOSIN 04U	830.7	10	1.71	24.57
29 Veracruz	2003	EDVERCB 03	450	1	10.18	791.93
30 Veracruz	2006	VRZCB06U	5,112.25 <sup>b</sup>	29.5	1.69	-92.12
31 Veracruz	2006	VRZCB06	1,107	29.5	11.14	852.67
32 Veracruz	2008	VRZCB 08	212.5	27.5	19.09	1,988.50
33 Veracruz	2008	VRZCB 08U	995.5	27.5	2.40	318.93
34 Distrito Federal	2003	GDFCB 03	2,500	6	7.97	571.50
35 Distrito Federal	2004	GDFCB 04	1,190	5	8.59	712.58
36 Distrito Federal	2004	GDFCB 04-2	500	5	8.19	673.21
37 Distrito Federal	2005	GDFCB05	800	10	11.29	574.06
38 Distrito Federal	2006	GDFCB 06	1,400	9.3	9.17	656.28
39 Distrito Federal	2007	GDFCB07	575	20	10.51	724.13
40 Distrito Federal	2007	GDFCB07-2	2,425	9.3	9.25	597.75
41 Distrito Federal	2009	GDFCB 09	1,000	5	8.60	786.29
42 Distrito Federal	2010	GDFCB 10	1,431.1	5	7.10	862.81
43 Distrito Federal	2010	GDFCB 10-2	2,521	10	11.10	1,263.40

Sources: Own calculations with data from the Mexican Stock Exchange (Bolsa Mexicana de Valores, 2012), National Banking and Securities Commission (Comisión Nacional Bancaria y de Valores, 2012), Bank of Mexico (Banco de México, 2012), and the National Institute of Statistics and Geography (Instituto Nacional de Estadística y Geografía, 2012).

<sup>a</sup>Exchange rate (as of April 2013): U.S.\$1 = 12.30 Mexican Pesos approximately.

<sup>b</sup>The bond was issued in a currency called "UDI" (Unidades de Inversion). The number appearing here is its equivalent in Mexican pesos.

purchased at their face value (this is assumed because there is practically no secondary market for such debt instruments).<sup>8</sup> Descriptive statistics for the variables considered in the regressions are depicted in Table 2a (United States) and Table 2b (Mexico).

### Findings and Discussion

The analysis of the bond yield spread determinants for both countries was conducted using ordinary least squares with robust standard errors.<sup>9</sup> The results of the regressions are shown in Table 3.

The regression for the U.S. case (i.e., the benchmark) was estimated first. As the results reported in Table 3 reveal, variables from the four categories mentioned have a statistically significant effect on the yield spread of municipal bonds (equity market risk premium, bond features, and local financial environment). As expected, the features of the different types of municipal bonds that are issued in this country have an effect on the dependent variable, but the effect of the face value and the amount of a bond on the yield spread is inimical. The coupon associated with a particular bond and its maturity term have a more considerable effect. For every 1% increase in the coupon of a bond, one would expect to observe an increase of approximately 51 bps in the yields spread. If the maturity term of a bond were shortened by a year, one would expect to observe a reduction in the yield spread of approximately 3 bps.

The local financial environment that prevails in the entity that issues a municipal bond is also expected to have an effect on the dependent variable. The bond market places significant importance on the fiscal condition of the issuer, particularly the status of its revenues and expenditures with respect to gross state product (GSP). Holding all else constant, a revenue increase of 1% with respect to GSP will be reflected in a reduction of more than 3000 bps, on average. On the other hand, the market is expected to penalize bond issuers if the expenditure–GSP ratio deteriorates, as a 1% increase in expenditures with respect to GSP would result in an increase of almost 4000 bps in the yield spread.

Finally, three of the control variables included in the regression, which allow us to conclude that the type of bond issued matters in terms of the risk premium to be paid, is statistically relevant. Entities considering the issuance of special tax bonds<sup>10</sup> would expect this to reduce the yield spread by 91 bps (i.e., almost a percentage point reduction in the spread with regard to the 3-month T-bill), a certificate of participation<sup>11</sup> would reduce the dependent variable by 22 bps and the issuance of a GO unlimited bond<sup>12</sup> by 14 bps.

Table 3 also shows the results of two regression models that use data on Mexican *Cebures*. Model 1 includes the 43 observations comprising the sample of subnational bonds, whereas model 2 excludes the bonds issued by the Federal District from the estimation. This distinction was considered necessary because Mexico's constitutional arrangement gives the Federal District a legal status that is different from that of the rest of the states.<sup>13</sup> Such a distinction does not alter the obtained regression coefficients significantly. Notice that, contrary to what occurs in the United States, only a handful of variables have a statistically significant effect on the yield spread of the bonds under scrutiny. As the  $R^2$  coefficient shows, three variables explain 84% of the variation in the dependent variable

**Table (2a). Descriptive Statistics: United States**

Variable	Mean	Standard deviation	Minimum	Maximum
United States				
Bond yield spread (in basis points)	204.86	171.65	-372.85	703.84
Equity market risk premium (in %)	2.26	19.58	-43.72	52.69
Bond coupon (in %)	4.54	0.78	0.2	8.0
Bond maturity (in years)	12.73	6.05	0.25	50.0
Bond amount (in thousands of constant U.S.\$, base 2002)	5,840.72	12,006.84	0.82	98,360.91
Bond face value (in constant U.S.\$, base 2002)	4,513.48	3213.26	412.50	101,581.00
State liabilities as % of GSP (in %)	11.84	5.50	0.01	43.42
State assets as % of GSP (in %)	17.20	14.32	0.02	368.15
State revenues as % of GSP (in %)	0.07	0.02	0.00005	0.19
State expenses as % of GSP (in %)	0.07	0.02	0.00005	0.23
Bond type: certificate of participation	—	—	0	1
Bond type: GO limited bonds	—	—	0	1
Bond type: GO unlimited bonds	—	—	0	1
Bond type: GO unlimited notes	—	—	0	1
Bond type: revenue bonds	—	—	0	1
Bond type: special obligation	—	—	0	1
Bond type: special tax	—	—	0	1

Source: Own calculations with data from the U.S. Bureau of Economic Analysis (2012), U.S. Municipal Securities Rulemaking Board (2012b), and the Federal Reserve Bank of St. Louis (2012).

**Table (2b). Descriptive Statistics: Mexico**

Variable	Mean	Standard deviation	Minimum	Maximum
Mexico				
Yield spread (in basis points)	537.28	407.96	-259.31	1,988.50
Risk free rate of return (28-day CETES, in %)	2.02	1.44	-1.53	5.55
Equity market risk premium (in %)	18.06	21.84	-16.79	42.33
Bond face value (in constant Mexican pesos, base 2002)	129.73	89.26	71.14	315.00
Bond amount (millions of constant Mexican pesos, base 2002)	1,573.37	2,103.00	163.48	11,083.34
Bond maturity (in years)	13.51	9.30	1.00	30.00
Bond coupon (in %)	7.41	2.54	2.50	14.69
Gross state product (GSP) per capita in constant terms (in constant Mexican pesos, base 2002)	90.62	50.87	35.62	175.65
Total debt as % of revenue sharing transfers	5.20	3.92	0.00	13.96

Sources: Own calculations with data from the Mexican Stock Exchange (Bolsa Mexicana de Valores, 2012), National Banking and Securities Commission (Comisión Nacional Bancaria y de Valores, 2012), Bank of Mexico (Banco de México, 2012), and the National Institute of Statistics and Geography (Instituto Nacional de Estadística y Geografía, 2012).

Note: The data in this table do include the Federal District.



Table 3. Regression Results

Factors	Regression coefficients		
	United States	Mexico	
	Benchmark model n = 16,976	Model 1 (including the federal district) n = 43	Model 2 (excluding the federal district) n = 33
Variables			
Constant	-7.66 (17.24)	124.36 (129.07)	40.72 (120.06)
Equity market risk premium	3.10*** (0.05)	-2.87 (1.48)	-1.97 (1.06)
Bond features	-0.01*** (0.003)	-2.322*** (0.29)	-2.27*** (0.29)
Bond amount	0.0007*** (0.0001)	-0.03* (0.01)	-0.02* (0.01)
Coupon	51.35*** (1.50)	103.59*** (19.53)	115.30*** (16.70)
Maturity	-3.03*** (0.25)	0.02 (3.20)	2.13 (3.26)
Local financial environment			
GSP per capita	0.03*** (0.002)	0.83 (0.66)	0.25 (0.46)
Liabilities as % of GSP	-1.64*** (0.24)		
Assets as % of GSP	-1.66*** (0.20)		
Revenue as % of GSP	-3821.16*** (240.53)		
Expenditures as % of GSP	3995.74*** (230.48)		
Total debt as % of revenue sharing transfers		-6.86 (9.81)	-11.53 (8.32)
Control variables			
Special tax	-91.50*** (9.94)		
Revenue bond	0.61 (6.97)		
GO unlimited bond	-14.0* (6.35)		
GO limited bond	-11.37 (8.12)		
Certificate of participation	-22.54** (7.48)		
Model properties	0.25	0.84	0.92
R <sup>2</sup>			

Sources: Own calculations with data from the Mexican Stock Exchange (Bolsa Mexicana de Valores, 2012), National Banking and Securities Commission (Comisión Nacional Bancaria y de Valores, 2012), Bank of Mexico (Banco de México, 2012), the National Institute of Statistics and Geography (Instituto Nacional de Estadística y Geografía, 2012), the U.S. Bureau of Economic Analysis (2012), U.S. Municipal Securities Rulemaking Board (2012b), and the Federal Reserve Bank of St. Louis (2012). Numbers in parenthesis indicate robust standard errors.

\*p < .05; \*\*p < .01; \*\*\*p < .001.

when all the sampled bonds are considered, and 92% of the variation when the Federal District is not taken into account. These three variables reflect the inherent features of the issued bonds. Just as occurs in the United States, the total amount of the bond is almost null (one would expect a 1 million Mexican peso increase in the bond amount to reduce the spread by 0.02 bps).<sup>14</sup> The face value also does not have a considerable effect. Increasing the face value by 1 Mexican peso would be associated with an expected reduction in the spread of 2.27 bps, holding all else constant. The coupon is the only explanatory variable that has a somewhat significant effect on the yield spread of a *Cebure*; a percentage point increase in the bond coupon would be associated with an increase in the spread of approximately 115 bps.

Several points can be inferred from the above results. As Mexican bond market analysts Lira and Thierry (2005) explain, legislative changes that have been introduced since the early 2000s have encouraged the growth of structured finance transactions. For some state and local governments, *Cebures* have turned into a useful instrument for debt securitization. One of the enacted measures to augment investor confidence in these instruments has been the requirement to set up private trusts. These are legal vehicles where entities seeking to issue *Cebures* deposit the financial resources to secure bond repayment. At first glance, the results of the regression seem to suggest that the trust has been effective, to the extent that market participants no longer consider the financial environment of the issuing entity as a significant risk factor. The variables reflecting the states' financial environment have no statistically significant effect on the yield spreads. The variables explaining the largest share of the variation in the expected value of yield spreads are the face value, the coupon, and the total amount issued. These variables account for 84% of the variation in Model 1 and 92% in Model 2, as the  $R^2$  illustrates. The market sets risk premium values by taking into account the particular features of the financial instrument that is issued, and not the credit quality of the issuer. At least in the case of *Cebures*, the behavior of the Mexican market is not consistent with what occurs in the benchmark. In the U.S. municipal bond market, investors pay close attention to local financial conditions. As inferred from the benchmark model in Table 3, bond buyers demand higher risk premiums when expenditures (as percentage of GSP) increase but reward them when revenues (as percentage of GSP) go up.

What may explain the counterintuitive result in Mexico's market for *Cebures*? In principle, two potential explanations are feasible. First, the answer could stem from the incentives that the existing legal framework induces, as bond buyers may consider a well-structured trust agreement as sufficient to protect their investment against the possibility of a default. Using private trusts as vehicles to guarantee repayment seems to be working adequately in separating the credit quality of the bond instrument from the credit quality of the issuer.

The second explanation may have to do with the revenue source that state governments pledge to the trust when issuing *Cebures*. SNG finances in Mexico rely heavily on a type of federal transfer known as *participaciones federales* (in English, they are commonly known as revenue sharing transfers). These are tax resources collected by the federal government, incorporated into the annual

federal budget, and distributed among states and municipalities according to preestablished allocation formulas (see Espinosa, 2011). There are no conditions attached to the delivery of such funds, so recipients usually consider them as a stable source of future revenues. The tendency in Mexico has been to commit a growing portion of this type of transfers as guarantee for repayment. This is a situation that bond buyers may perceive as positive for two reasons. On the one hand, it is unlikely that revenue sharing transfers to states will decrease over time.<sup>15</sup> On the other hand, the trust agreement signed by a state may grant the federal government explicit authorization to deduct any unpaid portion of the debt from future revenue sharing amounts.

To what extent can governments use public policy to induce changes in the dependent variable under scrutiny (i.e., the yield spread of *Cebures*)? Based on the results of the regression, one concludes that any attempt to intervene in the bond market by manipulating the relevant explanatory variables will be fruitless, or will give meager results. The results of the regression analysis for Mexico listed in Table 3 show that, although state governments can define the terms of the bond to be issued (i.e., its coupon, face value, and amount), the effect on the expected value of the yield spread will not be substantial. A more effective way to influence the spread in bond markets in a nascent stage of development (as they are in Mexico) would be through federal policy. As Zigman and Cota (2011) point out, a trustworthy fiscal policy can contribute to reduce risks, produce a better organization of public debt instruments and, in general, underpin economic growth. They suggest that a credible fiscal policy should be pursued so as to reduce the cost of government borrowing to the smallest possible measure. The specific contribution that fiscal policy may have for the development of Mexico's SNG bond market remains a topic for further research.

### Conclusion

This article is based on regression analysis to identify the variables that affect the yield spread in a sample of Mexican subnational bonds known as *Cebures*. When comparing the obtained results with a large sample of U.S. municipal bonds, one observes that most of the variation in the yield spread of *Cebures* is explained by three variables associated with the particularities of the issued bond. Contrary to what occurs with U.S. municipal bonds, variables reflecting the financial condition of the issuer are not statistically significant. Investors in Mexican *Cebures* appear to be separating the risk associated with each bond and the risk associated with the issuer in purchasing decisions. This article explains that the situation may follow from the legal requirement for issuers to deposit the future flow of resources to secure bond repayment in private trusts. In terms of the possibility to use government policy to try to influence yield spreads, one concludes that in the case of Mexico that is not an option. If government authorities want to further the development of subnational bond markets, it will be necessary to devise alternative policy measures to reduce bond yield spreads. Reducing such spreads remains a necessary condition to make subnational bonds attractive to investors.

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## Notes

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<sup>2</sup>The *Cebures* are a type of fiduciary stock exchange certificates (*certificados bursátiles fiduciarios*) that are regulated under Mexico's Stock Exchange Act (see *Ley del Mercado de Valores*, 2005, arts. 61–69).

<sup>3</sup>The literature on the determinants of yield spreads is extensive and will not be discussed in detail in here. Readers interested in the European case can review Favero, Giavazzi, and Spaventa, (1997) and Favero, Pagano, and von Thadden (2010). The most recent discussion on the prospects of a Eurobond can be read in Favero and Missale (2012).

<sup>4</sup>See Fernández and Aguirreamalloa (2012).

<sup>5</sup>Arbitrage price theories establish that, in the absence of arbitrage, the risk premium of a financial asset is a linear combination of the relevant market, plus the sum of valuations associated with other market factors. As Gilles and LeRoy (1991) explain, APT relates the expected rates of return on a sequence of primitive securities to their factor exposures, suggesting that factor risk is of critical importance in asset pricing (see Gilles & LeRoy, 1991; Ross, 1976).

<sup>6</sup>See Markowitz (1991).

<sup>7</sup>1 basis point equals 1/100th of 1%, so 100 basis points equal 1%.

<sup>8</sup>The standard formula to calculate the yield to maturity is:

$$C + \frac{\left(\frac{F - P}{n}\right)}{\frac{F + P}{2}}$$

Where  $C$  = coupon,  $F$  = face value,  $P$  = market price for the bond, and  $n$  = years to maturity. What this assumption entails is that the yield-to-maturity for the bonds will result from dividing the coupon by the face value.

<sup>9</sup>Robust standard errors were used because the Breusch–Pagan/Cook–Weisberg test showed the presence of heteroskedasticity in the baseline models for Mexico and the United States.

<sup>10</sup>Defined as “a bond secured by one or more designated taxes other than ad valorem taxes. For example, bonds for a particular purpose might be supported by sales, cigarette, fuel or business license taxes, but the designated tax does not have to be directly related to the project purpose” (see U.S. Municipal Securities Rulemaking Board, 2012a).

<sup>11</sup>Defined as “an instrument evidencing a pro rata share in a specific pledged revenue stream, usually lease payments by the issuer that are subject to annual appropriation. The certificate generally entitles the holder to receive a share, or participation, in the lease payments from a particular project. The lease payments are passed through the lessor to the certificate holders. The lessor typically assigns the lease and lease payments to a trustee, which then distributes the lease payments to the certificate holders” (see U.S. Municipal Securities Rulemaking Board, 2012a).

<sup>12</sup>GO bonds are defined as “a bond that is secured by the full faith, credit, and taxing power of an issuer.” GO bonds issued by local units of government are typically secured by a pledge of the issuer's ad valorem taxing power; GO bonds issued by states are generally based on appropriations made by the state legislature for the purposes specified (see U.S. Municipal Securities Rulemaking Board, 2012a).

<sup>13</sup>This is particularly evident in the case of its debt obligations and debt management mechanisms. Because the constitution establishes that Mexico is not technically a sovereign state, any outstanding debt is fully guaranteed by the federal government.

<sup>14</sup>The exchange rate as of August 2012 was 13.50 Mexican pesos for U.S.\$1.

<sup>15</sup>Between 1990 and 2006, revenue sharing transfers in Mexico increased by an average of 4.8% per year in constant terms (the only year where they decreased was 1995). See SHCP (2007).

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