THE INFORMATION RELEVANCE OF GOVERNMENT-WIDE FINANCIAL REPORTING: EVIDENCE FROM THE PUBLIC CAPITAL MARKETS

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Abstract

I examine the relevance to credit analysts and investors of information presented in the government-wide financial reports of municipalities. Government-wide, accrual-basis measures such as those required by GASB Statement 34 are potentially useful for assessing local government credit quality and pricing local government bonds because most local governments have capital-intensive infrastructure assets. I examine information relevance in the context of municipal bond credit analysis, primary market pricing, and secondary market pricing of new issue municipal bonds. I find that government-wide financial information does have incremental value relative to traditional fund-based measures. However, I also find that fund-based measures are far more relevant for assessing default risk and for pricing new issue municipal bonds. The clearest evidence of information relevance of the government-wide information for pricing efficiency in the secondary market. These results have implications for our understanding of the implications of accrual-basis accounting in US governments.

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1. INTRODUCTION

Governmental Accounting Standards Board Statement No. 34 - *Basic Financial Statements - and Management's Discussion and Analysis - for State and Local Governments* (GASB No. 34) - requires state and local governments to present, among other information, a set of government-wide financial statements prepared on an accrual basis. Some GASB stakeholders, especially small and medium-sized local governments, have questioned the value added of these statements. Most jurisdictions have now issued at least five years of financial reports based on this new reporting model, and governmental accounting research has begun to examine directly the long-term costs and benefits of this model.

In this paper I examine the relevance to the public capital markets of government-wide financial information. I use data from a national sample of municipalities - defined here as incorporated cities, counties, villages, towns, and townships - to determine whether government-wide financial performance and financial position measures have unique information relevance compared to similar fund-based measures. In doing so I extend our understanding of how government-wide financial information matters in two important ways. First, I examine these effects in the context of municipal governments. There are two main reasons we might expect the government-wide statements of local governments to have special relevance to the capital markets. First, municipal governments maintain extensive networks of infrastructure assets like roads, bridges, and d are the context for previous research in this area (Plummer, Hutchison, and Patton 2007), most municipal governments maintain extensive networks of infrastructure assets like roads, bridges, and sewers. The public capital markets are the principal source of financing for local public infrastructure, so we might expect bond raters and investors to closely monitor municipal government-wide measures more carefully than similar measures for schools and other local government units. I test this claim directly.

A second unique aspect of municipal governments is the relationship between government wide revenues and expenses. General government services like public safety and public health generate expenses but do not generate revenues. Rather, these services are subsidized by general, non-exchange revenues like property taxes and sales taxes. Government-wide expenses often exceed government-wide revenues by several multiples, and most financial performance measures from Statement of Activities are skewed negatively as a result. It seems reasonable that this information reflect this form of subsidy as low quality accruals, or whether differences in relative degrees of "negative performance" are information relevant. In other words, is "less negative" on a key performance indicator synonymous with better performance? Here I provide the first known analysis of this question among municipal governments.

The second contribution is that I examine the implications of government-wide information for several different capital markets outcomes, including: 1) bond ratings, 2) interest costs on new bond issues, and 3) prices on secondary market transactions. There is a rich literature on accounting and public capital markets, and much of it examines

the implications for perceived default risk of accounting policy choices and of particular kinds of disclosures. Research in this area has begun to examine whether accrual-based measures of overall financial condition and financial position are reflected in bond ratings. Plummer, Hutchinson, and Patton (2007) report findings from the first known analysis along these lines. They found the statement of net assets is relevant compared to fund-based measures like fund balance, but the accrual "earnings" measure from the statement of activities is not informative relative to fund-based earnings measures. I apply a methodology similar to theirs in the context of municipal governments.

Default risk is one of the many different characteristics of an issuer and its bonds that matter to the public capital markets. Buy-side analysts, portfolio managers, hedge funds, and other institutional investors also conduct credit analysis that could be informed by accrual-based financial information. For example, a jurisdiction with aging infrastructure that will require extensive capital investments will likely issue more new bonds than a jurisdiction whose infrastructure is comparatively new. An investor considering taking up a position in a jurisdiction's bonds, but unsure of when to do so, could get information information relevant to that decision from the Statement of Net Assets. That statement reports the condition of an entity's capital assets, outstanding debt used to finance those assets, and the need for future borrowing. Similar information could also be extrapolated from the Statement of Net Assets about a jurisdiction's ability to borrow relative to debt ceilings and other debt limits, whether it can restructure its service delivery obligations and the infrastructure required to deliver those services, and many other factors that have implications for the supply, demand, and prices of municipal bonds. I address this question by examining how information presented in government-wide financial statements affects bond pricing in both the primary (i.e. new issue) and secondary (i.e. transactions in a bond after its initial reoffering period) markets.

The findings suggest the information presented in government-wide financial statements is relevant compared to fund-based measures. However, that relevance varies across the different stages of the capital markets. At the ratings stage, government-wide financial position measures bring about a statistically significant improvement in default risk prediction, but the substantive significance of the traditional fund-based measures is far greater. I observe a similar relationship between government-wide financial performance measures on interest rates on new municipal bonds. Here the government-wide measures matter, but add little explanatory power. I also find that government-wide measures have the strongest information relevance in the secondary market for municipal bonds (i.e. trades in bonds that occur after the initial reoffering period). Here I find that government-wide financial position and financial performance measures are statistically and substantively significant in several different model specifications, where comparable fund-based measures. I also find that different government-wide measures matter in different ways to different types of secondary market investors. Specifically, the government-wide financial performance measures are a significant determinant of price volatility for transactions between bond brokers/dealers, but not for transactions between dealers and other customers, and the financial position measures are a significant influence on price volatility for trades between dealers and customers, but not for

trades between dealers. These findings from the secondary market suggest that different investors use different types of government-wide financial information in their respective bond pricing evaluations.

This research contributes to three areas of the accounting literature. First, it adds further evidence on the relevance of accrual accounting measures presented by governmental entities. Accruals are still new to government and it is currently unclear how they are incorporated into analysis of government financial condition. Second, it advances our understanding of how financial information is used in assessments of local government credit quality. One potential implication of the recent financial markets turbulence is that local governments will reverse the decades-long growth in revenue-backed bonds. Credit quality for revenue bonds is determined mostly by the stability of the revenue stream that supports the debt. Current speculation is that issuers will return to issuing bonds backed by general revenues. Should this happen, issuer financial condition will become one of if not the most important factor in determining issuer credit quality, and government-wide financial information is central to that assessment. And third, this study speaks to the role of accounting and financial information in municipal credit analysis broadly. Aside from guidelines issued by the ratings agencies, there is little systematic evidence on how bond raters, buy-side analysts, portfolio managers, and other market participants use financial statements. The limited evidence (Robbins and Simonsen 2009) shows that analysts are attuned to financial statement information and its timely disclosure.

The rest of this paper is organized as follows. In the next section I develop six hypotheses about the relationship between government-wide financial information and key outcomes in the public capital markets. As mentioned, those hypotheses are taken directly from previous work on the relationship between government-wide variables and default risk. The third section explains the variables and data used to collect those hypotheses. The fourth section presents the findings, and the fifth section summarizes those findings and presents some thoughts for future research.

2. HYPOTHESIS DEVELOPMENT

GASB 34 was designed to expand governmental accounting's traditional focus beyond near-term financial activity to include information on long-term, or "economic resources," condition. Discussions of the new accounting/reporting model presented in Statement 34, the arguments for and against its adoption (Copley, et. al. 1997), and some of its initial consequences have been provided elsewhere and require no summary here.

Following Plummer, et. al. (2007), I test several hypotheses based on the claim that the government-wide financial measures provide incremental information relative to similar fund-based measures.[1] Those measures fall in two categories - financial performance

[1]My specifications are different from Plummer, et. al. in two ways. First, I do not include a direct measure of the jurisdiction's performance. In their analysis of public schools Plummer, et. al. use the weighted average daily attendance, a commonly cited school performance indicator. Many municipalities do similar types of performance measurement, but those measures are not uniform across jurisdictions.

and financial position. Government-wide financial performance measures are presented on the Statement of Activities that are compared to figures from the fund-based Statement of Changes in Revenues, Expenditures, and Fund Balance, and government-wide financial position measures presented in the Statement of Net Assets, that I compare to measures from the Balance Sheet that cover essentially the same general government services and activities. If information in the government-wide statements is not relevant, the commonly-held explanation is that the market perceives them as lower quality accrual basis statements that provide no incremental information relative to the governmental funds statements (Plummer, et. al. 2007).

There is a rich literature on accounting and public capital markets on the implications for credit ratings of selected accounting policy choices. Credit ratings are an appropriate place to study the implications of financial reporting because of the intuitive relationship between financial condition and default risk, because of the sheer size of the public capital markets[2], and because default risk is a focal point for many of the day-to-day activities of government financial management. I test the following hypothesis:

H1: There is a significant association between the accounting information provided by government-wide financial statements and municipal default risk.

To test this hypothesis, again following Plummer, et. al. (2007), I use two government-wide measures that parallel fund-based measures used throughout accounting and capital markets research (Wilson 1983; Apostolou et al. 1985): revenues less expenses and total net assets. Following Plummer, et. al I also allow the relationship between default risk and total net assets to vary depending on whether the jurisdiction's total net assets are above or below the median for all jurisdictions.

The second hypothesis follows from the claim that the different components of total net assets each provides relevant information:

H2: There is a significant association between the separate components of total net assets (*INVCAP*, *RNA*, and *UNA*) and municipal default risk.

Again following Plummer, et. al. I expect *INVCAP* to be inversely related to default risk because lower capital-related debt should be associated with lower default risk. I also expect unrestricted net assets *UNA* to associate with lower default risk because higher levels of slack resources indicate the jurisdiction has resources available to pay debt service in the event of a financial downturn. A related recent paper by Marlowe (2008) finds that unrestricted net assets are reflected in both credit ratings and borrowing

Second, unlike Plummer, et. al. I do not include a measure of growth in demand for services, mostly to avoid the econometric problems of including both stock and flow variables in a single model.

[2]For instance, according to the Federal Reserve, at the end of 2007 there were nearly 2 million outstanding municipal securities, issued by more than 50,000 distinct issuers, with a total par value exceeding $2.5 trillion. In 2007, more than $6 trillion in par value of these bonds was exchanged in more than 8.6 million secondary market transactions.

costs on new issue municipal bonds. I allow these relationships to vary on whether the jurisdiction has high or low levels of both *INVCAP* and *UNA*. I also include the jurisdiction's restricted net assets, although, as explained by Plummer, et. al., there is no clear a priori prediction on whether RNA will have a positive or negative effect on default risk.[3]

The third hypotheses is on whether the government-wide statements provide additional information over fund-based measures that cover the same types of financial activity:

H3: Relative to the fund statements, government-wide financial statements provide incremental information about local governments' default risk.

This hypothesis reflects the basic claim made by GASB 34 advocates. My GASB 34 critics suggest findings on this hypothesis will suggest the government-wide statements do not add incremental information, or the addition will small relative to the benefits.

As mentioned, default risk is only one of many capital markets considerations. A second, and perhaps more important concern is borrowing costs on new issue municipal bonds. For many local government financial managers the goal of the debt management process is to achieve the lowest possible cost of capital through a timely, fair, and transparent debt procurement process. Most local government debt issues are long-term, fixed coupon securities. A few basis point difference in interest costs on those securities can have multi-million dollar implications for overall cost of capital. As such, if government-wide financial measures have a significant association with local government borrowing costs, it behooves local financial managers to understand and properly manage those relationships.

Recent work on accounting and public capital markets has examined whether broad accounting policies, like statewide requirements for GAAP accounting among local governments (Baber and Gore 2008) and improved financial disclosures (Reck and Wilson 2006). In general, that research finds that improved disclosures result in lower cost of capital. To date, findings on the relevance for borrowing costs of accrual-based measures is also mixed. For example, some studies show that unfunded accrued liabilities for pensions and other post-employment benefits (OPEB) are reflected in ratings (Marlowe 2007), where others have shown they are not (Copeland and Ingram 1983). Here I assume the new government-wide financial information represents an improvement in disclosure, and as such, will result in lower cost of capital. With that logic established, I re-examine these three hypotheses after substituting cost of capital as the dependent variable in question:

[3]I do not include two variables included in Plummer, et. al.'s (2007) hypotheses. The first is a direct measure of current liabilities. This measure is not included because these data were not available. Second, I do not differentiate net assets restricted for debt service from those restricted for other purposes. My data only included an aggregate restricted net assets measure, so that measure was included in my model specifications. Despite these differences, I believe I fairly reproduce the Plummer, et. al. tests in the municipal government context.

H4: There is a significant association between the accounting information provided by government-wide financial statements and cost of capital on new local government bond issues.

H5: There is a significant association between the separate components of total net assets (*INVCAP*, *RNA*, and *UNA*) and cost of capital on new local government bond issues.

As mentioned, I expect the government wide financial statements to be information relevant to primary market bond investors because those statements provide information about the jurisdiction's long-term capital needs and its management of those capital needs. The basic relationships between the financial measures and cost of capital are the same as those for default risk. Higher levels of *INVCAP*, *RNA*, and *UNA* are expected to associate indirectly with lower default risk, and directly with lower cost of capital as a result. I also expect that higher levels of each of these variables indicate lower near-term capital needs, which lowers the forthcoming supply of bonds from that jurisdiction, which in turn increases demand for those bonds and lowers cost of capital.

Consistent with the logic on default risk, I also expect the government-wide statements provide incremental information relevant to primary market cost of capital:

H6: Relative to the fund statements, government-wide financial statements provide incremental information about cost of capital on new local government bond issues.

Research on public capital markets has also begun to examine how accounting and financial disclosure affects bond pricing in the secondary market, or all transactions in a bond after its initial sale. The argument presented above also applies here. That is, cetaris paribus, government-wide financial information is information relevant if it improves secondary market pricing efficiency. To my knowledge, no studies in accounting and public capital markets examine the relationship between accrual-basis disclosures and secondary market prices.[4] Therefore, I re-examine these same three hypotheses using secondary market price efficiency as the variable in question. The central claim behind this analysis of the secondary market is that the government-wide statements provide a more comprehensive evaluation of a government's financial condition, and will therefore be valuable to secondary market analysts who require simple but effective analytical heuristics.

H7: Relative to the fund statements, government-wide financial statements provide incremental information relevant to secondary market pricing efficiency of local government bonds.

H8: There is a significant association between the accounting information provided

[4]Reck and Wilson (2006) and Reck (2004) examine secondary market pricing using price quotes from a matrix pricing service. Price quotes are a fair proxy for aggregate price behavior on a limited number of bonds. My analysis uses data on actual prices of secondary market transactions and allows for a far more precise analysis of prices across the entire secondary market.

by government-wide financial statements and secondary market pricing efficiency of local government bonds.

And again, I expect that government-wide information financial information will have unique information relevance for pricing efficiency compared to the traditional fund-based measures.

H9: Relative to the fund statements, government-wide financial statements provide incremental information relevant to secondary market pricing efficiency of local government bonds.

3. VARIABLE DEFINITIONS AND SAMPLE

I look at how government-wide financial information is or is not reflected in the behavior of three different actors in the public capital markets: 1) credit raters, 2) primary market underwriters, and 3) secondary market investors. My basic analytical strategy is to incorporate government-wide financial information into standard models of the behavior of each.

3.1 Measures of the Capital Market Response

Previous work on the information relevance of the government-wide statements uses underlying bond ratings as a dependent variable. Here I use essentially the same approach. I use a local government's underlying debt rating ($CRATE$) as a measure of default risk. For uninsured bond issues I use the higher of Moody, Standard & Poor's, or Fitch underlying rating. For issues sold with third party default protection I use, where available, the highest of the Moody's, Standard &Poor's, or Fitch underlying rating. The lowest rating observed was B-/B3, which is ten notches below AAA/Aaa. Therefore, I measure default risk as follows:

$CRATE$ = a numerical transformation of the local government's underlying debt ratings, with values between 1 and 10, where larger values indicate greater default risk.

The second "stage" of the public capital markets is issuance, or the process whereby jurisdictions procure debt financing. Most new issue municipal bonds are sold through underwriting syndicates of national and/or regional investment banks. There is a rich literature on the primary market's structure and dynamics. Some seeks to identify the implications for issuer's borrowing costs of choices managers make during the issuance process, such as whether to use negotiated or competitive sale (Simonsen and Robbins 1996; Daniels and Vijayakumar 2001; Kriz 2003; Brucato 2003), to include a call feature, to work with an independent financial advisors, and many others.

The dependent variable in studies of primary market outcomes is typically some measure of the issuer's interest costs and/or overall cost of capital. Here I measure cost

of capital as true interest cost (TIC) on new issue municipal bonds. TIC is the discount rate that sets all future cash outflows for principal and interest on a new issue bond to a net present value equal to the proceeds of the sale. Qualitatively, it is the interest rate that reflects the time-value-of-money adjusted cost to the government for procuring debt financing,.[5] and it represents the effective cost of capital to the borrower. When a bond issue consists of multiple serial maturities (where the principal is paid gradually rather than at maturity), as is often the case, TIC is calculated as follows:

$$B = \sum_{n=e}^{f} \Big(\sum_{t=1}^{n} \frac{C_t}{(1+TIC)^t} + \frac{M}{(1+TIC)^n} \Big) \tag{1}$$

Where B is the price of the issue, e is the number of periods to the earliest bond maturity, f = number of semi-annual periods to the final bond maturity, n is the years to maturity, t is the index of period, C is the coupon for a bond in the issue, M = maturity value of a bond in the issue, and TIC is the true interest cost. The version of TIC calculated here does not include any up-front issuance costs, such as the underwriter discount, insurance costs, bond counsel fees, etc. because data on those costs are not readily available for a large sample of new issues. Excluding those costs can bias TIC calculations by a few basis points. Nonetheless, that bias is not substantial enough to threaten the generalizability of these findings.

There is a growing literature on the role of financial disclosure in the secondary market for municipal securities. Of particular interest to this paper is the concept of price volatility, or how fast an asset's price changes over time (Harris, 2003: 76). A widely accepted view from the microstructure literature is that volatility happens when traders are uncertain about some aspect of an asset's underlying value. If different investors perceive a bond's value differently, they will purchase it at different prices. Harris (2003: 410-417) characterizes the variation in those perceptions as either "fundamental volatility," or disagreement about an asset's quality, and "transitory volatility," or differences that occur when traders bring different information sets to bear on a transaction. Fundamental volatility is less of a concern for municipal bonds because of their low default rate, and because, until recently, a majority of municipal bonds were issued with third party bond insurance (Denison, 2001; Justice and Simon, 2003). Moreover, many of the main characteristics of muni's fundamental value can be controlled for - including the rating, But transitory volatility is an important consideration, and the focus of much recent research on municipal bonds.

Municipal securities are bought and sold in over-the-counter markets (i.e. there is no central exchange) comprised of overlapping networks of dealer-brokers. These dealer-brokers match investors seeking to move out positions in bonds with other investors who seek to take up positions. This market is largely self-regulated. Aside from guidance from the Municipal Securities Rulemaking Board - the self-regulatory agency for municipal

[5]For more on the development, advantages, and disadvantages of TIC see Simonsen and Robbins (2002), and Robbins, Simonsen, and Jump (2005).

bond underwriters and traders - and certain IRS rules, brokers have wide latitude to set prices and commissions. Moreover, information on prices of comparable bonds is not readily available.[6] Price volatility *PXVOLATILE*, or range of prices at which a bond trades in the secondary market during a particular time period. Price volatility has been measured several ways in the microstructures literature. Here I use the measure of choice in the extant literature on municipal secondary market (Downing and Zhang, 2004). That measure is the difference between the highest and lowest priced trades in a particular bond during a particular week, scaled by the average price of all trades in that bond during that week. Formally, this is:

$$S_i(t) = \frac{100}{\overline{P}_i(t)}((P_i^{max})(t) - P_i^{min}(t)) \tag{2}$$

Where $P_i^{max}(t)$ and $P_i^{min}(t)$ are the maximum and minimum observed prices for bond i during week t, and $\overline{P}_i(t)$ is the average price.

In substance, price volatility represents the uniformity of investor informedness about an issue. It therefore provides a fair proxy for pricing efficiency.

Market microstructure theory (Campbell, et. al. 1997; Harris 2003) and empirical findings on the municipal secondary market (Downing and Zhang 2004) suggests that trade prices are highly influenced by the information sets and trading objectives of the parties involved in the transaction. For that reason I calculate two different versions of the price volatility measure. The first restricts the calculation to trades in bonds that resulted in sales to customers. The second restricts the calculation to trades between dealer/brokers. Interdealer trades usually take place at higher volumes and with lower transaction costs, both of which reduce potential price volatility. Information asymmetries between dealers are also believed to be lower than similar asymmetries between dealers and customers.[7]

3.2 Variables from Government-Wide Financial Statements

Following Plummer, et. al., I calculate five different measures from the government-wide financial statements:

[6]The MSRB now provides real-time price information for certain kinds of transactions. Whether that additional price transparency has any substantial impact on pricing and transaction costs is undetermined.

[7]This measure characterizes volatility in terms of variance. A potential alternative and/or complimentary measure of volatility is a bond's price movements relative to market-wide price movements. This is typically measured through β, the Macaulay Duration, convexity, or other measures commonly found in the capital asset pricing model (CAPM) literature (see, among many others, Sharpe 1964). I do not use those measures here because the goal is not necessarily to control for investor risk perceptions, but rather to account for heterogeneity in investor pricing behavior.

POS_{GW}	=	a measure of the government's financial position, computed as total net assets, divided by total revenues;
$PERF_{GW}$	=	a measure of the government's financial performance, computed as total revenues minus total expenses, divided by total revenues;
$INVCAP$	=	the government's "invested in capital assets, net of related debt," divided by total revenues;
UNA	=	the governments unrestricted net assets, divided by total revenues;
RNA_{TOTAL}	=	the governments total restricted net assets, divided by total revenues;

The variables POS_{GW}, $INVCAP$, UNA, and RNA_{TOTAL} were taken from each jurisdiction's Statement of Net Assets, and $PERF_{GW}$ is calculated from the Statement of Activities. These variables were used to test hypotheses 1, 2, 4, 5, 7, and 8.

3.3 Variables from the Governmental Funds Statements

Hypotheses 3, 6, and 9 test whether information provided by the government-wide variables is incremental to the information provided by the following variables from the governmental funds statements:

POS_{FUND}	=	a measure of the government's financial position, computed as total fund balance, divided by total fund revenues;
$PERF_{FUND}$	=	a measure of the government's financial performance, computed as total fund revenues minus expenditures, divided by total fund revenues;

These variables were constructed using information from the "total governmental funds" column of each jurisdiction's Balance Sheet. Governmental funds cover financial activity in essentially the same services as those covered by the governmental activities.

3.4 Jurisdiction-Specific Control Variables

Again following Plummer, et. al., in the default risk model I control for four characteristics known to affect a jurisdiction's credit quality:

$DEBT$	=	the governments outstanding bond amount, divided by its equalized assessed taxable property value;
$SIZE$	=	log of the jurisdiction's population;
$OWNREV$	=	percentage of the government's revenues derived from property taxes, sales taxes, and other own-source revenues;
$POVERTY$	=	percentage of the jurisdiction's population that falls below the federal poverty line;

These variables represent resource munificence and other socioeconomic factors. I expect *Debt* will increase default risk, as more outstanding debt creates additional competition for debt service resources in the event of a financial downturn. I also expect that *SIZE* will lower default risk, as larger jurisdictions are likely to have more professionalized staff and will enjoy broader access to the public capital markets. I expect *OWNREV* will lower default risk because locally-controlled revenues tend to be more stable, predictable, and can quickly generate additional revenues if necessary. A higher *POVERTY* rate is expected to increase default risk. Poverty is included here to proxy for pressure on local tax bases and demand for higher spending on social services that can compete for resources otherwise intended for debt service.

3.5 Bond Issue-Specific Control Variables

I also include the following control variables from the "Standard Model" (Robbins and Simonsen 1996) of primary market municipal bond pricing;

BBBRATE	=	issue's highest rating from Moody's, Standard & Poor's, or Fitch was BBB-/Baa3, BBB/Baa2, or BBB+/Baa1;
ARATE	=	issue's highest rating from Moody's, Standard & Poor's, or Fitch was A-/A3, A/A2, or A+/A1;
AARATE	=	issue's highest rating from Moody's, Standard & Poor's, or Fitch was AA-/Aa3, AA/Aa2, or AA+/Aa1;
AAARATENAT	=	issue's highest rating from Moody's, Standard & Poor's, or Fitch was "natural AAA";
INSURED	=	issue was sold with third party insurance against default;
EXPERIENCE	=	the governments number of new debt sales from January 1, 2002 through December 1, 2009;
FA	=	issue was sold with the assistance of a public financial advisor;
NORTHEAST	=	government in states of CT, MA, MD, ME, NY, NH, PA, RI;
MIDWEST	=	government in states of IA, IL, IN, KS, MI, MN, MO, ND, OH, WI;
SOUTHEAST	=	government in states of AL, FL, GA, KY, LA, MS, NC, SC, TN, VA;
WEST	=	government in states of AK, CA, CO, HI, MT, NV, OR, UT, or WA;
SOUTHWEST	=	government in AZ, NM, OK, or TX;
BQ	=	issue was bank qualified;
COUNTY	=	issuer was a county government;
COMPETITIVE	=	issue was sold through competitive auction;
MATURITY	=	number of years from the dated date to the maturity date of issue's final maturity;
GENERALPURP	=	issue's proceeds were for general purpose public projects;
REFUNDING	=	issue's proceeds were used to refund another outstanding issue;
CALLABLE	=	issue contains a provision that allows the issuer to refund some or all of the issue before its stated maturity date;
UNLGO	=	issue is backed by the jurisdiction's unlimited general obligation pledge;
TAXABLE	=	interest payments to holders of the issue are subject to federal income tax;
BB20IDX	=	the Bond Buyer 20 weekly index for the week of the sale;
SIZE	=	par value of the issue;

The first group of independent variables are the issue's credit quality. Consistent with previous work that uses credit quality as an independent variable, I include a series of dummy variables identifying the higher of Moody's, Standard & Poor's, or Fitch rating as either BBB, A, AA, or "natural" AAA (bonds that received the highest rating without insurance). Underlying ratings were used for issues sold with third party bond insurance. Higher rated bonds are expected to sell at lower TIC. I also identify issues sold with

third party bond insurance. Insurance provides additional credit quality certification, thus lowering the issue's expected TIC.

An issuer's past experience in the municipal bond market is also an important determinant of borrowing costs. Frequent issuers, the logic suggests, develop technical expertise that is brought to bear on future bonds issues and lowers future borrowing costs (Bland 1985). I control for experience by including in the model the number of new issues from that issuer from January 1, 2002 through December 31, 2009. As an additional control for market expertise I include a dummy variable that denotes whether a a public financial advisor participated in the sale (Vijayakumar and Daniels 2006).

The model also includes "bank qualification." Bank qualification is a feature unique to bonds from infrequent issuers. Bonds that carry this designation receive favorable federal tax treatment if they are held by commercial banks. Much like insurance, this feature tends to homogenize the risk-return relationship for the bond, and in turn reduce potential price volatility. That distinction is expected to improve the marketability of smaller and lower TIC on those issues as a result. I also control for differences in regional credit markets by including a dummy variable denoting the region of the issuer, and a separate dummy variable denoting county issuers. None of these variables have a hypothesized impact on borrowing costs.

Several decades of empirical research shows that bonds sold through competitive auctions rather than negotiated sales where the underwriter is selected in advance (Bland, 1987; Simonsen and Robbins, 1996; Kriz, 2003).[8] Competitive sales are expected to result in lower cost of capital.

The model also includes several characteristics of the issue itself. The longer the time until a bond matures, the higher the level of interest rate risk and default risk. A positive relationship is therefore expected between time to maturity and TIC. Larger par value issues are thought to attract attention from a broader segment of the underwriting community. This additional exposure leads to more information sharing among potential investors, and that additional information presumably lowers TIC. Another important consideration is the the intended purpose of the borrowed funds. To control for this I denote all bonds identified as "general public purpose." This is a catch-all category that distinguishes money borrowed for general public services like streets, roads, and bridges from money borrowed for specialized public services like utilities and economic development projects. Bonds for general public purposes are expected to have lower borrowing costs because they enjoy broader support from elected officials and taxpayers, thus lowering their default risk and in turn reducing TIC. I also controls for the bond's repayment features. Refunding bonds are expected to have lower TIC because they are typically issued during periods of lower prevailing interest rates. I also denote issues that contain a call feature and issues. Call features uncertainty about how long investors will earn interest payments on their investment, and that uncertainty has been shown to result

[8]Surprisingly, despite this fact, the vast majority of new issues are sold through negotiated sales.

in higher borrowing costs. Unlimited general obligation bonds where the jurisdiction pledges its full taxing authority are expected to have lower TIC.

The final group of factors are market conditions at the time of the issue. To control for prevailing market interest rates I include in the model the *Bond Buyer* 20 index for the week of the sale. I expect a positive association between it and TIC. A related concern is the tax treatment of the bond interest earnings. Bonds where those earnings are subject to state income taxes typically carry higher interest rates to compensate for this lack of implicit tax advantage. I denote those bonds as "state taxable." And finally, following previous work (Simonsen and Robbins, 1996; Marlowe, 2007).

3.6 Price Volatility Control Variables

Following Downing and Zhang (2004), I specify a model of the hypothesized determinants of price volatility, and I incorporate the financial statement measures into that that model. Three variables are common to this model and to the *TIC* model described above: *CRATE*, *MATURITY*, and *CALLABLE*. Higher rated bonds are expected to have lower price volatility, longer time to maturity and callable bonds both carry additional interest rate and default risk that is expected to increase price volatility. This model also includes three four variables uniquely relevant to secondary market transactions.

COUPON	=	the coupon rate on an individual bond;
MTYREMAIN	=	number of years from the trade date to the bond's maturity;
TRADEVOL	=	the par value traded in a bond week;
TRADESIZE	=	the mean trade size in a bond week;

Trading dynamics are a known determinant of price volatility. This specification includes two measures of those dynamics: 1) Mean trade size for a bond during a bond week, and 2) trade volume, or the total dollar volume of all trades during that bond week. Both are known to have negative relationships with price volatility. The prevailing explanation for this relationship is that both of these measures proxy for investor informedness. Dealers and institutional investors tend are typically better informed then smaller, retail investors, and they tend to trade in larger lots than retail investors. As such, larger par value and higher volume trades are executed at more uniform prices. Including these factors in a model of price volatility corrects for these market segmentation effects.

Two additional bond characteristics have implications uniquely for price volatility. A bond's coupon is its fixed interest rate. Higher coupons are expected to associate with higher volatility because they imply greater potential default risk. *MTYREMAIN* is the time between a transaction and the maturity date on the transacted bond. Longer maturities carry higher market risk and interest rate risk, thus increasing a bond's potential price volatility.

3.7 Sample Construction

I obtained local government financial statement information from the Government Finance Officers' Association's Financial Indicators database for fiscal years 2003-2006. This database contains selected variables from both the government-wide and fund sections of the financial statements of local governments that apply for GFOA's annual Excellence in Financial Reporting award. The sample covers cities, counties, villages, towns, and townships from around the U.S. with populations ranging from 550 to more than 3.5 million (City of Houston, TX).[9] FY2003 was the first year that these data include figures from the government-wide statements. The number of jurisdictions included in the Financial Indicators data ranges from 1,830 to 1,975 for the selected years. Complete data on all model variables for all years were available for 1,130 jurisdictions. To remove any obvious outliers or data entry errors I winsorized all financial statement variables at the 1% and 99% levels. These data also contain the government's self-reported annual population and equalized assessed value.

I then identified all new issue general obligation, fixed coupon municipal bonds sold by local governments from January 1, 2003 through December 31, 2007. The sample is limited to general obligation bonds because default risk and pricing on general obligation bonds will be more directly linked to the issuer's financial condition. This is in contrast to revenue bonds, where default risk and pricing are determined in large part by the quality and predictable of the revenue pledge supporting the debt rather than the issuing jurisdiction's overall financial condition. Data on bond issues were provided by Ipreo, LLC. The Ipreo data contain both issue-level characteristics such as the rating, par value, purpose of the proceeds, insurance characteristics, etc., and series level (data on individual bonds within a bond issue; also known as "maturities," "CUSIPs", or "serials") characteristics like the dated date, maturity date, coupon, and par value. I then matched data on bonds to the financial statement data for their issuing jurisdiction. Following Payne and Jensen (2002), who found that average municipal government audit delay is approximately 6 months, I match each issue to its issuer's correspond financial statement data for the previous year if the sale took place within six months of the end of the issuer's fiscal year. Bond sales that took place 6 months or more after the fiscal year end were matched to financial statement information for the fiscal year that corresponded to the bond sale year. This matching process produced complete data on 1,430 bond issues comprised of 23,787 individual bonds. Of those 1,430 issues. Descriptive statistics for the financial statement information were computed for these 1,430 issuer-year observations. Table 2 presents the percentage of the total sample for which a particular characteristic applies. Those figures and descriptive statistics on the bond issues are presented in Tables 1 and 2. I then selected the most recent issue from every issuer in the sample. This produced 308 issues with complete information. This sub-sample is used in the empirical analysis of *CRATE* to avoid autocorrelation issues that will likely occur from including multiple

[9]GFOA is the main professional association for local government finance directors. As such, a potential criticism is that this sample is biased toward more professionalized governments that will have implicitly better credit quality.

issues from the same issuer, given that local government bond ratings change infrequently.

I then identified all secondary market transactions during the reoffering period for those 23,787 bonds and matched those transactions to the dataset containing the financial and bond issue variables. Transactions data were taken from the Municipal Securities Rulemaking Board's Historical data files. All MSRB-registered broker-dealers are required to report their trades within fifteen minutes. On average, six to seven million transactions are reported each year, with par value in excess of $3 trillion. Almost all trades in municipal bonds are included in these data. Following Green, et. al. (2006) I define the reoffering period as 90 days before and after the initial sale date and exclude any transactions outside that period. I then eliminated any transactions with missing data and winsorized all variables at the 1% and 99% levels to eliminate any obvious pricing mistakes or data entry errors.

Calculating secondary market price volatility required several additional steps. I first eliminated transactions where the bond in question traded less than twice during any given week during the reoffering period. A bond week was defined as 12am on Sunday to 11:59pm the following Saturday.[10] For each bond week I then computed the highest price, lowest price, mean price, and total trade volume. Those data were then used to compute the price volatility measure specified in Equation (2). The final dataset included 369,941 trades (par value traded of $97.9 billion) in 21,588 unique bonds aggregated into 50,788 unique bond weeks.

4. METHODS AND RESULTS

This section presents the methodology and findings from the empirical analysis.

4.1 Descriptive Statistics

Descriptive statistics on continuous variables are presented in Table 1, and the proportion of bond issues that contained a particular qualitative characteristic are reported in Table 2. Table 1 demonstrates two stylized facts about government-wide financial statements for local governments. First, municipal governments have substantial levels of net assets. The mean government-wide financial position measure is 6.80, which indicates a typical jurisdiction has total net assets equivalent to 680% of total annual government wide revenues. Contrast this to Plummer, et. al., who report this same parameter for school districts is .730, or only 73%. On average, the unrestricted component of net assets is .85 for local governments, but .257 for schools. A second finding is that, as expected, the government-wide performance indicators are large and negative. This suggests that in most cases government-wide expenses exceed government-wide revenues. The mean for this measure is -2.41, or government-wide expenses in excess of revenues equivalent to 241% of those revenues. For schools, again according to Plummer, et. al. (2004), this

[10] Municipal bonds trade in an over-the-counter market, so after hours and weekend trading is common.

measure was .039, or 3.9% of revenues.

Regarding the dependent variables, we find *TIC* is normally distributed with a mean interest rate of 4.06%. *CRATE* is reverse coded to facilitate interpretation in terms of default risk. As such, the mean value of 4 associates with an equivalent rating of AA-/Aa3, and we note the distribution is slightly skewed toward better overall credit quality. *PXVOLATILE* is also normally distributed, and its mean value suggests that in a typical bond week the difference between the highest priced and lowest priced transaction is equal to 1.23% of that bond's mean weekly trade price. These figures are all consistent with previous work on the primary and secondary municipal debt markets.

The figures reported in Table 1 also indicate a typical jurisdiction in the sample is a small to mid-sized population with own-source revenues equivalent to 14% of current annual revenues, outstanding debt equivalent to 4% of taxable value, and that sells approximately four new bond issues each year (mean of 40 divided by nine years of data).

Table 2 illustrates one important fact about this particular analysis. That is, the sample of new issues examined here is slightly skewed toward insured, unlimited general obligation bonds sold through competitive sales. This is not unexpected, given that many states require general obligation bonds to be sold through competitive sale (Robbins 2002). Given that I can control for this fact in the multivariate model, there is no reason to believe this trend introduces any sort of selection bias or other validity problems.

4.2 Hypotheses 1-3

To test hypotheses 1-3 I begin with the following basic model specification:

$$\begin{aligned} CRATE = \beta_0 &+ \beta_1 POS_{GW} * Small + \beta_2 POS_{GW} * Large + \beta_3 PERF + \beta_4 DEBT \\ &+ \beta_5 SIZE + \beta_6 OWNREV + \beta_7 POVERTY + \epsilon \end{aligned} \tag{3}$$

where:

Small	=	an indicator variable equal to 1 if POS_{GW} is smaller than the median, and 0 otherwise
Large	=	an indicator variable equal to 1 if POS_{GW} is larger than the median, and 0 otherwise

The first specification (Specification 1 in Table 2) consists of the government-wide position and performance measures, and a battery of control variables. To test for the relevance of the specific components of net assets this model is respecified as:

$$\begin{aligned} CRATE = \beta_0 &+ \beta_1 INVCAP * Small + \beta_2 INVCAP * Large + \beta_3 UNA * Small \\ &+ \beta_4 UNA * Large + \beta_5 RNA + \beta_6 PERF + \beta_7 DEBT + \beta_8 SIZE \\ &+ \beta_9 OWNREV + \beta_{10} POVERTY + \epsilon \end{aligned} \tag{4}$$

This second specification in Table 1 substitutes invested in capital assets net of related debt, unrestricted net assets, and restricted net assets for the general financial position measure (total net assets). It also includes the government-wide performance measure and the same group of control variables.

I estimated these models using ordered logistic regression with heteroskedastic-consistent standard errors to account for any potential non-independence across observations (due to state laws, regional market segmentation, etc.). A correlation matrix of all explanatory variables in all the models used throughout this paper was constructed and is available upon request. That matrix indicated no risk of multicolinearity in any of the models. The model estimates to test hypotheses 1 and 2 are presented in Table 3.

The log-likelihood and prediction rate (the % of observations the model correctly predicts) suggest an appropriate model fit. Consistent with previous findings (Marlowe 2007), socioeconomic status and outstanding debt are the key predictors of credit quality. With the exception of *INVCAP* all coefficient signs are in their expected direction.

These estimates provide some support for Hypothesis 1. The government-wide performance indicator is statistically significant at the .1 level (on a two-tailed test), and as expected, higher total net assets associate with lower default risk. The estimates from the second specification provide some support for Hypothesis 2. Those results indicate that unrestricted net assets have a significant and negative relationship with credit quality. The capital assets measures do not. Also note that controlling for the components of net assets eliminates the statistical significance of the government-wide performance measure. Taken together, these findings suggest that government-wide position is information-relevant, and much of that relevance is driven by bond rater attention to unrestricted net assets.

To test Hypothesis 3 I respecified the model by substituting the fund-based measures for the government-wide measures. That specification is as follows:

$$CRATE = \beta_0 + \beta_1 POS_{Fund} * Small + \beta_2 POS_{Fund} * Large + \beta_3 PERF + \beta_4 DEBT + \beta_5 SIZE + \beta_6 OWNREV + \beta_7 POVERTY + \epsilon \quad (5)$$

Ordered logit estimates of this model are reported in Table 4. Model fit for these estimates is slightly less than for the specification that includes the government-wide measures. And like the previous estimates, socioeconomic variables and outstanding debt are key predictors of default risk. These estimates also show that fund-based measures of financial position are also key predictors. This finding, along with the previous estimates, suggests fund-based and government-wide measures of financial position are information relevant.

Table 5 presents statistical tests designed to directly test Hypothesis 3 for the financial position variables. It reports estimates from three different re-specifications of this basic model. The first, or "Funds Model" includes the fund-based position measures and

the control variables, the second specification, or "Government-Wide" model includes the government-wide position measures and the control variables, and the "expanded model" includes both the government-wide and fund-based position measures along with the control variables. The quantities of interest for this exercise are the changes in the model fit statistics across these different model specifications. I am also concerned, although less so, with the size and significance of the coefficients on the position measures across the models. These estimates show that, in fact, the government wide measures have information relevance that is independent of the expanded model. This is indicated by the statistical significance of a χ^2 test on the difference in the likelihood ratio between the government-wide model compared to the expanded model. Substantively speaking, this means the model fit without the government-wide measures is significantly less than that same fit for the model without the fund-based measures, relative to a model that includes all four variables. At the same time, the coefficients on the government-wide measures are comparatively small, and only the coefficient for $LARGE$ jurisdictions is significant. This suggests that even though the government-wide measures improve the overall model fit relative to the fund-based measures, their actual effect on default risk is marginal. Taken together, these findings provide tepid support for Hypothesis 3.

4.2 Hypothesis 4-6

In this section I repeat this analytical process using TIC as the dependent variable, and a set of controls appropriate to it. The tests of Hypotheses 4-6 begin with the following basic model specification:

$$\begin{aligned} TIC = \beta_0 &+ \beta_1 POS_{GW} * Small + \beta_2 POS_{GW} * Large + \beta_3 PERF + \beta_4 DEBT \\ &+ \beta_5 SIZE + \beta_6 OWNREV + \beta_7 POVERTY + \beta_8 BB20IDX + \beta_9 EXPERIENCE \\ &+ \beta_{10} ISSUESIZE + \beta_{11} BQ + \beta_{12} FA + \beta_{13} COUNTY + \beta_{14} MATURITY \\ &+ \beta_{15} COMPETITIVE + \beta_{16} TAXABLE + \beta_{17} INSURED + \beta_{18} CALLABLE \\ &+ \beta_{20} UNLGO + \beta_{21} REFUNDING + \beta_{22} GENERALPURP + \beta_{23} MIDWEST \\ &+ \beta_{23} SOUTHEAST + \beta_{24} WEST + \beta_{25} SOUTHWEST + \beta_{26} BBBRATE \\ &+ \beta_{27} ARATE + \beta_{28} AARATE + \beta_{29} AAARATENAT + \epsilon \end{aligned} \tag{6}$$

Substituting the components of net assets for the generic net assets measure produces the following re-specification:

$$\begin{aligned} TIC = \beta_0 &+ \beta_1 INVCAP * Small + \beta_2 INVCAP * Large + \beta_3 UNA * Small \\ &+ \beta_4 UNA * Large + \beta_5 RNA + \beta_6 PERF + \beta_7 DEBT \\ &+ \beta_8 SIZE + \beta_9 OWNREV + \beta_{10} POVERTY + \beta_{11} BB20IDX + \beta_{12} EXPERIENCE \\ &+ \beta_{13} ISSUESIZE + \beta_{14} BQ + \beta_{15} FA + \beta_{16} COUNTY + \beta_{17} MATURITY \\ &+ \beta_{18} COMPETITIVE + \beta_{19} TAXABLE + \beta_{20} INSURED + \beta_{21} CALLABLE \\ &+ \beta_{22} UNLGO + \beta_{23} REFUNDING + \beta_{24} GENERALPURP + \beta_{25} MIDWEST \\ &+ \beta_{26} SOUTHEAST + \beta_{27} WEST + \beta_{28} SOUTHWEST + \beta_{29} BBBRATE \\ &+ \beta_{30} ARATE + \beta_{31} AARATE + \beta_{32} AAARATENAT + \epsilon \end{aligned} \tag{7}$$

To test these models I estimated two ordinary least squares regression models. For both models I computed heteroskedastic and autocorrelation-consistent standard errors to correct for any heteroskedasticity problems resulting from the inclusion of multiple issues from the same issuer. Those estimates are presented in Table 6. The left column in this table associates with Equation (6), and the right column with Equation (7). For both sets of estimates the model fit is strong and is consistent with previous work on the determinants of TIC. As expected, the coefficient on *BB20IDX* indicates that a ten basis point increase in prevailing interest rates associates with a 4.5 basis point increase in TIC. With the exception of *EXPERIENCE*, all other coefficients signs are in their expected direction.

These estimates provide tentative support for Hypothesis 4. The government-wide performance measure is significant and negative in Specification (I). However, including the components of net assets obviates this finding in Specification (II). Results for Specification (II) also provide weak support for Hypothesis 5. Unrestricted net assets below the median have a significant and negative association with *TIC*. However, none of the other components of net assets have a significant effect.

I then respecified this model, substituting the fund-based measures for the government-wide measures:

$$\begin{aligned} TIC = \beta_0 &+ \beta_1 POS_{Fund} * Small + \beta_2 POS_{Fund} * Large + \beta_3 PERF + \beta_4 DEBT \\ &+ \beta_5 SIZE + \beta_6 OWNREV + \beta_7 POVERTY + \beta_8 BB20IDX + \beta_9 EXPERIENCE \\ &+ \beta_{10} ISSUESIZE + \beta_{11} BQ + \beta_{12} FA + \beta_{13} COUNTY + \beta_{14} MATURITY \\ &+ \beta_{15} COMPETITIVE + \beta_{16} TAXABLE + \beta_{17} INSURED + \beta_{18} CALLABLE \\ &+ \beta_{19} UNLGO + \beta_{20} REFUNDING + \beta_{21} GENERALPURP + \beta_{22} MIDWEST \\ &+ \beta_{23} SOUTHEAST + \beta_{24} WEST + \beta_{25} SOUTHWEST + \beta_{26} BBBRATE \\ &+ \beta_{27} ARATE + \beta_{28} AARATE + \beta_{29} AAARATENAT + \epsilon \end{aligned} \tag{8}$$

This model was also estimated using ordinary least squares with heteroskedastic and autocorrelation consistent standard errors. Those estimates are presented in Table 7. Model fit characteristics and findings on the control variables here are nearly identical to the findings presented in Table 6. The key finding to emerge from this Table is that the fund-based measures have no significant effect on *TIC*. This is consistent with previous work (Marlowe 2008).

A direct test of Hypothesis 6 is presented in Table 8. Here specified and estimated models identical to those presented in Table 5, this time using OLS regression to estimate these models with *TIC* as the dependent variable. Once again, the quantities of interest are an F test on the change in adjusted R^2 for the expanded model compared to the models that include only the fund-based measures or government-wide measures. These findings support Hypothesis 6. They suggest that the information relevance of the government-wide only model is significantly less than that of the expanded model. However, once again, these findings are of minimal substantive significance, both in terms of

the coefficients for the position measures, and for the overall change in model fit. Therefore, although there is support for Hypothesis 6, that support is minimal.

4.3 Hypothesis 7-9

In this section I repeat this analytical process once again using *PXVOLATILE* as the dependent variable, and a set of controls appropriate to it. The tests of Hypotheses 7-9 begin with the following basic model specification. As mentioned, this specification includes some controls from the *TIC* model, and some controls unique to secondary market dynamics:

$$\begin{aligned} PXVOLAT = \beta_0 &+ \beta_1 POS_{GW} * Small + \beta_2 POS_{GW} * Large + \beta_3 PERF \\ &+ \beta_4 PAR + \beta_5 MTYREMAIN + \beta_6 BBBRATE + \beta_7 ARATE + \beta_8 AARATE \\ &+ \beta_9 AAARATENAT + \beta_{10} CALLABLE + \beta_{11} COUPON + \beta_{12} TRADEVOL \\ &+ \beta_{13} TRADESIZE + \epsilon \end{aligned} \tag{9}$$

Substituting the components of net assets for the generic net assets measure produces the following re-specification:

$$\begin{aligned} PXVOLAT = \beta_0 &+ \beta_1 INVCAP * Small + \beta_2 INVCAP * Large + \beta_3 UNA * Small \\ &+ \beta_4 UNA * Large + \beta_5 RNA + \beta_6 PERF + \beta_7 PAR \\ &+ \beta_8 MTYREMAIN + \beta_9 BBBRATE + \beta_{10} ARATE + \beta_{11} AARATE \\ &+ \beta_{12} AAARATENAT + \beta_{13} CALLABLE + \beta 14 COUPON + \beta 15 TRADEVOL \\ &+ \beta 16 TRADESIZE + \epsilon \end{aligned} \tag{10}$$

I implemented these model with a nested regression approach. For each bond week (all the trades in a bond from Sunday-Saturday) I estimated an ordinary least squares regression model with the price volatility for each individual bond week as the dependent variable, and the other model variables as independent variables. Those models were run separately for all 260 bond weeks from January 1, 2003 through December 31, 2008. The number and type of transactions in each bond week varies, depending on the when the sample bonds were issued. Then I aggregated the coefficients from those regression 260 bond-week models. Those aggregated results are reported in Table 9. The coefficient reported for each independent variable is the mean of the regression coefficients for all 260 bond weeks, and the figures in parentheses are Fama-McBeth (1973) t statistics, calculated as the standard deviation of the regression coefficients divided by their standard error. N is the average number of trades included in each bond week regression, and the F statistics and R^2 statistics are means of those measures for all the weekly regressions. This process produces estimates akin to what we might expect from a panel data set, even though most municipal bonds do not trade often enough to form an unbroken time series.

Table 9 presents estimates from models designed to test Hypothesis 7. This table reports four sets of estimates - sales to customers and inter-dealer trades for Model 1 that corresponds to Equation (9), and sales to customers and interdealer trades for Model 2 that corresponds to Equation (10). Model fit characteristics are similar to those from previous research on the determinants of price volatility (Downing and Zhang 2004). All the control variables are in their expected direction. As expected, bonds have lower price volatility if they trade in larger average transactions, and higher volatility if they trade in larger volume. This is consistent with the idea that large trades between institutional market participants happen at lower price volatility than trades between dealers and customers.

These results provide support for Hypotheses 7 and 8. They indicate that government-wide position for small jurisdictions has a significant and negative association with volatility for both types of trades. Although these coefficients do not lend themselves well to direct interpretation, consider that the coefficient on POS_{GW} *$Small$ indicates that a 100% increase in total net assets as a percentage of total revenues associates with a 25 basis point reduction in price volatility. For a bond that traded at an average weekly price of 100, this means the weekly price range decreased by 2.5% of par value. So for instance, a bond that traded between 100 and 105 might now trade between 100 and 102.5 as a result of this reduction in volatility. Given that municipal bonds often trade in large blocks of $1 million or more, this reduction in price volatility has clear economic implications.

Especially interesting about these findings is the differences in coefficients on the government-wide performance measures. Here it appears this information is reflected in price volatility among dealers, but not among dealer-customer transactions. And even more surprising is that better performance associates with higher price volatility in inter-dealer trades. This suggests significant disagreement among dealers about the pricing implications of a closer match between government-wide revenues and expenses. I also find that each form of the $INVCAP$ and UNA measures are significant for sales to customers across both of the Model II specifications. This suggests customers are attunded to the components of net assets, even though dealer-to-dealer transactions are not. In the aggregate, this suggests the government-wide measures matter to pricing efficiency, and perhaps more important, that they matter in different ways to different types of capital market participants.

I then respecified this model, substituting the fund-based measures for the government-wide measures:

$$\begin{aligned} PXVOLAT = \beta_0 &+ \beta_1 POS_{Fund} * Small + \beta_2 POS_{Fund} * Large \\ &+ \beta_3 PERF + \beta_4 PAR + \beta_5 MTYREMAIN + \beta_6 BBBRATE + \\ &+ \beta_7 ARATE + \beta_8 AARATE + \beta_9 AAARATENAT + \beta_{10} CALLABLE \\ &+ \beta_{11} COUPON + \beta_{12} TRADEVOL + \beta_{13} TRADESIZE + \epsilon \end{aligned} \tag{11}$$

Table 10 presents OLS estimates of a model based on this specification. Model fit

characteristics and the results on the control variables for this model are similar to the previous estimates. However, these estimates suggest the fund-based performance and financial position measures are not relevant to secondary market pricing efficiency.

Table 11 shows the pricing efficiency version of the change in model fit tests reported in Tables 5 and 8. For brevity and clarity of presentation I report only the results from sales to customers. Estimates for inter-dealer trades are similar. These results indicate a statistically and substantively significant improvement in model fit for the government-wide measures model relative to the expanded model. This lends support to Hypothesis 9.

5. CONCLUSION

In this paper I presented findings on the information relevance to the public capital markets of accrual-based, government-wide financial information. I find that for assessments of default risk and for primary market pricing, the government-wide information is information relevant but not substantively significant compared to traditional fund-based measures of government financial position and performance. I also find that government-wide information is particularly relevant for pricing efficiency in the secondary market, and that different government-wide measures used in different ways by investors and traders. This is the first known evidence that accrual-based government financial information matters to capital market participants outside the traditional new debt issuance process.

The importance of government-wide information to the secondary market suggests several potential future research directions. First, it would be appropriate to consider a CAPM-style analysis of whether government-wide financial information is a priced factor for yields on individual bonds. Future research might also consider different ways of measuring market segmentation. The sales-to-customer vs. inter-dealer trade distinction neglects potentially important differences in terms of trade size, geography, type of issue, and many other potential forms of market segmentation. Whether government-wide information matters in different ways in different segments is a potentially useful direction for future research.

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Table 1: Descriptive Statistics for Continuous Variables					
Variable	Mean	1Q	Median	3Q	SD
Panel A: Government-Wide Measures					
POS_{GW}	6.80	2.87	5.31	8.69	6.46
$PERF_{GW}$	-2.41	-3.09	-2.15	-1.37	1.58
INVCAP	5.11	1.76	3.73	6.50	5.35
UNA	0.85	0.13	0.74	1.50	1.52
RNA_{TOTAL}	0.79	0.17	0.52	0.99	0.98
Panel B: Total Governmental Funds Measures					
POS_{FUND}	0.57	0.38	0.62	0.78	0.37
$PERF_{FUND}$	-0.08	-0.19	-0.11	-0.01	0.15
Panel C: Credit Quality Variables					
TIC	4.06	3.78	4.03	4.3	0.18
CRATE	4.1	3	4	5	1.81
PXVOLATILE	1.23	.215	.749	1.745	3.705
Panel D: Jurisdiction Characteristics					
DEBT	0.04	0.02	0.03	0.05	0.03
POPULATION	183000	33800	63000	136000	571416
OWNREV	0.14	0.01	0.09	0.24	0.16
POVERTY	0.13	0.07	0.13	0.18	0.07
EXPERIENCE	39.90	32	36	44	7.40
Panel E: Issue Characteristics					
ISSUESIZE ($000)	183	33.8	63	136	102400
MATURITY	17.1	12.6	19.3	20.2	6.31
COUPON	4.123	4	4	4.5	.625
BB20IDX	4.48	4.35	4.45	4.59	0.20
N = 1,430					

Table 2: Percentage Counts for Categorical Variables	
Variable	Percentage
BQ	26.00%
FA	83.10%
COUNTY	7.79%
COMPETITIVE	57.80%
TAXABLE	4.87%
INSURED	63.30%
CALLABLE	80.80%
UNLGO	65.60%
REFUNDING	30.20%
GENERALPURP	82.10%
MIDWEST	26.60%
SOUTHEAST	20.10%
WEST	11.40%
SOUTHWEST	31.50%
BBBRATE	0.97%
ARATE	4.22%
AARATE	19.80%
AAARATENAT	11.70%
AAARATEINS	57.50%
N = 1,030	

Table 3: Ordered Logit Estimates of Credit Ratings on Government-Wide Measures and Control Variables

		Specification (I)		Specification (II)	
	Predicted	Coefficient	p-val	Coefficient	p-val
POS_{GW} *Small*	-	-0.071	0.357		
POS_{GW} *Large*	-	-0.029	0.098		
$PERF_{GW}$	-	-0.043	0.548	-0.089	0.287
*INVCAP*Small*	-			0.019	0.315
*INVCAP*Large*	-			-0.021	0.259
*UNA*Small*	-			-0.373	0.019
*UNA*Large*	-			-0.178	0.015
RNA_{TOTAL}	-			0.014	0.135
DEBT	+	8.778	<0.001	8.548	<0.001
SIZE	-	-0.514	<0.001	-0.561	<0.001
OWNREV	-	0.365	0.456	0.418	0.405
POVERTY	+	9.693	<0.001	9.192	<0.001
N		308		308	
Log-likelihood		-569.2(df=16)		-565.1(df=16)	
Prediction rate		34.36%		32.26%	

Table 4: Ordered Logit Estimates of Credit Ratings on Governmental Funds Measures and Control Variables

	Predicted	Coefficient	p-val
POS_{Fund}*Small*	-	-2.162	<0.000
POS_{Fund}*Large*	-	-0.683	0.015
$PERF_{Fund}$	-	-0.461	0.687
DEBT	+	7.449	0.008
SIZE	-	-0.503	<0.000
OWNREV	-	0.021	0.813
POVERTY	+	10.652	<0.000
N = 308			
Log-Likelihood = -567			
Prediction Rate = 27.01%			

Table 5: Tests of Government-Wide Accounting Variables vs. Governmental Funds Accounting Variables - Credit Ratings

Model Specification	Coefficient on on *POS*Small*	Coefficient on *POS*Large*	Model's Log-Likelihood
Funds model (POS_{FUND} **Small*, POS_{FUND} **Large)*	-2.16**	-0.67*	-567.2
Government Wide Model *(POS_{GW} *Small, POS_{GW} *Large)*	-0.08	-0.03*	-569.7
Expanded model (all four POS Variables)			-566.3
Likelihood Ratio χ^2 Tests:			
$\triangle\chi^2$ of expanded model vs. funds model			1.85
$\triangle\chi^2$ of expanded model vs. government-wide model			6.78**

* = p < .1, ** = p< .05

Table 6: Ordinary Least Squares Estimates of True Interest Cost on Government-Wide Measures and Control Variables

		Specification (I)		Specification (II)	
	Predicted	Coefficient	p-value	Coefficient	p-value
POS_{GW} *Small*	-	-0.008	0.208		
POS_{GW} *Large*	-	-0.001	0.485		
$PERF_{GW}$	-	-0.010	0.097	-0.003	0.639
*INVCAP*Small*	-			-0.016	0.114
*INVCAP*Large*	-			-0.002	0.319
*UNA*Small*	-			-0.044	0.001
*UNA*Large*	-			0.001	0.883
RNA_{TOTAL}	-			0.007	0.409
DEBT	+	-0.190	0.522	-0.223	0.446
SIZE	-	-0.007	0.459	-0.012	0.193
OWNREV	-	-0.111	0.082	-0.119	0.065
POVERTY	+	0.095	0.465	0.135	0.308
BB20IDX	+	0.451	<0.000	0.445	<0.000
EXPERIENCE	-	0.006	<0.000	0.006	<0.000
SIZE	-	0.006	0.535	0.007	0.508
BQ	-	-0.156	<0.000	-0.168	<0.000
FA	-	0.061	0.044	0.064	0.038
COUNTY	+	0.060	0.049	0.063	0.032
MATURITY	+	0.523	<0.000	0.529	<0.000
COMPETITIVE	-	-0.105	<0.000	-0.103	<0.000
TAXABLE	+	1.184	< 0.000	1.179	<0.000
INSURED	-	-0.031	0.376	-0.032	0.350
CALLABLE	+	-0.007	0.843	-0.004	0.899
UNLGO	-	-0.035	0.106	-0.038	0.073
REFUNDING	-	-0.175	<0.000	-0.172	<0.000
GENERALPURP	-	-0.029	0.180	-0.029	0.180
MIDWEST	?	0.148	<0.000	0.152	<0.000
SOUTHEAST	?	0.108	0.007	0.122	0.002
WEST	?	0.211	<0.000	0.225	<0.000
SOUTHWEST	?	0.153	<0.000	0.170	<0.000
BBBRATE	-	-0.088	0.771	-0.094	0.750
ARATE	-	-0.030	0.642	-0.028	0.667
AARATE	-	-0.156	<0.000	-0.151	<0.000
AAARATENAT	-	-0.167	<0.000	-0.155	<0.000
N		1034		1034	
Adjusted R^2		.697		.701	
F		86.5***		89.35***	

* = p < .1, ** = p< .05, *** = p < .01

Table 7: Ordinary Least Squares Estimates of True Interest Cost on Governmental Funds Measures and Control Variables		
	Coefficient	p-value
POS_{Fund}*Small*	-0.094	0.155
POS_{Fund}*Large*	-0.002	0.955
$PERF_{Fund}$	-0.033	0.512
DEBT	-0.208	0.485
SIZE	-0.005	0.587
OWNREV	-0.144	0.027
POVERTY	0.165	0.233
BB20IDX	0.451	<0.000
EXPERIENCE	0.006	<0.000
SIZE	0.010	0.361
BQ	-0.151	<0.000
FA	0.060	0.052
COUNTY	0.071	0.022
MATURITY	0.528	<0.000
COMPETITIVE	-0.104	< 0.000
TAXABLE	1.189	<0.000
INSURED	-0.030	0.395
CALLABLE	-0.014	0.684
UNLGO	-0.041	0.052
REFUNDING	-0.174	<0.000
GENERALPURP	-0.033	0.126
MIDWEST	0.140	<0.000
SOUTHEAST	0.111	0.008
WEST	0.199	<0.000
SOUTHWEST	0.144	<0.000
BBBRATE	-0.065	0.829
ARATE	-0.023	0.726
AARATE	-0.151	<0.000
AAARATENAT	-0.162	<0.000
Adjusted R^2 = .697		
F = 83.5***		
* = p < .1, ** = p< .05, *** = p < .01		

Table 8: Tests of Government-Wide Accounting Variables vs. Governmental Funds Accounting Variables - True Interest Costs

Model Specification	Coefficient on on *POS*Small*	Coefficient on *POS*Large*	Model R^2
Funds model (POS_{FUND} **Small*, POS_{FUND} **Large)*	-0.093	-0.008	.703
Government Wide Model *(POS_{GW} *Small, POS_{GW} *Large)*	-0.008*	-0.001	.702
Expanded model (all four POS Variables)			.704
F Tests:			
$\triangle R^2$ of expanded model vs. funds model			1.713
$\triangle R^2$ of expanded model vs. government-wide model			3.426**
* = p < .1, ** = p< .05			

Table 9: Ordinary Least Squares Estimates of Price Volatility on Government-Wide Measures and Control Variables

	Model I				Model II			
	Sales to Customers		Interdealer Trades		Sales to Customers		Interdealer Trades	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
POS_{GW} *Large*	-0.004	0.330	-0.002	0.590				
POS_{GW} *Small*	-0.025	0.015	-0.029	0.012				
$PERF_{GW}$	-0.004	0.730	0.017	0.037	-0.011	0.380	0.022	0.024
*INVCAP*Large*					-0.012	0.087	<0.000	0.987
*INVCAP*Small*					-0.056	0.092	-0.041	0.103
*UNA*Large*					-0.079	0.008	0.001	0.943
*UNA*Small*					0.057	0.092	0.021	0.625
RNA_{TOTAL}					-0.019	0.681	0.037	0.417
COUPON	-0.076	0.097	-0.069	0.017	-0.107	0.028	-0.089	0.003
CALLABLE	-0.014	0.797	0.056	0.189	-0.013	0.833	0.122	0.170
RATINGORD	-0.004	0.783	-0.005	0.721	-0.032	0.074	-0.010	0.448
MATURITY	0.376	<0.000	0.669	<0.000	0.382	<0.000	0.677	<0.000
PAR	0.046	0.046	0.020	0.217	0.009	0.770	0.011	0.528
TRADESIZE	-0.792	<0.000	-0.788	0.432	-0.786	<0.000	-0.785	<0.000
TRADEVOL	0.782	<0.000	0.603	<0.000	0.790	<0.000	0.603	<0.000
N	110		110		128		128	
R^2	0.47		0.53		0.507		0.555	

Table 10: Ordinary Least Squares Estimates of Price Volatility on Governmental Funds Measures and Control Variables

	Sales to Customers		Interdealer Trades	
	Coefficient	p-value	Coefficient	p-value
POS_{Fund}*Large*	0.140	0.319	0.037	0.440
POS_{Fund}*Small*	0.171	0.486	-0.088	0.343
$PERF_{Fund}$	0.179	0.582	0.094	0.590
COUPON	-0.092	0.018	-0.080	0.006
CALLABLE	-0.012	0.881	0.059	0.155
RATINGORD	0.016	0.574	-0.013	0.905
MATURITY	0.388	<0.000	0.674	<0.000
PAR	0.056	0.011	0.026	0.089
TRADESIZE	-0.782	<0.000	-0.779	<0.000
TRADEVOL	0.771	<0.000	0.597	<0.000
N	118		118	
R^2	0.48		0.53	

Table 11: Tests of Government-Wide Accounting Variables vs. Governmental Funds Accounting Variables - Price Volatility

Model Specification	Coefficient on on *POS*Small*	Coefficient on *POS*Large*	Model R^2
Funds model (*POS_{FUND} *Small*, *POS_{FUND} *Large)*	0.138	0.167	.482
Government Wide Model *(POS_{GW} *Small*, *POS_{GW} *Large)*	-0.025**	-0.027*	.462
Expanded model (all four POS Variables)			.489
F Tests:			
$\triangle R^2$ of expanded model vs. funds model			.987
$\triangle R^2$ of expanded model vs. government-wide model			4.784**

* = p < .1, ** = p< .05