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The Information Content and Redistribution Effects of State and Municipal Rating Changes in Mexico

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Abstract

The fiscal and financial reforms carried out in Mexico in 2000 have encouraged a widespread presence of rating agencies and have allowed several States and Municipalities to raise funds through bond offerings in the capital market. Any local government in Mexico intending to access credit and capital markets must count with at least one credit rating from one of the three main agencies: FitchRatings, Moody's and Standard & Poor's. This paper investigates the impact of rating changes to State and Municipal governments on bond returns in Mexico. By employing a Capital Asset Pricing Model (CAPM) structure for the mean equation that allows conditional volatility, we find strong support for the Information Content Signaling Hypothesis (ICSH), i.e., rating upgrades (downgrades) are followed by greater (lower) bond returns. We also find some support for the Wealth Redistribution Hypothesis (WRH) indicating that rating upgrades (downgrades) are followed by lower (greater) bond returns. In addition to this, we find high volatility persistence, significant asymmetric responses of volatility to bad and good news, a negative association between market volatility and the level of bond returns and significant effects of volatility in response to rating changes. Finally, the estimations show the market anticipates and responds to rating changes within five-day momentum windows. There is a comparatively stronger reaction of returns on the event day favoring the hypothesis of market inefficiency.

JEL: C22, G14, G20, H74, H77

Keywords: Credit rating changes; municipal bond returns; CAPM; EGARCH-in-Mean

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1 Introduction

In an emerging country like Mexico where information on local government public finances is generally less reliable, less timely and less comparable cross-sectionally, credit ratings to States and Municipalities might convey sensitive non-public information about the financial soundness of local governments. In addition to minimizing the asymmetry between creditors and local governments—pointed out by Hochman and Valadez (2004) and Hernandez-Trillo (1997)—credit rating agencies might provide the market with timely and more reliable information on the creditworthiness of a local governments.

Rating agencies assess the creditworthiness of local governments by providing an initial rate and then re-evaluate ratings after a close analysis of credit, solvency and macroeconomic environment among other factors. Credit rating changes can then affect the price of bond offerings made by local governments in Mexico via two channels: an Information Content Signaling Hypothesis (ICSH) effect and a Wealth Redistribution Hypothesis (WRH) or substitution effect.

The information content effect has been investigated extensively in the U.S. and other markets. For the U.S. Wansley and Clauretie (1985), Holthausen and Leftwith (1986) and Cornell et. al. (1989) find rating downgrades are followed by a *negative* response in returns, while Barron, et. al. (1997) and Choy, et. al. (2006) find support in the UK and Australian markets respectively. The WRH on the other side has found support in the studies by Zaima and McCarthy (1998) who find that rating upgrades are followed by bond and stock return downgrades and more recently by Abad-Romero and Robles-Fernandez (2006) who find significantly negative excess returns for upgraded firms in the Spanish stock market.

The aim of this paper is to examine the reaction of Mexican local government bond returns and volatility to rating changes announcements by FitchRatings, Moody’s and Standard & Poor’s.

Very few studies have investigated the effect of credit rating changes to local governments on bond returns. The exceptions are the works by Ingram, et. al. (1983) who investigated the information content of municipal bond rating changes, and Liu, et. al. (1991) who examined the impact of socioeconomic variables and credit ratings on municipal bond risk premia. In this respect the main contribution of this paper is to extend the literature investigating the effect of rating changes to local governments on bond returns in an emerging country.

This paper is also unique as it provides a very first approach to the study of local government bond market in Mexico by examining the time series properties of States and Municipal bond offerings. In contrast with the majority of the studies in the literature using the event study methodology, several time series properties are individually examined here such as risk premia, persistence of shocks to volatility and the asymmetric response of conditional variance to positive and negative returns. This is achieved through the flexible process by Nelson (1991) known as the Exponential-GARCH(1,1) that allows for fat tails in the returns conditional distribution and leverage effects.

To motivate the paper the following section examines the institutional setting and recent developments in the local bond market in Mexico. In section 3 the hypotheses on the effect of rating changes on bond returns are examined with special referral to the

Mexican context. Methodology and data are presented in section 4 while estimation results are presented in section 5. The article closes with some conclusions and discussion in section 6.

2 Financial Reforms and the Emergence of Credit Rating Agencies in Mexico

The emergence and increasing popularity of rating agencies among States and Municipalities in Mexico is relatively new. Its origins can be found in the Tequila Crisis of 1995 and also on the fiscal and financial reforms carried out in 2000 aiming at minimizing local governments' fiscal indiscipline and commercial banks incentives to lend without proper individual risk assessments.

The fiscal indiscipline of local governments was notorious in the aftermath of the Tequila crisis when interest rates soared to 75% in April 1995. As Hochman and Valadez (2004)[1] have noted, most States and many Municipalities missed principal or interest payments or both. In some cases the default lasted only a few weeks but in others default extended over a year. Defaults however were not the exclusive result of heavy debt loads, shrinking payments and soaring interest rates, but also due to a generalized belief that the federal government would step in and provide financial assistance. This belief was shared by both local governments and commercial banks that lend to States and Municipalities without formally assessing individual creditworthy-ness.

Such bailout belief was fulfilled when the federal government implemented two explicit debt relief programs to save from collapse virtually all states: one in 1995 and a second in 1998. These programs involved extending debt maturities and converting old debt into a new inflation-adjusted unit of account (Unidad de inversion, or UDI) that carried fixed interest rates. In return, State and Municipal governments agreed to restore fiscal discipline, increase transparency and improve financial reporting—Hochman and Valadez (2004). An interesting finding by Hernandez-Trillo et. al. (2002) suggests the federal government might have carried out in fact additional secret or hidden bailouts through lax debt renegotiations with development banks.

A first reaction of commercial banks to the explicit bailout programs was to reject the new terms and suspend all lending to local governments—as they were themselves highly vulnerable. However, they finally agreed on a temporary 'mandate' from states to transfer pledged shared revenues—this accord lasted until March 2000.

In order to prevent the need of future bailouts, and remove the presence of the federal government on this fiscal and financial equation, a series of significant measures was implemented. First, by modifying article 9 of the Fiscal Coordination Law the federal government ceased the banks' ability to request direct transfers from the federal Treasury of a State or Municipal government's shared revenue. This was an important step since such ability of banks created two information asymmetry problems. In one side state governments had the incentive to borrow excessively and declare bankruptcy, knowing that the federal government would step in (*moral hazard problem*). On the other, while local governments knew their real financial performance banks could not

[1] This section is based extensively on the account provided by these authors.

distinguish—and had little interest in finding out—the true credit condition of States and Municipalities and assigned the same credit risk to all State and Municipalities (*adverse selection*)—see Hernandez-Trillo (1997) for more on this.

A second significant step was the introduction of a master trust (Fideicomiso Maestro) that enables local governments to use their shared revenues as debt collateral by channeling a share of these funds directly to the trust. The trustee of the fund is given rights to a significant percentage of the municipality's shared revenues from the federal government, and all these revenues are pledged so that they can be used as a guarantee for issue repayment—Hochman and Valadez (2004).

The trust fund structure and the use of share revenues as collateral are in all certainty the factors that have allowed bond issues to obtain high credit ratings. Under this scheme there have been more than 40 issues by States, Municipalities and Local Public Authorities since 2001 which have used shared transfers, payroll taxes, property taxes, vehicle taxes or the proceedings from toll-road fees as collateral—see Table A1 in the appendix.

A third significant measure was the institution of credit rating requirements from April 2000 as part of a set of new bank regulations and also in line with the regulations on capital standards derived from Basel II in the late ninties. All bank lending to local governments requires since then to set aside capital reserves calculated in relation to a credit rating provided by recognized rating agencies. The amount of capital reserves is calculated as the rating gap between the loan and the credit rating of federal government. The bigger the gap, the larger the capitalization requirement and the higher the banks' interest rate charge.

Credit ratings should minimize the information asymmetry problems described above—moral hazard and adverse selection. Banks in one hand should lend according to individual creditworthiness while local governments on the other should have incentives to keep their finances in order.

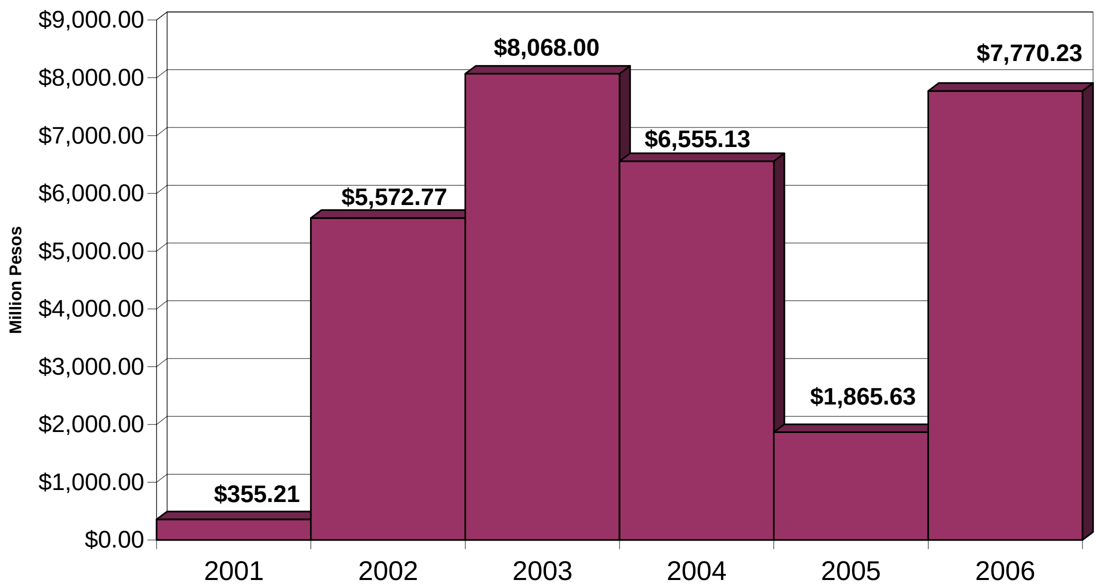
There are three rating agencies in Mexico: FitchRatings, Moody's and Standard & Poor's. To date the majority of the 31 States and the Federal District count with at least two ratings. Seven of these States count with three ratings and two of them—Querétaro and Morelos—currently count with only one rating. Seventy six municipalities have already been assigned two ratings, a pre-condition for debt offerings in the capital market. Thirteen municipalities have obtained only one rating and the municipality of Solidaridad in Quintana Roo has been assigned three ratings.[2]

Despite all these positive steps the capital market for local debt in Mexico is still emerging. In addition to the evident swings of local debt outstanding—see graph 1 below—there has also been a change in the composition of issuers. In 2003 for instance a total bond offering of MXP$ 8,068 million pesos (mp) was carried out by a diversified set of local governments: five States (Mexico, Veracruz, Guerrero, Nuevo León and Hidalgo), two Municipalities (Aguascalientes and San Pedro Garza García), the Tlalnepantla Water Authority (TWA) and Mexico City Government. By 2006 a similar amount of debt—MXP 7,770.23 m.p.—was offered by only three key big players: Mexico City, Nuevo León and Veracruz. This simply suggests that capital markets in Mexico might become a source of cheap financing exclusive to some well-endowed

[2] Information provided by Valmer (www.valmer.com.mx).

States[3] with occasional offerings by municipalities and other States counting with two investment grade credit ratings.

Graph 1: Local Government Debt in the Capital Market
Base 2003=100



Source: Bolsa Mexicana de Valores, Definitive Listing Prospectus.

3 Hypotheses on the Effect of Rating Changes

The literature has identified two hypotheses to explain the potential effect of rating changes on bond returns: the Information Content Signaling Hypothesis (ICSH) and the Wealth Redistribution Hypothesis (WRH). The ICSH claims that rating agencies possess additional inside information about the probability of default and hence a rating action might provide the market with valuable information on the true financial condition of a given firm, State or Municipality. A rating change could be interpreted by the market as a signal of the local government 'true' financial outlook and as a consequence bond returns should move in the same direction of the rating change, that is, rating upgrades would be followed by greater returns while rating downgrades would be followed by lower bond returns.

It has been observed however that rating upgrades (downgrades) are sometimes followed by lower (greater) bond returns. This conundrum has been explained in the firm by the WRH as the result of an agency problem between bondholders and shareholders. Shareholders seek to maximize their return at the expense of bondholders. In a context of limited liabilities shareholders may engage in riskier investments in the

[3] Mexico City and Nuevo León for instance concentrate around 30% of the Gross Domestic Product in Mexico.

pursuit of higher returns, thus affecting the value of the firm and/or the stability of cash flows. If a downgrade occurs due to riskier (higher variance) investments, bond value decreases and stock value increases. In consequence there is wealth redistribution from bondholders to stockholders—Zaima and McCarthy (1988).

An alternative way to look at this hypothesis of wealth redistribution in the context of local governments would be to focus on the agency conflict between credit lenders and bondholders. A greater variance of public investments and cash flows might indeed lead to a lower credit rating. A lower credit rating in turn constrains the amount of low cost investment-debt a local government can raise with banks in the form of direct credit. Instead of commercial debt offerings, creditors and investors in local governments could opt for safer lending instruments such as bond certificates. An increase in the demand of local government bond certificates should then be observed pushing up prices and returns.[4] Overall, bond certificates value increases while stock value (the local treasury) decreases.

The specific fiscal and financial arrangement that makes local government bond offering possible in Mexico provides us with an *alternative* hypothesis which we find is more likely to explain why rating upgrades (downgrades) are followed by lower (greater) returns. To illustrate let us consider what I name the '*trust fund effect'*, unique to government bonds (CB) in Mexico. Principal and coupon payments of most local government bond offerings are fully guaranteed among others by federal share transfers, payroll taxes or toll-road fees, a good proportion of which goes directly into a master trust. The existence of this trust has undoubtedly a positive effect on CB returns as it provides investors with enhanced certainty to all coupon and principal payments. However, a reduced amount of share transfers or other income is left over every period to the local government treasury and this could be perceived by the rating agency as a deteriorating financial condition. Debt ratios as a proportion to shared transfers for instance would increase and a rating downgrade might be assigned.[5] What is more, debt payments might also increase every period as a result of servicing these CB issues. Hence, while the trust fund provides certainty to the market increasing the demand for bonds and pushing up prices and returns, the very existence of the trust fund could lead to credit rating downgrades due to a higher perception of debt and debt servicing.

4 Methodology and Data

4.1 Methodology

To investigate the effect of rating changes on bond returns and volatility a time series version of the market model is augmented to capture the linear association between

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[4] The increase in demand for government bonds is logical since most issues have a good investment rating. A bond certificate is a much more safer investment than direct credits to the local government since coupon and principal payments are backed by federal share transfers which minimize default risk. On the other side, direct debt nor its service usually any collateral to back or support debt service apart from local taxes.

[5] There is ongoing research that confirms that variables related to *debt stock* and *debt service* in Mexico explain the variations in credit ratings—see García-Romo, et. al. (2005) and Yorio (2007).

bond returns and time varying conditional variance as a proxy of the 'risk premium'. In order to avoid bias in the systematic risk of small and large issuers by omitting conditional heteroskedasticiy—as noted by Reyes (1999)—we extend the market model with the Exponential GARCH (EGARCH) model by Nelson (1991).[6] Hence our EGARCH(1,1)-in-Mean market model is as follows:

$$r_t = c + \delta\sqrt{\sigma_t^2} + \beta_M r_{M,t} + \varepsilon_t;$$

$$\varepsilon_t = e_t\sigma_t, \quad e_t \sim iid\ \ GED(0,1) \tag{1}$$

$$\ln(\sigma_t^2) = w + \alpha(|e_{t-1}| + \lambda e_{t-1}) + \beta\ln(\sigma_{t-1}^2)$$

where r_t is the bond return, δ is the 'risk premium' parameter; σ_t^2 is the conditional variance; $r_{M,t}$ is the return on the market at time t; β_M is the common stock beta; ε_t is the error term and $\{e_t\}$ is a sequence of independent, identically distributed GED random variables with mean zero and variance one. In the conditional variance equation α captures the ARCH effects, β captures the persistence of conditional volatility and λ captures the asymmetric response of volatility to positive and negative shocks.

This model ignores however the possibility of rating changes to local governments or other rating changes having an effect on bond returns. Hence, model (1) is extended to seize the effect of rating changes on both the level and conditional volatility of bond returns:

$$r_t = c + \delta\sqrt{\sigma_t^2} + \beta_{M,t} r_M + \gamma_e DE_t + \gamma_O DO_t + \varepsilon_t;$$

$$\varepsilon_\text{t} = e_t\sigma_t, \quad e_t \sim iid\ GED(0,1) \tag{2}$$

$$\ln(\sigma_t^2) = w + \alpha(|e_{t-1}| + \lambda e_{t-1}) + \beta\ln(\sigma_{t-1}^2) + \phi_e DE_t + \phi_O DO_t$$

where DE and DO are dichotomous variables that take a value of unity on the date there is a change of credit rating to the local government or other credit rating announcement related to a given local government respectively. These dummy variables take a value of zero otherwise. The parameters γ_e, γ_0, ϕ_e and ϕ_0 indicate the average impact of DE and DO on the mean and variance equation respectively.

In order to account for the fat tails reported extensively in the literature of financial returns it is assumed that e_t follows a *i.i.d.* Generalized Error Distribution (GED) with mean zero, variance one and tail thickness parameter $\nu>0$[7]:

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[6] Other studies that have considered extending the market model to account for time varying conditional variances are Barron et. al. (1997) and Abad-Romero (2006) both employing a GARCH(1,1) model to examine UK and Spanish stock returns respectively.

[7] There are some distributions that could capture the thickness of tails in the distribution of returns, among them the *Laplace distribution* and the t-*distribution*. The first of these distributions however is contained within the GED distribution, which in turns allows for a much richer family of distributions.

$$f(e_t) = \frac{\nu}{\lambda 2^{(1+\nu^{-1})}\Gamma(\nu^{-1})} \exp\left(-\frac{1}{2}\left|\frac{e_t}{\lambda}\right|^{\nu} \right) \tag{3}$$

with

$$\lambda = \left[2^{-\frac{2}{\nu}} \frac{\Gamma\left(\frac{1}{\nu}\right)}{\Gamma\left(\frac{3}{\nu}\right)} \right]^{\frac{1}{2}}$$

where $\Gamma(\bullet)$ is the gamma function and ν is a positive parameter governing the shape and thickness of the tails in the distribution. When ν=2, ν =1 and $\nu \rightarrow \propto$ the normal, double exponential and uniform distribution are obtained respectively. In general for ν>2 the distribution of e_t has thinner tails than the normal, while for ν<2 the distribution of e_t exhibits thicker tails than the normal. We expect the parameter to be lower than two indicating thicker tails. Maximum Likelihood estimates are obtained by employing the BHHH optimization algorithm[8] and the S-GARCH module in S-Plus.

The literature investigating the effect of rating changes on returns has widely favored the use of Event Studies (ES).[9] However, there are several advantages of using a time series approach over Event Study methods: we are able to approximate more closely the process followed by bond returns; we are also able to provide individual estimates on the magnitude, direction and statistical significance of the risk premium; to examine the existence of asymmetries; to assess the persistence of volatility shocks and most importantly we are able to provide specific measures on the effect and significance of individual rating changes on the conditional first and second moments of local bond returns. While there have been some ES studies that have allowed the market model to incorporate conditional volatilities, they usually provide no information on these parameters. In this study we aim at investigating whether time series market models with conditional volatilities are suitable processes for State and Municipal bond returns in Mexico. As it is reported shortly we take this path at the expense of constraining the analysis to some selected time series.

5 Estimation Results

5.1 Bond Prices and Credit Ratings Database

The data analyzed in this article comprises all capital market bond offerings (Certificados Bursátiles) by States, Municipalities and local government authorities

[8] For more on the statistical properties of EGARCH models, stationarity conditions and optimization details the reader is referred to Nelson (1991).

[9] See for instance Holthausen and Leftwich (1986), Zaima and McCarthy (1998) and more recently Choy, et. al. (2006) and Abad-Romero and Robles-Fernandez (2006).

listed on the Mexican Stock market from 2000. Bond prices and returns[10] of a total of 31 bonds have been examined for different time periods starting with the first ever local-government issue in the market by the municipality of Aguascalientes on December 11, 2001.[11]

Credit Ratings Changes to State and local authorities have been reported by Moody's, Standard & Poor's and FitchRatings. The announcement of rating changes by these agencies—and its direction, i.e., whether they were downgrades or upgrades—has been obtained from a database of financial information published over the internet known as Invertia (**www.invertia.com.mx**) and from rating agencies various resources. For Moody's we use the rating actions available in the Corporate, Banking and sovereign database published on the company's web site (**www.moodys.com**). A rating history list was kindly provided by Standard & Poor's that contains all ratings and rating changes of local and regional governments since 1975.[12] For FitchRatings *Invertia* was at the only publicly available source of information.

In addition to State debt ratings changes, we also collect information on *other* related rating changes or credit rating announcements made by the rating agencies that might affect investors' perception about the individual creditworthiness of these issuers.

5.2 Descriptive Analysis

After an exhaustive initial time series analysis of the data and application of the restricted market model in equation (1) it was found that bond returns by four state offerings—Chihuahua, Hidalgo and Nuevo León—and the Tlalnepantla Water Authority (TWA) converge satisfactorily and do not exhibit correlation in the residuals nor squared residuals.[13] The analysis in this article is performed using these five time series. Appendix A.2 provides more detailed information on these selected issues.

Table 1 shows the history of State ratings changes and other rating changes for the selected States and the Tlalnepantla Water Authority (TWA). One important point to

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[10] Bond prices (P_t) have been kindly provided by Price Provider ValMer Inc. Returns are calculated as the log difference of prices in two consecutive trading days, i.e., $r_t = \ln(P_t) - \log(P_{t-1})$.

[11] Table A.1 in the appendix describes selected features of these 31 public offerings including date of issuance, collateral, volume, maturity, credit rating and spreads.

[12] The author would like to acknowledge Daniela Brandazza and Patricia Calvo of Standard and Poor's for kindly providing this information.

[13] A total of 31 time series were initially examined for different orders in the mean and conditional variance. The final series were selected according to Aikaike Information, Criteria (AIC), Bayes Information Criteria (BIC) and whether the resulting residuals and squared residuals were free from serial correlation. The results are not presented here but are readily available from the author. Part of this exhaustive search was to contrast the model with many other different univariate GARCH models among them: GARCH(1,1) of Bollerslev (1986); Garch-in-Mean Models by Engle (1987) with different variables in variance such as standard deviation, variance and the log of variance; EGARCH-in-Mean models also with different variables in-mean. From all these specifications and using different conditional distributions (normal, t-student, double exponential and GED distribution) we found that the models presented in this paper are the ones that give the best empirical fit. The aim of the paper is not to select the best process to model the behavior of bond market returns but in fact to investigate the effect of rating changes on returns. It is acknowledged however that given the very small sample presented here the results can hardly be generalized to the market of local bonds.

note is that except for the case of the TWA, all rating changes to States recorded in this database have been rating upgrades.

Table 2 shows descriptive statistics of log-returns for these local government offerings from different starting dates to October 10, 2006.[14] Daily bond returns—with abbreviated tickers CH-04, CH-042, HGO-032, NL-032 and TLAL-03—show very similar magnitudes both in mean and unconditional variances. There does not seem to be a positive relation between expected return and volatility as standard market models would suggest. That is, greater variability of returns are not apparently accompanied by greater expected returns. Mean returns and volatility of the TWA bonds—see TLAL-03—differ substantially from those of State offerings. Also, TWA mean returns are negative and the magnitude of the unconditional variance is almost 31 times as high as average returns. There is an evident excess kurtosis in all series indicating fat tails and the Jarque-Bera test for normality confirms bond returns are not normality distributed—a common finding in the literature of financial returns. It is worth noting that in contrast with other bond offerings the distribution of TWA returns is negatively skewed.

5.3 Estimation Results

In this section we estimate and test the market model introduced in equation (2). This model is used to investigate several issues: i) the relationship between the level of market risk and returns, ii) the size and significance of systematic risk, iii) the effect of credit rating changes on bond returns, iv) the asymmetric impact of negative and positive bond returns on conditional variance, v) the persistence of shocks to volatility, vi) fat tails in the conditional distribution of returns, vii) the effect of rating changes on the volatility of bond returns and viii) the impact of rating changes on returns using two symmetric five-day momentum windows around the rating change date.

Table 3 provides the parameter estimates and t-ratios for the five time series by rating agency. First note the high significance of most parameter estimates and the absence of serial correlation in the residuals and squared residuals. Also, the three sets of coefficient estimates are not identical and differ from one rating agency to the other. This suggests the market makes its own distinction on the information provided by each rating agency and reacts differently to announcements.

Next we examine the empirical issues raised above: i) Market risk and return. In line with the seminal paper by Nelson (1991), the estimated risk premium ( ) is negatively correlated with returns, with ranging from -0.04 to -1.37. This parameter estimate is highly significant in all cases except for the TWA risk premium—see fourth column of Standard and Poor's. The existence of a negative risk premium might seem counterintuitive. However, Backus and Gregory (1993) argue that the theoretical relation between the market risk premium and the market variance is not necessarily a positive, linear function. In general the function depends on the preferences of the representative agents and the stochastic nature of the economy. The literature investigating the association between risk and returns using GARCH-M models confirms this is the case.

[14] This is with the exception of TWA where the local authority decided to use its right redeem the issue in anticipation on October 19, 2005. Starting dates and other features of selected offerings are shown in table A.2 in the appendix.

Table 1. Credit Rating Changes to Mexican States and Tlalnepantla Water Authority

Issuer	Date of Rating Change	Action and Direction
Moodys		
Chihuahua	September 13, 2004	*State Upgrade from A2.mx to A1.mx*
	September 20, 2005	*State Upgrade from A1.mx to Aa3.mx*
	September 22, 2005	Preliminary Rating of new bond issues
	November 9, 2005	Rating of new bonds
	November 14, 2006	Announcement of DAM[a]
	December 8, 2006	Credit Opinion
Hidalgo	November 13, 2006	*Assigns State Rating A2.mx*
	November 14, 2006	Announcement of DAM
	December 8, 2006	Credit Opinion
Nuevo León	December 6, 2004	Rating of Trust Certificates
	April 20, 2006	*State Upgrade from A3.mx to A1.mx*
	September 25, 2006	Rating of Bonds
	November 14, 2006	Announcement of DAM
	December 8, 2006	Credit Opinion
Tlalnepantla (TWA)[b]	May 19, 2004*	Assigns Baaa1 Rating to TWA
	February 14, 2005	*Downgrade Warning to OPDM* Municipality downgrade from Aa3.mx to A2.mx
	May 23, 2005*	*Downgrade TWA to Baaa2.mx*
Standard & Poor's		
Chihuahua	May 13, 2005	*State Upgrade from mxA to mxA+*
	Dec 9, 2005*	Confirmation of CB's Rating mxAA+
Nuevo León	Jan 9, 2004*	*Confirms State rating to mxA-*
	May 5, 2006	Upgrade from mxA-/Stable to mxA-/Watch Positive
	December 18, 2006	*Upgrade from mxA-/Watch Positive to mxA-/Positive*
Tlalnepantla (TWA)	August 1, 2003*	Assigns rating mxBBB to OPDM
	May 26, 2004	Downgrade municipality from mxAA/Stable to mxAA/Negative
	January 21, 2005	Downgrade municipality from mxAA/Negative to mxA-/Watch Negative
	March 30, 2005*	Downgrade TWA rating from mxBBB to mxBB
	June 2, 2005	Municipality upgrade rating from mxA-/Watch Negative to mxA-/Stable
FitchRatings		
Chihuahua	October 27, 2005*	*Confirms State Rating A- with positive outlook*
Nuevo Leon	January 10, 2005*	Assign Rating AA to State Credit
	October 13, 2005*	Confirms State Rating A

[a]Default Analysis Methodology (DAM). [b]Tlalnepantla Water Authority (TWA). *Information provided by *Invertia*

Table 2. Descriptive Statistics

	X [b]	σ [c]	Max [d]	Min [e]	Skew [f]	K [g]	JB [h]	n [i]
CH-04 [a]	0.0008	0.0097	0.1227	-0.0309	4.81	47.36	0.00	627
CH-042	0.0008	0.0131	0.1326	-0.0313	6.14	51.96	0.00	605
HGO-32	0.0007	0.0204	0.5597	-0.0231	24.84	666.02	0.00	842
NL-032	0.0003	0.0077	0.1445	-0.0513	7.99	158.07	0.00	808
TLAL-03	-0.0070	0.2152	0.6920	-2.7823	-10.01	113.2242	0.00	594

[a]The offerings by Chihuahua are indicated by CH-04 and CH-042 respectively. The numbers in front indicate the issuance date and series; hence CH-042 means the *second* issue made by the State of Chihuahua in 2004. Accordingly, HGO-32 refers to the second issue by the State of Hidalgo in 2003. The offerings by the State of Nuevo Leon (NL-032) and the Tlalnepantla Water Authority (TLAL-03) are interpreted similarly. [b]Expected Return (arithmetic mean). [c]Standard deviation. [d]Maximum. [e]Minimum. [f]Skewness. [g]Kurtosis. [h]P-value of Jarque-Bera tests for normality. [i]Sample size.

French, Schwert and Stambaugh (1987) and Scrugs (1998) for instance find a significant positive relation while Campbell (1987), Glosten, Jagannathan and Runkle (1993) report a significant negative association.[15]

ii) Systematic risk. The common stock beta (β_M) is in general positive and highly significant. The magnitude of the parameter estimate indicates local government bonds systematic risk is low and independent of the market behavior. This low size is also consistent with the high credit rating (AAA) assigned by FITCH to all the five issues considered herewith.[16]

iii) The effect of credit rating changes on bond returns. First we consider the effect of rating changes on bond returns captured by γ_e. The results show in general a significant positive effect of rating changes on bond returns, i.e., credit rating upgrades are followed by greater returns. This finding conveys some evidence in favor of the Information Content Signaling Hypothesis (ICSH) considered in previous sections of this paper. There is new quality information provided by rating agencies to the market on the true financial outlook of issuing States. We acknowledged however that we do not have a sufficiently large sample to reach a definite conclusion on whether the ICSH dominates either the WRH or the Trust Fund Effect hypothesis in this paper.

Two estimations—see HGO-032 on Moody's panel and NL-032 on Standard & Poor's panel—suggest the Asset Wealth Redistribution Hypothesis (WRH) more than compensates the positive effect of ICSH. For the States of Hidalgo and Nuevo León, our results imply that credit rating upgrades (possibly induced by lower variability of investments and cash flows in State finances) might expand the availability of cheaper bank financing. Banks however would presumably look for higher return instruments, hence lowering the demand for local government bonds and bringing down bond prices

15 It must be stressed out however that the main concern of this paper is based on time series analysis. It is in this context more than in an asset-pricing context that such negative relationship makes sense: a negative shock can lead to higher variance, smaller current price and hence lower returns. It is acknowledged here that a negative relationship between expected returns and volatility can indeed seem counterintuitive in an asset pricing context. The author would like to thank this observation made by an anonymous referee.

16 As a proxy for the market index we take the Mexican Stock Exchange Index—Índice de Precios y Cotizaciones (IPC) de la Bolsa Mexicana de Valores—and calculate log returns as indicated in footnote 9 of this article.

and returns. This way credit rating upgrades can be associated to lower bond returns. That is, for the Hidalgo and Nuevo León issues the substitution effect overrides the ICSH effect following rating upgrades—see direction of γ_e in Moody's and Standard & Poor's panel respectively.

An alternative plausible explanation for these two cases where rating upgrades are followed by lower returns is due to the *Trust Fund Effect* introduced in section 3—see the parameter γ_e for HGO-32 in Moody's and for NL-032 in Standard and Poor's. In both cases the ratings recorded are upgrades and also new initial ratings. In the particular case of Hidalgo (HGO-32) the Master Trust Effect is very likely scenario since principal and coupon payments are guaranteed by federal share transfers, 75% of which go directly into a master trust. While this master trust positively affects returns providing more certainty to all coupon and principal payments, on the other side a reduced amount of share transfers is taken out every period from Hidalgo local treasury which in turn could be perceived by rating agencies as deteriorating financial conditions. Debt ratios as a proportion to shared transfers would increase and also the proportion of debt service would also increase. A rating downgrade could be a natural outcome and hence the sign observed in these tables. It also should be noted that this empirical effect is not supported for NL-032 rated by FitchRatings.

On the other side, there is also evidence in favor of an asset substitution effect in the case TLAL-03 where rating downgrades are followed by greater bond returns—see γ_e in the fifth column of Moody's panel. As suggested by the WRH, a greater variance of investments and cash flows might lead to a lower credit rating.[17] A lower credit rating to the municipality should increase in turn the local government default risk and financial agents would then look for safer lending instruments such as bonds. An increase in the demand for local government bonds should be observed pushing up prices and returns. It would be natural for the banks to substitute credits for capital market investments due to the high risks involved with direct lending. Hence, under these circumstances lower credit ratings can be associated to higher bond returns. As with NL-032, the substitution effect is stronger than the ICSH effect in Tlalnepantla—see γ_e for TLAL-03 in Moody's panel.

The effect of other relevant rating changes or announcements on bond returns has been captured by γ_O. It is observed in general that the effect of other rating changes on bond returns is mixed. For the case of Moody's rating upgrades lead to significant bond returns increases, while negative significant effects on returns are reported by Fitch rating changes and a non-significant estimates are observed by Standard & Poor's rating changes.

iv) Asymmetric impact of negative and positive bond returns on conditional variance. The asymmetric relation between returns and changes in volatility is captured by λ. The estimates in all cases are highly significant and confirm that negative bond returns affect the conditional volatility more than positive bond returns.

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[17] This is actually what happened to the municipality of Tlalnepantla which faced liquidity and financial distress from the beginning of 2005. Conditions deteriorated rapidly and rating agencies downgraded both the Municipality of Tlalnepantla and the TWA (see Table 1). The local authority decided to redeem initial debt offerings on October 20, 2005. While there was no default of this issuer, rating downgrades indeed anticipated, revealed and confirmed financial distress that would have probably remained non-public otherwise.

Table 3. Contemporaneous effects of Rating Changes on Government Bond Returns Level and Volatility.

	Moody's					Standard & Poor's				FitchRatings		
	CH-04	CH-042	HGO-32	NL-032	TLAL-03	CH-04	CH-042	NL-032	TLAL-03	CH-04	CH-042	NL-032
Mean Equation												
c_1	0.0010*	0.0005*	0.0002*	-0.0001*	0.0175*	0.0011*	0.0005*	-0.0001*	0.0108*	0.0011*	0.0006*	-2.6e-5**
	(19.476)[a]	(19.237)	(2.861)	(-5.900)	(27.390)	(24.970)	(14.428)	(-3.087)	(3.2381)	(25.222)	(15.277)	(-2.108)
δ	-0.1742*	-0.1455*	-0.1826*	-0.0358*	-0.0927*	-0.1856*	-1.365*	-0.0445*	-0.0511	-0.1781*	-0.1276*	-0.0638*
	(-11.479)	(-17.614)	(-14.945)	(-7.129)	(-60.896)	(-15.004)	(-14.512)	(-7.434)	(-0.7311)	(-11.265)	(-12.339)	(-13.500)
γ_e	0.0076**	0.0005	-0.0017*	0.0007*	0.0280*	0.0199*	0.0027*	-0.0004*	-0.1395*	0.0014***	0.0011*	0.0003*
	(2.399)	(0.9926)	(-6.538)	(11.390)	(4.498)	(35.846)	(39.313)	(-12.902)	(-6.2314)	(1.8309)	(7.311)	(2.851)
γ_o	0.0011***	-0.001***	0.0008*	0.0001*	—	—	—	—	-0.0128	—	—	-0.0001*
	(1.970)	(-1.7953)	(3.087)	(9.327)					(-0.8355)			(-7.850)
β_M	0.0002*	0.0002*	-0.0007*	0.0001*	-0.0026*	0.0003	0.0006*	0.0001*	0.0002	0.0003	0.0003*	0.0001*
	(5.206)	(3.7689)	(-15.024)	(19.916)	(-9.905)	(5.063)	(8.725)	(12.229)	(0.0861)	(5.7717)	(7.033)	(6.092)
Variance Equation												
ω	-0.3268*	-0.1979*	-0.1629*	-0.5029*	-0.1264*	-0.2801*	5.4e-08***	-0.3152*	-0.0492*	-0.3537*	-0.1154*	-0.3124*
	(-22.401)	(-47.279)	(-39.802)	(-58.095)	(-29.482)	(-24.321)	(1.677)	(-25.106)	(-12.644)	(-23.762)	(-20.323)	(-67.083)
α	0.2847*	0.2071*	0.1392*	0.1114*	0.0217*	0.2961*	0.1114*	0.1229*	0.0082*	0.3203*	0.1978*	0.0970*
	(9.1120)	(15.840)	(22.757)	(7.812)	(6.386)	(8.686)	(7.782)	(5.464)	(4.3738)	(8.4331)	(9.941)	(6.886)
β	0.9821*	0.9910*	0.9931*	0.9685*	0.9741*	0.9863*	0.9252*	0.9772*	0.9951*	0.9812*	0.9979*	0.9764*
	(881.76)	(1967.94)	(2995.9)	(1629.6)	(2881.4)	(1372.55)	(275.9)	(1340.34)	(1328.84)	(762.57)	(2327.8)	(2149.02)
λ	-0.5501*	-0.6716*	-0.9614*	-0.6470*	-0.2198	-0.6311*	-0.6216*	-0.6452*	-1.0000*	-0.5753*	-0.6999*	-0.5771*
	(-14.051)	(-31.158)	(-728.64)	(-6.133)	(1.284)	(-23.038)	(-46.966)	(-7.815)	(-2.5217)	(-12.184)	(-23.459)	(-10.648)
ϕ_e	1.7949*	1.3829*	0.4964	1.6620*	2.1368*	-0.9854	-4.5e-05*	1.0407*	0.2065	-0.4134	-1.1956*	3.1185*
	(10.193)	(4.0574)	(1.643)	(3.775)	(13.515)	(-1.542)	(-2.939)	(2.652)	(1.4914)	(-0.2988)	(-3.531)	(18.169)
ϕ_o	-0.3913**	-0.1165	0.7684*	-1.1186*	—	—	—	—	0.2813	—	—	-0.4968*
	(-2.549)	(-0.5387)	(3.370)	(-3.193)					(1.3544)			(-3.747)
ν	0.5305*	0.5106*	0.4733*	0.4627*	0.2968*	0.5519*	0.5166*	0.4452*	0.9138*	0.5386*	0.4743*	0.4422*
	(21.653)	(34.268)	(90.133)	(27.493)	(23.935)	(22.120)	(22.482	(26.059)	(67.876)	(21.994)	(27.900	(25.230)
Decision Criteria and Specification Tests												
$L(\theta)$[b]	2380.39	2289.63	4247.72	3712.85	1052.94	2441.85	2302.01	3706.08	679.33	2435.78	2299.93	3710.40
AIC[c]	-4736.8	-4555.27	-8471.4	-7401.7	-2085.88	-4863.70	-4584.02	-7392.15	-1334.66	-4851.56	-4579.86	-7396.80
BIC[c]	-4683.7	-4502.44	-8414.6	-7345.36	-2042.01	-4819.29	-4539.97	-7345.21	-1282.01	-4807.15	-4535.80	-7340.47
$Q(\varepsilon)$[d]	17.8589	0.6706	1.6347	11.7720	8.9144	18.89	0.9515	13.8908	7.02	15.73	0.8798	10.011
	[0.5974][e]	[1.0000]	[1.0000]	[.9236]	[0.9838]	[0.5286]	[1.0000]	[0.8359]	[0.9966]	[0.2040]	[1.0000]	[0.9679]
$Q(\varepsilon^2)$[d]	0.0828	0.0574	0.0244	0.3863	0.7552	0.070	0.0533	0.4632	0.5566	0.0511	0.0530	0.3573
	[1.0000]	[1.0000]	[1.0000]	[1.0000]	[1.0000]	[1.0000]	[1.0000]	[1.0000]	[1.0000]	[1.0000]	[1.0000]	[1.0000]

***, ** and *** Significant at the 1%, 5% and 10% level respectively. [a]T-ratios in parenthesis. [b]$L(\theta)$ denotes maximized likelihood value. [c]Akaike Information Criterion (AIC) and Bayes Information Criterion (BIC) respectively. [d]Twentieth order Ljung-Box tests for autocorrelation in the standardized residuals and squared standardized residuals respectively. [e]P-values in brackets.**

v) The persistence of shocks to volatility. Another finding of these estimations is the high persistence and extremely high *t*-ratios shown in all estimations. The largest estimated β is 0.9979 for the case of CH-042 under FitchRatings panel. In order to gain some intuition about the degree of persistence implied by this parameter estimate we use the *half-life* statistic, i.e., the number *h* that makes β^h=0.5. Using this, a shock to the variance lasts for about one year (329.7 days) while for the lowest estimate (β=0.9252 or CH-042 under Standard and Poor's) the half-life is of just nine days. We should be cautious interpreting high persistence parameters since our sample sizes are short. Nonetheless we believe the results might suggest long-memory in the volatility of local government bonds in Mexico and possibly non-stationarity—although Nelson (1991) observes the effect of a unit root on $ln(\sigma^2_t)$ is still unclear.

vi) Fat tails in the conditional distribution of returns. To account for the fat tails, model (2) allows e_t to follow a GED(ν) distribution with ν capturing the shape of the distribution. As table 3 shows all estimates of ν are highly significant and below one indicating that the conditional distribution has ticker tails than the normal and double exponential distribution respectively.

vii) The effect of rating changes on the volatility of bond returns. Including the downgrade to the municipality of Tlalnepantla and TWA, Moody's rating changes to the States in this study exert a positive impact on the conditional volatility of bond returns—see ϕ_e. The exceptions is HGO-032 which shows a positive but non-significant effect. In turn, the effect of rating changes by Standard & Poors and FitchRatings on the variability of returns is mixed. The effect of other related rating changes on the variability of returns (ϕ_O) is also mixed.

viii) The impact of rating changes using five-day momentum windows. In table 4 we analyze the impact of rating changes on returns by looking at two symmetric windows around the rating change date: (-5,0) and (0,5).[18] DE_t and DO_t in equation (2) are now dummy variables taking on the value of one during the five days before and the five days after the rating change date respectively. We aim with this to capture the *momentum* in the bond market before and after the rating change date (0,0). The associated parameters γ_e are now interpreted as the cumulative returns on the momentum window.[19]

With few exceptions, we find strong significant evidence in favor of market anticipation and post-reaction five days before and five days after rating changes—see γ_e for every rating agency. Also, as it would be expected, in almost all cases the results indicate the effect on volatility is much greater on the event day than in the pre and post-rating change date momentum windows—compare the magnitude of ϕ_e in tables 3 and 4. To gain some intuition on these findings let us consider Moody's rating actions for instance. Our results suggest the market anticipated the rating agency upgrading to Nuevo León—see γ_e under NL-32—not only by pushing up prices and returns five days before, but also by raising bond returns five days after. Cumulative returns in these five-day momentum windows are however lower than the impact observed on the rating change

[18] In order to focus on the impact of rating changes on bond returns level and volatility we present a summarized version of the estimations. Detailed results on decision criteria and residuals tests are available upon request.

[19] This exercise is similar to what Event Studies perform. However in contrast with such studies we do not constraint the estimation window and use instead the whole sample for each time series.

Table 4. Pre-Event and Post-Event Effects of Rating Changes by Moody's, FitchRatings and Standard & Poors.

	CH-04		CH-042		HGO-032		NL-032		TLAL-03	
	(-5,0)[a]	(0,5)[a]	(-5,0)	(0,5)	(-5,0)	(0,5)	(-5,0)	(0,5)	(-5,0)	(0,5)
Moody's										
δ	-0.1843*	-0.0491*	-0.1039*	-0.1366*	-0.2051*	-0.2500*	-0.0507*	-0.0478*	-0.0968*	-0.0735*
	(-9.810)[b]	(-3.085)	(-7.707)	(-12.642)	(-14.387)	(-16.552)	(-5.949)	(-14.606)	(-33.481)	(-20.676)
γ_e	0.0012*	-0.0038*	0.0033*	-0.0016***	-0.0004	5.9e-5	0.0003*	0.0005**	0.0412*	0.0107*
	(1.327)	(-12.222)	(14.051)	(-1.617)	(-1.6158)	(0.1975)	(5.613)	(2.1428)	(378.07)	(6.7550)
γ_o	0.0013*	-0.0008*	0.0012*	-0.0016*	0.0002	-5.8e-5	0.0002*	0.0001*	—	—
	(6.056)	(-12.628)	(9.857)	(-32.983)	(0.9014)	(-0.734)	(18.280)	(7.5367)		
β_M	0.0003*	0.0006*	0.0005*	0.0002*	-6.2e-5*	-4.9e-5*	0.0001*	0.0002*	-0.0001	0.0005*
	(4.854)	(4.9473)	(8.301)	(4.598)	(-3.9844)	(-7.211)	(8.056)	(15.497)	(-0.8936)	(1.9474)
ϕ_e	0.2720*	0.1678	0.3984*	0.3538*	0.1109	-0.1085	0.3532*	0.5217*	0.1036*	0.2186*
	(3.4990)	(0.8347)	(4.516)	(5.386)	(0.7492)	(-1.2398)	(5.416)	(10.582)	(17.751)	(4.0134)
ϕ_o	-0.0460	-0.3954**	-0.1215***	-0.1002*	0.1337***	0.1284*	-0.0920*	-0.0221	—	—
	(-0.9630)	(-2.3446)	(-1.854)	(-2.188)	(1.6612)	(3.033)	(-2.090)	(-0.664)		
Standard & Poor's										
δ	-0.1703*	-0.1769*	-0.1370*	-0.1498*	—	—	-0.0642*	-0.0571*	-0.0776*	-0.0770
	(-10.535)	(-9.9700)	(-13.703)	(-15.482)			(-16.005)	(-7.717)	(-53.561)	(-1.5120)
γ_e	0.0010*	0.0025*	0.0013*	0.0092*	—	—	-0.0005*	-0.0004*	7.6e-5	-0.0664*
	(17.750)	(2.9880)	(20.798)	(30.182)			(-16.665)	(-18.148)	(0.0424)	(-7.3765)
γ_o	—	—	—	—	—	—	—	—	-0.0051*	-0.0144*
									(-14.913)	(-2.7816)
β_M	0.0002*	0.0002*	0.0003*	0.0005*	—	—	0.0002*	0.0002*	-0.0776*	-0.0011
	(3.5890)	(2.9670)	(4.8880)	(14.931)			(26.044)	(11.479)	(-15.975)	(-0.4931)
ϕ_e	0.0320	-0.1839	-0.2057*	-0.3220*	—	—	0.0560*	0.1150*	0.1396*	-0.0040
	(1.3580)	(-1.0050)	(-4.351)	(-9.408)			(0.9847)	(2.1880)	(7.9386)	(0.1800)
ϕ_o	—	—	—	—	—	—	—	—	0.0952*	0.1107*
									(15.339)	(3.0728)
FitchRatings										
δ	-0.1867*	-0.1861*	-0.1383*	-0.1415*	—	—	-0.0268*	-0.0502*	—	—
	(-10.2625)	(-15.334)	(-14.201)	(-11.929)			(-4.5128)	(-12.972)		
γ_e	-7.3e-5	-0.0003	-0.0013*	-0.0002**	—	—	-0.0007*	-0.0006*	—	—
	(-0.0981)	(-0.0914)	(-6.964)	(-2.344)			(-11.163)	(-17.441)		
γ_o	—	—	—	—	—	—	0.0003*	-2.0e-5	—	—
							(7.0472)	(-0.5145)		
β_M	0.0003*	0.0003*	0.0006*	0.0006*	—	—	9.7e-5*	0.0001*	—	—
	(4.2407)	(8.8784)	(12.088)	(9.532)			(3.6757)	(8.5030)		
ϕ_e	-0.1080	-0.5057***	-0.2560	-0.3665*	—	—	0.0448	0.4188	—	—
	(-0.3670)	(-1.9514)	(-1.606)	(-5.157)			(0.2182)	(4.1777)		
ϕ_o	—	—	—	—	—	—	-0.3259***	-0.1253	—	—
							(-1.648)	(-0.7034)		

*, ** and *** Significant at the 1%, 5% and 10% level respectively. [a] (-5,0) and (0,5) indicate pre and post-event five-day momentum windows respectively. [b] T-ratios in parenthesis.

date. Similarly, the impact of rating upgrades on the conditional volatility of returns was greater on the event date than during the five-day pre and post-momentum windows—compare ϕ_e in tables 4 and 5 under NL-032.

As indicated by the five-day *post*-event momentum window, there is evidence for an asset substitution effect in the State of Chihuahua offerings after Moody's rating upgrades—see CH-04 and CH-042 in Moody's panel. A similar finding is observed for FitchRatings upgrades where we find evidence for an asset substitution effect on the pre-event momentum window in both Chihuahua and Nuevo León offerings.

The estimated risk premium in all cases remains practically unaffected both in direction or magnitude except for the CH-042 issue, where the size of the risk premium before and after the rating change by Standard & Poor's was about ten times weaker relative to the event day.

Finally β_M, the measure of the local government systematic risk, remains low and highly significant in all cases except for TLAL-03 where β_M changes from positive and non significant to negative and significant during the pre-event five-day momentum window under Standard & Poors panel.

6 Conclusions and Discussion

Fiscal and financial reforms carried out in 2000 have encouraged a widespread presence of rating agencies in Mexico and have allowed several States and Municipalities to raise funds through bond offerings in the capital market. Any local government in Mexico intending to access credit and capital markets must count with at least one credit rating from one of the three main agencies: FitchRatings, Moody's and Standard & Poor's. This paper investigates the effect of rating change announcements by these agencies on returns of bond offerings by States, municipalities and local authorities in Mexico during the period November 2002 to October 2006. In addition to accounting for the systematic risk in a market model, we extend the process to examine the relationship between the level of market risk and returns, the effect of rating changes on the conditional volatility of bond returns and to capture the momentum in the market around a given rating change date.

This is one of the few empirical works investigating the effect of credit rating changes on State and Municipal bond returns. In line with Liu and Seyyed (1991) we find that credit ratings have a significant influence on bond returns. We also find that the market makes its own distinction between the information conveyed by each rating agency and reacts distinctively.

The results show in general a significant positive effect of rating changes on bond returns, providing support in favor of the Information Content Signaling Hypothesis (ICSH) for the cases considered in this study. This result adds to the findings of Ingram, et. al. (1983) for the U.S. municipal bond market and more recently to Folowill and Martell (1997) and Choy, et. al. (2006) for stock returns. While issuers in the Mexican Stock Market are required to provide all relevant financial information to the market, the findings in this article suggest that not necessarily all value affecting information is contained in the prospectus and the rating change might reveal sensitive non-public information and be an important signal to market participants. Liu and Seyyed (1991) in fact argue that information about municipal bonds is not as readily available as for corporate securities and when it is available it is less reliable, less timely and less comparable than information about corporations.

We also find an opposite reaction of bond returns to rating changes in some bond offerings indicating that either the Trust Fund Effect introduced in this paper or the Asset Wealth Redistribution Hypothesis (WRH) more than compensate the effect of ICSH. This is in line with the studies of Goh and Ederington (1993) in the U.S. market and Barron et. al. (1997) and Abad and Robles (2006) for the U.K., Australian and Spanish market respectively. Support for the WRH in this article could be interpreted as the result of an asset substitution effect where market participants decide to look for less risky instruments such as bonds after a rating downgrade to the local government is announced hence raising bond returns or the result of a Trust Fund Effect.

While Moody's rating changes announcements exert a positive impact on the conditional volatility of bond returns it is found that the effect of other related rating changes announcements on the variability of returns is otherwise mixed. In contrast, using a GARCH(1,1) model Barron et. al. (1997) found no significant change in excess return volatility after the assignment of new ratings, whereas Abad and Robles (2006) having accounted for GARCH type conditional heteroskedasticiy, do not provide estimates on the effect of rating changes on bond returns volatility.

In order to capture the *momentum* in the bond market before and after the rating change date announcement, we examined the impact of rating changes on returns by looking at two symmetric windows around the rating change date. With few exceptions, we find strong significant evidence in favor of market anticipation and post-reaction five days before and after rating changes respectively. We also find the response to a given rating change is stronger both in magnitude and significance on the event date. The occurrence of simultaneous rating-return changes is interpreted here as evidence of municipal bond market inefficiency.

Finally, we document significant time varying risk premiums, low systematic risk, a leverage effect in the volatility of bond returns, fat tails in the conditional distribution of returns and high persistence of shocks to volatility.

References

Abad-Romero, P. and D. Robles-Fernandez (2006). Risk and Return Around Bond Rating Changes: New Evidence from the Spanish Market. *Journal of Business Finance & Accounting*, Vol. 33, pp. 885–908.

Backus, D.K. and A.W. Gregory (1993). Theoretical Relations between Risk Premium and Conditional Variances. *Journal of Business & Economic Statistics*, Vol. 11, pp. 177–185.

Barron, M.J., A.D. Clare and S.H. Thomas (1997). The Effect of Bond Rating Changes and New Ratings on UK Stock Returns. *Journal of Business Finance & Accounting*, Vol. 24, pp. 497–509.

Bollerslev, T. (1986). Generalized autoregressive conditional heteroscedasticity. *Journal of Econometrics* 31, 307–327.

Campbell, J.Y. (1987). Stock Returns and the Term Structure. *Journal of Financial Economics*, Vol. 18, pp. 373–399.

Choy, E., S. Gray and V. Ragunathan (2006). Effect of Credit Rating Changes on Australian Stock Returns. *Accounting and Finance*, Vol. 46, pp. 755–769.

Cornell, B.; Landsman, W. and A.C. Shapiro (1989). Cross-sectional regularities in the response of stock prices to bond rating changes. *Journal of Accounting, Auditing and Finance*, Volumen 4, pp. 460–479.

Engle, R.F., Lillian, D.M. and R.P. Robins (1987). Estimating time-varying risk premium in the term structure: ARCH-M Model. *Econometrica* 55, 391–407.

Followill, R and T. Martell (1997). Bond review and rating change announcements: An examination of informational value and market efficiency. *Journal of Economics and Finance*, Springer, vol. 21(2), pages 75–82, June.

French, K. R., G. W. Schwert and R. E. Stambaugh (1987). Expected Stock Returns and Volatility. *Journal of* Financial *Economics*, 19, 3–29.

García-Romo, G., J. Ibarra-Salazar and L. Sotres-Cervantes (2005). Determinants of Mexican States Government Credit Ratings. *Draft* not published, Departament of Economics, Instituto Tecnológico de Estudios Superiores de Monterrey.

Glosten, L.R., R. Jagannathan and D.E. Runkle (1993). On the Relationship between the Expected Value and the Volatility of the Nominal Excess Return on Stocks. *The Journal of Finance*, Vol. 48, pp. 1779–1801.

Goh, J. C. and L.H. Ederington (1993). Is a bond rating downgrade good news, bad news or no news to stockholders? Journal of Finance, 48, 2001–2008.

Hernandez-Trillo, F. (1997). Es Disciplinado el Mercado Crediticio Estatal Mexicano?, Una Arista para el Nuevo Federalismo. *El Trimestre Económico*, Vol. 64, pp. 199–219.

Hernandez-Trillo, F., A. Diaz and R. Gamboa (2002). Determinants and Consequences of Bailing-Out States in Mexico. *Eastern Economic Journal*, Vol. 28, pp. 365–380.

Holthausen, R.W. and R.W. Leftwich (1986). The Effect of Bond Rating Changes on Common Stock Prices. *Journal of Financial Economics*, Vol 17, pp. 57–89.

Hochman, S. and M. Valadez (2004). Using Credit Ratings Can be an Effective Means of Instilling a Culture of Creditworthiness. In *Subnational Capital Markets in Developing Countries: From Theory to Practice*, Ed. Mila, F. The World Bank.

Ingram, R.W., L.D. Brooks and R.M. Copeland (1983). The Information Content of Municipal Bond Rating Changes: A Note. *The Journal of Finance*, Vol. 38, pp. 997–1003.

Liu, P. and F. J. Seyyed (1989). The Impact of Socioeconomic Variables and Credit Ratings on Municipal Bond Risk Premia. *Journal of Business Finance and Accounting*, Vol. 18, pp.735–746.

Nelson, D.B. (1991). Conditional Heteroskedasticity in Asset Returns: A New Approach. *Econometrica*, Vol. 59, pp. 347–370.

Reyes, M.G. (1999). Size, Time Varying Beta and Conditional Heteroskedasticity in UK Stock Returns. *Review of Financial Studies*, Vol. 8, pp. 1–10.

Scruggs, J.T. (1998). Resolving the Puzzling Intertemporal Relation between the Market Risk Premium and Conditional Market Variance: A Two Factor Approach. *The Journal of Finance*, Vol. 53, 575–603.

Wansley, J.W. and T.M. Clauretie (1985). The Impact of CreditWatch Placement on Equity Returns and Bond Prices? *The Journal of Financial Research*, vol. 8, pp. 31–42.

Yorio, G. (2006). Calificaciones de riesgo crediticio de los gobiernos estatales en México. Tesis Maestría en Economía. El Colegio de México.

Zaima, J.K. and J. McCarthy (1988). The Impact of Bond Rating Changes on Common Stocks and Bonds: Tests of the Wealth Redistribution Hypothesis. *The Financial Review*, Vol. 23, pp. 483–498.

Appendix

Table A.1 State and Municipal Bond Offerings 2001-2006.

State (S) / Municipality(M)	Rating[a] Issue	Rating[a] Issuer	Offering Date	Collateral	Size (mp)[b]	Maturity (years)	Rate	Spread / Rate[f]
Aguascalientes (M)	AAA	AA+	2001	Share Transfers	$ 90	5	CETES182[c]	0.90%
Morelos (S)	AA+	A	2001	Share Transfers	$ 216	7	TIIE28[d]	1.00%
San Pedro Garza García (M)	AAA	AA	2002	Share Transfers	$ 110	7	Fixed Rate	10.99%
Monterrey (S)	AAA	AA	2002	Share Transfers	$ 168	5	CETES182	0.90%
Zapopan (M)	AAA	AA	2002	Share Transfers	$ 147	5	CETES182	0.90%
Chihuahua (S)	AA+/AAA	A+	2002	Toll-Road Fees	$ 1,460	10	UDI[e]	7.50%
Guadalajara (G)	AAA	AA	2002	Share Transfers	$ 800	10	CETES182-91	1.40%
México (S)	AA	BB/BB+	2002	Payroll Tax	$ 334	5	CETES91	3.00%
México (S)	AA	BB/BB+	2002	Payroll Tax	$ 186	5	Fixed Rate	13.00%
México (S)	AA	BB/BB+	2002	Payroll Tax	$ 245	5	CETES91	3.00%
México (S)	AA	BB/BB+	2002	Payroll Tax	$ 619	5	M5	12.50%
Chihuahua (S)	AA+/AAA	A+	2002	Toll-Road Fees	$ 1,064	10	UDI	7.50%
México (S)	AA	BB/BB+	2003	Payroll Tax	$ 331	5	CETES91	3.00%
México (S)	AA	BB/BB+	2003	Payroll Tax	$ 285	5	CETES91	4.00%
Veracruz (S)	AA	A+	2003	Toll-Road Fees	$ 450	1.2	CETES182	7.95%
Guerrero (S)	AA+	A-	2003	Share Transfers	$ 860	12	CETES182-91	1.00%
Tlalnepantla de Baez (M)	AAA	AA	2003	Water Fees	$ 96	10	UDI	5.50%
San Pedro Garza García (M)	AAA	AA	2003	Share Transfers	$ 50	7	M5	9.50%
Guerrero (S)	AA+	A-	2003	Share Transfers	$ 480	12	CETES182-91	1.00%
Nuevo León (S)	AAA	A+/A	2003	Payroll Tax	$ 978	12	CETES182-196	2.25%
Hidalgo (S)	AAA	A+/A-	2003	Share Transfers	$ 700	7	CETES182	1.50%
Hidalgo (S)	AAA	A+/A-	2003	Share Transfers	$ 500	7	CETES28	1.50%
Aguascalientes (M)	AAA	AA+	2003	Share Transfers	$ 100	5	CETES182-91	0.85%
Nuevo León (S)	AAA	A+/A	2003	Payroll Tax	$ 738	12	CETES182-196	1.70%
Distrito Federal	AAA	AAA	2003	Share Transfers	$ 2,500	6	CETES182	0.75%
Sinaloa (S)	AA+	A/A-	2004	Share Transfers	$ 831	10	UDI	5.35%
Chihuahua (S)	AA	A+	2004	Toll-Road Fees	$ 1,000	10	CETES182	2.95%
Atlixco (M)	AAA	AA	2004	Toll-Road Fees	$ 520	15	Tasa Real	6.40%
Chihuahua (S)	AA	A+	2004	Toll-Road Fees	$ 750	10	CETES182	2.95%
Distrito Federal	AAA	AAA	2004	Share Transfers	$ 1,190	5	CETES91	0.72%
Distrito Federal	AAA	AAA	2004	Share Transfers	$ 500	5	TIIE28	0.32%
Nuevo León (S)	AAA	A+/A	2004	Toll-Road Fees	$ 2,246	25	UDI	5.70%
Chihuahua (S)	AA	A+	2005	Toll-Road Fees	$ 1,213	10	TIIE28	0.27%
Aguascalientes (M)	AAA	AA+	2005	Share Transfers	$ 100	5	TIIE28	0.50%
Distrito Federal	AAA	AAA	2005	Share Transfers	$ 800	10	Fixed Rate	9.99%
Nuevo León (S)	AAA	A	2006	Vehicle Tax	$ 2,676	30	Fixed Rate	6.18%
Nuevo León (S)	AAA	A	2006	Share Transfers	$ 2,413	2	TIIE28	0.49%
Distrito Federal	AAA	AAA	2006	Share Transfers	$ 1,400	10	TIIE28	0.29%
Veracruz (S)	AAA	A+	2006	Vehicle Tax	$ 1,107	30	TIIE182	0.95%

Source: Mexican Stock Exchange.

[a] Ratings by Fitch. [b] Millions of Pesos. [c] 182-day Treasury Bills. [d] 28-day Inter-Bank Equilibrium Rate. [e] Inflation Adjusted Unit of Investment. [f] The spread is shown for floating interest rates while fixed rates are shown as indicated.

Table A.2: Features of selected local government issues

	Chihuahua		Hidalgo	Nuevo León	Tlalnepantla
Ticker	CHIHCB-04	CHIHCB-042	EDOHGO 032	EDONL-032	FTLALCB-03U
Label	CH-04	CH-042	HGO-032	NL-032	TLAL-03
Bond Price	$MXP 100	$MXP 100	$MXP 100	$MXP 100	100 UDIS[a]
Rating of Bonds	AA	AA	AAA/mxAAA[c]	AAA	mxAAA
Program Offering	$MXP 1,750	$MXP 1,750	$MXP 1,200	$MXP 1676[b]	$MXP 95,900
Series Offering	$MXP 1,000	$MXP 750	$MXP 500	$MXP 738	$MXP 95,900
Issuance Date	Aug 13th, 2004	Sep 14, 2004	Oct 10, 2003	Nov 28, 2003	Jun 30, 2003
Maturity Date	Aug 1, 2014	Aug 1, 2014	Oct 1, 2010	Sep 18, 2015	Apr 20, 2013 Apr 20. 2014[d]
Maturity in years	10	10	7	12	10/11[d]
Spread	2.95%	2.95%	1.50%	1.70%	n.a.
Coupon periodicity	182 days	182 days	28 days	28 days	n.a.[e]
Collateral	Toll-road fees	Toll-road fees	Share Transfers	Payroll Taxes	Rights

[a]Inflation-adjusted Unit of Investment (UDI). [b]A first issue was made by the State of Nuevo León in this year for $MXP 978 million pesos. [c]Ratings by Fitch and Standard & Poors respectively [d]An extended period of redemption can be employed by the Tlalnepantla Water Authority (TWA) in order to suspend payments of principal or consequtive periods If this indenture is applied then the maturity of the credit is extended likewise. [e]Not applicable.