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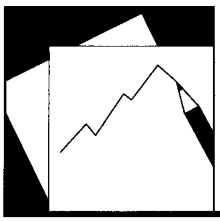

IMF Working Paper

Are There Spillover Effects from Munis?

Rabah Arezki, Bertrand Candelon and Amadou N. R. Sy

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Are There Spillover Effects from Munis?

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Abstract

This paper studies the spillover effects both within the bond markets for individual U.S. states and between the latter and the market for U.S. Treasury securities. We perform the Forbes and Rigobon (2002) spillover test using daily bond yield data over the period 2005 to 2011. Results are twofold. First, we find that between most markets for individual U.S. state bonds there are negative spillovers. In other words, an increase in borrowing costs in one U.S. state results in better borrowing conditions for other states. Second, we find no substantial spillover effect between shocks originating from state securities and from federal markets, except for a few large issuers. Using causality tests in the frequency domain, we find that the Treasury bond market directly causes changes in the markets for municipal bonds in both the short and long run. There is also some evidence of causality from the municipal to the Treasury bond market, but only of a long-run nature. Our results shed some light on the policy debate on the nature of spillover effects within fiscal unions.

JEL Classification Numbers: E44, G10, H77.

Keywords: Spillover, Bond Market, Fiscal Union.

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Contents

I. INTRODUCTION

The market for US municipal bonds, a $2.9 trillion tax-exempt bond market amounting to about a third of the US treasury market, has often been viewed as a safe haven by individual investors.[2] The most recent U.S. state to default was Arkansas in 1933, during the Great Depression.[3] Throughout history there have been but a handful of state defaults—10 in the aftermath of the U.S. Civil War and eight plus the then-territory of Florida during the 1830s and 1840s (Ang and Longstaff, 2011). But in the aftermath of the financial crisis, the safety of the muni market has been questioned, especially for its largest issuers: individual U.S. states and New York City. A relevant question is whether and how shocks to individual state bond market spread to other state bond markets. Another relevant question is whether shocks to individual state bond market spread to US treasury securities and vice versa. The present paper studies the potential spillover effects both within the bond markets for individual U.S. states and between the latter and the market for U.S. Treasury securities over the period 2005 to 2011.

The housing bust, the financial crisis, and the recession have devastated state and local tax revenues. As a result, the U.S. municipal bond market has experienced worrisome signs of instability. As shown in Figure 1, the average rate on municipal bonds at times surpassed the rates on U.S. Treasury securities. In normal times, rates on municipal securities are lower than on U.S. government offerings because of the tax benefits munis receive. The now higher borrowing costs for individual U.S. states reflect concerns about their future revenues and pension obligations, among other things. In addition, there is no bankruptcy mechanism governing state defaults, unlike Chapter 9 for municipalities. In other words, U.S. states can repudiate their debt. Under the 11th Amendment to the U.S. Constitution, individual states have the same sovereign immunity as countries, and states can be sued only with their consent.

For more than three years, states have responded to investor concerns with a series of measures to address both short- and long run fiscal issues—including cutting spending, raising taxes, borrowing, and turning to the federal government for help in keeping their budgets balanced. However, there is increasing concern that if a state defaults— and many face severe budget issues—the effects would spill over to other municipal securities and even affect the market for U.S. government securities. Also, with few places left to find savings, states are rolling back funds for cities, counties, and school districts. The resulting layoffs could become a drag on the national economy at a time when the recovery from the financial crisis still appears to be fragile. The recent Standard & Poor's downgrade of the U.S. credit rating from AAA to AA+ is a further concern. Although so far it has had little, if any, effect on U.S. Treasury securities, the one-notch downgrade has increased investor worries that U.S. state bond markets might face consequences were there financial disruptions in federal

[2] The 45,000. bond issuers include state and local governments, school districts, and water authorities that sell their debt securities in the so-called muni market.

[3] The Jefferson County, Alabama in November 2011 is the largest-ever U.S. municipal failure.

markets. Moreover, the prospect of more federal budget tightening could further erode already precarious state finances.

The literature on spillover effects in financial markets, which we review in the following section, is abundant, but has so far focused mainly on spillover effects between countries. The contribution of this paper is to explore the spillover effects within the same country namely the United States. The benefits of such a study are twofold. First, it allows us to study spillover between different entities within the same institutional arrangement and culture unlike in cross-country studies. Indeed, the lack of uniformity in institutional arrangements and culture as well as other unobservable or simply difficult to measure country specific features may lead to biases in the analysis of spillover between countries. Second, analyzing spillover effects within the same country allows us to study "bottom-up" spillover effects--from bond markets for individual U.S. states to the market for U.S. Treasury securities--and "top-down" spillover effects—from the market for U.S. Treasury securities to bond markets for individual U.S. states.

From a policy standpoint, this is quite important as many existing or would be fiscal unions ought to worry not only about the potential risk of spillover from countries outside their union but also from within their own union. In turn understanding the nature of those spillovers can help inform risk management strategies both at the supra-national and sub-national levels. The raging debate in Europe over whether there should be a stronger fiscal union and whether the issuance of a common euro bond would aid ailing euro area economies certainly illustrate the importance of studying spillover not only between countries but also within fiscal unions.

To study spillover effects in the markets for bonds of U.S. states and federal (that is, U.S. Treasury) securities, we empirically tested whether a shock specific to one market is transmitted to other markets. Our tests correct for the higher volatility observed during the financial crisis, starting in 2008 (Forbes and Rigobon, 2002).There are obvious linkages between U.S. states, as well as between states and the federal government (transfer payments being a good example). Those linkages could be invoked to explain spillover effects between various bond securities. In contrast, other factors such as investor psychology make spillover effects more difficult to explain. As a result, we focused on describing the nature of the spillover effects rather than trying to find a specific explanation for them.

The results presented in this paper are twofold. First, we find that between most markets for individual U.S. state bonds there are negative spillovers. In other words, an increase in borrowing costs in one U.S. state results in better borrowing conditions for other states. Second, we find no substantial spillover effect between shocks originating from state securities and from federal markets, except for a few large issuers. Using causality tests in the frequency domain, we find that the Treasury bond market directly causes changes in the markets for municipal bonds in both the short and long run. There is also some evidence of causality from the municipal to the Treasury bond market, but only of a long-run nature. The remained of the paper is organized as follows. Section II reviews briefly the so-called spillover literature and presents the Forbes-Rigobon test. Section III presents the main results. Section IV concludes.

II. SPILLOVER LITERATURE AND TEST

A. Spillover Literature

The literature has traditionally used the evolution of cross-units correlation to investigate the existence of potential spillover. Theoretically, there are two main strands of literature. First, the non-crisis-contingent theories consider that the propagation of shocks does not lead to a shift from a good to a bad equilibrium, but that the increase in cross-correlation is the continuation of linkages (trade and/or financial) existing before the crisis. This form of contagion is often referred to as a "strong form of contagion".

Second, the crisis-contingent theories motivates the increase in market cross-correlation after a shock in several ways including multiple equilibria based on investor psychology, endogenous liquidity shocks causing portfolio decomposition, and/or political disturbances affecting the exchange rate regime. The transmission of the crisis and the subsequent increase in cross correlation between markets is often referred to as a "weak form of contagion" or "shift-contagion". [4] Such an approach does not specify the channels of transmission which might be unstable and crisis-dependent. Empirical tests for weak form of contagion avoid the identification of transmission channels and focus on changing patterns of cross-market correlation. For example, the propagation of the Asian crisis from Thailand to Indonesia is revealed by a higher correlation between returns of these financial markets during the crisis period. This correlation breakdown has been considered by several empirical studies (see for instance King and Wadhwani, 1990, Calvo and Reinhart, 1995 and Baig and Goldfajn, 1998). Forbes and Rigobon (2002) (FR hereafter) shows that an increase in the unconditional correlation during a crisis may fallaciously lead to support for shift-contagion whereas it is simply driven by an increase in volatility. They thus propose to robustify the correlation for this potential bias in order to investigate the existence of shift-contagion. When considering the 1994 Mexican and the 1997 Asian crises the hypothesis of shift contagion is rejected using the FR test.[5]

B. The Forbes and Rigobon's Test

In the following, we present the linear framework used in Forbes and Rigobon (2002). Formally, the basic specification is a *VAR(p)* model with the following form:

$$x_t = \Phi(L)x_t + \psi(L)z_t + \eta_t,$$

[4] Masson (1999) considers the particular case of "false" shift-contagion, where the increase in cross-correlation may be due to the simultaneous occurrence of macroeconomic shocks across countries. According to the "monsoonal effect" theory, this artifact of shift-contagion is likely to happen as macroeconomic shocks are correlated.

[5] Several recent papers have proposed other test for shift contagion. We subsequently discuss the relative performance of those tests vis-à-vis Forbes and Rigobon test.

where $x_t = (x_{i,t}, x_{j,t})'$ is a bivariate vector composed of yields associated with municipal bonds issued by states *i* and *j*, z_t is a set of exogenous variables used to control for common shocks such as S&P 500 returns, η_t the residuals of the *VAR* model and *p* the optimal lag order determined using the Akaike information criterion. The model requires to be correctly specified so that residuals correspond to idiosyncratic (i.i.d) shocks. The covariance matrix $\sum = \eta_t{}'\eta_t$, is symmetric composed of the variance of $\eta_{i,t}$ and $\eta_{j,t}$ on the diagonal and composed of the latter residuals correlation ρ out of the diagonal. An increase in ρ constitutes evidence of a higher level of synchronization between shocks and thus higher co-movement. Forbes and Rigobon (2002) further show that using unconditional correlation, ρ, between residuals to assess spillover effects is misleading when volatility changes over time. Indeed, they prove that an increase in the unconditional correlation during a crisis may fallaciously lead to support for shift-contagion whereas it is simply driven by an increase in volatility. They thus propose to robustify the correlation for this potential bias in order to investigate for contagion. Formally, FR correction is as follows:

$$\rho_t^u = \rho_t \sqrt{\frac{1+\delta_t}{1+\delta_t \rho_t^2}},$$

where ρ_t^u is the unadjusted (or conditional) correlation coefficient, ρ_t is the actual (or unconditional) correlation coefficient, and δ_t is the relative increase in the variance of x_t:

$$\delta_t = \frac{\sigma_{xx}^{high}}{\sigma_{xx}^{low}} - 1,$$

where σ_{xx}^{high} is the VAR residuals' variance in the sub-sample with high variance and σ_{xx}^{low} is the variance in the low variance sub-sample.

While Forbes and Rigobon remains commonly used in the empirical literature on spillover, several other spillover tests have been recently put to the fore including Favero and Giavazzi (2002), Bae et al. (2003) and Pesaran and Pick (2007) to name but a few. Dungey et al. (2005) evaluate the relative performance of these tests using Monte Carlo simulations. They found evidence that Pesaran and Pick test is "under-sized." In other words, Pesaran and Pick test points too often to the absence of spillover effects. In contrast Bae et al. and Favero and Giavazzi tests is found to be "over-sized." In other words the later test points too often to the presence of spillover effects. Dungey et al. (2005) found that a version of Forbes and Rigobon test, where the low and high volatility sub-samples are independent, performs relatively better than the other tests. In the present analysis we thus use the very same version of the Forbes and Rigobon test as in Dungey et al (2005).[6]

[6] As a robustness check we also used two other versions of the Forbes and Rigobon test detailed in Dungey et al. (2005). Note that Dungey et al. (2005) also recommend the use of a multivariate version of the Forbes and Rigobon which is impracticable in our case given the large number of states involved. We found that the main result presented in the present paper is unchanged. Results are not reported in tables but are available upon request.

III. MAIN RESULTS

In this section we present the results of two main exercises using daily 10-year municipal and treasury bond yields data from Bloomberg for the period going from 01/01/2005 to 01/13/2011. **The 10-year Treasury yield is the constant maturity yield. The yield for each state for each month is estimated from a yield curve populated with general obligation bonds issued by the state government and municipalities in the state. All bonds have the same average rating as the state general obligation. The option-free yield curve is built using option adjusted spread model. The yield curve is based on contributed pricing from the municipal securities' rule-making board, new issue calendars, and other proprietary prices contributed to Bloomberg.**

Figures 2 and 3 show the evolution of the twenty two largest US municipal bond issuers included in our sample. First, we consider the potential spillover between those municipal bond markets. Second, we consider the potential spillover between municipal bond market and treasury securities. As discussed the above section, we first need to identify a break date such that the increase in the VAR residuals' variance between the two resulting sub-samples is maximum. We find the break date to be August 29th, 2008 as illustrated in table 1.[7]

A. Within Muni Spillover

Table 2 reports the FR spillover test statistics. The statistic follows asymptotically a student distribution so that a test statistics higher (lower) than 1:96 supports (rejects) the presence of spillover. The sign of the test statistic is also important as a positive test statistic for a given pair of states indicates that a negative or positive shock in a one bond market is associated with a similar co-movement in the yield of the other state bond market. On the contrary, a negative test statistic for a given pair of states indicates opposite co-movement between the yields of those two states' bond markets. Overall, the results indicate that during a period of volatility, investors seek "safer" municipal investments—a sort of "flight to safety" that occurs during financial crises when investors (domestic and international) become less concerned about yield and more concerned about the safety of their funds and buy U.S. Treasury securities, long considered one of the world's safest investments. In other words, an increase in borrowing costs in one U.S. state results in better borrowing conditions for other states. We find that other states benefit through lower borrowing costs (bond yields) when a few of the largest municipal issuers—such as the states of California (the largest of all), Georgia, and Maryland and the City of New York—experience problems (in other words, the spillover is negative).

In this paper, we do not study in detail the transmission channels between different muni markets. One potential explanation for our present finding is that domestic US retail

[7] The main results presented in this paper are robust to alternate break date.

investors, the main holders of state debt, invest through muni bond funds.[8] Muni bond funds are dedicated mutual funds which hold portfolios of muni bonds. Our results could thus suggest that those funds, perhaps because of their dedicated nature, reallocate funds to other state bonds (as opposed to other type of securities), following a negative shock to a particular state bond market.

In addition to higher yield, technical considerations such as lower market liquidity and worsening credit rating quality below a particular threshold can lead to portfolio rebalancing by institutional investors seeking to comply with their investment mandate. Tax considerations are also important for municipal bond investors, for instance, investors resident in a particular state benefit from state and local tax exemptions, which could lead them not to sell such bonds even following a negative shock. This behavior would lead to low or no correlation between bonds issued by different states. In contrast, a market selloff following a herding behavior by investors would affect most of the asset class and lead to positive correlation between different states.

There are a handful of states, such as Connecticut and Florida, where the correlation is positive— that is, their borrowing costs increase when another state is having problems. On balance, though, market participants so far have not penalized most U.S. states when there is heightened stress in another state's bond market.

B. Bottom-Top and Top-Down Spillover

Table 3 provides the FR test statistics between treasury securities and municipal bonds. Overall, we found no substantial spillover effects between shocks originating from state securities and federal markets, except for a few large issuers. Indeed, for a few states that are among the largest borrowers, we found that problems in their market can lead to troubles in the federal market. We found evidence of positive spillover—albeit below the conventional level of significance—between the U.S. Treasury market and the markets for New Jersey, Texas, Washington state, and New York City—with the strongest result for New York City. But when it comes to the largest municipal bond issuer in the United States, California, we found a negative spillover with the market for U.S. Treasury securities. Our results indicate that the yields on bonds issued by the state of California and those on federal government securities move significantly in opposite directions following a shock to both bond markets. Overall, our analysis suggests that in only a few key states are bond markets linked with the Treasury bond market. A shock to the bond market in one of these states may lead to heightened instability in the Treasury bond market. To evaluate the robustness of our results, we used additional lags and controlled for S&P 500 returns. We concluded that our findings were robust.

[8] Data from the Federal Reserve Board indicate that as of 2010, holders of US muni bonds included households (37 percent of total), mutual funds (18 percent), property and casualty insurance (12 percent), money market funds (11 percent), commercial banks (9 percent), life insurance (4percent), and other investors (9 percent).

C. Causality

One remaining question was whether the spillover between the municipal bond market and the Treasury bond market is short run, long run, or both. We also needed to sort out the direction of the shocks—whether they went primarily from the Treasury market to the muni markets or vice versa. The empirical tests we used to determine spillovers do not say much about the direction of the transmission of shocks. The approach is also silent on whether the evidence is of a short term or long-term nature.

To explore this avenue, we used a causality test that allowed us to sort out which way shocks are transmitted and whether they have a short- or long-term effect (Breitung and Candelon, 2006). The test consists in a granger causality test in the frequency domain, indicating whether the null of no causality cannot be rejected and whether the frequency is close to zero (far from zero) implying a long (short) dependence. Figures 4 and 5 present the causality test statistics in the frequency domain respectively from municipal to treasury bond yields and from treasury to municipal bond yields.

Using Breitung and Candelon test, we found that the Treasury bond market directly causes changes in the markets for municipal bonds in both the short and long run. There is also some evidence of causality from the municipal to the Treasury bond market, but it is only of a long-run nature. Depending on whether the spillover effects between states and between state securities and federal markets are positive or negative, those results suggest that structural reforms that have a positive impact on the federal budget in the long run will also benefit or worsen the borrowing condition of U.S. states. Similarly, reforms at the state level should help either reduce or increase the cost of borrowing for the federal government.

IV. Conclusion

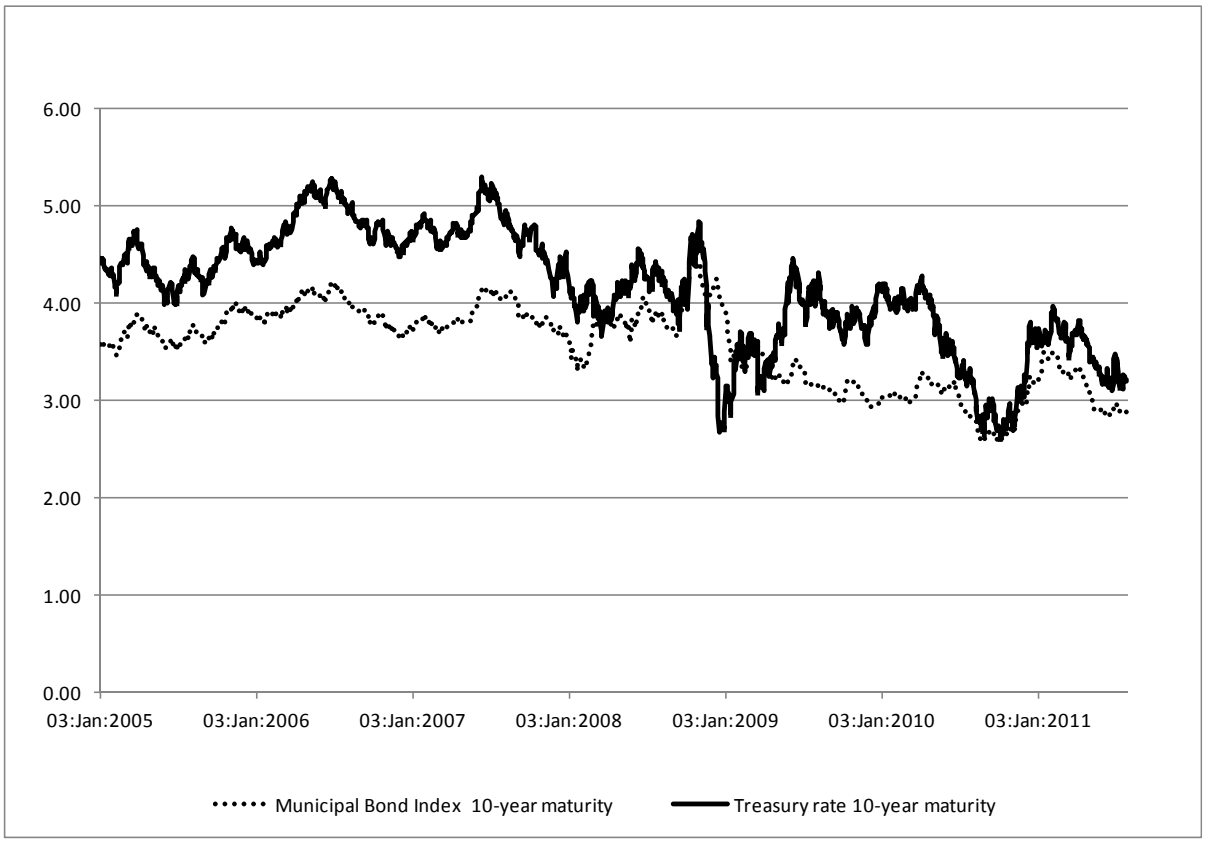
This paper has investigated the spillover effects both within the bond markets for individual U.S. states and between the latter and the market for U.S. Treasury securities. We found that between most markets for individual U.S. state bonds there are negative spillovers. In other words, an increase in borrowing costs in one U.S. state results in better borrowing conditions for other states. We also found no substantial spillover effect between shocks originating from state securities and from federal markets, except for a few large issuers. Using causality tests in the frequency domain, we found that the Treasury bond market directly causes changes in the markets for municipal bonds in both the short and long run. There is also some evidence of causality from the municipal to the Treasury bond market, but only of a long-run nature.

There are potentially important policy lessons to be drawn from that evidence of spillover from and within the muni market—and they are not limited to the United States. Fiscal unions with developed bond markets for securities issued by states or provinces should not simply worry about the potential spillover from neighboring countries but also investigate thoroughly the nature of the spillover across their sub-national bond markets and between those markets and their supra-national bond market. The design of risk management policies must be informed by the nature of those linkages and adapted to their evolving nature. In

Europe, a debate is raging over whether there should be a stronger fiscal union and whether the issuance of a common euro bond would aid ailing euro area economies.

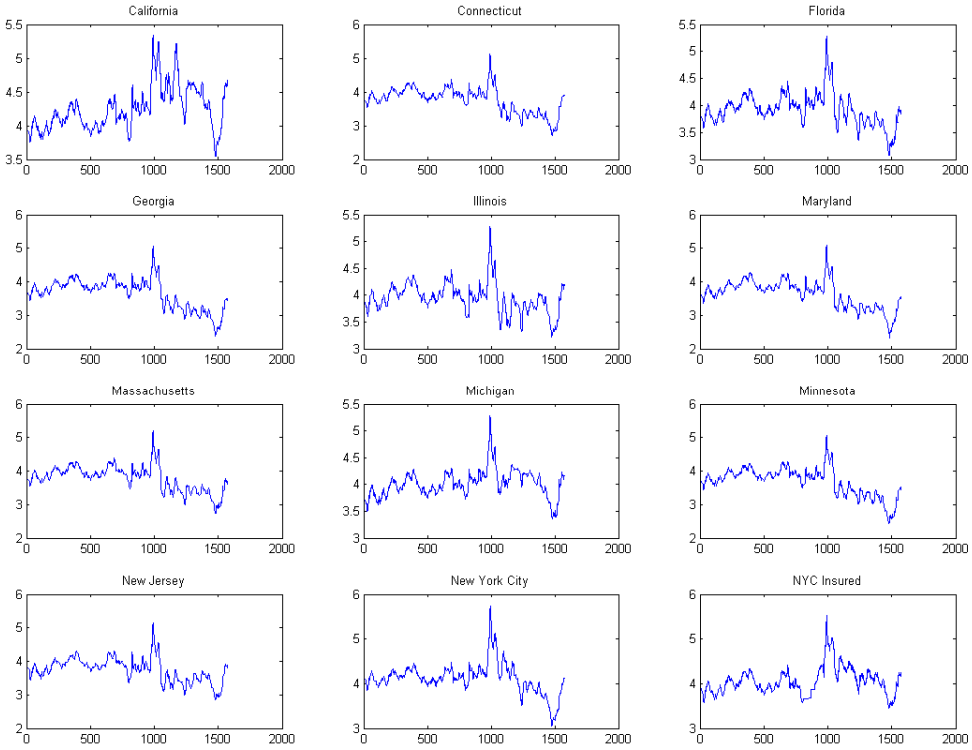
But it is important to reflect on the impact that such fiscal union would have on linkages between bond markets in euro area economies. This study suggests that the markets for individual U.S. state bonds are prone not to contagion but rather to flight to quality, which implies that the problems in one state did not make matters worse for other states and thus did not increase systemic risk. Would this be a byproduct of more fiscal union? Further research is needed to help answer this important question, perhaps by providing further insights both theoretically and empirically.

Figure 1. Evolution of Treasury and Municipal Bond Yields



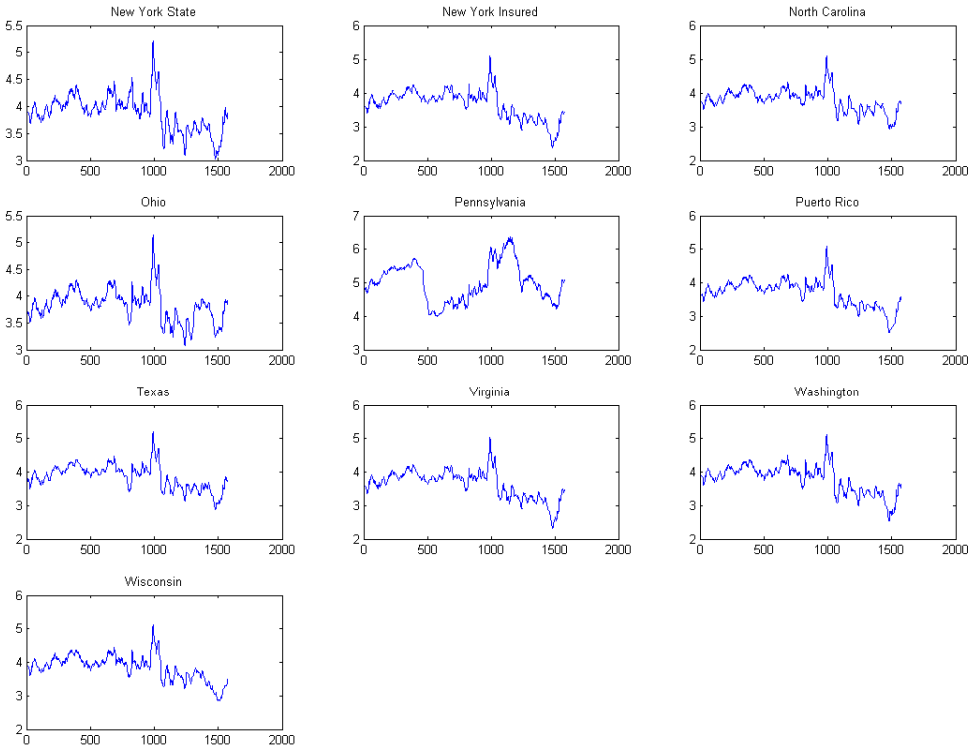
Note: Data are from Bloomberg and Haver Analytics.

Figure 2. Evolution of the Ten-Year Municipal Bond Yields



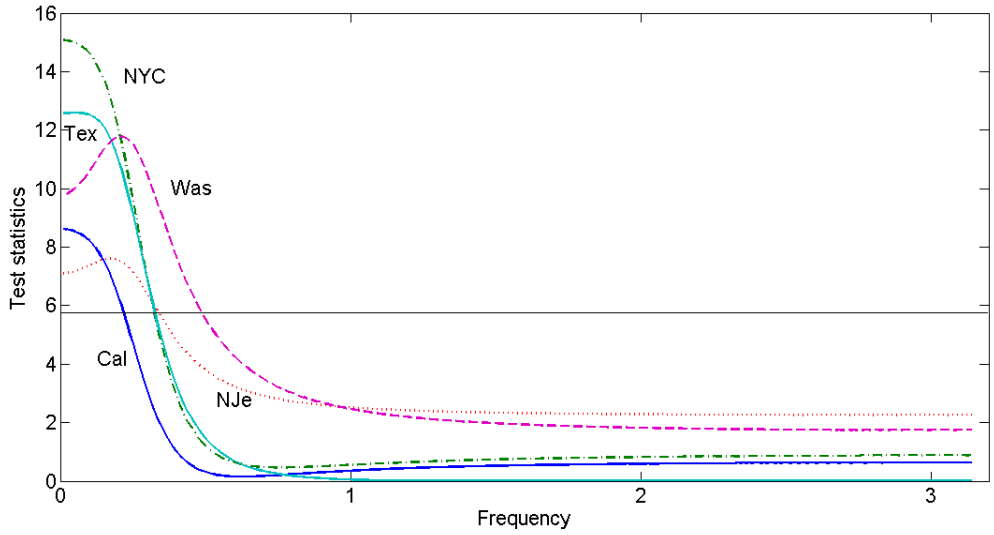
Note: The graphs use ten-year municipal bond yields from Bloomberg.

Figure 3. Evolution of the Ten-Year Municipal Bond Yields



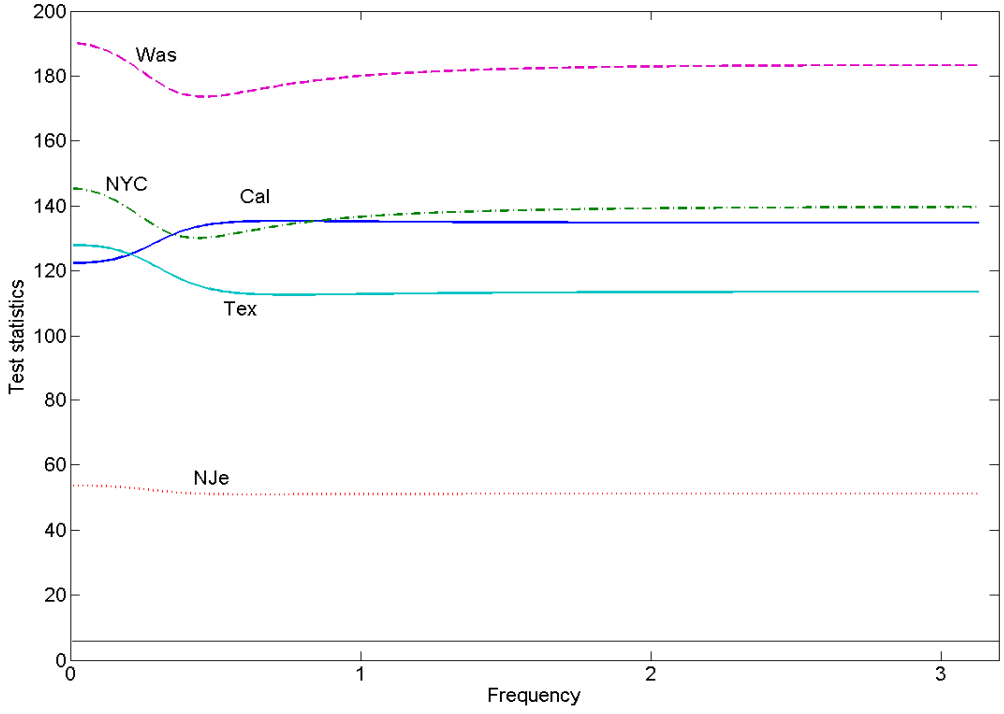
Note: The graphs use ten-year municipal bond yields from Bloomberg.

Figure 4. Causality Test Statistics in the Frequency Domain from Municipal to Treasury Securities



Note: The solid line indicates the critical value of the test statistics at the 95 percent confidence level.

Figure 5. Causality Test in the Frequency Domain from Treasury to Municipal Securities



Note: The solid line indicates the critical value of the test statistics at the 95 percent confident level.

Table 1. Volatility Before and After the Break Date

Munis	σ_{low}	σ_{high}
California	0.1661	0.3647
Connecticut	0.2053	0.4430
Florida	0.1732	0.3996
Georgia	0.1680	0.5047
Illinois	0.1739	0.3709
Maryland	0.1839	0.4677
Massachusetts	0.1717	0.4457
Michigan	0.1658	0.3277
Minnesota	0.1663	0.4988
New Jersey	0.1874	0.4222
New York City	0.1266	0.5128
NYC Insured	0.1876	0.3786
New York State	0.1602	0.4017
North Carolina	0.1681	0.4926
Ohio	0.1596	0.4093
Pennsylvania	0.1755	0.3777
Puerto Rico R.	0.5062	0.6068
South Carolina	0.1691	0.4688
Texas	0.1964	0.4261
Virginia	0.1689	0.4910
Washington	0.1755	0.4748
Wisconsin	0.1743	0.4426

Note: σ_{low}, σ_{high} are the standard deviations of municipal bond yields over respectively the "low" and "high" volatility sub-sample periods. The break date is set to August 29th, 2008 so as to maximize the increase in volatility between any two sub-sample periods.

Table 2. Forbes-Rigobon Test Statistics between Municipal Bond Yields

	Con.	Flo.	Geo.	Ill.	Mar.	Mas.	Mic.	Min.	Nje	NYC	NYC I	NYS.	Nca.	Ohi.	Pen.	PRR	Sca.	Tex.	Vir.	Was.	Wis.
Cal.	6.30	-3.43	-4.50	0.20	-5.54	-4.64	-5.73	-4.55	-4.78	-1.43	-2.11	-3.25	-4.84	-5.19	-6.63	-4.26	-4.67	-5.33	-4.16	-6.01	-4.38
	Con.	11.65	9.14	11.98	9.62	8.56	14.94	8.64	11.17	9.10	11.12	13.76	9.39	8.53	11.75	9.04	9.10	10.42	9.30	8.08	8.07
		Flo.	2.51	11.07	-1.22	5.70	1.97	3.65	3.40	1.95	-5.01	4.15	2.68	-1.07	4.10	-3.23	1.83	2.03	3.27	2.37	-2.48
			Geo.	12.10	-8.63	3.66	-3.21	-2.47	-2.08	3.02	-2.90	0.69	-4.85	0.75	-1.23	-4.13	-7.44	1.90	-4.33	-2.39	-3.75
				Ill.	8.56	9.71	8.58	6.55	12.61	-1.74	-1.61	15.15	12.34	11.06	15.38	3.44	9.22	9.82	9.39	10.98	7.91
					Mar.	5.73	-5.60	-2.49	-3.92	1.45	-3.69	-0.79	-1.71	-1.89	-2.49	-4.54	-8.90	0.18	-3.62	-3.26	-4.48
						Mas.	1.94	4.26	5.71	1.22	-4.61	3.12	4.26	-4.21	1.27	-2.12	2.63	-1.21	5.02	3.37	-0.26
							Mic.	-4.09	-1.74	1.60	-2.80	2.62	-2.21	1.05	-1.70	-2.01	-3.96	2.64	-4.26	1.94	-2.40
								Min.	0.19	1.49	-3.55	3.51	1.19	0.78	0.55	-2.96	-2.19	3.23	-1.48	3.05	-0.65
									Nje	4.92	-2.89	3.39	-2.24	0.56	0.73	-4.34	-2.05	3.00	0.33	0.86	-0.13
										NYC	-0.51	3.43	3.12	-0.49	4.85	2.27	1.48	0.87	1.07	1.61	-0.28
											NYC I	-5.11	-3.33	-8.36	-4.21	-0.82	-5.56	-4.16	-5.45	-6.90	-8.28
												NYS.	0.09	0.37	2.83	-1.89	0.67	2.66	2.13	0.80	-1.60
													Nca.	-1.10	-1.14	-3.64	-4.56	2.15	-0.54	0.30	-2.56
														Ohi.	-0.75	-2.87	-0.61	-3.22	0.41	-1.22	-5.61
															Pen.	-3.55	0.42	3.81	0.40	0.15	-0.07
																PRR	-2.46	-1.60	-2.92	-4.14	-4.62
																	Sca.	-0.14	-6.82	-1.28	-2.86
																		Tex.	2.10	0.82	-3.95
																			Vir.	1.24	-0.56
																				Was.	-6.58
																					Wis.

indicates a significant negative spillover at 95 percent confidence level

indicates a significant positive spill-over at 95 percent confidence level

Note: The twenty two municipal bond yields are filtered out by a VAR(2) and conditionned by the ten-year US bond yield and the S&P 500 return
The break date is set to August 29th, 2008.

Table 3. Forbes-Rigobon Test Statistics between Municipal and Treasury Bond Yields

	Cal.	Con.	Flo.	Geo.	Ill.	Mar.	Mas.	Mic.	Min	NJe.	NYC	NYCI	NYS.	NCa.	Ohi.	Pen.	PRR.	SCa	Tex.	Vir.	Was.	Wis.
2lags	-1.09	-0.78	0.55	-0.03	-0.46	0.13	-0.51	-0.25	0.49	1.10	1.79	-0.22	-0.71	-0.14	0.11	-0.54	-0.01	0.39	1.42	-0.85	1.56	-0.51
2lags+SP500	-0.78	-0.11	0.82	0.25	-0.23	0.39	-0.28	-0.08	0.78	1.46	1.88	0.05	-0.51	0.16	0.24	-0.24	0.02	0.67	1.65	-0.59	1.80	-0.26
4lags	-1.80	-0.24	0.31	-0.12	-0.55	0.02	-0.73	-0.47	0.32	0.81	1.55	-0.63	-0.92	-0.40	-0.44	-0.66	-0.06	0.13	1.06	-1.41	1.22	-0.56
4lags+SP500	-1.76	0.07	0.31	-0.15	-0.64	0.04	-0.82	-0.57	0.33	0.76	1.62	-0.40	-1.01	-0.38	-0.58	-0.72	-0.27	0.03	1.05	-1.48	1.24	-0.64

Note: The twenty two municipal bonds are filtered out by a VAR with either two or four lags and when indicated conditioned by S&P 500 returns. The break date is set to the 29th August, 2008.

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