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Local fiscal policies, default risk, and municipal borrowing costs

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This paper provides an empirical study of the effects that a local government's fiscal decisions exert on its cost of borrowing, using a sample of New Jersey municipalities. The results are consistent with the view that current period fiscal decisions do impact the cost of borrowing. A one standard deviation increase in the amount borrowed is associated with a 66 basis point increase in the annual yield. Furthermore, that the standard approach of treating current period policy variables as exogenous regressors leads to a downward bias in the effect of additional borrowing on the interest rate.

1. Introduction

The relationship between municipal fiscal policies and municipal borrowing costs has been a long-standing topic of concern for both investors and municipal governments. Recently, much attention has focused on the credit market's reaction to municipalities that carry heavy debt burdens relative to their ability to repay. In a market where defaults are not possible, fiscal and economic characteristics of a particular municipal issuer should have no impact on its cost of borrowing, after controlling for the term structure of interest rates, tax rates of lenders, and the effects of various contingent claims that are often written against municipal bonds.[1] When the possibility of default is introduced, however, a town's bond rate will depend on issuer-specific characteristics that affect the risk of default.

This paper addresses the topic of how a local government's fiscal policies affect the default risk premium on its cost of borrowing. In particular, the

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[1]These contingent claims include such arrangements as call provisions and third party insurance coverage.

paper focuses on the magnitude of the market's reaction to increases in an issuer's debt burden. The empirical results are based on a sample of general obligation bond sales by New Jersey municipalities.[2] The empirical specification is motivated by a model of municipal borrowing costs which incorporates the impact of an issuer's borrowing decisions. By considering the simultaneous relationship that exists between fiscal decisions and borrowing costs, the study finds some implications for the empirical estimation which have not been addressed in the existing literature. In particular, the standard approach of treating current period policy variables as exogenous regressors can lead to biased estimates of the effect that additional borrowing exerts on the borrowing rate.

The existing evidence on the determinants of municipal interest rates generally supports the view that issuer-specific characteristics are significant contributors to the cross-sectional variation in yields. This conclusion has been reached in studies that examine new issue costs on municipal securities [Rubinfeld (1973), Wallace (1981), Benson et al. (1984, 1986, 1988) and Wilson and Howard (1984)] as well as studies which look at offering yields in the secondary market [Hastie (1972), Browne and Syron (1977, 1979), Ingram and Copeland (1982) and Liu and Thakor (1984)].

One issue that is not addressed in the existing empirical literature on borrowing costs is the potential endogeneity of the issuer's fiscal policies to its cost of borrowing.[3] Just as the interest rate on a bond may depend on a town's budget decisions, these budget decisions will also be influenced by the cost of borrowing. This is particularly relevant to the question of how the market reacts to increases in the issuer's debt burden, since the amount that a town borrows might fall as its borrowing rate rises. This suggests that the amount borrowed could be negatively correlated with the error term of the interest cost equation leading to a downward bias in the estimated effect of additional debt.

This paper estimates a structural equation for municipal borrowing costs, in which instrumental variables are used to correct for the endogeneity of municipal financial structure. The empirical specification is motivated by a model of interest rate determination under uncertainty in which fiscal policy affects the interest rate through changes in default risk.

The major finding of this paper is that a local government's cost of borrowing is positively related to the size of its debt burden, both the stock

[2]Unlike revenue bonds, which are backed by earmarked sources of revenue, general obligation bonds are backed by the full taxing authority of the issuer.

[3]One notable exception is a study of survey prices on state bonds by Goldstein and Woglom (1991); they assume that insofar as there is a correlation between borrowing levels and the error term of the yield equation, it is purely a cross-sectional correlation that can be controlled for with panel data using fixed effects techniques. It should also be noted that the interest rate sensitivity of borrowing plays a central role in the literature on municipal financial practices. [See, for example, Metcalf (1990).]

of debt already outstanding and the size of its current year bond issue. Furthermore, the measured effect of additional borrowing on the interest rate is biased downward by treating the amount borrowed as an exogenous variable. When the borrowing level is treated as an exogenous variable, an increase in the borrowing level is associated with no increase in the borrowing rate. By contrast, when the borrowing amount is treated as an endogenous variable, a standard deviation increase in the amount borrowed is associated with a 66 basis point increase in the interest rate. This response is greater than the average yield spread between the 'medium grade' and 'prime grade' long-term general obligation bond indices published by Salomon Brothers, indicating that credit markets impose a substantial penalty on municipalities that increase their debt burdens by large amounts.

The determination of interest rates is described in section 2. Section 3 discusses the data and the empirical specification, and section 4 outlines the results. Section 5 concludes.

2. Municipal yields with bankruptcy

This section develops predictions for the relationship between a municipality's debt burden and its borrowing rate. Since the emphasis here is on the supply side, a relatively simple structure will be assumed for lenders. Lenders are risk-neutral agents who can borrow and lend risklessly at a real after-tax rate of interest r. Therefore, the expected payment on a one-period municipal bond of principal size B must be at least $(1+r)B$. I will also assume that the municipal bond market is competitive in the sense that lenders make zero expected profits; hence expected payments on a municipality's debt must *equal* $(1+r)B$.

Bonds are backed by the municipality's ability to levy taxes. If Y_2 denotes the maximum amount of tax revenue available for debt repayment in period 2, and if i denotes the *promised* interest rate on the debt, then full repayment will occur as long as $Y_2 \geqq (1+i)B$. Y is treated as an exogenous rental income stream from which lump-sum taxes are levied.[4] The possibility of default is introduced by supposing that Y fluctuates over time by a random growth factor of θ (i.e. $Y_2 = \theta Y_1$). If Y_1 denotes the maximum revenue available in period 1, then full repayment in period 2 occurs when $\theta \geqq (1+i)(B/Y_1)$, or equivalently $\theta \geqq (1+i)b$, where b is the amount of debt issued scaled by the income level Y_1. If revenues in period 2 are insufficient to pay off the bond, then bondholders are assumed to receive all available revenues. The promised interest rate will be set to equate the expected return on the bond with the risk free rate of return:

[4]In practice, taxes are levied against property values rather than rental income. In the empirical specification, the equalized property value will be used as a proxy for the tax base.

$$\mathrm{Prob}(\theta>(1+i)b)*(1+i)b+\mathrm{Prob}(\theta\leqq(1+i)b)*\mathrm{E}[\theta\,|\,\theta\leqq(1+i)b]$$
$$=(1+r)b. \tag{1}$$

If, at the time of the bond issue, the community has existing obligations which constitute senior claims on its revenues (such as outstanding debt obligations or spending commitments that take legal precedence over debt repayment), then full repayment on the bond will only occur if $Y_2 \geqq (1+i)B + S^*$, or equivalently, $\theta \geqq (1+i)b+s^*$, where S^* is the level of senior obligations, and s^* is the level scaled by the size of the town's tax base. For simplicity, assume that the bondholders receive nothing if $Y_2 < S^*$. The equation determining the interest rate now becomes:

$$[1-F((1+i)b+s^*)](1+i)b+[F((1+i)b+s^*)$$
$$-F(s^*)]\mathrm{E}[\theta-s^*\,|\,s^*<\theta\leqq(1+i)b+s^*]-(1+r)b=0, \tag{2}$$

where $F(\cdot)$, denotes the cumulative probability distribution of θ. Eq. (2) provides a *deterministic* relationship between the interest rate and the amount borrowed. To allow for econometric error, I will suppose that the level of senior obligations is comprised of an observable component (S) and an unobservable (to the econometrician) component (εY_1) which is assumed to be proportional to the tax base. s^* can now be rewritten as $s^*=S^*/Y_1 = S/Y_1+\varepsilon Y_1/Y_1 \equiv s+\varepsilon$. Substituting this into (2) gives:

$$[1-F(\theta^*)](1+i)b+[F(\theta^*)-F(\hat{\theta})]\mathrm{E}[\theta-\hat{\theta}\,|\,\hat{\theta}<\theta\leqq\theta^*]-(1+r)b=0, \tag{3}$$

where $\theta^*=(1+i)b+s+\varepsilon$ (total obligations) and $\hat{\theta}=s+\varepsilon$ (total obligations other than the bond).

The reason for introducing that unobserved component into the equation is to allow for 'exogenous' changes in the interest rate (i). ε can be interpreted as the source of econometric error in the interest rate equation. Although the interest rate is an endogenous variable, I will refer to the variation in ε as an exogenous change in the interest rate, since it cannot be attributed to observables. Statistical problems arise if the town's choice of b is correlated with ε, since b will then fail to be an instrumental variable of the interest rate equation. Since the error term of the model is interpreted as an omitted variable, I must also assume that these errors are uncorrelated with other exogenous variables that influence yields (although some violations of this assumption will be tested).

By differentiating through eq. (3), the following comparative static results can be derived:

$$\frac{\mathrm{d}i}{\mathrm{d}b}=[1-F(\theta^*)]^{-1}[F(\theta^*)-F(\hat{\theta})]\mathrm{E}\left\{\frac{\theta-\hat{\theta}}{b^2}\,\middle|\,\hat{\theta}<\theta<\theta^*\right\}>0, \tag{4}$$

$$\frac{\mathrm{d}i}{\mathrm{d}s}=\frac{\mathrm{d}i}{\mathrm{d}\varepsilon}=[1-F(\theta^*)]^{-1}[F(\theta^*)-F(\hat{\theta})]b^{-1}>0, \tag{5}$$

$$\frac{\mathrm{d}i}{\mathrm{d}r}=[1-F(\theta^*)]^{-1}>1, \tag{6}$$

Eqs. (4) and (5) give the response of the promised interest rate to increases in the amount of debt issued (b) and increases in the amount of debt already outstanding (s). Both responses are positive, reflecting the increase in the default probability ($F(\theta^*)$) brought about by the heavier debt burden. Eq. (5) also gives the direct effect of an increase in the unobservable component of senior obligations (ε). $\mathrm{d}i/\mathrm{d}\varepsilon$ is positive, reaffirming the interpretation of increases in ε as exogenous increases in the interest rate. Finally, eq. (6) shows the effect on the promised interest rate of an increase in the riskless rate (r). The promised rate must rise by more than the riskless rate, to compensate for the possibility that the owner of the risky bond may not receive the additional promised payments.

Eq. (3) suggests that the municipal yield increases with the amount borrowed (b) and with the level of senior obligations that will compete for future revenues with the current bond issue (s). One might be tempted to estimate by OLS a linear approximation of (3), in which the municipal interest rate is regressed against the amount borrowed and some measure of outstanding debt. In Capeci (1990), a model of municipal borrowing behavior is developed which argues that such a procedure will lead to biased estimates of the parameters in the yield equation. In particular, the model produces comparative static results which suggest that exogenous increases in the interest rate (ε) will lead to reductions in the amount borrowed, as the municipality switches from borrowing to taxes as a means of financing; a negative correlation emerges between the town's interest rate and its chosen borrowing level. In section 4, instrumental variables estimates of the yield equation are used to address this problem.

3. Data and empirical specification

The sample includes new issues made by New Jersey municipalities between 1 January 1975 and 31 December 1977. The primary source of data is the Bond Buyer's Post Sale Microfiche, which has detailed information about individual issues. Budget data come from the *Annual Reports* of the N.J. Division of Local Government Services and the N.J. Commissioner of Education. The original sample represents the entire set of competitively auctioned new issues by New Jersey municipalities with issue amounts above

\$1 million.[5] Issues sold on a negotiated basis rather than a competitive auction are excluded. The vast majority of G.O. issues, however, were sold competitively during the sample period.[6] Revenue bonds, callable bonds, or bonds for which budget data could not be found are dropped from the original sample. The remaining sample of 243 bonds includes 148 issues by local governments, 28 by counties, and 67 by independent school districts.

Eq. (3) suggests a fairly complicated non-linear specification for the yield equation. Rather than attempt to estimate a non-linear specification based on an assumed functional form for $F(\theta)$, I will estimate a linear approximation of the form:

$$i_i = \alpha_0 + \alpha'_A CC_i + \alpha'_B IC_i + \alpha'_C MC_i + u_i,$$

where i denotes the real yield to maturity on the bond issue. CC denotes a vector of community characteristics, IC denotes a vector of issue characteristics, and MC denotes a vector of market characteristics at the time of the bond issue. Table 1 describes how all variables are constructed.

Eq. (3) suggests that the community characteristics which affect the yield are the amount of debt issued (*BORROW*) and variables which reflect net senior expenditures that will compete with the bond issue on future repayment dates. In the estimation, these variables include the stock of debt (other than the bond being auctioned) that is either outstanding or authorized for issuance during the year of the auction (*DEBT*). Also, to reflect the availability of local aid receipts, I include the current year level of local aid receipts (*AID*). The size of the issuing municipality, as measured by equalized property value (*PROPVAL*), is included to capture any economies of scale that can be achieved by large issuers.[7] This variable also serves as a proxy for the property tax capacity of the issuing government.

After controlling for factors that influence the ability of the town to repay its obligations, the issuer's budget should have no impact on its interest rate. In this vein, the empirical specification will also include two variables that

[5]The sample selection based on the size of the principal amount suggests the possibility of sample selection bias in the coefficient estimates, since the model predicts that the unobservable errors in the yield equation will be correlated with the errors affecting the level of borrowing. I do not consider this to be a serious problem, however, since issues under one million dollars in size represent a very small fraction of the total volume of general obligations. Between January 1986 and August 1988, for example, they constituted 1.25 percent of the total volume of new G.O. issues (figure courtesy of Securities Data Corporation). I have been unable to obtain the analogous figure for the period of my sample; presumably the figure would be somewhat larger due to the effects of inflation. Nevertheless, I consider the sample to be representative of the market as a whole.

[6]According to Kidwell and Sorensen (1983), 8.6 percent of all G.O.s were sold on a negotiated basis during the period 1975–1977.

[7]As Benson et al. (1981) point out, the volume of secondary market transactions for bonds of particular issuers is relatively thin for most small issuers; large issuers may enjoy a corresponding liquidity premium of their bond prices.

Table 1
Variable list.[a]

Name	Average (std. dev.)	Description
i	2.00% (0.91)	Annual real internal rate of return on the serial bond issue, equal to the nominal internal rate of return on the semiannual coupon payments (annualized) less a measure of expected inflation. Expected inflation is calculated as an ARIMA forecast based on an AR(4) model in the log difference of the GNP implicit price deflator. *Source*: Bond Buyer Post Sale Microfiche.
BORROW	\$0.011 (0.012)	Issue size, scaled by equalized property value (see *PROPVAL* below). *Source*: Bond Buyer Microfiche.
DEBT	\$0.027 (0.028)	Debt outstanding and/or authorized at the end of the fiscal year (excluding the bond issue being priced), scaled by equalized property value. *Source*: Annual reports of the New Jersey Division of Local Government Services and the New Jersey Department of Education.
AID	\$0.005 (0.009)	Total intergovernmental aid receipts from the state and federal government during the fiscal year, scaled by equalized property value. *Source*: Annual Reports of the N.J. D.L.G.S., and the N.J. D.O.E.
DISCREV	\$0.037 (0.024)	'Discretionary revenue' in the current fiscal year, defined as total revenue less debt service payments, scaled by equalized property value. *Source*: Annual Reports of the N.J. D.L.G.S., and the N.J. D.O.E.
DEBTSERV	\$0.002 (0.002)	Debt service payments in the current fiscal year, scaled by equalized property value. *Source*: Annual Reports of the N.J. D.L.G.S., and the N.J. D.O.E.
SLACK	\$0.007 (0.022)	Amount of additional debt that the municipality can issue before reaching its statutory debt limit, measured at the start of the current fiscal year. The variable is expressed as a fraction of a 3-year moving average of state equalized value because the statutory limits are defined against this same base. The limits take on values of 3.5% for municipal issuers, 2% for counties, and anywhere from 1.5% to 4% for independent school districts, depending on the grades covered. *Source*: Annual Reports of the N.J. D.L.G.S., and the N.J. D.O.E.
PROPVAL	\$1.82 bil (4.14 bil)	State equalized property value, equal to the state's estimate of market value on taxable property, based on a sample of actual sales. *Source*: Annual Reports of the N.J. D.L.G.S., and the N.J. D.O.E.
SCHOOL	0.276 (0.448)	Issuer type = school district. Missing category: *MUNICIPALITY*.
COUNTY	0.115 (0.320)	Issuer type = county. Missing category: *MUNICIPALITY*.
AVMAT	2.26 yr (0.23 yr)	Natural logarithm of the average maturity on the serial issue, where the maturities are weighted by principal amount. *Source*: Bond Buyer Microfiche. (The average maturity has a mean of 9.8 years and a standard deviation of 2.1 years.)
INSURED	0.20 (0.40)	Dummy variable indicating private insurance coverage on the bond issue. *Source*: Bond Buyer Microfiche.
QBA	0.04 (0.20)	Dummy variable indicating that the bond qualifies for coverage under New Jersey's Qualified Bond Act, whereby certain state aid moneys are earmarked for repayment of principal and interest on the bond. *Source*: Bond Buyer Microfiche.

Table 1 (continued)

Name	Average (std. dev.)	Description
ABA	0.03 (0.18)	Dummy variable indicating that the bond is eligible for additional building aid, a program that provides state support for principal and interest payments on bonds used to finance certain school building projects. *Source*: Bond Buyer Microfiche.
NBID	1.64 (0.40)	Natural logarithm of the number of bidding syndicates participating in the bond auction. *Source*: Bond Buyer Microfiche. (The number of bidders has a mean of 5.5 bidders, and a standard deviation of 2.1 bidders.)
TREAS	0.61% (0.47%)	Real after tax yield on a treasury bond with maturity that matches the average maturity on the municipal issue. The nominal before tax yield is taken from the *Wall Street Journal* on the day of the auction. The tax rate used to create the after tax treasury bond rate is the implicit tax rate (t) which equates M with $(1-t)T$, where M denotes the value of Salomon Brothers' Prime grade 10-year general obligation yield index, and T denotes the value of Citibase's 10-year treasury bond index. The inflation rate used to create the real interest rate is summarized in the description of the dependent variable (i). *Source*: *Wall Street Journal*, and Salomon Brothers *An Analytical Record of Yields and Yield Spreads*.
BANKDEM	\$0.29 (0.36)	Net purchases of municipal debt by commercial banks during the quarter of the bond sale per dollar of net issues of municipals during the same quarter. *Source*: Federal Reserve Flow of Funds Statistics.
Aaa, Aa, A1, A, Baa1, Baa		Moody's rating category dummy variables. The percentage breakdown is as follows: 3.3% Aaa, 20.2% Aa, 22.2% A1, 34.2% A, 15.6% Baa1, 2.9% Baa, 1.6% unrated.
Instruments		
INCPROP	\$0.45 (0.17)	Personal income in 1977 scaled by equalized property value. *Source*: Annual Report of the N.J. D.L.G.S.
POP	85,016 (173,181)	Population during the year of the bond sale. *Source*: Annual Report of the N.J. D.L.G.S.
POPL	85,659 (175,797)	Population during the year prior to the bond sale. *Source*: Annual Report of the N.J. D.L.G.S.
DEBTSERVL	\$0.002 (0.002)	Debt service payments in the previous fiscal year. Defined analogously with *DEBTSERV*.
DISCREVL	\$0.038 (0.025)	'Discretionary revenue' in the previous fiscal year, defined analogously with *DISCREV*.
AIDL	\$0.004 (0.008)	Total intergovernmental aid receipts from the state and federal government during the previous fiscal year. Defined analogously with *AID*.
TREASBT	3.26% (0.45%)	'Before-tax' yield on a treasury bond whose remaining time to maturity is as close as possible to the average maturity on the issue. Defined in the same way as *TREAS*, except no adjustment for taxes is made.

[a]All dollar amounts are expressed in 1982 dollars using the GNP implicit price deflator.

measure the size of the government's current operating budget: *DISCREV* refers to the government's 'discretionary revenues' which are defined here as total current revenues less outlays on debt service payments (*DEBTSERV*). Debt service payments are entered separately to allow for the possibility that current debt service payments provide an informational signal of ability to repay in the future.

The empirical specification will also be augmented to allow for debt limits on G.O. borrowing that are imposed by the state. In New Jersey these take the form of percentage limits as a fraction of equalized valuation. The vast majority of municipalities in the New Jersey data set are well below their limits; nevertheless, the yield equation includes a variable representing the amount of additional borrowing that the issuer can undertake before reaching the statutory limit (*SLACK*).

Finally, dummy variables are included to reflect the type of governmental unit: municipality, county, or school district.

A variety of issue characteristics are also included. The discussion in section 2 takes place in the context of a bond with one period maturity; however, most municipal bonds are issued in serial packages of several maturities, ranging typically from 1 to 10 or 20 years. To allow for possible yield curve effects, I include the average maturity (*AVMAT*) as a regressor. Since there often tends to be a flattening of the municipal yield curve at high maturities, *AVMAT* is entered in natural log form. Associated with the issue of maturity length is the issue of call protection. Today many municipalities stipulate some kind of call provision on their bonds to protect against unexpected declines in interest rates. In the sample used here, only 5 percent of the bonds are callable, and rather than attempt to estimate the option value of the call provisions, I have simply omitted these bonds from the sample.

The estimated specification also includes variables that indicate whether or not third parties have made commitments toward repaying the debt service on the bond. The first of these is a dummy variable that indicates the presence of private insurance coverage on the repayment of principal and interest (*INSURED*). Approximately 20 percent of this sample is insured privately. Two other dummy variables indicate that the bond issue is eligible for financial support through one or both of two local aid programs run by the state of New Jersey. The first (*QBA*) indicates that the bond is eligible to receive financial support under the state's Qualified Bond Act of 1976, a law that allows a municipality to earmark state aid revenues as a backup source for debt repayment. The second dummy variable (*ABA*) indicates that the bond proceeds are to be used in school building construction and that the debt service payments are backed by 'additional building aid' from the state. Since both of these programs enhance the credit worthiness of the bond, they should be associated with lower yields.

Another institutional feature of the issuing process that is relevant to the pricing of municipal bonds is the auction in which most new issues are sold. The bidders in this process are syndicates of underwriters, who submit sealed bids of coupon rates, with the sale of the bond issue going to the bidder offering the lowest net interest cost to the municipality.[8] Since the appearance of papers by West (1965) and Kessel (1971), most authors acknowledge that the degree of underwriter bidding competition will have a significant affect on yields. Furthermore, West finds that the yield reductions brought about by additional bidders falls as the number of bidders increases. With this in mind, I include the natural log of the number of bidders (*NBID*) as a regressor in the yield equation.

The yield equation will also control for certain demand-side variables that have been found elsewhere to influence municipal yields. The most important of these is the marginal investor's after-tax opportunity cost of capital. This will be proxied by an 'after-tax' treasury bond yield of similar maturity to the average maturity of the municipal issue (*TREAS*). Table 1 describes the calculation of this variable.

One final demand-side factor which I include is a variable to reflect the presence of commercial banks as significant sources of demand for municipals. Because of the tax-free status of municipal bond interest as opposed to treasury bonds, and because federal tax rates vary from investor to investor, there will be infra-marginal purchasers of municipals who have federal tax rates above the tax rate that applies to the marginal investor. The most significant group of infra-marginal investors during the estimation period were commercial banks, who were taxed at the full corporate rate and who held 46 percent of all outstanding state and local debt in 1980 [see Kidwell et al. (1983, p. 98)]. To control for increases in infra-marginal demand by banks, I include a measure of relative bank demands. This measure is the ratio of net acquisitions of municipals by commercial banks relative to the net volume of state and local debt issued during the quarter of bond sale (*BANKDEM*).

The linear specification for the yield can be written as:

$$\begin{aligned} i_i = {} & \alpha_0 + \alpha_1 BORROW_i + \alpha_2 DEBT_i + \alpha_3 AID_i + \alpha_4 DISCREV_i \\ & + \alpha_5 DEBTSERV_i + \alpha_6 SLACK_i + \alpha_7 PROPVAL_i + \alpha_8 SCHOOL_i \\ & + \alpha_9 COUNTY_i + \alpha_{10} AVMAT_i + \alpha_{11} INSURED_i + \alpha_{12} QBA_i \\ & + \alpha_{13} ABA_i + \alpha_{14} NBID_i + \alpha_{15} TREAS_i + \alpha_{16} BANKDEM_i + u_i. \qquad (7) \end{aligned}$$

[8]The net interest cost of a bond issue is the weighted sum of semiannual coupon payments, where the weights increase with the number of remaining years that the coupon payments will be made. Net interest cost *does not* take into account the effects of discounting.

Table 1 describes the variables in greater detail. The impact of debt increases is captured by the parameters α_1 and α_2.

4. Results

Table 2 presents the estimates of eq. (7).[9] In the OLS specification of column (1), the debt variables (*BORROW* and *DEBT*) both enter with positive coefficients; however, the magnitude of the coefficients is quite small and neither one is statistically significant.

Since the small magnitude of the coefficient on *BORROW* could be the result of an endogenous variable bias, a version of the interest rate equation is estimated which instruments *BORROW* (using two-stage least squares). However, the estimation will also instrument other explanatory variables which may be correlated with the interest rate residual.

First, the after-tax treasury bond rate will be instrumented by the before-tax treasury bond rate since, as Poterba (1986) points out, the implicit tax rate used to construct the after-tax series may contain measurement error. Second, the current period outside aid variable will be instrumented by the previous year's aid receipts, since towns that are currently suffering under heavy interest rates might be viewed as aid targets by higher levels of government. Finally, current period debt service payments will be instrumented by the prior year's debt service payments, since the interest payments on the bonds take place less than one year after issuance, introducing a potential correlation between the level of current debt service and the interest rate residual.[10] As additional instruments, I use personal income per dollar property value in 1977, current and lagged values of the town's population, and the lagged value of discretionary revenues.[11] These are exogenous variables that underlie the model of municipal borrowing, taxation, and interest rates developed in Capeci (1990).

The results from the instrumental variables specification are shown in the third column of table 2. To see how the endogenous treatment of borrowing affects the results, compare the third column of table 2 with the second column, which instruments all of the above-mentioned variables *except* the amount borrowed. Comparing these two sets of estimates, one finds that a

[9]Since the yield formula that is implied by (3) is a non-linear function of borrowing levels, one might object to using a linear approximation. A variant of eq. (7) that includes higher order terms of the borrowing level (quadratic) was also estimated and it produces substantially similar results to those in table 2. The estimated quadratic term is not significant at the 10 percent rejection level. The results are not shown here but can be obtained from the author.

[10]Interest payments begin 6 months after the issue date; therefore, the first interest payment on the bond will appear as part of current period debt service for bonds issued before July. Ceteris paribus, the higher is the borrowing rate on the bond, the higher will be the level of debt service.

[11]None of the municipalities in the data set had access to local income tax collections during the sample period.

Table 2
Estimates of eq. (8)
Dependent variable: Real municipal borrowing rate (in %)
Sample size = 243.

Equation:	(1)	(2)	(3)	(4)
Method:	OLS	2SLS	2SLS	2SLS
BORROW exogenous?	Yes	Yes	No	No
INTERCEPT	0.75 (0.41)	0.84 (0.43)	0.71 (0.55)	0.79 (0.53)
BORROW	2.95 (4.53)	−1.17 (4.75)	54.83* (22.85)	38.08* (19.31)
DEBT	3.72 (2.11)	3.16 (2.21)	18.63* (6.70)	14.35* (5.63)
AID	22.5* (8.5)	21.71* (10.57)	50.61* (17.55)	37.75* (15.16)
DISCREV	0.75 (3.36)	5.25 (4.26)	−16.91 (10.26)	−9.00 (8.76)
DEBTSERV	−40.88 (23.31)	−92.22* (27.06)	−74.43* (34.94)	−82.62* (29.43)
SLACK	1.98 (2.60)	−0.85 (2.72)	23.43* (10.15)	17.73* (8.56)
PROPVAL	−0.049* (0.012)	−0.045* (0.012)	−0.044* (0.016)	−0.027 (0.019)
SCHOOL	0.17 (0.12)	0.25 (0.13)	0.13 (0.17)	0.16 (0.14)
COUNTY	0.46* (0.19)	0.44* (0.21)	0.67* (0.28)	0.65* (0.25)
AVMAT	0.74* (0.14)	0.80* (0.15)	0.47* (0.22)	0.53* (0.19)
INSURED	0.12 (0.08)	0.11 (0.08)	0.00 (0.11)	−0.10 (0.09)
QBA	−0.32 (0.21)	−0.30 (0.22)	−0.29 (0.28)	−0.23 (0.25)
ABA	−0.16 (0.20)	−0.28 (0.20)	0.12 (0.30)	0.31 (0.27)
NBID	−0.79* (0.09)	−0.85* (0.09)	−0.73* (0.13)	−0.56* (0.12)
TREAS	1.12* (0.07)	0.95* (0.10)	1.12* (0.11)	1.18* (0.11)
BANKDEM	−0.11 (0.09)	−0.19* (0.09)	−0.14 (0.11)	−0.22* (0.10)
Aaa	–	–	–	−0.74 (0.40)
Aa	–	–	–	−0.75* (0.26)
A1	–	–	–	−0.53* (0.27)
A	–	–	–	−0.30 (0.26)

Table 2 (continued)

Equation:	(1)	(2)	(3)	(4)
Method:	OLS	2SLS	2SLS	2SLS
BORROW exogenous?	Yes	Yes	No	No
Baa1	–	–	–	−0.19 (0.27)
Baa	–	–	–	−0.00 (0.35)
R^2	0.77			
F-test of model[a]	47.39 [0.0001]	38.92 [0.0001]	24.44 [0.0001]	26.39 [0.0001]
d.f.	16,226	16,226	16,226	22,220
Specification test[b]		$F=$	9.42 [0.0001]	7.48 [0.0001]
d.f.			5,221	5,215
Overidentification test[c]		$\chi^2=$	1.05 [0.59]	1.34 [0.51]
d.f.			2	2

Standard errors are in parentheses.
Significance levels for tests are in square brackets.
*Significant at the 5% rejection level.
[a]This is the test of the linear restriction that all coefficients other than the constant term equal zero.
[b]This is the Hausman–Wu specification test for correlation of certain explanatory variables with the error term. Variables tested: *BORROW*, *DISCREV*, *DEBTSERV*, *AID* and *TREAS*.
[c]Chi-square test for the admissibility of the instruments. Instruments used: *DISCREVL*, *DEBTSERVL*, *AIDL*, *TREASBT*, *INCPROP*, *POP*, and *POPL*.

number of coefficients change dramatically. Most noticeably, the coefficient on *BORROW* rises from −1.17 and insignificant in column (2) to 54.83 and significant at the 5 percent rejection level in column (3). This increase is consistent with the prediction of the model, namely that borrowing should be negatively correlated with exogenous increases in the borrowing rate, leading to a downward bias in the estimated coefficient when the level of borrowing is treated as exogenous.

The coefficient of 54.83 suggests that if a community with the average level of borrowing (1.1 cents per dollar of equalized value) were to increase its borrowing requirements by a one standard deviation amount (an increase of 1.2 cents per dollar equalized value – roughly doubling its initial borrowing level), the community would experience an increase in its borrowing rate of *0.66 percent* (*66 basis points*). To put this response into perspective, compare it with the yield differential between quality grades. Salomon Brothers reports that between 1975 and 1977, the average spread between Prime Grade (Aaa) and Medium Grade (A and high Baa) general obligations was 0.51 percent. This change can also be expected to lead to increases in future issue costs as it will add to the total stock of previously authorized debt at the start of the next fiscal year. Therefore, it appears as though differences in municipal debt burdens can go a long way in explaining the market's perceptions of differences in credit risk.

As a consistency check on the model, the bottom of the third column reports the results from a specification test and an overidentification test. The specification test uses a procedure described in Hausman (1978) to examine whether the use of the instrumental variables procedure gives significantly different parameter estimates than the ones obtained by OLS. The resulting F-statistic of 9.42 suggests that substantial differences arise, providing further motivation for the instrumental variables procedure. The overidentification test uses a procedure outlined in Hausman (1983) to examine whether the variables chosen as instrumental variables satisfy the necessary property of being uncorrelated with the residual in eq. (7). The small chi-square statistic of 1.05 is consistent with an acceptance of this hypothesis.[12]

The third column of table 2 reveals some additional results which are at odds with the model presented in section 2. Contrary to predictions, the current period discretionary revenue and current period debt service variables both have a negative impact on yields, although only at marginal significance levels. Furthermore, current period aid receipts have a significant positive effect on borrowing costs. One possible explanation for these findings is that the symmetric information assumptions made in section 2 are not valid. The true 'ability to pay' of a town might be unobservable to lenders, even after careful inspection of budget sheets. Current period budget variables could then serve as signals of the unknown credit risk, either directly or indirectly through the ratings. The finding of a negative impact of debt service payments is consistent with Robbins' (1984) model of debt service repayments as a signal of ability to pay. Alternatively, high levels of aid receipts could signal an inability to pay.

Another curious result is the finding that slack on the borrowing constraint is associated with higher borrowing costs. This could be based on fears that future debt holders will compete with current period debt holders for repayment in the event of a default.

[12]In addition to running these tests jointly on groups of variables, Capeci (1990) carries out a sequence of specification tests and a sequence of overidentification tests on individual variables. All of the instruments listed in note 3 of table 2 pass the individual overidentification tests, and any regressor which fails an individual specification test is treated as endogenous in columns (3) and (4) of table 2.

Bond ratings

So far, the estimation has excluded any measure of bond ratings as regressors. This is not because ratings are unimportant, but rather because their inclusion will mask the full effects of a number of local characteristics which can impact borrowing costs both directly and indirectly through the ratings.[13] Nevertheless, one may wonder whether the ratings completely capture the effects of town-specific characteristics which affect the risk of default. Column (4) of table 2 presents regression results where Moody's rating dummies are included directly.[14] A number of town-specific characteristics (including both the amount borrowed and the stock of debt authorized) still have an independent effect. Not surprisingly, however, the magnitude of the coefficients on many town-specific characteristics is reduced, since their full effect is partially hidden by the rating dummies.

5. Conclusion

The main result which comes out of this study is that borrowing rates do appear responsive to current period fiscal decisions. In particular the borrowing rate is positively related to the amount borrowed per dollar property value, even after controlling for the independent effect of credit ratings.

Quantitatively, the instrumental variables results suggest that the response of a one standard deviation rise in the amount borrowed is associated with an increase in the borrowing rate of approximately 66 basis points. This positive effect is consistent with the story that increases in the level of debt issued are associated with increased costs of risk bearing, costs which must be weighed against the marginal costs of taxation when determining appropriate municipal financial policy.

With regard to methodological issues, a comparison of OLS yield regressions with two-stage versions suggests that the endogeneity of budget variables is a real problem which should be addressed when looking at interest rates charged on new issues. In particular, failing to address the simultaneity of the amount borrowed can lead to estimates of the effect of issue size which are downward biased.

The empirical results also suggest a number of features of the municipal

[13]By excluding the ratings, I am forced to maintain that the portion of the credit rating variation which cannot be explained by the regressors of the yield equation is uncorrelated with these regressors. Alternatively, if one includes the ratings into the specification, one must assume that there are no significant variables related to the credit worthiness of the issuer that are omitted from the yield equation. If there are, then even if these omitted variables are uncorrelated with every included municipal characteristic, they will likely be correlated with the ratings, and biased inferences can be drawn [see Capeci (1991)].

[14]Unrated issues are the omitted category.

market which are at odds with a two-period symmetric information model of borrowing costs. A modeling strategy which takes into account asymmetries of information as well as the dynamic nature of the borrowing process [as in Robbins (1984)] might provide useful explanations for some of the observed correlations.

References

Benson, E., D. Kidwell, T. Koch and R. Rogowski, 1981, Systematic variations in yield spreads for tax-exempt general obligation bonds, Journal of Financial and Quantitative Analysis 16, 685–702.

Benson, E., B. Marks and K. Raman, 1984, State regulation of accounting practices and municipal borrowing costs, Journal of Accounting and Public Policy 3, 107–122.

Benson, E., B. Marks and K. Raman, 1986, Municipal borrowing costs and the differential impact of accounting information across rating categories, Research in Governmental and Nonprofit Accounting 2, 261–273.

Benson, E., B. Marks and K. Raman, 1988, Tax effort as an indicator of fiscal stress, Public Finance Quarterly 16, 203–218.

Browne, L. and R. Syron, 1977, City bonds after New York, New England Economic Review (July/August) 3–15.

Browne, L. and R. Syron, 1979, Municipal market since the New York City crisis, New England Economic Review (July/August) 11–26.

Capeci, J., 1990, Local fiscal policies, default risk, and municipal borrowing costs, Brandeis University working paper, no. 259.

Capeci, J., 1991, Credit risk, credit ratings and municipal bond yields: A panel study, National Tax Journal 44, part 1, 41–56.

Goldstein, M. and G. Woglom, 1991, Market based fiscal discipline in monetary unions, Working paper.

Hastie, K.L., 1972, Determinants of municipal bond yields, Journal of Financial and Quantitative Analysis 7, 1729–1748.

Hausman, J., 1978, Specification tests in econometrics, Econometrica 45, 1251–1271.

Hausman, J., 1983, Specification and estimation of simultaneous equation models, in: Z. Griliches and M. Intriligator, eds., Handbook of econometrics, vol. 1 (North-Holland, Amsterdam).

Ingram, R. and R. Copeland, 1982, Municipal market measures and reporting practices: An extension, Journal of Accounting Research 20, 766–772.

Kessel, R., 1971, A study of the effects of competition in the tax exempt bond market, Journal of Political Economy 79, 706–738.

Kidwell, D. and E. Sorensen, 1983, Investment banking and the underwriting of new municipal issues, in: F. Fabozzi et al., eds., The municipal bond handbook (Dow Jones-Irwin, Homewood, IL) 169–180.

Kidwell, D., F. Fabozzi and C. Moore, 1983, Investors in municipal services, in: F. Fabozzi et al., eds., The municipal bond handbook (Dow Jones-Irwin, Homewood, IL) 94–107.

Liu, P. and A. Thakor, 1984, Interest yields, credit ratings, and economic characteristics of state bonds: An empirical analysis, Journal of Money, Credit and Banking 16, 344–351.

Metcalf, G., 1990, Federal taxation and the supply of state debt, National Bureau of Economic Research, Working paper no. 3255.

Poterba, J., 1986, Explaining the yield spread between taxable and tax exempt bonds: The role of expected tax policy, in: H. Rosen, ed., Studies in state and local public finance (University of Chicago Press, Chicago, IL) 5–51.

Robbins, E., 1984, Pricing municipal debt, Journal of Financial and Quantitative Analysis 19, 467–483.

Rubinfeld, D., 1973, Credit ratings and the market for general obligation municipal bonds, National Tax Journal 26, 17–27.

Wallace, W., 1981, The association between municipal market measures and selected financial reporting practices, Journal of Accounting Research 19, 502–520.

West, R., 1965, New issue concessions on municipal bonds: A case of monopsony pricing, Journal of Business 38, 135–148.

Wilson, E. and T. Howard, 1984, The association between municipal market measures and selected financial reporting practices: Additional evidence, Journal of Accounting Research 22, 207–224.